

# Great Yarmouth Third River Crossing

OUTLINE BUSINESS CASE

MARCH 2017

Supporting Document 12 – Environmental Options Assessment  
Report

# Great Yarmouth Third River Crossing

## Options Environmental Appraisal Report

Produced for:



Prepared by



St John's House  
Queen's Street  
Manchester  
M2 5JB  
UK

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## Acronyms

Acronym	Description
AADT	Annual Average Daily Traffic
ADMS	Atmospheric Dispersal Modelling Software
AM	Ante-Meridiem
AQMA	Air Quality Management Area
ARN	Affected Road Network
AST	Appraisal Summary Table
BAP	Biodiversity Action Plan
BGS	British Geological Society
CA	Conservation Area
Defra	Department of Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DM	Do Minimum
DS	Do Something
EA	Environment Agency
EPS	European Protected Species
FBC	Full Business Case
GIS	Geographical Information Systems
GWDTEs	Groundwater Dependent Terrestrial Ecosystems
HSI	Habitat Suitability Index Survey
HA	Highways Agency (now Highways England)
HDV	Heavy Duty Vehicle
IP	Inter Peak
LDF	Local Development Framework
NHER	Norfolk Historic Environment Record
NVZ	Nitrate Vulnerable Zone
LNR	Local Nature Reserve
MAGIC	Multi-Agency Geographical Information for the Countryside
NEPG	Norfolk Environmental Protection Group
NIA	Noise Important Areas
NPPF	National Planning Policy Framework
NPSNN	National Policy Statement for National Networks
NPV	Net Present Value



Acronym	Description
OBC	Outline Business Case
OS	Ordnance Survey
PCM	Pollution Climate Mapping
PM	Post meridiem
pSPA	Potential Special Protection Area
SPA	Special Protection Area
SAC	Special Area of Conservation
SuD	Sustainable Drainage Systems
NCC	Norfolk County Council
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TAG	Transport Appraisal Guidance
WFD	Water Framework Directive
WIMBY	What's in My Backyard

Units	Description
CO <sub>2</sub>	Carbon Dioxide
CO <sub>2</sub> e	Carbon Dioxide Equivalent
KM	Kilometre
M	Metre
MBGL	Metres Below Ground Level
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Oxides of Nitrogen
PM <sub>10</sub>	Particulate Matter with an aerodynamic diameter of 10µm or less
PM <sub>2.5</sub>	Particulate Matter with an aerodynamic diameter of 2.5µm or less
µg/m <sup>3</sup>	Microgram per cubic metre
µm	Micrometre (Micron)

# 1 Introduction

## 1.1 Overview and Purpose of the Report

1.1.1 This document is the Environmental Appraisal Report, prepared in support of the Outline Business Case (OBC) for the proposed Great Yarmouth Third River Crossing (hereafter referred to as the 'scheme'). The report is prepared on behalf of Norfolk County Council (NCC) for consideration by the New Anglia Local Enterprise Partnership and the Department for Transport (DfT). The form and content of this Options Environmental Appraisal Report is informed by guidance set out in the DfT's Transport Appraisal Guidance (TAG) Unit A3 – Environmental Impact Appraisal (November 2014).

1.1.2 The report assesses the impacts on the environment of options for the proposed Great Yarmouth Third River Crossing scheme to inform its OBC. The results of the environmental impact appraisals are set out within appropriate TAG worksheets (where possible), which have then been used to complete Appraisal Summary Tables (ASTs) for the options being considered.

1.1.3 The OBC, which this environmental appraisal supports, explains why the proposed scheme should receive support and provides a clear audit trail for the purposes of public accountability.

## 1.2 Content of the Report

1.2.1 This report is structured as follows:

- Chapter 1: Provides an overview of the OBC and the purpose of the Options Environmental Appraisal Report.
- Chapter 2: Describes the site location, characteristics of the area and provides an overview of the options under consideration at this stage.
- Chapter 3: Provides an overview of the appraisal methodology that has been adopted for the environmental appraisal in support of the OBC.
- Chapters 4 - 10: These chapters set out the specific methodologies adopted for each of the WebTAG sub-impacts appraised. Furthermore, the chapters provide an evaluation of topic related constraints and presents the required environmental impact appraisal of each option in TAG worksheets, where possible. Summary environmental assessment scores are provided for each option appraisal, where possible.
- Chapter 11: Sets out the environmental impact appraisal inputs to the ASTs for each of the options under consideration.

## 2 Description of Options

### 2.1 Site Location and Overview of the Existing Environment

- 2.1.1 The proposed scheme is a new river crossing over the River Yare, a river which flows into the North Sea at Gorleston, Great Yarmouth, and 40km (25 miles) east of Norwich. River Yare is approximately 51km (32 miles) long and flows from Norwich to Gorleston-on-Sea in Great Yarmouth. River Yare is one of five major rivers within the Broadland Rivers catchment which includes Rivers Ant, Bure, Wensum and Waveney<sup>1</sup>. These sub-catchments drain into the Broads; a tidally dominated area of inland waterways. The catchment area is approximately 3,200km<sup>2</sup> and predominantly rural with the main urban conurbation of Norwich, Great Yarmouth and Lowestoft.
- 2.1.2 Great Yarmouth is an ancient coastal town in Norfolk and is located on a peninsula between the North Sea and the River Yare. It lies at the mouth of the River Yare and was once a thriving fishing port, mainly for herring fishery, but this industry experienced a sharp decline in the 20<sup>th</sup> century. However, the 1960's brought about the oil rig supply industry with the discovery of oil in the North Sea and in recent times, increased development of renewable energy sources has seen a shift in industries in this area.
- 2.1.3 The town is separated from other areas of the borough such as Gorleston and Southtown by the River Yare, with the two existing bridges; Haven Bridge and the A12 Breydon Bridge providing transport links between these areas. Both bridges lift to enable boats and ships to pass through. To the west of Breydon Bridge lies Breydon Water, a large, sheltered estuary which forms the gateway to the Norfolk Broads which is designated as a Ramsar site, a Special Protection Area (SPA), a Site of Special Scientific Interest (SSSI) and a Local Nature Reserve (LNR).
- 2.1.4 Great Yarmouth is connected to Norwich and Lowestoft by rail and by road. The main transport links in the area include the A12 which runs between London and Great Yarmouth town, where it terminates, the A143 which connects Great Yarmouth to Haverhill in Suffolk and the A47 which links the town to Birmingham. The Breydon Bridge serves as a bypass route for A12 traffic avoiding the town centre and the Haven Bridge provides access into the northern extents of the town centre. There are no other bridges further south of the River Yare and as a result, the southern part of Great Yarmouth, is effectively isolated from the rest of the borough.
- 2.1.5 The existing A12 has a speed limit of 50mph, other existing local roads within the vicinity of the scheme have a 30mph speed limit while the proposed link over the River Yare would have a speed limit of 30mph.
- 2.1.6 The scheme is expected to improve connectivity by improving links across the town and region, reducing congestion and attract investment which will help in the creation of thousands of new jobs.
- 2.1.7 Figure 1 shows the area of the scheme in relation to the town, economic areas and the local road network.

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<sup>1</sup> <http://www.catchmentbasedapproach.org/anglian/broadland-rivers> [accessed October, 2016]

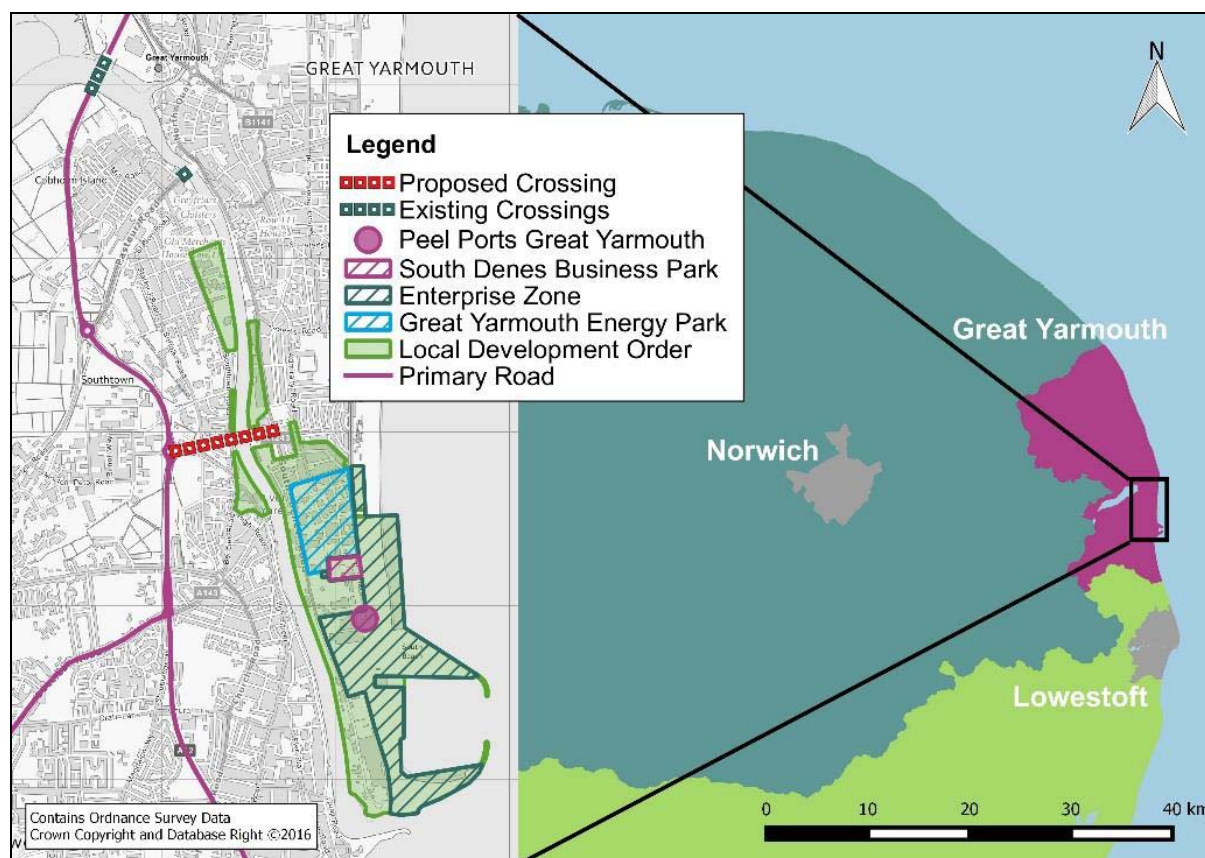


Figure 1: Location of the Scheme

2.1.8 Three options (Options 32, 33 and 37) are being considered for the scheme. These are described below and are shown on in **Appendix A**.

## 2.2 Options 32 and 33

2.2.1 There are a number of similarities between Options 32 and 33 with respect to design and general arrangement. Both options connect to the A12 via a new four-arm roundabout at William Adams Way to the west and link up to South Denes Road via a new traffic signal controlled junction to the east.

2.2.2 These two options also have a clear air draft height of about 4.5m above the mean high level water, and would bridge over Southtown Road, which would remain open to traffic.

2.2.3 Options 32 and 33 would connect to the A12 Hafrey's Roundabout via a new four-arm roundabout junction arrangement at William Adams Way on the western side of the River Yare. The new road would then extend east over Southtown Road, crossing the River Yare via a bascule bridge arrangement and link up to a new traffic signal controlled junction at South Denes Road on the eastern side of the River Yare, where it terminates.

2.2.4 Both options also have a number of non-motorised user provisions incorporated within the proposals at this stage, these include:

- A 4.5m wide footway and two-way cycleway link from William Adams Way, across the eastbound side of the new bascule bridge, and linking to a new on

carriageway cycle lane on Sutton Road. This route also includes new Toucan crossing facilities at the William Adams Way roundabout, and the new traffic signal controlled junction on South Denes Road;

- A 1.5m wide footway on the westbound side of the link across the new bascule bridge;
- A new footway/cycleway link from the William Adams Way roundabout to Suffolk Road, and a new pedestrian crossing on Suffolk Road; and
- A footway/cycleway link from William Adams Way to the Hafrey's roundabout on the A12.

### *Differences between Options 32 and 33*

2.2.5 Option 32 comprises a dual carriageway with a four lane high level bridge across the River Yare, and traffic signals to the east at South Denes Road.

2.2.6 Option 33 is a three lane carriageway, with new four arm roundabout at Suffolk Road to tie-in to the west, a three lane high level bridge across the River Yare and traffic signals to the east at South Denes Road. This option would operate as a tidal flow arrangement depending on the traffic flow conditions. The tidal flow arrangement would be controlled by overhead lane signals mounted on cantilever / portal gantries.

2.2.7 These options are shown on Figures 1076653-MOU-HGN-OPT32-DR-D-0001(P1,S2) and 1076653-MOU-HGN-OPT33-DR-D-0003(P1,S2) in **Appendix A**.

## **2.3 Option 37**

2.3.1 Option 37 is a single carriageway with an at-grade junction at Southtown Road to tie-in to the west, a two lane low level bridge with traffic signal junctions to the west and the east at South Denes Road.

2.3.2 This option would involve construction of a new at-grade junction with Southtown Road, land-take requirements impacting on Queen Anne's Road and the stopping up of the existing William Adams Way to vehicular traffic and access to be maintained only as a cycleway/footway.

2.3.3 This option is shown on Figure 1076653-MOU-HGN-OPT37-DR-D-0005(P1,S2) in **Appendix A**.

## **2.4 Bridge Opening**

2.4.1 The opening duration of the bridge is dictated by two factors: bridge movement and vessel movement.

2.4.2 The time taken for the bridge to open and close comprises the time to clear the bridge of traffic and the time for the bridge to raise, while closing time includes the bridge lowering and the traffic controls lifting. The duration of this will vary depending on the nature of the traffic control system installed, with control of pedestrians being the probable limiting factor. In total, a time of 240 seconds may be required to allow the opening of the bridge.

2.4.3 The vessel movement time includes the transit time (that is the time it takes a vessel

to manoeuvre through the bridge passage) including the time taken for the vessel to approach the bridge following opening. The location of the bridge, on a bend in the river, will probably increase both the approach and transit times in comparison with a bridge with a straight approach.

- 2.4.4 Following extensive liaison with the Port Authority and analysis of current vessel movements past the proposed location of the scheme, using an assumed bridge opening pattern for an average and worst case day, it has been determined that the bridge is likely to open between 10 and 20 times daily, generally between the hours of 7am and 7pm. The majority of bridge openings will last 5 minutes or less.

## 3 Appraisal Methodology

### 3.1 WebTAG guidance

3.1.1 The WebTAG guidance for Environmental Impact Appraisals (TAG Unit A3, December 2015) provides guidance on appraising transport options against the Government's objective for transport. There are eight sub-impacts which cover the impacts upon the environment. The sub-impacts are as follows:

- Noise
- Air Quality
- Greenhouse Gases
- Landscape
- Townscape
- Biodiversity
- Historic Environment and
- Water Environment.

3.1.2 The methodology adopted for the environmental impact appraisal has been informed by the guidance provided in the relevant chapters of TAG Unit A3. Some assessment of the potential environmental impact and effect of the options, using guidance contained in the Design Manual for Roads and Bridges (DMRB) Volume 11, has been undertaken to inform the environmental impact appraisal.

3.1.3 Where a monetary assessment is not feasible, WebTAG provides guidance on the qualitative assessment of the impacts. The impacts are then assessed using the recommended seven point scale which breaks down impacts into Slight/Moderate or Large Beneficial or Adverse and Neutral. The WebTAG guidance also provide information on the type of evidence to be used when applying this scale. These units contain worksheets which allow for a description of the qualitative impacts to be provided and then summarised in the AST to help inform the overall appraisal of the options.

3.1.4 To inform the Environmental Impact Appraisal, desk-based data gathering was undertaken for each of the environmental sub-impacts. This data search involved reviewing previous studies / reports and publically available datasets from sources such as online mapping, local authority websites and Geographical Information System (GIS) digital downloads. This data gathering exercise was supplemented by site visits to confirm the condition of the baseline environment, where appropriate. An environmental constraints plan has been produced and is shown in Figure 1 in **Appendix A**.

3.1.5 A preliminary ecology survey was also undertaken to inform the scope of ecology surveys if this scheme secures the required funds following submission of the OBC. This survey has also helped identify the need for targeted protected species surveys

and inform the forward programme where these surveys are seasonally constrained. See **Appendix B** for a report on the findings of this survey.

## 3.2 Scope of Environmental Appraisal

- 3.2.1 In line with the guidance set out in Chapter 5 (Environmental Capital Approach) of TAG Unit A3, the non-traffic related environmental sub-impacts have been subjected to an initial review to identify the study area for the sub-impact, identify the key environmental resources, appraise the environmental capital and proposal's impact and determine the overall assessment score. It is worth noting that TAG Unit A3 Chapter 5, Paragraph 5.3.3 states that "*Appraisal should be no more detailed than is required to support robust decision making. Where impacts are deemed to be minimal, further analysis may be scoped out*".
- 3.2.2 In view of the above, due to the absence of appropriate traffic data for the options, a proportionate air quality and noise assessment has been undertaken to inform the environmental impact appraisal. This has comprised a qualitative analysis of the likely impacts using available information, such as potential number of sensitive receptors (e.g., properties), and sensitive areas (e.g. the Department for Environment, Food & Rural Affairs (Defra) Noise Important Areas (NIA) and Air Quality Management Areas (AQMA)) to be affected by the options and a high level review of potential traffic changes caused by the options. This assessment methodology does not provide a Net Present Value (NPV) as required for the environmental impact appraisal. The appraisal also scopes out the Greenhouse Gases sub-impact as it is deemed that this would not present a material change on the optioneering process at this stage. However, the assessment utilises currently available information for each of the options under consideration to enable a comparative appraisal.
- 3.2.3 Should the scheme progress and require a Full Business Case (FBC), detailed modelling using traffic data will be undertaken to inform the air quality and noise assessment and appraisal. This would provide quantification of the air quality and noise impacts, including the numbers of sensitive receptors likely to be impacted by the scheme and an estimated NPV.
- 3.2.4 The scheme would be located wholly within the urban setting of Great Yarmouth town, where the overriding character is defined predominantly through its built development and infrastructure. There are few constituent landscape types or features (for example agricultural land pattern, woodlands, farmlands, hedgerows, etc.) that would merit a separate landscape appraisal of the study area, other than through its function as a townscape setting. A review of relevant landscape characterisation and classification studies has shown that the area is classed as an "urban" landscape typology (Great Yarmouth Borough Landscape Character Assessment April 2008).
- 3.2.5 The Broads National Park is situated approximately 1km to the north-west of the scheme. The National Policy Statement for National Networks<sup>2</sup> (NPSNN) places great weight on the conservation of landscape and scenic beauty in National Parks and Areas of Outstanding Natural Beauty, where designated areas have statutory purposes which help to ensure their continued protection. Initial walk-over surveys,

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<sup>2</sup> National Policy Statement for National Networks, Department for Transport (December 2014).



undertaken by an appropriately qualified and experienced landscape architect have concluded that none of the scheme alternatives would materially impact on the National Park, nor represent any impact on its perceived setting as a landscape.

- 3.2.6 In line with the guidance on the Environmental Capital Approach (Chapter 5 of TAG Unit A3), it has accordingly been concluded that, given the urban nature of the scheme, the townscape sub-impact adequately considers the potential impacts in relation to the setting and that the landscape sub-impact would not be directly relevant to the decision making process. Accordingly, the landscape sub-impact has been scoped out of the overall appraisal. This report therefore presents the findings of the appraisal of the proposed bridge options against the remaining six environmental sub-impacts.

### **3.3 Consultation**

- 3.3.1 The assessment undertaken for this appraisal has involved data gathering from publicly available source and other non-publicly available sources such as the Local Historic Environment Records (Norfolk Historic Environment Record) and local biological record centre (Norfolk Biodiversity Information Service). No other consultation on the environmental assessment of the proposal has been undertaken at this stage.

- 3.3.2 Detailed consultation will be undertaken if this scheme progresses to the FBC stage. The following organisations will be consulted during the detailed assessments of the project scheme in order to gather further information on environmental constraints, considerations and on the scope of the environmental assessment:

- Norfolk County Council (NCC);
- Natural England;
- Environment Agency;
- Eastern Inshore Fisheries and Conservation Authority;
- Marine Management Organisation and
- Historic England.

## 4 Noise

### 4.1 Introduction

- 4.1.1 A high level review of the options has been undertaken to give an indication of their potential noise impacts. The options have the potential to affect traffic noise and vibration levels as experienced by potential noise sensitive receptors, such as residential properties, in the vicinity of the new carriageways.
- 4.1.2 At this stage it has not been possible to undertake a quantitative or monetised assessment of the potential impacts as sufficiently detailed predicted traffic data has not yet been developed to enable complete noise calculations in accordance with the DMRB, Volume 11, Section 3, Part 7 'Noise and Vibration'. As a result of this a noise WebTAG worksheet has not been provided.
- 4.1.3 A qualitative assessment of the potential impacts of the options has instead been undertaken based on counts of properties within a defined study area based on proximity to each of the options and noise sensitive areas - NIA. The outcome of this assessment is summarised in the ASTs for the options, provided in Chapter 10.

### 4.2 Appraisal Methodology

- 4.2.1 Due to the absence of appropriate traffic data for a detailed noise assessment it has not been possible to define a noise study area as required by the DMRB, Volume 11, Section 3, Part 7. Traffic data in the form of AM, PM and Inter-peak Period (IP) was provided for the following scenarios and scheme options:
- 2023 (Opening Year) Do Minimum (DM);
  - 2023 (Opening Year) Do Something (DS) Option 32; and
  - 2023 (Opening Year) DS Option 37.
- 4.2.2 Using the available traffic data, a high level review of traffic changes brought on by the options was undertaken.
- 4.2.3 A study area 300m around the options has been adopted for a count of the number of Defra NIAs within the study area of the options.
- 4.2.4 The 300m boundary was split into banding zones at 0-50m; 50-100m; 100-200m; and 200-300m from the scheme's road centreline and counts of the number of potential noise sensitive receptors within the bandings for each option have been made. When detailed predicted traffic flows are available this study area may be extended to include the impacts due to changes in flow, speed or composition on other roads on the local network as appropriate.
- 4.2.5 The Environment Agency's open source data has been studied to identify any Defra NIAs in the vicinity of the scheme.

### 4.3 Existing Environment

- 4.3.1 Noise sensitive receptors are split into residential and non-residential receptors

according to the DMRB. A review of the baseline environment showed that the west bank area around the proposed bridge crossing has a relatively low number of residential properties whilst the east bank area is predominantly industrial.

#### 4.3.2 Non-residential sensitive receptors include:

- Community services and centres on Alpha Road, Harry Miller Court and Pegotty Road;
- Public/village halls or other community facilities including the Kings Centre/MIND on Queen Annes Road;
- Educational establishments such as Great Yarmouth Day Centre on Suffolk Road;
- Parks including recreation grounds/playgrounds on Boundary Road, Suffolk Road and Pegotty Road; and
- Residential Institutions (such as care homes).

## 4.4 Brief Evaluation of Topic Related Constraints

### *Option Sensitive Receptor Counts*

4.4.1 As an indication of the potential impact, receptor counts split into distance bands have been undertaken as receptors located closer to the scheme are expected to experience the highest adverse noise impact.

4.4.2 The number of receptors within each study area distance banding are presented in Table 4-1 and Table 4-2.

*Table 4-1: Noise Sensitive Receptor Counts – Options 32 and 33*

Distance Bands (m)	Number of Receptors per Distance Band				
	Dwelling	Health Facility	Education	Care Home	Community facility
0 to 50	32	0	0	0	0
50 to 100	53	0	1	0	0
100 to 200	158	0	1	1	6
200 to 300	410	0	1	0	0
Totals	653	0	3	1	6

Table 4-2: Noise Sensitive Receptor Counts - Option 37

Distance Bands (m)	Number of Receptors per Distance Band				
	Dwelling	Health Facility	Education	Care Home	Community facility
0 to 50	27	0	0	0	0
50 to 100	32	0	1	0	1
100 to 200	140	0	2	0	3
200 to 300	364	0	0	1	0
Totals	563	0	3	1	4

## 4.5 Noise Appraisal

- 4.5.1 During the operational phase, the crossing is expected to impact upon those receptors located closest to it. The three options have the potential to increase noise impacts at sensitive receptors and the closer the sensitive receptors are to the scheme the larger the likely impact.
- 4.5.2 Sensitive receptors could experience an increase in noise impact due to an increase in traffic flows, increase in percentage of heavy vehicles, increase in traffic speeds and changes in alignment which move vehicles closer to receptors.
- 4.5.3 For the purposes of this noise appraisal, the potential noise impacts of Options 32 and 33 are considered to be similar as they share the same centreline, albeit having a different number of running lanes. In view of this, the aforementioned traffic provided for Option 32 (paragraph 4.2.1) has therefore been used to assess Option 33.
- 4.5.4 The table above shows that there is a marginal difference in the number of potentially affected noise sensitive receptors based on proximity to the options alone where Options 32 and 33 come within a closer proximity to a higher number of receptors than Option 37. A high level evaluation of potential changes in noise levels as a result of altered traffic flow, speed and compositions brought on by the options has been undertaken, however this has only covered a limited study area (see paragraph 4.2.3) and should be revised once appropriate traffic data for the noise assessment is available.

### *Traffic flow comparison*

- 4.5.5 The currently available traffic data predicts changes in AM, PM and IP peak hours total vehicle flows as a result of a proposed third river crossing in the anticipated year of the scheme opening 2023. The AM and PM flows have been summed and then assessed for change to gauge the likely changes in annual average weekday traffic which is the traffic flow descriptor used to assess road traffic noise.
- 4.5.6 The road links with potentially significant traffic changes for noise impact, based on

changes in traffic flow, speed or composition, were the same ones for all the options and are as follows:

- Significant increases in traffic flow are anticipated on William Adams Way between the A12 roundabout and the scheme tie in point at the Suffolk Road junction;
- There are also significant increases in traffic flow predicted on St Denes Road, again at the scheme tie in point on the eastern bank of the scheme; and
- Significant decreases in traffic flow are predicted to occur on Suffolk Road and Southtown Road.

4.5.7 The above changes are broadly similar across the options – 32, 33 and 37.

#### *Defra Noise Important Areas*

4.5.8 Defra NIAs are locations where the 1% of the population are affected by the highest noise levels from major roads according to the results of Defra's strategic noise maps.

4.5.9 There are no Defra NIAs within 600m of the scheme location. There are a number of NIAs within the wider area of Great Yarmouth at distances between 600m and further away from the scheme location which are associated with high levels of road traffic noise on the A12 and the A149 to the north. The closest is NIA number 4989 for which the noise making authority is Highways England.

#### *Options Appraisal*

4.5.10 An overall adverse impact is expected as sensitive because receptors close to the options are anticipated to experience an increase in noise impact as a result of increased traffic flows and new road alignments/widening. It is worth noting that the noise impact on the wider network is unknown.

4.5.11 One of the aims of the proposed third crossing of the River Yare is to relieve congestion on the wider Great Yarmouth road network. A reduction in traffic flows could result in decrease in noise impact on the existing network. However, any improvement scheme that relieves congestion could serve to attract additional traffic to the vicinity which could result in increases in noise and vibration.

4.5.12 Option 37 is marginally further away from sensitive receptors across all banding zones (see Table 4-2), therefore, this option could be expected to result in the lowest impact of the options proposed.

4.5.13 Confirmation of changes to traffic characteristics along the scheme and the wider road network would be required to inform a more in-depth assessment.

4.5.14 The level of uncertainty in this appraisal is considered high due to the methodology being primarily based on one parameter - a count of sensitive receptors.

## 5 Air Quality

### 5.1 Introduction

- 5.1.1 This chapter provides a review of the options associated with the proposed Great Yarmouth Third River Crossing. A high level environmental appraisal has been conducted in accordance with the WebTAG methodology for air quality.
- 5.1.2 The proposed Great Yarmouth third river crossing will change the physical arrangement of the local road network and therefore result in changes to vehicle flow volumes, composition, and speeds. As such, there is the potential for local and regional concentrations of air pollutants to be affected by changes in vehicle emissions associated with the scheme.
- 5.1.3 Emissions of oxides of nitrogen (NO<sub>x</sub>), nitrogen dioxide (NO<sub>2</sub>), and particulates with an aerodynamic diameter of 10µm or less (PM<sub>10</sub>) and particulates with an aerodynamic diameter of 2.5µm or less (PM<sub>2.5</sub>) from vehicle exhausts are of primary concern with respect to air pollution within urban areas of the UK.
- 5.1.4 The relevant national air quality standards and objectives for NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>, as prescribed through the Air Quality Strategy and most applicable for the appraisal of air quality, are presented in Table 5-1.

Table 5-1: Relevant National Air Quality Standards and Objectives

Pollutant	Averaging Period	Air Quality Standard		Objective Date
		Concentration	Allowance	
Nitrogen dioxide (NO <sub>2</sub> )	1-Hour	200µg/m <sup>3</sup>	18 exceedances per calendar year (*)	31/12/05 <sup>1 2</sup>
				01/01/10 <sup>3 4</sup>
	Annual	40µg/m <sup>3</sup>	-	31/12/05 <sup>1 2</sup>
				01/01/10 <sup>3 4</sup>
Particulates (PM <sub>10</sub> )	24-Hour	50µg/m <sup>3</sup>	35 exceedances per calendar year (**)	31/12/04 <sup>1 2</sup>
				01/01/05 <sup>3 4</sup>
	Annual	40µg/m <sup>3</sup>	-	31/12/04 <sup>1 2</sup>
				01/01/05 <sup>3 4</sup>
Particulates (PM <sub>2.5</sub> )	Annual	25µg/m <sup>3</sup>	-	01/01/15 <sup>4</sup>

\* Expressed as the 99.79<sup>th</sup> percentile of hourly mean concentrations

\*\* Expressed as the 90.41<sup>st</sup> percentile of daily mean concentrations

- 1) Air Quality (England) Regulations 2000
- 2) Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 Vol 2
- 3) EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe
- 4) Air Quality Standards Regulations 2010

## 5.2 Appraisal Methodology

### *Local Air Quality Appraisal*

- 5.2.1 TAG Unit A3<sup>3</sup> presents the methodology for assessing and valuing air pollution associated with the operation of the scheme.
- 5.2.2 The WebTAG appraisal methodology is based upon the screening of traffic data against the criteria for local and regional air quality as defined in the DMRB, Volume 11, Section 3.
- 5.2.3 To define the study area for the local air quality assessment, the following criteria apply:
- Road alignment will change by 5m or more; or
  - Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more; or
  - Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
  - Daily average speed will change by 10km/hr or more; or
  - Peak hour speed will change by 20km/hr or more.
- 5.2.4 To define the study area for the regional emissions assessment, the following criteria apply:
- A change of more than 10% in AADT; or
  - A change of more than 10% to the number of heavy duty vehicles; or
  - A change in daily average speed of more than 20km/hr.
- 5.2.5 The screening of traffic data against the DMRB Local and Regional assessment criteria given above determines the Affected Road Network (ARN).
- 5.2.6 For this high level WebTAG appraisal exercise traffic data in a format comparable with the DMRB screening criteria were not available, instead, forecast model flows for the AM and PM peak and Inter-peak Period (IP) were provided for the following scenarios and scheme options:
- 2023 (Opening Year) DM;
  - 2023 (Opening Year) DS Option 32; and
  - 2023 (Opening Year) DS Option 37.
- 5.2.7 In view of the above, a WebTAG compliant appraisal has therefore not been possible

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<sup>3</sup> The Department for Transport (2013 as amended 2016) *Transport Analysis Guidance: WebTAG Unit A3 Environmental Impact Appraisal*

with the traffic data available at this stage. In place of screening AADT traffic data against the DMRB screening criteria to determine where local air quality is likely to be impacted by the proposal, a comparison of the DM ('without scheme') and DS ('with scheme') traffic data has been made to determine if there is a predicted increase in traffic flows as a result of the options. It has not been possible to define the ARN based upon the available traffic data therefore a high level approach has been taken focussing on the road links that are part of each scheme option and those links that are situated in the immediate surrounding area of the scheme options. If this scheme progresses, it is recommended that a full WebTAG appraisal is conducted using appropriate traffic data.

5.2.8 Traffic data for Option 33 was not available, therefore Option 33 has been assessed based on the Option 32 traffic data as advised by a traffic specialist. The air quality impact is not expected to be significantly different between Option 32 and Option 33 based upon the similarity of the two designs. It is expected that should Option 33 be selected for the Full Business Case, that traffic data, specific to Option 33 would be provided for the air quality assessment and appraisal.

5.2.9 WebTAG requires that the number of sensitive properties within 200m of the ARN is calculated, however it has not been possible to define the ARN with the traffic data available. To enable a high level comparison of the options the number of potentially sensitive properties within 200m of each option design has been calculated and split within bands of 50m using detailed OS mapping and Address Base Plus data to enable a high level assessment of the potential for local air quality impacts resulting from the change in vehicle flows associated with the DS scenario. This has enabled a comparison of the potential for the options to impact on sensitive receptors. Sensitive receptors as defined in HA207/07 Section 11.3.1 for air quality, include:

- Residential dwellings;
- Designated ecological sites;
- Locations of the young and elderly (nurseries and care homes);
- Hospitals; and
- Schools.

#### *Regional Air Quality Appraisal*

5.2.10 For regional air quality, the key pollutant for appraisal purposes is NO<sub>x</sub>, which can be transported in the lower atmosphere over large distances, having the potential to contribute to regional air pollution through the formation of ozone. Carbon dioxide (CO<sub>2</sub>), emissions can also be transported over large distances within the atmosphere and has a high atmospheric residence time, are considered within the greenhouse gases appraisal.

5.2.11 WebTAG requires that the potential implications for regional air quality, as a result of each option are assessed on the basis of screening traffic data for the DM and DS scenarios against the DMRB regional air quality criteria given in paragraph 5.2.2, to identify the number of road links predicted to experience an increase in traffic flows. In absence of traffic data that is suitable for DMRB Regional screening, a traffic comparison exercise has been conducted to identify the number of road links



predicted to experience an increase or decrease in traffic. A high level assessment of potential regional air quality impacts related to traffic emissions as a result of the scheme options has been undertaken for the purposes of the OBC based upon increase and decrease in traffic flows.

### *Future Modelling*

- 5.2.12 The above approach to appraising air quality represents an initial, high-level qualitative review of potential air quality impacts associated with the scheme options. The FBC will include a detailed air quality modelling study, which will enable a comprehensive assessment of local and regional air quality impacts and air pollution valuation to be completed, in accordance with DMRB HA207/07 and WebTAG Unit A3.
- 5.2.13 The FBC WebTAG appraisal will consider the scheme Opening Year (2023) and Design Year which is 15 years after opening (2038).

### *Baseline Review*

- 5.2.14 A desk study was undertaken to inform the appraisal of options developed for the OBC. The desk study comprised a review of baseline air quality at the location of the scheme and the surrounding area.
- 5.2.15 This section provides a brief review of local air quality associated with the scheme location and surrounding area and within the context of relevant national air quality standards and objectives.
- 5.2.16 The following data and information were used to inform the baseline review of air quality:
- Presence of AQMAs within Great Yarmouth Borough – designated as locations where a national Air Quality Strategy Objective(s) is not being and / or not likely to be achieved;
  - Defra's local air quality background data for the 1 x 1km<sup>2</sup> grids covering the scheme and surrounding area<sup>4</sup>;
  - Identification of Defra Pollution Climate Mapping (PCM) model links within study area. PCM links are roads that are included in the Defra model used in conjunction with measured concentrations from Defra's national monitoring network to provide an air quality assessment that is reported to the European Commission in accordance with European Directives;
  - Presence of ecologically designated sites (Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Ramsar, and SSSIs) that could be affected by NO<sub>x</sub> within 1km of the scheme's location; and
  - Local Authority air quality monitoring data as contained within the Great Yarmouth Borough Council's local air quality review and assessment reports

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<sup>4</sup> Defra (2015) Air Pollution Background Maps [online] <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html> as accessed on the 14/10/16.

provided by the Environmental Health Officer for Great Yarmouth Borough Council.

### 5.3 Existing Environment

#### *Air Quality Management Areas*

- 5.3.1 Great Yarmouth Borough Council does not have any AQMAs<sup>5</sup>. This is an indication that the baseline air pollutant levels within Great Yarmouth Borough and in proximity to the scheme location are not likely to be exceeding the respective national air quality objective concentrations in Table 5-1.

#### *Designated Sites Sensitive to NO<sub>x</sub>*

- 5.3.2 DMRB HA207/07 states that statutory designated conservation sites may be sensitive to NO<sub>x</sub> and nitrogen deposition, which can have direct and indirect impacts upon vegetation, affecting species composition and ecosystem health.
- 5.3.3 The Defra Multi Agency Geographical Information System for the Countryside (MAGIC) website<sup>6</sup> was used to identify statutory designated ecological sites such as SSSIs, SACs, SPAs and Ramsar sites in the vicinity of the scheme. In accordance with DMRB HA207/07, designated ecological sites within 200m of the ARN should be assessed with respect to changes in air quality. As the ARN could not be defined at this stage a search for designated sites situated within 200m of the scheme options has been completed. There are no designated sites which fall under the definition prescribed by DMRB HA207/07, which may be affected by NO<sub>x</sub> emissions as a result of any of the options.

#### *Air Quality Monitoring in Great Yarmouth Borough*

- 5.3.4 Great Yarmouth Borough Council undertakes ambient monitoring of NO<sub>2</sub> across the borough through the operation of a continuous chemiluminescent monitoring station at Gorleston and passive NO<sub>2</sub> diffusion tubes across 11 sites.
- 5.3.5 There are four NO<sub>2</sub> diffusion tubes within 500m of the scheme. The results from these diffusion tubes, as reported in the 2016 Air Quality Annual Status Report, are presented in Table 5-2.

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<sup>5</sup> Department for Environment, Food and Rural Affairs (Defra) (2015) Air Quality Management Areas [online] <http://uk-air.defra.gov.uk/aqma/> as accessed on the 14/03/17.

<sup>6</sup> Defra (2016) MAGIC Geographic Information about the Natural Environment from across Government [online] <http://magic.defra.gov.uk/> as accessed on 14/10/16.

Table 5-2: Great Yarmouth Borough Nitrogen Dioxide Diffusion Tube Monitoring

Site ID	Location	OS Grid Reference		Annual Mean NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )				
		X	Y	2011	2012	2013	2014	2015
DT7	41 Southgates Rd	652611	306223	24.3	23.8	20.8	22.9	20.9
DT8a	Maltings House (1)	652492	305612	20.3	18.5	18.2	17.8	16.0
DT8b	Maltings House (2)	652492	305612	19.9	18.3	14.3	16.9	16.3
DT8c	Maltings House (3)	652492	305612	19.5	17.8	17.2	15.4	15.7
<b>NO<sub>2</sub> Annual Mean Objective</b>				<b>40µg/m<sup>3</sup></b>				

- 5.3.6 The results demonstrate that there were no exceedances of the national objective for NO<sub>2</sub> since 2011 at the aforementioned NO<sub>2</sub> diffusion tube monitoring sites. This further establishes that levels of NO<sub>2</sub> remained fairly stable over this period. The diffusion tube sites at Maltings House are co-located with the Gorleston continuous monitoring station.
- 5.3.7 The continuous monitoring station is positioned at Maltings House, Malthouse Lane, Gorleston, Great Yarmouth and is classified as an urban background monitoring location. This location is situated approximately 340m to the south of the options.
- 5.3.8 Annual mean NO<sub>2</sub> data from 2011 to 2015 taken from the continuous monitoring station location is presented in Table 5-3, and this was sourced from the 2016 Air Quality Annual Status Report<sup>7</sup>.

Table 5-3: Great Yarmouth Borough Council Nitrogen Dioxide Continuous Monitoring

Site ID	Location	Type	OS Grid Reference		Annual Mean NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )				
			X	Y	2011	2012	2013	2014	2015
<b>CM1</b>	Gorleston	Urban BKG	652492	305612	20.0	18.8	18.2	17.1	16.8
<b>NO<sub>2</sub> Annual Mean Objective</b>					<b>40 µg/m<sup>3</sup></b>				

- 5.3.9 The results presented in Table 5-3 indicate that exceedance of the annual mean NO<sub>2</sub> objective has not been recorded at the continuous monitoring station between 2011 and 2015.
- 5.3.10 At present, PM<sub>2.5</sub> particulate monitoring is not undertaken by Great Yarmouth Borough Council. However, the council is considering the following measures to address PM<sub>2.5</sub>:
- Reviewing current air quality monitoring arrangements and assessing feasibility to sample ambient atmospheric concentrations of PM<sub>2.5</sub> within the borough by the 2017-18 financial year;

<sup>7</sup> Great Yarmouth Borough Council (2016) 2016 Air Quality Annual Status Report for Great Yarmouth Borough Council.

- Working through the Norfolk Environmental Protection Group’s (NEPG) Air Quality Sub-Group to ensure regular two-way engagement with representatives of Public Health England, and the Director of Public Health at Norfolk County Council; and
- Dialogue with Officers of Norfolk County Council Highways, and through the NEPG Air Quality Sub-Group on proposed significant changes to highways and traffic flows in the borough, and also considers potential improvements to PM<sub>2.5</sub> exposure during this dialogue.

### Background Pollutant Concentrations

5.3.11 The background pollutant concentrations for NO<sub>x</sub>, NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> are published on Defra’s UK website for every 1km x 1km grid square covering the UK. The background estimates are available throughout the UK for years between 2010 and 2030. The relevant background concentrations which encompasses the scheme location for years 2015 to 2017 are presented in Table 5-4.

Table 5-4: Defra Background Mapped NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> Concentrations Per Grid Square Covering the Scheme Location – 2015 to 2017

Pollutant	Objective Value (annual average concentration µg/m <sup>3</sup> )	X	Y	2015 (µg/m <sup>3</sup> )	2016 (µg/m <sup>3</sup> )	2017 (µg/m <sup>3</sup> )
NO <sub>x</sub>	30*	651500	306500	19.0	18.2	17.4
NO <sub>2</sub>	40			13.6	13.1	12.6
PM <sub>10</sub>	40			15.4	15.3	15.1
PM <sub>2.5</sub>	25			10.9	10.8	10.7
NO <sub>x</sub>	30*	652500	306500	22.7	21.8	20.8
NO <sub>2</sub>	40			15.9	15.3	14.7
PM <sub>10</sub>	40			15.5	15.3	15.2
PM <sub>2.5</sub>	25			11.2	11.1	10.9
NO <sub>x</sub>	30*	653500	306500	16.7	16.1	15.5
NO <sub>2</sub>	40			12.1	11.7	11.3
PM <sub>10</sub>	40			13.9	13.8	13.7
PM <sub>2.5</sub>	25			10.1	10.0	9.9
NO <sub>x</sub>	30*	651500	305500	19.1	18.3	17.6
NO <sub>2</sub>	40			13.6	13.1	12.6
PM <sub>10</sub>	40			15.0	14.9	14.7
PM <sub>2.5</sub>	25			10.8	10.7	10.5
NO <sub>x</sub>	30*	652500	305500	24.7	23.7	22.6
NO <sub>2</sub>	40			17.1	16.4	15.8
PM <sub>10</sub>	40			16.1	15.8	15.5
PM <sub>2.5</sub>	25			11.6	11.4	11.2
NO <sub>x</sub>	30*	653500	305500	16.5	15.9	15.2
NO <sub>2</sub>	40			11.9	11.5	11.1
PM <sub>10</sub>	40			14.0	13.8	13.7
PM <sub>2.5</sub>	25			10.1	10.0	9.9

\* All background concentrations were obtained from the latest 2013 based background maps. The values are rounded to 1 decimal place.

- 5.3.12 The highest background NO<sub>2</sub> concentration between 2015 and 2017 (17.1µg/m<sup>3</sup>) covers the area of the A12, the A143 / B1370 Church Road roundabout and several other minor roads in close proximity to Fisherman's Wharf in 2015. All background concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> recorded in this period are below the relevant annual mean objectives.

#### *Pollution Climate Mapping Links*

- 5.3.13 PCM modelling is undertaken by Defra to produce 1km x 1km background pollutant concentrations, such as those presented in Table 5-4 above, in addition to producing approximately 9,000 representative roadside pollutant concentrations based on a national network of road-link specific emissions.
- 5.3.14 These modelled data are used to fulfil part of the UK's commitment to the requirements of EU Directive (2008/50/EC)<sup>8</sup> to report on the concentrations of particular pollutants in the atmosphere, which includes NO<sub>x</sub>, NO<sub>2</sub>, and PM<sub>10</sub>.
- 5.3.15 The PCM road links located within 200m of the scheme's location, for which a roadside pollutant concentrations are produced by PCM modelling, were identified. The respective modelled roadside NO<sub>2</sub> concentrations for the years 2013, 2015, 2020, 2025 and 2030 are provided in Table 5-5.

*Table 5-5: PCM Links within 200m of each Option*

Road Name / Number	Census ID	PCM Roadside NO <sub>2</sub> (µg/m <sup>3</sup> )				
		2013	*2015	2020	2025	2030
A12	29011	32.0	29.4	23.0	19.0	18.0

*\*2015 concentrations were obtained by linear interpolation based on the change between year 2013 and year 2020 PCM Roadside NO<sub>2</sub> concentrations.*

- 5.3.16 The PCM modelled roadside NO<sub>2</sub> data for all links identified within 200m of the scheme showed that the 40µg/m<sup>3</sup> annual mean objective is not predicted to be exceeded by 2030.

## **5.4 Local Air Quality Appraisal**

- 5.4.1 Total traffic flows for the AM and PM peak periods and for the Inter Peak (IP) period were provided for the opening year (2023) DM and DS scenarios for each option and associated study area were provided by a traffic specialist. With the traffic data available at this stage a comparison exercise was completed to identify the links experiencing an increase or decrease in flows per option. The results of this analysis for each option are given in Table 5-6.

<sup>8</sup> The European Parliament and the Council of the European Union (2008) *Ambient Air Quality Directive (2008/50/EC)*

Table 5-6: Number of Road Links with an Increase or Decrease in Flow (2023 Do Something versus Do Minimum)

Flow change	Option 32	Option 33	Option 37
	No. links	No. links	No. links
Increase	21	21	19
Decrease	16	16	18
New Road Links	2	2	2
Total Links	39	39	39

5.4.2 WebTAG requires that the number of potentially sensitive receptors within 200m of the ARN are calculated. In the absence of a defined ARN, the number of potentially sensitive receptors within 200m of each option was obtained using OS Address Base Plus data. The results of these analyses for each option are presented in Table 5-7.

Table 5-7: Number of Sensitive Receptors within 200m of Each Option

Distance bands (m)	Number of Properties per Distance Band	
	Options 32 and 33	Option 37
0 to 50	32	27
50 to 100	54	34
100 to 200	166	145
Total	252	206

5.4.3 The address data review indicates that Options 32 and 33 have a greater number of potentially sensitive receptors situated within 200m of their design footprint than Option 37.

5.4.4 The traffic data comparison and review indicates that Options 32 and 33 have the greatest number of key links – Table 5-6 (the scheme and roads immediately surrounding the scheme), for which traffic data has been provided by a traffic specialist, experiencing an increase in traffic flow based upon combined AM, IP and PM flow data.

5.4.5 As the scheme is to build an additional bridge over the River Yare, it is likely that the traffic would reduce on the existing road links around the existing bridge. In view of this and the absence of an AQMA in the vicinity of the scheme, an overall neutral local air quality impact is considered most likely for each option.

5.4.6 Nevertheless, further detailed air quality dispersion modelling using Atmospheric Dispersal Modelling Software (ADMS) ADMS-Roads is required to predict the magnitude of local air quality impact relating to each scheme, which will take account of other key variables such as link speed, HDV percentage, and meteorology.

## 5.5 Regional Air Quality Appraisal

5.5.1 The review of 2023 DM and DS traffic data for the options is presented in Table 5-6, showing the number of links predicted to experience an increase or decrease traffic

flows (combined AM, PM and IP flows).

- 5.5.2 As the scheme is to provide an additional passing bridge over the River Yare, it is likely that the total vehicle mileage travelled will be reduced and there regional emissions reduced. However, in the absence of AADT traffic data, a conclusion as to the number of links expected to experience a change in excess of the DMRB AADT criterion could not be made. Based upon the period flow data available, and taking into account the expected improvements in traffic congestion as a result of the scheme an overall beneficial impact in emissions is considered most likely for each option. It should be noted that the scores provided are based on traffic data for the AM, PM and Inter-Peak periods only and not 24hr AADT traffic data, therefore the scores may be subject to change when the quantitative assessment is completed.

## 6 Townscape

### 6.1 Introduction

6.1.1 The following sections provide an appraisal of potential townscape effects relating to the proposed third crossing of the River Yare at Great Yarmouth. The appraisal describes and evaluates the townscape resource of the study area, reports on the potential changes as a result of the different options under consideration and makes an informed prediction of the likely effects.

### 6.2 Appraisal Methodology

6.2.1 A desk study has been undertaken to inform the appraisal of the options developed for the OBC. This desk study has included a review of designated and non-designated sites from the sources identified below:

- OS mapping and a site walk-over to identify the location of visual receptors;
- Information from the Local Planning Authority regarding townscape appraisals, conservation area appraisals and local plan policies relating to townscape; and
- The location and nature of any significant planned development in the area.

6.2.2 The study area for the townscape appraisal has been driven by the geographical scope of the options developed for the OBC. An initial walk-over survey by an appropriately qualified and experienced landscape architect has been undertaken to inform the appraisal and the extent to which the options may influence the perception of townscape within Great Yarmouth and its immediate environs.

6.2.3 The proposed bridge, being an animated structure will enact varying degrees of visibility and accordingly townscape influence. When closed its potential for influence is limited by the river corridor environs and the immediate local urban context surrounding the scheme. When open however, the bridge will be a temporary but much more visible component of townscape; in this regard the study area has considered the wider townscape setting of Great Yarmouth, from Gorleston-on-Sea at the mouth of the Yare and north to the historic townscape frontages of South Quay, the Haven Bridge and as a backdrop to the Broads National Park on the north and west fringes of the town.

6.2.4 The appraisal has followed the process described in TAG Unit A3 Chapters 5 and 7. The methodology for appraising the impact on the townscape follows the five step general approach to appraising 'environmental capital':

- Step 1: Scoping and identification of study area (as set out above);
- Step 2: The identification of the key townscape environmental resources and describing their features. In order to accurately assess the character of the key townscape environmental resources, it was necessary to identify and describe the features of the townscape as per the guidance set out in TAG Unit A3 Chapter 7. Therefore the townscape features have been described in terms of their layout, density and mix, scale, appearance, human interaction,



cultural and land use to allow a summary of the townscape character to be developed;

- Step 3: The townscape appraisal has been undertaken against the following set of indicators to establish the significance of each key townscape resource: scale it matters, rarity, importance substitutability, and baseline changes;
- Step 4: An impact assessment has been undertaken of the options under consideration for the OBC on the significance of the townscape. All impacts on the townscape, both adverse (damaging) and beneficial (enhancing) have been identified along with their predicted magnitude. The appraisal process has addressed how the options could impact on and change:
  - The character of key townscape environmental resources, such as effects on the locally distinctive pattern of townscape features;
  - The ambience of an urban area and the way people interact with the key townscape environmental resource; and
  - The tolerance of the key townscape environmental resource to accommodate further change.
- Step 5: The townscape effects on the townscape have been summarised from the Townscape Appraisal Worksheets (see Section 6.5) for inclusion in the ASTs for the options. These are based on the seven point scale for scoring of effects in line with the guidance set out in TAG Unit A3 Chapter 7.

6.2.5 The appraisal has adopted the following design assumptions for each of the alternatives as presented:

- The long term development and regeneration aspirations for the River Yare and its environs in accordance with the Great Yarmouth Waterfront Area Action Plan;
- A bascule bridge form, with opening spans rising to a vertical height of 31.5m above its closed elevation;
- The incorporation of appropriate landscape mitigation and planting provision in relation to new road infrastructure; and
- The narrowing of the river width to accommodate the bridge may allow the scope for environmental enhancement measures, however this has not informed the comparison of the options.

### 6.3 Existing Environment

6.3.1 Great Yarmouth, situated at the mouth of the River Yare on Norfolk's east coast, has a varied townscape quality arising from its maritime history, its Victorian expansion as a holiday destination and in latter times its continued evolution as a recreational and tourism focus.

6.3.2 The historic and retail core of the town is centred on a broad and linear marketplace, a mixture of intact historic street pattern intervened by larger scale retail development. A fine grain of interconnecting residential street pattern surrounds this core, linking with the more formal Victorian parades and open green spaces along the seafront, for which Great Yarmouth is most familiarly identified. Within the scheme area, there are four Conservation Areas.

6.3.3 The River Yare is an integral aspect of Great Yarmouth's townscape, its course defining the western edge of the promontory on which the main town is situated. It

provides a point of passage and haven for private and commercial craft between the inland waterway network of the Broads and the coastal waters of the North Sea. The river townscape is largely industrial but with areas of recognised high quality and appealing quayside frontage along South Quay near the existing bridge crossings. The river defines a sense of arrival, with open prospects along the river corridor and in particular from the South Quay, Haven Bridge and towards the river mouth at Gorleston-on-Sea.

- 6.3.4 In the vicinity of the scheme, the river townscape is a fragmented mix of residential and port-related development. Residential terraces define a largely continuous frontage along the western riverside, with the eastern margin flanked by warehouses, storage yards and larger, maritime related infrastructure. The overriding character is of a locally maritime and generally unremarkable townscape quality, with little in the way of townscape definition beyond the immediate confine of the river itself.
- 6.3.5 Despite the mixed townscape quality there is a sense of movement and passage throughout the river corridor, where larger vessels moor along the urban quaysides and animate the river setting with a sense of dynamic, temporary change of aspect. The existing lift bridges form a part of this animation and of river character. The temporary visibility of lift bridges, set above and against the residential and industrial skyline is an aspect of the town's character.
- 6.3.6 West of the River Yare, residential and retail development define a generally unremarkable hinterland townscape. Development is low rise and of medium density, interspersed by pockets of open land. Southtown Common Recreation Ground and adjoining allotments provide an established vegetation buffer and a well-used facility between neighbouring residential areas and the A12 road corridor.
- 6.3.7 The broad expanse of the Norfolk landscape is evident immediately beyond the developed fringes of Great Yarmouth. The Norfolk Broads National Park borders the town to its west and north, an exposed river, estuary and wetland landscape with often far reaching views. The low skyline of Great Yarmouth and its exposed industrial edge forms a backdrop to Breydon Water, with the National Park boundary extending to the confluence of the Rivers Yare and Bure at the very edge of the town.

## **6.4 Brief Evaluation of Topic Related Constraints**

- 6.4.1 The Broads National Park, bordering Great Yarmouth to its immediate north and west is influenced by the low skyline and industrial fringe of the town. Changes to townscape setting, in particular to the skyline of the town may have the potential to influence the perception of landscape from within the Park. The river is also a point of passage to and from the inland waterway network, and so as a gateway becomes an indirect part of visitor experience.
- 6.4.2 There are no other designations that relate directly to townscape in the immediate area of the scheme. The river corridor does however contribute to setting and there are open vistas along the river corridor, from existing bridging points and from areas of more established, historic townscape character. The bridge crossing will be a visible structure with the potential to add or detract from both local townscape and that of the wider river context.
- 6.4.3 Public open green space provision in the vicinity of the scheme is well screened from surrounding development. There is a potential for significant effect on its setting as a

consequence of any loss of established boundary vegetation.

- 6.4.4 The dynamic form of a bascule bridge means that when open, the structure has the potential to be a much more influential aspect of townscape form, albeit temporarily. This nature of change and its potential influence is considered in the appraisal of options.

## **6.5 Townscape Appraisal - WebTAG Worksheets**

- 6.5.1 For each of the options assessed, the following reference sources have been utilised:
- Great Yarmouth Core Strategy 2013 - 2030 (Great Yarmouth Borough Council Local Development Framework (LDF))
  - Great Yarmouth Waterfront Area Action Plan (LDF)
  - Great Yarmouth Borough Landscape Character Assessment (April 2008)

Option 32 - Townscape Worksheet

Option 32 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
<b>Layout</b>	<p>The town layout is heavily influenced by the Rivers Yare and Bure, which define the promontory upon which Great Yarmouth is sited. Between seafront and river, the historic and retail core of the town is centred on a broad and linear marketplace, a mixture of intact historic street pattern intervened by larger scale retail development. A fine grain of interconnecting residential street pattern surrounds this core, linking with the more formal parades and open green spaces of the seafront.</p> <p>Townscape layout is heavily fragmented where residential areas abut with the coarser grained, working quayside environments alongside both sides of the River Yare. Beyond the river to the west, the hinterland of Great Yarmouth is comprised largely of residential streets and estates interspersed with open green space, encompassing the A12 road corridor and extending south to the seaside town of Gorleston-on-Sea at the mouth of the Yare. The expanse of Harfreys Industrial Estate, in the immediate vicinity of scheme at Southtown, is a noticeable interruption of this otherwise residential framework, beyond which the horizontal expanse of the fen landscape frames the town.</p>	The townscape layout in the vicinity of the proposed crossing, both east and west of the River Yare, matters at a local scale.	<p>Conservation Areas (CA) to the north (town centre areas and seafront) would suggest local rarity.</p> <p>The river itself is a formative feature of the town.</p> <p>Local to the scheme location, layout has no rarity value.</p>	<p>The town centre areas defined by the CA and the historic seafront townscape layout is of high importance at a local level.</p> <p>The river corridor setting is of moderate importance at a local level, where established historic frontages face toward the Bure.</p>	<p>The seafront and river context are not readily substitutable.</p> <p>Townscape layout elsewhere is substitutable.</p>	Townscape Layout would not substantially alter.	<b>Neutral</b> The local townscape pattern would not substantially alter as a consequence of the change of road layout.
<b>Density and mix</b>	<p>The River Yare corridor is largely industrial in character, though set alongside areas of terraced residential frontage and, to the north of the proposed bridge crossing a more defined historic quayside of greater density.</p> <p>The retail core of the town is of small and medium density development, with recreational facilities focused along the sea front and along several linking routes into the town. Around this core is largely residential land use of a consistent, moderate property density.</p>	Composition and distribution within the townscape matters at a local scale.	<p>The CA would suggest local rarity in respect of the seafront context and buildings fronting the Bure to the south.</p> <p>No perceived rarity elsewhere.</p>	<p>The density and composition of the seafront townscape and that of the River Yare corridor matters at a local level.</p>	Density and mix are substitutable.	Density and mix of townscape would not substantially change or differ.	<b>Neutral</b> The density and mix of development will not substantially differ.
<b>Scale</b>	<p>The vertical scale of townscape across Great Yarmouth is broadly low and consistent, the area being of a flat topography with no particular dominance of built development occupying its skyline.</p> <p>The sea front forms a prominent vista, with 3-4 storey buildings flanking the main promenade. The retail core has some massing of larger scale development, but aside of this the residential and retail scale of the town is predominantly low rise.</p> <p>The River Yare is of a broad horizontal scale with key vistas along its course, these being evident from the approaches to the town and across its bridging points. It is a key contextual reference to the town, its bridges being of prominence locally and the river providing a sense of place and scale in positioning the town within the exposed, wider landscape context. Structures associated with the industrial quayside are of a prominent scale locally.</p>	The scale of the local townscape matters at a local level.	<p>The scale of the River Yare through the urban fabric of Lowestoft has a rarity value, although expansive inland waterspace is a feature of the nearby rural Broads landscape.</p>	<p>The scale of the river corridor is of local importance, being a visible and defining feature.</p> <p>The seafront townscape is important at a local level in respect of identity.</p>	The scale of the townscape is substitutable.	The scale of townscape in vicinity of the scheme would significantly change in a without scheme case.	<b>Neutral</b> The bascule bridge would be in scale with the river environment. It would however alter townscape scale temporarily at a local level when opened, although not out of context with the setting and in character with other bridges locally.
<b>Appearance</b>	<p>The town has a mix of architectural styles. The seafront has an established and regular townscape appearance where 3 and 4 storey Victorian terraces and civic buildings flank the promenade. Other more recent modifications and recreational developments along the promenade and along main streets into the town are of mixed quality, some of which impact negatively on townscape appearance.</p> <p>The quayside frontages of South Quay alongside the River Yare have a well-defined, intact townscape form. However the majority of the river corridor through the town is industrial by nature and generally of low quality appearance. While the river setting is contained, the larger storage towers and warehouses alongside the river corridor are visible elements of the townscape.</p>	The appearance of the river townscape matters at a local scale.	<p>The appearance of the buildings and structures that surround the River Yare in the vicinity of the scheme are unremarkable.</p> <p>CA elsewhere in the town would suggest a recognised level of rarity.</p>	<p>The appearance of the seafront townscape and its architecture is important at a local level in terms of identity.</p> <p>The river corridor has limited importance in appearance.</p>	The townscape appearance is substitutable. The potential for townscape change in and around the river setting is high.	The likely nature of townscape change and its influence on the setting would not substantially differ.	<b>Neutral</b> The introduction of a new road bridge across the river would not significantly alter the appearance of the setting. It would be in keeping with the appearance of the urban river corridor, although would interrupt existing views along the River Yare from vantage points such as The Haven Bridge & South Quay.

Option 32 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
	Residential development is generally unremarkable and townscape value quickly diminishes beyond the town core.						Views along the river corridor and of the bridge in an open position would highlight the location within the townscape temporarily.
Human interaction	Great Yarmouth's seafront promenade and its town core are the main areas of focus for social activity and interaction. Outside of these areas the townscape is predominantly residential, reflecting typical levels of associated social activity and function. In the vicinity of the scheme there is a mix of well used open green space and allotments. Interaction along the River Yare is limited to areas of historic and intact frontage, at South Quay in the town and further south towards Gorleston-on-Sea. Elsewhere along the urban river corridor, the over-riding industrial context offers little in the way of interaction.	The scale of human interaction matters mainly at a local level. The town centre, seafront provide the most interaction, with little interaction in the vicinity of the scheme.	The context of the River Yare and immediate setting in respect of interaction matters at a local scale with no inherent rarity.	The current river townscape in the vicinity of the scheme has a low importance in respect of interaction.	The nature of interaction is substitutable.	No change.	<b>Slight Beneficial</b> Improved access for pedestrians/cyclists would improve interaction. There would be some loss of interaction in the immediate community through loss of residential property and allotment space. The provision of the bridge crossing would potentially alleviate pressures on the Haven and Breydon Bridge locations to the north, allowing greater interaction benefits for this area of locally important townscape.
Cultural	Great Yarmouth's history as a fishing town and subsequently its development as a seaside resort is reflected by its townscape and architecture. The Victorian seafront and its recreation focus is a characteristic aspect of the town, which to a large degree creates a cultural identity. Within the town there are specific buildings and architectural frontages that reference the town's maritime heritage, with a sense of cultural time depth and isolated townscape quality. The River Yare is closely linked with the cultural character of the town, integral to its townscape and from its past and ongoing maritime use.	The river and its formative role in the townscape evolution matter at a local scale.	Rarity in the river townscape is limited to those areas of intact historic frontage, north and south of the proposed bridging point.	The association of Yarmouth as a seaside destination, and point of passage to inland waterways are important cultural aspects of the town, its townscape elements derived from this cultural baseline.	The cultural heritage of townscape features is not substitutable. Cultural change by its essence is ongoing and will modify townscape.	Cultural change would not differ in a without-scheme scenario.	<b>Neutral</b> The scheme would introduce a new built feature into the river corridor townscape, visible temporarily as a landmark/reference and potentially changing cultural perception of the location.
Land use	The town core and seafront comprises a mix of retail and commercial land use, with the town relying heavily on leisure as a focus. The urban river corridor comprises a mixture of predominantly maritime and industrial activity. Outside of these areas, land use is predominantly residential with linked facilities. Light industry is focused largely within a single industrial estate, to the western fringe of the town.	The associated function of the river in terms of its passage for leisure and commercial craft matters at a local level.	The land use in the immediate vicinity of the river corridor has no rarity value.	Land use and the resulting townscape elements matter at a local level.	Land use is substitutable. However the river as a physical form is not easily substitutable.	The nature of land use change in the vicinity of the river corridor would not substantially alter.	<b>Neutral</b> There would be no significant change of land use as a result of the scheme.
Summary of character	The townscape of Great Yarmouth is defined by the historic and contemporary seafront context of the town; the promontory of land on which Great Yarmouth is historically sited and which has a mixed townscape quality (the older, more intact historic townscape in contrast to surrounding residential development); the division and maritime corridor created by the River Yare and its mix of historic frontage and maritime industrial townscape; the developed hinterland of Great Yarmouth, west of the River Yare and surrounding the A12 link road and the town's relative exposure as a settlement within the wider fen landscape. In the vicinity of the scheme, townscape character is a fragmented mix of residential and industrial development. Alongside the river corridor, residential terraces define a largely continuous frontage along the western river edge, whereas the eastern margin is flanked by low warehouses, storage yards and larger, maritime related infrastructure. The overriding character is locally	Scale matters at a predominantly local level, with CA designations emphasising the significance of the relative scale of the seafront townscape.	The CA would suggest local rarity in respect of the seafront context. No perceived rarity of townscape in the vicinity of the scheme.	The appearance of the seafront townscape and its architecture is important at a local level in terms of identity. The existing river character is of no importance in the vicinity of the scheme.	The majority of the townscape surrounding the river corridor is substitutable, although the character of the town centre and seafront not readily so.	The townscape evolution around the River Yare in the area of the scheme would not significantly change in a without-scheme case.	<b>Neutral</b> The introduction of the bridge would not significantly alter the townscape character within Great Yarmouth. However the bridge form would serve temporarily as a visual reference and landmark, heightening a sense of townscape animation along the river corridor. The scheme would alleviate vehicular congestion, benefiting more established and valued

Option 32 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
	maritime but of a poor townscape quality, with little in the way of townscape definition beyond the immediate confine of the river itself.						townscape areas of the town.

*Option 32 Summary Appraisal (including Assessment Score)*

- 6.5.2 The road infrastructure changes to provide access to the bridge crossing would cause the loss of some existing residential townscape and associated allotment resource. However the area does not have a particularly strong or defined townscape value and the layout of the new roundabout and bridge approaches would not represent any material disruption of the nearby Southtown Common Recreation Ground and its established boundaries. Alleviation of vehicular pressure on the Haven and Breydon bridge crossings to the north may potentially improve human interaction potential in this locally more important area of townscape.
- 6.5.3 The bascule bridge crossing would be in context with the urban nature of the river corridor, and would not (other than when open) have any major influence on townscape. Existing vistas along the river corridor may be interrupted or fore-shortened by the structure, although the bridge would not appear out of context in terms of how these views are perceived.
- 6.5.4 The opening of the bridge, estimated at a frequency of 10-20 times daily would temporarily transform the bridge and its visible influence on townscape. When open, the bridge spans would rise to a vertical height of 31.5m above its closed elevation (at 6.9m above the existing quaysides), this would represent a prominent feature in the context of the river corridor and an influence on the wider townscape. The nature of the bridge opening would be similar (though of greater span and height) to other bridges along the river, in that it would represent a dynamic change of townscape but also a potential point of reference, in context with the wider animation of the active urban river space. Overall there would be no direct loss of any perceived rare or important townscape quality, although the bridge may become a skyline feature to views along the river corridor.
- 6.5.5 The height of the fully open bridge structure would be an evident, but distant feature of the Great Yarmouth skyline from within the Broads National Park. It would be perceived in the context of the town as an existing developed and in part industrial backdrop to the Park setting.
- 6.5.6 In summary, the majority of impacts are predicted on balance to have a neutral effect on an area of locally unremarkable townscape quality, although it is observed that the introduction of a third bridge crossing would have a beneficial effect on human interaction (non-motorised users) by way of improved townscape linkages. The bridge would interrupt the existing open aspect of the river corridor and appear as an aspect of townscape from quayside locations to the north and south. The bridge in its temporary open position would be an evident feature of Great Yarmouth's contextual townscape as a skyline feature, although this would not fundamentally change the associated character of the river corridor nor how the town is perceived in context with its surrounding landscape.

Summary Assessment Score: **Neutral**

Option 33 – Townscape Worksheet

Option 33 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
<b>Layout</b>	<p>The town layout is heavily influenced by the Rivers Yare and Bure, which define the promontory upon which Great Yarmouth is sited. Between seafront and river, the historic and retail core of the town is centred on a broad and linear marketplace, a mixture of intact historic street pattern intervened by larger scale retail development. A fine grain of interconnecting residential street pattern surrounds this core, linking with the more formal parades and open green spaces of the seafront.</p> <p>Townscape layout is heavily fragmented where residential areas abut with the coarser grained, working quayside environments alongside both sides of the River Yare. Beyond the river to the west, the hinterland of Great Yarmouth is comprised largely of residential streets and estates interspersed with open green space, encompassing the A12 road corridor and extending south to the seaside town of Gorleston-on-Sea at the mouth of the River Yare. The expanse of Harfreys Industrial Estate, in the immediate vicinity of the scheme at Southtown, is a noticeable interruption of this otherwise residential framework, beyond which the horizontal expanse of the Broads landscape frames the town.</p>	The townscape layout in the vicinity of the scheme, both east and west of the River Yare, matters at a local scale.	<p>Conservation Areas to the north (town centre areas and seafront) would suggest local rarity.</p> <p>The river itself is a formative feature of the town.</p> <p>Local to the scheme location, layout has no rarity value.</p>	<p>The town centre areas defined by the CA and the historic seafront townscape layout is of high importance at a local level.</p> <p>The river corridor setting is of moderate importance at a local level, where established historic frontages face toward the Bure.</p>	<p>The seafront and river context are not readily substitutable.</p> <p>Townscape layout elsewhere is substitutable.</p>	Townscape Layout would not substantially alter.	<b>Neutral</b> The local townscape pattern would not substantially alter as a consequence of the change of road layout.
<b>Density and mix</b>	<p>The River Yare corridor is largely industrial in character, though set alongside areas of terraced residential frontage and, to the north of the scheme a more defined historic quayside of greater density.</p> <p>The retail core of the town is of small and medium density development, with recreational facilities focused along the sea front and along several linking routes into the town. Around this core is largely residential land use of a consistent, moderate property density.</p>	Composition and distribution within the townscape matters at a local scale.	<p>The CA would suggest local rarity in respect of the seafront context and in buildings fronting the Bure to the south.</p> <p>No perceived rarity elsewhere.</p>	The density and composition of the seafront townscape and that of the River Yare corridor matters at a local level.	Density and mix are substitutable.	Density and mix of townscape would not substantially change or differ.	<b>Neutral</b> The density and mix of development will not substantially differ.
<b>Scale</b>	<p>The vertical scale of townscape across Great Yarmouth is broadly low and consistent, the area being of a flat topography with no particular dominance of built development occupying its skyline.</p> <p>The sea front forms a prominent vista, with 3-4 storey buildings flanking the main promenade. The retail core has some massing of larger scale development, but aside of this the residential and retail scale of the town is predominantly low rise.</p> <p>The River Yare is of a broad horizontal scale with key vistas along its course, these being evident from the approaches to the town and across its bridging points. It is a key contextual reference to the town, its bridges being of prominence locally and the river providing a sense of place and scale in positioning the town within the exposed, wider landscape context. Structures associated with the industrial quayside are of a prominent scale locally.</p>	The scale of the local townscape matters at a local level.	<p>The scale of the River Yare through the urban fabric of Lowestoft has a rarity value, although expansive inland waterspace is a feature of the nearby rural Broads landscape.</p> <p>The overall scale of the seafront townscape is relatively scarce within the regional coastal landscape.</p>	<p>The scale of the river corridor is of local importance, being a visible and defining feature.</p> <p>The seafront townscape is important at a local level in respect of identity.</p>	The scale of the townscape is substitutable.	The scale of townscape in the vicinity of the scheme would significantly change in a without scheme case.	<p><b>Neutral</b></p> <p>The bascule bridge would be in scale with the river environment.</p> <p>It would however alter townscape scale temporarily at a local level when opened, although not out of context with the setting and in character with other bridges locally.</p>
<b>Appearance</b>	<p>The town has a mix of architectural styles. The seafront has an established and regular townscape appearance where 3 and 4 storey Victorian terraces and civic buildings flank the promenade. Other more recent modifications and recreational developments along the promenade and along main streets into the town are of mixed quality, some of which impact negatively on townscape appearance.</p> <p>The quayside frontages of South Quay alongside the River Yare have a well-defined, intact townscape form. However the majority of the river corridor through the town is industrial by nature and generally of low quality</p>	The appearance of the river townscape matters at a local scale.	<p>The appearance of the buildings and structures that surround the River Yare in the vicinity of the scheme are unremarkable.</p> <p>CA elsewhere in the</p>	<p>The appearance of the seafront townscape and its architecture is important at a local level in terms of identity.</p> <p>The river corridor has limited importance in appearance.</p>	The townscape appearance is substitutable. The potential for townscape change in and around the river setting is high.	The likely nature of townscape change and its influence on the setting would not substantially differ.	<p><b>Neutral</b></p> <p>The introduction of a new road bridge across the river, including overhead signage gantries would not significantly alter the appearance of the setting. It would be in keeping with the appearance of the</p>

Option 33 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
	appearance. While the river setting is contained, the larger storage towers and warehouses alongside the river corridor are visible elements of the townscape. Residential development is generally unremarkable and townscape value quickly diminishes beyond the town core.		town would suggest a recognised level of rarity.				urban river corridor, although would interrupt existing views along the River Yare from vantage points such as The Haven Bridge & South Quay. Views along the river corridor and of the bridge in an open position would highlight the location within the townscape temporarily.
Human interaction	Great Yarmouth's seafront promenade and its town core are the main areas of focus for social activity and interaction. Outside of these areas the townscape is predominantly residential, reflecting typical levels of associated social activity and function. In the vicinity of the scheme there is a mix of well used open green space and allotments. Interaction along the River Yare is limited to areas of historic and intact frontage, at South Quay in the town and further south towards Gorleston-on-Sea. Elsewhere along the urban river corridor, the over-riding industrial context offers little in the way of interaction.	The scale of human interaction matters mainly at a local level. The town centre, seafront provide the most interaction, with little interaction in the vicinity of the scheme.	The context of the River Yare and immediate setting in respect of interaction matters at a local scale with no inherent rarity.	The current river townscape in the vicinity of the scheme has a low importance in respect of interaction.	The nature of interaction is substitutable.	No change.	<b>Slight Beneficial</b> Improved access for pedestrians/cyclists would improve scope for interaction either side of the river. There would be some loss of interaction in the immediate community through loss of residential property and allotment space. The provision of the bridge crossing would potentially alleviate pressures on the Haven and Breydon Bridge locations to the north, allowing greater interaction benefits for this area of locally important townscape.
Cultural	Great Yarmouth's history as a fishing town and subsequently its development as a seaside resort is reflected by its townscape and architecture. The Victorian seafront and its recreation focus is a characteristic aspect of the town, which to a large degree creates a cultural identity. Within the town there are specific buildings and architectural frontages that reference the town's maritime heritage, with a sense of cultural time depth and isolated townscape quality. The River Yare is closely linked with the cultural character of the town, integral to its townscape and from its past and ongoing maritime use.	The river and its formative role in the townscape evolution matter at a local scale.	Rarity in the river townscape is limited to those areas of intact historic frontage, north and south of the proposed bridging point.	The association of Yarmouth as a seaside destination, and point of passage to inland waterways are important cultural aspects of the town, its townscape elements derived from this cultural baseline.	The cultural heritage of townscape features is not substitutable. Cultural change by its essence is ongoing and will modify townscape.	Cultural change would not differ in a without-scheme scenario.	<b>Neutral</b> The scheme would introduce a new built feature into the river corridor townscape, visible temporarily as a landmark/reference and potentially changing cultural perception of the location.
Land use	The town core and seafront comprises a mix of retail and commercial land use, with the town relying heavily on leisure as a focus. The urban river corridor comprises a mixture of predominantly maritime and industrial activity. Outside of these areas, land use is predominantly residential with linked facilities. Light industry is focused largely within a single industrial estate, to the western fringe of the town.	The associated function of the river in terms of its passage for leisure and commercial craft matters at a local level.	The land use in the immediate vicinity of the river corridor has no rarity value.	Land use and the resulting townscape elements matter at a local level.	Land use is substitutable. However the river as a physical form is not easily substitutable.	The nature of land use change in the vicinity of the river corridor would not substantially alter.	<b>Neutral</b> There would be no significant change of land use as a result of the scheme.
Summary of character	The townscape of Great Yarmouth is defined by the historic and contemporary seafront context of the town; the promontory of land on which Great Yarmouth is historically sited and which has a mixed townscape quality (the older, more intact historic townscape in contrast to surrounding residential development); the division and maritime corridor created by the	Scale matters at a predominantly local level, with CA designations emphasising the	The CA would suggest local rarity in respect of the seafront context. No perceived rarity	The appearance of the seafront townscape and its architecture is important at a local level in terms of identity.	The majority of the townscape surrounding the river corridor is substitutable,	The townscape evolution around the River Yare in the area of the scheme would not significantly change in a without-	<b>Neutral</b> The introduction of the bridge would not significantly alter the townscape character within



Option 33 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
	<p>River Yare and its mix of historic frontage and maritime industrial townscape; the developed hinterland of Great Yarmouth, west of the River Yare and surrounding the A12 link road and the town's relative exposure as a settlement within the wider fen landscape.</p> <p>In the vicinity of the scheme, townscape character is a fragmented mix of residential and industrial development. Alongside the river corridor, residential terraces define a largely continuous frontage along the western river edge, whereas the eastern margin is flanked by low warehouses, storage yards and larger, maritime related infrastructure. The overriding character is locally maritime but of a poor townscape quality, with little in the way of townscape definition beyond the immediate confine of the river itself.</p>	significance of the relative scale of the seafront townscape.	of townscape in the vicinity of the scheme.	The existing river character is of no importance in the vicinity of the scheme.	although the character of the town centre and seafront not readily so.	scheme case.	<p>Great Yarmouth. However the bridge form would serve temporarily as a visual reference and landmark, heightening a sense of townscape animation along the river corridor.</p> <p>The scheme would alleviate vehicular congestion, benefiting more established and valued townscape areas of the town.</p>

*Option 33 Summary Appraisal (including Assessment Score)*

- 6.5.7 The Option 33 layout corresponds closely with Option 32. The townscape appraisal comments for the road network modifications and for the bridge appearance are broadly similar.
- 6.5.8 Option 33 differs in that the bridge itself would be narrower in cross section, which would represent slightly less of an influence on townscape when the bridge is in its opened, temporary position. The presence of permanent gantry mounted signals approaching and across the bridge would have a slightly greater impact on townscape at a local level, although these variations would have little effect on townscape at a wider scale.
- 6.5.9 In summary, the majority of impacts are predicted on balance to have a neutral effect on an area of locally unremarkable townscape quality, although it is observed that the introduction of a third bridge crossing would have a beneficial effect on human interaction (non-motorised users) by way of improved townscape linkages. The bridge would interrupt the existing open aspect of the river corridor and appear as an aspect of townscape from quayside locations to the north and south. The bridge in its temporary open position would be an evident feature of Great Yarmouth's contextual townscape as a skyline feature, although this would not fundamentally change the associated character of the river corridor nor how the town is perceived in context with its surrounding landscape.

Summary Assessment Score: **Neutral**

Option 37 – Townscape Worksheet

Option 37 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
<b>Layout</b>	<p>The town layout is heavily influenced by the Rivers Yare and Bure, which define the promontory upon which Great Yarmouth is sited. Between seafront and river, the historic and retail core of the town is centred on a broad and linear marketplace, a mixture of intact historic street pattern intervened by larger scale retail development. A fine grain of interconnecting residential street pattern surrounds this core, linking with the more formal parades and open green spaces of the seafront.</p> <p>Townscape layout is heavily fragmented where residential areas abut with the coarser grained, working quayside environments alongside both sides of the River Yare. Beyond the river to the west, the hinterland of Great Yarmouth is comprised largely of residential streets and estates interspersed with open green space, encompassing the A12 road corridor and extending south to the seaside town of Gorleston-on-Sea at the mouth of the River Yare. The expanse of Harfreys Industrial Estate, in the immediate vicinity of the scheme at Southtown, is a noticeable interruption of this otherwise residential framework, beyond which the horizontal expanse of the fen landscape frames the town.</p>	The townscape layout in the vicinity of the scheme, both east and west of the River Yare, matters at a local scale.	<p>Conservation Areas to the north (town centre areas and seafront) would suggest local rarity.</p> <p>The river itself is a formative feature of the town.</p> <p>Local to the scheme location, layout has no rarity value.</p>	<p>The town centre areas defined by the CA and the historic seafront townscape layout is of high importance at a local level.</p> <p>The river corridor setting is of moderate importance at a local level, where established historic frontages face toward the Bure.</p>	<p>The seafront and river context are not readily substitutable.</p> <p>Townscape layout elsewhere is substitutable.</p>	Townscape Layout would not substantially alter.	<b>Neutral</b> The local townscape pattern would not substantially alter as a consequence of the change of road layout, although there would be some fragmentation of road pattern.
<b>Density and mix</b>	<p>The Yare river corridor is largely industrial in character, though set alongside areas of terraced residential frontage and, to the north of the scheme a more defined historic quayside of greater density.</p> <p>The retail core of the town is of small and medium density development, with recreational facilities focused along the sea front and along several linking routes into the town. Around this core is largely residential land use of a consistent, moderate property density.</p>	Composition and distribution within the townscape matters at a local scale.	<p>The CA would suggest local rarity in respect of the seafront context and in buildings fronting the Bure to the south.</p> <p>No perceived rarity elsewhere.</p>	The density and composition of the seafront townscape and that of the River Yare corridor matters at a local level.	Density and mix are substitutable.	Density and mix of townscape would not substantially change or differ.	<b>Neutral</b> The density and mix of development will not substantially differ.
<b>Scale</b>	<p>The vertical scale of townscape across Great Yarmouth is broadly low and consistent, the area being of a flat topography with no particular dominance of built development occupying its skyline.</p> <p>The sea front forms a prominent vista, with 3-4 storey buildings flanking the main promenade. The retail core has some massing of larger scale development, but aside of this the residential and retail scale of the town is predominantly low rise.</p> <p>The River Yare is of a broad horizontal scale with key vistas along its course, these being evident from the approaches to the town and across its bridging points. It is a key contextual reference to the town, its bridges being of prominence locally and the river providing a sense of place and scale in positioning the town within the exposed, wider landscape context. Structures associated with the industrial quayside are of a prominent scale locally.</p>	The scale of the local townscape matters at a local level.	<p>The scale of the River Yare through the urban fabric of Lowestoft has a rarity value, although expansive inland waterspace is a feature of the nearby rural Broads landscape.</p> <p>The overall scale of the seafront townscape is relatively scarce within the regional coastal landscape.</p>	<p>The scale of the river corridor is of local importance, being a visible and defining feature.</p> <p>The seafront townscape is important at a local level in respect of identity.</p>	The scale of the townscape is substitutable.	The scale of townscape in vicinity of the scheme would significantly change in a without scheme case.	<p><b>Neutral</b></p> <p>The bascule bridge would be in scale with the river environment.</p> <p>It would however alter townscape scale temporarily at a local level when opened, although not out of context with the setting and in character with other bridges locally.</p>
<b>Appearance</b>	<p>The town has a mix of architectural styles. The seafront has an established and regular townscape appearance where 3 and 4 storey Victorian terraces and civic buildings flank the promenade. Other more recent modifications and recreational developments along the promenade and along main streets into the town are of mixed quality, some of which impact negatively on townscape appearance.</p> <p>The quayside frontages of South Quay alongside the River Yare have a well-defined, intact townscape form. However the majority of the river corridor through the town is industrial by nature and generally of low quality</p>	The appearance of the river townscape matters at a local scale.	<p>The appearance of the buildings and structures that surround the River Yare in the vicinity of the scheme are unremarkable.</p> <p>CA elsewhere in the town would suggest</p>	<p>The appearance of the seafront townscape and its architecture is important at a local level in terms of identity.</p> <p>The river corridor has limited importance in appearance.</p>	<p>The townscape appearance is substitutable. The potential for townscape change in and around the river setting is high.</p>	The likely nature of townscape change and its influence on the setting would not substantially differ.	<b>Neutral</b> The introduction of a new road bridge across the river would not significantly alter the appearance of the setting, although there would be some fragmentation of residential townscape.

Option 37 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
	appearance. While the river setting is contained, the larger storage towers and warehouses alongside the river corridor are visible elements of the townscape. Residential development is generally unremarkable and townscape value quickly diminishes beyond the town core.		a recognised level of rarity.				The bridge would be in keeping with the appearance of the urban river corridor, although would interrupt existing views along the River Yare from vantage points such as The Haven Bridge & South Quay. Views along the river corridor and of the bridge in an open position would highlight the location within the townscape temporarily.
Human interaction	Great Yarmouth's seafront promenade and its town core are the main areas of focus for social activity and interaction. Outside of these areas the townscape is predominantly residential, reflecting typical levels of associated social activity and function. In the vicinity of the scheme there is a mix of well used open green space and allotments. Interaction along the River Yare is limited to areas of historic and intact frontage, at South Quay in the town and further south towards Gorleston-on-Sea. Elsewhere along the urban river corridor, the over-riding industrial context offers little in the way of interaction.	The scale of human interaction matters mainly at a local level. The town centre, seafront provide the most interaction, with little interaction in the vicinity of the proposed bridge.	The context of the Yare and immediate setting in respect of interaction matters at a local scale with no inherent rarity.	The current river townscape in the vicinity of the proposed bridge has a low importance in respect of interaction.	Density and mix are substitutable.	No change.	<b>Slight Beneficial</b> Improved access for pedestrians/cyclists would improve scope for interaction either side of the river. The provision of the bridge crossing would potentially alleviate pressures on the Haven and Breydon Bridge locations to the north, allowing greater interaction benefits for this area of locally important townscape.
Cultural	Great Yarmouth's history as a fishing town and subsequently its development as a seaside resort is reflected by its townscape and architecture. The Victorian seafront and its recreation focus is a characteristic aspect of the town, which to a large degree creates a cultural identity. Within the town there are specific buildings and architectural frontages that reference the town's maritime heritage, with a sense of cultural time depth and isolated townscape quality. The River Yare is closely linked with the cultural character of the town, integral to its townscape and from its past and ongoing maritime use.	The river and its formative role in the townscape evolution matter at a local scale.	Rarity in the river townscape is limited to those areas of intact historic frontage, north and south of the proposed bridging point.	The association of Yarmouth as a seaside destination, and point of passage to inland waterways are important cultural aspects of the town, its townscape elements derived from this cultural baseline.	The cultural heritage of townscape features is not substitutable. Cultural change by its essence is ongoing and will modify townscape.	Cultural change would not differ in a without-scheme scenario.	<b>Neutral</b> The scheme would introduce a new built feature into the river corridor townscape, visible temporarily as a landmark/reference and potentially changing cultural perception of the location.
Land use	The town core and seafront comprises a mix of retail and commercial land use, with the town relying heavily on leisure as a focus. The urban river corridor comprises a mixture of predominantly maritime and industrial activity. Outside of these areas, land use is predominantly residential with linked facilities. Light industry is focused largely within a single industrial estate, to the western fringe of the town.	The associated function of the river in terms of its passage for leisure and commercial craft matters at a local level.	The land use in the immediate vicinity of the river corridor has no rarity value.	Land use and the resulting townscape elements matter at a local level.	Land use is substitutable. However the river as a physical form is not easily substitutable.	The nature of land use change in the vicinity of the river corridor would not substantially alter.	<b>Neutral</b> There would be no significant change of land use as a result of the scheme.
Summary of character	The townscape of Great Yarmouth is defined by the historic and contemporary seafront context of the town; the promontory of land on which Great Yarmouth is historically sited and which has a mixed townscape quality (the older, more intact historic townscape in contrast to surrounding residential development); the division and maritime corridor created by the River Yare and its mix of historic frontage and maritime industrial townscape; the developed hinterland of Great Yarmouth, west of the River Yare and surrounding the A12 link road and the town's relative exposure as a	Scale matters at a predominantly local level, with CA designations emphasising the significance of the relative scale of the seafront townscape.	The CA would suggest local rarity in respect of the seafront context. No perceived rarity of townscape in the vicinity of the scheme.	The appearance of the seafront townscape and its architecture is important at a local level in terms of identity. The existing river character is of no importance in the vicinity	The majority of the townscape surrounding the river corridor is substitutable, although the character of the town centre and	The townscape evolution around the River Yare in the area of the scheme would not significantly change in a without-scheme case.	<b>Neutral</b> The introduction of the bridge would not significantly alter the townscape character within Great Yarmouth. However the bridge form would serve temporarily as

Option 37 Townscape Worksheet							
Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in Without-Scheme case	Impact
	settlement within the wider fen landscape. In the vicinity of the scheme, townscape character is a fragmented mix of residential and industrial development. Alongside the river corridor, residential terraces define a largely continuous frontage along the western river edge, whereas the eastern margin is flanked by low warehouses, storage yards and larger, maritime related infrastructure. The overriding character is locally maritime but of a poor townscape quality, with little in the way of townscape definition beyond the immediate confine of the river itself.			of the scheme	seafront not readily so.		a visual reference and landmark, heightening a sense of townscape animation along the river corridor. The scheme would alleviate vehicular congestion, benefiting more established and valued townscape areas of the town.

*Option 37 Summary Appraisal (including Assessment Score)*

- 6.5.10 The road changes to provide access to the bridge crossing would have a slightly greater impact on layout than Options 32 and 33, as a result of the loss of more existing residential frontage along the river edge and in the stopping up of roads. However the area does not have a particularly strong or defined townscape value, also the layout of the new junction and bridge approaches would not represent any material disruption of the nearby Southtown Common Recreation Ground and its established boundaries. As with the other options, alleviation of vehicular pressure on the Haven and Breydon bridge crossings may potentially improve the human interaction potential in this locally more important area of townscape to the north.
- 6.5.11 The bridge would be approximately 2.4m lower in elevation than Options 32 and 33 across its centre span, which would reduce the physical and perceived scale of the structure within the local townscape. Consequently the vertical elevation of the raised bridge (at 31.5m above its closed elevation) would be 2.5m lower than Options 32 and 33, with slightly less visibility of the bridge structure within the townscape and from surrounding areas as a result. As a single carriageway crossing, the bridge would have slightly less of an influence on townscape when the bridge is in its opened position.
- 6.5.12 In summary, the majority of impacts are predicted on balance to have a neutral effect on an area of locally unremarkable townscape quality, although it is observed that the introduction of a third bridge crossing would have a beneficial effect on human interaction (non-motorised users) by way of improved townscape linkages. The bridge and embanked road junction would interrupt the existing open aspect of the river corridor and appear as an aspect of townscape from quayside locations to the north and south. The bridge in its temporary open position would be an evident feature of Great Yarmouth's contextual townscape as a skyline feature, although this would not fundamentally change the associated character of the river corridor nor how the town is perceived in context with its surrounding landscape.

Summary Assessment Score: **Neutral**

## 7 Biodiversity

### 7.1 Introduction

7.1.1 This chapter summarises the findings of the ecological assessment undertaken for the options being considered. It considers the potential ecological effects on nature conservation and biodiversity. The ecological assessment has been informed by detailed desk studies identifying designated wildlife sites, non-designated habitats, and field surveys to identify potential for encountering protected species within the study area.

7.1.2 Field surveys focussed on land within the scheme's footprint, but also examined adjacent habitats where appropriate (e.g. ponds and water courses located off-site but within the scheme's zone of influence).

### 7.2 Appraisal Methodology

7.2.1 A study area, extending up to 2km from the site of the scheme location was surveyed in order to determine impacts and likely constraints to the scheme. The study set out to:

- Consult records of statutory protected sites within 2km of the scheme;
- Identify habitats and species present or likely to be present, that are ecologically important and/or have legal protection;
- Identify invasive species that might be present on site.

7.2.2 The Norfolk Biodiversity Information Service was consulted to gather information on records of species and nature conservation designations from within the study area.

7.2.3 A review of the MAGIC<sup>9</sup> online resource was also undertaken to gather information on statutory nature conservation designations within the study area.

7.2.4 A walkover survey, undertaken broadly in accordance with Phase 1 habitat survey methodology<sup>10</sup>, was carried out on 28<sup>th</sup> and 29<sup>th</sup> September 2016. Habitat types were identified and mapped, with target notes made to identify features of interest. The suitability of habitats within the site to support legally protected, valuable or controlled species was assessed with incidental field signs or sightings of species recorded as seen.

### 7.3 Existing Environment

#### *Statutory Designated Sites*

7.3.1 The Outer Thames Estuary Special Protection Area is within 2km of the proposed bridge crossing point. This site is designated because it supports 38% of the Great

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<sup>9</sup> Multi-Agency Geographic Information for the Countryside (MAGIC) (2016) Home [Online]. Available at [www.magic.gov.uk](http://www.magic.gov.uk) [accessed 18 March 2016].

<sup>10</sup> Joint Nature Conservancy Council (JNCC) (2007). Handbook for Phase 1 Habitat Survey – A Technique for Environmental Audit. Peterborough, UK

British population of red-throated diver *Gavia stellate*, which is listed on Annex 1 of the EU Birds Directive.

### *Non-Statutory Designated Sites*

7.3.2 There are no non-statutory designated sites within 2km of the scheme location.

### *Species*

7.3.3 The information returned from the desk study contained a record of goat moth *Cossus cossus*, which is a UK Biodiversity Action Priority (BAP) species.

### *Amphibians*

7.3.4 One record of natterjack toad *Epidalea calamita* was returned. This record was for Gorleston on Sea and is undated.

7.3.5 There are three records of common toad *Bufo bufo*, the most recent dating from March 1999. These records are for Southtown Common, approximately 800m west of the scheme location.

7.3.6 There are areas of terrestrial habitat within 250m of the scheme that are suitable for use by amphibians. This includes the land on the northern and western edge of Southtown Common, which also includes a ditch with standing water. The ditch passes under William Adams Way and runs north beneath Queen Anne's Road before turning to the north-west. As the ditches are linked underneath the two roads, they are considered here as one water body.

7.3.7 There is a small pond at TG523058. This is located roughly in the centre of the survey area, adjacent to William Adams Way and Queen Anne's Road. This and the surrounding habitat of grassland, scrub and woodland is suitable for use by amphibians.

7.3.8 Both waterbodies were subject to a Great Crested Newt Habitat Suitability Index (HSI) assessment. The outcome of this is detailed in Table 8-1.

Table 8-1: HSI Assessment Result

Pond	Location	Pond Area	Pond Permanence	Water Quality	Pond Shading	Waterfowl	Fish Count	Pond Count	Terrestrial Habitat	Macrophyte Cover	HSI Assessment
Ditch	1	0.8	0.9	0.01	1	1	0.33	0.65	0.67	0.8	0.49
Pond	1	0.05	0.5	0.67	0.2	1	1	0.65	1	0.7	0.52

7.3.9 The scores of 0.49 which correlates as Poor and 0.52 which correlates as Below Average indicate that great crested newts are unlikely to use these ponds and further surveys are therefore unlikely to be required.

### *Reptiles*

7.3.10 There are four records of common lizard *Zootoca vivipara*, the most recent being

from Southtown Common in June 2008.

7.3.11 There are two records of slow-worm *Anguis fragilis*, the most recent of which was from grid reference TG52530771 in August 2008.

7.3.12 The majority of the site is made up of either short and open sward or hard open concrete urban areas and is of negligible value for reptiles. The allotments south of Queen Anne's Road at TG523058 provide habitat suitable for use by reptiles including a mix of tall ruderal vegetation and rough sward amongst areas of compost and logs that could be used as refugia.

#### Water Vole

7.3.13 There are fourteen records of water vole *Arvicola amphibius* from within 2km of the scheme, the most recent dating from December 2012.

7.3.14 The drainage ditches associated with the A12 provide suitable habitat for water vole.

#### Otter

7.3.15 There are three records of otter *Lutra lutra* within 2km of the scheme, the most recent at a site by the name of Coopers in October 2011.

7.3.16 The main channel of the River Yare is canalised and provides no suitable holt habitat in which otters may build holts.

#### Bats

7.3.17 There are multiple records of bat species within the 2km study area, many of which are from within the footprint of the scheme. The most recent of these are described in Table 8-2.

Table 8-2: Bat Species Records within 2km of Study Area

Species	Number of Records	Most Recent Record
Common pipistrelle, <i>Pipistrellus pipistrellus</i>	5	June 2015
Soprano pipistrelle, <i>Pipistrellus pygmaeus</i>	1	May 2015
Nathusius' pipistrelle, <i>Pipistrellus nathusii</i>	2	May 2015
Serotine, <i>Eptesicus serotinus</i>	1	May 2015
Daubenton's bat, <i>Myotis daubentonii</i>	1	May 2015
Noctule, <i>Nyctalus noctula</i>	3	May 2015
Brown long-eared bat, <i>Plecotus auritus</i>	1	May 2015

7.3.18 There are several structures within 100m of the proposed bridge crossing point that may be suitable for use by roosting bats. These include two uninhabited and poorly

maintained houses at TG524058 as well as old brick buildings at TG524057 on the west side of the River Yare.

- 7.3.19 To the east, a disused pub at TG525060, a smokery at TG52606 and empty, damaged buildings at TG526059 offer further possible roosting sites for bats.

#### *Badger*

- 7.3.20 There is one record of badger *Meles meles* within 2km of the scheme, dating from September 2014.
- 7.3.21 No evidence of badgers was found during the surveys.

#### *Other Mammals*

- 7.3.22 There are eight records of hedgehog *Erinaceus europaeus*, the most recent dating from September 2009. Brown hare *Lepus europaeus* has also been recorded within 2km of the scheme, in August 2013.
- 7.3.23 No evidence of hedgehog was found during the survey but the scheme is located within areas of habitats suitable to support this species.
- 7.3.24 No evidence of brown hare was found during the survey. The scheme area of the does not contain suitable habitat for this species.

#### *Birds*

- 7.3.25 A large number of bird species have been recorded within 2km of the scheme. These include 50 species included on Schedule 1 Part 1 of the Wildlife and Countryside Act 1981 (as amended) which are protected at all times of the year.
- 7.3.26 A number of bird species were recorded within the site during the survey, and these include wood pigeon *Columba palumbus*, magpie *Pica pica*, carrion crow *Corvus corone*, house sparrow *Passer domesticus*, blue tit *Cyanistes caeruleus* and robin *Erithacus rubecula*.
- 7.3.27 The mosaic of urban areas with scattered ruderal vegetation with areas of grassland and scrub is suitable habitat for use by black redstart *Phoenicurus ochruros*.
- 7.3.28 Trees and areas of scrub within and adjacent to the scheme location are suitable for use by nesting birds. Old brick buildings where access is possible through broken windows and other gaps provide suitable nesting sites for pigeons.

## **7.4 Brief Evaluation of Topic Related Constraints**

### *Statutory Designated and Non-Statutory Protected Sites*

- 7.4.1 The Outer Thames Estuary SPA is within 2km of the scheme. It is a requirement that a Screening study for Habitats Regulations Assessment is undertaken.

### *Habitats*

- 7.4.2 The site is largely urban, interspersed with areas of improved grassland, scattered trees, scrub and standing water. These habitats are of low biodiversity value and are



not a constraint to the scheme.

#### *Amphibians and Reptiles*

7.4.3 Although small areas of habitat that is suitable to provide foraging, shelter and hibernation areas for these groups exist, the site is located within a predominantly urban environment and is not connected to areas of suitable offsite habitat. No further work in respect of amphibians and reptiles is recommended. The loss of these areas of habitat would not be significant on reptiles as extensive suitable habitat are present elsewhere on adjacent and nearby land.

7.4.4 During construction it is possible, though unlikely, that individual animals may be present in these isolated areas of suitable habitat. Precautionary measures are recommended as follows to ensure that individual animals are not affected during the works.

#### *Water Vole*

7.4.5 The wider area supports water voles and the ditches associated with the A12 are suitable to support this species. Further surveys are therefore recommended.

#### *Bats*

7.4.6 The buildings within the site are either to be purchased for demolition or will be subject to disturbance during the construction of the Scheme. It is recommended that further surveys are undertaken to confirm the presence or absence of bats within these buildings.

#### *Hedgehog*

7.4.7 The habitats within the site, and the surrounding residential gardens, are suitable to support hedgehogs. It is recommended that a watching brief is maintained during the works to protect individual hedgehogs that may be present.

#### *Birds*

7.4.8 Black redstart is listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). This species is recorded as breeding within Norfolk and Suffolk and further surveys are recommended to determine the presence of this species in the scheme area.

7.4.9 Area of scrub and woodland which are present are suitable for use by breeding birds. No further surveys are recommended, however, in order to minimise the risk of disturbing breeding birds, the removal of woody vegetation should ideally be undertaken outside of the breeding season (typical breeding bird season is March to July inclusive). If tree and vegetation removal has to take place during this period, the vegetation should be checked prior to removal for the presence of nests by an appropriately experienced ecologist. If nests that are in use are present, it may be necessary to delay work in immediate proximity the nest until the young have fledged.

### **7.5 Biodiversity Appraisal - WebTAG Worksheets**

Option 32 - Biodiversity Worksheet

Option 32 Biodiversity Worksheet							
Area	Description of feature/ attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment Score
Outer Thames Estuary SPA	This is an area along the east coast of England within the Southern North Sea and extends northwards from the Thames Estuary to the sea area off Great Yarmouth on the East Norfolk Coast, providing an important foraging ground during the breeding season.	National	The site is designated as it supports 38% of the Great British population of red-throated diver <i>Gavia stellate</i> , which is listed on Annex 1 of the EU Birds Directive. <sup>11</sup>		High	Neutral	Neutral
Standing water habitat	These would include natural systems such as lakes, pools, man-made systems such as ponds, canals and gravel pits.	Local	They have the potential to support protected species. The biodiversity value of the ponds and ditches individually could be greater depending on presence of significant populations of protected species.	Agricultural intensification has traditionally resulted in the loss of standing water habitat. The decline in dependant species, such as great crested newts, can be attributable to this process.	Lower	Unknown	Unknown
River Yare	River Yare is one of five major rivers within the Broadland Rivers catchment; a tidally dominated area of inland waterways.	Local	Riparian habitat provides an important corridor for the movement of animals between habitats and the formation of meta-populations.  Both the aquatic and riparian habitats have the potential to support legally protected and ecologically significant species.	Across the UK in the past 100 years, river engineering has significantly impacted riparian ecosystems, particularly in urban areas.	Lower	Neutral	Neutral
Bat species	Protected Species	Local	All bat species receive legal protection under Schedule II of the Conservation (Natural Habitats, &c.) Regulations 1994 through which they are given the status of European Protected Species (EPS).  They also receive protection nationally through inclusion in Schedule 5 of the Wildlife and Countryside Act 1981. There are records of the following bat species within the 10km grid square: parti-coloured bat, daubenton, serotine and noctule, pipistrelle, nathusius's pipistrelle, soprano pipistrelle, brown long-eared	The common bat species, including common pipistrelle and daubenton's, have generally shown a decline in population and distribution both nationally and in Europe. The trends in rarer bat species is not entirely known due to recording difficulties, but generally appear to have declined.	Low	Unknown	Unknown
Water Vole	Protected Species	Borough	Water voles receive full legal protection through inclusion in Schedule 5 of the Wildlife and Countryside Act 1981, following an amendment in April 2008.  There are records of water vole within the 10km grid square.	Water voles are listed as moderately common in the UK, but declined substantially in the 1990s due to habitat loss, degradation, population fragmentation and predation by feral American Mink.  The decline is thought to have stabilised, and the species is not currently listed as threatened.	Medium	Unknown	Unknown
Breeding birds	Protected Species	Local	Breeding birds receive legal protection at the national level through their inclusion in the Wildlife and Countryside Act 1981. The legislative protection is not	Some bird species are listed as Schedule 1 species, which are identified as ecologically significant	Low	Minor negative	Slight adverse

<sup>11</sup> <http://jncc.defra.gov.uk/page-7249> [Accessed 15/03/17]

Option 32 Biodiversity Worksheet							
Area	Description of feature/ attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment Score
			related to conservation status or vulnerability, and covers all birds regardless of how common they are.  Swift and song thrush are listed on the Norfolk BAP Priority list.	or sensitive. Many common bird species are not listed as threatened.			
Black redstart	Protected Species	Local	Black redstarts receive full legal protection through inclusion in Schedule 1 of the Wildlife and Countryside Act 1981, as amended. There are records of black redstart within the 10km grid square.	Black redstart population size and range have declined in since the 1980s with the species being red listed as a result of these declines.	Medium	Unknown	Unknown
Hedgehog	Priority Species	Local	Hedgehog are listed in the UK BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of hedgehog within the 10km grid square.	Hedgehog populations and distributions have seen considerable declines since the 1950's due to habitat loss, degradation and fragmentation.	Low	Unknown	Unknown
Common toad	Priority Species	Local	Common toad are listed in the UK BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of common toad within the 10km grid square.	Widespread but in decline countrywide. 50% of rural populations have declined between 1985 and 2000, including extinction in some areas.	Low	Unknown	Unknown
Song thrush	Priority Species	Local	Song thrush is listed in both the UK and Norfolk BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of song thrush within the 10km grid square.	Widespread but has suffered a steep decline since the mid-1970s.	Low	Unknown	Unknown
Swift	Priority Species	Local	Swift is listed in the Norfolk BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of swift within the 10km grid square.	Widespread but has suffered declines across the UK since 1994.	Low	Unknown	Unknown

*Option 32 Summary Appraisal (including Assessment Score)*

7.5.1 As the Option passes through several areas of habitat that are suitable for breeding birds, these protected species may potentially be affected. There are also several buildings which may have suitable bat roost within them that could be impacted. It is anticipated that once assessment of these populations have been made and potential mitigating activities completed, the overall result should not exceed a slight adverse effect.

Summary assessment score: **Slight Adverse**

Option 33 – Biodiversity Worksheet

Option 33 Biodiversity Worksheet							
Area	Description of feature/ attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment Score
Outer Thames Estuary SPA	This is an area along the east coast of England within the Southern North Sea and extends northwards from the Thames Estuary to the sea area off Great Yarmouth on the East Norfolk Coast, providing an important foraging ground during the breeding season.	National	The site is designated as it supports 38% of the Great British population of red-throated diver <i>Gavia stellate</i> , which is listed on Annex 1 of the EU Birds Directive. <sup>12</sup>		High	Neutral	Neutral
Standing water habitat	These would include natural systems such as lakes, pools, man-made systems such as ponds, canals and gravel pits.	Local	Standing water habitats, including ponds and ditches, is listed as a BAP broad habitat. They have the potential to support protected species. The biodiversity value of the ponds and ditches individually could be greater depending on presence of significant populations of protected species.	Agricultural intensification has traditionally resulted in the loss of standing water habitat. The decline in dependant species, such as great crested newts, can be attributable to this process.	Lower	Unknown	Unknown
River Yare	River Yare is one of five major rivers within the Broadland Rivers catchment; a tidally dominated area of inland waterways.	Local	Riparian habitat provides an important corridor for the movement of animals between habitats and the formation of meta-populations.  Both the aquatic and riparian habitats have the potential to support legally protected and ecologically significant species.	Across the UK in the past 100 years, river engineering has significantly impacted riparian ecosystems, particularly in urban areas.	Lower	Neutral	Neutral
Bat species	Protected Species	Local	All bat species receive legal protection under Schedule II of the Conservation (Natural Habitats, &c.) Regulations 1994 through which they are given the status of an EPS.  They also receive protection nationally through inclusion in Schedule 5 of the Wildlife and Countryside Act 1981.  There are records of the following bat species within the 10km grid square: parti-coloured bat, daubenton, serotine and noctule, pipistrelle, nathusius's pipistrelle, soprano pipistrelle, brown long-eared	The common bat species, including common pipistrelle and daubenton's, have generally shown a decline in population and distribution both nationally and in Europe. The trends in rarer bat species is not entirely known due to recording difficulties, but generally appear to have declined.	Low	Unknown	Unknown
Water Vole	Protected Species	Borough	Water voles receive full legal protection through inclusion in Schedule 5 of the Wildlife and Countryside Act 1981, following an amendment in April 2008. There are records of water vole within the 10km grid square.	Water voles are listed as moderately common in the UK, but declined substantially in the 1990s due to habitat loss, degradation, population fragmentation and predation by feral American Mink.  The decline is thought to have stabilised, and the species is not currently listed as threatened.	Medium	Unknown	Unknown

<sup>12</sup> <http://jncc.defra.gov.uk/page-7249> [Accessed 15/03/17]

Option 33 Biodiversity Worksheet							
Area	Description of feature/ attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment Score
Breeding birds	Protected Species	Local	Breeding birds receive legal protection at the national level through their inclusion in the Wildlife and Countryside Act 1981. The legislative protection is not related to conservation status or vulnerability, and covers all birds regardless of how common they are.  Swift and song thrush are listed on the Norfolk BAP Priority list.	Some bird species are listed as Schedule 1 species, which are identified as ecologically significant or sensitive. Many common bird species are not listed as threatened.	Low	Minor negative	Slight adverse
Black redstart	Protected Species	Local	Black redstarts receive full legal protection through inclusion in Schedule 1 of the Wildlife and Countryside Act 1981, as amended. There are records of black redstart within the 10km grid square.	Black redstart population size and range have declined in since the 1980s with the species being red listed as a result of these declines.	Medium	Unknown	Unknown
Hedgehog	Priority Species	Local	Hedgehog are listed in the UK BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of hedgehog within the 10km grid square.	Hedgehog populations and distributions have seen considerable declines since the 1950's due to habitat loss, degradation and fragmentation.	Low	Unknown	Unknown
Common toad	Priority Species	Local	Common toad are listed in the UK BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of common toad within the 10km grid square.	Widespread but in decline countrywide. 50% of rural populations have declined between 1985 and 2000, including extinction in some areas.	Low	Unknown	Unknown
Song thrush	Priority Species	Local	Song thrush is listed in both the UK and Norfolk BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of song thrush within the 10km grid square.	Widespread but has suffered a steep decline since the mid-1970s.	Low	Unknown	Unknown
Swift	Priority Species	Local	Swift is listed in the Norfolk BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of swift within the 10km grid square.	Widespread but has suffered declines across the UK since 1994.	Low	Unknown	Unknown

*Option 33 Summary Appraisal (including Assessment Score)*

7.5.2 As the Option passes through several areas of habitat that are suitable for breeding birds, these protected species may potentially be affected. There are also several buildings which may have suitable bat roost within them that could be impacted. It is anticipated that once assessment of these populations have been made and potential mitigating activities completed, the overall result should not exceed a slight adverse effect.

Summary assessment score: **Slight Adverse**

Option 37 – Biodiversity Worksheet

Option 37 Biodiversity Worksheet							
Area	Description of feature/ attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment Score
Outer Thames Estuary SPA	This is an area along the east coast of England within the Southern North Sea and extends northwards from the Thames Estuary to the sea area off Great Yarmouth on the East Norfolk Coast, providing an important foraging ground during the breeding season.	National	The site is designated as it supports 38% of the Great British population of red-throated diver <i>Gavia stellate</i> , which is listed on Annex 1 of the EU Birds Directive. <sup>13</sup>		High	Neutral	Neutral
Standing water habitat	These would include natural systems such as lakes, pools, man-made systems such as ponds, canals and gravel pits.	Local	Standing water habitats, including ponds and ditches, is listed as a BAP broad habitat. They have the potential to support protected species. The biodiversity value of the ponds and ditches individually could be greater depending on presence of significant populations of protected species.	Agricultural intensification has traditionally resulted in the loss of standing water habitat. The decline in dependant species, such as great crested newts, can be attributable to this process.	Lower	Unknown	Unknown
River Yare	River Yare is one of five major rivers within the Broadland Rivers catchment; a tidally dominated area of inland waterways.	Local	Riparian habitat provides an important corridor for the movement of animals between habitats and the formation of meta-populations.  Both the aquatic and riparian habitats have the potential to support legally protected and ecologically significant species.	Across the UK in the past 100 years, river engineering has significantly impacted riparian ecosystems, particularly in urban areas.	Lower	Neutral	Neutral
Bat species	Protected Species	Local	All bat species receive legal protection under Schedule II of the Conservation (Natural Habitats, &c.) Regulations 1994 through which they are given the status of an EPS.  They also receive protection nationally through inclusion in Schedule 5 of the Wildlife and Countryside Act 1981.  There are records of the following bat species within the 10km grid square: parti-coloured bat, daubenton, serotine and noctule, pipistrelle, nathusius's pipistrelle, soprano pipistrelle, brown long-eared	The common bat species, including common pipistrelle and daubenton's, have generally shown a decline in population and distribution both nationally and in Europe. The trends in rarer bat species is not entirely known due to recording difficulties, but generally appear to have declined.	Low	Unknown	Unknown
Water Vole	Protected Species	Borough	Water voles receive full legal protection through inclusion in Schedule 5 of the Wildlife and Countryside Act 1981, following an amendment in April 2008. There are records of water vole within the 10km grid square.	Water voles are listed as moderately common in the UK, but declined substantially in the 1990s due to habitat loss, degradation, population fragmentation and predation by feral American Mink.	Medium	Unknown	Unknown

<sup>13</sup> <http://jncc.defra.gov.uk/page-7249> [Accessed 15/03/17]

Option 37 Biodiversity Worksheet							
Area	Description of feature/ attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment Score
				The decline is thought to have stabilised, and the species is not currently listed as threatened.			
Breeding birds	Protected Species	Local	Breeding birds receive legal protection at the national level through their inclusion in the Wildlife and Countryside Act 1981. The legislative protection is not related to conservation status or vulnerability, and covers all birds regardless of how common they are.  Swift and song thrush are listed on the Norfolk BAP Priority list.	Some bird species are listed as Schedule 1 species, which are identified as ecologically significant or sensitive. Many common bird species are not listed as threatened.	Low	Minor negative	Slight adverse
Black redstart	Protected Species	Local	Black redstarts receive full legal protection through inclusion in Schedule 1 of the Wildlife and Countryside Act 1981, as amended. There are records of black redstart within the 10km grid square.	Black redstart population size and range have declined in since the 1980s with the species being red listed as a result of these declines.	Medium	Unknown	Unknown
Hedgehog	Priority Species	Local	Hedgehog are listed in the UK BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of hedgehog within the 10km grid square.	Hedgehog populations and distributions have seen considerable declines since the 1950's due to habitat loss, degradation and fragmentation.	Low	Unknown	Unknown
Common toad	Priority Species	Local	Common toad are listed in the UK BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of common toad within the 10km grid square.	Widespread but in decline countrywide. 50% of rural populations have declined between 1985 and 2000, including extinction in some areas.	Low	Unknown	Unknown
Song thrush	Priority Species	Local	Song thrush is listed in both the UK and Norfolk BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of song thrush within the 10km grid square.	Widespread but has suffered a steep decline since the mid -1970s.	Low	Unknown	Unknown
Swift	Priority Species	Local	Swift is listed in the Norfolk BAP Priority list. Although the species does not receive legal protection, this identifies the species as being of ecological significance. There are records of swift within the 10km grid square.	Widespread but has suffered declines across the UK since 1994.	Low	Unknown	Unknown

*Option 37 Summary Appraisal (including Assessment Score)*

7.5.3 As the Option passes through several areas of habitat that are suitable for breeding birds, these protected species may potentially be affected. There are also several buildings which may have suitable bat roost within them that could be impacted. It is anticipated that once assessment of these populations have been made and potential mitigating activities completed, the overall result should not exceed a slight adverse effect.

Summary assessment score: **Slight Adverse**

## 8 Historic Environment

### 8.1 Introduction

8.1.1 This chapter identifies and assesses the potential impacts upon cultural heritage resources as a result of the options being considered for the scheme. The heritage resource consists of archaeological remains, historic buildings and the historic landscape and covers both designated and non-designated assets.

### 8.2 Appraisal Methodology

8.2.1 The study area which has been adopted for the assessment of cultural heritage features extends to 500m around the combined options for undesignated cultural heritage assets, and 1km around the combined options for designated assets. Areas impacted by traffic noise have also been taken into account.

8.2.2 There is scope for the study area to be reduced for further stages of assessment, however a larger study area allows any cultural heritage assets to be considered within their wider context. For this study area, the following was undertaken:

- Data was gathered on designated heritage assets from the National Heritage List for England and Historic England Archive;
- Conservation Area data was obtained from the relevant local authority websites;
- Details of un-designated heritage assets was gathered from the Norfolk Historic Environment Record (NHER);
- A preliminary historic landscape assessment was made based on modern mapping, readily available aerial photography and Historic Landscape Characterisation data obtained from NHER; and
- A preliminary assessment of the archaeological potential of the study area.

8.2.3 Initial value assessments have been made for each cultural heritage asset following the guidance set out in DMRB Volume 11, Section 3, Part 2 (HA208/07).

8.2.4 The appraisal has followed the assessment methodology as required by TAG Unit A3 Chapters 5 and 8. This follows the five step approach to appraising 'environmental capital':

- Step 1: Scoping and identification of study area (as detailed above);
- Step 2: the key environmental resources have been identified and their features described as per the requirements of TAG Unit A3 Chapter 8, in terms of their form, survival, condition, complexity, context and period;



- Step 3: The appraisal has been undertaken against the following set of indicators to establish the significance of each key historic environmental resource in question; the scale at which it matters, significance (value) and rarity;
- Step 4: An impact assessment has been undertaken of the options on the historic environmental resources in terms of seriousness and scale. Incremental, secondary and cumulative impacts have also been considered. The extent to which resource is adversely affected or enhanced will be described; and
- Step 5: An assessment of the significance of all impacts on the receptors has been undertaken to determine the overall appraisal score using the definitions for overall impact outlined in TAG Unit A3 Table 8. The significant impacts on the historic environment have been summarised on the Historic Environment Worksheets (see section 9.4) for inclusion in the ASTs.

### 8.3 Existing Environment

- 8.3.1 There are no World Heritage Sites, Scheduled Monuments, Registered Parks and Gardens, Registered Battlefields or Protected Wreck sites within 1km of the options.
- 8.3.2 There are four Conservation Areas and 45 Listed Buildings within 1km of the options. The listed buildings consist of one Grade I, four Grade II\* and 40 Grade II. The majority of the listed buildings will be screened from the options by topography, vegetation and existing structures. The listed buildings represent a mixture of domestic, religious, industrial and leisure uses and mainly date to the post-medieval period.
- 8.3.3 There are 90 undesignated heritage assets recorded on the Norfolk Historic Environment Record (NHER) in the study area. The vast majority of these sites represent World War II structures, camps and bomb crater sites, with the remaining sites comprising finds and structures which reflect the important Naval and shipping history of the town. The majority of the known recorded sites date to the post medieval period. Within the wider study area, there is evidence of remains dating to the medieval period, as well as a single findspot of a Neolithic scraper. A full list of identified heritage assets is presented in **Appendix C: Gazetteer of Heritage Assets**.
- 8.3.4 A deposit model for Great Yarmouth has been created by the Great Yarmouth Archaeological Map project using data from 142 boreholes which were drilled by the Norfolk County Laboratory. The model shows that, the area where Great Yarmouth now stands started out as the mouth of a great estuary. Since the last Ice Age, a south bound current has laid a spit of sand across the north of the estuary, from the north end to the south. The sand spit blocked off the estuary, leading to the formation of the peat which was cut to make the Broads. The sand spit was breached by the sea, and left as either a low tidal island or a shoal until about 1300 years ago, when it gradually took shape. When it was first occupied, probably sometime in the tenth century, it was a low lying sand spit, most of it about 1m above sea level. Throughout the first centuries of habitation, large drifts of windblown sand buried dwellings and shifted sand dunes, and by the time the walls were built around the medieval town in

the 13th and 14th centuries the ground level was over 1m high.

- 8.3.5 The boreholes, and evidence from archaeological excavations in the area suggest the presence of buried medieval shorelines (evidence of this has been found just outside the 500m study area at the site of the Power Station during its construction).
- 8.3.6 The medieval walled town lies to the north of the scheme location, just outside the 500m study area for undesignated sites, but within this area the remains of boats have been found on an earlier buried shoreline at around 3m below the current ground level. An old landing place was also recorded below the Town Hall site in 1887.
- 8.3.7 All of the above suggests that buried medieval deposits may survive deep below the current ground level on either side of the River Yare within the study area.
- 8.3.8 As mentioned above, the vast majority of features within the study area date to the modern period, and specifically the period of the Second World War. Unfortunately, most, if not all, of these features recorded on the NHER have since been demolished and modern development has wiped out all trace of these features. The town was first bombed during World War I in 1915 and this event represents the first aerial bombardment in the UK, however the majority of wartime features date to World War II. During this time the town suffered extensive bombing by the Luftwaffe as it was the last significant place the German bombers could drop bombs before returning home. However, despite this, two-thirds of the medieval town wall survived. At least 43 air raid shelters are recorded on the NHER within the 500m study area, along with Anti-Aircraft batteries, pill boxes, gun emplacements, barbed wire obstructions, blast walls, beach defences, anti-tank defences and military camps. There are also at least 12 recorded bomb craters.
- 8.3.9 The majority of the built heritage remains within the study area are listed buildings. The area has undergone substantial industrial redevelopment in the 20<sup>th</sup> century. Earlier buildings are now isolated, although still maintain links to the wharfs and river. The listed buildings consist of a mixture of uses, but a number of these are related to the Naval Hospital which dates from 1806 and was built to treat the sick and wounded from the North Sea Fleet which was engaged in war with France. Great Yarmouth was an important naval base throughout the Napoleonic Wars, and Admiral Lord Horatio Nelson is known to have landed at Great Yarmouth on three occasions. Following Nelson's death, funds were raised to erect a monument in the town, 30 years before a monument was erected in Trafalgar Square. The monument is also a listed building, and lies within the study area. It is 144 feet high.

## **8.4 Brief Evaluation of Topic Related Constraints**

### *Constraints Common to All Options*

- 8.4.1 The options lie close to one another and the underlying historic environment characteristics of the area is relevant to all options. The study area contains a total of 135 recorded heritage assets, but as outlined above, many of these records relate to demolished Second World War defences. Deposit Modelling has indicated the presence of buried medieval deposits on both shores of the River Yare, and the earliest recorded evidence from recent archaeological investigations dates to the

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early medieval and medieval periods. It is unlikely that local conditions before this date would have been suitable for prehistoric settlers, however, the possibility of prehistoric finds or features surviving within the study area cannot be ruled out.

### *Options 32 and 33*

8.4.2 These options are almost identical, and as a result constraints affecting these options are the same. These constraints include:

- WWII defensive structures (barbed wire obstruction, military building and roadblock) for which no remains survive above ground;
- A 19<sup>th</sup> century railway line;
- A levelled bomb crater;
- Setting of the Camperdown and Gorleston Conservation Areas;
- Setting of the Grade II Listed Gas Works; and
- Setting of the Grade II Listed Dolphin Public House (immediately adjacent to the scheme options).

### *Option 37*

8.4.3 The constraints affecting this option are:

- WWII defensive structures (barbed wire obstruction, military building & roadblock) for which no remains survive above ground;
- A 19<sup>th</sup> century railway line;
- Setting of the Camperdown and Gorleston Conservation Areas;
- Setting of the Grade II Listed Gas Works; and
- Setting of the Grade II Listed Dolphin Public House (c.37m from the scheme option).

## **8.5 Historic Environment Assessment - WebTAG Worksheets**

8.5.1 The options are listed and described in the following order:

- Options 32 and 33; and
- Option 37.

8.5.2 Options 32 and 33 are considered together as the impacts associated with both options are identical.

Options 32 and 33 – Historic Environment Worksheet

Options 32 and 33 Historic Environment Worksheet

Feature	Description	Scale it matters	Significance	Rarity	Impact
<b>Form</b>	<p>Within the study area there are no World Heritage Sites, Scheduled Monuments, Registered Parks and Gardens, Registered Battlefields or Protected Wreck Sites within 1km of Options 32 and 33. There are 45 listed buildings (1 Grade I, 4 Grade II* and 40 Grade II) and 4 Conservation Areas within 1km of these options.</p> <p>The part of the study area in proximity to these options has an industrial, commercial, transportation, and slight residential character. It is located about 2km to the south of the medieval, post medieval and modern core of Great Yarmouth.</p> <p>Two Grade II listed buildings are in close proximity to the scheme location and would be visually impacted by Options 32 and 33. Four non-designated heritage assets also lie within close proximity to Options 32 and 33, and will be directly impacted by these options. These assets date from the 19<sup>th</sup> century to the modern period, and mainly relate to WWII defences for which no above ground remains survive today. Deposit modelling also suggests the presence of buried medieval deposits on either side of the River Yare which may be impacted by these options.</p>	The protection and enhancement of heritage assets is of national concern as set out in the National Planning Policy Framework (NPPF), which sets out to conserve heritage assets in a manner appropriate to their significance.	The Grade I and Grade II* listed buildings are of national significance. The Grade II listed buildings are of Regional Significance. The survival of later prehistoric palaeoenvironmental and archaeological remains, and medieval archaeological remains would be of regional or local significance. Other identified archaeological remains are of regional or local significance	The known heritage resource at this part of the study area is not rare within a national or regional context. However, the current level of archaeological work means that potential sub-surface remains are rare locally.	The proposed bridge would cross the River Yare interrupting views up and down the river and would result in a <b>slight adverse</b> impact on the character of the historic landscape. These Options would have <b>moderate adverse</b> impact on the listed buildings. There is a moderate potential for unknown archaeological remains of a medieval or later date to be located.
<b>Survival</b>	The area was extensively developed during the early 20 <sup>th</sup> century and the construction of buildings and infrastructure will have adversely impacted sub-surface remains of earlier periods. Little archaeological investigation has occurred and the survival of archaeological remains is indeterminate.	The protection and enhancement of heritage assets is of national concern as set out in the NPPF, which sets out to conserve heritage assets in a manner appropriate to their significance. The survival of heritage assets is a contributing factor to its significance.	The significance of sub-surface heritage assets is indeterminate	The survival of the heritage resource is not rare.	There would be a <b>neutral</b> impact on the survival of the listed buildings. Options 32 and 33 may have an adverse effect on unknown buried remains, but this is not quantifiable at this stage.
<b>Condition</b>	The listed buildings are in good condition. The condition of unknown sub-surface archaeological remains is indeterminate.	The protection and enhancement of heritage assets is of national concern as set out in the NPPF, which sets out to conserve heritage assets in a manner appropriate to their significance. The condition of heritage assets contributes to their significance and sensitivity to impacts.	The condition of designated heritage assets is important as, in good condition, they can inform our understanding of the history of the region and contribute to the economic wellbeing of the local areas. The significance of the condition of undesignated assets will vary with the individual asset and cannot be quantified at this stage.	The condition of the known heritage assets is common locally.	There would be <b>neutral</b> impact on the condition of the listed building. The scheme may have adverse impacts upon non-designated assets, but this cannot be quantified at this point.
<b>Complexity</b>	The complexity of the heritage resource is average for the type and periods.	The protection and enhancement of heritage assets is of national concern as set out in the NPPF, which sets out to conserve heritage assets in a manner appropriate to their significance. The complexity of assets, including individually complex assets or groups of assets contribute to their significance.	The listed buildings are not complex, but represent a variety of forms and purposes in the medieval, post medieval and modern periods that is significant to the local area in particular and to the region in general. The complexity of the undesignated assets is unknown at this stage.	The level of complexity of the designated assets is common nationally. Complexity of non-designated assets is unknown.	The scheme would not have an effect on the complexity of designated or undesignated assets.
<b>Context</b>	The options cross industrial, transport and commercial areas located either side of the River Yare.	The context and setting of most cultural heritage assets is a material	The context of related groups of listed buildings is locally significant. The	The context of the designated assets is	Most designated assets are screened from the scheme by

Options 32 and 33 Historic Environment Worksheet					
Feature	Description	Scale it matters	Significance	Rarity	Impact
		consideration at the local, regional and national policy level.	context of many designated and non-designated assets is dependent on as-yet unassessed non-designated assets. The significance is therefore unknown.	common in this region. The setting of the non-designated assets is common nationally	topography and the existing built environment. However, two Grade II listed buildings will be affected.
<b>Period</b>	The dominant historic character is 19 <sup>th</sup> and 20 <sup>th</sup> century industrial, transportation and commercial. Within the study area there few examples of assets of a medieval date as the main medieval core is situated c.2km to the north.	Period does not necessarily determine the importance of the historic resource although it can affect it. Policies within the Local and Regional Plans make reference to the safeguarding and enhancement of cultural heritage assets. The protection of listed buildings regardless of their period is of national concern as set out in the NPPF	The range and periods of the designated and non-designated assets is relatively narrow, but important in terms of understanding the development of the region.	The heritage assets of all periods are not uncommon in the region.	The scheme would not have an effect on the periods of designated or undesignated assets.

*Options 32 and 33 Summary Appraisal (including Assessment Score)*

8.5.3 Options 32 and 33 would have a moderate adverse impact upon the setting of two listed building due to their proximity to the options. The construction of either of these options would have a major adverse impact upon any unknown sub-surface archaeological remains, which deposit modelling suggests could include buried medieval layers.

Summary Assessment Score: **Moderate Adverse**

Option 37 – Historic Environment Worksheet

Option 37 Historic Environment Worksheet

Feature	Description	Scale it matters	Significance	Rarity	Impact
<b>Form</b>	<p>Within the study area there are no World Heritage Sites, Scheduled Monuments, Registered Parks and Gardens, Registered Battlefields or Protected Wreck Sites within 1km of option 37. There are 45 listed buildings (1 Grade I, 4 Grade II* and 40 Grade II) and 4 Conservation Areas within 1km of this option.</p> <p>The part of the study area in proximity to this option has an industrial, commercial, transportation, and slight residential character. It is located c.2km to the south of the medieval, post medieval and modern core of Great Yarmouth.</p> <p>Two Grade II listed buildings are in close proximity to the scheme and would be visually impacted by Option 37. Three non-designated heritage assets also lie within close proximity to Option 37, and will be directly impacted by this option. These assets date from the 19<sup>th</sup> century to the modern period, and mainly relate to WWII defences for which no above ground remains survive today.</p> <p>Deposit modelling also suggests the presence of buried medieval deposits on either side of the River Yare which may be impacted by this option.</p>	<p>The protection and enhancement of heritage assets is of national concern as set out in the NPPF, which sets out to conserve heritage assets in a manner appropriate to their significance.</p>	<p>The Grade I and Grade II* listed buildings are of national significance. The Grade II listed buildings are of Regional Significance. The survival of later prehistoric palaeoenvironmental and archaeological remains, and medieval archaeological remains would be of regional or local significance. Other identified archaeological remains are of regional or local significance</p>	<p>The known heritage resource at this part of the study area is not rare within a national or regional context. However, the current level of archaeological work means that potential sub-surface remains are rare locally.</p>	<p>The proposed bridge would cross the River Yare interrupting views up and down the river and would result in a <b>slight adverse</b> impact on the character of the historic landscape. The alignment would have <b>moderate adverse</b> impact on the listed buildings. There is a moderate potential for unknown archaeological remains of a medieval or later date to be located.</p>
<b>Survival</b>	<p>The area was extensively developed during the early 20<sup>th</sup> century and the construction of buildings and infrastructure will have adversely impacted sub-surface remains of earlier periods. Little archaeological investigation has occurred and the survival of archaeological remains is indeterminate.</p>	<p>The protection and enhancement of heritage assets is of national concern as set out in the NPPF, which sets out to conserve heritage assets in a manner appropriate to their significance. The survival of heritage assets is a contributing factor to its significance.</p>	<p>The significance of sub-surface heritage assets is indeterminate</p>	<p>The survival of the heritage resource is not rare.</p>	<p>There would be a <b>neutral</b> impact on the survival of the listed buildings. Option 37 may have an adverse effect on unknown buried remains, but this is not quantifiable at this stage.</p>
<b>Condition</b>	<p>The listed buildings are in good condition. The condition of unknown sub-surface archaeological remains is indeterminate.</p>	<p>The protection and enhancement of heritage assets is of national concern as set out in the NPPF, which sets out to conserve heritage assets in a manner appropriate to their significance. The condition of heritage assets contributes to their significance and sensitivity to impacts.</p>	<p>The condition of designated heritage assets is important as, in good condition, they can inform our understanding of the history of the region and contribute to the economic wellbeing of the local areas. The significance of the condition of undesignated assets will vary with the individual asset and cannot be quantified at this stage.</p>	<p>The condition of the known heritage assets is common locally.</p>	<p>There would be <b>neutral</b> impact on the condition of the listed building. The scheme may have adverse impacts upon non-designated assets, but this cannot be quantified at this point.</p>
<b>Complexity</b>	<p>The complexity of the heritage resource is average for the type and periods.</p>	<p>The protection and enhancement of heritage assets is of national concern as set out in the NPPF, which sets out to conserve heritage assets in a manner appropriate to their significance. The complexity of assets, including individually complex assets or groups of assets contribute to their significance.</p>	<p>The listed buildings are not complex, but represent a variety of forms and purposes in the medieval, post medieval and modern periods that is significant to the local area in particular and to the region in general. The complexity of the undesignated assets is unknown at this stage.</p>	<p>The level of complexity of the designated assets is common nationally. Complexity of non-designated assets is unknown.</p>	<p>The scheme would not have an effect on the complexity of designated or undesignated assets.</p>

Option 37 Historic Environment Worksheet					
Feature	Description	Scale it matters	Significance	Rarity	Impact
Context	This option crosses industrial, transport and commercial areas located either side of the River Yare.	The context and setting of most cultural heritage assets is a material consideration at the local, regional and national policy level.	The context of related groups of listed buildings is locally significant. The context of many designated and non-designated assets is dependent on as-yet unassessed non-designated assets. The significance is therefore unknown.	The context of the designated assets is common in this region. The setting of the non-designated assets is common nationally	Most designated assets are screened from the scheme by topography and the existing built environment. However the setting of two Grade II listed buildings will be affected.
Period	The dominant historic character is 19 <sup>th</sup> and 20 <sup>th</sup> century industrial, transportation and commercial. Within the study area there few examples of assets of a medieval date as the main medieval core is situated approximately 2km to the north.	Period does not necessarily determine the importance of the historic resource although it can affect it. Policies within the Local and Regional Plans make reference to the safeguarding and enhancement of cultural heritage assets. The protection of listed buildings regardless of their period is of national concern as set out in the National Planning Policy Framework.	The range and periods of the designated and non-designated assets is relatively narrow, but important in terms of understanding the development of the region.	The heritage assets of all periods are not uncommon in the region.	The scheme would not have an effect on the periods of designated or undesignated assets.

*Option 37 Summary Appraisal (including Assessment Score)*

8.5.4 This option would have a moderate adverse impact upon the settings of two listed building due to its proximity to the buildings. The construction of the scheme would have a major adverse impact upon any unknown sub-surface archaeological remains, which deposit modelling suggests could include buried medieval layers.

Summary Assessment Score: **Moderate Adverse**

## 9 Water Environment

### 9.1 Introduction

9.1.1 This chapter assesses the potential impacts on the water environment and takes into account; surface hydrology and quality; groundwater quality and hydrogeology; and fluvial geomorphology. A desk study of the hydrological and hydrogeological features associated with the options has been undertaken. As at the time of preparing this report, no site walk-over has been undertaken to supplement the desk study.

### 9.2 Appraisal Methodology

9.2.1 A desk study has been undertaken to inform the appraisal of the options for the OBC. The desk study has identified any changes to known water environment resources previously identified by other studies, primarily the Simple Environmental Assessment (Mott MacDonald 2009) and has also considered any new features including designated and non-designated sites. The following sources of information have been interrogated as part of the desk based exercise:

- Mott MacDonald report 'Great Yarmouth Third River Crossing – Simple Environmental Assessment' (August 2009);
- Environment Agency (EA) 'What's in My Backyard' (WIMBY) Online Mapper;
- Environment Agency Catchment Data Explorer;
- Environment Agency Long Term Flood Risk Information Mapper;
- British Geological Survey's Onshore GeoIndex Online Mapper;
- Ordnance Survey Opendata; and
- Defra's online GIS portal - <http://www.magic.defra.gov.uk/>

9.2.2 The study area has been defined as the physical area of the scheme under consideration and a buffer of 1km either side of the scheme and any surface or groundwater bodies or water dependent conservation sites located up to 1km downstream of any potential future outfalls that will discharge highway drainage. The water environment receptors detailed within this Chapter are shown on Figure 1 in **Appendix A: Environmental Constraints Plan**.

9.2.3 Potential water abstractions from both surface and groundwater sources have been considered. The EA list abstractions within the WIMBY interactive mapper, however this is considered to be a non-exhaustive list with the potential for smaller abstractions, falling outside of the EA's licensing criteria, to occur.



- 9.2.4 Water Framework Directive (WFD) data<sup>14</sup> for surface, groundwater, transitional and coastal waters is provided within the EA Catchment Data Explorer.
- 9.2.5 The appraisal will follow the methodology as required by TAG Unit A3 Chapters 5 and 10. This follows the five step approach to appraising 'environmental capital':
- Step 1: Scoping and identification of study area (as detailed above);
  - Step 2: key environmental resources have been identified and their features described. The resources have been described in terms of features or services that the resources provide;
  - Step 3: The indicators that have been used to make a judgement on the importance of a feature under consideration are quality, scale, rarity and substitutability. Having gathered information against each of the four indicators, a summary of the value of each feature has been established based upon the criteria in TAG Unit A3 Chapter 10, Table 14;
  - Step 4: An impact assessment of the scheme on identified water features has then been undertaken. Incremental, secondary and cumulative impacts have been considered and the extent to which resources are adversely affected or enhanced has been described; and
  - Step 5: This step combines the appraisal of the importance of the water environment features, with the appraisal of the magnitude of the impacts, to determine the consequence of those impacts. A two-step process is required. The first step has assessed the significance of a potential impact on each affected feature (refer to Table 16 of TAG Unit A3, Chapter 10) based on the likely impact magnitude and the importance of the feature. The second step has combined the assessment of each feature into an assessment score for each key water environmental resource (based on the definitions given in Table 17 of TAG Unit A3, Chapter 10). The significant impacts on the water environment have been summarised on the Water Environment Worksheets (see Section 11.5) for inclusion in the AST.

## 9.3 Existing Environment

### *Surface Watercourses*

- 9.3.1 The scheme crosses the River Yare once at TG524058, between Southtown Road to the west and Southgates Road to the east. The River Yare flows north to south throughout the study area, and is tidally influenced. The tidal extent of the River Yare reaches 15km upstream with a spring tidal range of approximately 2.2m<sup>15</sup>. The source of the River Yare is located near Shipham (TF937063, approximately 52km upstream of the scheme), where it flows east, skirting around the city of Norwich. It then flows south-east, then north-east towards the Norfolk Broads where it enters its

<sup>14</sup> Environment Agency, (2015). Anglian River Basin District. Retrieved 6<sup>th</sup> October 2016 from: <http://environment.data.gov.uk/catchment-planning/RiverBasinDistrict/5>

<sup>15</sup> Mott MacDonald (2009) Great Yarmouth Third River Crossing Simple Environmental Assessment.

estuary at Breydon Water at TG 469051. The Rivers Bure and Waveney also flow into the estuary from the north and south respectively. Downstream of Breydon Water, the Yare then flows south through the study area at Great Yarmouth and flows into the North Sea at TG534037.

- 9.3.2 Breydon Water is located 2.3km north-west and upstream of the scheme, and comprises of a large stretch of sheltered estuary which is 5km in length and up to 1.5km in width. It features extensive mudflats and is a designated SSSI (ID 1002542), Special Protection Area (ID UK9009181), Royal Society for the Protection of Birds Nature Reserve, Local Nature Reserve (ID 1008804) and Ramsar Site (UK11008) (Defra, 2016)<sup>16</sup>.
- 9.3.3 Under the Water Framework Directive, the study area falls within the Anglian TraC (Transitional and Coastal) management catchment, within the Anglian River Basin District<sup>17</sup>. The Norfolk East TraC, is an operational catchment which is a subset of the Anglian TraC. The Norfolk East coastal waterbody and the Bure, Waveney, Yare & Lothing transitional waterbody are subsets of the Norfolk East TraC.
- 9.3.4 The River Yare in the vicinity of the study area is classified as part of the Bure, Waveney, Yare & Lothing transitional waterbody (ID GB510503410700). This waterbody extends north and upstream of the study area, up the River Chet to Chedgrave (TM 366 991) to the west, up the River Bure to Thurne (TG376 029) north-west of the site, and along the entire River Waveney to Lake Lothing at Lowestoft. This waterbody has an overall status of Poor, a Good chemical status and a Poor ecological status (due to poor biological quality elements such as Angiosperms). It is protected under the Conservation of Wild Birds Directive, Habitats Directive, Nitrates Directive and Urban Waste Water Treatment Directive. It is also classified as Heavily Modified<sup>18</sup>. It also features the marine designated SPA named Outer Thames Estuary Extension (Site Code UK9020309) with the status as a potential Special Area of Protection (pSPA).
- 9.3.5 Downstream of the scheme, the River Yare flows into North Sea, which is classified as the Norfolk East coastal water (ID GB650503520003). It has an overall water body status of Moderate, an ecological status of Moderate (due to Moderate levels of dissolved Inorganic Nitrogen) and a chemical status of Good. It is protected under the Bathing Water Directive, Conservation of Birds Directive and Habitats Directive. It also has a Heavily Modified hydromorphological designation. The North Sea at Great Yarmouth is also a designated marine SPA 'Outer Thames Estuary (Site Code UK9010309) and a possible SAC (Inshore) 'Southern North Sea' (no site code available)<sup>16</sup>.
- 9.3.6 As part of site investigation work carried out in 2007 by Mott MacDonald, water samples from the River Yare were taken to collate information on water quality. Results indicated there were a number of parameters which exceeded Environmental

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<sup>16</sup> Defra (2016) Magic Map Application. Retrieved 12th October 2016 from <http://magic.defra.gov.uk/MagicMap.aspx>

<sup>17</sup> Environment Agency (2016) Catchment Data Explorer. Retrieved 12th October 2016 from <http://environment.data.gov.uk/catchment-planning/RiverBasinDistrict/5>

<sup>18</sup> Environment Agency (2016) Catchment Data Explorer. Retrieved 12th October 2016 from <http://environment.data.gov.uk/catchment-planning>

Quality Standards. These parameters include copper, Biological Oxygen Demand and Total Suspended Solids<sup>21</sup>.

### *Groundwater*

- 9.3.7 The study area is underlain by the Broadland Rivers Chalk and Crag groundwater body (Waterbody ID GB40501G400300) which has an overall status of Poor, and both a quantitative and chemical status of Poor. This is as a result of a Poor status for a quantitative Groundwater Dependent Terrestrial Ecosystems (GWDEs) test, as well as poor Chemical results within a Drinking Water Protected Area. The scheme is within a Nitrate Vulnerable Zone (NVZ - Zone ID 79). There are no Source Protection Zones (SPZs) within the study area.
- 9.3.8 The study area is underlain by Breydon Formation Clays and Silts along the River Yare, and north towards the Breydon Water. There are superficial peat deposits located west of the scheme location towards the A12, and North Denes Formation sand and gravel deposits located east of the scheme. The study area is underlain by sand and gravels of the Crag Group Bedrock<sup>19</sup>.
- 9.3.9 The superficial deposits are designated as a Secondary A aquifer, comprising permeable layers capable of supporting water supplies at a local scale. The bedrock aquifer within the study area is designated as a principal aquifer, meaning that they typically provide a high level of water storage, and may support water supply/river base flow on a strategic level<sup>20</sup>. The study area is also entirely classified as having a groundwater vulnerability of Major Aquifer – High.
- 9.3.10 Ground Investigation works carried out in 2007 reported groundwater levels between 0.77 and 2.83 metres below ground level (mbgl), with groundwater flow direction unclear due to the tidal influence. The groundwater is also likely to be connected to the river level<sup>21</sup>. Groundwater quality monitoring was also carried out, with a number of contaminants exceeding the drinking water standards. These included dissolved arsenic, boron, nickel, selenium, nitrate, sulphate, benzo(a)pyrene and total cyanide. Dissolved nickel and selenium levels exceeded the drinking water standards in shallow water samples at one site, BH104. High dissolved boron concentrations were observed at all monitoring sites<sup>21</sup>.

### *Abstractions*

- 9.3.11 There are two tidal water sources of abstraction along the River Yare, a medium sized abstraction located approximately 1km upstream of the scheme and a large abstraction located 1km downstream<sup>20</sup>.
- 9.3.12 The information provided by the EA (2007) detailed in the previous Environmental Assessment reported five abstractions from the River Yare for industrial uses

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<sup>19</sup> British Geological Survey (BGS) (2016) Geology of Britain Viewer 1:50,000 scale. Retrieved 12<sup>th</sup> October 2016 <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.

<sup>20</sup> Environment Agency (2016) 'What's in your backyard' online mapper. Retrieved 12<sup>th</sup> October 2016 from [http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=\\_e](http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e)

<sup>21</sup> Mott MacDonald (2007) Great Yarmouth Third River Crossing – Simple Environmental Assessment.

(approximately 500m downstream of the scheme), and two groundwater abstractions from the glacial sand and gravel deposits<sup>15</sup>.

- 9.3.13 No information on domestic private water supplies were available as part of this assessment. This data will be sought from NCC as part of any detailed design work and assessment.

#### *Pollution*

- 9.3.14 Within the study area, one major pollution incident (featuring oil and fuel spill) and two significant pollution incidents (featuring oils, fuel and other waste material) relating to the water environment have been reported. There are six discharge consents along the River Yare, three relating to waste processes and three relating to discharges from fuel and power sources<sup>20</sup>.

#### *Flooding*

- 9.3.15 Based on long term flood risk information provided by the EA, the study area features an extensive area along the River Yare which has a high flood risk (1% or 1 in 100 chance or greater of flooding each year). This is under the footprint of the scheme location from the roundabout on the western extent to the eastern side of the River Yare, and extensively in the Southtown area. Also along the River Yare downstream as far as the North Sea but less extensively. The River Yare watercourse itself is designated as a high flood risk. Upstream, there is a high risk of flooding (3.3% or 1 in 30 year chance) across the Breydon Water and adjacent marshland<sup>22</sup>.
- 9.3.16 There are existing flood defences located upstream of the study area at Vauxhall Bridge at TG251081 and the existing A1243 crossing north of the scheme. Upgrades and repairs to the flood defences are due to be complete in 2017<sup>23</sup>.
- 9.3.17 Surface water flooding data indicates that there are areas of medium and high risk surface water flooding between the A12 roundabout and the River Yare, and along the eastern banks of the River Yare between the river and the A1243 road, all of this area is built up ground<sup>22</sup>.

#### *Value of Receptors*

- 9.3.18 The value (importance) of water environment features is summarised below in Table 9-1.

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<sup>22</sup> Environment Agency (2016) Long term flood risk information. Retrieved 12<sup>th</sup> October from <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

<sup>23</sup> Environment Agency (2015) Press release - £18m scheme under way to construct flood defences in Gt Yarmouth. Available from <https://www.gov.uk/government/news/18m-scheme-under-way-to-construct-flood-defences-in-gt-yarmouth>

Table 9-1: Criteria Used to Estimate the Value of Receptors

Value	Criteria
Very High	<p><b>Surface Water Quality and Biodiversity</b>                      Large or medium watercourses with pristine / near pristine water quality                      ‘High’ WFD Overall Status surface water body                      Sites protected under EU wildlife legislation (Special Area of conservation, Special Protection Areas and Ramsar)                      Watercourses supporting a wide range of significant species and habitats sensitive to changes in suspended sediment concentrations and turbidity such as salmon or freshwater pearl mussels                      Water dependent ecosystems of international/national biodiversity value</p> <p><b>Hydromorphology</b>                      A watercourse exhibiting a range of natural morphological features such as pools and riffles, active gravel bars and varied river bank types, such morphological variability is a primary determinant of ecological diversity. Minimal modification</p> <p><b>Hydrology and Flood Risk</b>                      Watercourses or floodplains, with direct flood risk to adjacent populated areas and/or presence of critical infrastructure such as schools and hospitals etc, which are highly sensitive to increased flood risk by the possible increase in water levels</p> <p><b>Groundwater</b>                      Aquifer Productivity - Principal                      Groundwater vulnerability – Major Aquifer High                      Designated GWDTEs and GWDTEs located within designated areas</p> <p><b>Water Supplies</b>                      Watercourse supporting major/critical public water supplies                      Public water supply or large private water supply serving &gt;10 properties</p>
High	<p><b>Surface Water Quality and Biodiversity</b>                      Medium or small watercourses with minor degradation of water quality as a result of anthropogenic factors                      ‘Good’ WFD Overall Status surface water body                      Sites protected under UK wildlife legislation (Sites of Special Scientific Interest and National Nature Reserves)                      Water dependent ecosystems of regional/county biodiversity value                      Watercourses supporting some species and habitats sensitive to changes in suspended sediment concentrations and turbidity</p> <p><b>Hydromorphology</b>                      A watercourse exhibiting a range of morphological features with very little modification</p> <p><b>Hydrology and Flood Risk</b>                      Watercourses or floodplains, with a possibility of direct flood risk to less populated areas without critical infrastructure, which are sensitive to increased flood risk by the possible increase in water levels</p> <p><b>Groundwater</b></p>

Value	Criteria
	<p>WFD Good overall status groundwater body                      Aquifer Productivity – Secondary A                      Groundwater vulnerability – Major Aquifer Intermediate/Low                      Non designated GWDTEs with highly groundwater dependent NVC communities</p> <p><b>Water Supplies</b>                      Watercourses supporting minor/non-critical public drinking water supplies                      Private water supply serving 2-10 properties</p>
Medium	<p><b>Surface Water Quality and Biodiversity</b>                      Small watercourses with degradation of water quality as a result of anthropogenic factors                      ‘Moderate’ WFD Overall Status surface water body                      Water dependent ecosystems of county/district biodiversity value                      Watercourses supporting limited species and habitats sensitive to changes in suspended sediment concentrations and turbidity</p> <p><b>Hydromorphology</b>                      A watercourse exhibiting some signs of modifications and recovering to a natural equilibrium. Limited morphological features and a limited range of fluvial processes</p> <p><b>Hydrology and Flood Risk</b>                      Watercourses or floodplains, with a possibility of direct flood risk to high value agricultural areas, which are moderately sensitive to increased flood risk by the possible increase in water levels</p> <p><b>Groundwater</b>                      Aquifer Productivity – Secondary B                      Groundwater vulnerability – Minor Aquifer High/Intermediate                      Non designated GWDTEs with moderately groundwater dependent NVC communities</p> <p><b>Water Supplies</b>                      Watercourses supporting private drinking water supplies or for agricultural/industrial use                      Private water supply serving a single property</p>
Low	<p><b>Surface Water Quality and Biodiversity</b>                      Small, heavily modified watercourses or drains with poor water quality as a result of anthropogenic factors                      ‘Poor’/‘Bad’ WFD Overall Status surface water body                      Water dependent ecosystems of local/less than local biodiversity value                      Watercourses which do not support any significant species and habitats sensitive to changes in suspended sediment concentrations and turbidity</p> <p><b>Hydromorphology</b>                      A watercourse exhibiting no morphological diversity; flow is uniform, gravel bars absent and bank type’s uniform and stable, with no evidence of active fluvial processes. Such watercourses may have been subject to past modification such as straightening, bank protection and culverting, or other anthropogenic pressures.</p> <p><b>Hydrology and Flood Risk</b>                      Watercourses or floodplains passing through low value agricultural areas, which are less sensitive to increased flood risk by the possible increase in water levels</p>

Value	Criteria
	<p><b>Groundwater</b> WFD Poor overall status groundwater body Aquifer Productivity – Secondary (undifferentiated) Groundwater vulnerability – Minor aquifer Low</p> <p><b>Water Supplies</b> Watercourses not supporting water abstractions</p>

- 9.3.19 The value/importance of surface watercourses (River Yare) is considered to be **Very High**, due to the connectivity of the River Yare with designated sites upstream and downstream.
- 9.3.20 The value of groundwater is considered to be **Low**, due to the Poor WFD status criteria for the Broadland Rivers Chalk and Crag groundwater body.
- 9.3.21 The value of surface and groundwater receptors in the area is considered to be **High**, based on the confirmation of agricultural/industrial water supplies in the study area, and uncertainty about any private domestic supplies.
- 9.3.22 The value/importance of river floodplain receptors is considered to be **High** due to the presence of High risk areas of flooding within the study area.

#### 9.4 Brief Evaluation of Topic Related Constraints

- 9.4.1 The potential impacts of the three proposed bridge options have been considered in this appraisal. Options 32 and 33 are similar in terms of design, construction, operation and maintenance, the only difference being in the finer design details and road layout. The impacts of the proposed bridge options on the water environment have been adjudged to be similar. Therefore, this chapter presents the constraints of Options 32 and 33 together and the Option 37 separately.
- 9.4.2 Summarily, there are a number of potential environmental constraints highlighted within Section 9.3 which have been considered and these include:
- Surface Watercourses – potential for impact as a result of pollution from construction works, accidental spillage and routine run-off to the River Yare and local drainage networks. There may be geomorphological changes to watercourses as a result of new structures such as bridges and culverts;
  - Groundwater – The construction of road cuttings and deep excavations associated with structural foundations have the potential to impact on groundwater levels and flows, with subsequent impacts on groundwater dependant receptors such as private water supplies and GWDTEs. If there are any groundwater discharges there is potential for pollution to groundwater from construction, routine run-off and accidental spillage;
  - Flooding – there is potential for an increase in river and surface water flood risk, due to potential increase in impermeable areas created by the scheme.

In relation to flooding from sewers, it has not been possible to draw any conclusions on this risk due to the lack of available data; and

- Abstractions – tidal abstractions along the River Yare and groundwater abstractions within the study area may be impacted, due to changes in water flow and quality during construction and operation of the scheme.

9.4.3 The three options currently being considered are located entirely within floodplain cited as Flood Zone 3 (land assessed as having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding in any year). With flood defences, there is low risk of flooding to the eastern and western areas of the option, however the central part of the option which crosses over the River Yare remain at high risk.

9.4.4 All three options do not fall within the Environment Groundwater SPZ. However, they are located entirely within the British Geological Society (BGS) Bedrock Principal aquifer designation and partially within the BGS Superficial Deposits Secondary A aquifer designation.

9.4.5 All three options are not within the maximum extent of flooding from reservoirs. There are no major sources of artificial flooding affecting the scheme area.

#### *Option 32*

9.4.6 Option 32 consists of a dual carriageway with new four arm roundabout Suffolk Road tie-in to the west (four lane high level bridge across the River Yare, roundabout as west tie in and traffic signals to the east at South Denes Road). At the location of the bridge crossing, the water body is approximately 85m wide and is characterised as a heavily modified water body, with artificial, developed banks and a tidal flow regime.

9.4.7 There are small areas of low, medium and high risk of flooding from surface water. The notable area of risk is located to the south-east of the existing Hafrey's roundabout, in the location of the proposed new roundabout.

#### *Option 33*

9.4.8 Option 33 consists of a three lane carriageway, new four arm roundabout Suffolk Road tie-in to the west (three lane high level bridge across the River Yare, roundabout as west tie in and traffic signals to the east at South Denes Road). This option would operate as a tidal flow arrangement depending on the traffic flow conditions. The tidal flow arrangement would be controlled by overhead lane signals mounted on cantilever / portal gantries. At the location of the bridge crossing, the water body is approximately 85m wide and is characterised as a heavily modified water body, with artificial, developed banks and a tidal flow regime.

9.4.9 There are small areas of low, medium and high risk of flooding from surface water. The notable area of risk is located to the south-east of the existing Hafrey's roundabout, in the location of the proposed new roundabout.



### *Option 37*

- 9.4.10 Option 37 consists of a single carriageway with at grade junction Southtown Road tie in to the west (single carriageway two lane low level bridge with traffic signal junctions to the west and the east at South Denes Road). At the location of the bridge crossing, the water body is approximately 85m wide and is characterised as a heavily modified water body, with artificial, developed banks and a tidal flow regime.
- 9.4.11 Option 37 is entirely located within floodplain cited as Flood Zone 3 (land assessed as having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding in any year). With flood defences, there is low risk of flooding to the eastern and western areas of the option, however the central part of the option which crosses over the River Yare remain at high risk.
- 9.4.12 There are small areas of low, medium and high risk of flooding from surface water. The notable area of risk is located to the south-east of the existing Hafrey's roundabout, at a section along the alignment of the new road which links the existing roundabout to the proposed river crossing.

## **9.5 Water Environment Appraisal - WebTAG Worksheets**

- 1.1.1 The options are listed and described in the following order:
- Options 32 and 33; and
  - Option 37.

Options 32 and 33 - Water Environment Worksheet

Options 32 and 33 Water Environment Worksheet									
Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
<b>Surface Water</b>									
Potential floodplain loss and increased flood risk	Sea and Estuaries-River Yare	Conveyance of flood levels and overland flows, flood risk	Option falls within Flood Zone 3. Existing flood risk – fluvial and tidal.	Entire scheme within floodplain.	Feature of all watercourses and estuaries	Floodplain is heavily developed with urban environments and artificial surfaces on floodplain where scheme crosses land. Major compensation or mitigation of floodplain loss likely to be required through potential structural or sustainable flood management measures. Suitable location for attenuation Sustainable Drainage Systems (SuDS) to be sought outside of the floodplain	High	Large Adverse	Significant
Pollution to surface waters from construction	Sea and Estuaries-River Yare	Water quality	WFD Chemical - Good WFD Overall - Poor Ecological Status – Poor (due to poor biological quality elements such as Angiosperms). Classified as a Heavily Modified Water Body.	Regional	Medium	Limited	Medium	Slight adverse	Insignificant
Pollution to surface waters from routine runoff	Sea and Estuaries-River Yare	Water quality	WFD Chemical - Good WFD Overall - Poor Ecological Status – Poor (due to poor biological quality elements such as Angiosperms). Classified as a Heavily Modified Water Body.	Regional	Medium	Limited	Medium	Slight adverse	Insignificant
Pollution to surface waters from accidental spillage	Sea and Estuaries-River Yare	Water quality	WFD Chemical - Good WFD Overall - Poor Ecological Status – Poor (due to poor biological quality elements such as Angiosperms). Classified as a Heavily Modified Water Body.	Regional	Medium	Limited	Medium	Negligible	Insignificant
Alteration to surface flow characteristics that may affect channel, erosive or deposition processes	Sea and Estuaries-River Yare	Channel geomorphology	WFD - Heavily Modified Water Body Urbanised environment.	Local	Low	Limited	Low	Negligible	Insignificant
Alteration to availability of surface water abstractions	Sea and Estuaries-River Yare	Water supply	Tidal watercourse, with high saline content reducing resource demand	Local	Low	High	Low	Slight adverse	Insignificant
Chemical impacts of River Yare through diffuse pollution and highways	Seas and Estuaries-River Yare	Chemical Water Quality	Currently good chemical status	Measured on catchment	Common, region-wide	Substitute to ground water discharge	Medium	Minor Adverse	Insignificant

Options 32 and 33 Water Environment Worksheet									
Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
discharge				wide basis.					
Pollution or flow alterations, including structures	Sea and Estuaries- River Yare	Chemical Water Quality- Transport and dilution of waste products	Tidal watercourse with potential for transport and dilution from consented discharges. Currently Good chemical status	Local	Medium	Not feasible	Low	Negligible	Insignificant
Groundwater									
Impact upon groundwater supply and abstractions	Water Supply- Broadland Rivers Chalk and Crag groundwater body	Principal Aquifer. Within a Nitrate Vulnerable Zone (NVZ)	Water has high mineral content.	Regional feature and important for supply.	Principal bedrock aquifer.	Widespread aquifer, surface water over abstraction. Unlikely to be substituted.	Very High	Negligible	Low significance
Impact and introduction of groundwater discharges and diffuse pollution to groundwater sources.	Groundwater Quality- Broadland Rivers Chalk and Crag groundwater body	Groundwater Vulnerability WFD status	Ground water vulnerability of Major Aquifer – High. WFD chemical status of Poor.	Regional.	Important principal aquifer. Regional importance for industrial supply.	Unlikely to substitute. Promotion of surface water abstraction unlikely due to pressures on supply and abundance.	Low	Negligible	Insignificant
Restriction or disruption of infiltration and groundwater flow	Groundwater Flow - Broadland Rivers Chalk and Crag groundwater body	Urbanised area.	Heavily urbanised area with numerous impermeable surfaces and reduced permeable areas.	Small increase in permeable area in regional or local context	Common in urban area.	Potential to offset with introduction of green space and permeable areas.	Low	Negligible	Insignificant

*Options 32 and 33 Summary Appraisal (including Assessment Score)*

9.5.1 The options are deemed to be of significant adverse impact to the water environment as a result of impacts to the floodplain. Groundwater flows and hydrological linkages between the options and potential groundwater abstractions would need to be established. It is unlikely that increased impermeable surfaces would impact upon the permeability of surrounding land and aquifer recharge, given the urbanised land use. It is anticipated that any embankments or bridge structures would not obstruct or alter flood flows any more than existing residential and/or commercial structures.

Summary Assessment Score: **Moderate Adverse**

Option 37 – Water Environment Worksheet

Option 37 Water Environment Worksheet									
Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
<b>Surface Water</b>									
Potential floodplain loss and increased flood risk	Sea and Estuaries-River Yare	Conveyance of flood levels and overland flows, flood risk	Option falls within Flood Zone 3. Existing flood risk – fluvial and tidal.	Entire scheme within floodplain.	Feature of all watercourses and estuaries	Floodplain is heavily developed with urban environments and artificial surfaces on floodplain where scheme crosses land. Major compensation or mitigation of floodplain loss likely to be required through potential structural or sustainable flood management measures. Suitable location for attenuation SuDS to be sought outside of the floodplain	High	Large Adverse	Significant
Pollution to surface waters from construction	Sea and Estuaries-River Yare	Water quality	WFD Chemical - Good WFD Overall - Poor Ecological Status – Poor (due to poor biological quality elements such as Angiosperms). Classified as a Heavily Modified Water Body.	Regional	Medium	Limited	Medium	Slight adverse	Insignificant
Pollution to surface waters from routine runoff	Sea and Estuaries-River Yare	Water quality	WFD Chemical - Good WFD Overall - Poor Ecological Status – Poor (due to poor biological quality elements such as Angiosperms). Classified as a Heavily Modified Water Body.	Regional	Medium	Low level bridge which may potentially impede runoff from the full length of the bridge to be conveyed to the ends of the bridge and into stormwater treatment provision.	Medium	Minor adverse	Low significance
Pollution to surface waters from accidental spillage	Sea and Estuaries-River Yare	Water quality	WFD Chemical - Good WFD Overall - Poor Ecological Status – Poor (due to poor biological quality elements such as Angiosperms). Classified as a Heavily Modified Water Body.	Regional	Medium	Low level bridge which may potentially provide pathway for pollutants released through accidental spillage onto surface water receptors.	Medium	Minor adverse	Low significance
Alteration to surface flow characteristics that may affect channel, erosive or deposition processes	Sea and Estuaries-River Yare	Channel geomorphology	WFD - Heavily Modified Water Body Urbanised environment.	Local	Low	Limited	Low	Negligible	Insignificant

Option 37 Water Environment Worksheet									
Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
Alteration to availability of surface water abstractions	Sea and Estuaries- River Yare	Water supply	Tidal watercourse, with high saline content reducing resource demand	Local	Low	Limited	Low	Negligible	Insignificant
Chemical impacts of River Yare through diffuse pollution and highways discharge	Seas and Estuaries- River Yare	Chemical Water Quality	Currently good chemical status	Measured on catchment wide basis.	Common, region-wide	Substitute to ground water discharge	Medium	Minor Adverse	Low significance
Pollution or flow alterations, including structures	Sea and Estuaries- River Yare	Chemical Water Quality- Transport and dilution of waste products	Tidal watercourse with potential for transport and dilution from consented discharges. Currently Good chemical status	Local	Medium	Not feasible	Low	Negligible	Insignificant
Groundwater									
Impact upon groundwater supply and abstractions	Water Supply- Broadland Rivers Chalk and Crag groundwater body	Principal Aquifer. Within a Nitrate Vulnerable Zone (NVZ)	Water has high mineral content.	Regional feature and important for supply.	Principal bedrock aquifer.	Widespread aquifer, surface water over abstraction. Unlikely to be substituted.	Very High	Negligible	Low significance
Impact and introduction of groundwater discharges and diffuse pollution to groundwater sources.	Groundwater Quality- Broadland Rivers Chalk and Crag groundwater body	Groundwater Vulnerability WFD status	Ground water vulnerability of Major Aquifer – High. WFD chemical status of Poor.	Regional.	Important principal aquifer. Regional importance for industrial supply.	Unlikely to substitute. Promotion of surface water abstraction unlikely due to pressures on supply and abundance.	Low	Negligible	Insignificant
Restriction or disruption of infiltration and groundwater flow	Groundwater Flow - Broadland Rivers Chalk and Crag groundwater body	Urbanised area.	Heavily urbanised area with numerous impermeable surfaces and reduced permeable areas.	Small increase in permeable area in regional or local context	Common in urban area.	Potential to offset with introduction of green space and permeable areas.	Low	Negligible	Insignificant

*Option 37 Summary Appraisal (including Assessment Score)*

9.5.2 The option is deemed to be of a significant adverse impact to the water environment as a result of impacts to floodplain. There are also a number of low significant impacts of the option on the water environment in relation to pollution to surface water and groundwater bodies. Groundwater flows and hydrological linkages between the option and potential groundwater abstractions would need to be established. It is unlikely that increased impermeable surfaces would impact upon the permeability of surrounding land and aquifer recharge, given the urbanised land use. It is anticipated that any embankments or bridge structures would not obstruct or alter flood flows any more than existing residential and/or commercial structures.

Summary Assessment Score: **Moderate Adverse.**

## 10 Appraisal Summary Tables – Environment

### 10.1 Introduction

- 10.1.1 The AST displays the degree to which the five Central Government objectives for transport (environment, safety, economy, accessibility and integration) would be achieved. It is from this AST that a judgement should be made about the overall value-for-money of the options in achieving the Government's objectives.
- 10.1.2 The information provided in the AST enable a consistent view to be taken about the value of the options developed for the scheme.
- 10.1.3 Sections 10.3 to 10.5 present summary extracts from the environmental assessments focusing on the environmental sub-objectives of the ASTs for the options.

### 10.2 Distributional Impact

- 10.2.1 A WebTAG distributional impact assessment has not been undertaken at this stage of the appraisal process for Noise and Air Quality as the options are at the same crossing point, making the outcome of a distributional impact immaterial to the optioneering process. This will be required at the detailed assessment stage.

10.3 Option 32 Appraisal Summary Table

Impacts	Summary of key impacts	Assessment					
		Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp		
Environmental	Noise	<p>There are 663 sensitive receptor buildings and no Defra Noise Important Areas within the 300m study area.</p> <p>This option is likely to cause some increases in noise level at the dwellings and other noise sensitive receptors in the immediate vicinity of the both the new and improved sections of carriageway due to increases in road traffic generated noise.</p> <p>Preliminary traffic data indicates that there are road links in the immediate area of the scheme which will experience significant changes in traffic flow and hence noise level as a result of the introduction of this option.</p>	<p>A combined property count of all sensitive receptors has identified 663 buildings in the study area.</p>	N/A	Not Calculated	Not Calculated	
	Air Quality	<p>There are no designated AQMAs within 200m of this Option. There are also no ecologically designated sites considered sensitive to air pollution situated within 200m of this Option.</p> <p>An overall neutral local air quality impacts is likely given the traffic data provided (AM, IP &amp; PM flows). A beneficial impact on regional emissions can be expected given the likelihood of the new bridge to reduce the distance travelled to cross the River Yare.</p>	<p>There are 252 potentially sensitive receptors within 200m of this option.</p> <p>Background mapped air pollutant concentrations are well below national objective values.</p> <p>Max roadside PCM concentrations 2015: 29.4µg/m<sup>3</sup> 2020: 23µg/m<sup>3</sup></p>	N/A	Not Calculated	Not Calculated	
	Greenhouse gases	Scoped Out	<p>Change in non-traded carbon over 60y (CO2e)</p> <p>Change in traded carbon over 60y (CO2e)</p>	N/A	N/A	N/A	N/A
	Landscape	Scoped Out	N/A	N/A	N/A	N/A	
	Townscape	<p>This option would result in the loss of some existing residential townscape although not of particularly strong or defined townscape value. Existing vistas along the river corridor may be interrupted or fore-shortened by the structure, although the bridge would not appear out of context in respect of existing townscape.</p>	N/A	Neutral	N/A	N/A	

	The bridge when open would become a skyline feature to views along the river corridor and a distant feature of the Great Yarmouth skyline from within the Broads National Park. It would be perceived in the context of the town's existing townscape and in part industrial backdrop to the Park setting. The introduction of a third bridge crossing would have a beneficial effect on human interaction (non-motorised users) by way of improved townscape linkages.				
Historic Environment	The setting of at least 2 Grade II Listed Buildings and two conservation areas may be indirectly impacted upon by this Option. Four non-designated heritage assets, including a railway line, a bomb crater and WWII defensive features may be directly impacted by this Option. There is potential for this Option to impact upon currently unknown below ground heritage assets.	N/A	Moderate Adverse	N/A	N/A
Biodiversity	No adverse effects expected to any international or national designated nature conservation sites. Potential to impact bat roosts, breeding bird, water voles, black redstarts and hedgehogs due to the loss of suitable habitat for these species associated with land take for this option.	N/A	Slight adverse	N/A	N/A
Water Environment	Water environment impacts include increased discharge into water bodies (surface and groundwater), which may cause a slight decrease in water quality. Increased potential for accidental spillage contaminating surface water or groundwater.  Potential adverse impact to local aquifers during construction. Increase in flood risk along the watercourse due to increased run-off and reduction of floodplain.	N/A	Moderate Adverse	N/A	N/A



10.4 Option 33 Appraisal Summary Table

Impacts	Summary of key impacts	Assessment					
		Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp		
Environmental	Noise	<p>There are 663 sensitive receptor buildings and no Defra Noise Important Areas within the 300m study area.</p> <p>This option is likely to cause some increases in noise level at the dwellings and other noise sensitive receptors in the immediate vicinity of the both the new and improved sections of carriageway due to increases in road traffic generated noise.</p> <p>Preliminary traffic data indicates that there are road links in the immediate area of the scheme which will experience significant changes in traffic flow and hence noise level as a result of the introduction of this option.</p>	<p>A combined property count of all sensitive receptors has identified 663 buildings in the study area.</p>	N/A	Not Calculated	Not Calculated	
	Air Quality	<p>There are no designated AQMAs and no ecologically designated sites that are considered sensitive to air pollution situated within 200m of the option.</p> <p>An overall neutral local air quality impacts is likely given the traffic data provided (AM, IP and PM flows). A beneficial impact on regional emissions can be expected given the likelihood of the new bridge to reduce the distance travelled to cross the River Yare.</p>	<p>There are 252 potentially sensitive receptors within 200m of the option.</p> <p>Background mapped air pollutant concentrations are well below national objective values.</p> <p>Max roadside PCM concentrations 2015: 29.4µg/m<sup>3</sup> 2020: 23µg/m<sup>3</sup></p>	N/A	Not Calculated	Not Calculated	
	Greenhouse gases	Scoped Out	Change in non-traded carbon over 60y (CO <sub>2</sub> e)	N/A	N/A	N/A	N/A
			Change in traded carbon over 60y (CO <sub>2</sub> e)	N/A			
	Landscape	Scoped Out	N/A		N/A	N/A	N/A
	Townscape	This option would result in the loss of some existing residential townscape although not of particularly strong or defined townscape value. Existing vistas along the river corridor may be interrupted or fore-shortened by the	N/A		Neutral	N/A	N/A

	<p>structure, although the bridge would not appear out of context in respect of existing townscape.</p> <p>The bridge when open would become a skyline feature to views along the river corridor and a distant feature of the Great Yarmouth skyline from within the Broads National Park. It would be perceived in the context of the town's existing townscape and in part industrial backdrop to the Park setting. The introduction of a third bridge crossing would have a beneficial effect on human interaction (non-motorised users) by way of improved townscape linkages.</p>				
Historic Environment	<p>The setting of at least 2 Grade II listed buildings and two conservation areas may be indirectly impacted upon by this Option. Four non-designated heritage assets, including a railway line, a bomb crater and WWII defensive features may be directly impacted by this scheme Option. There is potential for this Option to impact upon currently unknown below ground heritage assets.</p>	N/A	Moderate Adverse	N/A	N/A
Biodiversity	<p>No adverse effects expected to any international or national designated nature conservation sites. Potential to impact bat roosts, breeding bird, water voles, black redstarts and hedgehogs due to the loss of suitable habitat for these species associated with land take for this option.</p>	N/A	Slight adverse	N/A	N/A
Water Environment	<p>Water environment impacts include increased discharge into water bodies (surface and groundwater), which may cause a slight decrease in water quality. Increased potential for accidental spillage contaminating surface water or groundwater.</p> <p>Increase in flood risk along the watercourse due to increased run-off and reduction of floodplain.</p>	N/A	Moderate Adverse	N/A	N/A

10.5 Option 37 Appraisal Summary Table

Impacts	Summary of key impacts	Assessment					
		Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp		
Environmental	Noise	<p>There are 663 sensitive receptor buildings and no Defra Noise Important Areas within the 300m study area.</p> <p>This option is likely to cause some increases in noise level at the dwellings and other noise sensitive receptors in the immediate vicinity of the both the new and improved sections of carriageway due to increases in road traffic generated noise.</p> <p>Preliminary traffic data indicates that there are road links in the immediate area of the scheme which will experience significant changes in traffic flow and hence noise level as a result of the introduction of this option.</p>	A combined property count of all sensitive receptors has identified 571 buildings in the study area.	N/A	Not Calculated	Not Calculated	
	Air Quality	<p>There are no designated AQMAs and no ecologically designated sites that are considered sensitive to air pollution situated within 200m of this Option.</p> <p>An overall neutral local air quality impacts is likely given the traffic data provided (AM, IP &amp; PM flows).</p> <p>A beneficial impact on regional emissions can be expected given the likelihood of the new bridge to reduce the distance travelled to cross the River Yare.</p>	<p>There are 206 potentially sensitive receptors within 200m of this Option.</p> <p>Background mapped air pollutant concentrations are well below national objective values.</p> <p>Max roadside PCM concentrations 2015: 29.4 µg/m<sup>3</sup> 2020: 23 µg/m<sup>3</sup></p>	N/A	Not Calculated	Not Calculated	
	Greenhouse gases	N/A	<p>Change in non-traded carbon over 60y (CO<sub>2</sub>e)</p> <p>Change in traded carbon over 60y (CO<sub>2</sub>e)</p>	N/A	N/A	N/A	N/A
	Landscape	Scoped Out	N/A	N/A	N/A	N/A	
	Townscape	This option would result in the loss of some existing residential townscape although not of particularly strong or defined townscape value. Existing vistas along the river corridor may be	N/A	Neutral	N/A	N/A	

	<p>interrupted or fore-shortened by the structure, although the bridge would not appear out of context in respect of existing townscape.</p> <p>The bridge when open would become a skyline feature to views along the river corridor and a distant feature of the Great Yarmouth skyline from within the Broads National Park. It would be perceived in the context of the town's existing townscape and in part industrial backdrop to the Park setting. The introduction of a third bridge crossing would have a beneficial effect on human interaction (non-motorised users) by way of improved townscape linkages.</p>				
Historic Environment	<p>The setting of at least two Grade II listed buildings and two conservation areas may be indirectly impacted upon by this scheme Option. Three non-designated heritage assets, including a railway line, a bomb crater and WWII defensive features may be directly impacted by this scheme Option. There is potential for this scheme Option to impact upon currently unknown below ground heritage assets.</p>	N/A	Moderate Adverse	N/A	N/A
Biodiversity	<p>No adverse effects expected to any international or national designated nature conservation sites. Potential to impact bat roosts, breeding bird, water voles, black redstarts and hedgehogs due to the loss of suitable habitat for these species associated with land take for this option.</p>	N/A	Slight adverse	N/A	N/A
Water Environment	<p>Water environment impacts include increased discharge into water bodies (surface and groundwater), which may cause a slight decrease in water quality. Increased potential for accidental spillage contaminating surface water or groundwater.</p> <p>Increase in flood risk along the watercourse due to increased run-off and reduction of floodplain.</p>	N/A	Moderate Adverse	N/A	N/A

## Appendices

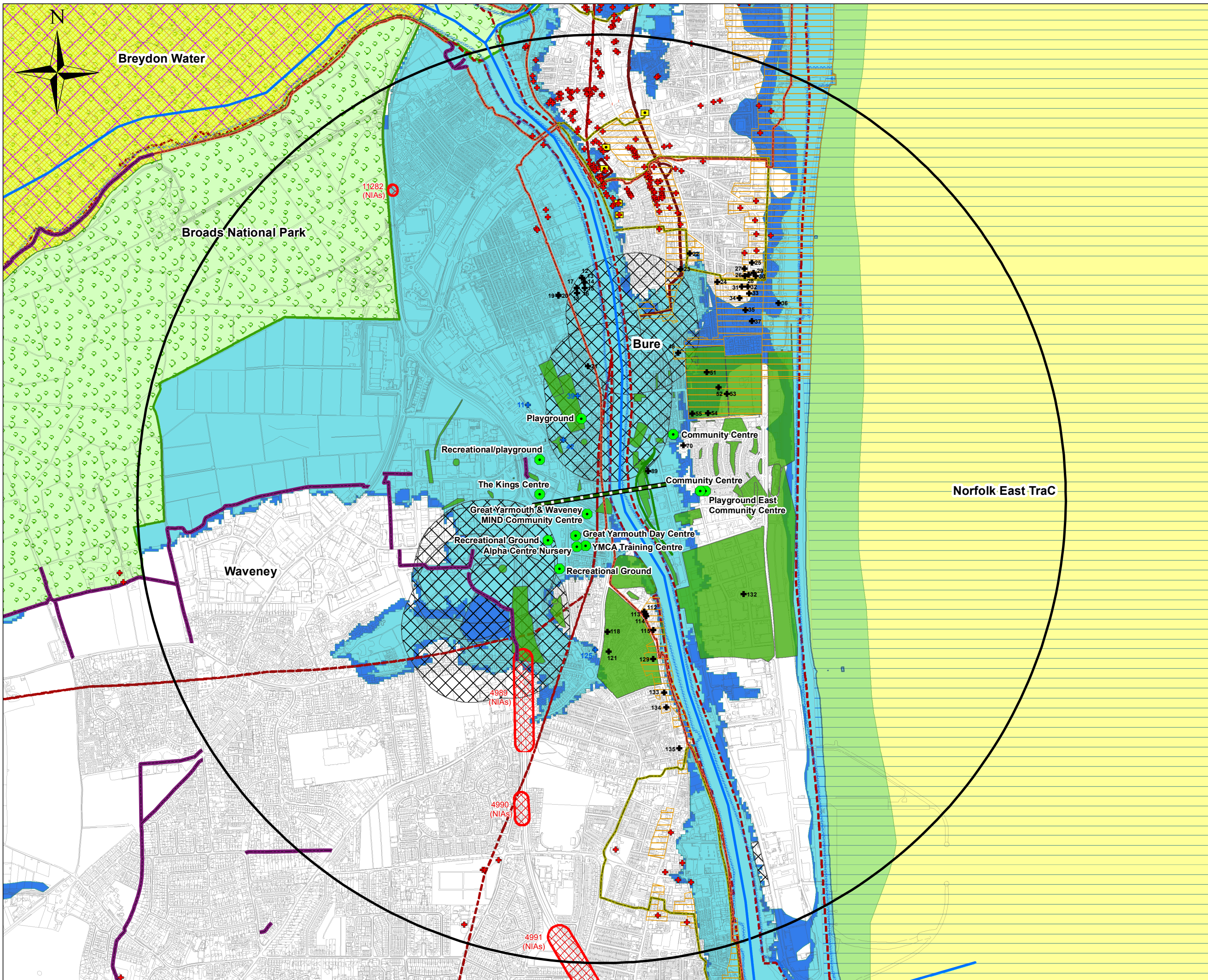
## Appendix A: Plans

Environmental Constraints Plan

Option 32

Option 33

Option 37



- KEY**
- Immediate Zone of Influence (2KM buffer)
  - Proposed Bridge Location
  - Watercourse
  - Undesignated Sites (Line) - Great Yarmouth
  - Undesignated Sites (Region) - Great Yarmouth
  - Undesignated sites - Great Yarmouth
  - Listed Buildings - Great Yarmouth
  - Listed Building
  - Other (non-dwelling) Noise Sensitive Receptors
  - Conservation Areas (Great Yarmouth)
  - Noise Important Areas
  - Scheduled Monument (Point)
  - Scheduled Monument (Areas)
  - Ramsar
  - Special Protection Areas
  - Sites of Special Scientific Interest (SSSI)
  - Public Rights of Way
  - Main Trails
  - Circulars Trails
  - Minerals and Waste Sites
  - National Character Areas
  - Broads National Park
  - WFD Surface Water Operational Catchments Cycle 2
  - Flood Zone 3
  - Flood Zone 2

**DRAFT**

A		IW 23/03/2017	OE 23/03/2017	RA 23/03/2017
Ver	Amendments	Originated by and date	Checked by and date	Approved by and date

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Client  
**Norfolk County Council**

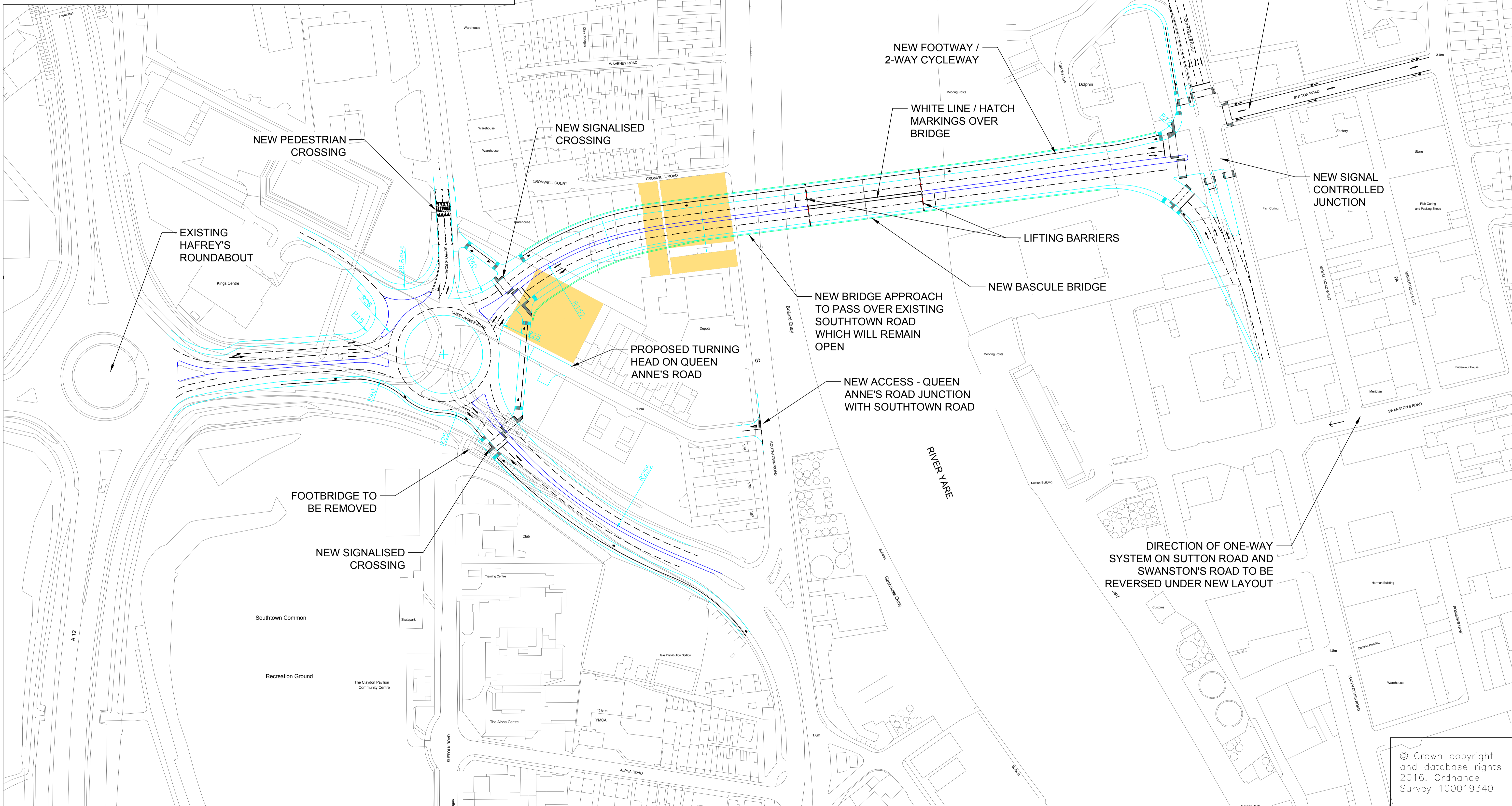
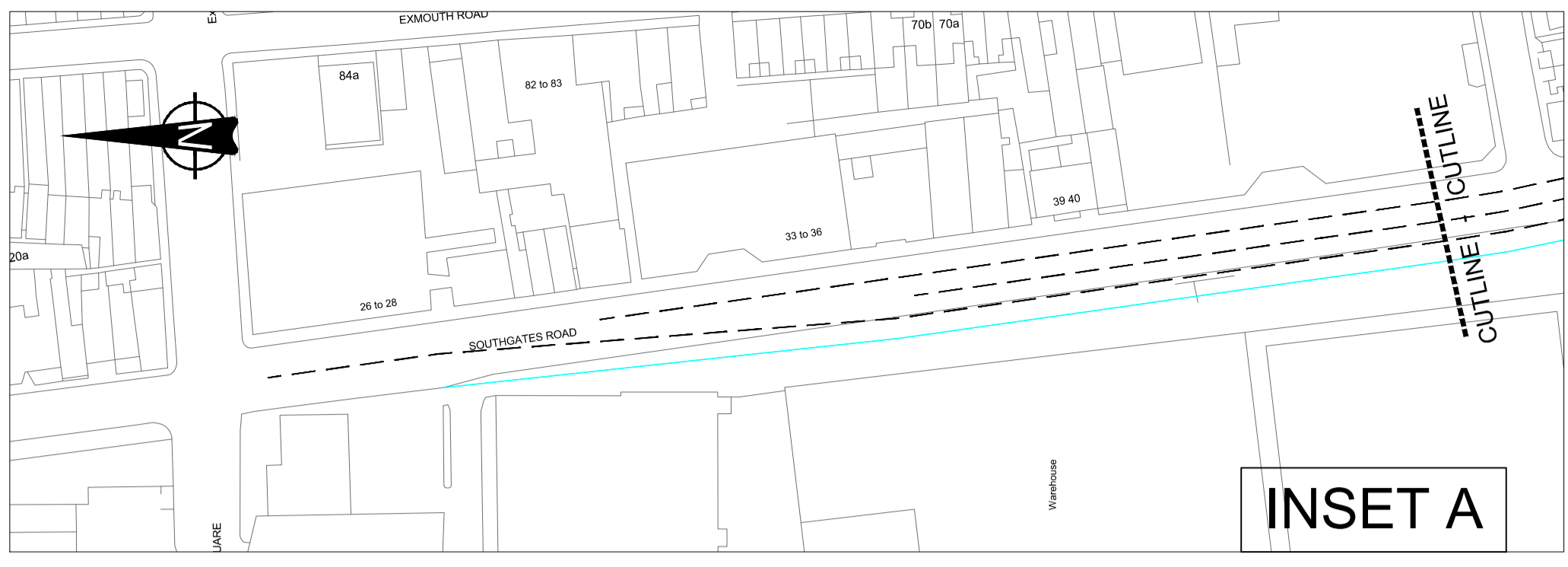
Project  
**Great Yarmouth Thrid River Corsing**

Drawing Title  
**Environmental Constraints Plan**

Drawing No.  
**FIGURE 1**

Scale @ A3 : 1:15,000

Purpose : Information

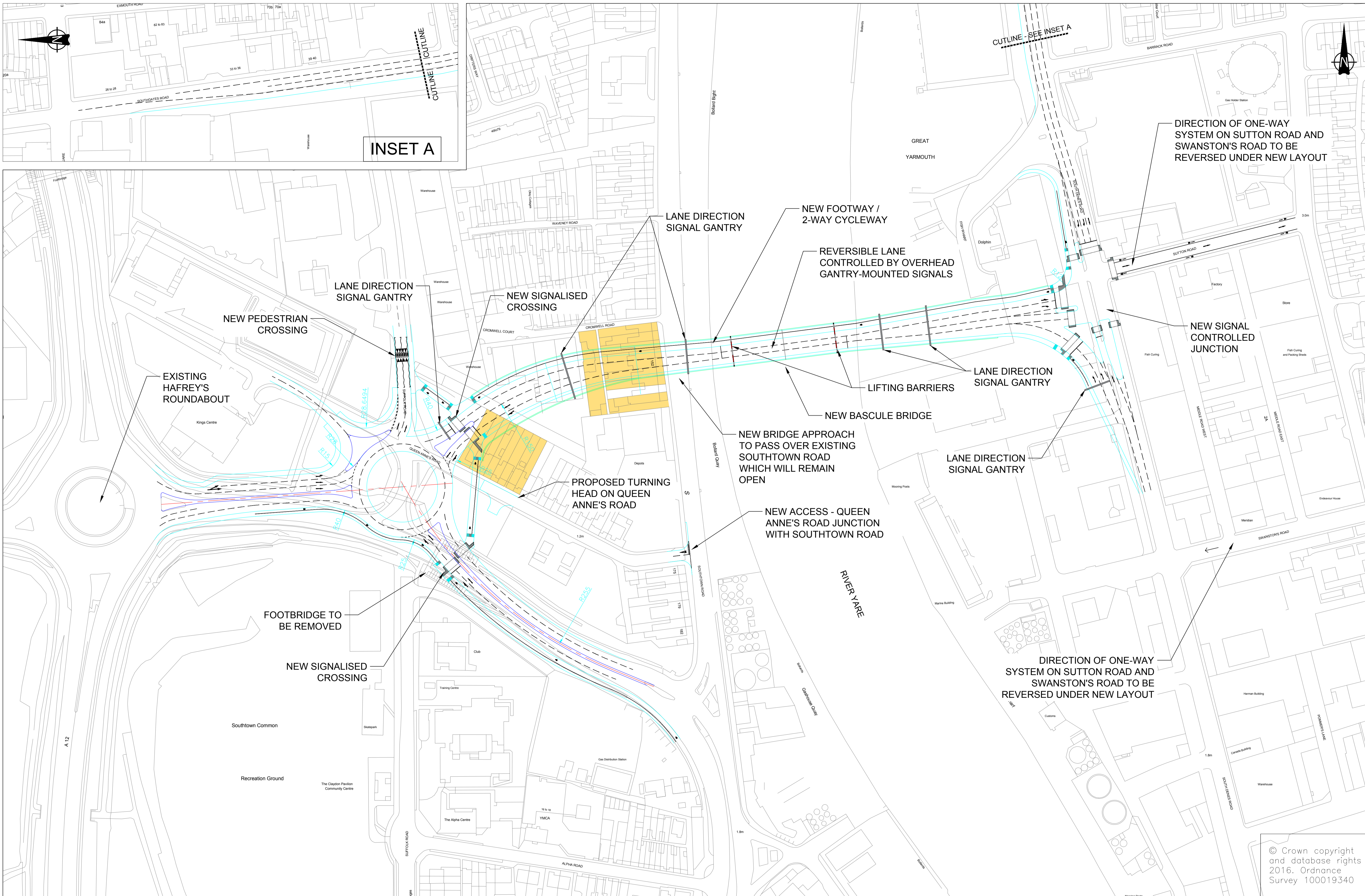


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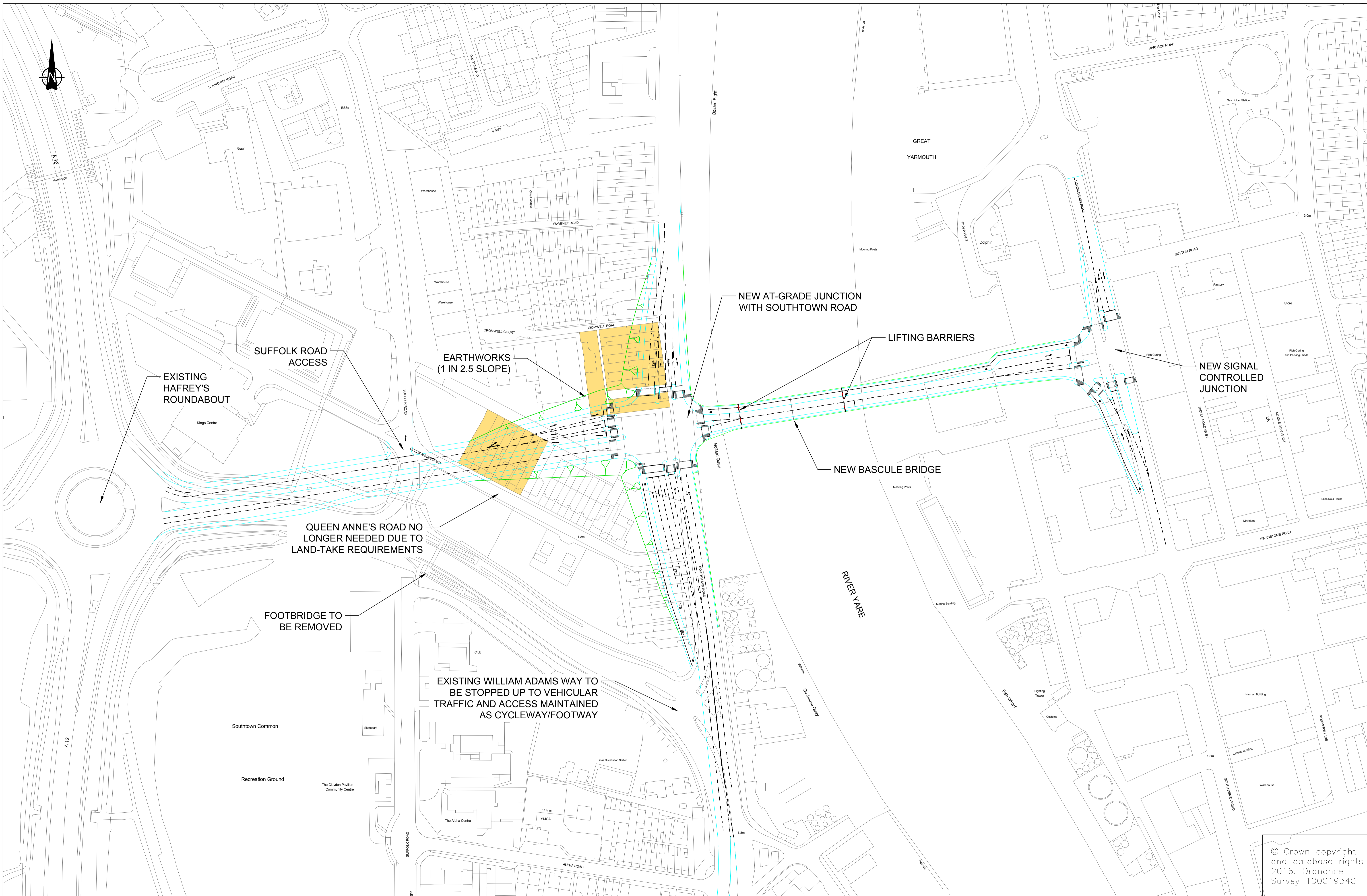
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DRAWN BY LP	FEB 17	PROJECT TITLE
CHECKED BY MM	FEB 17	GREAT YARMOUTH
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		SCALE 1:1000 @ A1
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CHECKED BY	MM	FEB 17	GREAT YARMOUTH THIRD RIVER CROSSING
APPROVED BY	RB	FEB 17	SCALE 1:1000 @ A1
			FILE No. 0005

## Appendix B: Preliminary Ecological Report

# GREAT YARMOUTH THIRD RIVER CROSSING

## Preliminary Ecological Appraisal

October 2016

*Produced for*



*Prepared by*



Unit 2180  
1<sup>st</sup> Floor  
Thorpe Park  
Century Way  
Leeds  
LS15 8ZB  
UK



## Document Control Sheet

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Date	Organisation	Contact	Format	Copies

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# 1 Introduction

## 1.1 Background

Mouchel was commissioned by Norfolk County Council to undertake a Preliminary Ecological Appraisal (PEA) of land at the proposed site of the Great Yarmouth Third River Crossing. The site has been identified by Norfolk County Council as the site of a future link to cross the River Yare.

This report presents the results of the PEA undertaken in September 2016. This report identifies ecological constraints located up to 1km from the site and makes recommendations for further survey work and/or avoidance or mitigation measures as appropriate.

## 1.2 Site Location

The scheme proposals would change the existing William Adams Way so that the crossing ties in directly with the A12, in the centre of Great Yarmouth, to the west of the river. On the west of the river, there are several residential properties as well as parkland and allotments. The crossing ties in to South Denes Road (the A1243) on the east of the river, with the land here being used by several industrial complexes.

## 1.3 Study Objectives

A study area, extending up to 1km from the site of the proposed scheme was surveyed in order to determine impacts and likely constraints to the proposed scheme. The study set out to:

- Consult records of statutory protected sites within 1km of the proposed scheme;
- Identify habitats and species present or likely to be present that are ecologically important and/or have legal protection;
- Identify invasive species that might be present on site.

## 2 Methods

### 2.1 Desk Study

The Norfolk Biodiversity Information Service (NBIS) was consulted to gather information on records of species and nature conservation designations from within the study area.

A review of the Multi-Agency Geographic Information for the Countryside<sup>1</sup> online resource was also undertaken to gather information on statutory nature conservation designations within the study area.

### 2.2 Field Survey

A walkover survey, undertaken broadly in accordance with *Phase 1 Habitat Survey Methodology*<sup>2</sup>, was carried out on 28<sup>th</sup> and 29<sup>th</sup> September 2016. Habitat types were identified and mapped, with target notes made to identify features of interest. The suitability of habitats within the study area to support legally protected, valuable or controlled species was assessed with incidental field signs or sightings of species recorded as seen.

### 2.3 Limitations

Survey work was undertaken during October, which is outside of the optimal season for carrying out botanical surveys (April to September inclusive). Nevertheless, it is considered that the survey work undertaken was sufficient to be able to map the habitats and ecological features present.

---

<sup>1</sup> *Multi-Agency Geographic Information for the Countryside (MAGIC, 2016)*. [www.magic.gov.uk](http://www.magic.gov.uk) [accessed 18 March 2016].

<sup>2</sup> *Joint Nature Conservancy Council (JNCC) (2007). Handbook for Phase 1 Habitat Survey – A Technique for Environmental Audit*. Peterborough, UK

## 3 Results

### 3.1 Desk Study Results

#### 3.1.1 Statutory Designated Sites

The Outer Thames Estuary Special Protection Area (SPA) is within 2km of the proposed scheme. This site is designated because it supports 38% of the Great British population of red-throated diver *Gavia stellate*, which is listed on Annex 1 of the EU Birds Directive.

#### 3.1.2 Non-Statutory Designated Sites

There are no non-statutory designated sites within 2km of the proposed scheme.

#### 3.1.3 Species

The information returned from the desk study contained a record of one moth, the goat moth *Cossus cossus*, which is a UK Biodiversity Action Priority (BAP) species.

#### 3.1.4 Amphibians

One record of natterjack toad *Epidalea calamita* was returned. This record was for Gorleston on Sea and is undated.

There are three records for common toad *Bufo bufo*, the most recent being dated March 1999. These records are for Southtown Common, approximately 800m west of the proposed scheme.

#### 3.1.5 Reptiles

There are four records for common lizard *Zootoca vivipara*, the most recent being from Southtown Common in June 2008.

There are two records for slow-worm *Anguis fragilis*, the most recent of which was from grid reference TG52530771 in August 2008.

#### 3.1.6 Mammals

There are fourteen records of water vole *Arvicola amphibius* from within 2km of the proposed scheme, the most recent being from December 2012.

There are three records of otter *Lutra lutra* within 2km of the proposed scheme, the most recent for a site by the name of Coopers in October 2011.

There are multiple records of bat species within 2km of the study area, many of which are from within the footprint of the proposed scheme. The most recent of these are described in the table below.

Species	Number of Records	Most Recent Record
Common pipistrelle, <i>Pipistrellus pipistrellus</i>	5	June 2015
Soprano pipistrelle, <i>Pipistrellus pygmaeus</i>	1	May 2015
Nathusius' pipistrelle, <i>Pipistrellus nathusii</i>	2	May 2015
Serotine, <i>Eptesicus serotinus</i>	1	May 2015
Daubenton's bat, <i>Myotis daubentonii</i>	1	May 2015
Noctule, <i>Nyctalus noctula</i>	3	May 2015
Brown long-eared bat, <i>Plecotus auritus</i>	1	May 2015

There are eight records of hedgehog *Erinaceus europaeus*, the most recent being from September 2009. Brown hare *Lepus europaeus*, has also been recorded within 2km of the proposed scheme, in August 2013.

There is one record of badger *Meles meles* within 2km of the proposed scheme, dating from September 2014.

### 3.1.7 Birds

A large number of bird species have been recorded within 2km of the proposed scheme. These include 50 species included on Schedule 1 Part 1 of the Wildlife and Countryside Act 1981 (as amended) which are protected at all times of the year.

## 3.2 Field Survey Assessments

### 3.2.1 Habitat Assessments

A plan showing the habitats identified within the site is shown in Figure 1.

#### 3.2.1.1 William Adams Way and Suffolk Road

Southtown Common recreation ground lies to the south of William Adams Way. This area contains amenity grassland dominated by perennial rye-grass *Lolium perenne*, with some white clover *Trifolium repens*, ribwort plantain *Plantago lanceolata* and common dandelion *Taraxacum officinale* also present.

To the north and west, the common is bordered by a ditch containing standing water. The banks are covered by common nettle *Urtica dioica*, bramble *Rubus fruticosus*, great willowherb *Epilobium hirsutum*, dog rose *Rosa canina* and creeping thistle *Cirsium arvense*.

A mixture of broadleaf trees are present in the margins of the common, as well as bordering William Adams Way to the north and south. Pedunculate oak *Quercus robur*, beech *Fagus sylvatica*, poplar *Populus* spp., willow *Salix* spp., hawthorn

*Crataegus monogyna*, sweet chestnut *Castanea sativa* and horse chestnut *Aesculus hippocastanum* are all present alongside ash *Fraxinus excelsior* and elder *Sambucus nigra*.

To the north of William Adams Way and to the west of Suffolk road, is an area of wet scrub. The ditch passes under William Adams Way and runs north away from the road. The area around the ditch contains willow, great willowherb, bramble, common nettle, hawthorn, poplar and field bindweed *Convolvulus arvensis* and hogweed *Heracleum sphondylium*.

The area to the east of Suffolk Road contains several allotments which, in addition to the native species already listed, contained varieties of arable crops and introduced garden plants.

The trees and scrub in this area are suitable for use by nesting birds. Overall, the habitats around William Adams Way and Suffolk Road are of low ecological value.

#### **3.2.1.2 South Denes Road**

The area to the east of the River Yare is well built up with roads, industrial buildings and concrete storage space for materials being shipped. Butterfly bush *Buddleja davidii*, creeping thistle and ragwort *Jacobaea vulgaris* were seen to be growing amongst the concrete.

The hedgerows and trees surrounding the site of the proposed scheme are suitable for nesting birds (an active woodpigeon nest was seen during the survey). Overall, the hedgerows are of low ecological value.

There are many old buildings in states of disrepair to the east of the river. These buildings may provide roosting sites for bats.

### **3.2.2 Species Assessments**

#### **3.2.2.1 Amphibians**

There are areas of terrestrial habitat within 250m of the proposed scheme that are suitable for use by amphibians. This includes the land on the northern and western edge of Southtown Common, which also includes a ditch with standing water. The ditch passes under William Adams Way and runs north beneath Queen Anne's Road before running north-west. As the ditches are linked underneath the two roads, they are considered here as one water body.

There is a small pond at TG523058. This and the surrounding habitat of grassland, scrub and woodland is suitable for use by amphibians.

#### **3.2.2.2 Reptiles**

The majority of the study area is made up of either short and open sward or hard open concrete urban areas and is of negligible value for reptiles. The allotments south of Queen Anne's Road at TG523058 provide habitat suitable for use by reptiles including

a mix of tall ruderal vegetation and rough sward amongst areas of compost and logs that could be used as refugia.

### 3.2.2.3 Mammals

There are several structures within 100m of the proposed scheme that may be suitable for use by roosting bats. There are two uninhabited and poorly maintained houses at TG524058 as well as old brick buildings at TG524057 on the west side of the River Yare.

On the east side a disused pub at TG525060, a smokery at TG52606 and empty, damaged buildings at TG526059 offer further possible roosting sites for bats.

The drainage ditches associated with the A12 provide suitable habitat for water vole.

### 3.2.2.4 Birds

Bird species recorded within the site during the survey include wood pigeon *Columba palumbus*, magpie *Pica pica*, carrion crow *Corvus corone*, house sparrow *Passer domesticus*, blue tit *Cyanistes caeruleus* and robin *Erithacus rubecula*.

Trees and areas of scrub within and adjacent to the proposed scheme are suitable for use by nesting birds. Old brick buildings where access is possible through broken windows and other gaps provide suitable nesting sites for pigeons.

The mosaic of urban areas with scattered ruderal vegetation provides some suitable habitat for black redstarts.

## 4 Evaluation & Recommendations

### 4.1 Statutory Designated and Non-Statutory Protected Sites

The Outer Thames Estuary SPA is within 2km of the proposed scheme. Screening for Habitats Regulations Assessment is strongly recommended.

### 4.2 Habitats

The study area is largely comprised of urban areas, with areas of improved grassland, scattered trees, scrub and standing water. These habitats are of low biodiversity value.

### 4.3 Species

#### 4.3.1 Amphibians and Reptiles

Overall, amphibians and reptiles are unlikely to be present. Although small areas of habitat that is suitable to provide foraging, shelter and hibernation areas exist, the study area is located within a predominantly urban environment and is not connected to areas of suitable offsite habitat. Accordingly, no further work in respect of amphibians and reptiles is recommended.

Both water bodies were assessed using the Habitat Suitability Index (HSI) to estimate their suitability for supporting breeding great crested newts (Table 1). The scores of 0.49 (ditches) and 0.52 (pond) indicate that great crested newts are unlikely to use these ponds and further surveys are therefore not recommended.

#### 4.3.2 Birds

Black redstart is listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). This species is recorded as breeding within Norfolk and Suffolk and further surveys are recommended to determine the presence of this species with regards to the location of the proposed scheme.

Areas of scrub and woodland which are present are suitable for use by breeding birds. No further surveys are recommended, however, in order to minimise the risk of disturbing breeding birds, the removal of woody vegetation should ideally be undertaken outside of the breeding season (typical breeding bird season is March to July inclusive). If tree and vegetation removal has to take place during this period, the vegetation should be checked prior to removal for the presence of nests by an appropriately experienced ecologist. If nests that are in use are present, it may be necessary to delay work in immediate proximity to the nest until the young have fledged.

#### 4.3.3 Mammals

The buildings within the site are either to be purchased for demolition or will be subject to disturbance during the construction of the proposed scheme. It is recommended that further surveys are undertaken to confirm the presence or absence of bats within these buildings.

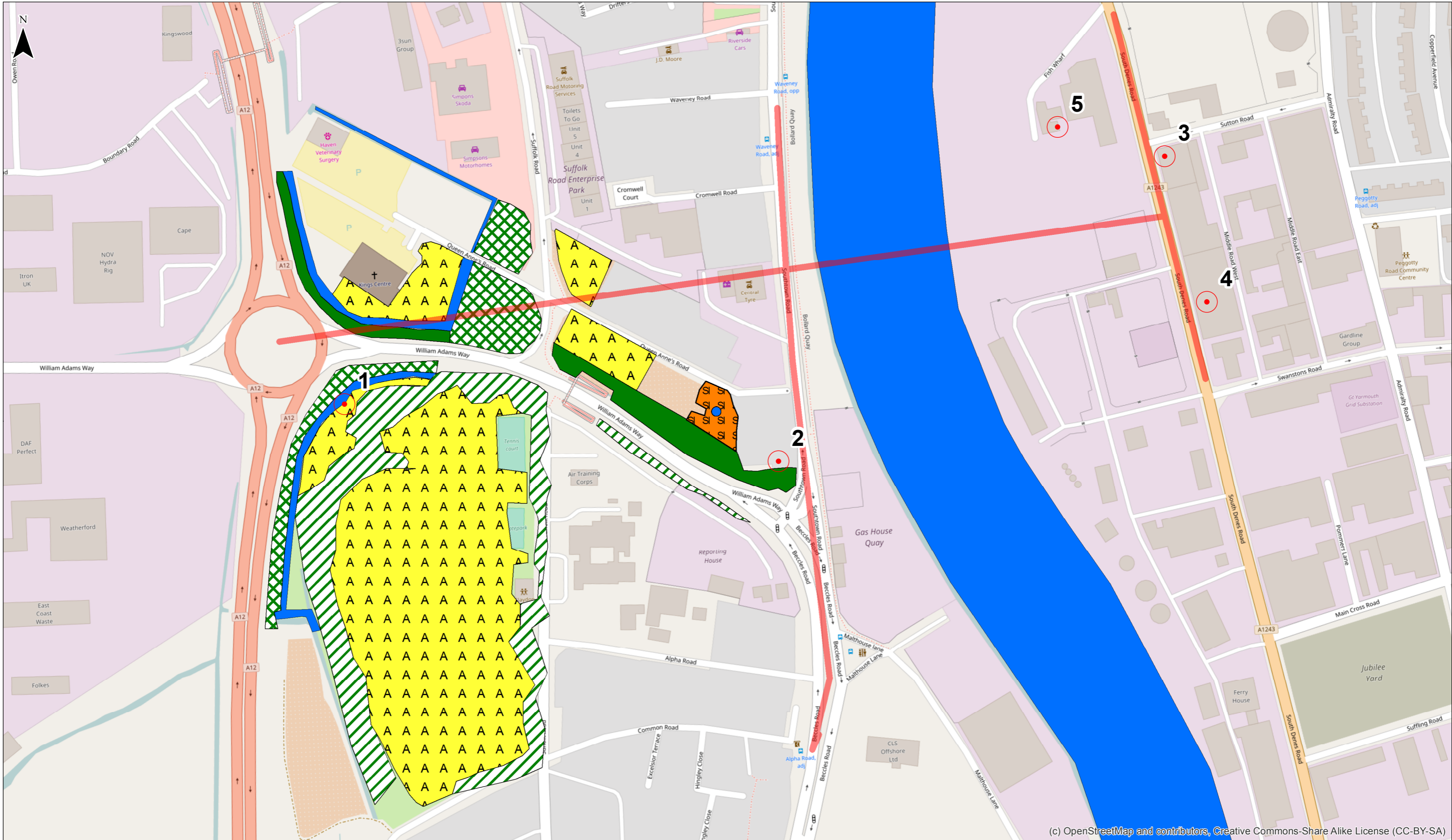


The wider area supports water voles and the ditches associated with the A12 are suitable to support this species. Further surveys are therefore recommended.

The habitats within the site, and the surrounding residential gardens, are suitable to support hedgehogs. It is recommended that a watching brief is maintained during the works to protect individual hedgehogs that may be present.

## 5 Figures

Figure 1 – Habitat Map



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**Legend**

-  Target Notes
-  Great Yarmouth River Crossing
-  Amenity Grasslands
-  Water
-  Neutral Grassland: Semi-improved
-  Scrub: Dense/Continuous
-  Woodland: Broad-leave Plantation
-  Woodland: Semi-natural

Client	Norfolk County Council		A		First Issue	06/12/2016	09/12/2016	09/12/2016
Project	The Great Yarmouth Third River Crossing (GYTRC)		Version		Amendment	Drawing Date	Review Date	Approved Date
Drawing Title	GYTRC Phase 1 Habitat Survey		Office		Puddle Dock	Tel		020 7822 2497
			Scale (at A3 size)		1:2,407		Purpose of Issue	
			mouchel		building great relationships		Information	
			Drawing Number		Page 1 of 1			

## Appendix C: Gazetteer of Heritage Assets

## Appendix C – Archaeology and Built Heritage Baseline Gazetteer

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
1	MNF49675 (NHER)	TG 5170 0621	Bomb Crater	A line of ten WWII bomb craters visible as earthworks on 1940s aerial photographs. Recent aerial photographs and OS mapping suggest the sites is now partially under Harfreys Industrial Estate and waste ground, and the craters have presumably been levelled.	HER	Modern (WWII)	Low
2	MNF49172 (NHER)	TG 5164 0606	Ditch, Bank	A disused drain which probably dates to the post medieval period visible on 1940s aerial photographs. It was probably associated with the drainage of Southtown marches in the post medieval period, but has now been built over.	HER	Post medieval	Low
3	MNF49672 (NHER)	TG 5175 0607	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
4	MNF49610 (NHER)	TG 5174 0589	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
5	MNF49606 (NHER)	TG 5190 0593	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
6	MNF49603 (NHER)	TG 5199 0587	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
7	MNF48761 (NHER)	TG 5200 0600	Pillbox	A possible WWII pillbox is visible as an extant structure on 1940s aerial photographs. It if was a pillbox, it would have formed part of a chain of anti-invasion defences sites along the landward side of Great Yarmouth to protect the town and	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				transport links. The structure was removed in 1945. An industrial park now occupies the site.			
8	MNF49697 (NHER)	TG 5209 0601	Air Raid Shelter	Three WWII air raid shelters visible on 1940s aerial photographs. They appear to have been within some sort of industrial site and are likely to have been industrial shelters for the site workers. The shelters have since been levelled and built over.	HER	Modern (WWII)	Low
9	MNF49681 (NHER)	TG 5212 0645	Bomb Crater, Spigot Mortar Emplacement	A pit dating to WWII which is possibly a bomb crater or a spigot mortar emplacement is visible as an earthwork on 1940s aerial photographs. If it was a mortar emplacement it may have been associated with the possible military training area 40m to the SE. The site has been levelled and built over.	HER	Modern (WWII)	Low
10	MNF49738 (NHER)	TG 5216 0644	Ropery, Ropewalk	A ropewalk is marked at this location on the OS 1 <sup>st</sup> edition map. It is one of several which once existed at Great Yarmouth. The site has since been levelled and mostly built over.	HER	Post medieval	Low
11	MNF32661 (NHER)	TG 5206 0632	Pillbox	A WWII type 24 pillbox survives on land at which is now Yarmouth Business Park in Southtown. It was visited on the ground in 1995. It was part of a line of anti-invasion defences cited to protect the landward side of Great Yarmouth.	HER	Modern (WWII)	Low
12	NHLE ref 1245813	TG 52303 06872	Building	Workshop range north of Number 244A. Range of outbuildings constructed for Admiralty barrack use in 1855. It was in commercial use from 1891 and converted to light engineering works in 1971. Built of red brick under Welsh slate roofs.	Listed (Grade II)	Post medieval	Medium
13	NHLE ref 1245811	TG 52303 06872	Barracks	Militia Barracks, built in 1853-5. Converted to light engineering works in 1971.	Listed (Grade II)	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
14	NHLE ref 1393268	TG 52313 06850	Offices	Utility block immediately east of No 244A Southtown Road. Smithy and Carpenters shop dating to 1806-1810 to designs of James Wyatt for the Ordnance Board. Converted to light engineering works in 1971.	Listed (Grade II)	Post medieval	Medium
15	NHLE ref 1245812	TG 52313 06850	Offices	Utility block immediately east of No 244A Southtown Road. Ancillary building to the naval arsenal by James Wyatt in 1806. Now light engineering works.	Listed (Grade II)	Post medieval	Medium
16	NHLE ref 1245814	TG 52314 06828	Arsenal	244B Southtown Road. Naval arsenal, built 1806 by James Wyatt. Now used as light engineering works. This building was the actual armoury and had until 1829 a fireproof stone roof.	Listed (Grade II)	Post medieval	Medium
17	NHLE ref 1245815	TG 52280 06827	Lodge	245 Southtown Road was the North Lodge to the former naval arsenal, shown as 'Clerk of the Cheques' House' in 1810. Built of 1806-10 by James Wyatt for the Ordnance Board. Altered probably in 1891 when the site was relinquished by the Admiralty for commercial use.	Listed (Grade II)	Post medieval	Medium
18	NHLE ref 1245810	TG 52281 06806	House	244 Southtown Road was a storekeeper's house to the naval arsenal. It was built in 1806 by James Wyatt and formed the south lodge to the complex. It is now commercial offices.	Listed (Grade II)	Post medieval	Medium
19	NHLE ref 1245807	TG 52201 06797	Wall	Boundary wall to south of number 66, built early 19 <sup>th</sup> century of tarred red brick	Listed (Grade II)	Post medieval	Medium
20	NHLE ref 1245808	TG 52201 06794	Wall	Boundary wall to south of number 67, built early 19 <sup>th</sup> century of brick.	Listed (Grade II)	Post medieval	Medium
21	NHLE ref 1245809 MNF48074 (NHER)	TG 52328 06490	House	83 & 84 Southtown Road. A pair of late 18 <sup>th</sup> century houses with 19 <sup>th</sup> century alterations. The houses are separated by an arched passageway with cast iron gates.	Listed (Grade II) & HER	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
22	NHLE ref 1096791	TG 52766 06976	Fish curing works	Tower fish curing works, built in 1880 in red brick with some stone to the south and east ranges. It is a triangular site with 3 ranges of buildings around a yard. The manager's house and office occupies the west end of the north range. Inside the complex, the brine tanks are still intact.	Listed (Grade II)	Post medieval	Medium
23	NHLE ref 1245561	TG 52727 06909	Fish curing works, pottery production site.	Fish Curing works, then converted to the Great Yarmouth potteries. Built early 19 <sup>th</sup> century against the town walls of 1285-95 to the east. Built of brick and flint with timber interior partitioning.	Listed (Grade II*)	Post medieval	High
24	NHLE ref 1246059	TG 52885 06854	Terrace	41-46 Nelson Road South. Terrace of 6 houses built in the mid-19 <sup>th</sup> century, all were converted into a hotels in the 20 <sup>th</sup> century. Built of gault brick with stuccoed and rusticated ground floors with slate and concrete tile roofs.	Listed (Grade II)	Post medieval	Medium
25	NHLE ref 1246584	TG 53034 06937	Hotel	The Royal Hotel opened in 1840. The façade and large rear extensions were added in 1877 by JB Pearce. It is of stuccoed red brick with a slate roof. Charles Dickens apparently stayed here in 1848-9 while writing David Copperfield.	Listed (Grade II)	Post medieval	Medium
26	NHLE ref 1096805	TG 53004 06878	Terrace, Hotel	Donna Doone Hotel (Nos 1, 1A & 2), Neptune Hotel (Nos 9-11) and Sienna Lodge Hotel (Nos 17-18). Terrace of houses, now including 3 hotels, which were built in 1844-47 of gault brick and partly stuccoed and colourwashed.	Listed (Grade II)	Post medieval	Medium
27	NHLE ref 1245564	TG 53002 06910	Terrace	11-16 Wellington Road. Terrace of houses built in the early 1840s of gault brick.	Listed (Grade II)	Post medieval	Medium
28	NHLE ref 1245566	TG 53020 06885	Arch	Wellington Arch is an archway forming the north entrance to the Victoria estate and was built in 1846 by John Brown. It was restored in 1980. It is built of gault brick with rendered details.	Listed (Grade II)	Post medieval	Medium



Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
29	NHLE ref 1245563	TG 53041 06894	Terrace	3, 4 and 5 Waterloo Road. Terrace of 3 houses built in the mid-19 <sup>th</sup> century of gault brick.	Listed (Grade II)	Post medieval	Medium
30	NHLE ref 1246583	TG 53051 06878	Hotel	Cavendish Hotel, formerly known as Brandon Mansions Hotel. Originated as a terrace of houses built in 1844 by Farrants & Turrel. Built of stuccoed brick with slate and concrete tile roof.	Listed (Grade II)	Post medieval	Medium
31	NHLE ref 1096806	TG 52991 06832	Terrace	The Embassy Hotel (Nos 38-41). Terrace of houses, part now a hotel, built in 1844-7 of gault brick.	Listed (Grade II)	Post medieval	Medium
32	NHLE ref 1271805	TG 53016 06832	Arch	Wellington Mews Arch is a monumental arch forming the entrance to the mews behind Kimberley Terrace. It was built in 1847 of gault brick.	Listed (Grade II)	Post medieval	Medium
33	NHLE ref 1271269	TG 53022 06805	Terrace	Carlton Hotel (Nos 1-5). Terrace of houses, part now a hotel. It was laid out from 1841 as the first part of the Victoria Building Company's estate under the overall direction of Thomas Marsh Nelson. Built of stuccoed brick with slate roofs.	Listed (Grade II)	Post medieval	Medium
34	NHLE ref 1096787	TG 52980 06784	Terrace	Mayflower Hotel (No 5), St Georges Hotel (Nos 7-8). Terrace of 8 houses, now 2 hotels. Built in 1844 of stuccoed brick with concrete and tile roofs.	Listed (Grade II)	Post medieval	Medium
35	NHLE ref 1271606	TG 53006 06732	Assembly Rooms	Masonic Royal Assembly Rooms built 1863 by HH Collins. It partly burnt out in 1870 and became the masonic lodge under patronage of HRH Prince of Wales. It is built of gault brick with slate roofs.	Listed (Grade II)	Post medieval	Medium
36	NHLE ref 1271608	TG 53148 06762	Winter Gardens	The Winter Gardens were designed and constructed in Torquay by John Watson and William Harvey between 1878 and 1881 at a cost of £12783. It was relocated to Great Yarmouth in 1904.	Listed (Grade II*)	Post medieval	High

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
37	NHLE ref 1271607	TG 53034 06684	House	Shadingfield Lodge, formerly a house, now a hotel. Built 1862-5 by AW Morant and altered internally in 1953 by AW Ecclestone. Built of gault brick under slate roofs.	Listed (Grade II)	Post medieval	Medium
38	MNF48764 (NHER)	TG 5223 0633	Air Raid Shelter, Bomb Crate, Defence work, gun emplacement, military training site, practice trench.	A WWII military site, comprising various features and defences including air raid shelters, slit trenches, bomb craters and possibly a searchlight emplacement. The precise function of the site is unclear, although the variety of installations and the disorganised layout would suggest a military training site. Much of the site has been built over and no features are no longer visible on the ground or on modern aerial photographs.	HER	Modern (WWII)	Low
39	MNF49703 (NHER)	TG 5228 0636	Air Raid Shelter	A possible air raid shelter dating to WWII visible as an earthwork mound (presumably covering a structure) on 1940s aerial photographs. Its size and shape suggest a private shelter, possibly an Anderson shelter. No trace of the structure survives above ground today.	HER	Modern (WWII)	Low
40	MNF49678 (NHER)	TG 5214 0617	Bomb Crater	Two WWII bomb craters are visible as earthworks on 1940s aerial photographs. The site has now been levelled and built over.	HER	Modern (WWII)	Low
41	MNF48763 (NHER)	TG 5219 0615	Roadblock, anti-tank block	A group of WWI anti invasion defences, comprising two road blocks and a possible pillbox, are visible on aerial photographs taken in 1944. They were situated on the western edge of the inhabited part of Southtown. They were removed in 1945 and no trace of them exists today.	HER	Modern (WWII)	Low
42	MNF12936 (NHER)	TG 5222 0617	Findspot	In 1977 a Neolithic scraper was found during building work. It was found at a depth of 4.2m.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
43	MNF49679 (NHER)	TG 5231 0616	Bomb Crater	A probable WWII bomb crater visible on 1940s aerial photographs. The site has since been levelled and built over.	HER	Modern (WWII)	Low
44	MNF48762 (NHER)	TG 5231 0610	Spigot Mortar Emplacement	A WWII spigot mortar emplacement is visible as an extant structure and earthwork on 1940s aerial photographs. It appears to have been associated with two roadblocks and other defences. It appears that site has been levelled.	HER	Modern (WWII)	Low
45	MNF48800 (NHER)	TG 5259 0655	Hut, Civil Defence Building	A hut or temporary building, probably related to civil defence or shelter during WWII was visible as an extant structure on 1940s aerial photographs. It was removed soon after the end of the war.	HER	Modern (WWII)	Low
46	MNF49709 (NHER)	TG 5262 0642	Air Raid Shelter	Six probable air raid shelters dating to WWII visible as structures and earthworks on 1940s aerial photographs. These were most likely private shelters and may have been Anderson shelters. There is no evidence of these structures above ground today.	HER	Modern (WWII)	Low
47	MNF46372 (NHER)	TG 5267 0646	Air Raid Shelter	A WWII air raid shelter is visible as an extant earth covered structure on 1940s aerial photographs. Its size and location within a light industrial yard would suggest it was placed to protect the local workforce. The site has been levelled and built over.	HER	Modern (WWII)	Low
48	NHLE ref 1245981	TG 52716 06548	Church	Parish church of St James. The nave and chancel date to 1870-78 by JP Seddon. The aisles date to 1902-8 by Bottle & Olley. Built of cut and knapped flint with red brick dressings.	Listed (Grade II)	Post medieval	Medium
49	MNF4340 (NHER)	TG 5283 0642	Barracks, Hospital, Royal Naval Hospital	St Nicholas's Hotel, also known as the Royal Naval Hospital, was built between 1809 and 1811. It was used as a military barracks between 1818 and 1854, but subsequently reverted	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				to its original use as a Naval hospital. The buildings surround a courtyard in which a greenhouse built around 1890, used to stand. In 1815 seven sailors and seventeen Waterloo soldiers were apparently buried in the courtyard. The burials were reported to have been excavated in 1979. During WWII the hospital was used as a Naval information centre and administrative quarters, named HMS Watchful. The surviving hospital buildings have been restored and converted into flats and houses.			
50	MNF46399 (NHER)	TG 5278 0651	Air Raid Shelter	A large WWII air raid shelter is visible as an extant earth covered structure on 1940s aerial photographs. It lay within the grounds of the former St James School, directly adjacent to the main school building as was presumably intended for use by the pupils and teachers of the school.	HER	Modern (WWII)	Low
51	NHLE ref 1245984	TG 52840 06464	Hospital	St Nicholas Hospital Main Entrance Range. These buildings consisted of guard rooms, archway and service rooms to the naval hospital, now general storage and kitchens to St Nicholas' Hospital. Of yellow stock brick with Portland stone dressings and slate roof.	Listed (Grade II*)	Post medieval	High
52	NHLE ref 1245983	TG 52890 06400	Naval hospital	St Nicholas Hospital, formerly Naval Hospital. Built in 1809-11 by William Pilkington under supervision of Edward Holl, Architect to the Navy Board. It became naval barracks in 1818 and subsequently a general hospital. It is of yellow brick laid in Flemish bond with dressings of Portland stone. It is on a quadrangle plan with single depth wards, with a west chapel. Each of the four wings is linked by a single storey quadrant	Listed (Grade II*)	Post medieval	High

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				passageway.			
53	NHLE ref 1245986	TG 52926 06371	Wall, Railings	St Nicholas Hospital Walls and Railings dating to 1811 with mid-20 <sup>th</sup> century insertions and repairs. By Edward Holl and William Pilkington, architects at the Navy Board. They are of brick and cast-iron. The walls run around the west, south and east sides of the site.	Listed (Grade II)	Post medieval	Medium
54	NHLE ref 1245985	TG 52845 06289	Hospital	St Nicholas Hospital South Block. This was an Isolation wing to the Naval Hospital, now St Nicolas' Hospital. It was built c.1809-11 by William Pilkington, supervised by Edward Holl, Architect to the Navy Board. It is of yellow stock brick under slate roofs. It is of one storey.	Listed (Grade II)	Post medieval	Medium
55	NHLE ref 1245982	TG 52778 06286	Mortuary, Chapel	St Nicholas Hospital CSSD store. Formerly a mortuary and chapel dating to c.1810, now dis-used. It is of various shades of red brick with a hipped slate roof. It is rectangular and single depth in plan.	Listed (Grade II)	Post medieval	Medium
56	MNF57307 (NHER)	TG 52550 06356	Naval storehouse	The surviving section of a sail loft and storehouse which was constructed in 1798 for the Royal Navy.	HER	Modern (WWII)	Low
57	MNF49707 (NHER)	TG 5269 0636	Air Raid Shelter	Three probable air raid shelters dating to WWII are visible as earthworks with structural elements on 1940s aerial photographs. These were probably private shelters. The site has since been redeveloped as housing and shelters have presumably been levelled.	HER	Modern (WWII)	Low
58	MNF48794 (NHER)	TG 5299 0641	Air Raid Shelter, Barrage Balloon Site, Hut	WWII military activity and installations are visible as extant buildings, structures and earthworks on aerial photographs from the 1940s. They were located immediately east of the	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				Royal Naval Hospital and may also have been under Naval control during the war. There is no evidence on the ground that these features still exist.			
59	MNF46973 (NHER)	TG 5316 0636	Barbed Wire Obstruction, Trench, Pillbox	A group of WWII anti invasion defences is visible as extant structures, buildings and earthworks on 1940s aerial photographs. The defences, which are visible on Great Yarmouth seafront stretching from Wellington Pier to the Pleasure Beach, formed part of a longer line of defences which extended all the way along the seafront. There is no evidence that any trace of the defences survives today.	HER	Modern (WWII)	Low
60	MNF46981 (NHER)	TG 5306 0627	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. It appears to have been removed some time before the end of the war.	HER	Modern (WWII)	Low
61	MNF46982 (NHER)	TG 5306 0622	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. A small structure to its west, which appears to be surrounded by a blast wall, may have been an associated defensive building. The road block seems to have been removed some time before the end of the war.	HER	Modern (WWII)	Low
62	MNF47003 (NHER)	TG 5304 0616	Air Raid Shelter	Nine small WWII air raid shelters, at least some of which were probably Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that any remains survive above ground.	HER	Modern (WWII)	Low
63	MNF46989 (NHER)	TG 5306 0611	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. As with other examples, they appear to have been removed before the end of the year.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
64	MNF47007 (NHER)	TG 5306 0606	Air Raid Shelter	A large WWII air raid shelter is visible as an arrangement of structures and earthworks on 1940s aerial photographs. It was levelled after the end of the war.	HER	Modern (WWII)	Low
65	MNF41610 (NHER)	TG 53137 06006	Fairground Ride	The 'scenic railway' was built in 1932, and is one of only a few examples in the world of an early wooden roller coaster, and may be the oldest outside of the USA.	HER	Modern	Low
66	MNF47061 (NHER)	TG 5278 0620	Air Raid Shelter	Two small WWII air raid shelters which could have been Anderson shelters or a similar design, are visible on 1940s aerial photographs. There is no evidence that any remains of the shelters survive above ground.	HER	Modern (WWII)	Low
67	MNF47065 (NHER)	TG 5279 0625	Air Raid Shelter	A group of earthwork mounds with structural elements, probably WWII air raid shelters, visible on 1940s aerial photographs. There is no evidence that any remains of these survive above ground today.	HER	Modern (WWII)	Low
68	MNF47063 (NHER)	TG 5285 0625	Air Raid Shelter	A group of earthwork mounds with structural elements, probably WWII air raid shelters, visible on 1940s aerial photographs. There is no evidence that any remains of these survive above ground today.	HER	Modern (WWII)	Low
69	MNF47000 (NHER)	TG 5295 0623	Air Raid Shelter	Four WWII air raid shelters visible as earth covered structures on 1940s aerial photographs. They all lay within the grounds of what is now Greenacre First and Middle Schools and were probably constructed for the use of its staff and pupils. These were levelled since the end of the war.	HER	Modern (WWII)	Low
70	NHLE ref 1096789 MNF32731	TG 52739 06149	Gas Works	Excellent example of a gasometer with ornate finials to the uprights of the frame which is braced with a lattice pattern. The gasometer was built at another site, but collapsed and was	Listed (Grade II) & HER	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
	(NHER)			rebuilt here in 1885. An old map shows this was the site of a steam engine before the gasometer was built.			
71	MNF47033 (NHER)	TG 5281 0611	Air Raid Shelter	Five small WWII air raid shelters, at least some of which were Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest any remains survive above ground today.	HER	Modern (WWII)	Low
72	MNF47029 (NHER)	TG 5287 0609	Air Raid Shelter	Eleven small WWII air raid shelters, at least some of which were probably Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence that any remains survive above ground today.	HER	Modern (WWII)	Low
73	MNF47024 (NHER)	TG 5295 0609	Air Raid Shelter	Fifteen small WWII air raid shelters, at least some of which were probably Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence that any remains survive above ground today.	HER	Modern (WWII)	Low
74	MNF47008 (NHER)	TG 5301 0602	Air Raid Shelter	Two small WWII air raid shelters, at least one of which was probably an Anderson shelter, visible as earthworks and structures on 1940s aerial photographs. There is no evidence that any remains survive above ground today.	HER	Modern (WWII)	Low
75	MNF46991 (NHER)	TG 5306 0600	Roadblock	WWII road block visible as a structure on 1940s aerial photographs. As with other examples, this one appears to have been removed some time before the end of the war.	HER	Modern (WWII)	Low
76	MNF46960 (NHER)	TG 5316 0564	Weapons Pit, Gun Emplacement	A group of WWII anti invasion defences is visible as extant structures, buildings and earthworks on 1940s aerial photographs. These defences were visible on Great Yarmouth seafront stretching from the Pleasure Beach to the open ground now used as a caravan park and were part of a longer	HER	Modern (WWII)	Low



Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				line of defences which extended all the way along the seafront. There is no evidence that any trace of the defences survive as upstanding features.			
77	MNF4328 (NHER)	TG 530 059	Battery	The South Star Battery was built in 1782. A magazine for storing gunpowder was added in 1793. The battery was restored and reconstructed several times and was still in use in 1914 when it was being used as a barracks. The site is now under Harbord Crescent east of battery road.	HER	Modern (WWII)	Low
78	MNF47009 (NHER)	TG 5305 0594	Air Raid Shelter	Five small WWII air raid shelters, at least some of which were probably Anderson shelters, are visible as earthworks and structures on 1940s aerial photographs. There is no evidence that anything of these remains above ground today.	HER	Modern (WWII)	Low
79	MNF47048 (NHER)	TG 5297 0595	Air Raid Shelter	Five small WWII air raid shelters, at least some of which were Anderson shelters are visible as earthworks on 1940s aerial photographs. There is no evidence that anything of these remains above ground today.	HER	Modern (WWII)	Low
80	MNF46992 (NHER)	TG 5305 0589	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. This was removed some time before the end of the war.	HER	Modern (WWII)	Low
81	MNF47012 (NHER)	TG 5303 0586	Air Raid Shelter	A small WWII air shelter, possibly an Anderson shelter, is visible as an earthwork on aerial photographs taken in 1945. There is no evidence that any remains of these survive above ground today.	HER	Modern (WWII)	Low
82	MNF46932 (NHER)	TG 5302 0584	Air Raid Shelter	Three WWII air raid shelters visible as earthworks and structures on 1940s aerial photographs. The site has been built over and the shelters probably levelled.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
83	MNF47081 (NHER)	TG 5254 0619	Military building	A group of probable WWII buildings visible as extant structures on wartime aerial photographs. All or some of the buildings might be military in origin and relate to the defence of Great Yarmouth or the naval base that was established at the town. Alternatively, they might relate to industrial activity at the quayside during the war years. The buildings have been since levelled and redeveloped in the post war period.	HER	Modern (WWII)	Low
84	MNF47068 (NHER)	TG 5259 0618	Bomb Crater	Two WWII bomb craters are visible as earthworks on 1940s aerial photographs. The intended target was probably the gas works 50m to the southeast. The site has since been levelled since the end of the war.	HER	Modern (WWII)	Low
85	MNF47071 (NHER)	TG 5263 0617	Gas Holder	A WWII air raid shelter and a former gas holder, the latter possibly used as an emergency water supply tank, and visible as extant earthworks and structures on 1940s aerial photographs. The site has since been levelled.	HER	Modern (WWII)	Low
86	MNF62069 (NHER)	TG 5253 0609	Salt Store, Ice House	Icehouse and salt stores visible on the 1 <sup>st</sup> edition ordnance survey map. The buildings have all since been demolished.	HER	Post medieval	Low
87	MNF47036 (NHER)	TG 5257 0582	Barbed wire obstruction, Military building	WWI defences, comprising a circuit of fencing and barbed wire as well as several small buildings, visible on 1940s aerial photographs. These were laid out along the quayside and around the former fish wharf buildings. They were removed after the end of the war.	HER	Modern (WWII)	Low
88	MNF13576 (NHER)	TG 52364 07247	Railway	During the mid and late 19 <sup>th</sup> century a series of railway lines were constructed within Great Yarmouth town. One section linked Vauxhall station to Beach Station, North Quay and the fishmarket, whilst the second linked Ballast Quay and North	HER	Post medieval	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				Pier. At first the trains were horse drawn, but after 1883 engines were used. The railways were closed at various times from 1927 onwards and many of the routes are now covered by modern development, although some features do survive in places.			
89	NHLE ref 1096829 MNF38779 (NHER)	TG 52587 06039	Public House	The Dolphin Public House was built between 1900 and 1904. It was designed by J.W. Cockrill and features his distinctive use of red brick over concrete and decorative tiles. The decorative tiles feature marine subjects.	Listed (Grade II), & HER	Modern	Medium
90	MNF48439 (NHER)	TG 5229 0597	Roadblock	A group of WWII anti invasion defences comprising anti-tank blocks, a type 24 pillbox and a spigot mortar emplacement, are visible as extant buildings, structures and earthworks on 1940s aerial photographs. In the post war period the site was levelled and built over, and there is no evidence that any part of the defences still survives.	HER	Modern (WWII)	Low
91	MNF48445 (NHER)	TG 5239 0588	Roadblock	A group of WWII anti invasion defences, comprising a substantial road block and tank trap protected by two or three pillboxes are visible on 1940s aerial photographs. The defences were removed before August 1945.	HER	Modern (WWII)	Low
92	MNF47054 (NHER)	TG 5287 0594	Air Raid Shelter	A small WWII air raid shelter, possibly an Anderson shelter, visible as an earthwork on 1940s aerial photographs. It lay in the back garden of a house and was probably a private shelter. There is no evidence to suggest that any remains above ground today.	HER	Modern (WWII)	Low
93	MNF61853 (NHER)	TG 5275 0584	Coal Fired Power Station	Great Yarmouth Electricity Works was Great Yarmouth's first power station using steam engines and steam turbines to	HER	Post medieval	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				provide power to industry, transport, public lighting and domestic use. It was decommissioned in 1958 and part of the building (although not original parts) still remain.			
94	MNF47044 (NHER)	TG 5280 0585	Military Building	A WWII structure, possibly a military building such as a guardhouse or sentry box, visible as an extant building on 1940s aerial photographs. It was demolished by 1951.	HER	Modern (WWII)	Low
95	MNF13576 (NHER)	TG 52364 07247	Railway	Railway lines constructed in the mid to late 19 <sup>th</sup> century, no longer extant.	HER	Post medieval	Low
96	MNF49602 (NHER)	TG 5234 0576	Bomb Crater	A probable WWI bomb crater visible as a partially backfilled earthwork on 1940s aerial photographs. The site has since been levelled and resurfaced.	HER	Modern (WWII)	Low
97	MNF49685 (NHER)	TG 5237 0573)	Air Raid Shelter	A WWII air raid shelter visible as an earthwork and structure on 1940s aerial photographs. Its small size and location within a garden suggest that it was a private shelter. The site has since been built over and the shelter probably levelled.	HER	Modern (WWII)	Low
98	MNF49691 (NHER)	TG 5232 0570	Air Raid Shelter	A WWI air raid shelter is visible as an earthwork on 1940s aerial photographs, It lay within what appears to have been an industrial site and its size suggests that it was an industrial shelter. The site has since been levelled and built over.	HER	Modern (WWII)	Low
99	MNF49598 (NHER)	TG 5196 0561	Bomb Crater	A probable WWII bomb crater is visible on an earthwork and disturbed ground on 1940s aerial photographs. Recent aerial photographs show that the site may still survive as a slight earthwork.	HER	Modern (WWII)	Low
100	MNF19084 & MNF19949 (NHER)	TG 5207 0537	Pillbox, Anti-Aircraft Battery	A WWII Light Anti-Aircraft Battery is visible as a group of earthworks, structures ad buildings on aerial photographs and has also been partially recorded on the ground, It comprised a	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				Bofors gun emplacement, a Type 22 pillbox, a possible earthwork gun emplacement and a variety of ancillary structures and huts. Many of the structures were removed at the end of the war, the pillbox was demolished in 1991 during the construction of the A12 (T) on top of the former railway embankment.			
101	MNF49686 (NHER)	TG 5234 0564	Air Raid Shelter	A probable WWII air raid shelter visible as an earthwork on 1940s aerial photographs. There is no evidence to suggest that anything survives above ground today.	HER	Modern (WWII)	Low
102	MNF49688 (NHER)	TG 5239 0564	Air Raid Shelter	A probable WWII air raid shelter visible as an earthwork on 1940s aerial photographs. There is no evidence to suggest that anything survives above ground today.	HER	Modern (WWII)	Low
103	MNF49687 (NHER)	TG 5241 0561	Blast Wall, Air Raid Shelter	A probable surface level air raid shelter is visible as an extant building on 1940s aerial photographs. It has since been levelled and built over.	HER	Modern (WWII)	Low
104	MNF49578 (NHER)	TG 5227 0558	Air Raid Shelter	Two possible WWI air raid shelters visible as earthworks on 1940s aerial photographs. The area has since been levelled.	HER	Modern (WWII)	Low
105	MNF49689 (NHER)	TG 5218 0548	Air Raid Shelter	A large WWI air raid shelter is visible as an earthwork and associated structures on 1940s aerial photographs. This was probably a public shelter. The site has since been levelled and built over.	HER	Modern (WWII)	Low
106	MNF49561 (NHER)	TG 5219 0543	Air Raid Shelter	Twelve probably WWII air raid shelters visible as earthworks and structures. The site has since been levelled.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
107	MNF48435 (NHER)	TG 5223 0544	Bomb Site, Water Tank	A static emergency water supply tank, dating to WWII, is visible as an extant structure on 1940s aerial photographs taken in 1944. It is one of several such tanks positioned around Great Yarmouth for use by fire fighters after bombing raids. It was located on what was probably a bomb site but had been removed by 1945.	HER	Modern (WWII)	Low
108	MNF49514 (NHER)	TG 5228 0545	Air Raid Shelter	A probable WWII air raid shelter visible as an earthwork on 1940s aerial photographs. There is no evidence that anything remains above ground today.	HER	Modern (WWII)	Low
109	MNF49567 (NHER)	TG 5233 0550	Air Raid Shelter	Two probable WWII air photographs visible on aerial photographs. The site has since been levelled.	HER	Modern (WWII)	Low
110	MNF15149 (NHER)	TG 525 055	Prison, Maltings	A post medieval maltings, dating from the early 19 <sup>th</sup> century. The maltings were said to have been used as a prison during the Napoleonic War. The buildings were demolished in the 1980s after being damaged by fire.	HER	Post medieval	Low
111	MNF48433 (NHER)	TG 5252 0550	Fire Station, Air Raid Shelter, Broadcasting Transmitter	Structures and buildings visible on 1940s aerial photographs. These may have represented WWII civil defence buildings. No traces of these structures are visible today.	HER	Modern (WWII)	Low
112	NHLE ref 1246973 MNF47922 (NHER)	TG 52570 05433	House	Providence Villa, built in 1843. It is built of red brick with a gault brick façade. There is a date plaque on the house which reads <i>Providence Villa I &amp; S L, 1843</i> .	Listed (Grade II), & HER	Post medieval	Medium
113	NHLE ref 1246972 MNF47923	TG 52575 05424	House	96 High Road was built around 1830s. It is mainly constructed of red brick but has a gault brick façade.	Listed (Grade II), & HER	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
	(NHER)						
114	NHLE ref 1246971 MNF48137 (NHER)	TG 52579 05414	Terraced House	95 High Road was once two early 19 <sup>th</sup> century terraced houses, but is now one house. It is constructed of gault brick and is of two storeys with a black glazed pantile roof.	Listed (Grade II), & HER	Post medieval	Medium
115	NHLE ref 1246970 MNF48136 (NHER)	TG 52610 05354	House	Ahoy and Manby House (86 and 87 High Road) are a pair of red brick houses built in the 1840s. Most of the structures are colourwashed. On no 86 there is an inscriptions stating that Captain G W Manby F.R.S, the inventor of life saving apparatus) lived in the house and dies there is 1854.	Listed (Grade II), & HER	Post medieval	Medium
116	MNF66695, MNF10562 (NHER)	TG 5250 0530	Church, Priory, Leper Hospital	This is the site of a large Augustinian Friary and church. The friary was founded in the 13 <sup>th</sup> century and was dissolved in 1538. Human skeletons have been found here since the 18 <sup>th</sup> century and excavations have revealed the presence of structures on the site. Remains of the friary buildings have also been incorporated into buildings to the north and south of Burnt Lane.	HER	Medieval	Medium
117	MNF49505 (NHER)	TG 5249 0537	Air Raid Shelter	Two probable WWII air raid shelters are visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that any part of the shelters now survives above ground.	HER	Modern (WWII)	Low
118	NHLE ref 1096790 MNF47939 (NHER)	TG 52411 05346	Methodist Chapel	Southtown and Gorleston Methodist Church is a late 19 <sup>th</sup> century red brick Methodist church which was extended in 1901. It has a gault brick façade under a slate roof and is of a single storey.	Listed (Grade II), & HER	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
119	MNF49503 (NHER)	TG 5245 0533	Air Raid Shelter	Two probable WWII air raid shelters visible as earthworks on 1940s aerial photographs. There is no evidence to suggest anything survives above ground today.	HER	Modern (WWII)	Low
120	MNF49506 (NHER)	TG 5250 0531	Air Raid Shelter	Possible WWII air raid shelter visible as an earthwork on 1940s aerial photographs. The site has since been built over.	HER	Modern (WWII)	Low
121	NHLE ref 1096804	TG 52417 05260	Friary	Remains of the house of the Austin Friary. This building dates to the 15 <sup>th</sup> century, but the Friary was founded in 1311. It is of flint and brick. The surviving remains consist of a short stretch of wall with part of a 15 <sup>th</sup> century chafered 4 centred brick arch.	Listed (Grade II)	Medieval	Medium
122	MNF49502 (NHER)	TG 5244 0528	Air Raid Shelter	Five probable WWII air raid shelters visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that anything survives above ground today.	HER	Modern (WWII)	Low
123	MNF66634 (NHER)	TG 5244 0527	Beam Slot, Timber Framed Building	A watching brief in 2013 revealed beam slots and post holes associated with a late medieval timber-framed building. Finds recovered from these features included late medieval brick, roof tile and wall plaster.	HER	Uncertain	Low
124	MNF49500 (NHER)	TG 5247 0525	Air Raid Shelter	Five probable WWII air raid shelters visible as earthworks and structures on 1940s aerial photographs. There is nothing to suggest that anything remains above ground today.	HER	Modern (WWII)	Low
125	MNF39960 (NHER)	TG 5236 0527	Boundary Post	A cast iron boundary post which is probably dated to 1819. It is inscribed ' <i>The Bounds of Gorleston and Southtown</i> '.	HER	Post medieval	Low
126	MNF49513 (NHER)	TG 5233 0526	Air Raid Shelter	A probable air raid shelter dating to WWII is visible as a structure on 1940s aerial photographs. The site has since been levelled.	HER	Modern (WWII)	Low



Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
127	NMF32655 (NHER)	TG 5264 0535	Gun emplacement	A group of WWII defences, comprising a tower for a light anti-aircraft gun, a spigot mortar emplacement and a possible air raid shelter, are visible as extant structures and earthworks on aerial photographs. The tower was demolished in the post war period and there is no evidence that any trace of the defences now survives at the site.	HER	Modern (WWII)	Low
128	MNF61540 (NHER)	TG 5264 0529	Findspot	An archaeological evaluation in August 2010 revealed an alluvial deposit and a residual sherd of late 18 <sup>th</sup> to late 19 <sup>th</sup> century pottery.	HER	Modern (WWII)	Low
129	NHLE ref 1246974	TG 52608 05230	House	Koolunga House, formerly known as Wishbone. The house has now been split into flats. It is dated 1826 and built of gault brick with slate roof.	Listed (Grade II)	Post medieval	Medium
130	MNF46945, MNF46934 (NHER)	TG 5291 0550	Military training site, weapons pit, pillbox	Evidence of WWII military activity, including anti invasion defences, is visible on 1940s aerial photographs as groups of earthworks, buildings and structures. These extended across a large area of South Denes, from Main Cross Road in the north to an area of open ground (now a caravan park) to the south. They included areas of pit digging, weapons pits, possible pillboxes, a possible air raid shelter, spigot mortar emplacements, barbed wire and anti-tank scaffolding. The majority of these features were removed by 1945.	HER	Modern (WWII)	Low
131	MNF46925 (NHER)	TG 5302 0576	Ambulance station	Two buildings are visible on 1940s aerial photographs. The precise function of the buildings is not clear, but they could have been a WWII ambulance station. One of these buildings may still survive as a garage building.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
132	NHLE ref 1246057	TG 52999 05508	Monument	Nelsons Monument, also known as Norfolk Pillar. Constructed in 1817-19 by William Wilkins. It was the first monument in England to Admiral Lord Nelson (Nelson's Column in London was 1840s, but the column in Dublin was of 1808). The monument consists of fluted Greek Doric column on a square pedestal standing on a raised plinth.	Listed (Grade I)	Post medieval	High
133	NHLE ref 1246978	TG 52657 05084	Milepost	Milepost in front of No 245 High Street. It is made of cast iron and dated 1828. It is triangular casting with a broach into a flat top.	Listed (Grade II)	Post medieval	Low
134	NHLE ref 1246977	TG 52665 05022	House	235 High Street is an early 19 <sup>th</sup> century house of rendered and colourwashed brick. It has a slate roof and is of 2 storeys with a dormer attic.	Listed (Grade II)	Post medieval	Medium
135	NHLE ref 1246975	TG 52721 04845	Public House	The Short Blue Public House was built in the early 18 <sup>th</sup> century and altered in the 20 <sup>th</sup> century. It is built of stuccoed brick and colourwashed. It has a pantile roof which is black glazed to the front.	Listed (Grade II)	Post medieval	Medium