Norfolk County Council

GREAT YARMOUTH THIRD RIVER CROSSING

Environmental Impact Assessment Scoping Report

70041951-ENV-EIA SCOPING/A
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PUBLIC

Norfolk County **Council**

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APPENDICES

1 INTRODUCTION

1.1 INTRODUCTION TO THIS REPORT AND THE PROPOSED SCHEME

1.1.1. WSP has been appointed by Norfolk County Council (NCC) to prepare a Scoping Report for the Environmental Impact Assessment (EIA) for the Great Yarmouth Third River Crossing (hereinafter referred to as the Proposed Scheme). This Report accompanies an application by NCC for a Scoping Opinion pursuant to Regulation 10(1) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the Regulations)[1]. The purpose of the Report is to provide the documentation and information required to comply with Regulation 10(3)(a) to (c) together with further information and representations which NCC considers appropriate for the purposes of Regulation 10(3)(d).

1.1.2. The scheme promoter is NCC. The proposed scheme will be located in the area of Great Yarmouth Borough Council (GYBC).

1.1.3. The Proposed Scheme will provide a third crossing over the River Yare, creating a new, more direct link between the western and eastern parts of Great Yarmouth. Specifically, it will provide a connection between the Strategic Road Network (A47) and the South Denes Business Park, Enterprise Zone, Great Yarmouth Energy Park and the Outer Harbour, all of which are located on the South Denes Peninsular. The Proposed Scheme is described further in Chapter 3.

1.2 ENVIRONMENTAL IMPACT ASSESSMENT

1.2.1. The Proposed Scheme is a Nationally Significant Infrastructure Project (NSIP)[2] following a Direction from the Secretary of State.

1.2.2. As NCC will be the highway authority for the project (if constructed), section 22(2)(b) of the Planning Act 2008 precludes the project falling within Section 14. However on 26 January 2018, NCC formally requested the Secretary of State to use his power of direction under Section 35.

1.2.3. By letter of 26 February 2018, the Secretary of State stated that he was satisfied that the Proposed Scheme was nationally significant and directed that the Proposed Scheme, together with any matters associated with it, was to be treated as development for which development consent is required. This Direction is included in Appendix A.

1.2.4. The Proposed Scheme is therefore now subject to the consenting regime comprised in the Planning Act 2008 and associated subordinate legislation (including the Regulations). NCC therefore proposes, in due course, to make an application to the Secretary of State for an order granting development consent for the Proposed Scheme. To facilitate this, NCC has applied for a Scoping Opinion pursuant to Regulation 10(1) of the Regulations.

1.2.5. The process and content of EIA is summarised in Regulations 5(1) and (2) of the Regulations. EIA applies to "EIA Development" as defined by the Regulations. This comprises development of a description mentioned in Schedule 1 of the Regulations, or mentioned in Schedule 2 where the development is likely to have significant effects on the environment by virtue of factors such as its nature, size and location. The Proposed Scheme does

[1] Note: where legislation referred to in this Report has been amended, the Report is to be read as referring to that legislation as amended.

[2] Strictly speaking,, a project which is the subject of a section 35 direction is a 'project of national significance' rather than a 'NSIP' but there is no material difference in substantive or procedural terms between a DCO for such a project and a DCO for a 'NSIP'. Thus, for convenience, the Proposed Scheme will be referred to as a 'NSIP

not fall within any Schedule 1 description, but it does fall within the following Schedule 2 description: the "construction of roads (unless included in Schedule 1)".

1.2.6. Taking into account the above, and the criteria in Schedule 3 of the Regulations and having considered the nature of the Proposed Scheme and the sensitivity of the receiving environment, NCC is of the opinion that the development has the potential for significant effects upon the environment. NCC has therefore decided that it will provide an Environmental Statement (ES) in relation to the Proposed Scheme and has notified the Secretary of State of this pursuant to Regulation 8(1)(b). This event has determined for the purposes of the Regulations that the Proposed Scheme is EIA Development[3].

1.3 SCOPING REPORT APPROACH

1.3.1. Scoping is an important part of the EIA process. It aims to assist the preparation of the ES by providing an opinion as to the scope of the information to be provided in the ES and the level of detail.

1.3.2. This Scoping Report considers and sets out currently anticipated likely effects on the environment using available baseline information and emerging design proposals that are available. Baseline surveys and consultation undertaken to date have been used to inform the methodologies proposed and this evidence is presented together with relevant reports appended as appropriate.

1.3.3. The required scope of an EIA is an evolving process and following the receipt of the Scoping Opinion, or a change in the Proposed Scheme or baseline knowledge, then adjustment to the scope of the EIA may be necessary. However, this Scoping Report, as well as the Scoping Opinion, will in any event remain important documents in the EIA process and will therefore be issued as a technical appendix to the ES.

1.3.4. Regulation 10(1) states that the request for a Scoping Opinion must include:

- a plan sufficient to identify the land (presented as drawing 62240375-GYTRC-Scoping Report Boundary-20180219, in Appendix B);
- a description of the proposed development, including its location and technical capacity;
- an explanation of the likely significant effects of the development on the environment; and
- such other information or representations as the person making the request may wish to provide or make.

1.3.5. In accordance with advice presented in Advice Note 7, this report aims to present the Planning Inspectorate with the following information.

The Proposed Development:

- an explanation of the approach to addressing uncertainty where it remains in relation to elements of the Proposed Development e.g. design parameters;
- referenced plans presented at an appropriate scale to convey clearly the information and all known features associated with the Proposed Development;

EIA Approach and Topic Areas:

- an outline of the reasonable alternatives considered and the reasons for selecting the preferred option;

[3] See Regulation 6(1) and 6(2)(a)

- a summary table depicting each of the aspects and matters that are requested to be scoped out allowing for quick identification of issues;
- a detailed description of the aspects and matters proposed to be scoped out of further assessment with justification provided;
- results of desktop and baseline studies where available and where relevant to the decision to scope in or out aspects or matters;
- aspects and matters to be scoped in, the report should include details of the methods to be used to assess impacts and to determine significance of effect e.g. criteria for determining sensitivity and magnitude;
- any avoidance or mitigation measures proposed, how they may be secured and the anticipated residual effects;

Information Sources:

- references to any guidance and best practice to be relied upon;
- evidence of agreements reached with consultation bodies (for example the statutory nature conservation bodies or local authorities); and
- an outline of the structure of the proposed ES.

1.4 STRUCTURE OF THIS REPORT

1.4.1. The remainder of the scoping report is set out as follows:

- Chapter 2 describes the Proposed Scheme and the Site Location;
- Chapter 3 presents an assessment of Alternative Options;
- Chapter 4 provides details of consultation undertaken to date;
- Chapter 5 details the proposed approach to the EIA;
- Chapter 6 presents the proposed scope of the technical assessments to be included within the EIA;
- Chapter 7 provides a summary of the proposed Scope; and
- Chapter 8 presents references and a glossary.

1.4.2. This report is also supported by eight appendices, which are as follows:

- Appendix A: Planning Act 2008 Section 35 Direction
- Appendix B: Figures and Drawings
- Appendix C: Legislation
- Appendix D: Consultation Responses
- Appendix E: Preliminary Ecological Appraisal
- Appendix F: Protected Species

- Appendix G: Heritage Desk Study
- Appendix H: Health Assessment Matrix
- Appendix I: Contaminated Land Desk Study

1.5 DESIGN UNCERTAINTY

1.5.1. At the time of preparing the Scoping Report the Proposed Scheme design continues to be refined. The preferred design option, formerly identified as Option 32, has undergone further refinement since the Outline Business Case. At the time of writing it is recognised that:

- the land requirements of the Proposed Scheme are yet to be wholly finalised;
- a bascule bridge design solution is being progressed for the Proposed Scheme, although consideration is being given to a potential alternative swing bridge design. This alternative has therefore been included within the Scoping Report; and
- areas for ecological mitigation are yet to be determined.

1.5.2. It is considered unlikely that refinements to the Proposed Scheme, in the light of further work, will result in a materially different scheme and hence the description given in Section 2 is considered applicable to inform this report.

2 PROPOSED SCHEME

2.1 THE NEED FOR THE PROPOSED SCHEME

2.1.1. The aim of the Proposed Scheme is to overcome the problems of poor access to the peninsula of Great Yarmouth, and the congestion that this causes.

2.1.2. The existing river crossings do not provide adequate access to the port and employment areas in the southern part of the peninsula. The lack of a direct bridge means that traffic is forced onto unsuitable routes within the town centre, including the historic South Quay. Congestion, especially on the Haven Bridge, causes delays and makes journey times unreliable. The importance of these issues is emphasised by the port's nationally significant role in the renewable energy sector and the offshore oil and gas industry, and its role as an International Gateway. Moreover, the mixture of port-related and local traffic makes it more difficult for people to access the town centre, seafront, and leisure facilities. The lack of a direct river crossing makes Great Yarmouth seem remote, and discourages inward investment. Bus users, cyclists and pedestrians have long, indirect journeys into the peninsula, which discourages commuting to work by more sustainable modes.

2.1.3. The Proposed Scheme is intended to improve connectivity and resilience substantially for all port activities, Moreover, the port and part of the peninsula have been designated as The Great Yarmouth Enterprise Zone, which has the potential to create 5,000 new jobs by 2025, alongside plans for 2,000 new homes and 20-30 hectares of employment development. Without a new crossing, the full potential for growth in the Enterprise Zone and Local Development Order may not be fully realised.

2.1.4. In his letter of 26 February 2018 (presented within Appendix A) the Secretary of State stated that he was satisfied that the Proposed Scheme was nationally significant for the following reasons:

- The port has a nationally significant role in the renewable energy sector and the offshore gas and oil industry and the scheme will substantially improve connectivity and resilience for port activities;
- The scheme will support the delivery of existing and potential future renewable energy NSIPs,
- Supports the port's role as an International Gateway

2.1.5. In addition, the Secretary of State recognised within the letter that the scheme will Improve the offer of the Port through better connectivity to the Enterprise Zone

2.1.6. Figure 1 shows the strategic location of the Proposed Scheme. The approximate position of the Proposed Scheme is marked in blue.

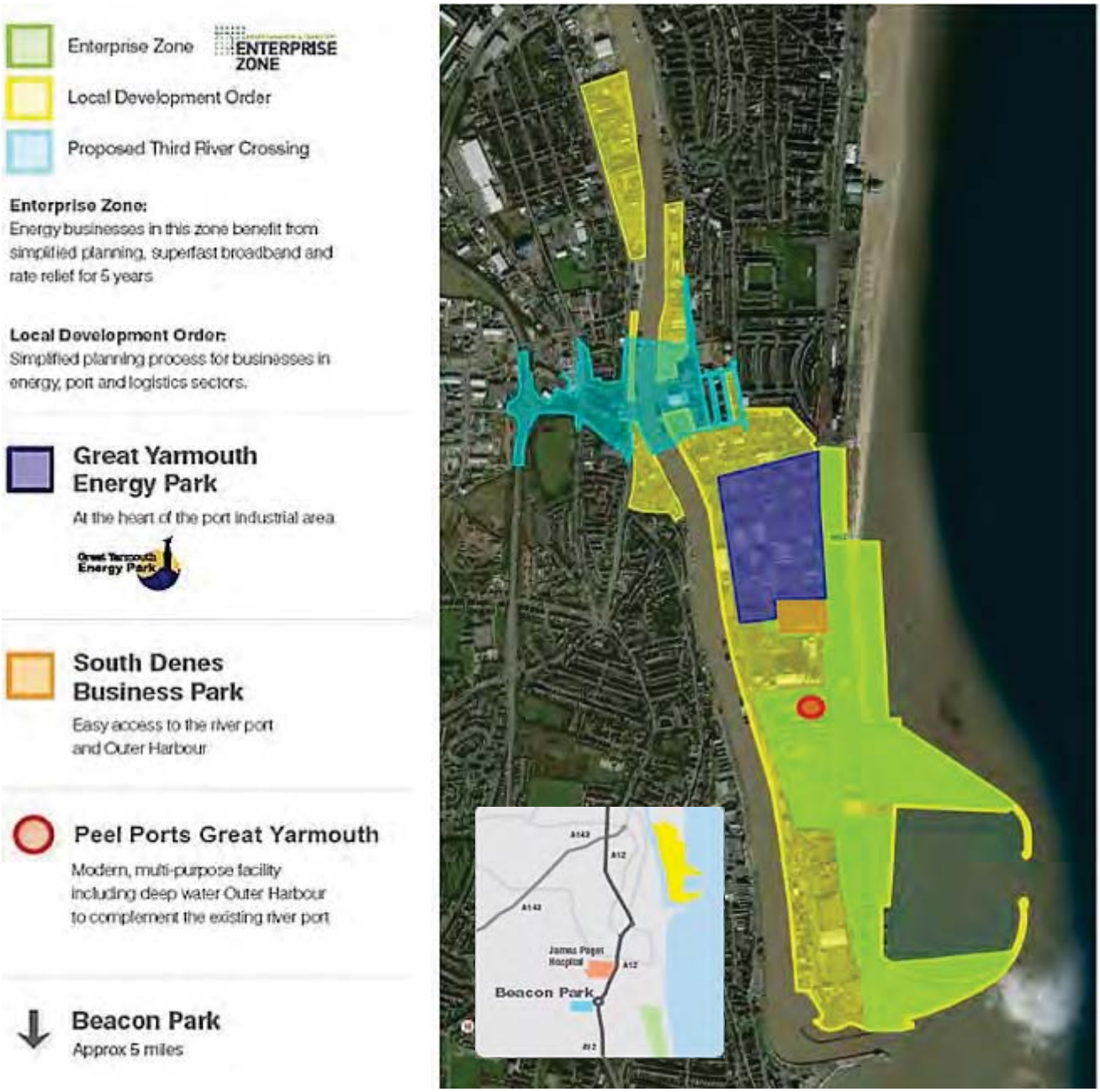

Figure 1 – Strategic Location

2.2 LOCATION OF PROPOSED SCHEME

2.2.1. Figure 2, presented in Appendix B shows the location of the Proposed Scheme. Great Yarmouth is located at the mouth of the River Yare, one of the main waterways providing access to the Norfolk Broads. The river bisects Great Yarmouth, with the town centre, seafront, industrial areas and outer harbour located on the narrow, 4 km long, South Denes peninsula between the river and the sea, isolated from the rest of the town. To the west of the River Yare, Gorleston-on-Sea is just a few hundred metres away as the crow flies, but over 7km distant by road.

2.2.2. The Proposed Scheme will provide a third crossing of the River Yare, creating a direct link into the southern part of the peninsula. It will greatly improve access to the port, outer harbour, employment areas, the seafront and residential areas. It will connect the peninsula to the strategic road network via the A47 Harfrey's roundabout.

2.2.3. There are a number of designations affecting the Proposed Scheme. These are marked on the Environmental Constraints Plan presented as Figure 3. Key designations and features include, but are not limited to, the following:

- European Designation:
  - The Outer Thames Estuary Special Protected Area (SPA)
  - The Potential Extension Outer Thames Estuary Special Protected Area (pSPA), covering the River Yare and the River Bure
  - Breydon Water SPA and Ramsar
  - Great Yarmouth North Denes SPA
- National Statutory Designation:
  - Breydon Water SSSI
  - Great Yarmouth North Denes SSSI
  - The Broads National Park[4]
- Heritage Designations
  - Town Walls Scheduled Ancient Monument
  - Listed buildings (Grades I, II* and II)
  - Conservation Areas – Four conservation areas identified within 1km of the Proposed Scheme:

2.3 PROPOSED SCHEME DESCRIPTION

2.3.1. A new highway crossing of River Yare, Great Yarmouth, connecting Harfrey's Roundabout to the west of the River Yare with South Denes Road to the east of the River Yare. The Proposed Scheme Boundary is shown in WSP drawing 62240375-GYTRC-Scoping Report Boundary-20180219, and the Proposed Scheme layout is shown in drawing 70041951-WSP-HAW-GYTRC-DR-D-0001-P01.1, both of which are presented in Appendix B.

2.3.2. A bascule bridge design solution is currently being progressed, as described within the following sections. Nevertheless, it should be noted that consideration is also being given a potential alternative swing bridge design

[4] "Broads National Park" is the term used by the Broads Authority to refer to the Broads for branding and marketing purposes. Whilst the Broads is not a statutory national park, being governed principally by the Norfolk and Suffolk Broads Act 1988, it shares many of the statutory characteristics of a National Park and is treated by Government policy as a member of the national park family.

solution. This potential alternative design has been included within this Scoping Report and a description of this has also been provided.

2.3.3. The bascule bridge represents the preferred design solution for the Proposed Scheme. The swing bridge design is only likely to be progressed past the preliminary design stage, where a decision is made not to proceed with the preferred bascule solution. This decision will be informed by early contractor involvement. It is expected that a decision on the bridge design will be made prior to the submission consultation in summer 2018.

Bascule Bridge Design Solution

Western Bank of the River Yare:

2.3.4. On the western side of the river, a new roundabout will be constructed on William Adams Way, at the site of the existing junction with Suffolk Road, to the east of the A47 Harfrey's roundabout. William Adams Way will be realigned and widened between Harfrey's Roundabout and the new roundabout, and between the new roundabout and Beccles Road / Southtown Road.

2.3.5. From the new roundabout, a new dual carriageway road will be constructed leading eastwards towards the new river bridge. It will cross Southtown Road on a flyover.

The New Bascule Bridge Crossing:

2.3.6. A new bridge will be provided to carry the new dual carriageway road across the river. Traffic will be controlled by lifting barriers at either end of the bridge and queuing space will be provided. Facilities will be provided for cyclists and pedestrians.

2.3.7. The new bridge will comprise a single span, double leaf trunnion bascule (upward opening). Draft structural drawing 1076653-WSP-SGN-OPT32-DR-S-0001-P02, presented in Appendix B, shows the bascule bridge conceptual general arrangement. As stated in the drawing title, the bascule bridge design is currently conceptual, therefore design details, such as the location and design of bascule chambers are currently being progressed. It is anticipated that hydraulic and electrical equipment shall be housed in plant rooms. At this stage it is anticipated that two plant rooms will be required, one per bridge leaf.

2.3.8. Drawing 1076653-WSP-SGN-OPT32-DR-S-0001-P02 shows a vertical clearance of 5.6m between the water level at Mean High Water Springs (MHWS) and the bottom bridge deck. The Bascule bridge design will require the construction of piers and fenders, one at each embankment of the River Yare. Drawing 1076653-WSP-SGN-OPT32-DR-S-0001-P02 shows a 50m clearance between fenders in order to maintain a suitable navigation channel within the River Yare. The dimensions of the clearance envelope, along with other design details, will be update in future EIA document as the scheme design progresses.

2.3.9. The Proposed Scheme will include a control tower for the new lifting bridge, although at the time of writing the location and design of this control tower have not been determined.

East Bank of the Yare:

2.3.10. On the eastern side of the river, the new dual carriageway will connect to the A1243 South Denes Road, which is currently shown to be a new signal controlled junction.

Cycle and Pedestrian Routes:

2.3.11. As well as being an important link for vehicular traffic, the new bridge will provide opportunities for more journeys by cycle and on foot. The current scheme proposes the following:

- A footway and cycleway link from William Adams Way, across the new bridge, and linking to a new on carriageway cycle lane on Sutton Road;

- A new footway/cycleway link from the William Adams Way roundabout to Suffolk Road, and a new pedestrian crossing on Suffolk Road;
- A footway/cycleway link from William Adams Way to the Harfrey's roundabout; and
- Enhanced public realm.

Potential Alternative Bridge Design: Swing Bridge Option

2.3.12. At this stage of the project a potential alternative bridge design is being considered. This alternative design comprises a single leaf Swing Bridge. Draft structural drawing 1076653-WSP-SGN-OPT32A-SK-S-0001-P01, presented in Appendix B, shows the bridge design conceptual general arrangement of the Swing Bridge.

2.3.13. This alternative bridge leaf design would likely comprise an asymmetric span structure rotating around a pintle bearing. The current preliminary design for this alternative option shows the rotating mechanism located on a pier at the western River Bank. The swing span leaf would travel through 90° between open and closed positions. Drawing 1076653-WSP-SGN-OPT32A-SK-S-0001-P01 shows that, when open the bridge leaf would sit parallel to the quay wall along the western river bank.

2.3.14. A 50m clearance between fenders in order to maintain a suitable navigation channel within the River Yare. The vertical clearance between the bridge deck and MHWS is shown to be 7.3m.

2.3.15. As with the preferred bascule option, this drawing is preliminary. This design may be subject to change, however as previously stated, the swing bridge design is only likely to be progress if a decision is made not to proceed with the preferred bascule bridge solution.

3 ASSESSMENT OF ALTERNATIVES

3.1 DEVELOPING OPTIONS

3.1.1. The Option Assessment Report (OAR) considered a range of locations for the Great Yarmouth Third River Crossing (GYTRC), as well as whether the crossing should be a bridge or tunnel. Three broad alignment corridors were considered: northern, central and southern. In each corridor, a high level and low level bridge option (on similar alignments) and a tunnel option were devised, giving nine different main options. Both the high and low level bridge options were to be for lifting bridges.

3.1.2. Results from the economic assessment carried out in the Option Assessment Report (OAR) showed that although the economic benefits of the tunnel option are nearly as high as those for the bridge options, its cost would be approximately three times that of the bridge confirming that a tunnel option is unlikely to become a viable solution.

3.1.3. A Stage 2 Assessment gave further consideration to the options which had emerged from the Stage 1 Assessment. As part of this assessment the proposed corridor for the new bridge crossing was identified, based upon commercial vessel movements and the number of bridge openings required.

3.1.4. The list of potential options was narrowed down to a selection of preferred options by removing those that did not make significant contributions to meeting the defined objectives, did not resolve the identified problems, or are not deliverable or feasible. Nine primary options were identified comprising variants of three different western tie-in forms and locations outlined in the OAR. These included:

- Option 4: A12 Harfrey's Roundabout tie-in; min 7.0m clearance; single carriageway
- Option 5: A12 Harfrey's Roundabout tie-in; min 7.0m clearance; dual carriageway
- Option 6: A12 Harfrey's Roundabout tie-in; min 7.0m clearance; 3-lane carriageway
- Option 31: Suffolk Road tie-in; min 7.0m clearance; single carriageway
- Option 32: Suffolk Road tie-in; min 7.0m clearance; dual carriageway
- Option 33: Suffolk Road tie-in; min 7.0m clearance; 3-lane carriageway
- Option 37: Southtown Road tie-in; min 3.0m clearance; single carriageway
- Option 38: Southtown Road tie-in; min 3.0m clearance; dual carriageway
- Option 39: Southtown Road tie-in; min 3.0m clearance; 3-lane carriageway

3.1.5. Following the development of the nine primary options, further operational appraisal was carried out to assess (i) value for money; (ii) the financial case; and (iii) the delivery case. The DfT Early Assessment Sifting Tool (EAST) was applied to reduce nine options down to the final three. The shortlisted options were subjected to preliminary operational testing using both SATURN and Paramics Discovery model platforms.

3.1.6. Options 32, 33 and 37 were recommended to be carried forward to next stage for further appraisal. Both options 32 and 33 met all specific, intermediate and operational objectives of the scheme and addressed a balance of benefits to both the local and strategic road network. Option 37, which is a two-lane low bridge that ties in at-grade to Southtown road, was to be carried forward as the low cost option.

3.1.7. Testing showed that all key indicators suggest that option 32 performs better than either option 33 or 37. Option 32 was forecast to provide the greatest potential benefit in terms of total travel distance and time saved across the modelled road network. In addition, Option 32 was also forecast to present the best operational performance at the junctions adjacent to the bridge, with the lowest levels of queueing and most efficient dissipation of these queues once the bridge re-opens for vehicular traffic.

3.1.8. Option 32 formed the basis for the Proposed Scheme, presented within this Scoping Report.

4 CONSULTATION

4.1 CONSULTATION TO DATE

4.1.1. Previous consultations have been undertaken by NCC on the Third River Crossing scheme, the most recent of these being:

- Initial engagement consultations in January 2017:

  The purpose of these consultations was to understand stakeholder views on congestion, to share the emerging proposals for the scheme and understand the level of support for it.

- Scheme development consultations in September/October 2017:

  The purpose of these consultations was to present details of the Proposed Scheme to date and understand views on it.

4.2 INFORMAL CONSULTATION RESPONSES

4.2.1. NCC as Applicant has undertaken non-statutory consultation in advance of preparing the EIA scoping report, based upon information presented in the Outline Business Case[5] and Options Assessment report[6].

4.2.2. Informal consultation responses have been received from Historic England, Natural England, The Broads Authority and the Environment Agency (EA). Consultation responses received to date are presented in Appendix D.

4.3 FUTURE CONSULTATION

4.3.1. Further consultation will be carried out in accordance with the requirements of the Regulations and the Planning Act 2008. It is intended to carry out statutory pre-application consultation during summer 2018 and Preliminary Environmental Information will be published and consulted on at that time.

[5] Norfolk County Council (2017) Great Yarmouth Third River Crossing Outline Business Case. [online] available at https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-yarmouth/third-river-crossing/outline-business-case-submission (Accessed January 2018)

[6] Norfolk County Council (2017) Great Yarmouth Third River Crossing Options Assess. [online] available at https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-yarmouth/third-river-crossing/outline-business-case-submission (Accessed January 2018)

5 ENVIRONMENTAL IMPACT ASSESSMENT APPROACH

5.1.1. Identification of the impacts and likely significant effects on the environment associated with the Proposed Scheme, and of the studies and assessments which it is intended should be undertaken to investigate them, has been largely informed by the National Networks National Policy Statement (NN NPS), which provides planning guidance for scheme promoters.

5.1.2. As stated in the NN NPS, Schedule 4 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 sets out the information that should be included in the environmental statement including a description of the likely significant effects of the proposed project on the environment, covering the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the project, and also the measures envisaged for avoiding or mitigating significant adverse effects.

5.1.3. In addition, the Deign Manual for Roads and Bridges (DMRB) provides guidance for all aspects of the planning, design and assessment of major road schemes. Volume 11 of the DMRB specifically addresses environmental assessment although it is acknowledged that the DMRB predates the current EIA Regulations.

5.1.4. The guidance in Volume 11 identifies impacts and effects which can be anticipated where a major road scheme is being introduced into the environment. The guidance has been used to enable the assessment team to establish which of these impacts and effects could potentially occur, and the specific nature of them for the Proposed Scheme. Where it has been concluded assessment is required, there is a description of the assessment considered appropriate and methods of assessment which are to be adopted.

5.1.5. The ES will aim to determine which potential effects of the Proposed Development are likely to be significant, both positive and negative, irrespective of duration. Direct effects will be assessed, together with (where relevant) indirect, secondary, cumulative and transboundary effects. Where possible effects will be assessed quantitatively.

5.1.6. The significance of effects will be assessed using one or more of the following criteria:

- international, national and local standards;
- relationship with planning policy;
- sensitivity of receiving environment;
- reversibility and duration of effect;
- inter-relationship between effects and cumulative effects; and
- the results of the consultations

5.1.7. The significance of effects reflects the professional judgement of the technical specialist as to (i) the value or sensitivity of the affected receptor(s); and (ii) the nature and magnitude of the predicted changes.

5.1.8. It is proposed that the methodology and criteria used for the EIA be based upon the approach published in Volume 11, Section 2, Part 5 of the DMRB (HA 205/08), updated as necessary to take account of the 2017 EIA Regulations. Where individual topics depart from this approach, the alternative methodologies and terminology will be provided within the relevant chapter.

5.1.9. Environmental value and impact magnitude detailed within HA 205/08 are reproduced in Table 1 and Table 2 respectively.

Table 1 - Environmental Value (or Sensitivity) and Typical Descriptors

Value (sensitivity)	Typical Description
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or lower	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 2 - Magnitude of Impact and Typical Descriptors

Magnitude of impact	Typical criteria descriptors
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).

5.1.10. Using the level of sensitivity (value) and the magnitude of an impact, the significance of an effect can be determined using the Significance Matrix presented in Table 3. Using this approach it is possible that a large adverse impact on a feature or site of low importance will be of lesser significance than the same impact on a feature or site of high importance.

5.1.11. Descriptors of effect significance are presented in Table 4. Table 3 and Table 4 are also based upon the significance matrix and significance descriptions published by the DMRB in HA 205/08.

5.1.12. Again, where individual assessment sections deviate from these terms, the alternative terminology has been explained as appropriate within the relevant chapter.

Table 3 - Significance of Effect Matrix

Importance / Sensitivity / Value						
	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
		Magnitude of impact				

Table 4 - Descriptors of the Significance of Effect Categories

Significance Category	Typical descriptors of effect
Very Large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

6 SCOPE OF TECHNICAL ASSESSMENTS

6.1 INTRODUCTION

6.1.1. This chapter describes the methodology to be used within the EIA for each topic chapter. Each section also includes a description of the baseline data collected to date and the potential effects identified. The methodology takes into account the requirements of the DMRB Volume 11 together with guidance on environmental mitigation provided in DMRB Volume 10 and the guidance provided by the NN NPS. New and emerging guidance not yet incorporated into the DMRB is included in IANs.

6.2 AIR QUALITY

BASELINE CONDITIONS

6.2.1. The level of air pollution adjacent to roads and within urbanised areas is typically a function of vehicle emissions. Emissions of nitrogen oxides (NO_x), including nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) from vehicles are of greatest concern with respect to human health.

6.2.2. Concentrations of these pollutants are most likely to approach their respective air quality limit values, established by European and UK legislation and prescribed in the UK Air Quality Strategy (AQS)[7] for the protection of human health and ecosystems, in proximity to the aforementioned areas. The review of the existing environment and subsequent air quality assessment scope will focus on these pollutants.

6.2.3. Information has been collected from the following sources to inform the review of existing air quality conditions:

- The GYBC Local Air Quality Management (LAQM) reports and published data.
- Department for Environment, Food and Rural Affairs (Defra) mapped background air pollution concentrations specific to the Proposed Scheme.
- Ordnance Survey (OS) mapping and address layer data to identify sensitive receptors in proximity to the Proposed Scheme and surrounding areas.

Local Air Quality Management Review

6.2.4. A review of the latest LAQM report published by GYBC – the 2016 Annual Status Report[8] – confirmed that there are no Air Quality Management Areas (AQMA) declared within the Borough, with no requirement for the Council to progress to further detailed assessment for any pollutant.

6.2.5. GYBC operates one automatic urban background monitoring site at Gorleston, located within 1km of the Proposed Scheme, which monitors ozone (O_3), Nitrogen Oxides (NO_x) and Particulate Matter to 10 microns (PM_{10}). The previous five years' monitoring results for annual mean Nitrogen Dioxide (NO_2) and PM_{10} concentrations are presented in Table 5 Concentrations in all years are well below the respective annual mean limit values.

[7] Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)
[8] Great Yarmouth Borough Council (2016) Annual Status Report 2016

Table 5 - Annual mean NO_2 and PM_{10} data recorded at GYBC Urban Background Monitoring Station

Site Name	Annual Mean Concentration (µg/m³)									
	2011*		2012*		2013*		2014*		2015*	
	NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
Gorleston	20.0	21.7	18.8	19.9	18.2	20.7	17.1	16.6	16.8	16.8
Annual Mean NO_2 and PM_{10} Limit value = 40 µg/m³										

* The 1-hour mean NO_2 and 24-hour mean PM_{10} standard was not breached in any of the years presented

6.2.6. GYBC operates a network of NO_2 diffusion tube monitoring sites, three of which are located within 1km of the Proposed Scheme and are presented in Table 6. Results obtained from these monitoring sites were well below the limit value (40µg/m³) for the five years 2011 – 2015.

Table 6 - Annual mean NO_2 data recorded by diffusion tube monitoring within 1km of the Proposed Scheme

Site Name	Site ID	Site Type	2015 Annual Bias-Adjusted NO_2 (µg/m³)				
			2011	2012	20132	2013	2015
9 Southgates Road	Diffusion Tube 6	Roadside	27.5	26.4	25.8	25.6	24.4
41 Southgates Road	Diffusion Tube 7	Roadside	24.3	23.8	20.8	22.9	20.9
Maltings House, Gorleston	Diffusion Tube 8_1	Co-location (x3 tubes) urban background	20.3	18.5	18.2	17.8	16.0
	Diffusion Tube 8_2		19.9	18.3	14.3	16.9	16.3
	Diffusion Tube 8_3		19.5	17.8	17.2	15.4	15.7
Annual mean limit value (µg/m³)			40				

Background Pollutant Concentrations

6.2.7. Defra publishes modelled background air pollutant data for the UK[9], based on a 1x1km grid, which accounts for a multitude of local emissions sources including road vehicles, industrial installations, domestic sources and other transport modes, in addition to regional sources and imported emissions. The modelled background data is available for years 2015 to 2030 inclusive.

6.2.8. Background pollutant concentrations of NO_2, NO_x, PM_{10} and $PM_{2.5}$ were obtained for the 1x1 km grid squares relative to the Proposed Scheme and surrounding area. These data are summarised in Table 7 for the current year (2016) and the proposed opening year (2023).

[9] DEFRA (2017) Air Pollution Background Maps. Available from: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html. [Accessed 01/12/2017]

Table 7 - Defra mapped background annual mean concentrations (µg/m^3) for each pollutant in current (2016) and future (2023) years

Pollutant	Annual mean concentrations (µg/m^3)						Annual Mean Limit Value (µg/m^3)
	Maximum		Minimum		Average		
	2017	2023	2017	2023	2017	2023	
NO_2	16.0	13.0	12.6	10.5	14.0	11.5	40
NO_x	22.5	17.9	17.2	14.1	19.4	15.6	30*
PM_{10}	17.7	17.0	14.1	13.5	15.7	15.0	40
$PM_{2.5}$	13.2	12.6	9.9	9.4	11.2	10.7	25

6.2.9. All background concentrations contained as part of the intervention area are well below their respective annual mean health based limit values for NO_2, PM_{10} and $PM_{2.5}$. Similarly, the annual mean limit NOx value set for the protection of vegetation and ecosystems is not exceeded.

Potentially Sensitive Receptors

6.2.10. The influence of vehicle emissions on ambient air quality is negligible beyond 200m of the respective road source, predominately due to horizontal and vertical atmospheric mixing. As such, an initial desk based review of potentially sensitive receptors to changes in air quality was undertaken to identify those located within 200m of the Proposed Scheme alignment and the likely affected links. This review was based on OS mapping and address layer data. Sensitive receptors as defined in the DMRB HA207/0710 include:

- The River Yare pSPA
- Residential dwellings;
- Designated ecological sites;
- Locations of the young and elderly;
- Hospitals; and
- Schools.

6.2.11. A summary of the sensitive receptor locations identified within 200m of the likely affected road network is presented in Table 8.

Table 8 - Identified Potentially Sensitive Receptor Locations based on OS Mapping

Property Type	Count
Residential	893
Designated Ecological Sites	0*
Education	2
Health Care (Hospitals, Care Homes)	0

* No sites identified within 200m of the Proposed Scheme alignment. However, this will be revisited once traffic data are issued.

[10] Highways Agency (2007) Design Manual for Roads and Bridges Volume 11, Section 3, Part 1 Air Quality.

Pollutant Climate Mapping Model

6.2.12. The Pollution Climate Mapping (PCM) model, operated by Defra, is collection of models designed to fulfil part of the UK's commitment to the requirements of EU Directive (2008/50/EC11) to report on the concentrations of particular pollutants in the atmosphere, which includes NO_x, NO_2 and PM_{10}.

6.2.13. The PCM model is used to produce the aforementioned 1x1km grid background pollutant concentrations, in addition to approximately 9,000 representative roadside pollutant values, thus accounting for vehicle emissions on the respective national roads.

6.2.14. The most relevant PCM road link to the Proposed Scheme is the A47, which intersects the proposed alignment at William Adams Way. The annual mean NO_2 concentrations predicted by the PCM model adjacent to the A47 are reported by Defra[12]:

- 2017 predicted NO_2 annual mean: 31.2 µg/m^3
- 2023 predicted NO_2 annual mean: 24.5 µg/m^3

6.2.15. The PCM predicted concentrations are below the respective annual mean limit values in the current year (2018) and future year (2023).

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.2.16. Effects which would be likely to result from the implementation of the Proposed Scheme comprise:

- The generation and deposition of dust during construction;
- Combustion engine emissions associated with construction-related traffic and construction plant operation;
- Changes in concentrations of traffic related pollutants (NO_x, NO_2, PM_{10}, $PM_{2.5}$) where sensitive receptors are located or will be located in the vicinity of the Proposed Scheme, and parts of the existing road network that would be subject to changes in traffic flows and/or speeds, as a result of the implementation and future use of the Proposed Scheme (impacts on local air quality); and
- Changes in the total emission of traffic-related pollutants associated with traffic using the Proposed Scheme and parts of the road network, which could be subject to changes in traffic flows and/or speeds across parts of the road network (regional emissions).

Construction Phase

6.2.17. Activities such as earthworks and the transport of materials on haul routes during construction, will generate fugitive dust emissions, including fine particles (PM_{10} and $PM_{2.5}$). If transported beyond the boundary of site works, fugitive dust has the potential to adversely impact designated sites, residential areas and other sensitive receptors as a result in soiling of surfaces through deposition.

6.2.18. Residential properties on Queens Anne's Road and Southdown Road are located within close proximity to the application where there will be a clear risk of nuisance associated with deposition during construction. With regards to these sensitive receptors, there are well established mitigation measures, such as documented by the Institute of Air Quality Management (IAQM[13]), which are focussed on the control and mitigation of dust

[11] The European Parliament and the Council of the European Union (2008) Ambient Air Quality Directive (2008/50/EC)
[12] Defra (2017) Pollution Climate Mapping. Available from: https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data [Accessed 4/12/17]
[13] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction (v1.1)

generation and deposition. Such measures will ensure the likelihood of there being a significant environment effect in the context of the Regulations[14] is minimised.

6.2.19. Other potential impacts during construction can be associated with elevated concentrations of NOx, NO_2 and fine particles at sensitive receptors within 200m of exhaust emissions from non-road mobile machinery, construction vehicles and diesel generators.

6.2.20. A construction assessment following the methodology set out in IAQM Guidance on the Assessment of Dust from Demolition and Construction will be presented in the ES. In addition, based upon available construction vehicle and plant information at the time of production of the ES, assessment of construction emissions may be required.

Operational Phase

6.2.21. Operation phase air quality impacts will be associated with changes to vehicle flow characteristics, and thus emissions of NOx, NO_2, PM_{10} and $PM_{2.5}$. This has the potential to result in localised impacts to air pollutant concentrations at identified sensitive receptors within 200m of road emission sources.

6.2.22. The River Yare pSPA is situated within the Proposed Scheme Boundary. Changes in vehicle emissions of NOx and NO_2 have the potential to impact designated ecological sites, particularly ecosystems and habitats sensitive to changes in nitrogen deposition and elevated concentrations of NO_x. Air quality impacts of the Proposed Development are considered for all relevant ecological receptors, and the specific criteria used for the assessment of ecological effects should be presented in the ES, with reference to the Air Pollution Information System (APIS) where appropriate.

6.2.23. There is potential for impacts to regional emissions, including those of NO_x, PM_{10} and carbon dioxide (CO_2), as a result of changes to vehicle flow characteristics across the affected road network. Whilst local air quality is characterised by pollutants with short term, immediate impacts, these pollutants can also travel longer distances, and can have impacts on a regional, national, or international scale. However, any change in mass emissions of these pollutants as a consequence of the Proposed Scheme are expected to be insignificant within the context of wider regional and national emissions totals.

PROPOSED ASSESSMENT METHODOLOGY

Construction Phase

6.2.24. Taking into account the availability of well-established mitigation measures, where there is a risk of dust deposition at sensitive receptors close to the application site, it is not intended that further assessment should be undertaken. The ES will, however, detail the mitigation measures which would be adopted and secured by way of their inclusion within a Construction Environmental Management Plan (CEMP) for any construction contracts during implementation of the Proposed Scheme. These measures would be commensurate with the scale and duration of the activities and can be secured via a DCO Requirement (similar to a planning condition), which will ensure that there are no significant local air quality effects with respect to either fugitive dust or exhaust emissions.

6.2.25. A qualitative assessment of construction traffic emissions will be undertaken with reference to DMRB207/074, subject to data availability, which will incorporate the potential influence of exhaust emissions from non-road mobile machinery on local air quality.

6.2.26. The Proposed Scheme is in close proximity to a number of European and nationally designated ecological sites. The Proposed Scheme will have a direct effect upon the River Yare which has been designated as a pSPA. The

[14] As defined within The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

construction assessment will give specific consideration to the impact on such sites and inform the ecological impacts assessment.

Operation Phase: Local Air Quality Assessment

6.2.27. The assessment of local air quality and regional emissions impacts associated with the operation of the Proposed Scheme will be informed by the approaches detailed in DMRB HA207/074, with reference to respective Defra air quality technical guidance[15] and IAQM guidance[16].

6.2.28. The local air quality assessment will involve screening of the Do Minimum (i.e. without the Proposed Scheme) and Do Something (i.e. with the Proposed Scheme) traffic data to identify any affected road links that adhere to the following criteria as provided by DMRB HA207/07:

- Road alignment will change by 5m or more; or
- Daily traffic flows will change by 1,000 Average Annual 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.

6.2.29. At the time of writing, preliminary traffic data for the Proposed Scheme was not available to assess the number of affected road links. However, given the introduction and potential realignment of a number of roads, a detailed local air quality assessment will be undertaken.

6.2.30. Emissions inventory databases for each pollutant (NO_x, PM_{10}, $PM_{2.5}$) will be developed for a minimum of three scenarios, based on traffic data provided for:

- Base year (e.g. 2017)
- Do Minimum for opening year of Proposed Scheme (e.g. 2023)
- Do Something for opening year of Proposed Scheme

6.2.31. The emissions databased will be developed using Defra's latest emission factor toolkit (currently EFTv8.0), which accounts for vehicle flow characteristics, such as:

- Link flow volumes as AADT;
- Link average speed (km/hr);
- Vehicle breakdown (e.g. percentage HDV's); and
- Link length.

6.2.32. Each scenario emissions database will be entered into the Atmospheric Dispersion Modelling System ADMS-Roads v4.1 to enable prediction of pollutant concentrations at the identified sensitive receptor locations. The

[15] Defra (2016) Local Air Quality Management Technical Guidance (TG16), London: Defra
[16] IAQM (2015) Guidance on land-use planning and development control: Planning for air quality v1

modelling exercise will utilise hourly sequential meteorological data from the most representative monitoring site in relation to the study area.

6.2.33. The base year model results will be verified in accordance with Defra's technical air quality guidance[15]. Model verification requires analysis of model outputs versus monitoring data for equivalent locations within the study area. Therefore, baseline air quality monitoring data is required that provides representative coverage of the area.

6.2.34. There is a network of three NO_2 diffusion tube monitoring locations operated by GYBC within 1km of the Proposed Scheme alignment, which do not provide adequate coverage of roads likely to be affected. As such, a scheme specific network of 40 sites has been established for a six month monitoring period commencing July 2017, covering a number of the likely affected road links. The locations of these tubes were agreed through consultation with the GYBC[17]. The final dataset of bias adjusted and annualised NO_2 concentrations at these locations will be reviewed and published at the PEIR stage.

6.2.35. The results of the baseline monitoring survey will inform the review of existing air quality conditions within the study area and enable a robust model verification of road emissions of NOx in the base year model scenario. The derived model verification factor will be applied to all subsequent model outputs of NOx/NO_2.

6.2.36. With regards to model verification, final verification factors applied will be clearly stated within the ES, with full justification provided for the values adopted as part of the detailed explanation of the modelling work and assumptions.

6.2.37. As the GYBC continuous analyser at Gorleston monitors real-time PM_{10} levels and is located within 1km of the Proposed Scheme alignment, data from this site will be used to derive a model verification factor for PM_{10}. In the absence of specific $PM_{2.5}$ monitoring data, the PM_{10} verification factor will be applied for this fraction of fine particulate matter also.

6.2.38. Current information available from Defra stipulates that concentrations of NO_2 are not reducing as expected, meaning future projected reductions in vehicle NOx/NO_2 emissions are considered too optimistic. To account for this, Highways England has published Interim Advice Note (IAN) 170/12v3 (2013) - Updated air quality advice on the assessment of future NOx and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1 Air Quality[18].

6.2.39. The IAN 170/12v3 guidance presents a methodology for the verified modelled NO_2 concentrations to be adjusted to account for the long term NO_2 profiles. This approach will be adopted for the Proposed Scheme air quality impact assessment.

6.2.40. The results of the atmospheric dispersion modelling at each identified sensitive receptor will be compared to the respective air quality limit values to evaluate the potential for exceedances in all scenarios.

Operation Phase: Regional Emissions

6.2.41. Screening of the Do Minimum and Do Something traffic data will be completed to identify any affected road links that adhere to the following criteria as provided by DMRB HA207/07[19]:

[17] Email communications between Alex Crayton (WSP) and David Addy (Great Yarmouth Borough Council) between 5th June- 18th July 2017.

[18] Highways England 2012 Interim Advice Note 170/12 v3 Updated air quality advice on the assessment of future NOx and NO2 projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality.

[19] Department for Transport (2011) Design Manual for Roads and Bridges Volume 11, Section 3, Part 1 (HD207/07) Air Quality. [online] available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf (Accessed November 2017)

- 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 or more than 20 km/hr.

6.2.42. The regional emissions assessment will focus on total annual mass emissions on NOx, PM_{10} and CO_2 associated with the same scenarios as assessed for local air quality impacts, in addition to:

- Design year for Do Minimum (e.g. opening year + 15 years); and
- Design year for Do Something.

6.2.43. Traffic data for affected road links in each scenario would be entered into Defra's EFT v8.0, enabling the calculation of total annual mass emissions of the respective vehicle exhaust species. This would allow the magnitude of change in emissions, as a consequence of the Proposed Scheme operation, to be predicted.

6.2.44. In the absence of specific significance criteria for assessing changes in regional emissions, the results of the assessment will be evaluated within the context of total regional road emissions data published by the National Atmospheric Emissions Inventory (NAEI).

Operational Phase: Significance

6.2.45. The A47 and A11 are part of the Strategic Road Network managed by Highways England, as such the NN NPS, may apply to the Proposed Scheme. The NN NPS states that whilst total PM10 and NOx emissions may be expected to increase slightly from the delivery of investment on the Strategic Road Network, this needs to be seen in the context of projected reductions in emissions over time as the result of tighter vehicle emissions standards and greater uptake of electric and other ultra-low emissions vehicles.

6.2.46. The NN NPS general principles of assessment state that environmental benefits and adverse impacts should be considered at national, regional and local levels. The ES will detail the likely significant effects of the Proposed Scheme on air quality.

Significance: Local Air Quality Effects

6.2.47. The magnitude of change of predicted concentrations at each receptor location, as a result of the Proposed Scheme, will be derived through analysis of the Do Something versus Do Nothing scenario data in the opening year of the Proposed Scheme. The significance of potential changes to local air quality will be determined with reference to the criteria provided by IAQM and Highways England[20].

6.2.48. The IAQM provides magnitude of change criteria that are equivalent to a percentage of the respective annual mean NO2 and PM10 limit values (40 µg/m3) described as the Air Quality Assessment Level (AQAL). An 'impact descriptor' is then assigned to each modelled receptor, dependent on the predicted annual mean concentration in the Do Something scenario relative to the national limit value. The IAQM magnitude of change criteria and impact descriptors framework is replicated in Table 9.

[20] Highways England (2013) Interim Advice Note 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality (HA207/07)

Table 9 – IAQM Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year (% of AQAL presented as concentration in µg/m^3)	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL≤ 30	Negligible	Negligible	Slight	Moderate
76-94% of AQAL (30.4 to 37.6)	Negligible	Slight	Moderate	Moderate
95-102% of AQAL (38 to 40.8)	Slight	Moderate	Moderate	Substantial
110% or more of AQAL (≥44)	Moderate	Substantial	Substantial	Substantial

6.2.49. The Highways England guidance adopts the same magnitude of change criteria for NO_2 and PM^{10} but focusses on receptors that exceed the annual mean limit value. Changes in pollutant concentration greater than one percent of the limit value (i.e. >0.4µg/m^3) – based on the Do Minimum versus Do Something opening year model results – are compared with guideline bands that inform the potential significance of the Proposed Scheme. The magnitude of change criteria for NO_2 and PM^{10} is replicated in Table 10.

Table 10 - Magnitude of Change Criteria (as published in IAN 174/13[21])

Magnitude of Change in Concentration	Value of Change in Annual Average NO_2 and PM_{10}
Large (>4)	Greater than full MoU value of 10 % of the air quality objective (4µg/m³).
Medium (>2 to 4)	Greater than half of the MoU (2µg/m³), but less than the full MoU (4µg/m³) of 10% of the air quality objective.
Small (>0.4 to 2)	More than 1% of objective (0.4µg/m³) and less than half of the MoU i.e. 5% (2µg/m³). The full MoU is 10% of the air quality objective (4µg/m³).
Imperceptible (≤ 0.4)	Less than or equal to 1% of objective (0.4µg/m³).

6.2.50. The guideline band ranges set the upper level of likely non-significance and the lower level of likely significance. Between these two levels are the ranges where likely significance is more uncertain and greater onus is afforded to professional judgement.

6.2.51. The magnitude of change criteria and associated impacts will be adjusted accordingly to facilitate analysis of the predicted $PM_{2.5}$ concentrations at each receptor.

[21] Highways England (2010) Interim Advice Note 174/13 Evaluation of significant local air quality effect., former Highways Agency, November 2010 [online] Available at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian174.pdf Accessed January 2018

6.2.52. The overall significance of the Proposed Scheme will be determined using professional judgement, as informed by the outcomes of the detailed dispersion modelling and associated analysis within the context of both the IAQM and Highways England guidance.

ASSUMPTIONS AND LIMITATIONS

6.2.53. Preliminary traffic data for the Proposed Scheme is not currently available to assess the number of affected road links.

6.2.54. In the absence of specific $PM_{2.5}$ monitoring data, the PM_{10} verification factor will be applied for this fraction of fine particulate matter also.

6.3 ACOUSTICS

BASELINE CONDITIONS

6.3.1. At the time of writing, surveys of the existing noise climate have yet to be completed, therefore a high level review of the route alignment of the Proposed Scheme has been undertaken to give an indication of the potential impact of the scheme. The modelled Do-Minimum Opening Year is considered to represent the baseline scenario for this assessment.

6.3.2. A study area has been adopted in line with DfT Transport Analysis Guidance, Table A.2b, Appendix A, January 2014. The study area is a boundary 300 m from the carriageway edge of the Proposed Scheme.

Potentially Sensitive Receptors

6.3.3. There are no Defra Noise Important Areas within the study area.

6.3.4. The River Yare pSPA has been identified within the study area.

6.3.5. An initial desk-based review of sensitive receptors, in line with HD213/11[22], has been undertaken to identify those located within 300 m of the Proposed Scheme alignments. This review was based on Ordnance Survey (OS) AddressBase Plus data.

6.3.6. As an indication of the potential impact, receptor counts are split into distance bands. Receptors located closer to the Proposed Scheme are expected to experience higher adverse impact. The number of receptors within each study area banding are presented in Table 11.

Table 11 - Number of acoustic receptors within each study area banding

Distance Band	Residential	Education	Health Facility	Care Home	Community Facility
0 m to 50 m	129	1	0	0	1
50 m to 100 m	239	1	0	0	2
100 m to 150 m	280	0	0	0	3
150 m to 200 m	245	0	0	0	0
200 m to 250 m	213	0	0	1	4
250 m to 300 m	245	1	0	0	1
Totals	1351	3	0	1	11

6.3.7. Non-residential sensitive receptors include:

- The Kings Centre, Queen Annes Road
- Great Yarmouth and Waveney Mind Community Allotments

[22] Department for Transport (2011) Design Manual for Roads and Bridges Volume 11, Section 3, Part 7 (HD213/11). [online] available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/hd21311.pdf (Accessed November 2017)

- Great Yarmouth and Gorleston Allotment Association Allotments;
- Great Yarmouth Day Centre, Suffolk Road
- Alpha Centre, Alpha Road
- Avery Lodge Nursing Home, Southtown Road
- St. James Church, Admiralty Road
- Great Yarmouth Primary Academy, Dickens Avenue

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.3.8. Potential noise and vibration impacts can occur during construction (temporary) and operation (permanent).

6.3.9. The risk and severity of potential construction impacts occurring is typically a function of the proximity of the activity to receptor, and the nature and duration of the activity.

6.3.10. Operation impacts occur due to changes in carriageway alignment, traffic flow, traffic speed and infrastructure.

PROPOSED ASSESSMENT METHODOLOGY

6.3.11. Noise Policy Statement for England (NPSE)[23] guidance has been incorporated in both the construction and operation assessment methods. The following guidance documents promote the application of (i) lowest-observed-adverse-effect level (LOAEL); and Significant Observed Adverse Effect Level (SOAEL):

- The Professional Planning Guidance (ProPG)[24] issued in May 2017 by a Working Group of the Institute of Acoustics, the Association of Noise Consultants and the Chartered Institute of Environmental Health. Although this document is primarily concerned with existing noise sources impacting on new residential development rather than new noise sources impacting on existing residential development, it emphasises the need to take into account the SOAEL, as defined in NPSE, in any noise assessment.
- A guidance document produced by Highways England specifically for their current Smart Motorways Programme. This document, titled "Smart Motorways Programme: Design Guide: Annex E5.04 – Noise Assessment Methodology (EnvTN09)", is dated August 2017. Although this document was specifically produced for the Smart Motorways project, it does show the direction of travel and current thinking about how Highways England (and presumably, therefore, the Department of Transport) consider that noise assessments should be undertaken. The document states that it "is not intended to replace the guidance contained within HD213/11" but also states that "it is intended to cover areas of the assessment methodology that have emerged as recent best practice for Highways England schemes".

[23] Department for Environment, Food and Rural Affairs, (2010), Noise Policy Statement for England (NPSE). [online] available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf (Accessed November 2017).

[24] Institute of Acoustics, the Association of Noise Consultants and the Chartered Institute of Environmental Health (2017) ProPG: Planning and Noise Professional Practice Guidance on Planning and Noise.

Construction

6.3.12. The assessment of predicted noise and vibration impacts takes into account the guidance set out in the NPSE and the guidance contained within BS 5228-1[25] and BS 5228-2[26].

6.3.13. It is noted that LOAEL and SOAEL in the NPSE is defined in terms of observed health effects based on the magnitude of the noise levels, i.e. absolute levels. In BS 5228 impacts are defined in terms of existing ambient noise level and change in noise levels. To date, there has been no official guidance published on how to reconcile these two methodologies.

6.3.14. The approach adopted for this assessment has been to use both the NPSE and BS 5228 methods and to consider the results in combination to provide an overall assessment. This approach is described in more detail below.

6.3.15. The assessment will focus on potential impacts associated with different phases of construction, these would typically include:

- Site preparation and earthworks;
- Compound construction;
- Bridge construction, including piling; and
- Road paving;

6.3.16. Consultation with NCC and GYBC will be undertaken as part of the scoping exercise to agree an appropriate level of assessment.

6.3.17. Prediction of noise levels from construction activities will follow BS 5228-1 guidance. Machinery source sound level data will also be taken from BS 5228-1.

6.3.18. The criteria for the assessment of potential significance of noise effects is presented in Table 12. Ambient noise is the all-encompassing noise in a given situation at a given time, usually composed of sound from many sources near and far, but excluding site (construction) noise. Site noise is the noise originating from the construction site. Total noise ($L_{Aeq,T}$) is ambient noise plus site noise.

Table 12 - Construction Noise Thresholds of Potential Adverse Effects at Dwellings, LAeq,T (dB)

Period	Time	LOAEL	SOAEL
Daytime weekday, Saturdays, Sundays	07:00 - 19:00	70	75
Night-time	23:00 - 07:00	50	55
Note 1: A significant effect is indicated where total noise level (pre-construction ambient noise plus site noise) exceeds LOAEL or SOAEL for a period of ten or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any six consecutive months. Note 2: If the pre-construction ambient noise is greater than LOAEL and less than SOAEL, then a potential observed effect is indicated if the total noise level (pre-construction ambient plus site noise) for the period			

[25] The British Standards Institution 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise

[26] The British Standards Institution 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Vibration

Period	Time	LOAEL	SOAEL
increases by more than 3 dB, and subject to the SOAEL limit. A potential significant observed effect is indicated if the total noise level (pre-construction ambient plus site noise) exceeds the SOAEL. Note 3: If the pre-construction ambient noise level exceeds the SOAEL, then a potential significant observed effect is indicated if the total noise level (pre-construction ambient noise plus site noise) for the period increases by more than 3 dB due to site noise.			

6.3.19. The adopted construction noise threshold value for the SOAEL is based on the BS 5228-1 ABC method Category C threshold noise levels, Advisory Leaflet 72: 1976 (as reproduced in BS 5228-1), and takes into account emerging Highways England guidance related to the Smart Motorways Programme.

6.3.20. The adopted threshold value for the LOAEL is based on the BS 5228-1 ABC method Category B threshold noise levels, Advisory Leaflet 72: 1976 (as reproduced in BS 5228-1), and takes into account emerging Highways England guidance related to the Smart Motorways Programme.

6.3.21. If, following completion of surveys, pre-construction ambient noise levels around the Proposed Scheme are found to be significantly lower than levels given in Table 12 then the levels can be modified to allow a meaningful assessment.

6.3.22. The assessment of potential construction phase impacts is used to define appropriate mitigation measures that should be implemented through a CEMP, which are commensurate to the scale and duration of the activities.

6.3.23. Where site noise levels are expected to exceed the SOAEL after the contractor has applied best practicable means to the provision of mitigation, special dispensation may be sort to complete required works, the contractor may apply to the local authority for prior consent under Section 61 of the Control of Pollution Act 1974 (CoPA).

6.3.24. The criteria for the assessment of potential significance of vibration effects is presented in Table 13.

Table 13 - Construction Vibration Thresholds of Potential Adverse Effects at Dwellings, PPV (mm/s)

Period	Time	LOAEL	SOAEL
Day and Night	00:00 – 00:00	1.0	10.0

6.3.25. The adopted construction vibration threshold value for the SOAEL is based on BS 5228-2. Vibration at this level is likely to be intolerable for any more than a very brief exposure. The level is also in line with emerging Highways England guidance related to the Smart Motorways Programme. The onset of cosmetic damage in buildings due to vibration is greater than the SOAEL.

6.3.26. The adopted construction vibration threshold value for the LOAEL is based on the BS 5228-2 guidance on human response to vibration. This is the vibration level that is likely to cause complaint, but can be tolerated if prior warning and explanation is given. The level is also in line with emerging Highways England guidance related to the Smart Motorways Programme.

Operation

6.3.27. The assessment of predicted noise impacts takes into account the guidance set out in the NPSE and the guidance contained within DMRB HD 213/11.

6.3.28. It is noted that LOAEL and SOAEL in the NPSE is defined in terms of observed health effects based on the magnitude of the noise levels, i.e. absolute levels. Whereas, in DMRB HD 213/11, impacts are defined in terms of change in noise levels. To date, there has been no official guidance published on how to reconcile these two methodologies.

6.3.29. The proposed approach for this assessment is to use both the NPSE and DMRB methods individually and then to consider the results in combination to provide an overall assessment that is consistent with the conventions set out in the IEMA Guidelines on Noise Impact Assessment, which is based on a semantic scale using the terms negligible, minor, moderate or major impact.

6.3.30. The numerical values used to define the No Observed Effect Level (NOEL), LOAEL and SOAEL are shown in Table 14.

Table 14 - Traffic noise levels and significance

Traffic Noise Level, LA10,18h (dB)*	Effect Level
≤54.4	NOEL
54.5 to 67.5	LOAEL
≥67.5	SOAEL
* Façade level, 06.00 to 24.00 hours	

6.3.31. The adopted threshold value for the SOAEL is based on the 'Relevant Noise Level', as set out in the Noise Insulation Regulations 1975 (NIR). This is the level of noise that would (provided that other criteria are met) trigger entitlement to the provision of sound insulated glazing (and, where necessary, ventilation) for residential properties located within 300 m of a new road scheme. The Relevant Noise Level specified in the NIR is 68 dB LA10,18h, although the regulations require that noise levels calculated to be between 67.5 and 67.9 dB are rounded up to 68 dB.

6.3.32. The adopted threshold value for the LOAEL is based on guidance contained within the WHO Guidelines for Community Noise. This states that the lowest observed threshold for the onset of community annoyance occurs for situations where the outside free-field noise level exceeds 50 dB LAeq,16h (07.00 to 23.00 hours). This uses a different noise measure, LAeq,16h which is used as a general measure of noise from all sources, and time period to that used to quantify road traffic noise, LA10,18h (06.00 to 24.00 hours). Where road traffic noise dominates conversion from LAeq,16h to LA10,18h uses the relationship set out in TAG Unit A3 Environmental Impact Appraisal (LAeq,16h = LA10,18h - 2 dB) with a further addition of 2.5 dB applied to account for the conversion from a free-field noise level to a façade noise level, in accordance with the Calculation of Road Traffic Noise (CRTN).

6.3.33. The noise Effect Levels set out in the above table are based on the absolute noise level. In terms of the change in noise level as a result of a new road scheme, DMRB HD 213/11 states "in terms of permanent impacts, a change of 1 dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible. Such increases in noise should be mitigated if possible".

6.3.34. Therefore, for the purposes of this assessment, the following road traffic noise change thresholds have been used, to indicate the potential for a significant effect to arise:

- ≥ ±1 dB LA10,18h in the Do-Minimum Opening Year to Do-Something Opening Year (short term); and
- ≥ ±3 dB LA10,18h in the Do-Minimum Opening Year to Do-Something Design Year (long term).

6.3.35. In addition to the above, emerging guidance from Highways England (not included in HD 213/11 or any Interim Advice Note) suggests that in the long term an increase of 1 dB LA10,18h where the Do-Minimum Opening Year noise level is already above the SOAEL should be considered as a potentially significant change. In other words a lower threshold should apply where road traffic noise levels are particularly high.

6.3.36. The approach taken for this assessment is to analyse the change in all noise levels for both short term and long term scenarios. Where no individual change exceeds the thresholds bulleted above, then it is assumed that there would most likely be no significant adverse effect. However, where noise levels exceed the stated thresholds, this provides an indication that there is potential for a significant adverse effect which triggers the

need to consider mitigation. In these instances, the predicted noise levels will be considered in more detail and, where necessary, mitigation measures will be explored.

6.3.37. Where long term significant adverse effects are identified, the traffic flow data for the Do-Minimum Design Year scenario will be interrogated to assist in determining whether the effects are as a result of the Proposed Scheme itself, or are rather a result of general traffic growth or other developments. Table 15 summarises the classification of magnitude of noise impacts associated with short and long term changes in noise levels, as set out in DMRB HD 213/11. Both adverse and beneficial changes are considered in the assessment.

Table 15 - Classification of Magnitude of Noise Impacts

Short-term Noise Change, LA10, 18h (dB)	Long-term Noise Change, LA10, 18h (dB)	Magnitude of Impact
0.0	0.0	No change
0.1 – 0.9	0.1 – 2.9	Negligible
1.0 – 2.9	3.0 – 4.9	Minor
3.0 – 4.9	5.0 – 9.9	Moderate
5.0+	10.0+	Major

6.3.38. In order to reconcile the different assessment methodologies set out in the NPSE and DMRB HD 213/11, consideration has been given to the current convention, as set out in the IEMA Guidelines on Noise Impact Assessment[27] (Table 7-14 Impact from the change in sound levels, source HS2 Phase 1 Environmental Statement), to classify the magnitude of identified impacts using the following categories:

- Negligible;
- Minor;
- Moderate; or
- Major.

6.3.39. Where the threshold between each of these categories is determined based on the guidance contained within the available standards and guidance documents.

6.3.40. For the purposes of classifying the overall noise impact against this semantic scale, the guidance contained within the NPSE and DMRB HD 213/11 has been combined in the manner shown in Tables 16 and 17.

6.3.41. Table 16 relates to the potential short-term impact (based on Do-Something compared against Do-Minimum in the opening year of the Proposed Scheme) and Table 17 relates to the potential long-term impact (based on Do-Something in the future assessment year, taken to be 15 year after the opening year compared against Do-Minimum in the year of opening) The overall impact classification (negligible, minor, moderate or major) applies to situations where there is a beneficial impact as well as to situations where there is an adverse impact.

6.3.42. In Tables 16 and 17, 'Noise Level' refers to the Do-Something LA10,18h (06.00 to 24.00 hours) road traffic façade noise level predicted at 1 metre from the sensitive receptor building.

[27] Institute of Environmental Management and Assessment (2014). Guidelines for Noise Impact Assessment [online] Available at: http://bailey.persona-pi.com/Public-Inquiries/LCY-Appeal/Core%20Documents/CD8/CD8.2.15%20IEMA%20guidelines.pdf (Accessed January 2018)

Table 16 - Significance criteria for operational traffic noise based on short-term noise change

Noise Increase, LA10,18h dB	Noise Level < LOAEL	Noise Level > LOAEL and < SOAEL	Noise Level > SOAEL
<0.9	Negligible	Negligible	Negligible
1.0 – 2.9	Negligible	Minor	Minor
3.0 – 4.9	Negligible	Moderate	Moderate
>5.0	Negligible	Major	Major

Table 17 - Significance criteria for operational traffic noise based on long-term noise change

Noise Increase, LA10,18h dB	Noise Level < LOAEL	Noise Level > LOAEL and < SOAEL	Noise Level > SOAEL
<0.9	Negligible	Negligible	Negligible
1.0 – 2.9	Negligible	Negligible	Minor
3.0 – 4.9	Negligible	Minor	Moderate
5.0 – 9.9	Negligible	Moderate	Major
>10.0	Negligible	Major	Major

6.3.43. The assessment method detailed above for the Proposed Scheme is broadly consistent with the guidance contained within EnvTN09. Although EnvTN09 was produced specifically for the Smart Motorways scheme, it is considered, in the absence of any other guidance on how to reconcile the requirements of NPSE and DMRB HD 213/11, to represent current best practice for the assessment of noise impacts associated with new road schemes.

6.3.44. It should also be noted that the assessment methodology detailed above is based on daytime (06.00 to 24.00 hours) traffic noise levels. For most roads, the diurnal patterns in road traffic flows are such that noise levels during the night-time (00.00 to 06.00 hours) are approximately 10 dB lower than those during the daytime. The threshold criteria for LOAEL and SOAEL would also be approximately 10 dB lower. An assessment of daytime noise levels against the significance criteria detailed above is therefore considered to be sufficient to provide an overall assessment that would be equally applicable to the night-time period.

ASSUMPTIONS AND LIMITATIONS

6.3.45. At this stage it has not been possible to undertake a quantitative or monetised assessment of the potential impacts.

6.3.46. At the time of writing, surveys of the existing noise climate have yet to be completed.

6.3.47. The modelled Do-Minimum Opening Year is considered to represent the baseline scenario for this assessment. A noise model of the Proposed Scheme and surrounding area has not yet been completed.

6.3.48. Measurement locations representative of nearby noise sensitive receptors will be agreed in consultation with NCC and GYBC. The measured levels will inform the construction noise assessment and therefore surveys will cover proposed construction hours, using attended short-term and/or non-attended measurements. Measurements are proposed for Spring 2018.

6.4 NATURE CONSERVATION

BASELINE CONDITIONS

6.4.1. This section is informed by the Preliminary Ecological Assessment (PEA) report and Protected Species Survey Report, which are presented in Appendix E and F respectively. The Protected Species Survey Report, presented in Appendix F, details specific surveys for water vole and bats, which were undertaken to identify changes to known biodiversity resources and include both designated and non-designated sites.

6.4.2. The appraisal considered two study areas:

- Desk study of European designated sites: Special Protection Areas (SPAs), potential SPAs (pSPAs), SACs, candidate SACs (cSACs), potential SACs (pSACs) and Ramsar sites within 2 km of the Scheme, extended accordingly where there are potential hydrological connections present and up to 30 km where bats are a qualifying feature of a SAC, cSAC or pSAC;
- Desk study of statutorily designated sites, including National Nature Reserves (NNRs), Local Nature Reserves (LNRs) and Sites of Special Scientific Interest (SSSIs) and non-statutorily designated sites including Local Wildlife Sites (LWSs) within 2 km of the Scheme;
- Desk study records of protected and notable species up to 2 km from the project site; and
- Extended Phase 1 Habitat Verification Survey within a 500 m corridor of the Scheme

6.4.3. The surveys have been undertaken with reference to the following guidance:

- TAG Unit A3 Chapters 5 and 9 (which also references DMRB Volume 11 Section 3 Part 4)[28];
- 'Guidelines for Ecological Impact Assessment in the UK' (Chartered Institute for Ecological and Environmental Management (CIEEM), 2006 and 2016[29]); and
- DMRB Volume 11 Section 4 Assessment of the Implications (of Highways and/or Road Projects) on European Sites (including Appropriate Assessment)[30].

6.4.4. Discussions with Natural England, the EA and the Marine Management Organisation (MMO) are ongoing in relation to surveys in respect of the marine environment.

Statutory Designated Sites:

6.4.5. The Broad Study Area includes the Outer Thames Estuary Special Protection Area (SPA) which 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 stellata*, which is listed on Annex 1 of the EU Birds Directive.

6.4.6. The following designated sites that could be impacted by the Proposed Scheme have been identified within the proposed study area:

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[28] Department for Transport (2015). TAG Unit A3 Environment Impact Appraisal Chapters 5 and 9. [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/638648/TAG_unit_a3_envir_imp_app_dec_15.pdf (Accessed January 2018)

[29] Chartered Institute of Ecology and Environmental Management (2006) Guidelines for Ecological Impacts Assessment in the United Kingdom CIEEM. Winchester. Ratcliffe, D.A (Ed.) (1977) A Nature Conservation Review. Cambridge University Press

[30] DMRB (1993) Design manual for roads and bridges (DMRB) Volume 11 Environmental Assessment [online] available at: http://www.standardsforhighways.co.uk/dmrb/vol11/section3.htm (Accessed November 2017).

Outer Thames Estuary Extension Special Protected Area

6.4.7. The boundary of the Outer Thames Estuary SPA is located approximately 500 metres to the east of the Proposed Scheme. The Outer Thames Estuary SPA lies along the east coast of England, predominantly in the coastal waters of the southern North Sea between the Thames Estuary and the east Norfolk coast. It covers an area of c. 3,924km2, classified for the protection of wintering red-throated diver. This area supports the largest aggregations of wintering red-throated diver in the UK, 38% of the GB population. The foraging areas protected for little tern *Sternula albifrons* and common tern *Sterna hirundo*, enhance the protection afforded to their feeding and nesting areas in the adjacent coastal SPAs.

6.4.8. The area of the SPA contains areas of shallow and deeper water, with high tidal current streams and a range of mobile sediments, including several shallow sandbanks. Much of the area is less than 20m water depth, extending into the 20-50 m depth contour towards the eastern boundary of the SPA.

6.4.9. It is noted, the River Yare and River Bure are currently marked as a potential SPA (pSPA). This stretch of the Yare has the potential to be included within the Outer Thames Estuary SPA. In the 2015 Outer Thames Estuary SPA Departmental Brief, produced by Natural England and the Joint Nature Conservation Committee (JNCC), it is proposed that the boundary of the Outer Thames Estuary SPA is extended to include these watercourses. The inclusion of the River Yare channel, to abut the eastern boundary of the existing Breydon Water SPA, and the lower River Bure, has been proposed to provide continuous SPA coverage for common terns foraging from this SPA. The pSPA will be treated as a confirmed SPA when assessing the potential ecological effects upon on River Yare. This includes the potential effects of constructing piers within the river and the potential effects upon the Conservation Objectives of the pSPA.

Breydon Water:

6.4.10. Breydon Water is located approximately 2.2km to the north/northwest of the Proposed Scheme and has been designated as (i) a Special Protected Area (SPA); (ii) a Ramsar; and (iii) a Site of Special Scientific Interest (SSSI).

6.4.11. The SSSI citation describes Breydon Water as an inland tidal estuary at the mouth of the River Yare and its confluence with the rivers Bure and Waveney. Extensive areas of mud are exposed at low tide and these form the only intertidal flats occurring on the east coast of Norfolk. Large numbers of wildfowl and waders are attracted to an abundant food supply when on passage and during the winter months. Several wintering wildfowl reach nationally important population levels and the site occupies a key position on the east coast for these species and for migrating birds. Rare species are regularly recorded. There is also considerable botanical interest with small areas of saltmarsh, reedbeds and brackish water communities in the surrounding borrow dykes. The invertebrate fauna is rich and includes one scarce species of snail.

Great Yarmouth North Denes:

6.4.12. The designations of Great Yarmouth North Denes are located approximately 3.2km to the north/northeast of the Proposed Scheme at their closest point. This areas has been designated as a SPA and a SSSI.

6.4.13. The site consists of a dune system on the east coast of Norfolk between Great Yarmouth and Caister and is an important example of an accreting “ness” or promontory. It supports a full successional sequence of vegetation from pioneer to mature types; foredune, mobile dune, semi-fixed dune and dry acid dune grassland are all represented, the latter being particularly extensive. The largest United Kingdom breeding colony of the rare Little Tern is located on the foreshore.

The Broads National Park:

6.4.14. The Broads National Park is located approximately 1km to the northwest of the Proposed Scheme at its closest point. The Norfolk and Suffolk Broads is Britain's largest protected wetland and third largest inland waterway, with the status of a national park. Birds are in particular abundance like teal and wigeon, reed and sedge warblers. The marsh harrier has made a comeback and bittern numbers have also increased in recent years.

Around 230 nationally important invertebrates (mini-beasts) can be found in the Broads including Britain's largest butterfly, the swallowtail, and the rare Norfolk hawker dragonfly.

Non-Statutory Designated Sites:

Breydon Water:

In addition to the statutory designations describes in paragraphs 6.4.10 and 6.4.11, Breydon water has also been designated as an RSPB Reserve.

Species Records:

6.4.15. The review of existing records of species within 2km of the Proposed Scheme identified the following;

6.4.16. Records exist of natterjack toad *Epidalea calamita*, common lizard *Zootoca vivipara*, slow-worm *Anguis fragilis*, water vole *Arvicola amphibious*, otter *Lutra lutra* and badger *Meles meles* within 2km of the Proposed Scheme.

6.4.17. Seven species of bats have been recorded within 2km of the Proposed Scheme. These are common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, Nathusius' pipistrelle *Pipistrellus nathusii*, serotine *Eptesicus serotinus*, Daubenton's bat *Myotis daubentonii*, noctule *Nyctalus noctula* and brown long-eared bat *Plecotus auritus*.

6.4.18. A large number of bird species have been recorded within 2km of the Proposed Scheme. These include fifty 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.

6.4.19. Biological Records of several priority species (S41 Natural Environment and Rural Communities (NERC) Act 2006 as amended) have been recorded within 2km of the Proposed Scheme. Species recorded include goat moth *Cossus cossus*, common toad *Bufo bufo*, hedgehog *Erinaceus europaeus* and brown hare *Lepus europaeus*.

Site Survey: Habitats

6.4.20. The types and extent of habitats identified within 200m of the Proposed Scheme alignments are described in Table 18 below, and shown in the Great Yarmouth Third River Crossing: Preliminary Ecological Appraisal (Mouchel, 2016).

Table 18 - Habitats identified within 200m of the Proposed Scheme alignment

Habitat	Description
River Yare	The proposed bridge will cross the River Yare. At this location the river is tidally influenced. Mud and silt, typically associated with this habitat are likely to support benthic invertebrate communities and fish stocks. As stated in paragraph 6.4.9 common terns are known to forage on the River Yare. It is noted that this stretch of the Yare is in use as a working port.
Amenity Grassland	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.
Arable (Allotments)	The area to the east of Suffolk Road contains several allotments which, in addition to scattered native tree species, contained varieties of arable crops and introduced garden plants.

Habitat	Description
Hard standing & Buildings	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.
Hedgerow	There are several species poor hedgerows surrounding properties east of the River Yare.
Scattered broad-leaved trees	A mixture of broadleaf trees are present in the margins of Southtown 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*.
Wet ditch	The north and west of Southtown Common is bordered by a ditch containing standing water. The banks are covered by common nettle *Uritca dioica*, bramble *Rubus fruticosa*, great willowherb *Epilobium hirsutum*, dog rose *Rosa canina* and creeping thistle *Cirsium arvense*. To the north of William Adams Way and to the west of Suffolk road, is a wet ditch and associated scrub habitat. 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*.

Site Survey: Species

6.4.21. A summary of species potential and results of surveys undertaken to date within the study is provided below in Table 19.

Table 19 - Species potential and results of surveys undertaken to date

Species	Description
Aquatic Ecology	The River Yare has the potential to support a range of aquatic species and communities including fish and benthic invertebrates. Aquatic ecological assessment work is yet to commence, however it has been identified as a future survey requirement.
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 containing 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 in this assessment to be 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.
Reptiles	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.
Birds	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.

Species	Description
	The mosaic of urban areas with scattered ruderal vegetation provides some suitable habitat for black redstarts.
Water Vole	The drainage ditches associated with the A47 provide suitable habitat for water vole. During the August 2017 survey, only the ditch south of William Adams Way was surveyed due to safety concerns in accessing the northern ditch. Evidence of water vole activity was found including feeding remains and droppings.
Bats	Thirteen structures were assessed for their suitability to support roosting bats. Ten were assessed as having Low Roost Suitability, and two as having Negligible Roost Suitability. One building was inaccessible. Foraging habitats such as open water, domestic gardens and allotments within the vicinity of the Proposed Scheme were fragmented and unconnected. This foraging habitat is of low suitability for use by foraging and commuting bats. Two transects were undertaken in July and August 2017. No bats were recorded along Transect 1. This was likely to be a result of the absence of vegetation and high levels of artificial lighting. One species of bat was recorded along Transect 2: common pipistrelle *Pipistrellus pipistrellus*. Four bat passes recorded commuting bats along the northern edge of Southtown Common, where it meets William Adams Way. No bat foraging activity was recorded.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.4.22. The DMRB recognises a number of nature conservation resources which could potentially be affected by the construction and future use of a road scheme of the type proposed. These comprise designated and non-designated sites, important habitats and habitat-types and protected and notable species.

6.4.23. Taking into account the intended design form and likely construction requirements of the Proposed Scheme, and the data derived from the desk studies, PEA and the species specific surveys undertaken to date, impacts which could result from implementation and future use of the Proposed Scheme have been identified. These are described below and will form the focus of the assessments which are yet to be undertaken.

- Direct loss of wildlife habitats through land-take;
- Direct loss of river banks/bed/aquatic habitats, through the construction of the bridge structure, including areas that fall within the River Yare pSPA;
- Potential for impacts upon the Conservation Objectives of the pSPA for bridge works, in terms of any piers, will be located within the pSPA.
- Killing, injuring and disturbance of protected species during construction;
- Fragmentation of retained habitats and/or severance of wildlife corridors;
- Wildlife fatalities as a direct result of severance of foraging routes, breeding sites or territories;
- Temporary reduction in water quality though sedimentation caused by construction works within the River Yare, with consequent impacts upon aquatic habitats, aquatic species and conservation designations;
- Contamination of watercourses through accidental spillage of fuels/chemicals with consequent impacts upon aquatic habitats, aquatic species and conservation designations;
- Contamination of watercourses and/or waterbodies associated with road related run-off. Consequent impacts upon aquatic habitats, aquatic species and conservation designations;

- Contamination of watercourses as a result of mobilisation of existing ground contamination Consequent impacts upon aquatic habitats, aquatic species and conservation designations;
- Disturbance of nocturnal animals, such as bats, where road lighting introduces a new light source;
- Disturbance of wildlife as a result of increased noise and vibration; and
- Potential contamination of nearby habitats, watercourses and designated sites as a result of a reduction in air quality (including construction related dust).

PROPOSED ASSESSMENT METHODOLOGY

Impact Assessment Guidelines

6.4.24. The assessments will be based on the methods outlined in the following guidance:

- The DMRB Volume 11, Section 3, Part 4 Ecology and Nature Conservation[30]
- IAN 130/10 – Ecology and Nature Conservation: Criteria for Impact Assessment, Highways Agency (2010)[31]; and
- Guidelines for Ecological Impact Assessment in the United Kingdom published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2006 and 2016)[29]

6.4.25. Establishment of the baseline environment for nature conservation will involve a review of the existing information relating to designated and non-designated sites, habitats and fauna and consultation with NCC.

6.4.26. A number of surveys are proposed to be undertaken to verify and update baseline information on habitats and fauna. These comprise:

- Water vole surveys
- Bat roost surveys
- Black redstart breeding surveys
- Aquatic ecology

6.4.27. The surveys have been undertaken with reference to the following guidance:

- TAG Unit A3 Chapters 5 and 9 (which also references DMRB Volume 11 Section 3 Part 4);
- 'Guidelines for Ecological Impact Assessment in the UK' (Chartered Institute for Ecological and Environmental Management (CIEEM),2016);
- DMRB Volume 11 Section 4 Assessment of the Implications (of Highways and/or Road Projects) on European Sites (including Appropriate Assessment);
- Bat Conservation Trust (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd Edition. Bat Conservation Trust, London;

[31] Highways England (2010). Interim Advice Note 130/10 - Ecology and Nature Conservation: Criteria for Impact Assessment Interim Advice Note 130/10. Highway England

- Strachan R and Moorhouse T (2006). Water Vole Conservation Handbook, 2nd Edition. Wildlife Conservation Research Unit (WildCRU), Oxford University; and
- Bibby C., N. Burgess, D. Hill & S. Mustoe (2000). Bird Census Techniques: 2nd edition. Academic Press.

6.4.28. Assessment of the significance of impacts on sites, habitats and species will be informed by the guidance provided in the Guidelines for Ecological Impact Assessment (CIEEM 2006 and 2016). These guidelines determine the ecological value of identified assets based on their geographic influence which ranges from sites of international importance to those within the local and immediate zone of influence of the Proposed Scheme. Those assets with a geographic value at the local level or above will be subject to detailed assessment, as will receptors of lesser value that are subject to some form of legal protection or which can act in combination to result in a cumulative impact.

6.4.29. Criteria relating to confidence, magnitude, extent, duration, reversibility and timing will be considered in combination with value to determine impact significance.

6.4.30. IAN 130/10 provides a methodology for the consideration of significance of effects (for those receptors identified as requiring detailed assessment). Potential impacts will be characterised through the:

- Probability of occurrence: certain, probable, unlikely;
- Complexity: whether direct, indirect, cumulative;
- Extent: area measures and percentage of total loss;
- Size: description of level of severity of influence;
- Duration: permanent or temporary in ecological terms;
- Timing and frequency: important seasonal and/or life-cycle constraints and any relationship with frequency considered; and as being
- Reversible or not reversible; and/or
- Positive (beneficial) or negative (adverse).

6.4.31. Significance of effects will be deduced from assessing the value of the receptors against any residual impact (taking into account mitigation). In line with the guidelines set out within the DMRB, significance will be addressed as neutral, slight, moderate, large or very large (refer to Table 20).

Table 20 – Significance Descriptors for Ecological Receptors

Significance	Typical descriptors
Very large	An impact on one or more receptor(s) of international, European, UK or national value
Large	An impact on one or more receptor(s) of regional value
Moderate	An impact on one or more receptor(s) of county value
Slight	An impact on one or more receptor(s) of local value
Neutral	No significant impacts on key nature conservation receptors

6.4.32. The assessment of impacts upon nature conservation will be undertaken as shown in Table 21 although as suggested in the CIEEM guidelines, a determination of significance ought to be determined based upon professional experience.

Table 21 – Nature Conservation Matrix of Significance

Magnitude of Impact	Biodiversity Value				
	International/ European	UK / National	Regional	County	Local
Major Negative	Very Large Adverse	Very Large Adverse	Large Adverse	Moderate Adverse	Slight Adverse
Intermediate Negative	Large Adverse	Large Adverse	Moderate Adverse	Slight Adverse	Slight Adverse
Minor Negative	Moderate Adverse	Moderate Adverse	Slight Adverse	Slight Adverse	Slight Adverse
Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Positive	Very Large Beneficial	Large Beneficial	Moderate Beneficial	Slight Beneficial	Slight Beneficial

6.4.33. Based on the findings of the assessments, mitigation measures leading to avoidance, reduction or compensation of adverse effects will be identified prior to an evaluation of the effects of impacts. Typical mitigation measures could include wildlife fencing, compensatory planting, habitat creation, adoption of working practices and programming to avoid or reduce disturbance.

Habitats Regulations Assessment

6.4.34. Pursuant to the Conservation of Habitats and Species Regulations 2017[32] an assessment will be undertaken of the Proposed Scheme's effects on the Breydon Water SPA and Ramsar site, the Great Yarmouth North Denes SPA and the Outer Thames Estuary SPA (including the River Yare pSPA) (the European Sites) in accordance with the four stage process, summarised below. It is proposed that Information relating to HRA will not duplicated in the ES but will be cross-referenced within the ecology chapter as appropriate.

Stage 1:

6.4.35. Identify whether it is likely that the Proposed Scheme, either alone or in combination with other plans and projects, will have a significant effect on any of the European Sites. The threshold is a very low one and the conclusion will be affirmative unless significant effects can be excluded on the basis of objective evidence.

Stage 2:

6.4.36. If there is an affirmative conclusion at Stage 1, an Appropriate Assessment will be undertaken to assess the effect of the Proposed Scheme, either alone or in combination with other plans and projects, on the integrity of the European Sites in view of their conservation objectives.

6.4.37. Mitigation measures incorporated within the Proposed Scheme design will be taken into account, however if there remains a reasonable risk that the Proposed Scheme could adversely affect the integrity of any of the European Sites, Development Consent can only be given if stages 3 and 4 of the HRA are followed.

6.4.38. *Stage 3:*

6.4.39. Examine alternative solutions to achieve the objectives of the project where adverse effects are identified.

Stage 4:

[32] S.I. 2017/1012

6.4.40. Where it is concluded under Stage 3 that no alternative solution exists and where adverse impacts remain, the final stage is to assess whether the Proposed Scheme must be carried out for imperative reasons of over-riding public interest (IROPI) and, if so, whether compensatory measures needed to maintain the overall coherence of the European site network can be achieved.

ASSUMPTIONS AND LIMITATIONS

6.4.41. The PEA survey work was undertaken during October 2016, 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.

6.5 CULTURAL HERITAGE

BASELINE CONDITIONS

6.5.1. The study area which has been adopted for the assessment of cultural heritage features extends to 500m around the Proposed Scheme for non-designated cultural heritage assets, and 1km around the scheme options for designated assets. Areas impacted by traffic noise will also be taken into account. 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 area, the following has been undertaken:

- Data has been gathered on designated heritage assets from the National Heritage List for England.
- Conservation Area data have been obtained from the relevant local authority websites.
- Details of non-designated heritage assets have been gathered from the Norfolk Historic Environment Record (NHER)[33].
- A preliminary historic landscape assessment was made based on modern mapping, readily available aerial photography and Historic Landscape Characterisation (HLC) data obtained from NHER
- A preliminary assessment of the archaeological potential of the study area.

6.5.2. Initial value assessments have been made for each cultural heritage asset following the guidance set out in DMRB volume 11, Section 3, Part 2 (HA 208/07)[34].

6.5.3. A Cultural Heritage Desk Based Assessment has been produced for the Proposed Scheme. This is presented within Appendix G.

6.5.4. There are no World Heritage Sites, Registered Parks and Gardens, Registered Battlefields or Protected Wreck sites within 1km of the Proposed Scheme options. There are 45 Listed Buildings and one Scheduled Monument within 1km of the Proposed Scheme. The Listed Buildings consist of (i) one Grade I, (ii) two Grade II*; and (iii) forty Grade II. The Scheduled Monument and the majority of the listed buildings will be screened from the Proposed Scheme by topography, vegetation and existing structures. The Scheduled Monument is the medieval defensive town walls. The listed buildings represent a mixture of domestic, religious, industrial and leisure uses and mainly date to the post-medieval period. The proposed scheme is not located within a Conservation Area, although the following four conservation areas have been identified within 1km of the Proposed Scheme. These are (i) Camperdown (ii) Gorleston Conservation Area Extensions; (iii) King Street; and (iv) Seafront.

6.5.5. There are a further 90 non-designated heritage assets recorded on the NHER. The vast majority of these assets 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 remaining recorded assets date to the post medieval period. Within the wider study are there is evidence of buried urban and riverfront remains dating to the Medieval period, as well as a single findspot of a Neolithic scraper.

6.5.6. A deposit model for soils in 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 large 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

[33] Norfolk County Council Historic Environmental Record 2015-2018 [online] Available at: https://www.norfolk.gov.uk/libraries-local-history-and-archives/archaeology-and-historic-environment/historic-environment-record Accessed January 2018

[34] Highways England (2007) Design Manual for Roads and Bridges, Cultural Heritage, Volume 11, Section 3, Part 2 [online] available at: http://www.standardsforhighways.co.uk/dmrb/vol11/section3/ha20807.pdf (Accessed November 2017).

south. The sand spit blocked off the estuary, leading to the formation of the peat in 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, gradually rising to become permanently dry. When it was first occupied, probably at some point during the tenth century, it was a low lying sand bank 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 higher.

6.5.7. 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).

6.5.8. The medieval walled town lies to the north of the Proposed Scheme options, just outside the 500m study area. The boundary of the medieval town is represented by the well preserved remains of the defensive walls, built in the 13th century and now designated as a Scheduled Monument. The southern end of the town wall lies approximately 600m north of the Proposed Scheme and extends for distance of around 2km northwards. Within the study 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.

6.5.9. 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.

6.5.10. As stated above, the vast majority of features within the study area date to the Modern period, and specifically the period of the Second World War. Most, if not all, of these features recorded on the NHER have since been demolished and replaced by modern development.

6.5.11. The town was first bombed during World War I in 1915 (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 one of the last significant places German bombers could drop bombs before returning to base. 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. The presence of these known bomb craters and historic bombing activity suggests a significant risk of unexploded ordnance, particularly in softer riverbed deposits.

6.5.12. The majority of the built heritage remains within the study area are listed buildings. The area has undergone substantial industrial redevelopment in the 20th century. Earlier buildings are now isolated, although still maintain visual and/or transport 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 and can be seen from some parts of the study area.

6.5.13. There are no designated landscapes within the study area. Historic Landscape Characterisation (HLC) has been completed for the surrounding area, however this study specifically excluded an analysis of the areas within the town and village development limits. Therefore, although the smaller villages were considered as a part of a wider landscape context and character, no specific townscape or urban character assessments were undertaken. Some areas have had Historic Landscape Character completed as part of the Norfolk County Council HER Character Area Report. The study area falls across two different character types, with a linear strip of Coastal - Managed Wetland to the east of the study area. This land was previously Unimproved Intertidal land. There are also small blocks of Coastal - Drained Enclosure to the west, which were previously Coastal - Managed Wetland, Unimproved Marine Marsh or Brackish Fen.

6.5.14. Based on a preliminary study, the historic landscape of the study area is dominated by the late 19th and 20th century residential, industrial and commercial townscape, with the largely modern riverfront and harbour. The beach front is very strongly differentiated from the surrounding townscape with its 19th and 20th century leisure and tourist-focused landscape. These combined landscape types illustrate the evolution of Great Yarmouth in

the recent past but are not readily indicative of the medieval or early post medieval history of the town. There are some indications of the earlier history of the settlement preserved in the street layout in the northern parts of town around Market Street.

Value of Receptors

6.5.15. All designated and non-designated heritage assets within the study area are listed in the Cultural Heritage Desk Based Assessment presented within Appendix G. The majority of the known archaeological remains found within the study area have been allocated a negligible to low value as they consist of WWII defensive sites which are no longer extant. A single non-designated asset has been assessed as of medium value due to its age and rarity, the Church, Priory, Leper Hospital (HER ref MNF66695).

6.5.16. There is a reasonable potential to uncover previously unknown heritage assets within the study area, and this may include the buried former shoreline dating to the medieval period. If discovered within the study area, this asset would be of up to high value.

6.5.17. The non-designated built heritage assets are of low to medium value however, most are listed buildings of medium to high value.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.5.18. The majority of the impacts upon the cultural heritage assets will occur during the construction phase. Development activities such as pilling, stripping of overburden or hardstanding, landscaping, ground compaction access, service installation, stockpiling and storage may all have a negative effect on cultural heritage assets. These construction related impacts could lead to the following effects upon the Historic Environment:

- Permanent complete or partial loss of an archaeological feature or deposit as a result of ground excavation;
- Permanent or temporary loss of the physical and/or visual integrity of a feature, monument, building or group of monuments;
- Damage to resources as a result of ground excavation;
- Damage to resources due to compaction, desiccation or waterlogging; and
- Damage to resources as a result of ground vibration caused by construction.

6.5.19. There will also be a number of assets which may be adversely affected during operation. These will mainly be setting issues resulting from the introduction of new infrastructure, and the resulting increase in noise from vehicles using the new crossing.

6.5.20. Initial assessment suggests that there would be a potential physical impact to one known archaeological asset, the site of a railway which is no longer in use and a potential setting impact to the setting of the Dolphin Public House, a Grade II listed building. These are marked as assets 88 and 89 respectively in the Cultural Heritage Desk Based Assessment in Appendix G.

6.5.21. The assessment to date suggests the potential presence of unknown heritage assets in the form of a buried medieval shoreline and associated features or finds. The Proposed Scheme has the potential to impact upon these remains if they are present as a result of the engineering solutions required for the bridge supports. Previous dredging activities cannot be taken as an indication of archaeological sterility, as the depth of deposits is unknown.

PROPOSED ASSESSMENT METHODOLOGY

6.5.22. The assessment will involve reference to Annexes 5, 6 and 7 of the Design Manual for Roads and Bridges (DMRB), HA208/07[35] (Cultural Heritage) including consideration of the value of cultural heritage assets, examination of the magnitude of impact and assessment of the significance of effect of the Proposed Scheme.

6.5.23. The study area for the cultural heritage assessment will be defined according to the sensitivities of the cultural heritage assets in the receiving environment and the potential impacts of the Proposed Scheme. This could extend to the visual envelope of the works as defined by the Townscape and Visual impact assessment (Section 6.6).

Fieldwork

6.5.24. Impacts to the cultural heritage assets can be minimised or eliminated via appropriate mitigation. A full desk based assessment should be carried out, including a site visit to assess impacts, as well as opportunities for enhancement, in more detail.

6.5.25. Intrusive evaluation investigations in and around the River Yare have the potential to be challenging due to waterlogged conditions and depths of deposits and have the potential to adversely impact on the programme and costs for the proposed scheme. A separate palaeoenvironmental desk-based assessment will be prepared in order to understand the potential and significance of the palaeoenvironmental resource. This would draw on existing information, including that gathered for Great Yarmouth Archaeological Map, as well as the results of ground investigation works undertake as part of the application. The assessment work could be supplemented by a programme of non-intrusive survey, such as a marine geophysical survey, pending the results of the palaeoenvironmental desk-based assessment and access to river crossing. The assessment report will also provide an overview of options for further evaluation, where required.

6.5.26. DMRB Volume 10, Section 6, Part 1[36] states that 'The fundamental aim of archaeological mitigation is to avoid impacts on nationally important or highly significant remains. If this is not possible then such remains should be archaeologically recorded in order to 'preserve by record' the significant aspects of the site'. Preservation in situ of nationally important or highly significant remains which may be affected by the Proposed Scheme options is the preferred option, however, where this is not possible then alternative options will be investigated. Should no acceptable options be identified which would allow for the preservation of a site, detailed excavation (the scope of which will be agreed with the Norfolk Historic Environment Team) should be carried out in order to further our understanding of the site affected.

6.5.27. The area surrounding the river consists of an urban townscape with very little open ground that is not covered by active roads or buildings. This makes any non-intrusive archaeological investigation problematic as techniques available would be limited by the presence of hardstanding.

6.5.28. An important note for any intrusive investigation of the area is the high risk of previously unknown unexploded ordnance (UXO). Due to the history of this location, the soft surrounding ground surface, and the abundance of known bomb craters within the study area; any staff working on-site must be made aware of the likelihood of discovering UXO's and be given proper training before works can commence. It would also be recommended that a UXO specialist be present during all intrusive works to give their expertise if any such objects are found. While heritage surveys may aid in the identification of potential UXO, it cannot be seen as a replacement for specialist survey.

[35] Highways England (2009) Design Manual for Roads and Bridges Volume 11, Section 3, Part 2 (HD 208/07) Cultural Heritage, former Highways Agency, November 2009

[36] Highways England (2009) Design Manual for Roads and Bridges Volume 11, Section 6, Part 1 (HD 75/01) Trunk Roads and Archaeological Mitigation, former Highways Agency, November 2009

6.5.29. The Proposed Scheme may result in an impact on the setting of at least one Grade II listed building. Consultation should be undertaken with Historic England and the Norfolk Historic Environment Team to discuss appropriate mitigation options to reduce this impact.

6.5.30. No recorded historic landscapes will be impacted upon to a significant degree by the Proposed Scheme however, a new bridge structure may have an impact on the riverfront or 19th century townscape and further work should be done to assess this.

6.5.31. As defined by DMRB, the works including both a cultural heritage and palaeoenvironmental desk-based assessment constitute a "simple assessment", however options will be explored to see where this can be supplemented with information drawn from further evaluation work, where possible.

Value of Cultural Heritage Assets

6.5.32. Assessment of the value of cultural heritage assets will involve consideration of how far the asset(s) contribute to an understanding of the past, through their individual or group qualities, either directly or potentially. These are professional judgements, but they are also guided by legislation, national policies, acknowledged standards, designations, criteria and priorities. The assessment of value (also referred to as significance) will be undertaken in line with DMRB guidance, and in compliance with the NPPF and the following relevant professional guidelines: Chartered Institute for Archaeologists (CIfA) Standard and Guidance for Historic Environment Desk-based Assessment (2014)[37] and CIfA Code of Conduct (2014)[38]

The DMRB recommends the adoption of six ratings for value in relation to archaeological remains and built heritage: very high, high, medium, low, negligible and unknown. Definitions for each rating are outlined in Tables 22 and 23.

Table 22 - Factors for assessing the value of archaeological remains

Value	Example
Very High	World Heritage Sites (including nominated sites) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled Monuments (including proposed sites) Undesignated assets of scheduled quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Designated or undesignated assets that contribute to regional research objectives
Low	Designated and undesignated assets of local importance Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives
Negligible	Assets with very little or no surviving archaeological interest
Unknown	The importance of the resource has not been ascertained

[37] Chartered Institute for Archaeologists (2014) Standard Guidance for Historic Environment Desk Based Assessment [online] Available at: http://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf Accessed January 2018

[38] Chartered Institute for Archaeologists (2014) Code of Conduct [online] Available at; https://www.archaeologists.net/sites/default/files/CodesofConduct.pdf Accessed January 2018

Table 23 - Criteria for establishing the value of built heritage assets

Value	Example
Very High	International importance i.e. World Heritage Sites.
High	National importance i.e. listed buildings at Grade I and II* Scheduled Ancient Monuments with standing remains, conservation areas containing very important buildings and undesignated structures of clear national importance.
Medium	Regional importance i.e. listed buildings at Grade II, conservation areas containing buildings that contribute significantly to its historic character, historic townscape with important integrity in their buildings, or built settings and undesignated structures of clear regional importance.
Low	Local importance i.e. undesignated assets of modest quality in their fabric or historical association and historic townscape of limited historic integrity (including buildings and structures included in local list prepared by local authority).
Negligible	Assets of no architectural or historical note
Unknown	Assets with some hidden i.e. inaccessible potential for historic or architectural significance.

Magnitude of Impact

6.5.33. Assessment of the magnitude of impact of the Proposed Scheme on cultural heritage assets will involve consideration of the degree of change that would be experienced by the asset and its setting if the Proposed Scheme were to be completed as compared with a 'do nothing' situation. The assessment will take into account any mitigation that is part of the design.

6.5.34. The DMRB recommends the adoption of six ratings for magnitude of impact: no change, negligible, minor adverse, moderate and major. Factors for assessing the magnitude of impact are summarised in Table 24.

Table 24 - Factors for assessing the magnitude of impact

Magnitude of Impact	Example
Major	Change to most or all aspects of a cultural heritage asset, such that the resource is totally altered Comprehensive changes to setting
Moderate	Clear alteration to many aspects of a cultural heritage asset Considerable change to setting that affect the character of the asset
Minor	Slight alteration to cultural heritage asset. Sight alteration to setting
Negligible	Very minor changes to cultural heritage assets and their setting
No Change	No change to cultural heritage assets and their setting

Significance of Effect

6.5.35. Assessment of the significance of effect of the Proposed Scheme on cultural heritage assets combines the value of the resource and the magnitude of the impact (incorporating the agreed mitigation), for each cultural heritage asset.

6.5.36. The DMRB recommends the adoption of five ratings for significance of effect: neutral, slight, moderate, large and very large. The matrix for establishing significance of effect matrix is summarised in Table 25.

Table 25 - Significance of cultural heritage effects

Magnitude of Impact						
	Major	Neutral	Slight	Moderate/ Large	Large/Very Large	Major
	Moderate	Neutral	Slight	Moderate/ Slight	Moderate/ Large	Large/Very Large
	Minor	Neutral	Slight/Neutral	Slight	Moderate	Moderate/ Large
	Negligible	Neutral	Slight/Neutral	Slight/Neutral	Slight	Moderate/ Slight
	No Change	Neutral	Neutral	Slight/Neutral	Slight/Neutral	Slight
		Neutral	**Slight**	**Moderate**	**Large**	**Very Large**
		Value				

ASSUMPTIONS AND LIMITATIONS

6.5.37. The data used to compile this assessment includes secondary information derived from a variety of sources. The assumption is made that this data is reasonably accurate.

6.5.38. This assessment draws upon the records held on the National Heritage List for England[39] and Norfolk Historic Environment Record. The data does not represent a full record of all surviving archaeological receptors, but a record of the discovery of a wide range of archaeological and historical components of the historic environment. The information held within it is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown.

[39] https://historicengland.org.uk/listing/the-list/

6.6 TOWNSCAPE AND VISUAL IMPACTS

BASELINE CONDITIONS

6.6.1. This section identifies relevant designations and describes the baseline environment for townscape character of the study area.

Statutory Designated Sites

6.6.2. The Broads National Park boundary lies approximately 1km to the north west of the site and 1.5km to the north where it borders the Haven Bridge crossing within Great Yarmouth. The Broads cover a large area of gentle low lying landscape of lakes and rivers and views south into Great Yarmouth from the edge of the National Park typically comprise a low distant townscape skyline.

Relevant Non Statutory Sites

6.6.3. The Great Yarmouth Townscape Heritage Initiative (THI) centred on the King Street and St George's area within the town centre to the north of the Proposed Scheme. Views from within the area would be heavily contained by surrounding buildings.

6.6.4. There are a number of Conservation Areas associated with the urban environment of Great Yarmouth, none of which are located within the Proposed Scheme extents but would potentially afford views and be influenced by the Proposed Scheme. The closest of which being 'Hall Quay and South Quay' which follows the River Yare south of Haven Bridge.

Townscape Baseline

6.6.5. The townscape of the study area lies within the low lying urban environment of Great Yarmouth, which is bisected in a north/south orientation by the River Yare and is described below:

6.6.6. Within a very flat broader landscape, the study area to the west of the river consists of a mixed and fragmented urban fringe environment with no distinctive features, while large scale industrial and maritime activities tend to occupy the river bank to the east. The townscape of the study corridor either side of the river has a general run down semi derelict feel, due to the presence of many empty properties. The river corridor itself is characterised by an open aspect across the wide waterfront with areas that comprise hard standing following the banks of the river, which on the western bank is utilised as a public waterfront space. Building heights are broadly similar throughout the area, typically of no more than three storeys with the skyline of Great Yarmouth along the river occasionally punctuated by taller industrial towers or tanks.

6.6.7. The east bank of the river comprises an incoherent pattern of buildings with a variety of different sized warehouses, depots and industrial units while facilities comprising large tanks, storage areas and associated warehouses and offices act to contain views in and out of the river corridor. Some of the older warehouses and buildings have historical and architectural merit but are interspersed by new development and industrial infrastructure which offer limited architectural merit.

6.6.8. The properties overlooking the western bank of the river mainly comprise Victorian red brick terraces in small rows, interspersed with commercial premises, disused land parcels or overlooking an industrial riverfront environment. The residential properties most relevant to the Proposed Scheme are situated along Queen Anne's Road and Southtown Road.

6.6.9. Beyond Southtown Road and approaching the A47 there is less awareness of the industrial waterfront and more vegetation becomes apparent as it lines short sections of William Adams Way and Suffolk Road. There is also no distinctive townscape pattern apart from rows of properties fronting the river corridor, beyond which is a mix of land uses and scattered layout of commercial buildings while a more distinctive residential pattern beginning to the south of William Adams Way. There is also a prominent belt of conifers to the rear of Queen Anne's Road. Small pockets of green space are interspersed amongst the industrial/domestic land use either side of William Adams Way and provide a break from the surrounding commercial townscape. This includes Southtown

Common, which is located to the south of Beccles Road and adjacent to the A47 which is used as a recreation ground and is bounded by mature deciduous vegetation on the north and east sides to screen it from the busy road network.

6.6.10. The townscape quality of the study area would be considered to be typical to the region and important only at a local level with few distinctive features. There is a lack of pattern to the built environment and with human interaction with the study area tending to be limited to the use of vehicles and limited use of waterfront spaces.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.6.11. The Guidelines for Landscape and Visual Impact Assessment (GLVIA) Third Edition[40], identifies the importance of townscape and visual amenity, and sets out guidance on how development can influence and change the way in which these inter-related aspects are perceived. Major development such as that being proposed, will inevitably result in impacts on the townscape character of the area within which they are located, and on views experienced by residents and visitors to the area.

Potential Impacts

6.6.12. The introduction of the Proposed Scheme will result in a new prominent feature of a noticeably different scale and form within the immediate urban fabric of Great Yarmouth, resulting in the removal or modification to existing townscape features and potential fragmentation of the current land use patterns.

6.6.13. The introduction of the visually prominent structure within the context of the river, supporting roads and associated traffic will also change existing views, where it either intrudes into or obstructs an existing view in whole or in part.

6.6.14. It has, therefore, been concluded that townscape character and visual impact assessments should be undertaken to establish to what extent the introduction of the Proposed Scheme and its traffic would affect the quality and value of the existing townscape and existing views.

PROPOSED ASSESSMENT METHODOLOGY

6.6.15. A methodology for the assessment of townscape character and visual amenity will be prepared and agreed with representatives from the Great Yarmouth Borough Council. The key components of the methodology have been set out in the following paragraphs. Both assessments will be based on the guidance provided in GLVIA (Third Edition)[40], published by the Landscape Institute and the Institute of Environmental Management and Assessment (IEMA, 2013). Reference will also be made to guidance provided in:

- Highways England IAN 135/10[41] – Landscape Effects; and
- Natural England's, An Approach to Landscape Character Assessment (October 2014)[42].

6.6.16. The study area for townscape effects will be established following guidance provided in Guidelines for Landscape and Visual Impact Assessment (3rd Edition) (GLVIA), the study area being defined as the area through which existing townscape character may change or be influenced, or visual receptors potentially

[40] Landscape Institute and Institute of Environmental Management and Assessment (April 2013) Guidelines for Landscape and Visual Impact Assessment 3rd Edition, London: Routledge

[41] Highways England (2010) Interim Advice Note 135/10 Landscape and Visual Effects Assessment, former Highways Agency, November 2010

[42] Natural England (2014) An Approach to Landscape Character Assessment. [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/396192/landscape-character-assessment.pdf (Accessed January 2018)

impacted as a direct result of the construction and operation of the scheme. This will be identified through a combination of 3-D modelling and site work within a provisionally identified study area of 3km, to be agreed with GYBC, beyond which the potential for significant townscape or visual effects are not anticipated to arise due to the context, scale and nature of the development.

Townscape Character

6.6.17. The townscape character assessment will be based on the identification of the sensitivity of the townscape within the proposed study area, and the magnitude of impact within the townscape that will result from the construction and operation of the Proposed Scheme and the effect that this will have on the perception of townscape.

Baseline Environment and Sensitivity

6.6.18. The identification and evaluation of the existing townscape and visual context of the study area and wider area will involve the following tasks:

- Desk based analysis of OS mapping relating to landform, built form, vegetation, settlement patterns and the drainage regime in the wider area;
- Desk based analysis of aerial photography for the area;
- Preliminary review of the townscape units/types and relevant designations (e.g. Conservation Areas, Registered Parks and Gardens);
- Site surveys and identification of townscape units/types. Site recording involved annotation of 1:1,250 and 1:25,000 scale OS plans defining the units and the key elements determining character;
- Development and agreement of representative/key viewpoints to be assessed for potential effects on visual amenity;
- Site photography to illustrate character units, notable views / viewpoints and key landscape elements; and
- Drafting and description of local townscape character units within the context of the broader assessment and associated with the Proposed Scheme and wider setting including an evaluation of their quality, value and sensitivity to change in the context of the proposed form of development.

6.6.19. For townscape character, evaluation of the sensitivity to change will be based on the structure, quality and value of the existing townscape, and the extent to which it is considered as being capable of accepting change in the form of the Proposed Scheme. Sensitivity will be rated as being high, moderate or low. Magnitude of impact will be based on the extent to which the Proposed Scheme would be likely to emerge as a new component in the landscape and change the relationship between components that currently constitute character. The sensitivity of the receiving townscape and the magnitude of impact will be assessed to determine a significance of effect rating.

Visual Impact

6.6.20. Establishment of the existing visual context for the Proposed Scheme will involve consideration of the information relating to existing townscape character established during the townscape character baseline assessment, the definition of a Zone of Theoretical Visibility (ZTV) for the Proposed Scheme, and the identification of visual receptors (represented by key viewpoints) within the visual envelope that will contribute to the definition of the study area.

6.6.21. The ZTV will be identified and refined through a combination of 3-D modelling and site work within a study area to be a 3km radius around the Proposed Scheme, beyond which the potential for significant effects are not anticipated to arise due to the scale and nature of the Proposed Scheme.

6.6.22. The following tasks will be undertaken:

- Identification of key viewpoints that are representative of views from visual receptors, comprising residential properties and other sensitive locations used and visited by the public within the ZTV;
- Desk and site based appraisal of existing and predicted views for the identified viewpoint;
- Identification of mitigation in light of the identified impacts; and
- Evaluation of the order of impact for each viewpoint taking into account the sensitivity of the associated receptor and magnitude of the impact to determine if there would be a significant effect on the environment.

6.6.23. Key Viewpoints plotted via the desk based review and validated through site survey include the following:

- Residential clusters and individual properties;
- Roads with views of the site; and
- Recreational and public access areas, including footpaths and other rights of way.

6.6.24. Sensitivity to change will be primarily based on the type of receptor (dwelling, place of work, footpath), and will be qualified by the degree to which the receptor would be exposed to potential views of the structure.

6.6.25. Magnitude of impact considers the extent of the Proposed Scheme that is visible, the percentage of the existing view newly occupied by the Proposed Scheme and the viewing distance from the receptor to the Proposed Scheme.

6.6.26. The prime criteria used to evaluate visual effects, will relate to the extent to which existing views associated with Key Viewpoints (such as residents, users of public facilities and visitors to open space and public areas) will change, taking into account mitigation measures.

6.6.27. The identification of the resulting effects will be established through an evaluation of the sensitivity of the baseline and the magnitude of the impact likely to occur as a result of the Proposed Scheme. Where appropriate, cumulative visual effects on the baseline environment will also be taken into account in respect of the Proposed Scheme and consented development within the study area.

Artificial Lighting

It is anticipated that the full extent of the Proposed Development will be lit, therefore the potential impacts of artificial lighting are to be assessed in the ES. The ES will be supported by a isolux contour plans to determine that extent of light spill from street lighting and amenity lighting, proposed within the scheme deign.

The assessment of views of the new crossing will include consideration of both day time and night time views, and will assess light spill issues and potential effects associated with the visual amenity.

Conclusions

6.6.28. The preliminary review of baseline and likely geographical extent is reasonably constrained although prior to undertaking an appraisal of the Proposed Scheme and nature of the resulting impacts it is premature to make a determination of significance.

6.7 WATER ENVIRONMENT

BASELINE CONDITIONS

6.7.1. A desk study comprised a review of various information sources in order to obtain information relating to the water environment assembled from other studies and designated and non-designated sites. Information sources which have informed the desk study review include:

6.7.2. Following the production of the Stage 1 Assessment and the Stage 2 Scoping Report, the following surveys and assessments have been completed, and are drawn upon for this assessment:

- Great Yarmouth Third Yare Crossing, Stage 2 Environmental Impact Assessment Report 2009
- Great Yarmouth Third River Yare Crossing, Water and Sediment Quality Sampling and Analyses July 2009
- Great Yarmouth Third River Yare Crossing, Geotechnical and Geo-environmental Interpretative Report, February 2008
- Great Yarmouth Third River Crossing, Sediment Modelling, February 2008

6.7.3. Further data collected for this assessment has been obtained from the following sources:

- Environment Agency 'What's in My Backyard' Online Mapper[43];
- Ordnance Survey Opendata[44]; and
- Defra's online GIS portal MAGIC[45]

6.7.4. The study area has been defined as the physical area of the Proposed Scheme under consideration and a buffer of 1km either side of the route alignments; and any surface water receptors, such as water dependent conservation sites located within the River Yare between Breydon Water to the north and the mouth of the river to the south, as illustrated on Figure 4, in Appendix B.

6.7.5. This study area is considered to be appropriate for the assessment of indirect effects, based on the professional judgement and knowledge of the area.

Surface Water

6.7.6. The water bodies within the study areas are shown on Figure 4. The site is dominated by the tidally influenced River Yare which flows north to south through the centre of the site and enters the sea through a gap in the spit of land, at Gorleston-on-Sea. The tidal extent of the River Yare reaches 15 km upstream, with a spring tidal range of approximately 2.2 m.

6.7.7. A series of drains and ditches connecting the main river to the mudflat and marsh areas exists between the upstream tidal extent and the proposed crossing sites. The majority of these mudflats fall within Breydon Water, which is an internationally important RSPB nature reserve, and designated as a SPA, SSSI and is on the List of Wetlands of International Importance (Ramsar Site). This and other designated sites linked to the water environment are discussed in detail in Section 6.4. The boundaries of these designated sites are shown on Figure 3.

[43] http://apps.environment-agency.gov.uk/wiyby/default.aspx
[44] https://www.ordnancesurvey.co.uk/business-and-government/products/opendata.html
[45] http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx

6.7.8. A river confluence between the River Bure and the River Yare is located 2.1 km upstream from the Proposed Scheme. The River Waveney also joins the River Yare 8.2 km upstream. The distance to the River Waveney is considered sufficient such that no impact is likely to result from the Proposed Scheme and therefore the River Waveney confluence is not included in this assessment. Surface water from land and roads is managed through a number of drainage systems which also appear to flow into the River Yare. No other rivers or streams enter the River Yare between the Proposed Scheme and the harbour mouth.

6.7.9. The River Yare is approximately 85 m wide at the site of the proposed crossing, with normal spring tide discharge in the region of 400 m3/s and velocities of around 2 m/s. As part of the sediment modelling study in 2008, discharge rates of the River Yare within the study area were calculated. The discharge time series ranged from -160 m3/s (ebb tide) to 200 m3/s (flood tide). Within the study area, recorded river velocities ranged between 0.25 to 2.0 m/s.

6.7.10. Under the Water Framework Directive (WFD), the EA has determined that River Yare lies within the 'Bure & Waveney & Yare & Lothing' surface water body (GB510503410700), classified as a heavily modified, transitional water body.

Hydrogeology

6.7.11. The superficial deposits underlying the site are classified by the EA as a Secondary A aquifer; permeable layers capable of supporting water supplies at a local rather than strategic scale. The bedrock is classified as a Principal aquifer; having high intergranular and/or fracture permeability and usually providing a high level of water storage.

6.7.12. Groundwater levels in close proximity to the Proposed Scheme ranged between 0.77 and 2.83 m below ground level (BGL) based on monitoring data from a one month monitoring in 2008. The direction of groundwater flow is unclear from these monitoring results, although it is likely to be tidally influenced. There is likely to be connectivity between the river level and the surrounding shallow groundwater.

Groundwater Vulnerability

6.7.13. The entire study area is designated by the Environment Agency as Major Aquifer High; able to easily transmit pollution to groundwater. They are characterised by high leaching soils and the absence of low permeability superficial deposits.

Groundwater Quality

6.7.14. Under the WFD, the EA has determined the study area lies within the 'Broadland Rivers Chalk & Crag' groundwater body (GB40501G400300), classified as holding a 'Poor' status for both quantitative and chemical classifications based on the 2015 dataset. The main pressures were either from agricultural and rural land management or 'no sector responsible'. This waterbody is linked to protected areas under the Drinking Water Directive although the study area does not lie within a drinking water safeguard zone.

6.7.15. The Site Investigation Factual Report (NCC, October 2007) indicates that in 2007 there was groundwater contamination within the study area when compared to drinking water standards, notably arsenic, boron, nickel, selenium, nitrate, sulphate, cyanide and benso(a)pyrene.

Water Quality

6.7.16. Water and sediment samples were collected from the River Yare during a site investigation in November and December 2007.

6.7.17. The water quality results for the River Yare were compared to the standards set out in the current documents at the time. Parameters which exceeded the Environmental Quality Standards (EQS) included copper, Biological Oxygen Demand (BOD) and Total Suspended Solids.

6.7.18. The Environment Agency's method for classifying river water quality is known as the General Quality Assessment (GQA) scheme. Nutrient, biological and chemical GQAs provide an accurate and consistent

assessment of the state of water quality and changes in this state over time, describing quality in terms of parameters which detect the most common types of pollution.

6.7.19. The chemical GQA is defined by standards for BOD, dissolved oxygen (DO) and ammonia, and indicates if the river is affected by waste water discharges and run-off from rural areas containing organic material. Water samples collected at the site in 2007 showed that the River Yare was classified between Grades A (very good) and B (good) at that time. High BOD was observed during a spring tide, together with low DO saturation levels and high turbidity, but these outcomes were not observed during neap tides.

6.7.20. The river system is likely to be subject to high loading of sediment and organic material during large flood tides. The nutrient GQA is defined by standards for orthophosphate and nitrate. Results showed nutrient levels within Grades 1 (very low) and 2 (low).

Sediment Quality

6.7.21. Sediment samples were collected from the River Yare during a site investigation in November and December 2007. Grab and sediment samples were taken in the vicinity of and to the south of the Proposed Scheme and were tested for a range of heavy metals and polyaromatic hydrocarbons (PAHs). Core sediment samples exceeded Probable Effect Levels (PEL) standards for dibenzo(a,h)anthracene and phenanthrene. Sediments exceeding PEL standards suggest that remobilisation of these sediments could cause frequent adverse biological effects. Threshold Effect Levels (TEL) standards were exceeded for the majority of heavy metals and PAHs in the core and grab samples collected in the same area. Exceedance of TEL standards suggests that remobilisation could result in an occasional adverse biological effect.

6.7.22. The sediments of the River Yare were contaminated with both inorganic and organic substances. The spatial distribution of the organic and inorganic contamination shows that there is a higher level of contamination around the tunnel crossing location compared to the bridge crossing locations.

Abstractions and Discharges

6.7.23. Within 1 kilometre of the Proposed Scheme can be found the following licenced water abstractions:

- one large licenced tidal water abstraction to the south (< 2500 cubic metres per day), abstracting from the River Yare; and
- one medium sized groundwater abstraction to the northwest (>100 – 2499 cubic metres per day).

6.7.24. There are no Source Protection Zones (SPZ) within the study area of the Proposed Scheme.

6.7.25. The locations of these abstractions are shown on Figure 4.

6.7.26. There are known to be discharges within the study area to the River Yare. The consents include sewerage, trade effluent, storm overflow discharges and site drainage. Contaminants associated with these processes include faecal material, bleaches and cleaning products.

Road Drainage

6.7.27. Existing road drainage for the surrounding roads consists of a series of gullies and drains, discharging to ditches and balancing ponds. No information is currently available on the road drainage catchment area or discharge location, but it is assumed that the ditches eventually discharge to the River Yare.

Flooding

6.7.28. The Proposed Scheme predominantly lies within floodplain cited by the Environment Agency (EA) as Flood Zone 3 (defined as land having a 1 in 100 or greater annual probability of river flooding (1%) or land having a 1 in 200 or greater annual probability of sea flooding (0.5%)), with this typically adjacent and relatively close to the

banks of the River Yare and Great Yarmouth Harbour. Flood Zone 3 is the highest risk zone defined by the EA (EA, 2016). Flood zones at the location are shown in Figure 4.

6.7.29. Smaller areas of EA Flood Zone 2 are also within the study area (defined as land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or land having between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%)), primarily for the Proposed Scheme at Sutton Road and Swanston Road, where the route connects into the existing road network (EA, 2016).

6.7.30. The EA Flood Map for Planning[46] does not show any defences in Great Yarmouth however the EA have supplied WSP with a map and crest level information for the defences along the River Yare through Great Yarmouth that consist of quay walls, which are higher in level than the land behind them (EA reference: EAN/2017/48225).

6.7.31. Areas within the Proposed Scheme boundary are subject to a medium risk of surface water flooding according to the EA surface water maps. Flooding from sewers will be considered as part of this assessment and may be an issue given the urban nature of the Proposed Scheme site. There is no risk of flooding from reservoirs to the Proposed Scheme shown on the EA reservoir flooding map. The EA groundwater vulnerability map shows the Proposed Scheme rests on a 'Major Aquifer High', as such there is a potential for groundwater flooding.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.7.32. The potential impacts and methodologies adopted to assess them are largely based on guidance provided in DMRB HD 45/09 (Highways Agency, 2009)[47].

Potential Impacts on Surface Water

6.7.33. The potential significant impacts considered are:

- Pollution during construction due to increased generation and release of sediments and suspended solids, and increased risk of accidental spillage of pollutants such as oil, fuel and concrete associated with construction activities and site storage requirements;
- Pollution during road operation due to contaminants within routine road run-off. A broad range of potential pollutants, such as hydrocarbons i.e. fuel and lubricants, fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road surface during rainfall events, polluting the receiving surface water bodies;
- Pollution during road operation due to accidental spillage. On all roads, there is a risk that accidents or vehicle fires may lead to an acute pollution incident. Where commercial vehicles are involved, potential pollutants that may be spilled could range from hazardous chemicals to milk, alcoholic beverages, organic sludges and detergents. Spilled materials may drain from the road surface, polluting the receiving surface water bodies;
- Alterations to the hydromorphology (fluvial geomorphological) regime, such as increased erosion, deposition and channel migration processes. These changes can occur as a result of channel modification associated with the new crossing structures, increased road surface drainage, and outfalls. A reduction in hydromorphological diversity can subsequently impact on water quality and biodiversity;
- Loss or change to surface water supplies due to degradation of water quality, changes in drainage patterns or disruption to supply infrastructure due to the route options;

[46] Environment Agency flood map for planning, https://flood-map-for-planning.service.gov.uk/ accessed September 25th, 2017
[47] Design Manual for Roads and Bridges Volume 11, Section 3, Part 10 (HD 45/09) Road Drainage and the Water Environment, former Highways Agency, November 2009

- Loss of standing waters where the route options would be constructed through or close to existing ponds.

Potential Impacts on Groundwater

6.7.34. The potential significant impacts considered are:

- Pollution of groundwater and aquifers as a result of construction activities, such as excavation of deep cuttings; piling creating preferential pathways for contamination transmission to groundwaters, and seepage of spillages through ground profiles;
- Groundwater pollution during road operation due to contaminants within routine road run-off, where groundwater infiltration is proposed as part of the drainage strategy for the route options;
- Groundwater pollution during road operation due to accidental spillage;
- Direct loss or changes to groundwater aquifers and groundwater supported public and private water supplies, either below the footprint of the route options, or as a result of changes to groundwater flows and levels associated with the dewatering of deep cuttings and foundation excavations or piling into the aquifer;
- Indirect loss or change to surface water receptors, as a result of dewatering of groundwater aquifers; and
- Loss or changes to Groundwater Dependent Terrestrial Ecosystems (GWDTEs), including peatland habitats, either below the footprint of the route options as a result of severance of habitat, or as a result of changes to groundwater flows and levels associated with dewatering activities.

Potential Impacts of Flooding

6.7.35. Increase in flood risk caused by the Proposed Scheme, both within the vicinity of the route options and also elsewhere in the catchment is possible. This can involve a number of interrelated factors including:

6.7.36. Increases in water level due to Proposed Scheme within the channel or floodplain;

6.7.37. Loss of floodplain storage due to road infrastructure occupying areas which were previously available for flood storage or flows;

6.7.38. Impediment of water flow caused by road infrastructure crossing existing drainage channels, causing potential blockage and altering local catchment area boundaries;

6.7.39. The increase in surface water runoff due to any increase in impermeable area as a result of the Proposed Scheme;

- Groundwater flooding;
- Risk of flooding from sewers; and
- Risk of flooding from artificial sources.

PROPOSED ASSESSMENT METHODOLOGY

6.7.40. The road drainage and the water environment assessment will involve the following key tasks:

- Consultations with the relevant statutory and non-statutory bodies to establish the principal water environment issues associated with the study area;
- Detailed desk studies and field surveys to ascertain the current baseline conditions on site;
- Assessment of the potential impacts related to the construction and operation of the Proposed Scheme;

- Identification of measures to avoid, minimise or mitigate predicted impacts.

6.7.41. The assessment will focus upon defining the characteristics and subsequent potential impacts upon the surface water and groundwater receptors, including the wider hydrological catchments as categorised by the EA under the WFD. This hydrological catchment-based approach enables due consideration to be given to both individual locations where interactions occur and any cumulative impacts within larger water body areas.

Scoped Out Impacts

6.7.42. The specific characteristics of the Proposed Scheme enable particular impacts to be considered as highly unlikely to occur. Based on professional judgement and taking account of water environment characteristics and scheme design, the following items are not intended to be considered further, thus enabling focus upon the more likely impacts on the water environment (as discussed in the following subheadings):

- Loss of standing water - scoped out due to the scale of the Proposed Scheme, the urban setting of the study area and the lack of standing water bodies below or adjacent to the Proposed Scheme;
- Loss or change to Groundwater Dependent Terrestrial Ecosystems - scoped out due to the urban setting of the study area and the lack of such ecosystems below or adjacent to the options under development; and
- Changes to groundwater level or flows impact due to cuttings and related dewatering - scoped out as no cuttings are anticipated for this particular project, due to local topography, urban setting and flood risk characteristics.

Construction Pollution

6.7.43. Evaluation of the potential for pollution of surface waters as a result of spillage and of the release of sediments into watercourses or water bodies will involve a review of areas where construction would be required within or in close proximity (i.e. within 50m) to surface watercourses and water bodies.

6.7.44. Mobilisation of potentially contaminated sediments during construction will also be considered in terms of local receptors and also Breydon Water designated site to the north; this will be informed by sediment transport modelling that will be undertaken for the Proposed Scheme and sediment sampling to determine levels of contamination.

6.7.45. The potential for pollution of groundwaters/aquifers is greatest where piling through contaminated land or sediments is proposed. In addition groundwater vulnerability is classified as high for this area and therefore groundwater is more at risk from accidental spillage.

Pollution from Routine Run-off

6.7.46. DMRB HD 45/09 (Highways Agency, 2009) specifies procedures for the assessment of pollution impacts from routine run-off on surface waters, known as ‘Method A’.

6.7.47. The Method A assessment comprises two separate elements:

- HAWRAT Assessment: the Highways Agency Water Risk Assessment Tool (HAWRAT) is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road run-off. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment-bound pollutants, respectively; and
- EQS Assessment: EQS are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the WFD. The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.

6.7.48. To carry out these assessments a variety of baseline and drainage design information is required, including; traffic volumes, areas of impermeable and permeable road surfaces to be drained, proposed treatment train, receiving watercourse dimensions and flow data, water hardness, presence of sensitive sites (considered as international / national designated conservation sites) and in-stream structures or features which may influence the flow.

6.7.49. However, Method A was developed for assessment of discharges into freshwater bodies rather than transitional water such as the River Yare, with such water bodies having different characteristics, receptors and baseline conditions due to tidal influence and dilution factors. Therefore, the appropriate method of assessment for routine run-off shall require discussion and agreement with the EA.

6.7.50. The assessment method for groundwater is known as 'Method C', applied to drainage design features designed to discharge to groundwater specifically. The Method C assessment comprises a risk assessment procedure based on the source-pathway-receptor model, which considers the following parameters: traffic density, rainfall, soakaway design and geometry, depth to groundwater table, groundwater flow type, aquifer grain size and aquifer lithology.

Pollution from Accidental Spillage

6.7.51. The DMRB document HD 45/09 (Highways Agency, 2009)[47] specifies procedures for the assessment of pollution impacts from accidental spillage, known as 'Method D'. A summary of the methodology is provided below, with full details provided in HD 45/09[47].

6.7.52. The assessment takes the form of a risk assessment, where the risk is expressed as the annual probability of a serious pollution incident occurring. This risk is the product of two probabilities:

- The probability that an accident will occur, resulting in a serious spillage of a polluting substance on the carriageway; and
- The probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.

6.7.53. The probability of a serious spillage occurring is dependent on a variety of factors; namely, traffic volumes, percentage of heavy goods vehicles in the traffic volumes, whether the road is motorway, rural or urban trunk road, the road type categories within the road drainage catchment under assessment (i.e. 'no junction', 'slip road', 'cross road' or 'roundabout'), and the length of each road type within the catchment.

6.7.54. The probability of a serious spillage subsequently causing a serious pollution incident is dependent on the receiving surface water body and the response time of the emergency services; i.e., less than 20 minutes, less than one hour, or greater than one hour.

6.7.55. However, as for Method A, Method D was developed for assessment of discharges into freshwater bodies rather than the transitional water of the River Yare with associated tidal influence and dilution factors. Therefore, the appropriate method of assessment for accidental spillage shall require discussion and agreement with the Environment Agency.

Hydromorphological Changes

6.7.56. A hydromorphological assessment will be undertaken which will include sediment transport modelling of the Proposed Scheme to understand the impact of the presence of the bridge infrastructure on the hydromorphology of the River Yare. It will discuss the potential effects on river bed scour/erosion, sediment deposition and implications for Breydon Water designated site to the north from potential changes to sediment deposition patterns.

Loss or change to groundwater aquifers and supported water supplies

6.7.57. An assessment of the potential impacts of the Proposed Scheme on groundwater quality and quantity will be undertaken with respect to identified groundwater abstractions including licenced activities and private water supplies, and other groundwater dependent receptors.

Indirect loss or change to surface water receptors

6.7.58. Surface water bodies such as streams, lakes and wetlands can receive or recharge groundwater, with movement likely between the two receptors. Any changes to groundwater as a result of dewatering may indirectly impact surface water bodies and result in changes to surface water flow. The impact on surface water receptors shall be assessed qualitatively.

Impact Assessment Criteria

6.7.59. The predicted significance of impacts on surface waters and groundwater will be based on the importance or sensitivity of the relevant waterbody and the magnitude of the impact from the Proposed Scheme, as recommended in DMRB document HD 45/09 (Highways Agency, 2009[47]).

6.7.60. The importance or sensitivity of the waterbodies will be evaluated taking into account their quality, rarity, scale and substitutability. The criteria used will be based on the guidance and examples given in HD 45/09, Table A4.3.

6.7.61. The magnitude of the various impacts is evaluated taking into account the extent of loss and effects on integrity of the relevant waterbody attributes. The criteria used will be based on the guidance and examples given in HD 45/09, Table A4.4.

6.7.62. The estimation of the impact significance will be derived by combining the estimated importance of the affected waterbodies and the magnitude of the impacts, taking into account mitigation and the guidance provided in HD 45/09, Table A4.5 and this is provided as Table 26.

Table 26 - Impact Magnitude/Significance Matrix

		Magnitude Of Impact			
		Negligible	**Minor**	**Moderate**	**Major**
Importance of Attribute	**Very High**	Neutral	Moderate/ Large	Large/ Very High	Very Large
	High	Neutral	Slight/ Moderate	Moderate/ Large	Large/ Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight/ Moderate

6.7.63. Where there is more than one option for significance rating, professional judgement shall be used to determine the significance for the particular impact.

Water Framework Directive Assessment

6.7.64. A WFD Assessment will be undertaken to assess the Proposed Scheme against the key objectives of the water framework directive. A WFD scoping exercise will be undertaken and consulted on with the EA.

Flood Risk

6.7.65. The main source of flooding to the site of the Proposed Scheme is believed to be tidal. This forms a largely separate assessment from the rest of the Water Environment topic. It is therefore proposed that Flooding is presented within the ES as a stand-alone chapter. This is shown in the proposed structure for the ES, presented in Table 53.

6.7.66. A Flood Risk Assessment (FRA) will be carried out in accordance with the National Planning Policy Framework (NPPF)[48] and the NPPF Planning Practice Guidance (PPG). The objectives of the FRA are to:

- Assess the risk to the Proposed Scheme from all potential sources of flooding;
- Establish the existing and future flood risk to the Proposed Scheme;
- Consider flood risk to the Proposed Scheme site during construction;
- Assess the potential impacts of the Proposed Scheme on flood risk elsewhere; and
- Determine appropriate mitigation measures to manage flooding issues post development in a sustainable way.

6.7.67. As previously stated, the main source of flooding to the site of the Proposed Scheme is believed to be tidal. A 1D-2D ISIS-TUFLOW hydraulic model has been provided by the EA for use in this assessment. The model has been reviewed and a decision has been made to develop a new 2D TUFLOW model focussed on Great Yarmouth for the purposes of this assessment. The existing EA model includes representation of a large part of the Broadlands river system, it is not necessary to model this as part of this assessment. The 2D only model developed for this assessment will focus on the River Yare through Great Yarmouth and be used to model the impact of the Proposed Scheme on flood risk within Great Yarmouth. A suite of sensitivity tests will be undertaken to determine the impact of a variety of parameters on the model results, including roughness values representing land use with the model, fluvial inflows and tidal levels.

- The model will be used to investigate two scenarios:
- Baseline – to establish the existing flood risk to the Proposed Scheme site; and
- Proposed Scheme – to establish the impact of the Proposed Scheme on flooding elsewhere.

6.7.68. The water levels predicted by the model for the Proposed Scheme scenario will be compared to the predicted water levels for the baseline scenario. This will determine the impact of the Proposed Scheme on flood levels in Great Yarmouth. Three flood design events will be investigated using the flood model developed for the Proposed Scheme; these are: the 5% Annual Exceedance Probability (AEP) event, the 0.5% AEP event (tidal Flood Zone 3) and the 0.1% AEP event (tidal Flood Zone 2). Model runs will be undertaken for each design event with and without climate change allowances applied to determine present day flood risk in Great Yarmouth and predicted future flood risk.

6.7.69. In order to apply a climate change allowance to each of the design events being modelled, future sea level rise will be calculated using five different methods from a range of guidance sources and the maximum increase in sea level rise calculated will be used to represent the climate change events. The five guidance datasets/tables that will be considered are:

[48] Department for Communities and Local Government, National Planning Policy Framework (2012) Accessed online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf [07 September 2017]

- National Planning Policy Framework (NPPF)[48] – Table 3;
- UK Climate Change Projections, (UKCP09) 50% high emissions;
- UKCP09 95% high emissions;
- UKCP09 95% medium emissions; and
- Upper End allowance, Table 5 (Adapting to Climate Change).

6.7.70. The impact of and resilience to future flooding will be considered and mitigation against future flood risk up to and including the 0.5% AEP plus climate change event will be recommended as necessary. If it is determined that the Proposed Scheme is considered to be safety critical then it will also be assessed against the H++ UKCP09 estimates (high risk, low probability) for sea level rise to assess a credible maximum scenario. It is not expected that the design or mitigation will be provided to this level but the Proposed Scheme will be assessed against this scenario to understand the full picture of risk.

6.7.71. There is potentially a risk of flooding to the Proposed Scheme from other sources such as surface water flooding, groundwater inundation, risk of flooding from sewers and flooding from artificial sources. A review of all available data including the available EA mapping, local reports of flooding, photographs and sewer/service plans will be carried out to assess the risk. Calculations will be undertaken as part of the FRA to determine the greenfield runoff rate from the Proposed Scheme site and the runoff rate following construction of the Proposed Scheme. The volume of storage required as part of the Proposed Scheme in order to limit runoff from the site to the greenfield rate will be calculated and reported within the FRA.

Impact Assessment Criteria:

6.7.72. Table 27 shows how a given increase in flood depth from the baseline scenario to the post-development scenario will be classified in terms of impact. A minimal increase in flood depth (<=0.02m) between the two scenarios is classified as a negligible impact because this is within the tolerance of the hydraulic model used to predict flood risk to Great Yarmouth and would not significantly increase flood risk to receptors.

Table 27 - Classification of Magnitude of Flooding Impacts

Magnitude of Impact	Change in depth (m)
No Change	0
Negligible	>0.0 - <= 0.02
Moderate	>0.02 - <=0.3
Major	0.3+ OR Flooding in areas that were previously not flooding.

Table 28 within the NPPF PPG for flood risk and coastal change classifies receptors in terms of their flood risk vulnerability[49].

The need for flood mitigation is dependent on the magnitude of impact and the vulnerability of the receptor(s) that are affected by any increase in flood depth. Table 28 - Significance of Flood Impact overleaf compares the magnitude of impact and receptors to demonstrate when mitigation is required and the need for flood mitigation as part of the Proposed Scheme will be assessed using these parameters.

[49] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-2-Flood-Risk-Vulnerability-Classification

Table 28 - Significance of Flood Impact

Magnitude of Impact	Receptor Sensitivity				
	Water Compatible	Less Vulnerable	More Vulnerable	Highly Vulnerable	Essential Infrastructure
No Change	No mitigation required	No mitigation required	No mitigation required	No mitigation required	No mitigation required
Negligible	No mitigation required	No mitigation required	No mitigation required	Mitigation	Mitigation
Moderate	No mitigation required	Mitigation	Mitigation	Mitigation	Mitigation
Major	No mitigation required	Mitigation	Mitigation	Mitigation	Mitigation
All mitigation measures will be decided in consultation with the EA.					

6.8 CLIMATE CHANGE

BASELINE CONDITIONS

6.8.1. The greenhouse gas (GHG) assessment is not restricted by geographical area but instead includes any increase or decrease in emissions as a result of the Proposed Scheme. This includes:

- Construction and decommissioning emissions in the area of the Proposed Scheme footprint but also related to the transport of materials to and from the site, their manufacturing and disposal; and
- Operational emissions resulting from the Proposed Scheme infrastructure but also emissions, or any reduction in emissions, which result from the end-use of the Proposed Scheme (vehicle movements) and any consequent shifts in transport modes/patterns which may occur.

6.8.2. The study will use the air quality assessment to inform consideration of the end-user emissions. For the greenhouse gas assessment, the areas from which the construction materials are sourced in the UK is also included.

6.8.3. For the resilience assessment, the UK Climate Projections (UKCP0956) programme[51] currently provides probabilistic projections for the whole of the UK, at regional level and at local level. This assessment will adopt the local level projections, which are set out by UKCP09 using a 25km^2 grid. The grid reference for the projections used in this assessment is Area 1517 and contains the anticipated geographical extent of the Proposed Scheme.

Greenhouse Gas Emissions

6.8.4. In the baseline (do nothing) scenario, GHG emissions occur constantly and widely as a result of human and natural activity including energy consumption (fuel, power), industrial processes, land use and land use change – both in the area of the Proposed Scheme but also more widely. The GHG assessment will only consider where the Proposed Scheme results in additional or avoided emissions in comparison to the baseline scenario and its assumed evolution.

6.8.5. The total end-user GHG emissions from traffic flows in the 'do nothing' (baseline) scenario have not yet been modelled, however, this will be completed as part of the air quality assessment, in accordance with the Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 Air Quality; HA 207/07[50]. The modelling will include the total GHG emissions for all vehicles covered by the traffic model, including the strategic and local road network in the area of the Proposed Scheme and its surrounding region.

Climate Resilience

6.8.6. The baseline for the climate resilience assessment is summarised in Table 29 and comprises the recent historical (1961 to 1990) as well as the future projections for key climate parameters. All figures are taken from the UK Climate Projections[51] which cover the UK split into a grid of 5 kilometre squares. Future projections are provided for the 2020s (corresponding to the construction period) and the 2080s (during the operational design life of the Proposed Scheme).

[50] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 Air Quality (HA 207/07), former Highways Agency, May 2007.

[51] UK Climate Projections 2009, produced by British Atmospheric Data Centre, Environment Agency, Marine Climate Change Impacts Partnership, Met Office, National Oceanography Centre, Newcastle University, Tyndall Centre, University of East Anglia, 2009.

Table 29 - Baseline (historical and future) climate data for the study area (Location 1517)

Climate Category	Climate parameter With recent baseline (1961-1990)		Projection for 2020s[52] (2010-2039)			Projection for 2050s (2040-2069)			Projection for 2080s (2070-2099)		
			Med (50%)	High (50%)	Range	Med (50%)	High (50%)	Range	Med (50%)	High (50%)	Range
Temperature [°C]	Mean daily winter min	1.2	2.7	2.8	1.7 to 3.7	3.6	4.0	2.0 to 5.7	4.5	5.3	2.5 to 8.0
	Mean winter daily	3.9	5.2	5.2	4.3 to 6.0	6.0	6.4	4.8 to 7.7	6.9	7.5	5.2 to 9.5
	Change on coldest winter day	N/A	+1.3	+1.3	-0.1 to +2.8	+1.7	+2.0	-0.1 to +4.3	+2.0	+2.4	+0.2 to +5.5
	Mean daily summer max	19.8	21.4	21.3	20.4 to 22.6	22.7	23.1	20.7 to 25.5	23.9	25.0	10.0 to 28.8
	Mean summer daily	15.6	17.0	16.9	16.2 to 17.9	18.0	18.3	16.5 to 20.1	19.0	19.8	16.7 to 22.6
	Change on warmest summer day	N/A	+0.9	+1.2	-1.6 to +4.0	+1.8	+2.3	-1.5 to +7.0	+2.6	+3.4	-2.2 to +10.3
Rainfall [mm/day]	Winter mean daily	1.7	1.8	1.8	1.6 to 1.9	1.8	1.9	1.7 to 2.2	2.0	2.1	1.7 to 2.6
	Summer mean daily	1.6	1.5	1.6	1.3 to 1.9	1.3	1.3	1.1 to 1.7	1.3	1.2	1.0 to 1.7
	% change on wettest winter day	N/A	+5.1%	+5.6%	-4.4% to +18.9%	+11.3 %	+10.2 %	-5.2% to +26.5%	+15.9 %	+19.1 %	-0.9% to +42.1%

6.8.7. The environmental assessment topics for the Proposed Scheme will take into account the potential for in-combination impacts and effects in relation to these climate change projections.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

Greenhouse Gas Assessment

6.8.8. The impacts of GHGs relate to their contribution to global warming and climate change. These impacts are global and cumulative in nature, with every tonne of GHG contributing to climate change impacts upon natural and human systems.

6.8.9. GHGs are natural and man-made gases occurring in the atmosphere, which absorb and emit infrared radiation thereby maintaining the Sun's energy within the Earth's atmosphere. There is an overwhelming scientific consensus that the major increase in the concentration of GHGs from man-made sources is contributing to global warming and climate change.

6.8.10. The seven main GHGs defined by the Kyoto Protocol are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride. In combination, these GHG emissions are commonly expressed in terms of carbon dioxide equivalents according to their relative global warming potential. For this reason the shorthand 'carbon' may be used to refer to GHGs.

[52] Note - projections for medium and high emissions scenario and 50% probability level. Projection range for low emission scenario at 10% probability level to high emission scenario at 90% probability level.

6.8.11. The assessment approach considers the likely magnitude of GHG emissions (or avoided emissions) in comparison to the baseline scenario with no scheme development. It considers emissions throughout the lifecycle of the Proposed Scheme including:

- Construction stage e.g. embodied emissions associated with materials, transportation of materials to site and waste/arisings from site, and the construction process;
- Operation e.g. operation of lighting and controls, maintenance and replacement of original materials, as well as emissions (or avoided emissions) from end-user vehicles; and
- End of life (decommissioning) stage e.g. deconstruction and management of materials, arisings and waste.

Climate Resilience

6.8.12. Table 30 presents the potential impacts of climate change during the construction and operation period. These are not exhaustive and further assessment is required to identify extent of impacts.

Table 30 - Potential impacts during construction and operation

Phase of scheme	Climate event	Impact (hazards or benefits)
Construction	Increased temperatures, prolonged periods of hot weather	Warm and dry conditions exacerbate dust generation and dispersion, health risks to construction workers
	Increased precipitation, and intense periods of rainfall	Flooding of works and soil erosion Increased risk of contamination of waterbodies Disruption to supply of materials and goods
Operation	Increased precipitation, especially in Winter	Flooding Water scour causing structural damage Weakening or wash-out of structural soils Change in ground water level and soil moisture
	Temperature extremes	Stress on structures Stress on surfaces e.g. difficulties with maintaining required texture depth during construction and operation. Challenges for maintenance regimes

Design Mitigation/Enhancement

Greenhouse Gas Emissions

6.8.13. A range of design, mitigation and enhancement measures may be available as the Proposed Scheme progresses through detailed design and into construction and operation. These include:

- Design optimisation to reduce the requirement for construction materials, substitute construction elements for lower-carbon alternatives (e.g. changing the design and materials for a bridge) and reduce the requirement for earth movements to/from and within the construction site.
- Specification of materials and products with reduced embodied GHG emissions including through material substitution, recycled or secondary content and from renewable sources;

- Recovery and re-use / recycling of site arisings (ideally, on-site); and
- Selection and engagement of materials suppliers and construction contractors taking into account their policies and commitments to reduction of GHG emissions, including embodied emission in materials.

Climate Resilience

6.8.14. A range of design, mitigation and enhancement measures may be available as this Proposed Scheme progresses through detailed design and into construction and operation. These include:

- Design optimisation to remove particular scheme elements away from the source of a climate hazard e.g. moving sensitive infrastructure away from/above flood risk hotspots.
- Specification of materials and products which are more resilient to identified climate risks (e.g. heat resistant pavement materials, bridge bearings and Mechanical and Electrical equipment);
- Adoption of construction procedures to avoid particular climate impacts e.g. avoiding dust impacts due to earth movements during dry, windy periods by stopping work or enhanced mitigation (wetting).
- Adoption of scheme operation practices and systems to reduce or prevent potential impacts during the operational lifetime e.g. intelligent weather warning systems.

Residual Effects

6.8.15. It is not expected that there will be significant residual effects in terms of GHG emissions or climate change resilience. This assertion will be tested as part of the Proposed Scheme environmental assessment.

PROPOSED ASSESSMENT METHODOLOGY

Methodology - Greenhouse Gas Assessment

6.8.16. The GHG scoping assessment has been based on the following guidance:

- IEMA's EIA guide to Assessing GHG emissions and evaluating their significance[53]
- TAG Unit A3 Environmental Impact Appraisal (DfT, 2015). Chapter 4 Greenhouse Gases[54]; and
- PAS 2080:2016 Carbon management in infrastructure[55].

6.8.17. There are no specific criteria for assessing the significance of GHG emissions of highways schemes. A judgement is however made regarding the likely magnitude of emissions and the need for further assessment.

6.8.18. There are multiple GHG emission sources associated with each lifecycle stage of the Proposed Scheme. At this stage, limited information is available to assess GHGs during construction and operation. For example, a materials bill of quantities is not available and traffic modelling is not yet available.

[53] IEMA (2017) *EIA guide to Assessing GHG emissions and evaluating their significance*, [Link]

[54] Department for Transport (2015). TAG Unit A3 Environment Impact Appraisal Chapters 4 Greenhouse Gases. [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/638648/TAG_unit_a3_envir_imp_app_dec_15.pdf (Accessed January 2018)

[55] BSI (2016) *PAS 2080:2016 Carbon management in infrastructure* [Link]

Table 31, therefore, presents the key emissions sources associated with each lifecycle stage of the Proposed Scheme.

Table 31 - Lifecycle stages and key emissions sources

Lifestyle stage		Key GHG source	Scope in/out
Construction	Product stage (manufacture and transport of raw materials to suppliers)	Manufacture and supply of materials (e.g. aggregate and asphalt) for: - New dual carriageway and flyover across Southtown Road - New roundabout - Realignment of William Adams Way - New cycleway and footway on bridge. - New signal controlled junction Manufacture and supply of materials (e.g. steel, reinforced concrete) for, 55m for single span lifting bridge; including steel deck, 3 longitudinal steel box beams per leaf (x2), Piers (reinforced concrete box structures on reinforced concrete piles), approach embankments and retaining walls. Manufacturing and supply of drainage, barriers, signs, lighting.	Scope in
	Construction process stage (transport of materials and arisings to/from site; construction process, earth movements)	Emissions from construction activity including: Constructing bridge superstructure Delivery and laying of materials for dual carriageway, roundabout, cycleway and footway. Export and disposal of site excavations Delivery and installation of drainage, barriers, signs and lighting.	Scope in
	Land use, land use change and forestry	No significant land take or emissions.	Scope out
Operation	End-user emissions (regional traffic flows)	Vehicles using highways infrastructure. Change in end-user emissions expected from the surrounding network	Include in air quality assessment
	Operation and maintenance	Lighting expected to be efficient LED units providing some reduction in emissions compared to the baseline.	Scope out
	Repair, replacement, refurbishment	There will be an increase in emissions from road and bridge maintenance and refurbishment requirements proportional to the increase in the carriageway pavement area.	Scope out

6.8.19. The end of life stage has been scoped out as the expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of emissions activity.

Emissions Calculation

6.8.20. Emissions calculations will be completed within an industry recognised carbon calculation tool which focuses on emissions throughout the project lifecycle. For this particular assessment, Highways England's carbon tool will be used. Values will be reported as tonnes of carbon dioxide equivalents (tCO_2e).

Significance of Effects

6.8.21. At this stage, there is not enough information available to determine the level of magnitude or significance of emissions of the Proposed Scheme and, therefore, a detailed assessment will be undertaken during the environmental assessment.

Methodology - Climate Resilience

6.8.22. The assessment approach is based on the following guidance:

6.8.23. IEMA's Environmental Impact Assessment guide to Climate Change Resilience and Adaptation[56].

6.8.24. The impacts in relation to climate resilience relate to how the changing climate may affect the Proposed Scheme itself, both in terms of construction and operation of the infrastructure, its ability to function and the end-users.

6.8.25. The Proposed Scheme comprises construction of a new dual carriageway and lifting bridge over the River Yare, a new roundabout, new cycleway and footway for which there is potential for significant effects.

6.8.26. Climate resilience with respect to the functioning and capacity of the Proposed Scheme drainage system as well as the risk of flooding is considered as part of the separate chapter on Road Drainage and the Water Environment (Section 6.7).

6.8.27. The process for assessing the risk of climate change effects to potentially vulnerable receptors (Table 32) will be applied to the construction and operational phases of the Proposed Scheme.

Table 32 - Potential vulnerable scheme receptors

Receptor	Aspects
Geotechnics	Erosion
	Stability of earthworks and compaction
	Earthworks construction across existing landslip
	Increased scour and erosion of earthworks
	Stability of slopes, change in water levels/pore pressure
	Drainage ditches
Pavements	Design of foundations
	Materials integrity, specification and construction details
	Construction - laying surface dressing, microsurfacing, temperature susceptible materials
	Skid resistance
	Maintenance
Restricting network use	High winds
	Flooding
Restraint systems	Renewal and repair
	Stability

[56] Environmental Impact Assessment Guide to Climate Change Adaptation and Resilience, IEMA, 2015.

Receptor	Aspects
Signs and signals	Renewal and repair
Soft estate	Landscape, ecology
Structures (including gantries)	Thermal actions (loads) applied to superstructure
	Wind actions (loads) applied to superstructure
	Increased thermal range giving rise to increased earth pressures for integral bridges
	Earth pressures used in design affected by change in ground water level
	Foundation settlement affected by change in ground water level
	Design for increased scour risk for foundations
	Design of structure drainage
	Use of temperature sensitive components or materials in construction or rehabilitation (for example, epoxies used in fibre reinforced plastic strengthening)
	Design, management and maintenance of bearings and expansion joints
	Climatic constraints on construction and maintenance activities
	Optimum timing of maintenance interventions, in response to changes in deterioration rates

ASSUMPTIONS AND LIMITATIONS

6.8.28. The scoping assessment has been completed based on the currently available information regarding the scale and nature of the Proposed Scheme. The type and volume of materials required from the Proposed Scheme (to consider construction emissions) is not available and no information is yet available on the quantities of materials in construction elements such as major structures (e.g. roundabouts and bridges). This information will be required to assess the embodied carbon associated with the Proposed Scheme. No information is yet available to estimate the emissions from the construction process (e.g. from vehicles and construction plant).

6.8.29. No modelling of regional traffic emissions was available at the time of scoping and therefore it is not possible to determine the scale of any potential increase or reduction. However, this will be completed as part of the air quality assessment.

6.9 PEOPLES AND COMMUNITIES

BASELINE CONDITIONS

Population

6.9.1. The Proposed Scheme is located within Great Yarmouth, within Norfolk. The resident population was estimated to be 99,200 (totalling 49,000 males and 50,200 females) in 2016 based on the Office of National Statistics (ONS) NOMIS report[57]. There are a lower proportion of individuals aged 16-64 in Great Yarmouth (58.7%), compared with the averages across the East of England region (61.5%) and Great Britain (63.1%).

Deprivation

6.9.2. The Index of Multiple Deprivation (IMD) is the official measure of relative deprivation for small areas in England and ranks every small area in England from 1 (most deprived area) to 32,844 (least deprived area).

6.9.3. The IMD combines information from seven domains to produce an overall relative measure of deprivation. The domains are combined using the following weights:

- Income Deprivation (22.5%);
- Employment Deprivation (22.5%);
- Education, Skills and Training Deprivation (13.5%);
- Health Deprivation and Disability (13.5%);
- Crime (9.3%);
- Barriers to Housing and Services (9.3%); and
- Living Environment Deprivation (9.3%).

6.9.4. In the IMD 2015, Great Yarmouth was ranked 29 in England out of 326 local authorities and, as such, is one of the most deprived area in England. The Proposed Scheme is located within two Lower Layer Super Output Areas (LSOAs): Great Yarmouth 006A and Great Yarmouth 007B. The eastern extent of the Proposed Scheme is located in Great Yarmouth 006A LSOA, which is in the top 10% most deprived areas in the UK. The western extent of the Proposed Scheme is located in the Great Yarmouth 007B LSOA and is amongst the 20% most deprived neighbourhoods in England.

Employment and Local Economy

6.9.5. There are a number of local businesses located within the Site and surrounding area. Local businesses, including Kings Centre and Simpsons New and Used Motorhomes, are located off Queen Anne's Road. Businesses are also located off Suffolk Road, including, but not limited to, Space 4 U Storage Ltd and Great Yarmouth Day Services. Harfrey's Industrial Estate is situated immediately west of the A47 / Williams Adam Way roundabout. To the east of the River Yare, an industrial area is located adjacent to the river.

6.9.6. In Great Yarmouth, the proportion of individuals aged 16-64 who were estimated to be economically active in 2016 was 77.9% (47,300 people), compared with an average of 79.1% (437, 600 people) in Norfolk, 80.2% in

[57] Office for National Statistics, 2017, NOMIS official labour market statistics

the East of England and 78% across Great Britain. In 2015, there was an estimated 38,000 jobs in Great Yarmouth, with 60.5% full time and 42.1% part time.

6.9.7. In 2015, the job density levels (i.e. the ratio of total jobs to the population aged 16-64) was 0.71 in Great Yarmouth and 0.8 in Norfolk. This is lower than the averages across the East of England region (0.81) and Great Britain (0.83) and indicates less availability of employment opportunities within Great Yarmouth.

6.9.8. Table 33 details the estimated employee jobs by industry sector in 2016. In Great Yarmouth, the highest proportion of employee jobs are in the Human Health and Social Work Activities (Sector Q) at 21.1%. This is a greater proportion than the average across Norfolk (15%), the East of England region (11.8%) and Great Britain (13.3%). The construction industry (Sector F) constitutes 3.9% of the workforce (approximately 1,500 jobs) in Great Yarmouth, which is slightly lower than the regional average (5.3%) and national average (4.6%).

Table 33 - Overview of estimated employee by jobs by industry sector (2016)

Industry sector	Great Yarmouth	Norfolk	East of England	Great Britain
B: Mining and quarrying	0.9	0.2	0.1	0.2
C : Manufacturing	7.9	9.5	8.0	8.1
D : Electricity, gas, steam and air conditioning supply	0.2	0.1	0.2	0.4
E : Water supply; sewerage, waste management and remediation activities	1.2	0.8	0.7	0.7
F : Construction	3.9	5.3	5.5	4.6
G : Wholesale and retail trade; repair of motor vehicles and motorcycles	15.8	17.3	16.8	15.3
H : Transportation and storage	3.9	3.9	5.1	4.9
I : Accommodation and food service activities	15.8	8.1	6.6	7.5
J : Information and communication	0.8	1.9	3.9	4.2
K : Financial and insurance activities	0.7	3.6	2.4	3.6
L : Real estate activities	0.5	1.3	1.4	1.6
M : Professional, scientific and technical activities	7.9	5.6	8.7	8.6
N : Administrative and support service activities	5.3	8.6	11.3	9.0
O : Public administration and defence; compulsory social security	2.4	4.5	3.5	4.3
P : Education	7.9	8.9	9.1	8.9
Q : Human health and social work activities	21.1	15.0	11.8	13.3
R : Arts, entertainment and recreation	4.6	3.1	2.7	2.5
S : Other service activities	1.3	1.9	2.0	2.1

NOMIS, ONS

Land Uses and Planning Policy

6.9.9. The Agricultural Land Classification map (2011)[58] identifies the Proposed Scheme and the surrounding area as land predominately in urban use. The land uses within the Proposed Scheme boundary comprise a mix of residential properties to the west of River Yare, and industrial/commercial land to the east of River Yare, including South Denes Car and 4x4 Centre, Perenco as well as an industrial storage area. Grade 3 and Grade 4 agricultural land have been identified to the west and to the north of Great Yarmouth (and the Proposed Scheme) respectively. Local businesses and community facilities are also situated within the Site and surrounding area (see Paragraphs 6.9.5, 6.9.13 and 6.9.14).

6.9.10. The area between William Adams Way and Queen Anne's Road is allocated as an Open Amenity Space (REC11) in the Great Yarmouth Borough Council Local Plan (2015). The Proposed Scheme also includes a part of a Safeguarded Employment Area (CS6) to the north of Queen's Anne Road and a Safeguarded Employment Area (CS6) to the east of River Yare. A further Safeguarded Employment Area (CS6) is also located to the south of Southtown Road, albeit this falls outside of the Application Site.

Private Assets

6.9.11. Land within the Application Site and surrounding areas is in a mixture of private and public ownership. Private landholdings are owned by a mixture of companies such as SLA Property Company Limited and Simpsons Garage Limited. There are also residential properties owned by NCC within the site. The public sector land holdings are owned by Highways England, NCC and GYBC.

6.9.12. The Proposed Scheme extent also includes a section of the River Yare used for berthing and as a navigation channel for Port and for leisure vessels. The channel is maintained by the port operator Peel Ports.

Community Facilities

6.9.13. The following community facilities have been identified within 2km of the Proposed Scheme:

- Two secondary schools and six primary schools. The closest being Great Yarmouth Primary Academy, located approximately 600 m east of the Proposed Scheme.
- Seven general practitioners (GP) surgeries with the closest located approximately 1.3 km north of the Proposed Scheme.
- 17 Places of Worship with the closest being located approximately 360 m north-east of the Proposed Scheme.
- Three post offices with the closest being situated just over 1 km north-east of the Proposed Scheme.
- Nine care homes with St Augustine's Place being situated approximately 600 m south of the Proposed Scheme.
- Two fire stations with the closest located approximately 305 m to the north of the proposals (Gorleston Fire Station).
- A range of public food stores and shopping facilities.
- A number of sports facilities, dentists, pharmacies and opticians.

[58] Defra (2017) *MAGIC Interactive Map* [online] http://magic.defra.gov.uk/MagicMap.aspx Accessed March 2017

6.9.14. There are no hospitals located within 2 km of the Proposed Scheme. It should also be noted that there are Roots Mind Allotments and Great Yarmouth and Gorleston Allotment Association Allotments located immediately south of the Proposed Scheme.

6.9.15. Southtown Common Recreation Ground is a key community receptor; it is located to the south of William Adams Way. Allotment gardens are located to the south-west of the recreation ground. Harfrey's Industrial Estate is located directly west of the A47 / Williams Adam Way roundabout, offering a range of shops and also a gym.

Recreational Activities

6.9.16. Within the vicinity of the Site, there is the Southdown Common Recreation Ground, Community Mind Allotments and the allotment gardens to the south-west of the recreation ground. There are no water activity centres within the immediate vicinity of the Proposed Scheme; however the potential for water sports (including canoeing, rowing and kayaking) along the River Yare will be identified through consultation with local groups.

6.9.17. The Great Yarmouth sea front is located approximately 510m to the east of the Proposed Scheme at its closest point. There are numerous recreational attractions along the beach, including Pleasure Beach, a scenic railway and Pleasure Beach Gardens. Pleasure Beach offers family rises and attractions and is located approximately 460 m east of the most eastern extent of the Proposed Scheme.

6.9.18. The Great Yarmouth Open Space Study (Open Space Audits and Local Standards)[59] identified that there is 5.63ha of open space per 1,000 people in the Southtown and Cobholm ward and 4.38ha per 1,000 people in the Nelson ward. Across all wards, the total area of open space per ward ranges from 2.77 ha to 77.93ha. .

6.9.19. In general, the quality of open space in the Borough is very high. The average quality of outdoor sports facilities meets the proposed standard and for most types of sport there is sufficient supply. However, there are local variations and deficiencies in rural areas which were identified in the study. The average amenity greenspace is considered sufficient for the Borough. Sports facilities are considered to be well maintained across the Borough, but issues were identified with the ancillary facilities which require improvements (e.g. changing rooms and floodlighting). Outdoor sports facilities are considered to be accessible with most of the facilities catchment population within 0.5 mile radius, and many are accessible by public transport.

Highway Network and Public Routes

6.9.20. Sustrans Cycle Route 517 is located within the Proposed Scheme and runs alongside Southtown Road and Malthouse Lane, which both join with William Adams Way. There are a number of Public Rights of Way (PRoW) located within the surrounding area, mainly located to the east of the site, around Harfrey's Industrial Estate (see Figure 5). There is also a footway over William Adams Way, which provides access to Southtown Common Recreation Ground.

6.9.21. The main roads in the vicinity of the site includes the A47 which is located immediately west of the Proposed Scheme. The A47 is a key road in Great Yarmouth and connects the area to Norwich and other areas to the west. The A143 is located south of the Proposed Scheme, and links Great Yarmouth with areas in the south-west such as Bury St Edmunds.

Sensitive Receptors

- Economic receptors, i.e. individuals of working age and businesses;

[59] Great Yarmouth Borough Council (2013) Open Speace Study Part 1 Open space Audits and Local Standards [online] Available at https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1237&p=0 (Accessed January 2018)

- Recreational receptors, including terrestrial (e.g. users / visitors to the Southtown Common Recreational Ground) and marine activities (e.g. users of the River Yare);
- Private and public sector landholdings;
- Non-motorised user receptors, including pedestrian and cyclists users of the local PRoW and non-designated public routes; and
- Vehicle user receptors, including drivers along the highway network.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

Insignificant Effects

6.9.22. Whilst limited elements of the construction phase will require the employment of specialist contractors, it is assumed that the majority of the construction workforce will be from the region (east of England) and the resources and skills necessary to construct the Proposed Scheme are available. Given the large majority of workers will reside close to the site it is anticipated that a high proportion of construction workers will continue to reside within their current locations. Therefore, there is unlikely to be a significant increase in workers moving into the local area and associated increased demand for local services (e.g. education, healthcare or community facilities) or on recreational / open space. Therefore, this will not be considered further within the ES.

6.9.23. Given the nature of the Proposed Scheme (i.e. highways infrastructure), there are unlikely to be any significant changes to demands for local services, accommodation and recreational open space during the operation phase. Therefore, this will not be considered further within the ES.

6.9.24. Site security arrangements for the Proposed Scheme will be provided in accordance with the requirements of the Construction (Design and Management) Regulations 2015 and appropriate security (CCTV / security personnel) will be provided on-site. Therefore, effects in relation to crime and perception of crime will not considered further within the ES.

6.9.25. It is anticipated that there will be temporary blockade / partial closure of the roads surrounding the site for health and safety purposes during the construction phase. However, given the location of the site, it is not anticipated that these full or partial closures could cause a significant reduction in footfall for businesses, for example off Queen Anne's Road. Therefore, this will not be considered further within the ES.

6.9.26. Once operational, the Proposed Scheme will not involve changes further in land use, in terms of demolition or refurbishment. Therefore, changes in private and public landholdings during the operational will not be considered in the ES.

6.9.27. Once complete, it is anticipated that the design of the Proposed Scheme will incorporate measures to minimise changes in sediment and hydromorphological changes to the River Yare and the wider Norfolk coast, which could affect off-site recreational resources (e.g. beaches). As such, no significant changes to off-site leisure resources are anticipated from the Proposed Scheme and this will not be considered further as part of the ES.

6.9.28. Effects in relation to quality of surroundings and sense of place will be considered, where appropriate within Cultural Heritage Chapter and Townscape and Visual Chapter.

6.9.29. Effects in relation to health will be considered, as appropriate, within chapters covering Acoustics, Air Quality, Water Environment and Geology and Soils.

6.9.30. The potential for disturbance, disruption and reduction in amenity of residents during construction will be considered in in relation Chapters assessing Acoustics, Air Quality and Townscape and Visual, as appropriate.

Construction Phase

Generation of direct, indirect and induced employment opportunities:

6.9.31. The construction of the Proposed Scheme is likely to generate direct jobs through spend during this phase. In addition, construction phase activities are likely to lead to an increase in spending in the local economy by contractors. This increase in spend can be attributed to the sourcing of local supplies (indirect employment across wider supply chains) and local spend by on-site workers (induced employment) within and outside of their working hours. Therefore, direct, indirect and induced employment opportunities during the construction phase will be considered within the ES.

Loss of private and public land:

6.9.32. It is anticipated that a number of properties will be demolished to accommodate the Proposed Scheme. This includes residential properties and allotment land to the west of the River Yare. To the east of River Yare, the Proposed Scheme will require land that currently owned by South Denes Car and 4x4 Centre, Perenco as well as an industrial storage area. The potential effect of the Proposed Scheme on land use and directly affected businesses will therefore be considered in the ES.

Changes in accessibility for commercial marine activities;

6.9.33. Construction activities within the River Yare, associated with piers and the placement of the bridge, have the potential to affect vessel transport and Port operations. Construction of the new bridge will introduce a new structure within the River Yare which will reduce the width of the existing navigation channel.

6.9.34. The Proposed Scheme will result in the loss of quay spaces.

6.9.35. The Proposed Scheme is likely to result in additional delays to recreational vessels wishing to navigate the River Yare during both construction and operation.

Changes in driver stress and delay:

6.9.36. It is anticipated that temporary road blockages and diversions would be required during the construction of the Proposed Scheme. It is anticipated that these diversions could, temporarily, increase driver stress delay and stress for vehicle receptors. Therefore, potential effects on driver stress during construction will be assessed within the ES.

Changes in accessibility and amenity value of public routes and recreational resources:

6.9.37. It is anticipated that the Proposed Scheme will cause temporary disruption and change in accessibility for public routes and recreational resources (both terrestrial and marine). Changes in accessibility and amenity value of public routes and recreational resources will be considered within the ES.

6.9.38. The Proposed Scheme is likely to result in additional delays to recreational vessels wishing to navigate the River Yare during both construction and operation.

Operational Effects

Increase in economic activity due to improved connectivity:

6.9.39. During operation, the Proposed Scheme would provide a vehicular link across the River Yare, with the current crossing located approximately 1.5 km north of the proposals. Therefore, the Proposed Scheme would link the communities to the west and east of River Yare, which could increase footfall for businesses and generate positive effects on local businesses and the economy. Therefore, an increase in economic activity due to improved connectivity will be considered within the ES.

Changes in accessibility for commercial marine activities;

6.9.40. Once complete, the piers and the placement of the bridge, have the potential to affect vessel transport and Port operations.

Changes in driver stress and delay:

6.9.41. During operation, the Proposed Scheme is anticipated to provide a positive effect on driver stress and delay as the Proposed Scheme aims to improve journey times and reliability by providing an additional river crossing. As such, the potential effects of the Proposed Scheme on driver stress and delay during operation will be considered further within the ES.

Changes in accessibility and the amenity value of public routes and recreational resources:

6.9.42. It is anticipated that the Proposed Scheme will enhance connectivity for public routes and recreational resources (both terrestrial and marine) in the vicinity of the Proposed Scheme. Therefore, changes in accessibility and amenity value of public routes and recreational resources will be considered within the ES.

Potential Effects

6.9.43. Construction Phase:

- Generation of direct employment opportunities;
- Generation of indirect and induced employment opportunities;
- Loss of private and public land;
- Changes in accessibility for commercial marine activities;
- Changes in driver stress and delay;
- Changes in accessibility and the amenity value of public routes and recreational resources.

6.9.44. Operational Effects:

- Increase in economic activity due to improved connectivity;
- Changes in accessibility for commercial marine activities;
- Change in driver delay and stress;
- Changes in accessibility and the amenity value of public routes and recreational resources.

PROPOSED ASSESSMENT METHODOLOGY

Investigations

6.9.45. A more detailed desktop review will be undertaken in order to build on the baseline section of this Chapter. The review will cover the following sources::

- Office of National Census data (2015);
- NOMIS[57]
- Indices of Multiple Deprivation;

- Norfolk County Council definitive map;
- MAGIC[58];
- OS maps; and
- NCC and GYBC reports, such as the Open Space Study[59].

6.9.46. A site visit will also be undertaken to gain a better understanding of the baseline conditions, in particular the existing amenity value of the Site.

6.9.47. Where appropriate information from other studies, such as Non-Motorised User Context and Audit reports, Economic Impact Report and Vessel Simulation Modelling, will be used to inform the baseline and assessment of likely significant environmental effects.

6.9.48. Each effect will have a specific study area proportionate and appropriate to the anticipated geographic area of change. The anticipated study areas are indicated below, but these will be defined and developed further as part of the ES.

Consultation

6.9.49. Consultation will be undertaken with the relevant officers at NCC to discuss the detailed scope and methodology for the assessment of the Proposed Scheme. Local businesses, community organisations and recreational organisations will also be consulted to gain a greater understanding of the baseline conditions and the approach and methodology for the assessment.

Generation of direct, indirect and induced employment opportunities

6.9.50. The assessment of likely significant effects relating to employment opportunities during construction phase will use publicly available sources (i.e. Census 2011 and NOMIS). At this stage, it is considered that the local level study area will comprise Great Yarmouth and the regional level study area will comprise Norfolk.

6.9.51. In order to estimate the number of jobs that would be created during the construction phase, the total cost of the Proposed Scheme will be divided by the average output per year for construction workers in the area. These figures will be evaluated against the total number of employees in Industry Sector F (Construction) within the local and regional level study areas to determine the magnitude of change. This figure will be offset against the number of jobs that might be lost / displaced as a consequence of the need to relocate any affected businesses (albeit such jobs may be in a different sector).

6.9.52. The generation of indirect and induced employment opportunities associated with the construction phase of the Proposed Scheme will be calculated using a multiplier that is based on the anticipated linkages associated with the Proposed Scheme (i.e. 1.5 based on the multipliers set out in the Additionality Guide). As it will not be possible to isolate the Industry Sector where the impact may occur, the figures will be evaluated against the total number of employees in all Industry Sectors within the local and regional levels to determine the magnitude of change.

Loss of private and public land

6.9.53. The assessment for the construction and operation phases will be undertaken in accordance with the principles set out in the DMRB, Volume 11, Section 2, Part 6 'Land Use[60].'

[60] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 6 Land Use, former Highways Agency, August 2001

6.9.54. The assessment will focus on the importance of the land (i.e. whether it is imperative to a business operation), the availability of alternative land within the vicinity and proportion of the land-take as an overall of each land holding.

6.9.55. The study area used for the assessment will be the land within and immediately adjacent to the Site itself.

Changes in accessibility for commercial marine activities

6.9.56. A qualitative assessment of effects related to change in access for commercial marine activities will be undertaken for the construction and operational phases. This will focus on the potential disruption to operations within the River Yare and Port operations. The assessment will draw upon the vessel simulation modelling, which will allow a virtual navigation of a vessel through the River Yare to test how the Proposed Scheme interacts with Port operations.

6.9.57. The study area used for the assessment will be determined through the vessel simulation modelling.

Change in driver delay and stress

6.9.58. The assessment will be in accordance with DMRB, Volume 11, Section 3, Part 9 'Vehicle Travellers[61]' and will consider changes in driver delay and stress. The qualitative assessment during the construction and operation phases will be focussed on the anticipated delay (in terms of time) for vehicle receptors to travel through the study area, which will comprise roads within and immediately surrounding the Site.

6.9.59. Changes in driver stress, defined as the adverse mental and physiological effects experienced by a vehicle traveller traversing a road network, will also be considered. The qualitative assessment during the construction and operation phases will take into account the road layout, junction frequency, speed and flow per lane.

Changes to accessibility and amenity value of public routes and recreational resources

6.9.60. The assessment of changes to accessibility and amenity value of public routes and recreational routes will be undertaken in accordance with DMRB Volume 11, Section 3, Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects' and IAN 195/16 'Cycle Traffic and the Strategic Road Network'[62].

6.9.61. The qualitative assessment of changes to accessibility will focus on disruption to routes due to construction activities / vehicles and increases in journey length / decrease of the route /recreational resource. During the operational phase, the assessment will evaluate changes to the availability of routes and access to the recreational resource within the immediate area of the Site.

6.9.62. The DMRB defines amenity value as the relative 'pleasantness' of an experience and notes a number of factors which contribute to this, including receptor's exposure to traffic – noise, dirt and air quality – and the effect of the Proposed Scheme itself. Noise, dirt and air quality will be dealt with elsewhere in the ES, and therefore will not be considered as part of this assessment.

6.9.63. The qualitative assessment of amenity value will focus on changes to fear / safety associated within the below:

- The current condition of the route / recreational resource (e.g. width of route etc.);

[61] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 9 Vehicle Travellers, former Highways Agency, June 1993

[62] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects, former Highways Agency, June 1993

- Distance of the route / recreational resource from the works / the Proposed Scheme;
- The presence of any barriers between the users of the route / recreational resource and associated plant / traffic; and
- Changes to other conditions required for recreational activities (e.g. flow rate of the River Yare).

Increase in economic activity due to improved connectivity

6.9.64. A qualitative assessment of effects related to an increase in economic activity due to greater connectivity will be based on the implementation of the Proposed Scheme. The assessment will consider the potential effects on enhanced access for local businesses and industrial estates (including Harfrey's Industrial Estate) and reduction in journey times / delay. This will take into account the Economic Impact Report prepared for the Proposed Scheme.

ASSUMPTIONS AND LIMITATIONS

6.9.65. The assessment will rely upon the use of secondary data within calculations and assumptions to generate an understanding of the likely significant effects resulting from the Proposed Scheme. As such, there are limitations associated with the secondary data applied in each case.

6.9.66. No user counts / surveys of the local routes will be undertaken as part of the Peoples and Communities assessment. However, where appropriate, information from the Non-Motorised User Context and Audit reports will be used to inform the assessment of effects.

6.10 HEALTH

BASELINE CONDITIONS

6.10.1. This section sets out baseline conditions in relation to health, comprising sensitive receptors, local population and facilities information, and indicators of the status of the local health profile.

Study Area

6.10.2. The study area for the health baseline will be within the districts of Nelson, Southtown and Cobholm and Claydon. The area considered for potential direct impacts on health will be based on a 500m radius from the Proposed Scheme red line boundary.

6.10.3. The study area for the assessment of health will also need to take into account other topic assessments which have health-related impacts and the outcome of consultation with local health stakeholders.

Baseline Health Profile

6.10.4. The Public Health England (PHE) Health Profiles[63] for each local authority area compare the indicators of a number of population health statistics for each area with the national average. The information for Great Yarmouth is listed below.

Population Health:

6.10.5. The PHE profile indicates that excess weight in children and adults are both slightly higher than the national average. Life expectancy at birth for both male and female are slightly lower than the national average. Mortality rates for under 75 year olds from cardiovascular diseases and cancer are both higher than the national average. The PHE data therefore indicates that the population health within the study area is worse than the national average.

Table 34 - Indicators of Population Health for Great Yarmouth Compared with England

Indicator	Period	Great Yarmouth	England Value
Obese children (Year 6)	2015-16	20.8	19.8
Excess Weight in Adults	2015-16	66.2	61.3
Life Expectancy at birth – Males	2013-15	78.2	79.5
Life Expectancy at birth – Females	2013-15	82.4	83.1
Under 75 Mortality: Cardiovascular	2011-15	79.6	73.5
Under 75 Mortality: Cancer	2011-15	154.8	136.8

[63] Public Health England (2017) Great Yarmouth District Health Profile 2017 [online] Available at http://fingertipsreports.phe.org.uk/health-profiles/2017/e07000145.pdf Accessed January 2018

Health Inequality:

6.10.6. The profile indicates that the difference in life expectancy between the most and least deprived areas is high. If there was no inequality in life expectancy, the difference would be zero. The PHE data therefore indicates that there is health inequality in Great Yarmouth.

Table 35 - Difference in life expectancy in Great Yarmouth between most and least deprived areas 2013

Indicator	Male	Female
Life expectancy gap between most and least deprived areas	9.1 years	7.0 years

Deprivation:

6.10.7. The profile indicates that deprivation for the study area is higher compared to the national average. The PHE health profile data indicates that Nelson, Southtown and Cobholm and Claydon are more deprived areas than the national average.

Table 36 - Indicator of Deprivation for the Study Area Compared with England

Indicator	Period	Nelson	Southtown & Cobholm	Claydon	Great Yarmouth	England Value
Deprivation (Index of Multiple Deprivation)	2015	71.9	45	41.3	32.4	21.8

Lifestyle:

6.10.8. The profile indicates that smoking prevalence in Great Yarmouth is slightly higher than the national average. The percentage of physically active adults is lower in Great Yarmouth in comparison to the national average. The PHE data therefore indicates that the adult population in Great Yarmouth has a worse approach to lifestyle behaviour when compared to the national average.

Table 37 - Indicators of Lifestyle for Adults in Great Yarmouth Compared with England

Indicator	Period	Great Yarmouth	England Value
Smoking Prevalence in Adults	2016	15.7	15.5
Percentage of Physically Active Adults	2015-16	56.9	64.9

Children:

6.10.9. The proportion of children in low income families in Great Yarmouth is higher than the national average. The incidence of obesity amongst children in Great Yarmouth is slightly higher than the national average. The GCSEs achieved in Great Yarmouth are lower than the national average. The PHE health data therefore indicates that the level of health and education of children in Great Yarmouth is lower than the national average.

Table 38 - Indicators of Childhood Health in Great Yarmouth Compared with England

Indicator	Period	Great Yarmouth	England Value
Children in Low Income Families (under 16s)	2014	25.8	20.1
Obese Children (Year 6)	2015/16	20.8	19.8
GCSEs Achieved	2015/16	48.7	57.8

Collisions Risk:

6.10.10. The population of Great Yarmouth appears to experience a lower number of fatalities or instances of being seriously injured on roads than the national average. The PHE data therefore indicates that roads in Great Yarmouth are safer than the national average.

Table 39 - Indicator of Collision Risk in Great Yarmouth Compared with England

Indicator	Period	Great Yarmouth	England Value
Killed and Seriously Injured on Roads	2013-2015	30.9	38.5

Receptors

6.10.11. Receptors for potential health effects include:

- 893 residential properties;
- River Yare;
- Great Yarmouth Primary Academy;
- Frank Stone Court (Nursing home);
- Avery Lodge (Nursing home);
- Southtown Common Recreation Ground;
- Pleasure Beach;
- Footpath No.5 in Parish of Great Yarmouth and Gorleston;
- National Cycle Network 517;
- England Coast Path Stretch 2;
- Norfolk Coast Path;
- Peggotty Road Community Centre; and
- The Redeemed Christian Church of God.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.10.12. A number of potential construction impacts which may have adverse impacts on health were identified:

- Temporary impacts relating to dust and construction noise;
- Potential temporary closures or diversions of PRoW may affect different populations disproportionately or in different ways. For example, population from lower incomes will be more likely to walk to and from their destinations, making them more sensitive to changes in these routes;
- Potential temporary closures or diversions of roads and bus route may affect different populations disproportionately or in different ways. For example, older people, people with disabilities, pregnant women and families with young children will be more likely to travel through vehicles and public transport, making them more sensitive to changes in these routes. Furthermore, two fire stations are located within the 500m

study area and are likely to affect by route diversion, make fire rescue services more sensitive to changes in these routes due to increase journey time; and

- Potential temporary closures or diversions of cycle route may affect cyclist adversely due to increase journey time.

- Indirect effects from transportation and storage of materials and waste.

6.10.13. However, these impacts would be managed through standard environmental and traffic management practices during construction. They are unlikely to be significant. Furthermore, construction impacts are also addressed in relation to People & Communities, Air Quality and Noise assessments in this Scoping Report.

6.10.14. During operation, a number of potentially positive impacts on health were identified. These include increased connectivity; mobility; encourage walking and cycling; reduce and minimise road injuries; provide access to public transport, health care, social facilities and for people with mobility problems or a disability; improve access to natural and open spaces; provide access to local employment and training opportunities; and incorporate sustainable urban drainage techniques.

6.10.15. Although no negative effects were identified, there were a number of uncertain impacts which could result in negative effects on health. These comprise:

- Community severance – although communities will be better connected by provision of an additional bridge, the demolition of residences can affect people through stress, relocation and then potential loss of their local community networks;

- Air quality impacts from road traffic;

- Loss of local biodiversity;

- Increase in crime depending on design

PROPOSED ASSESSMENT METHODOLOGY

6.10.16. An initial health screening and scoping assessment was completed using the London Healthy Urban Development Unit (HUDU) screening tool[64] (Appendix F.1). This was undertaken so that the potential health effects could be identified and considered early on in project development. The exercise identifies potentially affected populations, including vulnerable groups, in addition to aspects of the project which may give rise to effects on health. Where there is potential for effects on health, issues to be considered during scoping and subsequent assessment are also identified.

6.10.17. Appendix H shows the results of the screening and scoping exercise.

6.10.18. A number of potentially vulnerable groups were identified:

- Gender (include pregnancy & maternity), pregnant women and those with young families would be temporarily adversely affected due to the restricted access and public transport;

[64] London Healthy Urban Development Unit (2017) Rapid Health Impact Assessment Tool Third Edition [online] Available at: https://www.healthyurbandevelopment.nhs.uk/wp-content/uploads/2017/05/HUDU-Rapid-HIA-Tool-3rd-edition-April-2017.pdf Accessed January 2018

- Religion & Belief, the Proposed Scheme may potentially anticipate a temporary adverse air quality and noise impact on users of the church during construction due to the close proximity of the church to the Proposed Scheme;
- Children and Young People (Age 0-19), potential temporary adverse air quality and noise impacts are anticipated during construction due to the close proximity of a primary school to the Proposed Scheme;
- Older People (Age 50+), would be temporary adversely affected due to the restricted access;
- Disability, would be temporarily adversely affected due to the restricted access and public transport; and
- Public Services, a potential temporary adverse impact is anticipated due to the increase journey time for fire rescue services.

6.10.19. Potential effects on health arising from air quality and noise would be covered under these respective sections of this report. The People and Communities assessment will also cover potential impacts on community severance, loss of property, economic benefits and community facilities. Impacts on landscape and nature conservation are unlikely to affect health given the existing urban nature of the environment and retention of open space. It is therefore proposed that a stand-alone health chapter is scoped out of the EIA as potential impacts are either positive, unlikely to be significant or are already being assessed within other Environmental Topic Chapters.

6.11 MATERIALS

6.11.1. This section considers the implications of the Proposed Scheme on the consumption of materials resources (which includes recovered site arisings), and the generation and disposal of waste. It sets out the proposed methodology and identifies those impacts that can be scoped out of the EIA.

6.11.2. The assessment methodology proposed in this assessment is based on guidance set out in IAN 153/11 (Highways Agency, 2011) Environmental Assessment of Material Resources[65]. IAN153/11[66] sets out the process and information required for the assessment of significant effects from material resources and waste.

6.11.3. Materials resources are defined in IAN 153/11 as "the materials and construction products required for the construction, improvement and maintenance of the road network. Materials resources include primary raw materials such as aggregates and minerals, and manufactured construction products. Many material resources will originate off site, purchased as construction products, and some will arise on site such as excavated soils or recycled road planings".

6.11.4. IAN 153/11 does not include a definition of waste, however the EU Waste Framework Directive[67] defines it as "any substance or object that the holder discards or intends or is required to discard".

BASELINE CONDITIONS

6.11.5. The primary study area comprises the Application Site boundary, as shown in Drawing 62240375-GYTRC-Scoping Report Boundary-20180219, which is presented in Appendix B.

6.11.6. The secondary study area extends to the availability of construction and recovered material resources within the East of England (Hertfordshire, Bedfordshire, Cambridgeshire, Essex, Norfolk and Suffolk) and the UK, and the capacity of waste management facilities in the East of England.

6.11.7. The operation and maintenance of the current infrastructural assets owned by NCC (highways, parking areas, lighting, pavements and kerbing – for example) within the boundary of the Proposed Scheme will require the consumption of some material resources, and will generate arisings that may need to be disposed of as waste.

6.11.8. Sections 6.11.9 to 6.11.29 describe baseline material consumption and waste disposal for these current assets, and provide a regional / national information and data in the context of which subsequent environmental impact assessment will be undertaken.

Material Resources

Materials currently required

6.11.9. The operation and maintenance of the current infrastructural assets within the Proposed Scheme boundary are likely to require a small number of specialist components (for example, light bulbs, signage steelwork, kerbstones) as well as some bulk products (asphalt for minor re-surfacing) for routine works and repairs.

6.11.10. The current consumption of construction and other material resources within the Site is, however, deemed negligible.

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[65] Highways Agency (2011) Interim Advice Note (IAN) 153/11 – Guidance on the Environmental Assessment of Material Resources [Link]

[66] Interim Advice Note (IAN) 153/11 (2011) Guidance on the Environmental Assessment of Material Resources, Volume 11 [online] available at: http://www.standardsforhighways.co.uk/ians/pdfs/ian153.pdf (Accessed November 2017).

[67] The EU Waste Framework Directive, European Directive 2006/12/EC, as amended by Directive 2008/98/EC. [Link]

6.11.11. The do-minimum option (no scheme pursued) is not expected to change the current consumption of material resources within the Proposed Scheme Footprint.

UK and regional perspective: availability of construction materials

Table 40 provides a summary of the availability of the main construction materials in the East of England and the UK, as required to deliver typical highways and bridge schemes. The overview provides a context in which the assessment of impacts and significant effects from material consumption on the Proposed Scheme can be undertaken.

Table 40 - Construction materials available in the East of England and the UK

Material type		Availability (2015 data unless otherwise stated)	
		East of England	UK
Aggregate	Sand and gravel *	11.6Mt	58.1Mt (to Q3 2015)
	Permitted crushed rock *	456,000t (2016)	98.5Mt
Recycled and secondary aggregate (as part of 'Aggregate', above) *		(not available)	63Mt
Ready-mix concrete +		1.4Mm3	25.2Mm3
Asphalt *		2.3Mt	26.3Mt
Concrete blocks #		(confidential)	72.9Mm3
Steel +		(not available)	11Mt
# stocks + production * sales			

6.11.12. Currently, data for the East of England regarding materials typically required for highways and bridge construction, are incomplete; accordingly, a full picture of resource availability in the region cannot be obtained.

6.11.13. However, the availability of all construction materials in the UK indicates that stocks / production / sales remain buoyant. Using UK data as a proxy, in combination with information that is available for the East of England, the sensitivity of materials availability for the Proposed Scheme is assessed to be low.

Site Arisings

Site Arisings Currently Generated:

6.11.14. Current routine operation and maintenance works on current infrastructural assets within the Proposed Scheme boundary (roads, roundabouts, junctions) are likely to generate negligible volumes of site arisings.

6.11.15. The do-minimum option (no scheme pursued) is not expected to change the volume or type of site arisings generated within the footprint of the Proposed Scheme.

National and Regional Perspective: Transfer, Recovery and Recycling:

6.11.16. Defra data (Table 40) shows that within England, the recovery rate for non-hazardous construction and demolition arisings has remained above 90% since 2010. This exceeds the EU target of 70%, which the UK must meet by 2020.

6.11.17. No regional data for construction, demolition and excavation production or recovery rates are currently available for the East of England.

Table 41 - Non-hazardous construction and demolition arisings and recovery in England

Year	Generation (Mt)	Recovery (Mt)	Recovery rate (%)
2010	43.9	39.7	90.5%
2011	44.1	39.9	90.6%
2012	45.3	41.3	91.1%
2013	46.3	42.1	91.1%
2014	49.1	44.9	91.4%

6.11.18. Figure 7 shows that rates of material transfer (non-civic), recovery and metal recycling within the East of England continue to rise steadily. Since 2011, rates for material recovery have increased notably. Data provided include all waste types in the region and hence will include, but are not specific to, construction, demolition and excavation arisings.

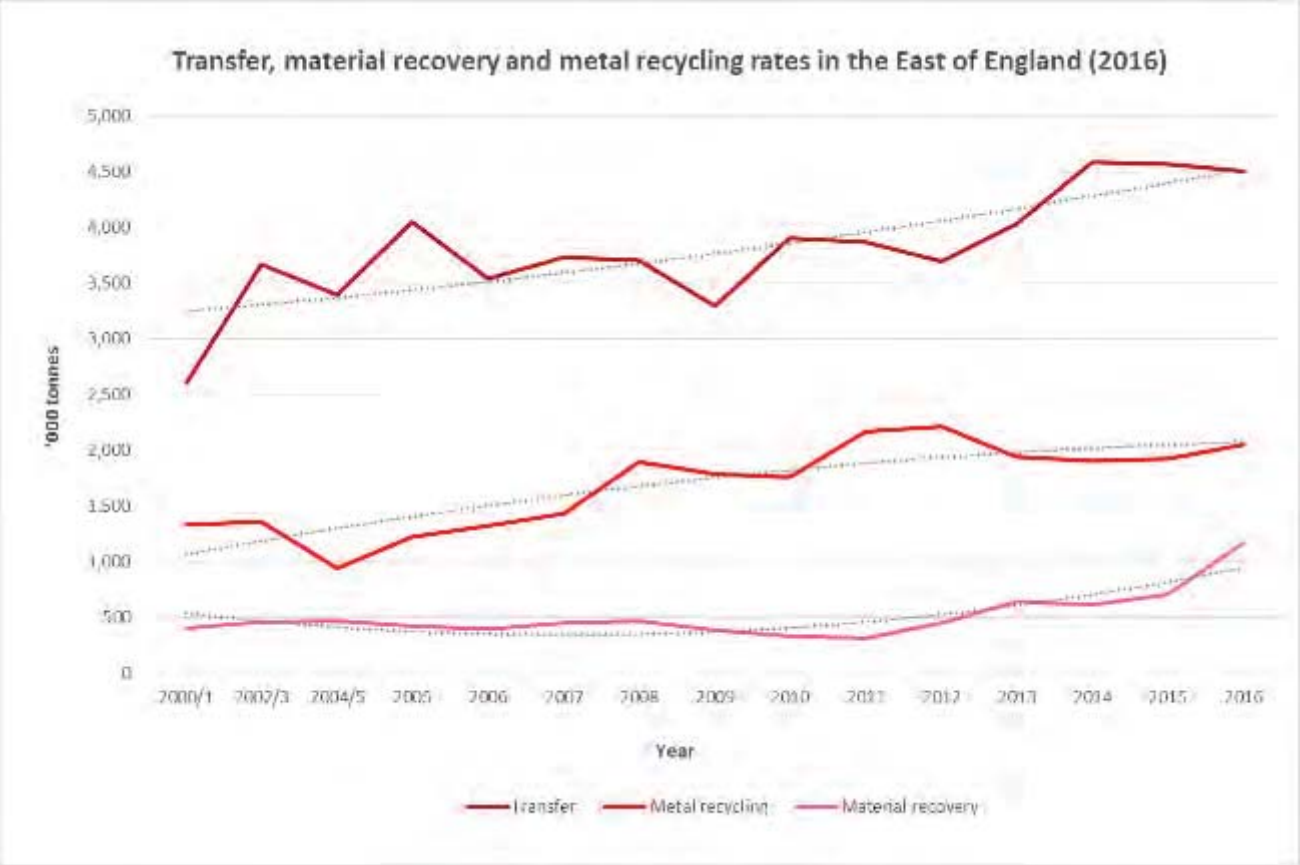

Figure 7 – Transfer, material recovery and metal recycling in the North East of England

6.11.19. Available data demonstrate that the upward trends for transfer, recovery and metal recycling within the East of England remain consistent. Data indicate that there is likely to be regional infrastructure and capacity for the transfer and recovery for construction, demolition and excavation arisings from the Proposed Scheme. Construction and demolition recovery trends across England (Table 36) demonstrate further capacity in this context.

6.11.20. The availability of materials recovery infrastructure in the East, and across England, suggests that there is strong potential to divert from landfill site arisings generated by the Proposed Scheme. Both the importance (positive value) of this infrastructure, and (hence) the potential to maximise the re-use / recycling value of site arisings, are assessed to be high.

Waste Generation and Disposal

Waste currently generated and disposed of:

6.11.21. The operation and maintenance of the infrastructural assets currently within the Proposed Scheme boundary are likely to generate small volumes of waste from routine highway maintenance, in combination with littering, light replacement, signage replacement, and replacement of reflective road studs (cats' eyes). The anticipated effects of disposing of this waste are deemed negligible in the context of available regional capacity.

Regional perspective: remaining landfill capacity:

6.11.22. At the end of 2016, the East of England had 45 active landfill sites with 58.2Mm^3 of remaining capacity. Table 42 summarises the Environment Agency data relating to these landfill types.

Table 42 - Landfill capacity in the East of England (2016)

Landfill type		Number of sites	Remaining capacity (M m3, end of 2016)
Inert		22	36.0
Non-hazardous	Non Hazardous	19	28.6
	Non Hazardous with Stable Non-Reactive Hazardous Waste Cell	4	6.5
Hazardous		0	0.0
Total remaining capacity		45	71.1

6.11.23. Environment Agency data confirm that at the end of 2016, remaining landfill capacity in the East of England was: 36.0Mm^3 for inert (up 16.4Mt from 2015) and 35.1Mm^3 for non-hazardous (3Mt down from 2015). No regional remaining capacity for hazardous waste was recorded.

6.11.24. Using the most up to date information available, trends for baseline regional landfill capacity are detailed in Figure 8 overleaf.

6.11.25. Due to the fact that a significant increase in inert landfill site capacity was recorded in 2016 for the East of England region (16.4Mt or 84%), incorporating forecasting data and trend lines for remaining void space to the first year of operation, has not been possible for this waste type.

6.11.26. Simple forecasting calculations (using the MSExcel forecast function) shows that non-hazardous landfill capacity may (in the absence of future provision) decrease as much as 56% by 2023/24 (the first year of scheme operation).

6.11.27. No new capacity for hazardous waste (currently absent) is expected in the region.

6.11.28. Individually, the sensitivity of different landfill capacity types is assessed to be inert (negligible), non-hazardous (high) and total (low). On average, the sensitivity of landfill capacity is assessed to be medium.

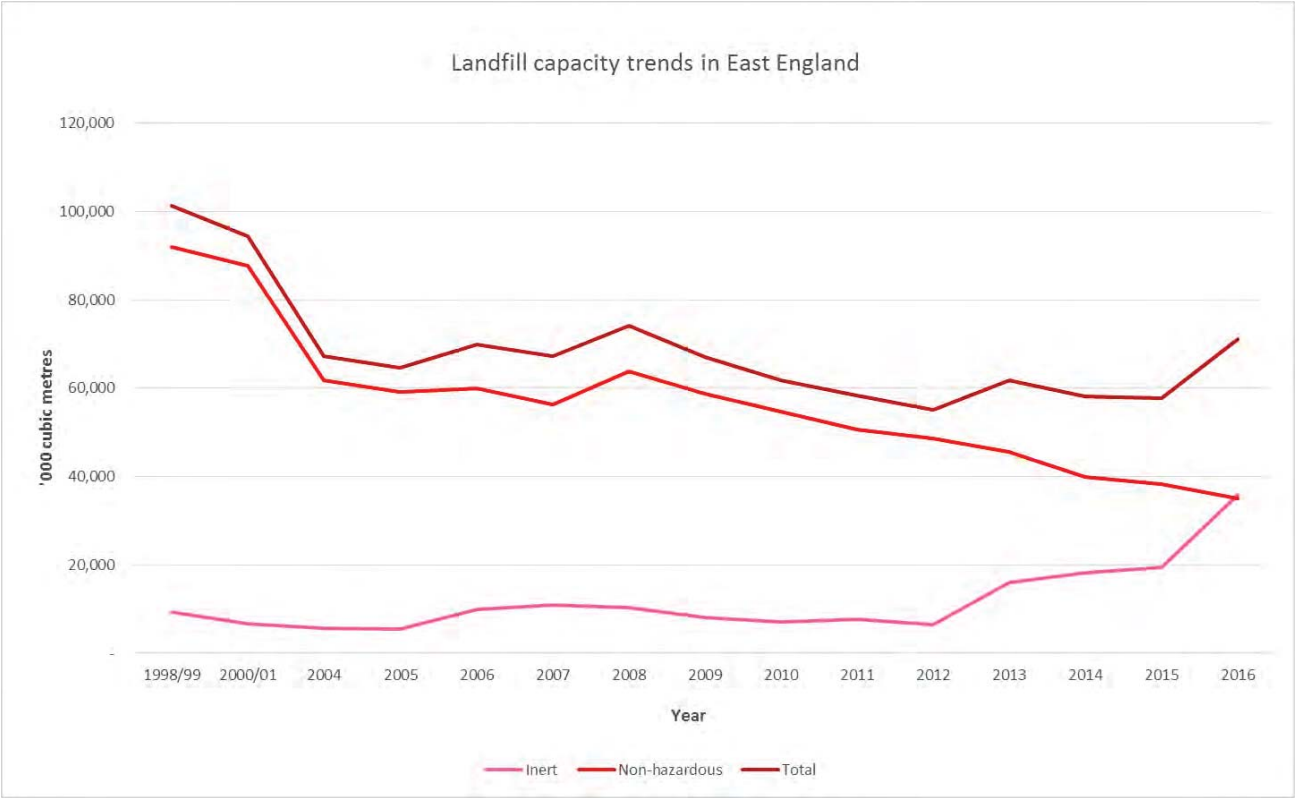

Figure 8 - East of England Remaining Landfill Capacity (2000/1-2016)

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.11.29. The Proposed Scheme has the potential to consume material resources (including those recovered from site arisings), and produce and dispose of waste, during the demolition, site preparation and construction phases of delivery.

6.11.30. The associated potential environmental impacts (both direct and indirect) will occur during these lifecycle phases. Impacts arising further into the operational lifecycle are expected to be negligible, and hence (as described in Table 43) have been scoped out of this assessment.

6.11.31. The effects associated with the described impacts include those associated with the production, processing, consumption and disposal of material resources. These effects are likely to occur on-site, off-site within the UK and, potentially, internationally.

6.11.32. It is important to note that direct and indirect impacts and effects as a result of the transportation of material resources and waste to and from site, will not be assessed within the Material Resources chapter. Instead, they will be considered in the Air Quality, People and Communities, Noise, Water & Drainage, and Climate chapters, as appropriate to these specialist topics. Similarly, issues concerning land contamination and resource sterilisation will be assessed within the Geology & Soils chapter.

6.11.33. In response to the requirements set out in IAN 153/11 (paragraph 3.2.1 of the guidance), a summary of the potential for material resource consumption and waste generation and disposal to generate significant environmental effects, is provided in Table 43. Where appropriate, the potential influence of recovering and reusing/recycling site arisings is also included within Table 43.

Table 43 - Potential impacts and significant effects of consuming material resources and disposing of waste

Element	Use of materials resources	Production and disposal of waste
Demolition	No potential significant effects identified with regards to the consumption of material resources during demolition.	▪ Waste in this phase of the works would be produced during the demolition (on the west side of the River Yare) of residential buildings and associated assets on Queen Anne's Road and Southampton Road, and during the demolition of a large non-residential building (warehouse) adjacent to Cromwell Court. ▪ Demolition waste would also be generated in the breaking out of highways and junctions on (particularly) Queen's Anne Road and Suffolk Road to the west of the River Yare, and in works required on the east of the river to a non-residential property (a warehouse and concreted external area). Wastes generated during demolition are likely to include: ▪ brick, mortar, concrete, steel, timber, tiles and glass; ▪ broken out concrete, cut steel and road surface planings; ▪ hazardous or contaminated material found on or beneath the Proposed Scheme; and ▪ other demolition wastes. ▪ As far as possible, it would be expected that arisings from demolition would be reused and / or recycled on or off site, with beneficial effect. Where diverting site arisings from landfill is not possible, the impacts associated with disposing of waste would be adverse, permanent and direct. ▪ The potential for significant effects from waste disposal is associated with the commensurate reduction in landfill capacity, and any indirect effects that result (greenhouse gas emissions, water consumption, water pollution – among others). Landfill capacity is increasingly considered a sensitive receptor in the UK. ▪ The demolition of buildings, highways and associated assets is likely to result in a considerable volume of arisings, a proportion of which (after the potential for reuse and recycling has been maximised) may need to be disposed of.

Element	Use of materials resources	Production and disposal of waste
		▪ Where demolition waste needs to be disposed of, and in combination with other the on-site phases, there is potential for significant adverse effects.
Site remediation and preparation	▪ Timber and steel products will required for the erection of perimeter fencing and temporary barriers as part of the site preparation phase. ▪ It is also expected that material resources (concrete, steel, formwork, other) will be required during the stabilisation, laying out and making safe of areas adjacent to the River Yare, ready for construction of the new river embankments, retaining walls and bridge. ▪ Temporary stockpile and construction areas may also be required, and could necessitate the consumption of aggregate and stone for ground improvements prior to use by heavy plant and equipment. ▪ Impacts associated with material resource consumption at this stage are likely to be adverse, permanent and direct. ▪ In combination with other lifecycle stages (particularly construction of the Proposed Scheme), there is potential to generate significant adverse effects from material resource consumption during site remediation and preparation.	Wastes likely to be generated during site preparation include: ▪ vegetation and other above ground materials produced by site clearance; ▪ paving, kerbing, bitumen and sub-base material; ▪ surplus non-highway subsoil material; ▪ hazardous or contaminated material found on or beneath the Proposed Scheme. ▪ The presence or extent of any hazardous or contaminated substances is currently unknown, but will be informed by Ground Investigation. ▪ There is potential for considerable waste to be produced and disposed of during site preparation works; associated impacts would be adverse, permanent and direct. Some impacts could be precluded where arisings e.g. subsoil and kerbing, can be diverted from landfill. ▪ Where waste from site remediation and preparation does need to be disposed of, there is potential for significant adverse effects.
Proposed Scheme construction	▪ Material resources will be required for the construction of the Proposed Scheme, including (but not limited to): local road realignment and development, alterations to roundabouts and junctions, the construction of the new embankments and retaining walls (7m) on either side of the River Yare, and the construction of the double leaf trunnion bridge. Construction materials required are anticipated to include: ▪ Bulk materials for earthworks (volumes will be dependent on the cut and fill balance); ▪ Road and pedestrian paving and kerbing materials, including sub-base and bituminous materials;	▪ Waste is anticipated to be generated during the construction of the Proposed Scheme, particularly during the construction of new roads, roundabouts and junctions, and in the digging out and construction of the new river embankments. It is anticipated that the following wastes would be generated: ▪ Timber and steel from formwork and fencing; ▪ Concrete, bricks, aggregate and steel waste; ▪ Road paving materials including sub-base and bituminous materials; ▪ Hazardous or contaminated material found or generated on site;

Element	Use of materials resources	Production and disposal of waste
	▪ Steel for bridge structures and sheet piling; ▪ Concrete including for pre-cast and prefabricated elements, especially for the new embankments, retaining walls and bridge structure; ▪ Bricks, sand and aggregate; ▪ Timber and steel for fencing and formwork; ▪ New street furniture, signage and lighting; ▪ Cabling; and ▪ Other general construction materials. ▪ The volumes of material resources required for the Proposed Scheme will be ascertained during environmental impact assessment. Volumes of bulk earthworks, road paving, steel, concrete and aggregate are expected to be significant. The main impacts as a result of the use of materials are the consumption of natural resources. Impacts would be considered adverse, direct and permanent, and would result in the following effects: ▪ depletion of natural resources and local / regional stocks; and ▪ degradation of the natural environment. ▪ Based on the scale and nature of the works it is anticipated that the consumption of material resources has the potential to have significant adverse effects.	▪ Surplus cabling; ▪ Redundant street furniture, signage and lighting; ▪ General construction waste e.g. packaging, ducting, damaged goods. ▪ The volumes of waste likely to be generated and disposed of as result of the Proposed Scheme will be identified and assessed during environmental impact assessment. ▪ Impacts as a result of waste generation would be adverse and direct, and are generally accepted to be permanent in nature. The resultant adverse effects would be a reduction in landfill void capacity, and any indirect effects that result (greenhouse gas emissions, water consumption, water pollution – among others). ▪ It is expected that a programme commitment to reuse or recycle site arisings will be established – making use of these resources either within, or outside, the Proposed Scheme boundary. Where this is not possible, disposal is likely to be required. ▪ Based on the scale and nature of the works, it is anticipated that there is potential for significance adverse effects from the generation and disposal of waste.
Operation and maintenance of asset	In the first year of operation, minor amendments and changes to the Proposed Scheme assets may be required. Depending on the extent of these changes, the potential to consume material resources (including recovered site arisings), and produce and dispose of waste may be required. Where these changes can be forecast for the first year of operation, they will be included in the environmental impact assessment. The extent of changes within the first year of operation is not currently known, but professional judgement would indicate that there are unlikely to be significant effects. Similarly, and beyond the first year of operation, it is predicted that there will no significant effects. This element has therefore been scoped out of the assessment.	

Design Mitigation/Enhancement

6.11.34. Specific design, mitigation and enhancement measures to avoid and mitigate adverse impacts from materials consumption and the generation and disposal of waste, and to encourage beneficial outcomes from the recovery and reuse of site arisings, may include those set out in Table 44.

6.11.35. Measures that have been (or will be) adopted, will be identified during subsequent assessment stages.

Table 44 - Potential design, mitigation and enhancement measures

Element	Enhancement and mitigation measures	Application lifecycle stage	Monitoring
Material resources	Identification and specification of materials that can be acquired responsibly, in accordance with BES 6001 Responsible Sourcing of Construction Products.68	Design, construction	Incorporate on engineering plans configurations and layouts that show how the most effective use of materials can be achieved. Maintain records of materials that were acquired in accordance with BES 6001 Responsible Sourcing of Construction Products.
	Design for resource optimisation: simplifying layout and form, using standard sizes, balancing cut and fill, maximising the use of renewable materials, and materials with recycled or secondary content, and setting net importation as a Proposed Scheme goal.	Design	
	Design for off-site construction: maximising the use of pre-fabricated structures and components, encouraging a process of assembly rather than construction	Design	
	Design for the future: considering how materials can be designed to be more easily adapted over an asset lifetime, and how deconstructability and demountability of elements can be maximised decommissioning/ at end-of-first-life.	Design	
Site arisings	Design for recovery and reuse: identifying, securing and using materials at their highest value, whether they already exist on site, or are sourced from other schemes.	Design	Incorporate on engineering plans configurations and layouts that show how the most effective use of site arisings can be achieved. Implement a regime of comparing and contrasting data on site arisings in a Design Site Waste Management Plan (forecast), with construction data (actuals)
	Identify opportunities to minimise the export and import of materials.	Design, construction	
	Working to a proximity principle, ensuring arisings generated are handled, stored, managed and re-used or recycled as close as possible to the point of origin.	Design, construction	
	Identify areas for stockpiling and storing arisings that will minimise quality degradation and leachate, and will minimise damage and loss.	Design, construction	

[68] British Research Establishment (BRE) BES 6001 The Framework Standard for Responsible Sourcing of Construction Products (Version 3.1 2014) [link]

Element	Enhancement and mitigation measures	Application lifecycle stage	Monitoring
	Ensure potential arisings and waste are properly characterised before or during design, to maximise the potential for highest value reuse.	Design	
	Capture information and data on site arisings recovered and diverted from landfill, by developing a Design Site Waste Management Plan once a preferred option has been selected.	Design	
	Implement a Materials Management Plan in accordance with the CL:AIRE 69 Definition of Waste: Code of Practice.	Construction	
Waste to landfill	Engage early with contractors to identify possible enhancement and mitigation measures, and to identify opportunities to reduce waste through collaboration and regional synergies.	Design, Procurement	Implement a regime of comparing and contrasting data on waste in a Design Site Waste Management Plan (forecast), with construction data (actuals) Ensure all legal documentation (waste carrier registration, landfill licence, waste transfer documentation) associated with the management of construction and operational materials, site arisings and waste is recorded and retained.
	Capture information and data on waste sent to landfill, by developing a Design Site Waste Management Plan once a preferred option has been selected.	Design	

Residual Effects

6.11.36. It is anticipated that, with the implementation of effective mitigation measures, including designing out waste, and implementing a Construction Environmental Management Plan (CEMP), Site Waste Management Plan (SWMP) and Materials Management Plan (MMP) on site, that there would be no significant residual effects associated with material resources.

6.11.37. This assertion will be tested fully as part of the Proposed Scheme environmental impact assessment.

PROPOSED ASSESSMENT METHODOLOGY

6.11.38. The primary guidance that will be used to inform the assessment process is IAN153/11 Environmental Assessment of Material Resources.

6.11.39. As the proposed works comprise demolition works, highway alterations and the generation of a new river crossing with associated infrastructure, the Proposed Scheme is classed as a ‘large local major scheme’; this aligns with the IAN153/11 guidance definition of 'complex improvement and large new construction works'. In

[69] CL:AIRE is the acronym for ‘Contaminated Land: Applications in Real Environments’

accordance with the requirements for complex works set out in the guidance, a detailed assessment of material resources shall be undertaken.

6.11.40. As stated in Table 44, the consumption of material resources and production / disposal of waste beyond the first year of Proposed Scheme operation, has been scoped out because forecasts anticipate negligible impacts and effects.

6.11.41. As part of the environmental impact assessment, the following tasks will be carried out:

- relevant waste legislation, policies and guidance will be reviewed to identify material use and waste management objectives, commitments and targets;
- the likely types of material resources (including site arisings) and waste will be identified, and quantities estimated for the Proposed Scheme; for waste, inert and non-inert forecasts will be made;
- impacts will be evaluated against the regional and national materials markets and the capacity of regional (or if appropriate, national) waste infrastructure;
- opportunities to eliminate, reduce, re-use, recycle or recover material resources, site arisings and (potential) waste, will be identified through a review of the Proposed Scheme (including proposed building materials, construction methods and design, where available) and in accordance with industry best practice; and
- identification of viable circular economy opportunities in design and construction will be made.

6.11.42. The Environmental Statement will take into account the nature of impacts (adverse/beneficial, permanent/temporary, direct/indirect) from material resources and waste. Significance of effects will be determined using Table 2.4 in DMRB Volume 11 Section 2 Part 5 HA 205/08[70] whilst also taking into account the requirements of the national and local policy documents.

6.11.43. The main outputs from the detailed assessment will be:

- the identification of the environmental impacts and the significance of effects associated with material resources (including site arisings) and waste; and
- the measures which will be implemented to eliminate or mitigate impacts, and to fulfil resource efficiency and circular economy opportunities.

ASSUMPTIONS AND LIMITATIONS

6.11.44. No assumptions have been made within the preparation of this assessment.

Limitations: availability of baseline data

6.11.45. Baseline data and information for the assessment are (unless otherwise stated) only available to 2016.

6.11.46. UK landfill operators can claim commercial confidentiality for their data at time of submission; data for sites with a commercial confidentiality in place are unavailable for the analyses presented in this assessment.

[70] Design Manual for Roads and Bridges Volume 11, Section 2, Part 5: H205/08, former Highways Agency, August 2008

Limitations: availability of CDE data

6.11.47. The Department of the Environment, Food and Rural Affairs has been consulted to determine whether generation and recovery rates for Construction, Demolition and Excavation (CDE) arisings were available by English region.

6.11.48. Defra confirmed that it does not publish Construction Demolition Excavation figures at a regional level, and only national (England) data are accessible through the publically available Waste Data Interrogator Database[71]; the database is held and operated by the Environment Agency. It was quoted that:

6.11.49. *"The methodology used to generate these figures is complex, in order to take into account the inherent double-counting and data gaps that are present within waste system data, and it would not be feasible to reproduce these on a regional basis."*

6.11.50. Until such a time that Construction, Demolition and Excavation generation and recovery rates by region are available, transfer (non-civic), recovery and metal recycling data (available through the Waste Data Interrogator Database) will be used as the closest possible proxy.

[71] Environment Agency, Waste Interrogator Database [link]

6.12 GEOLOGY AND SOILS

BASELINE CONDITIONS

Designated Sites

6.12.1. There are no geologically designated sites within 500m of the Proposed Scheme.

Bedrock Geology

6.12.2. Published geology as detailed on the British Geological Survey (BGS) website[72] indicates the bedrock geology underlying the site is sand and gravel of the Crag Group.

Superficial Geology

6.12.3. The BGS website also indicates that the site is underlain by superficial deposits comprising peat in the south west, clay and silt in the north, sand and gravel in the east beyond the River Yare and clay and silt within the River Yare.

Soils and Sediment

6.12.4. The nature of onsite soils is undetermined. A ground investigation is currently being undertaken to characterise these. The Soilscapes website (http://www.landis.org.uk/soilscapes/) indicates the soils to the west of the river and a thin strip to the east of the river are comprised of loamy and clayey soils of coastal flats with naturally high groundwater. The bulk of the soils to the east of the river are classified as freely draining slightly acid sandy soils. Beyond this, adjacent to the sea front are sand dune soils. However, due to previous development across the site, it is unlikely that significant amounts of naturally occurring soils are present and made ground is more likely to be prevalent.

Potentially Contaminated Sites

6.12.5. WSP prepared an Environmental Desk Study Report, reference 62240375-016-R01 dated July 2017(a separate report to this Scoping Report) presented in Appendix I, which includes a review of information from a GroundSure Report. This records that no locations within the site are determined as contaminated land under Part 2A legislation, but does record a number of historical ground workings, as well as industrial uses; all of which may have introduced contaminated material on to site, including a gasworks, boat building, an icehouse, fish canning, oilskin production, iron works, rope works, printing works, shoe factory and unspecified wharf /quay.

6.12.6. There is one record of an Environment Agency licensed waste site present onsite – waste transfer station for household, commercial and industrial waste, operated by Thurtle Walter. In addition, there are eight others within 250m, the closest being 13m to the south west.

6.12.7. Mott Macdonald Ltd report the findings of a ground investigation in their 2009 Simple Environmental Assessment report and this identified no significant contamination was identified, however, the interpretative report including the sampling rationale and strategy was not available for review.

[72] http://www.bgs.ac.uk/

6.12.8. As a result of the industrial heritage of the area including the waterfront / docks, there is the potential for contaminated sediments to be present within the River Yare which could be mobilised during construction and operation. Mott Macdonald Ltd undertook sediment sampling as reported in their 2009 Simple Environmental Assessment report and this identified sediments with concentrations of contaminants in excess of the CCME (Canadian Sediment Quality Guidelines for the Protection of Aquatic Life 1999) and the CEFAS (Centre for Environment Fisheries and Aquaculture Science) screening values.

POTENTIAL IMPACTS OF THE PROPOSED SCHEME

6.12.9. As no designated sites exist within the study area, impacts to important geological sites are considered unlikely.

6.12.10. The construction of the Proposed Scheme could establish potential pathways whereby contaminants / pollutants associated with construction activities, and other contaminated land, could have an impact on sensitive receptors, such as (i) human beings; (ii) watercourses; (iii) aquifers; (iv) aquatic habitats, including those associated with the River Yare pSPA, and other interconnected designations; (v) terrestrial habitats and protected species.

6.12.11. The hydrogeology and hydrology of the site indicates that there is a mechanism (termed a source-pathway-receptor linkage) which could allow the local groundwater environment and soils to be impacted by the Proposed Scheme. The introduction of large structures and associated earthworks as part of the permanent works, could potentially result in localised impacts on human health and/or groundwater.

PROPOSED ASSESSMENT METHODOLOGY

6.12.12. There is the potential for disturbance of existing contaminated land (including river bed sediments) and the possibility that construction could potentially establish pathways between pollutants and receptors. It is therefore intended that impacts on geology and soils will form part of the assessments within the ES.

6.12.13. The assessment will be based upon the guidance presented in DMRB Volume 11 Section 3 Part 11 Geology and Soils[73], although for geology and soils DMRB does not provide any specific methods of assessment or scales of measurement for either the value / sensitivity of the receptor or the magnitude of the impact. Assessment procedures contained within BS10175:2011[74] and CLR11[75] including an assessment of risk classification for the source-pathway-receptor protocol based on CIRIA C552[76] will be used in a phased approach together with professional judgement.

6.12.14. Specific consultation with the Environment Agency and Environmental Health Officers (EHOs) will be undertaken to identify any potentially contaminated sites.

6.12.15. A ground investigation is currently underway at the time of writing and will include a risk assessment which will assess the potential contaminant linkages identified in the desk study report.

6.12.16. This will allow the development of an updated site conceptual model to clarify potential source-pathway-receptor linkages, and assist with the assessment of potential impacts on groundwater.

Significance of Effects

[73] The Highways Agency et al, (1993), Design Manual for Roads and Bridges, Volume 11, Section 3, Part 11, Geology and Soils.
[74] British Standards Institution (2011). BS 10175:2011 Code of Practice for the Investigation of Contaminated Land.
[75] The Environment Agency (2004). Model Procedures for the Management of Land Contamination. Contaminated Land Report 11.
[76] CIRIA (2001). C552. Contaminated Land Risk Assessment. A guide to good practice.

6.12.17. The significance of the effects of the Proposed Scheme may have on soil, geology and geomorphology attributes and contaminated land receptors will be assessed in accordance with the DMRB guidance on the basis of the severity of the consequence, should the hazard be realised, and the probability that the hazard will be realised.

6.12.18. A Phase 1 Preliminary Risk Assessment (PRA) will be undertaken to establish baseline conditions within the study area. This will comprise a desk-based review of all relevant information including historical mapping and any available ground investigation reports and, if necessary, a walkover survey to inspect the study area and obtain recent photography.

6.12.19. Information from the PRA will be used to develop a preliminary Conceptual Site Model (CSM) which will identify potential 'source-pathway-receptor' contaminant linkages and associated estimated levels of risk.

6.12.20. The tables used to classify consequence and probability and the matrix used to determine the level of risk, reproduced from CIRIA C552: Contaminated Land: A Guide to Good Practice, are presented in Table 45, Table 46 and Table 47.

Table 45 - Qualitative Risk Assessment – Classification of Consequence

Classification	Definition
Severe	Short term (acute) risks to human health, likely to result in significant harm. Short-term risk of pollution of sensitive water resource. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.
Medium	Chronic damage to human health (significant harm). Pollution of sensitive water resources. A significant change in a particular ecosystem, or organism forming part of such ecosystem.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services.
Minor	Damage to sensitive buildings/structures/services or to the environment. Harm, not necessarily significant, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health. Easily repairable effects of damage to buildings, structures and services.

Table 46 - Qualitative Risk Assessment – Classification of Probability

Classification	Definition
High Likelihood	There is a pollution linkage and an event that appears very likely in the short term, and/or almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	It is probable that an event will occur. Whilst not inevitable, it is possible in the short term, and likely over the long term.
Low Likelihood	Circumstances are possible under which an event could occur, but it is not certain that (even over a long time period) such an event would occur.
Unlikely	It is improbable that an event would occur, even in the very long term.

Table 47 - Qualitative Risk Assessment – Determination of Risk Level

		Severity			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk

	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

6.12.21. The significance of the effects of the Proposed Scheme may have on soil, geology and geomorphology attributes and contaminated land receptors will be assessed in accordance with the DMRB guidance on the basis of the severity of the consequence, should the hazard be realised, and the probability that the hazard will be realised.

6.12.22. The outcome of the contaminated land assessment will inform the EIA and form part of the ES. If a detailed assessment is required this is likely to involve intrusive Phase 2 ground investigation works. These would be completed in accordance with BS10175:2011+A1:2013 'Investigation of potentially contaminated sites: Code of practice'. Following the intrusive works, quantitative risk assessments would be undertaken and a revised CSM developed.

6.12.23. If plausible contaminant linkages are present, it may be necessary to develop a remediation strategy. Implementation of the remediation strategy would be followed by validation works and production of a closure report.

6.13 TRAFFIC AND TRANSPORT

BASELINE CONDITIONS

Existing Highway Network

6.13.1. Great Yarmouth is connected to Norwich by rail, and by the A47 road which is part of the Strategic Road Network (SRN). It is linked to Lowestoft by rail, and by the A47 (formerly the A12) 3 also part of the SRN. The other important road is the A143 to Bury St Edmunds which terminates in the town.

Access

6.13.2. Through traffic on the A47 crosses the River Yare on the Breydon Bridge, to the north of the town centre. Access to the peninsula from the south and from the western part of the town is provided by (i) Breydon Bridge and Acle New Road; and (ii) the Haven Bridge which leads directly into the town centre, also at the northern end of the peninsula. Both are single carriageway lifting bridges. There are no crossings further south to give more direct access to the peninsula. As a result, the main industrial areas and deep water outer harbour are up to 4 km from the nearest bridge. Access to the sea-front is similarly constrained, with all vehicles, cyclists and pedestrians having to use the bridges at the northern end.

Congestion

6.13.3. Currently, the existing river crossings do not provide adequate access to the port and employment areas in the southern part of the peninsula. The lack of a direct bridge means that traffic is forced onto unsuitable routes within the town centre, including the historic South Quay. Congestion, especially on the Haven Bridge, causes delays and makes journey times unreliable. The mixture of port-related and local traffic makes it more difficult for people to access the town centre, seafront, and leisure facilities. The lack of a direct river crossing makes Great Yarmouth seem remote, and discourages inward investment.

6.13.4. A survey of local residents (Survey for the Great Yarmouth and Gorleston Area Transport Strategy) in 2009 identified traffic congestion as the most serious transport problem to be tackled, by a considerable margin,

6.13.5. As it can be quite difficult to measure congestion in absolute terms, a range of survey results, open source data, and model investigations have been used to illustrate the severity of queuing and delay on town centre roads. In support of the OBC, detailed classified traffic counts and queue length surveys were undertaken at key locations in the vicinity of the Haven Bridge and town centre on Thursday 15 October 2015.

6.13.6. This provided evidence that congestion is a very real problem for people in Great Yarmouth, not just a perception. This queuing is associated with the high volumes of traffic using the Haven Bridge and nearby roads. Journey times were show to be significantly longer in peak periods than in the off-peak.

6.13.7. Congestion is a problem in peak periods throughout the year, but also occurs during the summer when many tourists visit the town centre, pleasure beach and seafront attractions.

6.13.8. Congestion affects bus users and cyclists, as well as car users. Pedestrians are also affected by the long traffic signal cycle times needed to handle demand at junctions.

Public Transport

6.13.9. The main bus terminus is at the Market Gates shopping centre. Frequent delays at the Haven Bridge, and congestion associated with the traffic signals at either end of the bridge, pose particular problems for scheduled bus services in the area. When the Haven Bridge is raised, for river traffic, buses can be delayed for up to 20 minutes. Services may have to be cancelled, and delays can affect services throughout the day.

6.13.10. Efforts are being made to encourage tourists to use bus services from the holiday villages of Hemsby, Caister-on-Sea and Hopton, but it is difficult to grow this trade when services are badly affected by congestion.

6.13.11. Two existing bus routes penetrate part of the way into the South Denes area. In common with routes into the town centre, these services are affected by congestion at the existing bridges.

Pedestrians and Cycling

6.13.12. Pedestrians and cyclists also have to use the Haven Bridge to access the town centre, seafront and employment areas. A dedicated off road cycle route has recently been provided as part of the improvements to Marine Parade; there is an on-road route on Southtown Road on the west side of the river and a network of advisory or traffic calmed routes on both sides. However, it is possible that a lack of a more direct access into the peninsula also means that most journeys are longer than they could be, discouraging people from walking or cycling to work.

Traffic Collisions

6.13.13. In the five years from 2011 to 2015, there were 394 recorded collisions in the Great Yarmouth area, involving 489 casualties. Of the 489 casualties, 99 (20%) were pedestrians and 50 (10%) were cyclists with 72 casualties (15%) involving motorcycle accidents. There are clusters of accidents on the approaches to the existing bridges, including at North Quay.

6.13.14. On Pasteur Road and Bridge Road, accidents are grouped around the Pasteur Road/Thamesfield Way roundabout (three slight) and the Bridge Road link between Southtown Road and Hall Quay signals (one fatal, two serious, four slight). Of greatest concern is the prevalence of accidents on Bridge Road (seven). Six of these involved vulnerable road users suggesting problems in this motor vehicle dominated environment around the existing crossing of the River Yare.

6.13.15. The accident rate on Southtown Road is around three times the national average for 'other urban roads'. Accidents are scattered but tend to occur at junctions (Gordon Road and Bridge Station Road). The accident rate on South Quay and Southgates is just under twice the national average for urban A roads. Accidents are generally scattered, with clusters on Nottingham Way and Queen's Road, which are more heavily trafficked side roads.

6.13.16. It is notable that the number of accidents at the Southtown Road/William Adams Way roundabout is almost twice that of the nearby Pasteur Road roundabout. The large 80m diameter and wide circulatory carriageway without traffic signals may generate higher entry and circulatory speeds. Accidents are mainly "failure to give way" and tail end collisions.

POTENTIAL IMPACTS

6.13.17. The Proposed Scheme is likely to have the following traffic and transport effects that have the potential to be significant:

- Increased traffic flows during construction: there will be an increase in traffic flows on local roads during construction, including a temporary increase in Heavy Goods Vehicles (HGV) movements; and
- Redistributed traffic flows post-construction: there will be a redistribution of traffic flows on the surrounding road network post-construction, and, without mitigation, an associated potential for increased pedestrian severance, driver stress and delay, and collisions on the redistribution route.

6.13.18. The introduction of the Proposed Scheme will not in itself generate any additional traffic although providing the bridge as an alternative route to the current crossing options, will result in a redistribution of traffic and these impacts will be assessed.

6.13.19. The potential impacts of the Proposed Scheme with regards to traffic are likely to be predominantly positive, with journey time savings, vehicle operating cost savings, reduced congestion, enhanced journey time reliability, collision and casualty savings, and an increase in the use of more active modes of travel.

6.13.20. One of the main aims of providing the Proposed Scheme is to unlock land for regeneration which is currently constrained by congestion on the local highway network. New development will lead to an increase in overall travel and trip making.

6.13.21. More people will need to travel to work, the regenerated sites will need to be serviced and goods will have to be transported in and out.

6.13.22. Whilst the additional trips from new developments are not directly related to the DCO application for the new crossing, they are a by-product of the new crossing therefore the anticipated impact should be assessed within the ES. It is anticipated that the new crossing and associated infrastructure improvements will meet the demand for the additional trips by all modes without putting additional pressure on the existing transport networks.

6.13.23. There will be a potential impact on the area during construction, including an increase in HGV movements for the duration of construction. This impact will be assessed within the ES.

PROPOSED ASSESSMENT METHODOLOGY

6.13.24. A Transport Assessment (TA), which will assess the impact of the Proposed Scheme on the capacity of highway infrastructure, will be scoped with NCC and key stakeholders, and submitted in support of the DCO.

6.13.25. The ES will summarise the findings of the TA and will focus on likely significant environmental effects upon the local community, such as severance, driver delay or an increased collision rate. The ES will:

- Address changes to local traffic flows during the construction phase and once the Proposed Scheme is completed and operational;
- Address potential disruption to local pedestrians, cyclists and road vehicle users during the construction phase; and
- Provide information on transport conditions both before and after the Proposed Scheme is built, including changes in relative accessibility of the local area by foot, bicycle, and public transport.

6.13.26. The ES will take account of paragraphs 32 to 36 of the NPPF (2012)[77] and the IEMA Guidelines for the Environmental Assessment of Road Traffic (1993)[78]. Close consultation will be undertaken with key stakeholders, including Highways England, NCC and GYBC.

6.13.27. Further desk studies and site visits will be undertaken to identify key features of the existing road and pedestrian/cycle networks in the vicinity of the Proposed Scheme and to obtain data on existing collision rates and identify existing public transport services.

6.13.28. Traffic surveys will be undertaken at key junctions and links surrounding the Proposed Scheme, if sufficient existing data is unavailable. It is anticipated that the majority of data will be available from existing survey data and the strategic model for the area, which was used to support the OBC, and was scrutinised for use by the Department for Transport (DfT). The forecast years of assessment will be agreed with NCC when the detail of the modelling is scoped.

[77] Department for Communities and Local Government, National Planning Policy Framework (2012) Promoting Sustainable Transport Paragraphs 32 to 36 [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf Accessed January 2018

[78] Institute of Environmental Management and Assessment (1993) Guidelines for the Assessment of Road Traffic [online] Available at: http://www.devon.gov.uk/core-doc-t2-guidelines-for-the-environmental-assessment-of-road-traffic.pdf Accessed January 2018

6.13.29. The reassignment of traffic onto the Proposed Scheme will be taken from the strategic SATURN model, which is a highway assignment model.

6.13.30. An assessment of the impact of the redistribution of traffic on local junctions will be completed using appropriate software (such as JUNCTIONS8 and LINSIG) at the individual junctions, to determine where any additional mitigation is required based on capacity results (Ratio of Flow to Capacity (RFC), Degree of Saturation (DoS), Practical Reserve Capacity (PRC), as appropriate for the software type), delays and expected queue lengths.

6.13.31. The assessments will include forecast year scenarios for the year of opening and 15 years after opening and these scenarios will include traffic growth associated with planned / committed development.

6.13.32. The impacts on pedestrian and cycle connections, and improved public transport services/routes will also be reviewed within the ES.

Significance of Effect

6.13.33. The significance of traffic and transport effects on sensitive receptors will be determined by combining the sensitivity of identified receptors with the predict magnitude of change.

6.13.34. The IEMA Guidelines identify that the most discernible environmental impacts of traffic are noise, severance, pedestrian delay and intimidation and they provide additional information on how those impacts should be assessed:

6.13.35. "At low flows, increases in traffic of around 30% can double the delay experienced by pedestrians attempting to cross a road (DOT, 1983). Whether this is significant in absolute terms requires further consideration (see 3.19). Severance and intimidation are, however, much more sensitive to traffic flow and the Department of Transport, in its MEA, has assumed that 30%, 60% and 90% changes in traffic levels should be considered as "slight", "moderate" and "substantial" impacts respectively."

In order to undertake a relative assessment of the increase in road traffic, the criteria outlined in Table 48 and Table 49 will be used to determine the magnitude of impact and receptor sensitivity respectively. However, consideration should also be given to the local characteristics, such as the volume of traffic, pavement widths and availability of crossing facilities.

Table 48 - Magnitude of Traffic Impact Criteria

Change in Traffic Flow	Magnitude of Impact
Change in Total Traffic or HGV flows of over 90%	Major
Change in Total Traffic or HGV flows of 60% – 90%	Moderate
Change in Total Traffic or HGV flows of 30% - 60%	Minor
Change in Total Traffic or HGV flows of less than 30%	Negligible

Table 49 - Sensitivity of Traffic Receptors

Receptor sensitivity	Receptor Type
Major	Receptors of greatest sensitivity to traffic flow: schools, colleges, playgrounds, accident black spots, retirement homes, urban/residential roads without footways that are used by pedestrians.
Moderate	Traffic flow sensitive receptors including: congested junctions, doctors surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, unsegregated cycle ways, community centre, parks, recreational facilities.

Minor	Receptors with some sensitivity to traffic flow: places of worship, public open space, nature conservation areas, listed buildings, tourist attractions and residential areas with adequate footway provision.
Negligible	Receptors with low sensitivity to traffic flow and those with sufficient distance from affected roads and junctions.

6.13.36. The magnitude of change and sensitivity of the receptor will then be compared in order to determine the overall traffic effect significance, as shown in Table 50.

Table 50 - Determination of Significance of Traffic Effects

Sensitivity of Receptor	Magnitude of Effect			
	Negligible	Minor	Moderate	Major
Major	Minor	Moderate	Major	Major
Moderate	Negligible	Minor	Moderate	Major
Minor	Negligible	Negligible	Minor	Moderate
Negligible	Negligible	Negligible	Negligible	Minor

6.13.37. The potential effects will be considered to determine the level of significance, either major, moderate, minor or of negligible significance. Effects of major and moderate significance are considered to be significant in EIA terms.

6.14 CUMULATIVE EFFECTS

6.14.1. The EIA Regulations require that, in assessing the effects of a particular development proposal, consideration will also be given to the cumulative effects that may arise from the Proposed Scheme in conjunction with other existing and/or approved projects.

6.14.2. Cumulative impacts may arise as a result of a number of different factors and combined changes. Cumulative impacts can be defined as:

6.14.3. *"the additional changes caused by a Proposed Development in conjunction with other similar developments as the combined effect of a set of developments, taken together. In practice 'effects' and 'impacts' are used interchangeably."*

6.14.4. *These generally fall into three categories:-*

(i) Cumulative effects arising from the combination of the different environmental topics as outlined in the Environmental Statement;

(ii) Cumulative effects arising from a range of developments (projects), occurring at different locations or over a period of time. Separately, such individual projects may not create an unacceptable degree of adverse impact but collectively the results may potentially be significant;

(iii) Cumulative effects caused by the project in conjunction with other developments that occurred in the past, present or are likely to occur in the foreseeable future.

6.14.5. As identified in the second point above, cumulative or combined effects are those that are likely to arise when the Proposed Development is considered in relation to other foreseeable developments (projects) either located in the immediate vicinity or that have a relationship with similar environmental resource. Individually the impact of a Proposed Development may be of minor magnitude but when combined with the impact from other projects could increase the overall significance of an effect on an environmental resource. The results of this process enable the Local Planning Authority to ensure that this and any future developments are mutually compatible and remain within the environmental capacity of the area considered.

6.14.6. The NN NPS states at Paragraph 4.16 that when considering significant cumulative effects, any ES should provide information on how the effects of the proposal would combine and interact with the effects of other development (including projects for which consent has been granted, as well as those already in existence).

6.14.7. Guidance offered within Advice Note 17[79] identifies a four stage process to the Cumulative Effect Assessment (CEA) process and the ES will include a CEA that follows this approach, outlined in Table 51 below.

Table 51 – Cumulative Effects Assessment Stages

CEA Stage	Main Activities
Stage 1 – Establishing a zone of influence for the Proposed Scheme and identifying a long list of 'other development',	Identifying a long list of 'other development' that is proposed in the vicinity of the proposed scheme.
Stage 2 – Identify a shortlist of 'other development'.	Identifying the nature of the 'other development' and assessing whether there is the potential for significant cumulative effects.

[79] Advice note seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects; The Planning Inspectorate, December 2015

CEA Stage	Main Activities
Stage 3 – Information gathering	Collation of information on the 'other development' identified at Stage 2
Stage 4 - Assessment	Assessing

6.14.8. As acknowledged by the Planning Inspectorate in their advice note on CEA the information that is available on which a robust CEA can be undertaken on future development is likely to be proportional to the status of the development.

Stage 1

6.14.9. The following schemes have been identified as being of suitable scope to be included in Stage 2 as they could affect some environmental aspects cumulatively with the Proposed Scheme:

- Great Yarmouth and Lowestoft Enterprise Zone;
- Lake Lothing Third River Crossing;
- Great Yarmouth Tidal Barrier;
- East Anglia Array Windfarm;
- Beacon Park Enterprise Zone;
- Great Yarmouth Waterfront Area;
- South Denes Enterprise Zone and Energy Park; and
- A47 Great Yarmouth Vauxhall, Harfrey's and Gapton Junctions.

Stage 2

6.14.10. Development identified within Stage 1 will be screened to identify whether its location and attributes is worthy of greater consideration.

Stage 3

6.14.11. Available information on the status of the Stage 2 developments will be collated and used as the basis of the Stage 4 assessment.

Stage 4

6.14.12. The operational phase impacts assessments undertaken for air quality and noise, along with some aspects of the road drainage calculations, will include cumulative effects in so far that the traffic data that they are based upon includes both future development and natural traffic growth. CEA for noise and air quality impacts within the ES will focus construction phase of the Proposed Scheme. In addition, the flood risk assessment for the Proposed Scheme will likewise adopt a worst case approach through excluding the Great Yarmouth Tidal Barrier from the assessment model.

7 SUMMARY

7.1 ENVIRONMENTAL TOPICS FOR INCLUSION IN THE ES

7.1.1. Confirmation of the environmental topics that are scoped into the assessment, and a summary of the proposed assessment scope, are provided in Table 52.

Table 52 – Proposed environmental topics to be scoped into / out of the EIA

Topic	Scoped in / out	Summary
Air Quality (Section 6.2)	Scoped in	Effects which would be likely to result from the implementation of the Proposed Scheme include the generation and deposition of dust during construction ((PM_{10} and $PM_{2.5}$), the combustion engine emissions associated with construction-related traffic and construction plant operation, changes in concentration so traffic related pollutants NO_x, NO_2, PM_{10}, $PM_{2.5}$) where sensitive receptors are located or will be located in the vicinity of the Proposed Scheme and changes in the total emission of traffic related pollutants. It is proposed that the risk of dust deposition at sensitive receptors close to the application site is scoped out due to the availability of well-established mitigation measures. However, details of the mitigation measures will be given for inclusion within a Construction Environmental Management Plan (CEMP).
Acoustics (Section 6.3)	Scoped in	Potential noise and vibration impacts can occur during construction (temporary) and operation (permanent). The risk and severity of potential construction impacts occurring is typically a function of the proximity of the activity to receptor, and the nature and duration of the activity. Operation impacts occur due to changes in carriageway alignment, traffic flow, traffic speed and infrastructure.
Nature Conservation (Section 6.4)	Scoped in	A number of nature conservation resources which could potentially be affected by the construction and future use of a road scheme of the type proposed. These comprise designated and non-designated sites, important habitats and habitat-types and protected and notable species. Specific impact as a result of the Proposed Scheme on nature conservation include killing, injuring and disturbance of protected species during construction, fragmentation of retained habitats and/or severance of wildlife corridors, contamination of watercourse through accidental spillage of fuels/chemicals and disturbance of nocturnal animals, such as bats, where road lighting introduces a new light source.
Cultural Heritage (Section 6.5)	Scoped in	The majority of the impacts upon the cultural heritage assets will occur during the construction phase. Development activities such as pilling, stripping of overburden or hardstanding, landscaping, ground compaction access and may all have a negative effect on cultural heritage assets. Potential impacts include permanent complete or partial loss of an archaeological feature or deposit as a result of ground excavation and permanent or temporary loss of the physical and/or visual integrity of a feature, monument, building or group of monuments. Initial assessment suggests that there would be a potential physical impact to one known archaeological asset, the site of a railway which is no longer in use (asset 88) and a potential setting impact to the setting of the Dolphin Public House, a Grade II listed building (asset 89). Additionally, the assessment to

		date suggests the potential presence of unknown heritage assets in the form of a buried medieval shoreline and associated features or finds.
Townscape and Visual (Section 6.6)	Scoped in	The introduction of the Proposed Scheme will result in a new prominent feature of a noticeably different scale and form within the immediate urban fabric of Great Yarmouth, resulting in the removal or modification to existing townscape features and potential fragmentation of the current land use patterns. The introduction of the visually prominent structure within the context of the river, supporting roads and associated traffic will also change existing views, where it either intrudes into or obstructs an existing view in whole or in part.
Water Environment (Section 6.7)	Scoped in	The Scoping Report has identified several potential impacts on the water environment. Potential significant impacts considered include pollution during construction due to increased generation and release of sediments and suspended solids, and increased risk of accidental spillage of pollutants such as oil, fuel and concrete, alterations to the hydromorphology (fluvial geomorphological) regime, such as increased erosion, deposition and channel migration processes, groundwater pollution during road operation due to contaminants within routine road run-off and an increase in flood risk caused by the Proposed Scheme, both within the vicinity of the route options and also elsewhere in the catchment is possible. Based upon the Water Environment Characteristics it is proposed that the following elements are scoped out: ▪ Loss of standing water ▪ Loss or change to Groundwater Dependent Terrestrial Ecosystems ▪ Changes to groundwater level or flows impact due to cuttings and related dewatering Flood Risk: The main source of flooding for the scheme is thought to be tidal. It is proposed that this assessment is presented in a separate standalone chapter.
Climate (Section 6.8)	Scoped in	The assessment approach considers the likely magnitude of GHG emissions (or avoided emissions) in comparison to the baseline scenario with no scheme development. During construction, the Proposed Scheme could have the potential to contribute to GHG emissions from construction activities as well as from the manufacturing and supply of materials. At this stage, there is not enough information available to determine the level of magnitude or significance of emissions of the Proposed Scheme and, therefore, a detailed assessment will be undertaken during the environmental assessment.
People and Communities (Section 6.9)	Scoped in	The Proposed Scheme is located within Great Yarmouth, within Norfolk. The Proposed Scheme may result in the generation of direct, indirect and induced employment opportunities, loss of private and public land, changes in driver stress and delay and changes in accessibility and amenity value of public routes and recreational resources.
Health (Section 6.10)	Scoped out	Potential effects on health arising from air quality and noise would be covered under these respective sections of this report. The People and Communities assessment will also cover potential impacts on community severance, loss of property, economic benefits and community facilities. Impacts on landscape and nature conservation are unlikely to affect health given the existing urban nature of the environment and retention of open space.

		It is proposed that a separate health assessment is scoped out for the Great Yarmouth Third River Crossing as potential impacts are either positive, unlikely to be significant or are already assessed.
Materials (Section 6.11)	Scoped in	The Proposed Scheme has the potential to consume material resources (including those recovered from site arisings), and produce and dispose of waste, during the demolition, site preparation and construction phases of delivered. The associated potential environmental impacts (both direct and indirect) will occur during these lifecycle phases. Impacts arising further into the operational lifecycle are expected to be negligible, and hence have been scoped out of this assessment.
Geology and Soils (Section 6.12)	Scoped in	As no designated sites exist within the study area, impacts to important geological sites are considered unlikely. The hydrogeology and hydrology of the site indicates that there is a mechanism (termed a source-pathway-receptor linkage) which could allow the local groundwater environment and soils to be impacted by the Proposed Scheme. The introduction of large structures and associated earthworks as part of the permanent works could potentially result in localised impacts on human health and/or groundwater.
Traffic and Transport (Section 6.13)	Scoped in	The Proposed Scheme is likely to have several traffic and transport effects, which have the potential to be significant. For example, there will be an increase in traffic flows on local roads during construction, including a temporary increase in Heavy Goods Vehicles (HGV) movements. This impact will be assessed further in the ES. Additionally, there will be a redistribution of traffic flows on the surrounding road network post-construction, and, without mitigation, an associated potential for increased pedestrian severance, driver stress and delay, and collisions on the redistribution route.
Cumulative Effects (Section 6.14)	Scoped in	There are a number of approved developments that have the potential to result in cumulative effects, in conjunction with the Proposed Development. It is therefore proposed that an assessment of Cumulative effects is scoped into the EIA.

7.2 PROPOSED STRUCTURE OF ES

7.2.1. It is proposed that the ES be comprised of three volumes:

- Volume 1 will contain the main written statement of the ES
- Volume 2 will contain the Technical Appendix
- Volume 3 will contain the Figures.

7.2.2. These three volumes will be accompanied by a Non-Technical Summary of the ES.

7.2.3. The intended chapter layout for the Volume 1 of the ES is presented in Table 53.

Table 53 – Proposed Chapter Contents for ES Volume 1: Written Statement

Chapter	Title
1	**Introduction** Including: - Purpose of the report - Overview of the Project
2	**Environmental Impact Assessment Approach** - The requirement for an EIA; - Approach to Scoping - Legislative and Policy Context for the Proposed Scheme - The Structure of the Environmental Statement
3	**Proposed Scheme** Including: - Need for the Proposed scheme - Project Objectives - Site Location and Description - Proposed Scheme Description
4	**Assessment of Alternatives** Including: - Alternative options considered - Options selection process - Reasons for discounting options
5	**Consultation**
6	**Air Quality**
7	**Acoustics**
8	**Nature Conservation**
9	**Cultural Heritage**
10	**Townscape and Visual Impacts**
11	**Water Environment**
12	**Flooding**
13	**Climate Change**
14	**People and Communities**
15	**Materials**
15	**Geology and Soils**
16	**Traffic and Transport**
17	**Cumulative Effects**
18	**Summary**

7.3 PROPOSED TECHNICAL CHAPTER LAYOUT

It is proposed that the following layout is applied to each of the technical chapters:

- Introduction

  Introduction to the technical chapter.

- Assessment Methodology

  Details of the assessment methodologies to be applied to assess importance/sensitivity of assets/features, the magnitude of potential impacts and the predicted significance of effects.

- Baseline Conditions

  Description of the current existing baseline conditions at the Application Site as per the data that has been collected.

- Potential Significant Effects

  Text identifying the potential significant effects of the Proposed Scheme after embedded mitigation

- Mitigation

  Details of measures required to mitigate the effects of the Proposed Development. These should be split into construction and operational effects.

- Residual Effects

  Description of the effects following the implementation of Mitigation Measures.

8 REFERENCES AND GLOSSARY

8.1 REFERENCES

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Chapter 4: Consultation

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Chapter 5: Environmental Impact Assessment Approach

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Chapter 6: Scope of Technical Assessments

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8.2 GLOSSARY

Table 54 – Glossary of Terms

AADT	Average Annual Daily Traffic
ADMS	Atmospheric Dispersion Model System
AEP	Annual Exceedance Probability
AQMA	Air Quality Management Areas
BCR	Benefit to Cost Ratio
BGL	Below Ground Level
BGS	British Geological Survey
BOD	Biological Oxygen Demand
BS	British Standard
CCME	Canadian Sediment Quality Guidelines for the Protection of Aquatic Life
CDE	Construction, Demolition and Excavation
CEFAS	Centre for Environment Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CEMP	Construction Environmental Manangement Plan
CIEEM	Chartered Institute for Ecological and Environmental Management
CIRIA	Construction Industry Research and Information Association
CoPA	Control of Pollution Act 1974
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
dB	Decibel
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DO	Dissolved Oxygen
DoS	Degree of Saturation
EA	Environment Agency
EAST	Early Assessment Sifting Tool
EFT	Emission Factor Toolkit

EHOs	Environmental Health Officers
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standards
ES	Environmental Statement
EU	European Union
FRA	Flood Risk Assessment
GHG	Greenhouse Gas
GIS	Geographic Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GP	General Practitioners
GQA	General Quality Assessment
GQA	General Quality Assessment
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GYBC	Great Yarmouth Borough Council
GYTRC	Great Yarmouth Third River Crossing
HAWRAT	Highways Agency Water Risk Assessment Tool
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicles
HLC	Historic Landscape Characterisation
HUDU	Healthy Urban Development Unit
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
IEMA	Institute of Environmental Management and Assessment
IMD	Indices of Multiple Deprivation
IROPI	imperative reasons of over-riding public interest
JNCC	Joint Nature Conservation Committee
LAQM	Local Air Quality Management
LOAEL	Lowest-observed-adverse-effect level
LSOAs	Lower Layer Super Output Areas
MMP	Materials Management Plan
NAEI	National Atmospheric Emissions Inventory

NCC	Norfolk County Council
NERC	Natural Environment and Rural Communities
NHER	Norfolk Historic Environment Record
NIR	Noise Insulation Regulations 1975
NN NPS	National Policy Statement for National Networks
NOEL	No Observed Effect Level
NOx	Nitrogen Oxides
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Project
O3	Ozone
OAR	Option Assessment Report
OBC	Outline Business Case
ONS	Office of National Statistics
OS	Ordnance Survey
PAH	Polyaromatic Hydrocarbons
PCM	Pollution Climate Mapping
PEA	Preliminary Ecological Appraisal
PEIR	Preliminary Environmental Information Report
PEL	Probable Effect Levels
PHE	Public Health England
PM10	Particulate Matter to 10 microns
PM2.5	Particulate Matter to 2.5 microns
PPG	National Planning Practice Guidance
PRA	Preliminary Risk Assessment
PRC	Practical Reserve Capacity
ProPG	Professional Planning Guidance
PRoW	Public Rights of Way
pSPA	Potential Special Protection Area
RFC	Ratio of Flow to Capacity
SAC	Special Areas of Conservation
SOAEL	Significant Observed Adverse Effect Level

SPA	Special Protection Area
SPZ	Source Protection Zones
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
tCO2e	Tonnes of Carbon Dioxide Equivalents
TEL	Threshold Effect Levels
THI	Townscape Heritage Initiative
UK	United Kingdom
UKCP09	UK Climate Change Projections
UXO	Unexploded Ordnance
WFD	Water Framework Directive
ZTV	Zone of Theoretical Visibility

Appendix A

SECRETARY OF STATE DIRECTION

Department for Transport

Department for Transport
Great Minster House
33 Horseferry Road
London
SW1P 4DR
Tel: 0300 330 3000

Web Site: www.gov.uk/dft

Our Ref:
Your Ref:

DATE 26th February 2018

Mr [redacted]
Major Projects (Highways) Team Manager
Planning and Economy
Norfolk County Council
County Hall
Martineau Lane
Norwich
Norfolk
NR1 2DH

Dear Mark,

DIRECTION BY THE SECRETARY OF STATE UNDER SECTION 35 OF THE PLANNING ACT 2008 RELATING TO THE GREAT YARMOUTH THIRD RIVER CROSSING. NORFOLK.

By letter to the Secretary of State received on 29th January 2018, Norfolk County Council formally requested that the Secretary of State exercise the power vested in the Secretary of State under section 35 of the Planning Act 2008 ("the Act") to direct that the proposed scheme set out in the Norfolk County Council's letter and known as the Great Yarmouth Third River Crossing, as well as any associated matters, be treated as development for which development consent is required.

The Secretary of State is satisfied that:

- the development does not currently fall within the definition of a "nationally significant infrastructure project" and therefore it is appropriate to consider use of the power in section 35; and
- Norfolk County Council's request constitutes a "qualifying request" in accordance with section 35(10) of the Act.

The Secretary of State has made a decision within the primary deadline set out in section 35A(2) and wishes to convey that decision.

Having considered the details of the Great Yarmouth Third River Crossing set out in the request, the Secretary of State is of the view that this development by itself is nationally significant, for the reasons set out in the Annex below.

Accordingly, as the Secretary of State is satisfied that the proposed Great Yarmouth Third Rive Crossing is nationally significant, THE SECRETARY OF STATE DIRECTS that development, together with any matters associated with it, is to be treated as development for which development consent is required.

In addition, the Secretary of State further directs that any proposed application in relation to the Great Yarmouth Third River Crossing is to be treated as a proposed application for which development consent is required.

This direction is given without prejudice to the Secretary of State's consideration of any application for development consent which is made in relation to the Great Yarmouth Third River Crossing.

Signed by

[redacted]

[redacted]

A Civil Servant in the Department for Transport
For and On Behalf of the Secretary of State

26th February 2018

ANNEX A

REASONS FOR THE DECISION TO ISSUE THE DIRECTION

The Secretary of State is of the opinion that the Great Yarmouth Third River Crossing is of national significance for the following reasons:

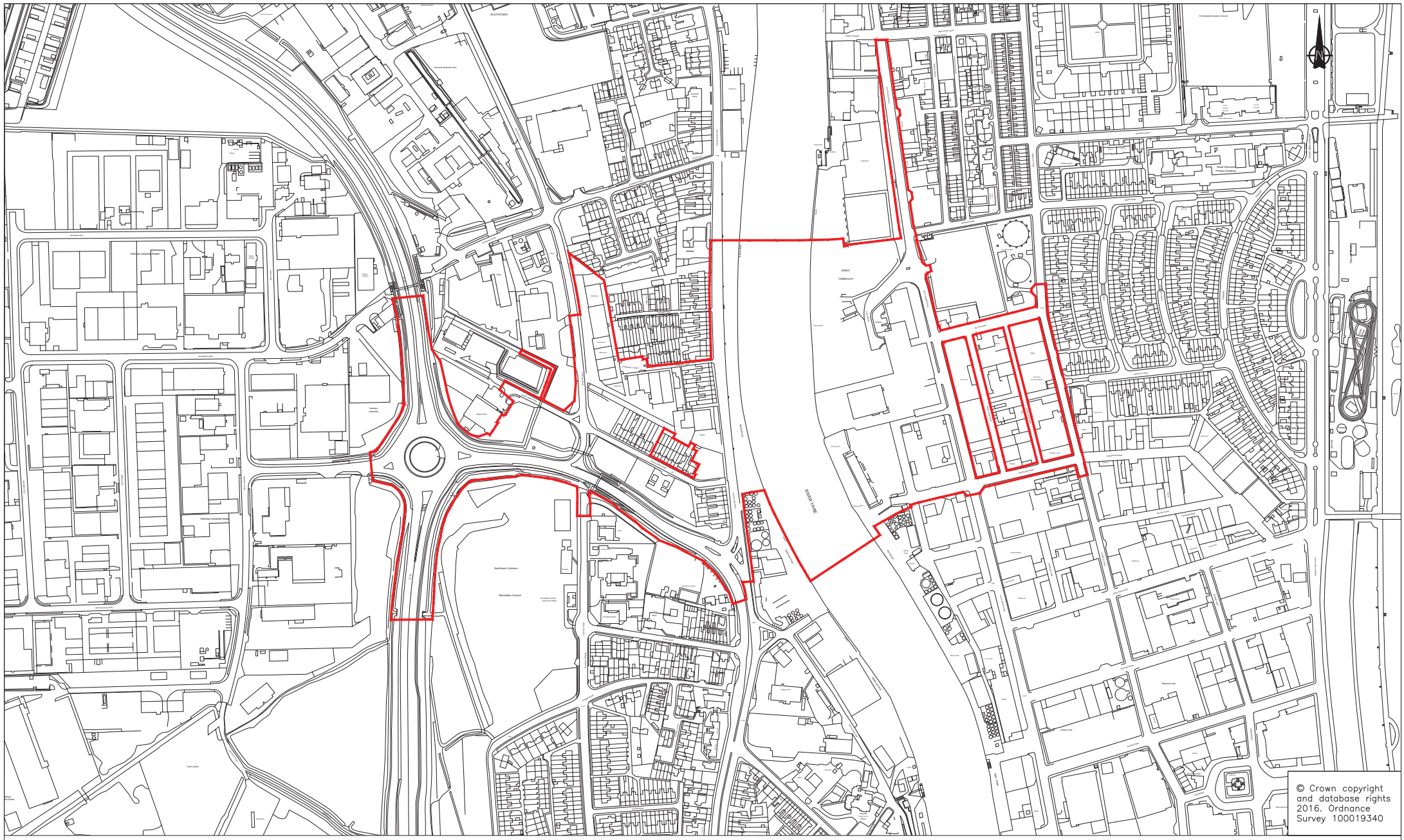
- The Port has a nationally significant role in the renewable energy sector and the offshore gas and oil industry and the scheme will substantially improve connectivity and resilience for port activities;
- The scheme will support the delivery of existing and potential renewable energy NSIPs,
- Supports the Port's role as an International Gateway

In addition the scheme will

- Improve the offer of the Port through better connectivity to the Enterprise Zone

Appendix B

DRAWINGS AND FIGURES



KEY

EXTENT OF WORKS BOUNDARY

0 50 100 150 200 m

Norfolk County Council

Tom McCabe
Executive Director of
Community and Environmental Services
Norfolk County Council
County Hall, Martineau Lane
Norwich NR1 2SG

DRAWING TITLE

GREAT YARMOUTH -THIRD RIVER CROSSING
SCOPING REPORT BOUNDARY

REV.	DESCRIPTION	CHECKED	DATE

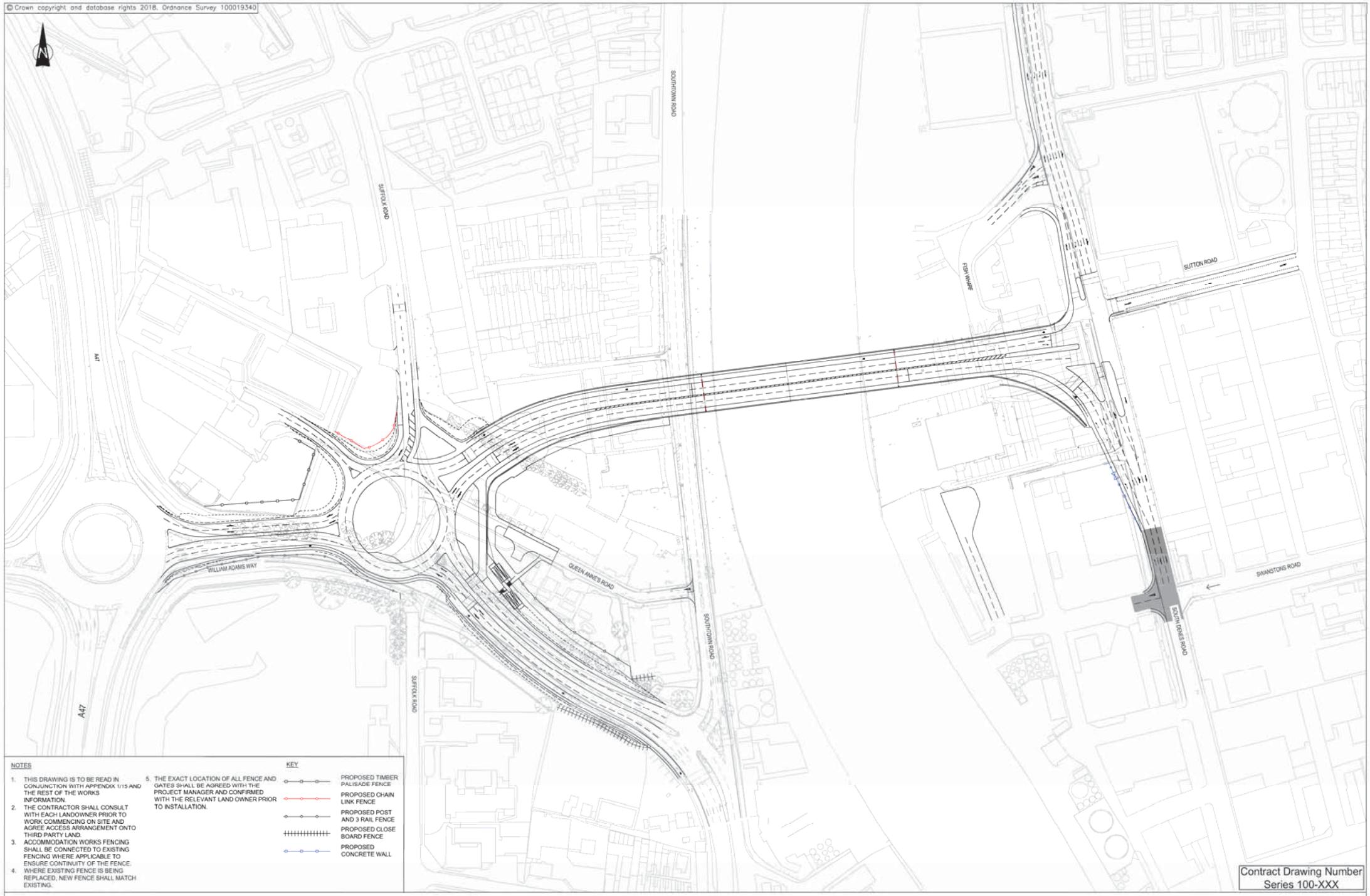
	INITIALS	DATE
DESIGNED BY	DE	FEb 18
DRAWN BY	DPP	FEb 18
CHECKED BY	YS	Feb 18
APPROVED BY	MD	Feb 18

DRAWING No. 62240375-GYTRC-Scoping Report Boundary-20180219

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:2000 @ A1

FILE No. 0001



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH APPENDIX 1/15 AND THE REST OF THE WORKS INFORMATION.
2. THE CONTRACTOR SHALL CONSULT WITH EACH LANDOWNER PRIOR TO WORK COMMENCING ON SITE AND AGREE ACCESS ARRANGEMENT ONTO THIRD PARTY LAND.
3. ACCOMMODATION WORKS FENCING SHALL BE CONNECTED TO EXISTING FENCING WHERE APPLICABLE TO ENSURE CONTINUITY OF THE FENCE.
4. WHERE EXISTING FENCE IS BEING REPLACED, NEW FENCE SHALL MATCH EXISTING.
5. THE EXACT LOCATION OF ALL FENCE AND GATES SHALL BE AGREED WITH THE PROJECT MANAGER AND CONFIRMED WITH THE RELEVANT LAND OWNER PRIOR TO INSTALLATION.

KEY

- PROPOSED TIMBER PALISADE FENCE
- PROPOSED CHAIN LINK FENCE
- PROPOSED POST AND 3 RAIL FENCE
- PROPOSED CLOSE BOARD FENCE
- PROPOSED CONCRETE WALL

Contract Drawing Number
Series 100-XXX

Norfolk County Council
at your service
Mike Jackson
Director of Planning and Transportation
Norfolk County Council
County Hall, Martineau Lane
Norwich NR1 2SG

wsp
62-64 Hills Road
Cambridge
CB2 1LA, UK
T+ 44 (0) 1223 558 050 F+ 44 (0) 1223 558 051
wsp.com

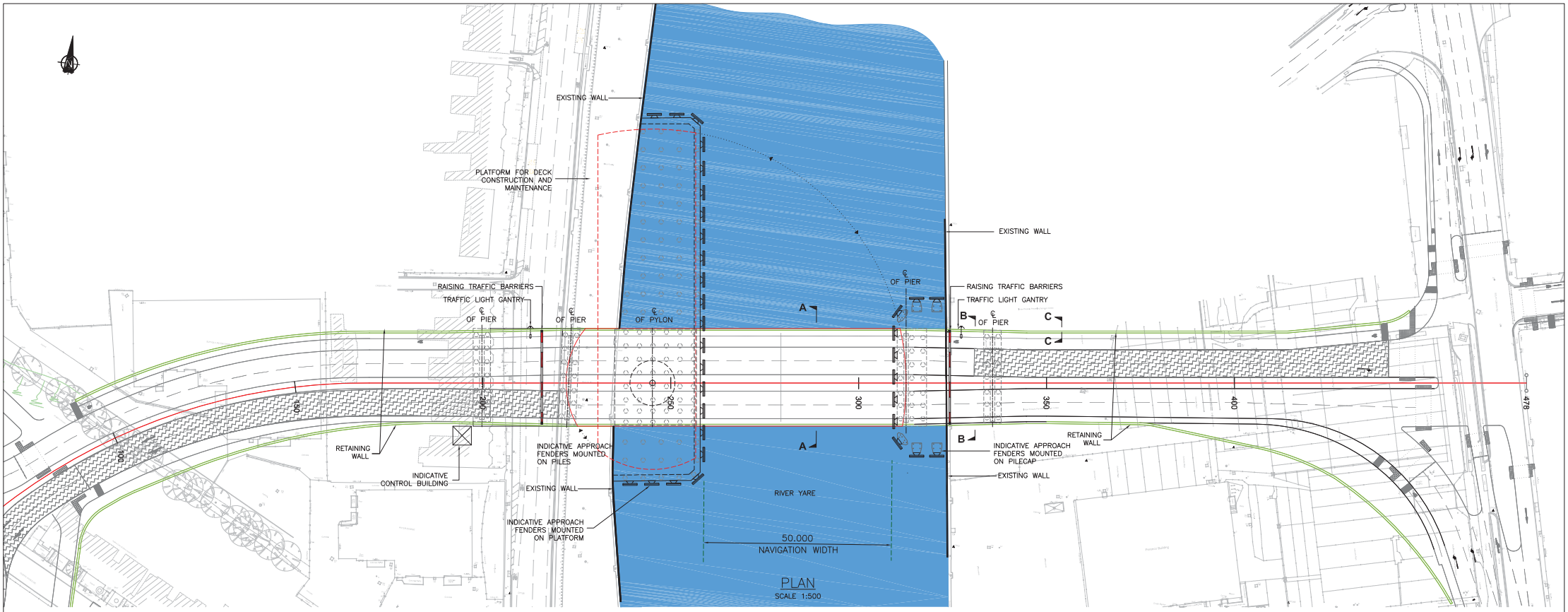
DRAWING TITLE

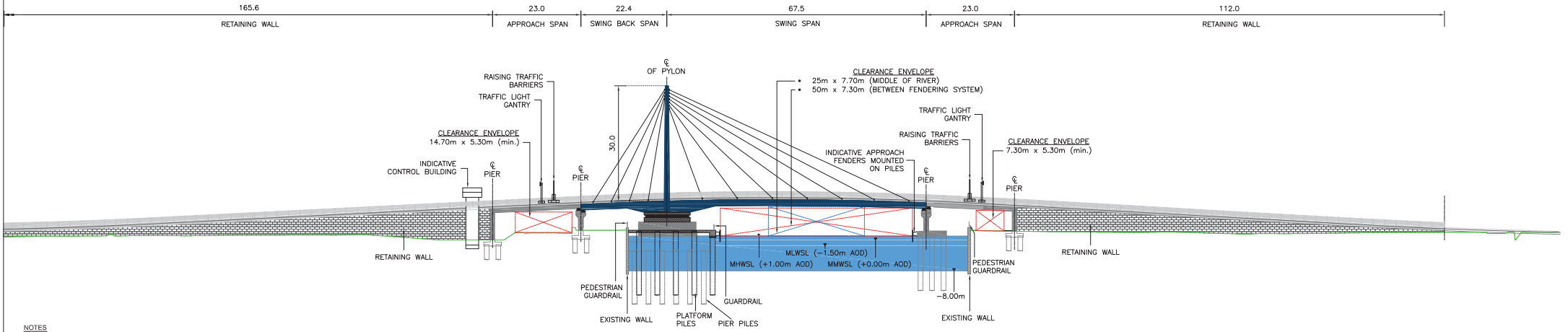
ACCOMMODATION WORKS PLAN

REV.	DESCRIPTION	CHECKED	DATE

	INITIALS	DATE
DESIGNED BY	DPP	03.18
DRAWN BY	EL	03.18
CHECKED BY	MO	03.18
APPROVED BY	YS	03.18

DRAWING No. 70041951-WSP-HAW-GYTRC-DR-D-0001
PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING
SCALE 1:1000 @ A1
FILE No. XXXXX





SOUTH ELEVATION
SCALE 1:500

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES UNLESS OTHERWISE STATED.
3. ALL CHAINAGES ARE IN METRES UNLESS OTHERWISE STATED
4. FOUNDATION ARRANGEMENTS ARE INDICATIVE AND TO BE CONFIRMED.
5. EXISTING WALL TO BE MAINTAINED/ REINSTATED IN CASE OF DAMAGE.

Norfolk County Council

Tom McCabe
Executive Director of
Community and Environmental Services
Norfolk County Council
County Hall, Martineau Lane
Norwich NR1 2SG

DRAWING TITLE

GREAT YARMOUTH THIRD RIVER CROSSING
OPTION 32A - SWING BRIDGE OPTION
CONCEPTUAL GENERAL ARRANGEMENT - SHEET 1 OF 2

REV.	DESCRIPTION	DRAWN BY	CHECKED	DATE
P01	AMENDMENTS OF RIGHT SUPPORT OF WEST UNDERPASS	EE	GS	19-01-18
P02	AMENDMENTS ON DOLPHIN WALL AND FENDERING SYSTEM	EE	GS	23-01-18
P03	RIGHT SUPPORT OF SWING SPAN AND SWING SPAN LENGTH AMENDED.	EE	GS	16-02-18

	INITIALS	DATE
DESIGNED BY	EE	15-01-18
DRAWN BY	EE	15-01-18
CHECKED BY	GS	16-01-18
APPROVED BY	GS	16-01-18

DRAWING No. 1076653-WSP-SGN-OPT32A-SK-S-0001
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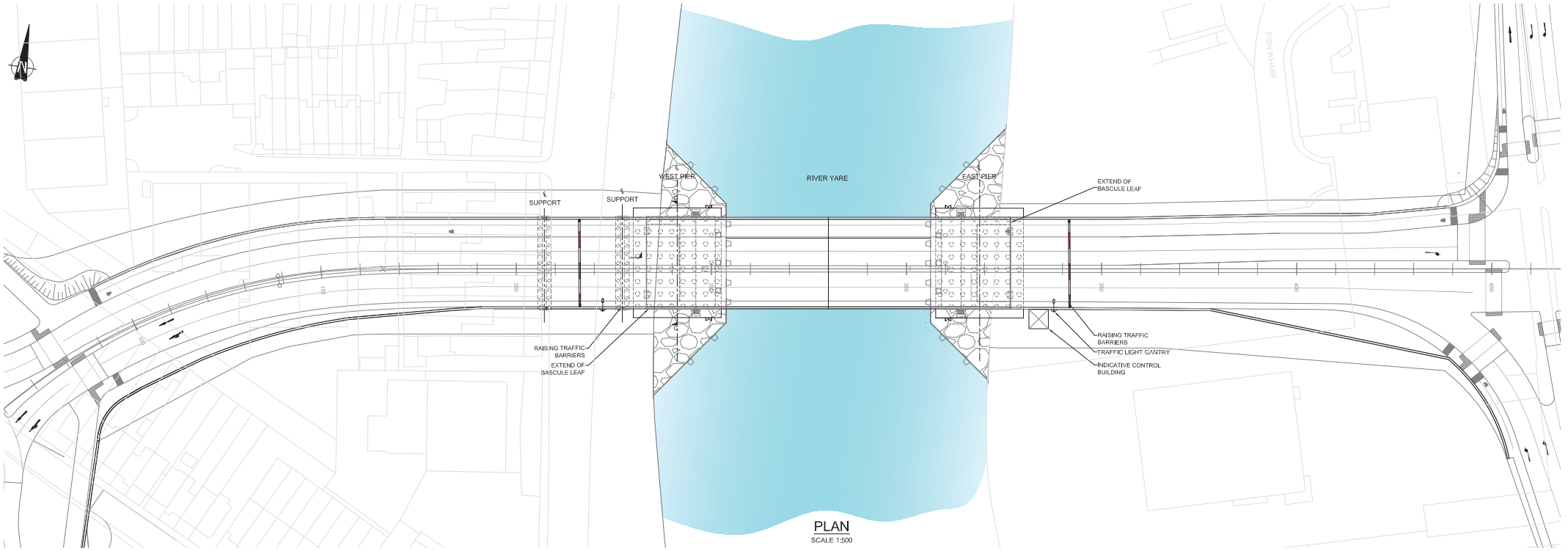
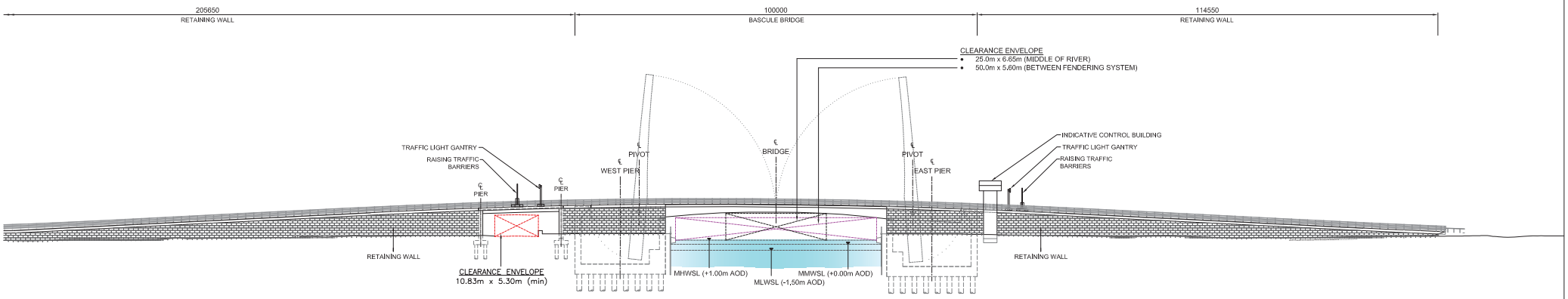
SCALE AS SHOWN
FILE No.



PLAN
SCALE 1:500



CHAINAGE	0.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	420.000	430.000	440.000	450.000	460.000	470.000	477.737
PROPOSED LEVELS	1.922	3.262	3.647	4.109	4.609	5.109	5.609	6.109	6.609	7.109	7.609	8.073	8.478	8.824	9.112	9.340	9.510	9.621	9.673	9.666	9.601	9.477	9.293	9.051	8.751	8.391	7.973	7.496	6.996	6.496	5.996	5.496	4.996	4.496	3.996	3.501	3.048	2.645	2.269	1.987	1.882
EXISTING LEVELS	1.705	0.680	0.818	1.044	0.966	1.299	1.268	1.397	1.565	1.694	1.768	1.930	1.938	1.877	1.658	2.421	-0.287	-0.304	-0.339	-0.316	-0.334	-0.308	-0.317	-0.302	-0.285	2.227	2.064	1.925	1.779	1.732	1.742	1.471	1.486	1.447	1.584	1.685	1.742	1.815	1.602	1.896	1.882
LEVEL DIFFERENCE	0.217	2.582	2.829	3.065	3.643	3.810	4.341	4.712	5.045	5.415	5.841	6.143	6.540	7.147	7.453	6.919	9.797	9.925	10.012	9.983	9.934	9.784	9.610	9.353	9.036	6.164	5.908	5.570	5.216	4.764	4.253	4.024	3.510	3.049	2.412	1.816	1.306	0.830	0.667	0.091	0.000

ELEVATION A-A
SCALE 1:500

Norfolk County Council

Tom McCabe
Executive Director of
Community and Environmental Services
Norfolk County Council
County Hall, Martineau Lane
Norwich NR1 2SG

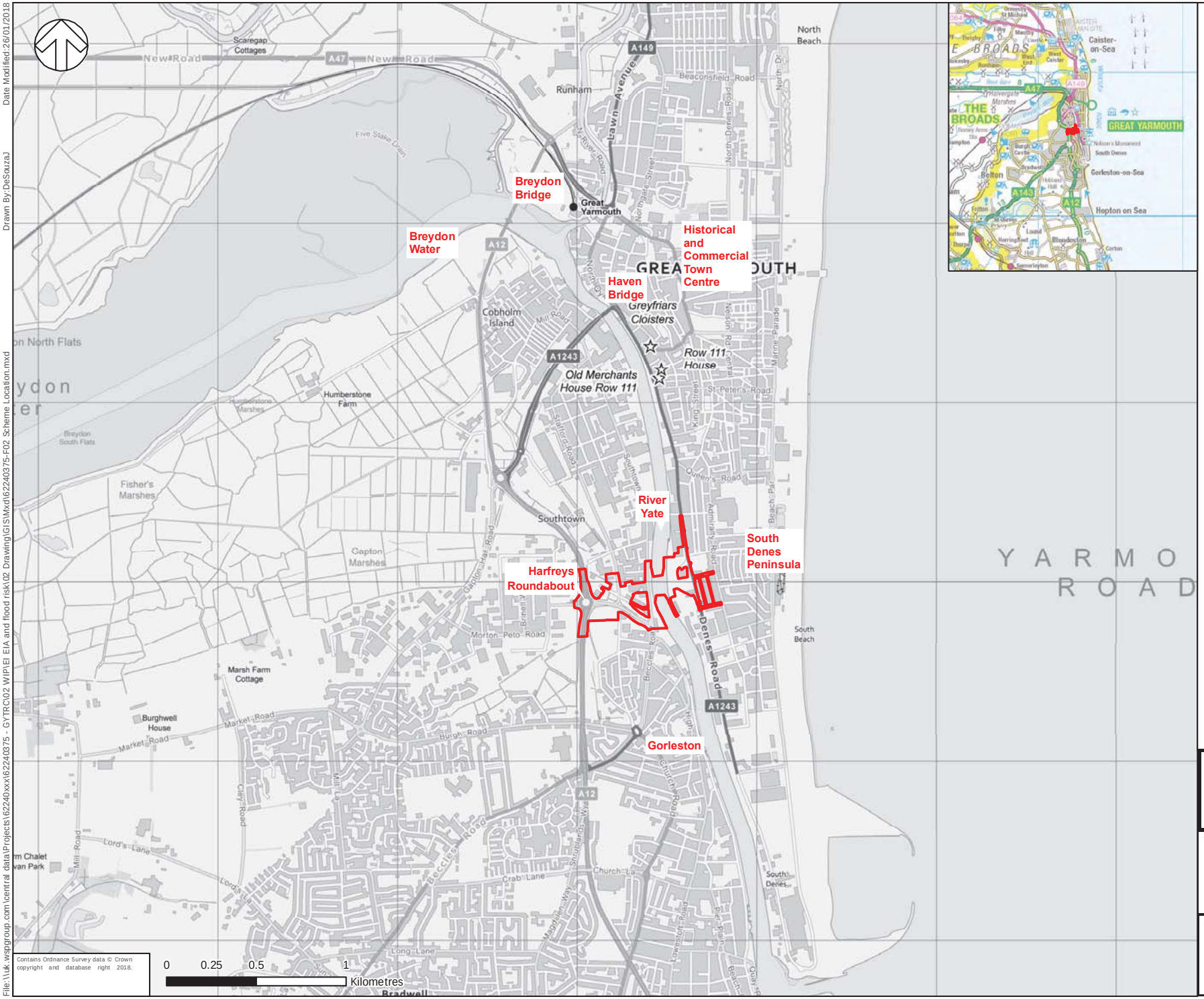
DRAWING TITLE

GREAT YARMOUTH THIRD RIVER CROSSING
BASCULE BRIDGE OPTION32 - CONCEPTUAL GENERAL ARRANGEMENT
SHEET 1 OF 2

REV.	DESCRIPTION	DRAWN BY	CHECKED	DATE
P01	RETAINING WALL PATTERN AND LENGTH AMENDED.	EE	GS	16-02-18
P02	CLEARANCE ENVELOPE ADDED ON THE WEST UNDERPASS AND BASCULE SPAN, AND WATER LEVELS AMENDED.	EE	GS	26-02-18

	INITIALS	DATE
DESIGNED BY	AH	15.03.17
DRAWN BY	OW	15.03.17
CHECKED BY	SA	15.03.17
APPROVED BY	GS	15.03.17

DRAWING No. 1076653-WSP-SGN-OPT32-DR-S-0001
PROJECT TITLE: GREAT YARMOUTH THIRD RIVER CROSSING
SCALE: AS SHOWN
FILE No.



Date Modified:26/01/2018

Drawn By:DeSouzaJ

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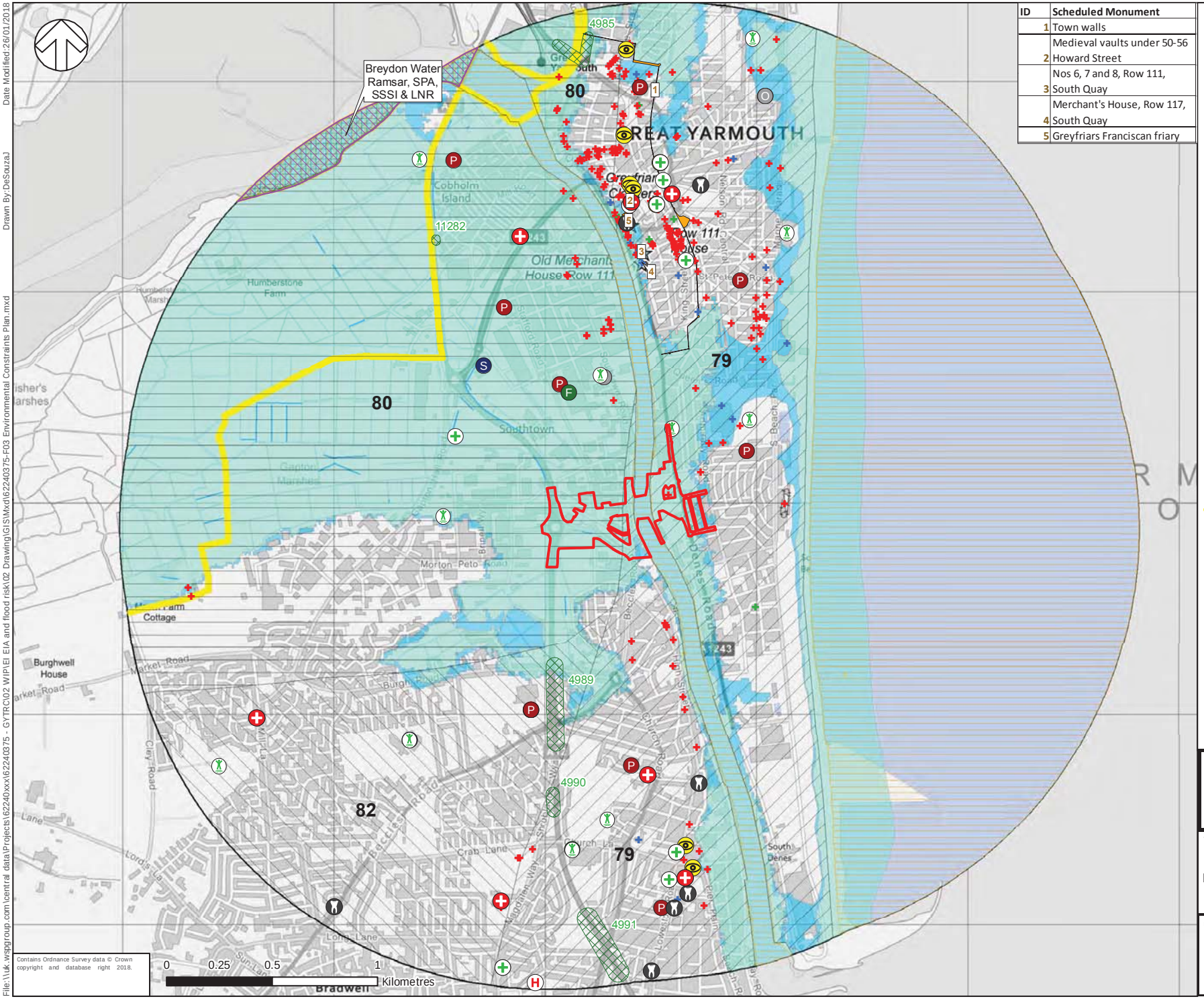
wsp

TITLE:
GREAT YARMOUTH
THIRD RIVER CROSSING
PROPOSED SCHEME LOCATION

FIGURE No:
FIGURE 2



ID	Scheduled Monument
1	Town walls
2	Medieval vaults under 50-56 Howard Street
3	Nos 6, 7 and 8, Row 111, South Quay
4	Merchant's House, Row 117, South Quay
5	Greyfriars Franciscan friary

- Site Boundary
- 2km Study Area

Air Quality and Noise
- Hospital (No A and
- GP Practice
- Pharmacy
- Dentist
- Optician
- Sports and Fitness
- Primary
- Secondary
- Further Education
- Other Educational Facility
- Noise Important Areas

Historic Environment
- Grade I Listed Building
- Grade II* Listed Buildings
- Grade II Listed Building
- Scheduled Monument

Townscape
- North East Norfolk and Flegg
- Suffolk Coast and Heaths (LCA49)
- The Broads (LCA80)
- Broads National Park

Biodiversity
- Ramar
- Special Protection Areas
- Potential Special Protection Areas
- Site of Special Scientific Interest
- Local Nature Reserve

Water Environment
- Flood zone 2
- Flood zone 3
- Rivers
- Watercourse

wsp

TITLE:
GREAT YARMOUTH THIRD RIVER CROSSING ENVIRONMENTAL CONSTRAINTS PLAN

FIGURE No:
FIGURE 3

Date Modified:26/01/2018
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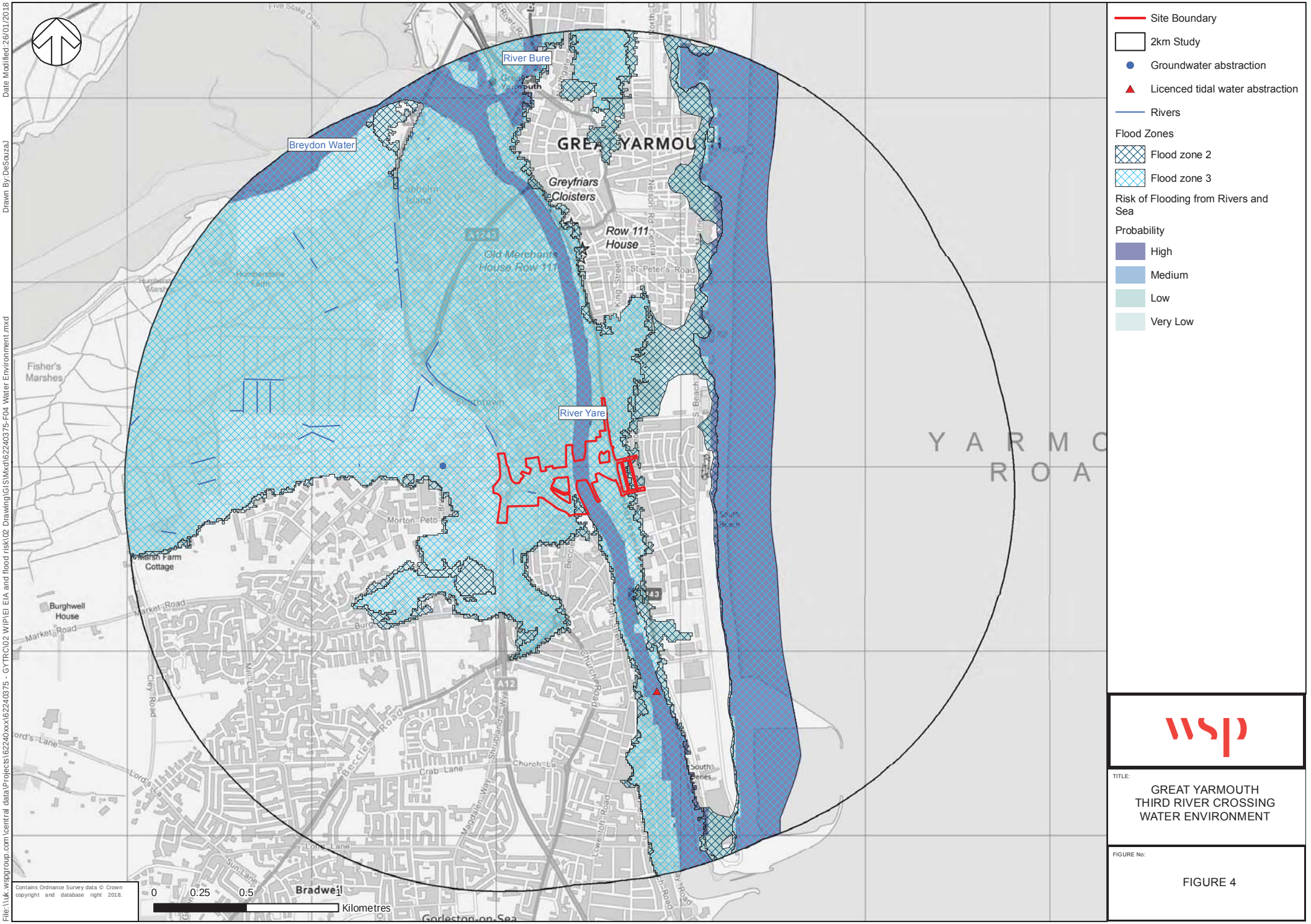

Date Modified:26/01/2018

Drawn By:DeSouzaJ

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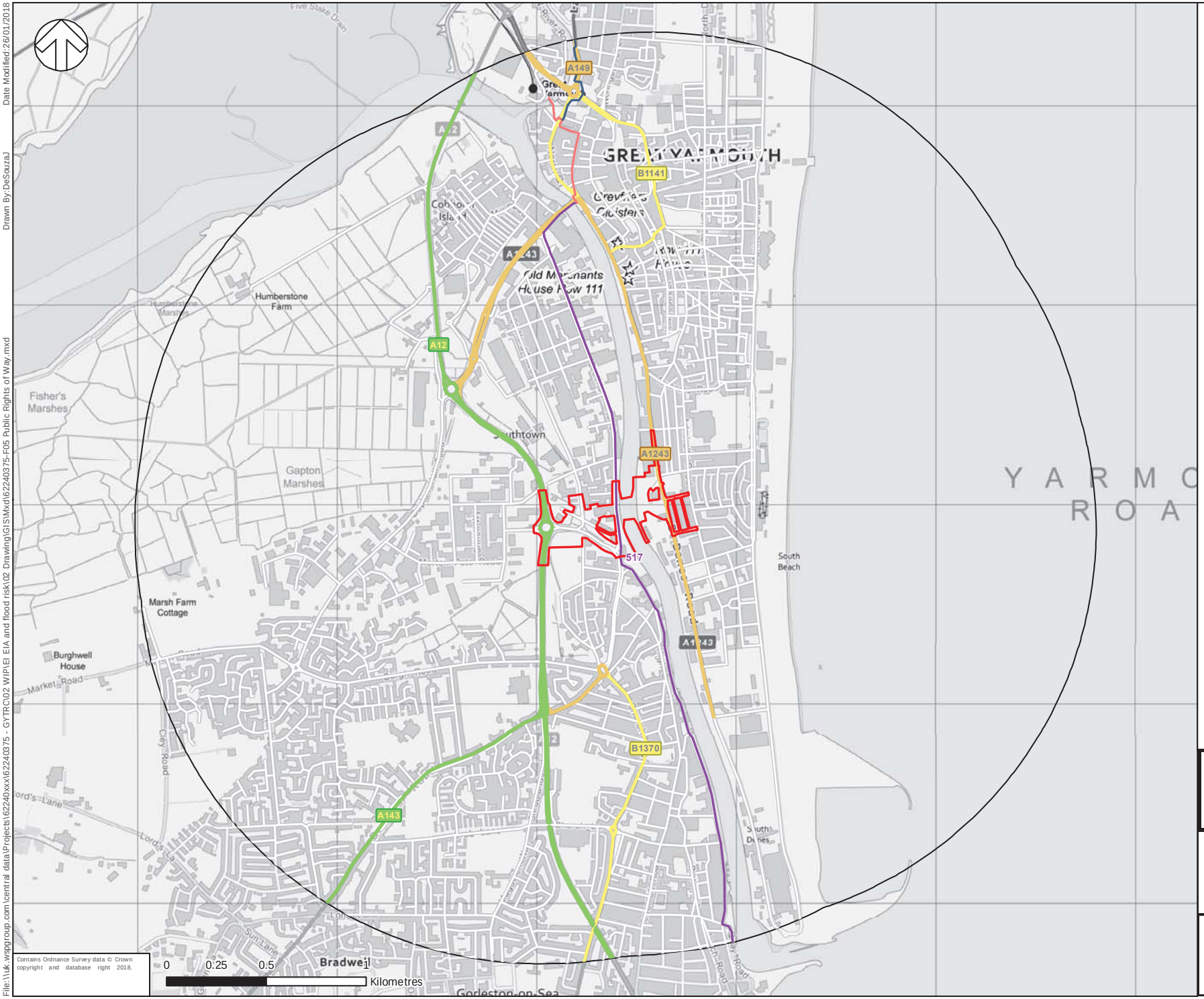
wsp

TITLE:

GREAT YARMOUTH THIRD RIVER CROSSING WATER ENVIRONMENT

FIGURE No:

FIGURE 4



Date Modified:26/01/2018

Drawn By:DeSouzaJ

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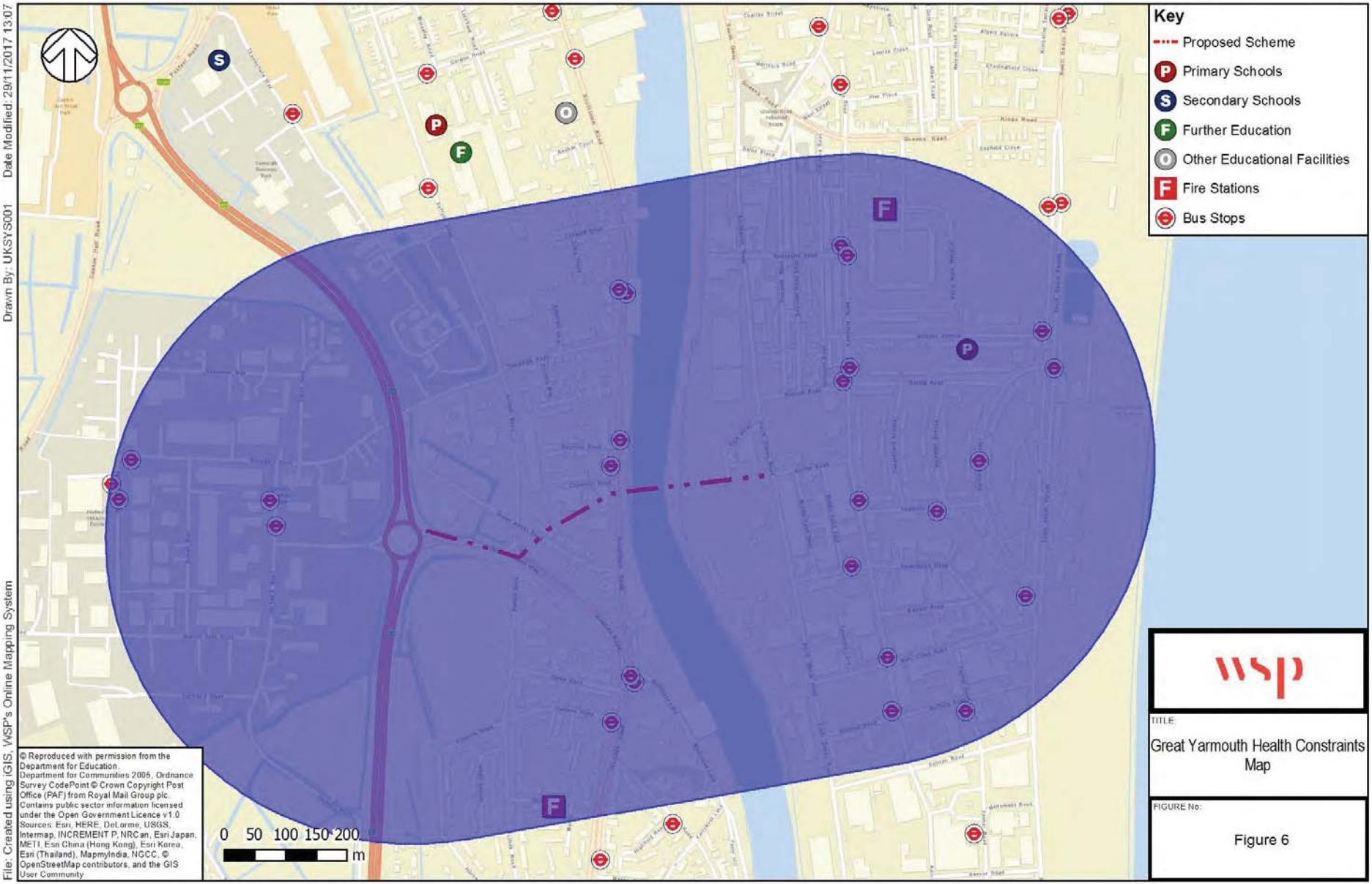
wsp

TITLE:

GREAT YARMOUTH
THIRD RIVER CROSSING
PUBLIC RIGHTS OF WAY

FIGURE No:

FIGURE 5


Key
Proposed Scheme
Primary Schools
Secondary Schools
Further Education
Other Educational Facilities
Fire Stations
Bus Stops
0 50 100 150 200
m
© Reproduced with permission from the Department for Education. Department for Communities 2005, Ordnance Survey CodePoint © Crown Copyright Post Office (PAF) from Royal Mail Group plc. Contains public sector information licensed under the Open Government Licence v1.0 Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
wsp
TITLE
Great Yarmouth Health Constraints Map
FIGURE No:
Figure 6
Drawn By: UKSYS001
Date Modified: 29/11/2017 13:07
File: Created using iGIS, WSP's Online Mapping System

Appendix C

LEGISLATION

NATIONAL PLANNING POLICY

The following is a list of national planning policy sources which will be taken into account in the EIA.

- National Policy Statement for National Networks (NN NPS) (Department for Transport 2014);
- National Planning Policy Framework (NPPF) (Communities and Local Government 2012);
- National Planning Practice Guidance (PPG) (available online).

LOCAL PLANNING POLICY

The following is a list of relevant local planning policy which will be taken into account in the EIA.

- Great Yarmouth Core Strategy 2013- 2030
- Great Yarmouth Waterfront Area Action Plan
- The Norfolk Local Transport Plan for 2026
- Great Yarmouth and Gorleston Area Transportation Strategy 2009
- New Anglia Strategic Economic Plan (SEP)

OTHER POLICIES, GUIDANCE AND DATA SOURCES

The following list includes other relevant policy and guidance documents that will inform the EIA.

- Planning Inspectorate Advice Notes:
  - Advice Note 3: EIA Notification and Consultation
  - Advice Note 7: Preliminary Environmental Information, Screening and Scoping
  - Advice Note 9; Rochdale Envelope
  - Advice Note 10; Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects
  - Advice Note 17; Cumulative Effects Assessment
  - Advice Note 18; The Water Framework Directive
- Communities and Local Government; Pre-Application Guidance (2015)
- National Infrastructure Plan 2014;
- The Natural Choice: securing the value of nature (Natural Environment White Paper, “NEWP”) (Defra 2011);
- Biodiversity 2020: A strategy for England’s wildlife and ecosystem services (Natural England 2011);
- Noise Policy Statement for England (Department for Environment, Food and Rural Affairs 2010);
- Noise Action Plan: Roads (Including Major Roads) (Defra 2014);
- Environmental Noise (England) Regulations 2006, as amended;

- The National Adaptation Programme. Making the country resilient to a changing climate (Department for Environment, Food and Rural Affairs “Defra” 2013);
- UK Climate Change Risk Assessment (Defra 2017);
- Climate Resilient Infrastructure: Preparing for a Changing Climate (Defra 2011);
- The Carbon Plan: Delivering our low carbon future (Department of Energy and Climate Change 2011);
- Interim Advice Note (IAN) 195/16 Cycle Traffic and the Strategic Road Network[80];
- Guidelines for Landscape and Visual Impact Assessment (3rd Edition, Landscape Institute and Institute of Environmental Assessment and Management 2013);
- Handbook for Cycle Friendly Design (Sustrans 2014);
- Technical Standards for the design, maintenance and operation of Sustainable Drainage Systems (Defra)

[80] Interim Advice Note (IAN) 195/16 (2011) Cycle Traffic and the strategic Road Network [online] available at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian195.pdf (Accessed January 2018).

Appendix D

INFORMAL CONSULTATION RESPONSES

Broad, Gavin

From: [redacted]
Sent: 13 October 2017 13:26
To: Great Yarmouth 3rd River Crossing
Subject: Broads Authority Response to consultation
Attachments: 2017_07_25 Revised A1 Poster.pdf; habi-sabi swift and bat refuge prospectus.pdf

Many thanks for allowing us an extension to the consultation. Planning Committee today endorsed the representation below.

The Broads Authority supports the scheme.

We do have some comments that we would like you to consider.

From a navigation point of view there needs to be a safe waiting point, particularly for small vessels (motor cruisers, rather than the Ports shipping vessels), while waiting to cross under the proposed new bridge. Current provision is very poor at Haven Bridge with a climb up a long slippery ladder to tie up vessels. This provision could take the form of pontoons (particularly downstream of the proposed new bridge) to allow safe mooring of vessels while waiting.

The Lake Lothing equivalent consultation included much information about the environmental considerations of the bridge when in place and during construction. It is not obvious where this information is for the Great Yarmouth scheme. Please find some general biodiversity related comments below. In addition, we request that the Senior Ecologist at the Broads Authority is contacted to discuss the project. A similar meeting was held with Suffolk County Council regarding the Lake Lothing crossing and this was very productive.

- What surveys have been undertaken relating to biodiversity, for example in relation to bats?
- What is the timeframe for the Environment Statement to be completed please?
- This development is next to the Broads and within some of the UK's most important biodiversity habitats that people cherish. Within the Environment Statement we would request the scheme to be very positive and explicit about bat and nesting bird enhancement and recommend that something similar to the habi-sabi is installed to ensure that this scheme is evidencing meeting its mitigation and enhancement targets. (see example designs attached)

Access and waterways comments:

- With regards to the bridge structure, a 4.5m air draft when closed (infinite when opened) would be acceptable in principle to the Broads Authority as Navigation Authority. This is also true of the span of the bridge between the supporting pylons. As this is shown as 50m, this is well outside the minimum width requirement.
- With regards to the access, no Public Rights of Way are affected by these proposals. The bridge is stated to not exceed a max gradient of 5% (1:20) which is in accordance with the design standard. There is a cycle route crossing the development area but this has been incorporated into the landscaping design and poses no problems with regards to access issues.

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Project Manager
Great Yarmouth Third River Crossing
Major Projects Team
Norfolk County Council
County Hall, Floor 2
Martineau Road
Norwich
NR1 2DH

Our ref:
Your ref:
Date: 3rd November 2017

Dear [redacted]

Great Yarmouth Third River Crossing Stage 2 Consultations

Thank you for inviting us to comment on the proposal for a third river crossing at Great Yarmouth. As previously discussed, we did not receive the original invitation and so we apologise that we have not been able to respond within you published timeframe. In terms of our overall response to your proposal, we have not identified any issues at this stage that present any irresolvable conflict with our objectives. This is based on the limited information available and careful consideration must be given to the environmental constraints as the proposal is developed further.

The document has made little reference to the environmental assessments that will be required to progress the proposal through the consenting process for an application of this scale and complexity. Therefore, we have considered the proposal and offer our comments below as a preliminary opinion for this project based on our outline assessment of the constraints for the site. We have indicated the areas for consideration and the relevant study or evidence that will be required as the scheme design progresses and will be necessary to inform decision making for development consent. The areas for further consideration are: how the proposal might be affected by or impact on the proposals for a tidal barrier, assessment and management of flood risk, impacts on the water environment, biodiversity and contaminated land.

We would be pleased to provide bespoke advice such as reviewing assessments and modelling advice based on our standard hourly rate as the scheme progresses

Proposed Tidal Barrier and Flood Risk

Tidal Barrier

The Environment Agency project manager for the Great Yarmouth Tidal Defences (Epoch 2 – 2016-2021) project met with David Allfrey from NCC in May this year to discuss the Third River Crossing. The purpose of the meeting was to share background information about both of the projects. The proposed bridge location will affect around 100m of river frontage on wall 80 on the west bank (Bollard Quay) and wall 22 on the

east bank. The Third River Crossing project is looking to narrow the river from one or other, or both sides, which would go in front of the current flood defences. Given the uncertainty concerning the details of both projects at that stage we agreed that we would keep each other updated on progress. Once we know our preferred options we can then then discuss how the projects overlap, possible constraints and opportunities.

Flood Risk

Our maps show the site lies wholly within tidal Flood Zone 3 defined by the 'Planning Practice Guidance: Flood Risk and Coastal Change' as having a high probability of flooding. A proposal such as this for a significant new bridge crossing can be classed as "essential infrastructure" specifically essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. This is defined in Table 2: Flood Risk Vulnerability Classification of the Planning Practice Guidance. This classification should be checked with the planning authority as they will make the final decision on the classification.

To comply with national policy the application is required to pass the Sequential and Exception Tests and be supported by a site specific Flood Risk Assessment (FRA). It has not been stated if this proposal will fall under a Nationally Significant Infrastructure Project (NSIP). If this proposal is considered an NSIP the National Policy Statement for National Networks should be referred to as well as the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) discussed above.

Flood Risk Assessment

The FRA should consider the risk to the proposed crossing itself. It should be noted that Table 3 of the PPG states that essential infrastructure located within Flood Zone 3a should be designed and constructed to remain operational and safe in times of flood.

As well as the risk posed to the bridge itself any off-site impacts that may be caused as a result of the new crossing displacing flood storage, or changing flow pathways in the event of flooding must be considered. We note that the proposals appear to narrow the channel which could have an impact upon flood risk. Any land raising within the floodplain such as bridge ramps or abutments could also have an impact and remove floodplain storage and should be considered. It is important to ensure that the proposed crossing does not increase flood risk elsewhere and where possible reduces flood risk overall in line with Paragraph 102 of the National Planning Policy Framework (NPPF). If there is likely to be an impact elsewhere mitigation will be required potentially in the form of compensatory storage.

Flood Modelling

In order to undertake this assessment flood modelling will be required. The Environment Agency hold a number of flood models which will be of use. The Great Yarmouth Model undertaken by Halcrow on behalf of the environment Agency was completed in 2011. The model itself and any outputs (flood levels and extents) and reports can be requested from us. Please be aware that we are in the process of updating this modelling. The new Essex Norfolk and Suffolk Coastal Modelling (2017) will replace the 2011 model. This is still in the process of being finalised but should be used if available. This information can be requested by emailing our Customers and Engagement Team on Enquiries_EastAnglia@environment-agency.gov.uk. This information is free of charge. For further information on our flood map products please visit our website at: www.environment-agency.gov.uk/research/planning/93498.aspx.

The FRA should consider a range of events over the lifetime of the proposed crossing. As a minimum the 5% (1 in 20), 0.5% (1 in 200) and 0.1% (1 in 1000) annual probability

flood events should be considered both with and without an allowance for climate change. As Great Yarmouth is defended the residual risk of a breach of these defences will also need to be considered. The FRA may also need to consider the impact of any significant temporary works which may be required to facilitate the installation of the crossing to ensure this does not increase flood risk. This is usually considered by obtaining our flood models and re running them to produce a before and after scenario. The FRA should illustrate and discuss any changes shown by this modelling as a result of the crossing in order to determine if mitigation is required. If flood modelling is undertaken this will need to be submitted to us for review.

Climate Change

Our current climate change guidance for Flood Risk Assessments is available on our website. Another important document to refer to is our Adapting to Climate Change: Advice for flood and Coastal Erosion Risk Management Authorities guidance document. If the proposal is considered a NSIP the NPS for National Networks should also be considered. This refers to other climate change allowances that need to be considered in a FRA for this kind of development. You should refer to paragraphs 4.41 – 4.44 of the National Networks NPS. It is important that the impact of and resilience to future flooding is considered and mitigation against future flood risk elsewhere is implemented where necessary. Section 4.41 of the NPS states that if transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario against the 2080's projections at the 50% probability level.

It is therefore important to determine if the bridge has safety-critical elements or is considered safety critical as this will inform the climate change allowances that need to be considered and if you need to assess the high emissions climate change scenario. If these allowances are relevant and the bridge is considered safety-critical the FRA should provide details of whether these allowances are higher or lower than the standard tidal allowances. The highest levels should then be used to inform the design and mitigation of the crossing.

According to the NPS document if the bridge is considered safety critical the high emissions scenario and H++ scenario also needs to be assessed. Safety critical elements of the design should be assessed against the H++ estimates (high risk, low probability scenario) for sea level rise to assess a credible maximum scenario. We would not normally expect the design or mitigation to be provided to this level but the crossing should be assessed against this scenario to understand the picture of risk.

The UKCP09 relative sea level rise projections are available for various emission scenarios on the UKCP09 user interface on their website. Please be aware that the next set of climate change projections (UKCP18) replacing UKCP09 is due in 2018.

Environmental Permit for Flood Risk Activities

Under the Environmental Permitting Regulations (EPR) for England and Wales (2016) an environmental permit for flood risk activities may be required for work in, under, over or within 8m of a fluvial main river or flood defence structure or culvert or within 16m of a tidal main river or flood defence structure or culvert. The proposed third crossing will cross the main river known as the River Yare.

The Environmental Permitting Regulations take a risk based approach that enables us to focus regulatory effort towards activities with highest flood or environmental risk. Lower risk activities can be excluded or exempt and only higher risk activities will require a permit. The bridge crossing itself will require a bespoke permit. Any other

facilitating works may fall under one or more of the following:

- An Exclusion
- An Exemption
- A Standard Rules Permit
- A Bespoke Permit

Application forms and further information can be found at:
https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.
If you require further advice please email FDCENS@environment-agency.gov.uk.

Water Environment and the Water Framework Directive

Our concerns for the water environment are to protect both surface and groundwater that may be receiving bodies for any sources of contamination. In addition to this there is an overriding obligation for all public bodies to seek to improve the status of water bodies to 'good' under the provisions of the Water Framework Directive.

Water Framework Directive (WFD)
The obligations of WFD extend to all public bodies and require an absolute responsibility to ensure no deterioration of a waterbody; overlaying this is a requirement to strive for improvement and this should underpin all elements of environmental assessment involving a water body. WFD applies to both surface and groundwater bodies. It will be necessary to undertake a preliminary assessment to fully understand the potential direct and indirect impacts on waterbodies both in the immediate vicinity of the proposed development and on wider waterbodies such as aquifers and river catchments together with options for mitigation and improvement.

Surface Water
Hydromorphological assessment – The development is expected to require narrowing of the tidal waterbody which will result in changes to the channel hydromorphology. This will require modelling and provision of evidence to demonstrate that this kind of modification will not cause a WFD deterioration.

Road Drainage and water environment – Plans should be in place to deal with surface water drainage issues created by new highways. This should include appropriate sustainable drainage systems (SuDS) to filter pollutants and prevent deterioration in the status of the receiving waterbodies. Any scheme for drainage should have appropriate number of treatments steps to protect both surface and groundwater receiving bodies. The use of SuDS may also provide an opportunity to incorporate new wetland habitat to promote biodiversity.

Groundwater
Environmental Setting
The geology in the area of the proposed bridge crossing is comprised of the North Denes Formation on the east bank. This superficial sand and gravel deposit is designated as Secondary A aquifer. On the west bank the superficial deposits comprise of the Breydon Formation, a peat deposit considered to be unproductive. The bedrock beneath the proposal area is the Crag Formation, a principal aquifer. The site is not within a Source Protection Zone (SPZ).

Groundwater Protection
We would wish to be consulted on any proposals to drill investigative boreholes into the river to ensure sufficient pollution prevention measures are taken to protect the

Cont/d..

underlying aquifer.
A piling risk assessment will need to be undertaken. Piling or any other foundation designs using penetrative methods can result in risks to groundwater, for example, pollution / turbidity, risk of mobilising contamination, drilling through different aquifers and creating preferential pathways. Therefore, it should be demonstrated that any proposed piling will not result in contamination of groundwater.

Biodiversity

The document makes little reference to the assessments that will be required to preserve the biodiversity of the site area as the proposal moves forward. In addition to the requirements mentioned previously the following key environmental considerations should be included in your assessments:

Nature Conservation
You should identify the likely significant effects of the proposed scheme on the biodiversity of the area, during constructional and operational phases. You should include statutory designated and non-designated sites, protected habitats, and impacts on legally protected species. Assessments should also consider impacts in relation to the distance from the site – Main (within 500m), Broad (2km), Extended (30km).

Phase 1 Habitat Survey
This should include both desk study and field studies. The desk study should identify the locations of any protected species records, Natura 2000 sites, SSSIs and non-statutory nature conservation sites (County Wildlife Sites, Local wildlife sites) within a 2km radius. Field study to identify and map habitat present within the study area, and asses their suitability to support protected species.

Habitats Regulations Assessments (HRA) Screening
This is required to assess the proposed scheme in relation to the requirements of the Habitats Regulations. It should also include consideration of compensatory measures.

Contaminated Land

The area of interest is in a predominantly industrial area and therefore a preliminary risk assessment (PRA) will need to be submitted as part of the planning application. The PRA should identify all previous uses of the land, potential contaminants associated with those uses and develop a conceptual model of the site including sources, pathways and receptors. The PRA will need to be followed up by a site investigation which will provide information for a detailed assessment of risk to all receptors, including those off site.

The results of the site investigation and risk assessment will enable an options appraisal and remediation strategy to be developed which will give full details of the remediation required. A verification report, providing all the data collected, will then need to be submitted to demonstrate remedial targets have been met and the works have been completed as set out in the remedial strategy.

I trust that you have found this information useful. As stated previously, we would be pleased to provided tailored advice and we would be interested to know which consenting route you consider to be most appropriate at this stage.

Yours sincerely

[redacted]

[redacted]
Planning Specialist

[redacted]
[redacted]
[redacted]

End

Historic England

EAST OF ENGLAND OFFICE

[redacted]

Norfolk County Council: Community and
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County Hall
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Norfolk
NR1 2DH

[redacted]

Our ref: PA00572687
Your ref: HI/MP/PKA018/GB

4 October 2017

Dear [redacted]

Pre-application Advice

GREAT YARMOUTH THIRD RIVER CROSSING - STAGE 2 CONSULTATION, GREAT YARMOUTH, NORFOLK

Thank you for seeking Historic England's pre application advice on the proposal for a third river crossing for Great Yarmouth. This is part of a wider consultation on the scheme development.

The crossing is proposed at the southern end of the river. It lies not far from Nelson's Column and to the south of the conservation area. The Nelson Monument a prominent landmark, listed grade I. Dating from 1817-19 it reflects Nelson's achievements and associations with the town and was a precursor to the more famous monument in Trafalgar Square. The design reflects the predominance of the classical style in this period and its functional role as a seamark. Its location was deliberately exposed to enhance its value as the latter. To the north of the site is the wooden scenic railway which opened in 1932. It is the second oldest scenic railway in the country and one of only six roller coasters built before the Second World War to survive. It is the major surviving ride from the Pleasure Beach, one of the earliest seaside amusement parks in the country and an important part of the outstanding collection of nineteenth and twentieth century entertainment buildings in Great Yarmouth. It was listed at grade II last year.

The design of the bridge has yet to be developed but would need to open to allow vessels along the river. A bascule bridge with a clearance of 4.5 meters at high tide is therefore proposed. An alternative option of a cable stayed swing bridge is also set out.

The impact of the new bridge and new road network on the setting and significance of Nelson's Column and the conservation area and other elements of the historic environment should be fully considered. Detailed information about the setting of heritage assets can be found in the Planning Practice Advice Note 3 The Setting of Heritage Assets. As a tall structure, the setting of the column extends over a wide area. The impact of the height of the bridge (in both a closed and open position) on the significance of the column should be considered. It would be helpful to for the impact of both bridge design options to be assessed. The design should aim to avoid or minimise any harm in line with planning policy.

Previous work in the area of the proposed development has highlighted the potential for buried archaeological remains and deposits to be preserved spanning the prehistoric period to the present day. This includes deposits of palaeoenvironmental interest, such as peat, that may preserve organic archaeological remains such as wood, pollen, plant remains, shells and insect remains that can provide information about how the landscape and the environment may have changed over time, as well as potentially providing information on the activities that were carried out in the area. A heritage statement will therefore be required in order to understand the archaeological potential of the area affected by the development, and how the proposed works would impact on the remains. This may highlight the need for additional work to be carried out, such as a borehole survey, deposit model and assessments being carried out to understand the deposits that are present, the remains that are present (artefacts and palaeoenvironmental remains) and their potential to address archaeological questions. Additional information about the approaches and techniques that could be used, and the remains that could be investigated can be found in the following Historic England guidance documents:

Environmental Archaeology (2011): <https://historicengland.org.uk/images-books/publications/environmental-archaeology-2nd/>

Geoarchaeology (2015): <https://historicengland.org.uk/images-books/publications/geoarchaeology-earth-sciences-to-understand-archaeological-record/>

Next Steps

We hope this initial advice is helpful in highlighting the historic environment issues that Historic England considers important. Please do contact me if you would like to discuss this further. If you would like further guidance on the archaeological issues, please contact the Historic England Science Advisor for the East of England, Zoe Outram (zoe.outram@historicengland.org.uk <mailto:zoe.outram@historicengland.org.uk>).

Yours sincerely

[redacted]

[redacted]

Principal Inspector of Historic Buildings and Areas

[redacted]

24 BROOKLANDS AVENUE, CAMBRIDGE, CB2 8BU

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HistoricEngland.org.uk

Date: 06 October 2017
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Dear [redacted]

Planning consultation: Great Yarmouth Third River Crossing Stage 2 Consultation

Thank you for your consultation dated and received by Natural England on 24 August 2017.

Natural England is a non-departmental public body. Our statutory purpose is to ensure that the natural environment is conserved, enhanced, and managed for the benefit of present and future generations, thereby contributing to sustainable development.

Natural England has reviewed the pre-application request that has been sent to us by your authority. As you may be aware, Natural England has introduced an improved service to provide discretionary advice related to planning proposals, supported by the introduction of charges – our Discretionary Advice Service (DAS).

Based on the consultation sent to Natural England by your authority and in accordance with Natural England's DAS requirements, Natural England can provide advice on the following areas:

European and Nationally Designated Sites and Protected Landscapes
Designated sites that may be impacted upon by the proposed development include:

- Breydon Water Special Protected Area
- Breydon Water Ramsar
- Breydon Water Site of Special Scientific Interest
- Great Yarmouth North Denes Special Protected Area
- Great Yarmouth North Denes Special Scientific Interest
- Outer Thames Estuary Extension Special Protected Area
- The Broads National Park

We acknowledge from the documents available at this stage that the proposal is to develop a third river crossing over the River Yare, Great Yarmouth. This use presents a number of potential impact pathways to the designated site features including:

- Noise disturbance (birds)
- Changes to recreation patterns at designated sites
- Runoff from the bridge (water quality)
- Landscape and visual impacts

The above listed SPA's are classified in accordance with Article 4 of the EC Birds Directive, they are classified for rare and vulnerable birds and regularly occurring migratory species. The noise and visual impact of the proposed development may effect these species and cause displacement. We suggest that potential disturbance to designated features are assessed.

Great Yarmouth is a popular seaside destination and improvements to the transport network may generate additional tourism and increase recreational pressure on sensitive sites such as Great Yarmouth and North Denes SPA. We suggest increased visitor pressure and potential impacts to designated sites are considered.

Runoff from the bridge into the River Yare may indirectly impact designated sites, specifically Breyon Water. We advise that potential impacts on water quality and controls for runoff and pollution are explored.

In addition, we feel landscape and visual impacts should be taken into account with reference to the likely effects on the special qualities of The Broads National Park.

Natural England advise that these potential impact pathways are considered within the application. We suggest a habitats regulation assessment to consider how the proposed development may impact designated sites. We recommend that the potential impacts on the features for which the SSSI is notified is also considered as some are different to the European site features. The Conservation objectives for each European site explain how the site should be restored and/or maintained and may be helpful in assessing what, if any, potential impacts a plan or project may have.

Please refer to our standing advice on protected species.

If the developer requires substantive pre-application advice in addition to that provided above, Natural England advises that the applicant/developer consults Natural England directly, so that they have the opportunity to express an interest in using DAS.

The first step is for the developer to fill out a simple form, so we can register their interest, and make sure they have the right adviser for their case. Please visit our website (http://www.naturalengland.org.uk/ourwork/planningdevelopment/spatialplanning/das/default.aspx) for more information and a downloadable request form here .

Yours sincerely

[redacted]
Norfolk and Suffolk

[redacted]

Appendix E

PRELIMINARY ECOLOGICAL APPRAISAL

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Ecological Appraisal

October 2016

Produced for

Norfolk County Council

Prepared by

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Document Control Sheet

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1	Final	D. Lovett	20/10/16	R. Bailey	21/10/16	A. Bascombe	24/10/16

Distribution

Date	Organisation	Contact	Format	Copies

This report is presented to Norfolk County Council in respect of the Great Yarmouth Third River Crossing and may not be used or relied on by any other person. It may not be used by Norfolk County Council in relation to any other matters not covered specifically by the agreed scope of this report.

Notwithstanding anything to the contrary contained in the report, Mouchel Limited is obliged to exercise reasonable skill, care and diligence in the performance of the services required by Norfolk County Council and Mouchel Limited shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

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Contents

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[1] 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*[2], was carried out on 28th and 29th 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.

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

[2] *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, *Pipistrellus pipistrellus*	5	June 2015
Soprano pipistrelle, *Pipistrellus pygmaeus*	1	May 2015
Nathusius' pipistrelle, *Pipistrellus nathusii*	2	May 2015
Serotine, *Eptesicus serotinus*	1	May 2015
Daubenton's bat, *Myotis daubentonii*	1	May 2015
Noctule, *Nyctalus noctula*	3	May 2015
Brown long-eared bat, *Plecotus auritus*	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 *Uritca dioica*, bramble *Rubus fruticosa*, 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*

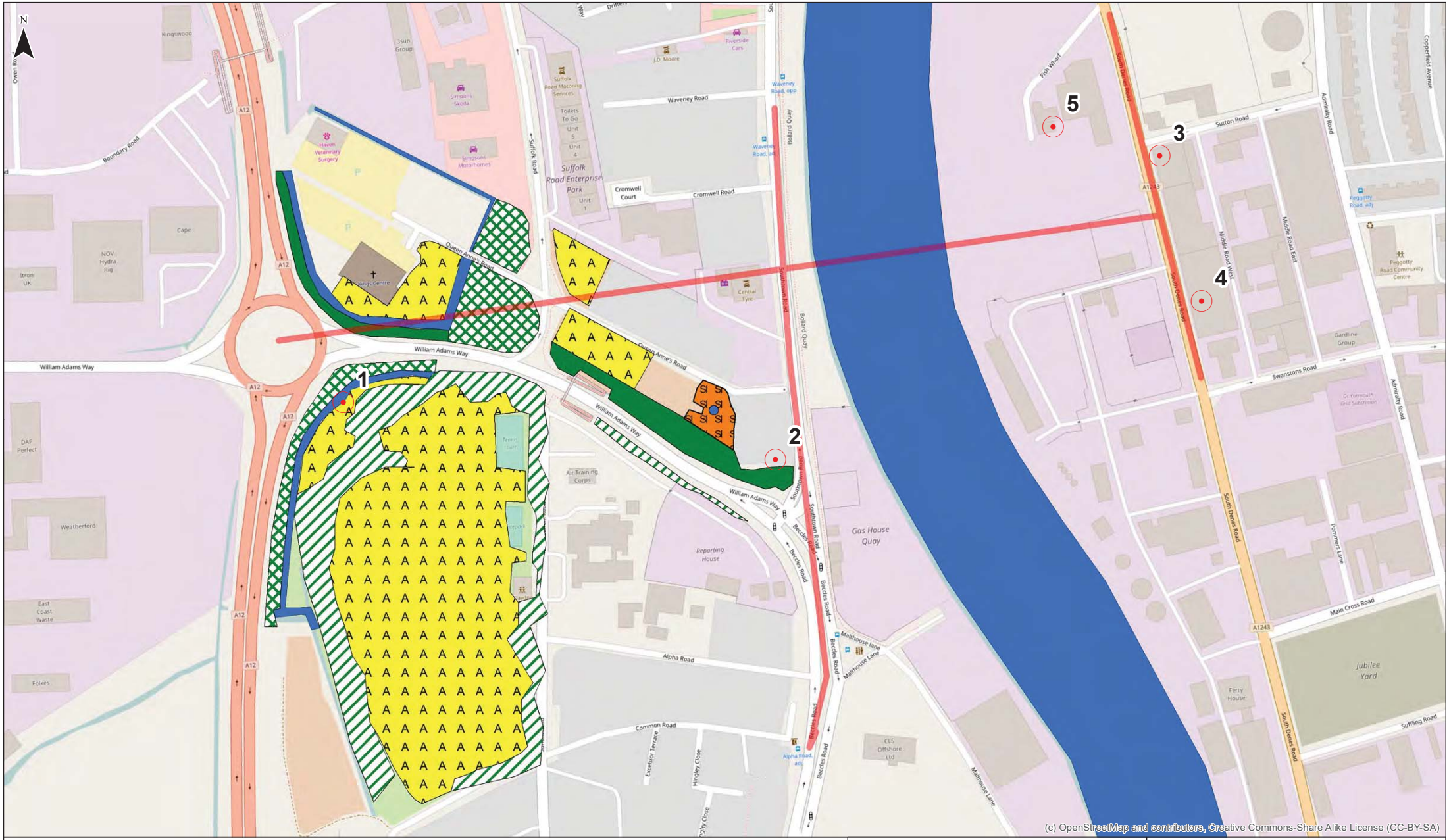
The buildings within the site are either to be purchased for demolition or will be subject to disturbance during the construction of the proposed scheme. It is recommended that further surveys are undertaken to confirm the presence or absence of bats within these buildings.

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



Legend

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

Version	Amendment	Drawing Date	Review Date	Approved Date
A	First Issue	06/12/2016	09/12/2016	09/12/2016

Client: Norfolk County Council

Project: The Great Yarmouth Third River Crossing (GYTRC)

Drawing Title: GYTRC Phase 1 Habitat Survey

mouchel
building great relationships

Office: Puddle Dock

Tel: 020 7822 2497

Scale (at A3 size): 1:2,407

Purpose of Issue: Information

Drawing Number: Page 1 of 1

Appendix F

PROTECTED SPECIES REPORT

Norfolk County Council

GREAT YARMOUTH THIRD RIVER CROSSING

Protected Species Survey Report

002
NOVEMBER 2017

PUBLIC

Norfolk County **Council**

GREAT YARMOUTH THIRD RIVER CROSSING

Protected Species Survey Report

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 62240375
OUR REF. NO. 002

DATE: NOVEMBER 2017

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks				
Date	21.08.2017			
Prepared by	David Lovett			
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Checked by	Becky Bailey			
Signature	[redacted]			
Authorised by	Andy Bascombe			
Signature	[redacted]			
Project number				
Report number				
File reference				

CONTENTS

TABLES

FIGURES

No table of figures entries found.

APPENDICES

No table of contents entries found.

This report was prepared by WSP for the account of Norfolk County Council, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given to by any modifications to be made to this document.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

1.1.1. WSP (formerly Mouchel) was commissioned by Norfolk County Council to undertake water vole and bat surveys for the Great Yarmouth Third River Crossing project, in order to assess the likely effects of the scheme on these species.

1.2 THE SITE

1.2.1. The Great Yarmouth Third River Crossing will be located in the centre of Great Yarmouth. It will cross the River Yare linking William Adams Way on the west side of the river to the A1243 South Denes Road on the east side. The area through which the scheme passes comprises mostly urbanised land, with small areas of vegetation present in the form of gardens, allotments and Southtown Common Recreation Ground.

1.3 OBJECTIVES

1.3.1. The proposed river crossing construction may require building demolition and the removal of vegetation, as well as the modification and/or destruction of water courses and adjacent bank habitats.

1.3.2. Water vole surveys were undertaken to identify whether water voles are present, to provide an estimate of the population size and to assess the effect of these activities on water voles.

1.3.3. Similarly, bat surveys sought to identify which bat species are present, how bats use habitats within the site and whether bat roosts are present and likely to be affected by the proposals.

1.3.4. The following activities were undertaken:

- A review of bat and water vole records from the local ecological data centre;
- A preliminary ecological assessment to identify suitable features that may be used by water voles as well as features suitable for roosting bats and features that provide suitable habitat for foraging and commuting;
- Field survey to search for evidence of water vole in suitable habitats within the footprint of the proposed scheme; and,
- Walked transects to identify the locations of important bat foraging and commuting habitats.

2 METHODOLOGY

2.1 DESK STUDY

SPECIES RECORDS

2.1.1. In 2016 the Norfolk Biodiversity Information Service (NBIS) was consulted to obtain bat and water vole records within 2km of the proposed scheme (the study area) from the last 10 years. This was undertaken as part of an earlier stage assessment.

2.1.2. The Multi-Agency Geographic Information for the Countryside (MAGIC) service was also used to obtain records of water vole and bat licences granted within this area.

2.2 PRELIMINARY ECOLOGICAL ASSESSMENT

WATER VOLE ASSESSMENT

2.2.1. Surveys performed by Mouchel Limited for Norfolk County Council in 2016, identified two watercourses that have the potential to support water voles. These watercourses are the two ditches associated with the A12 at the western extent of the proposed scheme.

BAT ASSESSMENT

2.2.2. Surveys performed by Mouchel Limited for Norfolk County Council in 2016 identified six built structures as having potential to support roosting bats. In 2017 these structures and all others within the footprint of the scheme were re-assessed using the assessment criteria as prescribed in the Bat Conservation Trust's (BCT) *Bat Surveys for Professional Ecologists - Good Practice Guidelines* (Collins, 2016) to determine whether the structures remained in the same condition. In total, thirteen built structures were assessed for their potential to support roosting bats.

2.2.3. Each structure was inspected from ground level to look for features that bats could use for roosting (Potential Roost Features or PRFs) such as damaged brickwork, missing mortar, missing roof tiles, damaged barge boards and loose guttering. Using guidance from Collins, 2016, the structures were identified as having negligible, low, moderate or high suitability to support roosting bats (see Table 1).

Table 1 - Assessment criteria for structures which could support roosting bats

Suitability	Roosting Habitat Description
Negligible	Negligible habitat features on site likely to be used by bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats.
Moderate	A structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status.
High	A structure with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.

2.2.4. Using guidance from Collins, 2016, the habitats within the site were identified as having either Negligible, Low, Moderate or High suitability habitat for bats (see Table 2).

Table 2 - Guidelines for assessing bat habitat on development sites

Suitability	Commuting & Foraging Habitat
Negligible	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	Habitat that could be used by small numbers of commuting bats such as gappy hedgerows or un-vegetated stream, but isolated i.e. not very well connected by other habitat to the surrounding landscape. Suitable but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	Continuous, high-quality habitat that is well connected to the wider landscape that likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

2.3 FIELD SURVEYS

WATER VOLE SURVEYS

2.3.1. A survey was undertaken in August 2017 to search for evidence of water vole. The areas surveyed for water voles are shown in Appendix A.

2.3.2. The surveys followed standard methods described in The Water Vole Mitigation Handbook (2016) and were undertaken under suitable conditions by experienced surveyors. The surveys were carried out during the water vole breeding season (March to October in south-east England), which is an optimal survey time for this species.

2.3.3. Where accessible, the banks of the watercourses were surveyed from within the channel. Surveyors systematically searched along each bank and any evidence of water vole was recorded when found. Where surveyors were unable to access the watercourse channel, evidence was searched for from the top of the banks, using binoculars as required.

BAT ACTIVITY SURVEYS

2.3.4. The following surveys, based on recommended methods published in Bat Conservation Trust Guidelines (Collins, 2016), were carried out in August 2017.

2.3.5. Two walked transects routes were designed to cover the west and east side of river Yare. The routes covered the majority of the site and incorporated all assessed built structures as well as adjacent habitats that may be used by bats for foraging and commuting. These transects are shown in Appendix B.

2.3.6. Bat activity surveys are undertaken in order to observe, listen for, record bats in flight away from their roost, commuting, feeding or socialising at dusk and dawn. Hand-held Batbox Duet detectors and a Song Meter SM4BAT FS recorder were used. During these walked transects, surveyors walked at a constant speed, recording information on any bats seen or heard on detectors. Information recorded included bat species, behaviour, flight direction, number of bats and number of passes. Surveyors stopped at pre-determined

"listening points" along each transect for 3-5 minutes to record bat activity at a single location. Each walked transect was undertaken by two experienced ecologists.

2.3.7. Sounds recorded with the Song Meter SM4BAT FS during the surveys were analysed using AnalookW software to confirm the species of bats recorded and their activity. In case of doubt on the species, a bat calls guide British Bat Calls: A Guide to Species Identification (Russ, 2012) was used to help the identification. Bat activity levels were assessed in terms of the number of bat passes occurring.

2.4 ASSESSMENT OF CONSERVATION IMPORTANCE

2.4.1. The conservation importance of water vole and bats was assessed using the Chartered Institute for Ecology and Environmental Management's Guidelines on Ecological Impact Assessment (EclA) in the UK and Ireland (CIEEM, 2016).

2.4.2. The importance of bat roosts and commuting and foraging habitat was evaluated based on the rarity, distribution, species and numbers of bats recorded and the way they use the site.

3 RESULTS

3.1 DESK STUDY

SPECIES RECORDS

3.1.1. The desk study identified no granted EPS licences for bats and water vole within 2km of the proposed scheme (see Table 3).

3.1.2. The Norfolk Biodiversity Information Service returned thirteen records of bat species within 2km of the proposed scheme (see Table 3) and fourteen records of water vole within 2km of the proposed scheme (see Table 4).

Table 3 - Records of bats within 2km of the Third River Crossing

Species	Date	number of records	Distance From Scheme
Common pipistrelle (Pipistrellus pipistrellus)	June 2015	5	~2km south-west
Soprano pipistrelle (Pipistrellus pygmaeus)	May 2015	1	~2km south-west
Nathusis' Pipistrelle (Pipistrellus nathusii)	May 2015	2	~2km south-west
Serotine (Eptesicus serotinus)	May 2015	1	~2km south-west
Daubenton's bat (Myotis daubentonii)	May 2015	1	~2km south-west
Noctule (Nyctalus noctula)	May 2015	3	~2km south-west
Brown long-eared bat (Plecotus auritus)	May 2015	1	~2km south-west

Table 4 - Records of water voles within 2km of the Third River Crossing

Date	Number of records	Location	Distance From Scheme
26/04/2011	1	TG512075	~2km north-west
18/12/2012	1	TG504059	~2km west
17/07/1968	1	TG5204	-
01/05/2009	1	TG519060	~600m west

Date	Number of records	Location	Distance From Scheme
2007	1	TG5133106699	~1.5km north-west
05/06/2008	5	TG520057	~300m south-west
1997	1	TG518078	~2km north

3.2 PRELIMINARY ECOLOGICAL ASSESSMENT

WATER VOLE

3.2.1. The two water courses associated with the A12 were assessed for their suitability to support water voles. The two water courses were wet ditches with areas of open water and thickly vegetated banks. The north ditch banks are covered by common nettle *Uritca dioica*, bramble *Rubus fruticosa*, great willowherb *Epilobium hirsutum*, dog rose *Rosa canina* and creeping thistle *Cirsium arvense*. The southern ditch is of similar species composition, but additionally supports field bindweed *Convolvulus arvensis* and hogweed *Heracleum sphondylium*.Both ditches were approximately 1m in depth and heavily silted.

BATS

3.2.2. Thirteen structures were assessed for their suitability to support roosting bats. Table 5 shows the details of the assessment such as building type, features present and BCT category.

3.2.3. Foraging habitats such as open water, domestic gardens and allotments within were found to be fragmented and unconnected. This foraging habitat is considered to be of low suitability for use by foraging and commuting bats.

Table 5 - Structures with features which could support roosting bats

Structure	Structure Type	Distance	Features	Roost Suitability
B1	Brick built disused public house	Within footprint	Some lifted roof tiles Gaps around boarded up window fittings present Missing mortar on roof corner	Low
B2	South Denes Car Centre – corrugated metal workshop and brick car sales room	Within footprint	Slightly lifted roof apex	Negligible
B3	Sutton Road residential property	Within footprint	-	Negligible
B4	Industrial brick building south of Sutton Road	Within footprint	Missing mortar in walls Missing tiles on roof	Low
B5	Brick building on edge of docks	Within footprint	No access	No access
B6	Industrial building with three hipped asbestos roofs	Within footprint	Several small gaps in middle roof ridge	Low
T1	Terrace at west end of Queen Anne's Road	Within footprint	-	Low
T2	Terrace centre of Queen Anne's Road	Within footprint	Several small gaps in roof Cracked tile at roof apex	Low
T3	Terrace at east	Within footprint	-	Low

Structure	Structure Type	Distance	Features	Roost Suitability
	end of Queen Anne's Road			
T4	Terrace on Southdown Road	Within footprint	Slipped tiles on roof of number 181	Low
T5	Terrace south of Cromwell Road	Within footprint	Small gaps and cracks in roof	Low
T6	Terrace north of Cromwell Road	Within footprint	-	Low
T7	Terrace south of Waveney Road	Within footprint	-	Low

3.3 FIELD SURVEYS

WATER VOLE SURVEYS

3.3.1. During the August 2017 survey, only the ditch south of William Adams Way was surveyed due to safety concerns in accessing the northern ditch. Evidence of water vole activity was found and is summarised in Table 6.

Table 6 - Water vole survey results

Location	Record type
TG52139 05869	Feeding remains, cut stems
TG52139 05869	5 droppings
TG52127 05872	1 dropping
TG52120 05866	Several droppings and feeding remains

BAT ACTIVITY SURVEYS

3.3.2. Two transects were undertaken in July and August 2017. The routes of the transects are shown in Appendix B. Survey details and weather conditions are shown in Table 7.

Table 7 - Survey type, date and weather conditions for both transects

Transect Number	Survey Records	Survey 1
1	Survey Type and Date	Dusk Transect 31.07.17
	Weather Conditions	20ºC, dry, CC 2/8, BF 1/8
2	Survey Type and Date	Dusk Transect 01.08.17
	Weather Conditions	17ºC, dry, CC 5/8, BF 0/8

*CC= Cloud Cover; BF= Beaufort scale

TRANSECT 1

3.3.3. No bats were recorded along Transect 1. This is likely due to the absence of vegetation and high levels of artificial lighting.

TRANSECT 2

3.3.4. One species of bat was recorded along Transect 2: common pipistrelle *Pipistrellus pipistrellus*.

3.3.5. Four bat passes were recorded commuting along the northern edge of Southtown Common, where it meets William Adams Way. No foraging activity was recorded.

4 DISCUSSION AND EVALUATION

4.1 WATER VOLES

4.1.1. The survey work undertaken has confirmed the presence of water vole within the study area, with feeding remains and water vole droppings being found. However, due to limitations in the survey methodology, it is not possible at this time to estimate the population density of water voles in the study area.

4.2 BAT ROOSTS

4.2.1. All structures assessed were given a low potential of supporting a bat roost. The low level of bat activity recorded during the transect surveys suggests that the likelihood of a roost being present within the footprint of the proposed scheme is low.

4.3 COMMUTING AND FORAGING BATS

4.3.1. The activity surveys showed that one species of bat uses the site for commuting and/or foraging.

4.3.2. Only one species of bat was recorded; the common pipistrelle. This species was observed commuting along the northern edge of Southtown Common Recreation Ground. This area contains mature trees, shrubs and open grassland as well as being subject to lower levels of artificial lighting.

4.3.3. The field survey showed that the bat population within the site consists of a low number of a single bat species. The site is assessed as being of importance only within the zone of influence of the proposed scheme for conservation of foraging and commuting bats.

5 CONCLUSION AND RECOMMENDATIONS

5.1 OVERVIEW – WATER VOLES

5.1.1. The water vole is protected within the UK from capture, killing, injury and disturbance and their places of shelter protected from damage, having access blocked or destruction, under the Wildlife and Countryside Act 1981 (as amended) (WCA, 1981). It is the client's responsibility to apply for a development licence through Natural England for activities that would constitute an offence under these legislations.

5.1.2. Two water courses will be affected by the proposed scheme for the Great Yarmouth Third River Crossing. The proposed scheme has the potential to result in negative impacts on water vole, including the damage and/or disturbance of water vole burrows along the length of the proposed scheme, which would constitute an offence under English legislation.

5.1.3. Accordingly, it is recommended that water voles are considered during the design phase with as much of the banks being retained and protected as reasonably possible. Where the proposals are likely to result in the loss, damage or disturbance of water vole habitats, it is likely that a licence will be required from Natural England in order to facilitate the works. A licence to disturb water vole may be required for works within 10m of a burrow, even if the burrow itself is retained.

5.1.4. Any licence application will likely include the requirement for a detailed mitigation strategy to avoid and/or minimise impacts on water vole. These may include measures such as careful timing of works, temporary displacement of water voles and provision of new areas of suitable habitat etc.

5.1.5. It is recommended that update surveys are undertaken once a final design has been produced to allow an accurate assessment of the impacts on water voles and inform any licence application which may be required. Surveys should also be undertaken prior to the commencement of construction works to check for the presence of any new burrows which may be affected.

5.2 OVERVIEW - BATS

5.2.1. All species of bats within the UK are protected from killing, injury and disturbance and their roosts protected from damage or destruction under the Conservation of Habitats and Species Regulations 2010 (Habitats Regulations, 2010). Their places of rest and shelter are also protected from disturbance and obstruction under the Wildlife and Countryside Act 1981 (as amended) (WCA, 1981). It is the client's responsibility to apply for a development licence through Natural England for activities that would constitute an offence under these legislations.

5.2.2. Several structures will be demolished during the construction of the Great Yarmouth Third River Crossing. It is unlikely that bats use these structures as roosts due to the high levels of disturbance from human activities taking place within the structures and high levels of artificial lighting as well as the structures not being well connected to more suitable foraging habitat. However, the possibility of bats using these structures cannot be entirely ruled out and internal inspections are recommended for any structures that are to be removed prior to construction beginning.

6 LIMITATIONS

6.1 WATER VOLE

6.1.1. It was not possible for surveyors to enter the channel of the water courses due to the depth making it unsafe to do so. Thick vegetation meant that only the south bank of the channel south of William Adams Way could be surveyed. Further survey work should be undertaken at a later date in order to cover the areas not yet surveyed.

6.2 BATS

6.2.1. It was not possible to assess every building from all angles due to the buildings being privately owned properties. However, as the activity surveys returned very low numbers of bats, this is not considered to be a limitation on the conclusions of this report.

6.2.2. Emergence and re-entry surveys will be undertaken at a later stage. The presence of roosts in trees within the site cannot be accurately determined until these surveys are completed.

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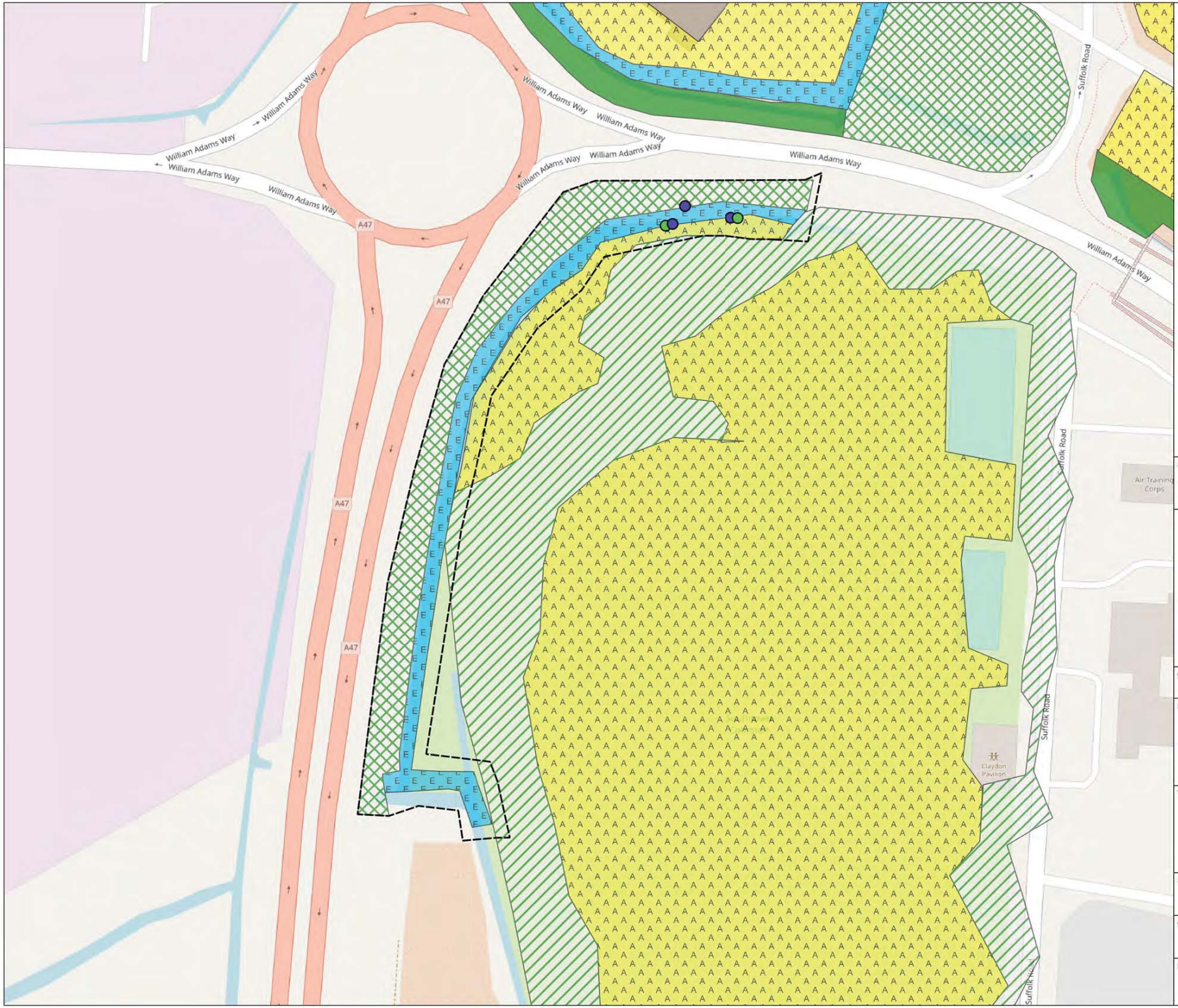

LEGEND:

- Water vole survey area
- Droppings
- Feeding remains

Phase 1 habitats

- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A2.1 - Scrub - dense/continuous
- G1.1 - Standing water - eutrophic

STATUS: FOR INFORMATION ONLY

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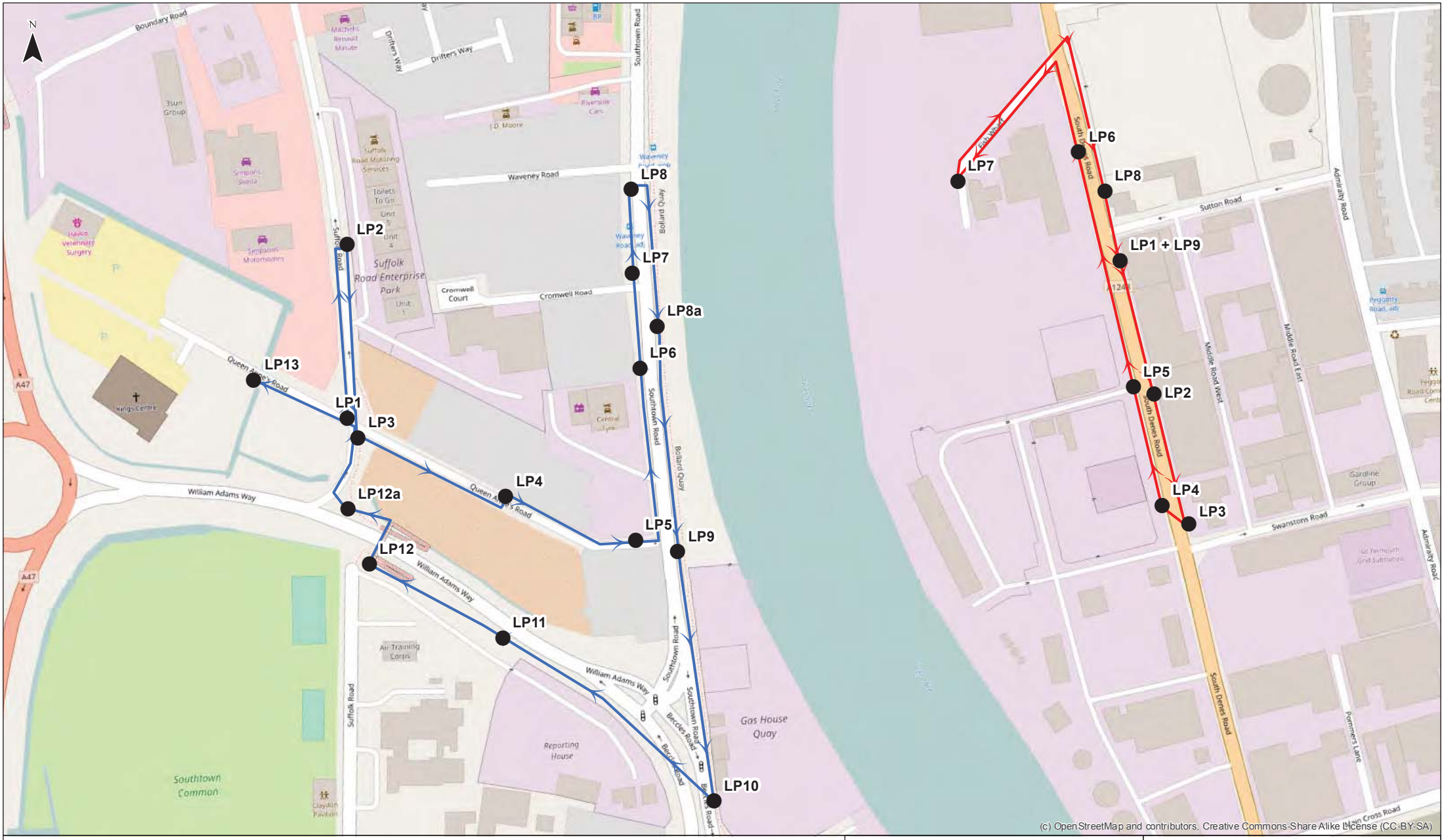
CLIENT: Norfolk County Council

PROJECT: Great Yarmouth Third River Crossing

TITLE: Water Vole Survey

SCALE @A3:	CHECKED:	APPROVED:
1:1,600	LE	BB
QGIS FILE:	DRAWN: 06/11/2017	DATE: 06/11/17
PROJECT No: 62240375	DRAWING No:	REV: 0.1



Legend

- Listening Point
- East Transect
- West Transect

Version	Amendment	Drawing Date	Review Date	Approved Date
A	First Issue	23/08/17 JR	24/08/17 LE	25/08/17 RB

Client	Norfolk County Council
Project	Great Yarmouth Third River Crossing
Drawing Title	Bat Survey Transects
Scale (at A3 size)	1:1,900
Purpose of Issue	Information
Office	White Rose
Tel	020 7822 2497
Drawing Number	Page 1 of 1

Appendix G

HERITAGE DESK STUDY

REPORT N^{O} 62240375-017-DBA

GREAT YARMOUTH THIRD RIVER CROSSING

CULTURAL HERITAGE DESK BASED ASSESSMENT

PUBLIC

JULY 2017

GREAT YARMOUTH THIRD RIVER CROSSING

CULTURAL HERITAGE DESK BASED ASSESSMENT

Norfolk County Council

Draft (V0.1)
Public

Project no: 62240375-017
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QUALITY MANAGEMENT

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Signature	[redacted]			
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PRODUCTION TEAM

CLIENT

Function	Name
Function	Name
Function	Name

WSP

Function	Name
Function	Name
Function	Name

SUBCONSULTANTS

Function	Name
Function	Name
Function	Name

LIMITATIONS

This report is presented to Norfolk County Council in respect of the “Great Yarmouth Third River Crossing” proposed development and may not be used or relied on by any other person. It may not be used by Norfolk County Council in relation to any other matters not covered specifically by the agreed scope of this Report.

Notwithstanding anything to the contrary contained in the report, WSP is obliged to exercise reasonable skill, care and diligence in the performance of the services required by Norfolk Country Council and WSP shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

This report has been prepared by WSP. No individual is personally liable in connection with the preparation of this report. By receiving this report and acting on it, the client or any other person accepts that no individual is personally liable whether in contract, tort, for breach of statutory duty or otherwise.

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

WSP have been commissioned by Norfolk County Council to undertake a cultural heritage Desk Based Assessment (DBA) to assess the heritage impact of the proposed works as part the of Great Yarmouth Third River Crossing.

This document will identify the known heritage resources and likely types of archaeological remains which may be encountered and the predicted impacts of the development upon them.

1.2 SITE DESCRIPTION

The proposed scheme is located approximately 800m to the south of the town centre of Great Yarmouth and sits at approximately 1.2m AOD. It consists of a new bridge that will be constructed between the A12 and South Denes Road, crossing the River Yare and improvements to the existing roads in this area. The roads are surrounded by industrial land, interspersed with smaller areas of residential and recreational land to the east and west of the river.

The site is centred at TG 52469 05894.

1.3 PLANNING BACKGROUND

This assessment has been carried out to support an Outline Business Case (OBC) for the construction of the Great Yarmouth Third River Crossing.

The requirement for a heritage statement is outlined in Policy 128 of the National Planning Policy Framework (NPPF) which outlines the need to identify and assess all heritage assets, their significance and the impact the proposals may have upon them (where possible). The assessment has been undertaken in accordance with the Chartered Institute for Archaeologists' Standards and Guidance for Historic Environment Desk-Based Assessments (CIfA 2014).

2 AIMS AND OBJECTIVES

The objectives of this desk-based assessment are to:

- à provide an assessment of appropriate records, cartographic and written sources in order to identify known heritage assets and where possible, quantify, the size, complexity and potential of any below ground archaeology issues;
- à provide a preliminary assessment of the potential impact of the proposed works to both known and unknown archaeological assets,
- à provide a preliminary assessment of the potential impact of the proposed works to built heritage within the study area,
- à advise on the requirement for, and scope of, any further work likely to be required to support any future planning applications; and
- à to inform future budgets and programmes.

The desk based assessment forms the first stage of an iterative process of a cultural heritage assessment which will be considered alongside wider scheme issues during development of the scheme design. As part of any future detailed design process, further archaeological investigations may be required to assess the extent, character and significance of buried remains.

It is necessary to assess the significance of any such archaeological interest and the likely impact of any proposed re-development upon the significance of any heritage assets, where possible, in accordance with Policy 128 of the National Planning Policy Framework.

3 LEGISLATIVE CONTEXT

3.1 NATIONAL, REGIONAL AND LOCAL POLICY

PLANNING (LISTED BUILDINGS AND CONSERVATION AREAS (P(LBCA)) ACT 1990

3.1.1 Section 1 of the P(LBCA) Act defines a listed building as a 'building which is for the time being included in a list compiled or approved by the Secretary of State under that section. For the purpose of the Act any object or structure fixed to the building, which, since on or before 1 July 1948, has formed part of the land and is comprised within the curtilage of the building is treated as part of the building. 'Building' is defined as including any structure or erection and any part of a building'. The key elements of this Act relevant to this assessment are outlined below:

- Section 66 places a responsibility upon the decision-maker in determining applications for planning permission for a Scheme that affects a listed building or its setting to have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses; and
- Section 72 of the Act places a duty upon the decision maker in determining applications for planning permission within conservation areas to pay special attention to the desirability of preserving or enhancing the character or appearance of that area.

HEDGEROWS REGULATIONS 1997

3.1.2 The Hedgerow Regulations Act presents the following criteria for determining important hedgerows (archaeology and history):

- The hedgerow marks the boundary, or part of the boundary, of at least one historic parish or township and for this purpose "historic" means existing before 1850;
- The hedgerow incorporates an archaeological feature which is: (a) included in the schedule of monuments compiled by the Secretary of State under section 1 (schedule of monuments) of the Ancient Monuments and Archaeological Areas Act 1979(7); or (b) recorded at the relevant date in a Sites and Monuments Record (Now Historic Environment Record);
- The hedgerow is: (a) is situated wholly or partly within an archaeological site included or recorded as mentioned in paragraph 2 or on land adjacent to and associated with such a site; and (b) is associated with any monument or feature on that site;
- The hedgerow: (a) marks the boundary of a pre-1600 AD estate or manor recorded at the relevant date in a Sites and Monuments Record or in a document held at that date at a Record Office; or (b) is visibly related to any building or other feature of such an estate or manor;
- The hedgerow is: (a) recorded in a document held at the relevant date at a Record Office as an integral part of a field system pre-dating the Inclosure Acts(8); or (b) is part of, or visibly related to, any building or other feature associated with such a system, and that system is (i) substantially complete; or (ii) is of a pattern which is recorded in a document prepared before the relevant date by a local planning authority, within the meaning of the 1990 Act(9), for the purposes of development control within the authority's area, as a key landscape characteristic.

NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

3.1.3 National planning policies on the conservation of the historic environment are set out in the NPPF (DCLG, March 2012). Sites of archaeological or cultural heritage significance that are valued components of the historic environment and merit consideration in planning decisions are grouped as 'heritage assets'. The NPPF states that "heritage assets are an irreplaceable resource" the conservation of which can bring "wider social, cultural, economic and environmental benefits."[1] . It also states that the "significance of any heritage assets affected including any contribution made by their setting... should be understood in order to assess the potential impact[2]. In addition to standing remains, heritage assets of archaeological interest can comprise sub-surface remains and, therefore, assessments should be undertaken for a site with potential below-ground archaeological deposits.

3.1.4 NPPF draws a distinction between designated heritage assets and other remains considered to be of lesser significance; "great weight should be given to the asset's conservation. Substantial harm to or loss of a Grade II listed building, park or garden should be exceptional. Substantial harm to or loss of designated heritage assets of the highest significance, including scheduled monuments, protected wreck sites, battlefields, Grade I and II* listed buildings and Grade I and II* registered parks and gardens and World Heritage Sites, should be wholly exceptional." [3]. Therefore, preservation in situ is the preferred course in relation to such sites unless exceptional circumstances exist.

3.1.5 It is normally accepted that non-designated heritage assets will be preserved by record, in accordance with their significance and the magnitude of the harm to or loss of the asset as a result of the proposals to "avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposals."[4]. Non-designated heritage assets of archaeological interest will also be subject to the policies reserved for designated heritage assets if they are of equivalent significance to Scheduled Monuments[5].

GREAT YARMOUTH LOCAL PLAN (ADOPTED 2015)

The policies in the Local Plan relates to the protection and enhancement of the historic environment and is relevant for the proposed development. Policy CS10: Safeguarding local heritage assets deals with development affecting Scheduled Monuments, Listed Buildings, Parks and gardens and Conservation Areas, and their settings, as well as regionally and locally important archaeological sites.

3.2 STANDARDS AND GUIDANCE

The archaeological assessment has been undertaken using guidance from with Volume 11, section 3, part 2 of the Design Manual for Roads and Bridges (DMRB HA 208/07), and the standards and guidance for desk based assessments set by the Chartered Institute for Archaeologists (CIfA 2014) which sets out supplementary policies and guidance on heritage.

The assessment has been undertaken using appropriate methods and practices which satisfy the stated aims of the project, which comply with the Code of Conduct and other relevant by-laws of the CIfA.

[1] NPPF Section 12, paragraph 126
[2] op cit, 128.
[3] op cit, 132
[4] op cit, 129
[5] op cit, 132

4 METHODOLOGY

This desk study has been undertaken to investigate, as far as is reasonable and practical, the character and extent of any known or potential heritage assets within a study area. The study area for designated assets is within 1km of the scheme, for non-designated assets are within a study area of 500m.

The assessment has been informed by a review of all available archaeological records; historical documentary evidence; cartographic evidence and photographic material. This has involved a consultation of the following sources:

- à Historic England - for all records relating to known designated heritage assets.
- à Norfolk Historic Environment Record (HER) - for all records relating to known heritage assets and secondary source material including archaeological investigation reports and aerial photographs;
- à Norfolk Archives - for historic documentary evidence relating to the site, including both primary and secondary sources;
- à National, regional and local planning policy;
- à Other readily available online sources such as Google Earth.

The solid and drift geology for the site has been identified based on that recorded by the British Geological Survey.

A site visit of the proposed scheme was conducted, where access and safety allowed, to allow for a consideration of the study area, the possible identification of landscape and archaeological features and factors that may have had an impact on buried remains (i.e. drains, services etc). The site walkover was undertaken on the 14th July 2017. Photographs were taken using a digital camera. Access was limited to public rights of way.

The assessment of the value of cultural heritage assets which make up the baseline environment has involved reference to the guidance provided in Annexes 5, 6 and 7 of the DMRB HA208/07. The annexes identify factors which it is appropriate to consider during the evaluation of cultural heritage assets. The guidance recommends the adoption of six ratings for value in relation to archaeology and built heritage: very high, high, medium, low, negligible and unknown. See tables 1 and 2 below.

Table 4-1: Criteria for Assessing the Value of Archaeological Assets

VALUE	EXAMPLE
Very High	World Heritage Sites (including nominated sites) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled Monuments (including proposed sites) Undesignated assets of scheduled quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Designated or undesignated assets that contribute to regional research objectives
Low	Designated and undesignated assets of local importance Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives
Negligible	Assets with very little or no surviving archaeological interest
Unknown	The importance of the resource has not been ascertained

Table 4-2: Criteria for Establishing the Value of Built Heritage Assets

VALUE	STATUS AND DEFINITION
Very High	International importance i.e. World Heritage Sites.
High	National importance i.e. listed buildings at Grade I and II* Scheduled Ancient Monuments with standing remains, conservation areas containing very important buildings and undesignated structures of clear national importance.
Medium	Regional importance i.e. listed buildings at Grade II, conservation areas containing buildings that contribute significantly to its historic character, historic townscape with important integrity in their buildings, or built settings and undesignated structures of clear regional importance.
Low	Local importance i.e. undesignated assets of modest quality in their fabric or historical association and historic townscape of limited historic integrity (including buildings and structures included in local list prepared by local authority).
Negligible	Assets of no architectural or historical note
Unknown	Assets with some hidden i.e. inaccessible potential for historic or architectural significance.

The assessment of the magnitude of the impact has involved the reference to the guidance provided in Annexes 5, 6 and 7 of the DMRB HA208/07. See table 3 below which is an amalgamation of the tree tables which are found in the above annexes.

Table 4-3: Assessing the magnitude of impacts

FACTORS IN THE ASSESSMENT OF MAGNITUDE OF IMPACTS	
Major	Changes to most or all key archaeological materials or key historic building elements such that the resource is totally altered. Change to most or all key historic landscape elements, parcels or components: extreme visual effects: gross change of noise or change to sound quality: fundamental changes to use or access: resulting in total change to historic landscape character unit. Comprehensive changes to setting.
Moderate	Changes to many key archaeological materials or key historic building elements, such that the resource is clearly modified. Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access: resulting in moderate changes to historic landscape character. Considerable changes to setting that affect the character of the asset.
Minor	Changes to key archaeological materials or key historic building elements, such that the asset is slightly altered. Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access: resulting in limited changes to historical landscape character. Slight changes to setting.
Negligible	Very minor changes to archaeological materials, historic buildings elements, or setting. Very minor changes to key historic landscape elements, parcels or compounds, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in very small change to historic landscape character.

FACTORS IN THE ASSESSMENT OF MAGNITUDE OF IMPACTS	
No Change	No change to fabric or setting. No change to elements, parcels or components; no visual or audible changes; no changes arising from in amenity or community factors.

The overall significance of impact has involved the use of the matrices provided in Annexes 5, 6 and 7 of the DMRB HA208/07 to establish an overall rating for each asset. This is subject to adjustment using professional judgement. Please see the matrix below.

Table 4-4: Significance of Impact

	NO CHANGE	NEGLIGIBLE	MINOR	MODERATE	MAJOR
Very high	neutral	Slight	moderate or large	large or very large	very large
High	neutral	Slight	moderate or slight	moderate or large	large or very large
Medium	neutral	neutral or slight	slight	moderate	moderate or large
Low	neutral	neutral or slight	neutral or slight	slight	slight or moderate
Negligible	neutral	Neutral	neutral or slight	neutral or slight	slight

All features identified through the research have been plotted on a site plan (Appendix B) in GIS and the site numbers correspond with the reference numbers in the gazetteer (Appendix A).

A PDF copy of the approved final report will also be deposited with the Norfolk Historic Environment Record.

5 SITE DESCRIPTION

5.1 PROPOSED SCHEME DESCRIPTION

The addition of a new bridge and road alterations are proposed for the site crossing the River Yare, running from the extant A12 and South Deres Road. The scheme aims to provide a much needed additional link across the River Yare, connecting the strategic road network and wider urban area to the southern part of Great Yarmouth, which is a key economic growth hub and Enterprise Zone. The land surrounding the scheme is primarily industrial, with some small areas of residential throughout the study area, towards Southtown to the west and the pleasure beach to the east.

5.2 SITE VISIT

A site visit was conducted on 14.07.17. Weather conditions were bright with cloud cover and some rain. Visibility was generally good, although some views were blocked by buildings and vegetation. Access was restricted to public rights of way. This did not affect the confidence of the assessment.

The purpose of the site visit was to assess the visual impact of the development on the heritage assets within the study area with particular regard to the designated assets in areas close to the proposed development, and also to identify any potential previously unknown heritage assets.

The study area consists of the proposed consists of the proposed bridge over the River Yare and associated road improvements in the surrounding area.

No previously unknown sites were identified during the walkover survey. Existing development may have affected the survival of any below ground remains, although there may be archaeology present at deeper levels.

5.3 GEOLOGY

The scheme is situated on bedrock geology of Crag Group - Sand and Gravel. This is sedimentary bedrock that formed approximately 0 to 5 million years ago in the Quaternary and Neogene periods. The local environment was previously dominated by shallow seas. These rocks were formed in shallow seas with mainly siliciclastic sediments (comprising of fragments or clasts of silicate minerals) deposited as mud, silt, sand and gravel.

The site has multiple superficial geological deposits. The River Yare has overlying superficial deposits of Tidal River or Creek Deposits - Clay and Silt. These are superficial deposits formed up to 2 million years ago in the Quaternary Period. These rocks were formed in shoreline environments with sediments deposited in beaches and barrier islands.

The western banks of the River Yare has superficial deposits of Happisburgh Glacigenic Formation - Sand. These are superficial deposits that were formed up to 3 million years ago in the Quaternary Period. The local environment was previously dominated by ice age conditions. These rocks were formed in shoreline environments with sediments deposited in beaches and barrier islands.

The eastern banks of the river comprise of superficial deposits of North Denes Formation - Sand and Gravel. These are superficial deposits formed up to 2 million years ago in the Quaternary Period. These rocks were formed in shoreline environments with sediments deposited in beaches and barrier islands.

6 HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

6.1 INTRODUCTION

The location of the designated heritage assets from the National Heritage List for England (NHLE) which lie within the site and within a 1km radius from the boundary and un-designated heritage assets taken from the Norfolk Historic Environment Record (HER) which lie within the site and within a 500m radius from the boundary are tabled in the Gazetteer and indicated in Figure 1 in the appendices of this report. A total of 136 assets have been identified. These are listed individually in the Gazetteer (Appendix A).

6.2 HISTORICAL AND ARCHAEOLOGICAL OVERVIEW

DESIGNATED ASSETS

There are no World Heritage Sites, Registered Parks and Gardens, Registered Battlefields or Protected Wreck sites within 1km of the proposed scheme options. There are 45 Listed Buildings and one Scheduled Monument within 1km. The Listed Buildings consist of 1 Grade I, 4 Grade II* and 40 Grade II. The majority of the Listed Buildings and the Scheduled Monument will be screened from the proposed development by topography, vegetation and existing structures. The Scheduled Monument is the medieval defensive town walls. The Listed Buildings represent a mixture of domestic, religious, industrial and leisure uses and mainly date to the late post-medieval period. The study area overlaps four Conservation Areas, listed below:

- Camperdown
- Gorleston Conservation Area Extensions
- King Street
- Seafront

KNOWN HERITAGE ASSETS

The assets within the study area are described in the context of a timeline of archaeological periods from prehistoric through to modern. The location of the recorded sites and features can be cross referenced with Figure 1 (Appendix B) and the Gazetteer (Appendix A). For reference, all assets are listed in Table 4 with an assessment of their value.

The time periods discussed can be broadly divided as follows:

- Prehistoric:
  - Palaeolithic 250,000 – 10,000 BC
  - Mesolithic 10,000 – 4,000 BC
  - Neolithic 4,000 – 2,500 BC
  - Bronze Age 2,500 – 700 BC
  - Iron Age 800 BC – AD 43
- Roman AD 43 – 410
- Early Medieval AD 410 - 1066
- Medieval AD 1066 – 1540
- Post-Medieval AD 1540 – 1900
- Modern AD 1900 to 2050

PREHISTORIC

The landscape surrounding the site has consisted primarily of shorelines up to the medieval period, and as such there has been little evidence of any prehistoric activity identified within the study area. A single Neolithic scraper (Asset Number 42) has been recovered at the junction of Boundary Road and Suffolk Road during construction works for a petrol tank. Further evidence of prehistoric activity in the study area may be buried beneath later shoreline deposits.

ROMAN AND EARLY MEDIEVAL

As with evidence of prehistoric activity, the landscape surrounding the site has consisted of primarily shorelines up to the medieval period. Therefore, for the same reason, there has been no evidence of any Roman or early medieval activity identified within the study area.

MEDIEVAL

The boundary of the medieval walled town lies to the north of the Proposed Scheme options, approximately 600m north of the proposed scheme. The extent of the medieval town is represented by the well preserved remains of the defence walls (Asset Number 136) which is designated as a Scheduled Monument. Construction of the walls began in the late 13th century, although they have been subjected to periodic remodelling, including during the refortification of the town in the 17th century during the Civil War.

Just outside the 500m study area for undesignated sites, within the medieval walled town area, the remains of boats have been found on a buried shoreline at around 3m below the current ground level. An old landing place was also recorded below the Town Hall site in 1887. This suggests that buried medieval deposits may survive deep below the current ground level on either side of the River Yare within the study area.

There are two further medieval assets within the study area:

The remains of the house of the Austin Friars comprising a church, priory and leper hospital are located on Burnt Lane (Asset Number 121). This friary was founded in the 13th century, although the earliest known buildings date to the 15th century. Much of the priory has now been destroyed, although the west gate is recorded to have still been standing up to the beginning of the last century. Remains from the structures have been recovered from the surrounding area, and some of the building materials have been re-used. The area has now been redeveloped as housing.

In 2013, a watching brief revealed beam slots and post holes associated with a late medieval timber-framed building located on Burnt Lane (Asset Number 123). Finds recovered from these features included late medieval brick, roof tile and wall plaster that could be high status. The beam slots and post holes described the south western corner of a medieval timber structure. The area has now been redeveloped as housing.

POST-MEDIEVAL

There are 51 post-medieval assets within the study area, principally 19th century houses and also including villas and a lodge, both mileposts and boundary posts and two churches. There are also industrial areas with railways, a coal power station, gas works, potteries, fish curing works, workshop ranges, utility blocks and a rope walk.

There is one Grade I Listed Building within the study area. Nelsons Monument (Asset Number 132), also known as the Norfolk Pillar, was the first of the Nelson columns, being erected in 1817, and comprises a figure of Britannia standing on top of a Doric column which faces towards Nelson's birthplace. The monument has recently been restored, and located within an industrial area. This asset may be inter-visible with the scheme.

There are 4 Grade II* Listed buildings of post medieval date. These consist of Great Yarmouth Potteries (Asset Number 23), formerly listed as Trinity Place fish curing house, which was built in the 19th century against the town walls. This asset may be inter-visible with the scheme.

The Winter gardens (Asset Number 36) are located on South Beach Parade, and were originally designed and constructed in Torquay in the late 1800s before being relocated to Great Yarmouth in 1904. The building comprises a single storey structure of cast iron framing and glass.

St Nicholas Hospital Main Entrance Range (Asset Number 51) Main Block (Asset Number 52), walls and railings (Asset Number 53) and South Block (Asset Number 54) form a naval hospital built for casualties from the North Sea squadron in the Napoleonic War, with the entrance range comprising guard rooms, an archway and service rooms. The main block became a naval barracks in 1818 and subsequently a general hospital. This asset may be inter-visible with the scheme.

A Grade II Listed Gasworks (Asset Number 70) lies to the north east of the scheme. The gasometer was originally built at another site, but collapsed and was rebuilt here in 1885. An old map shows this was the site of a steam engine before the gasometer was built. This asset may be inter-visible with the scheme.

Grade II Listed Buildings Providence Villa (Asset Number 112), 96 and 95 High Road (Asset Numbers 113 and 114) and Ahoy and Manby House (Asset Number 115) sit to the south of the scheme. These assets may be inter-visible with the scheme.

There are 7 undesignated assets which date to the post medieval period consisting of industrial assets such as railways (Asset Numbers 88 and 95) and a rope walk (Asset Number 10), as well as a maltings which was later used as a prison (Asset Number 110), a boundary post (Asset Number 125) and a ditch (Asset Number 2).

MODERN

There are 79 modern assets located within the study area. One of these is Grade II Listed. The Dolphin Public House (Asset Number 89), formerly known as Fish Wharf Refreshment Room, is a public house built in 1900. This asset is within the sightline of the proposed development.

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.

Other modern assets in the study area date to the Second World War, and consist of primarily military structures and associated assets. There are 12 bomb craters and one bomb site within the study area, which may indicate the possibility of further, potentially unexploded, ordinance. There are also 43 air raid shelters, anti-tank defences, three pillboxes, eight road blocks, two military buildings and multiple other assets including spigot mortar engagements, a barracks (Asset Number 13), barbed wire obstructions, weapons pits, a blast wall (Asset Number 103), a fire station (Asset Number 111) and an ambulance station (Asset Number 131).

Most of these features recorded on the NHER have since been demolished, with modern development having removed all trace.

HISTORIC LANDSCAPE

There are no designated landscapes within the study area.

Historic Landscape Characterisation (HLC) has been completed for the surrounding area, however this study specifically excluded an analysis of the areas within the town and village

development limits. Therefore, although the smaller villages were considered as a part of a wider landscape context and character, no specific townscape or urban character assessments were undertaken.

Some areas have had Historic Landscape Character completed as part of the Norfolk County Council HER Character Area Report. The study area falls across two different character types, with a linear strip of Coastal - Managed Wetland to the east of the study area. This land was previously Unimproved Intertidal land. There are also small blocks of Coastal - Drained Enclosure to the west, which were previously Coastal - Managed Wetland, Unimproved Marine Marsh or Brackish Fen.

6.3 ARCHAEOLOGICAL POTENTIAL

The study area has undergone extensive development as it forms part of the urban centre of Great Yarmouth. This development is likely to have disturbed any potential archaeological remains to the level of modern building foundations. The river itself has seen various alterations and may have been dredged, which would affect what could be uncovered during the course of any works.

Due to the presence of several WWII defensive structures within close vicinity to the site, there is the potential to uncover any underground remains or previously unknown WWII sites during the course of works. There are also numerous recorded bomb craters located close to the proposed site, the possibility of unknown unexploded ordinances should be considered. There is also a 19th century railway located to the east end of the proposed works, which may be uncovered.

There is generally a moderate potential for previously undiscovered remains of up to high value to be uncovered during the proposed works.

7 STATEMENT OF IMPACT

ARCHAEOLOGY AND HISTORIC LANDSCAPE

The majority of the potential impacts upon cultural heritage assets would occur during the construction phase. Development activities such as groundworks, topsoil stripping, landscaping, ground compaction access, service installation, stockpiling and storage will all have a negative effect on the cultural heritage assets. These construction related impacts could lead to the following effects upon the Historic Environment:

- Permanent complete or partial loss of an archaeological feature or deposit as a result of ground excavation;
- Permanent or temporary loss of the physical and/or visual integrity of a feature, monument, building or group of monuments;
- Damage to resources as a result of ground excavation;
- Damage to resources due to compaction, desiccation or waterlogging; and
- Damage to resources as a result of ground vibration caused by construction.

There could also be a number of sites which may be adversely affected during operation. These are mainly setting issues resulting from the introduction of new infrastructure, and the resulting increase in noise from vehicles using the new crossing.

There could be minor changes to the historic landscape setting but these would be negligible in magnitude.

POTENTIAL SOURCES OF IMPACT

The assessment to date suggests the presence of currently unknown heritage assets in the form of a buried medieval shoreline. The proposed works have the potential to impact upon these remains, if present, due to the engineering solutions required for the bridge supports and the potential requirement for excavation works associated with existing infrastructure.

Not enough is known about buried remains in the scheme area, further work is required to quantify potential impacts.

HISTORIC BUILDINGS

There could be a visual impact from the new bridge to the immediate setting of at least twelve Listed Buildings:

- A Gas Works (Asset Number 70) of medium value may suffer a minor impact as it could be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.
- The Dolphin Public House (Asset Number 89) of medium value may suffer a minor impact as it is within the sight line of the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.
- St Nicholas Hospital (Asset Numbers 51, 52, 53, 54 and 55) of medium to high value may suffer a minor impact as it would be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.

- The Great Yarmouth Potteries (Asset Number 23) of high value may suffer a minor impact as it would be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.
- Medium value assets Providence Villa (Asset Number 112), 96 and 95 High Road (Asset Numbers 113 and 114) and Ahoy and Manby House (Asset Number 115) may all suffer a minor impact as it would be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.

Parts of the study area overlap four Conservation Areas; Camperdown, Gorleston Conservation Area Extensions, King Street and Seafront. The magnitude of this impact is dependent on the design of the bridge; at present there is a no impact but depending on proposed bridge elements further impacts may occur and these should likewise be reassessed.

8 RECOMMENDATIONS

Impacts to the cultural heritage assets can be minimised or eliminated via appropriate mitigation.

DMRB Volume 10, Section 6, Part 1 states that 'The fundamental aim of archaeological mitigation is to avoid impacts on nationally important or highly significant remains. If this is not possible then such remains should be archaeologically recorded in order to 'preserve by record' the significant aspects of the site'. Preservation in situ of nationally important or highly significant remains which may be affected by the proposed scheme options is the preferred option, however, where this is not possible or appropriate then alternative options will be investigated. Should no acceptable options be identified which would allow for the preservation of a site, detailed excavation (the scope of which will be agreed with the Norfolk Historic Environment Team) should be carried out in order to further our collective understanding of the site affected.

As there is the potential for previously unknown archaeological remains, in the form of a buried former medieval shoreline, it would be necessary to carry out archaeological investigations in order to establish the presence or absence and character of any features within the proposed footprint of the chosen option. The appropriate technique, scope and scale for investigation should be agreed with the Norfolk Historic Environment Team, but may include archaeological trial trenching, specialist dredging, auguring or dive surveys.

There is also potential for visual impacts on 12 Listed Buildings, it is recommended that these impacts are considered in the design process. This may involve consultation with Historic England, Conservation Officers and the Norfolk Historic Environment Team to discuss appropriate mitigation options which would reduce the visual impact on affected buildings. Once the design has been finalised, impacts should be reassessed.

No recorded historic landscapes will be impacted upon by the proposed options, although there are a number of Conservation Areas within the wider study area. Appropriate mitigation would include design of lighting, surfacing and screening in line with those utilised within the Conservation Areas.

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Appendix A

GAZETTEER

Appendix A - 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 transport links. The structure was removed in 1945. An industrial park now occupies the site.	HER	Modern (WWII)	Low
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	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				been industrial shelters for the site workers. The shelters have since been levelled and built over.			
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 1st 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
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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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 storekeepers 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 19th 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 19th 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 18th century houses with 19th century alterations. The houses are separated by an arched passageway with cast iron gates.	Listed (Grade II) & HER	Post medieval	Medium
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 managers 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 19th 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-19th century, all were converted into a hotels in the 20th century. Built of gault brick with	Listed (Grade II)	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				stuccoed and rusticated ground floors with slate and concrete tile roofs.			
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
29	NHLE ref 1245563	TG 53041 06894	Terrace	3, 4 and 5 Waterloo Road. Terrace of 3 houses built in the mid-19th 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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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
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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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
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. It 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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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 to 1811. It was used as a military barracks between 1818 to 1854, but subsequently reverted to its original use as a Naval hospital. The buildings were 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.	HER	Modern (WWII)	Low
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 passageway.	Listed (Grade II*)	Post medieval	High

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
53	NHLE ref 1245986	TG 52926 06371	Wall, Railings	St Nicholas Hospital Walls and Railings dating to 1811 with mid-20th 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 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.	HER	Modern (WWII)	Low
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	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				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.			
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
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	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				that any remains of these survive above ground today.			
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 (NHER)	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 rebuilt here in 1885. An old map shows this was the site of a steam engine before the gasometer was built.	Listed (Grade II) & HER	Post medieval	Medium
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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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 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.	HER	Modern (WWII)	Low
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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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
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 1st 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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
88	MNF13576 (NHER)	TG 52364 07247	Railway	During the mid and late 19th 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 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.	HER	Post medieval	Low
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 provide power to industry, transport, public lighting and domestic use. It was	HER	Post medieval	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				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 19th 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 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	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				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
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

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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 19th 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 *Providence Villa I & S L, 1843*.	Listed (Grade II), & HER	Post medieval	Medium
113	NHLE ref 1246972 MNF47923 (NHER)	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
114	NHLE ref 1246971 MNF48137 (NHER)	TG 52579 05414	Terraced House	95 High Road was once two early 19th 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 13th century and was dissolved in 1538. Human skeletons have been found here since the 18th 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

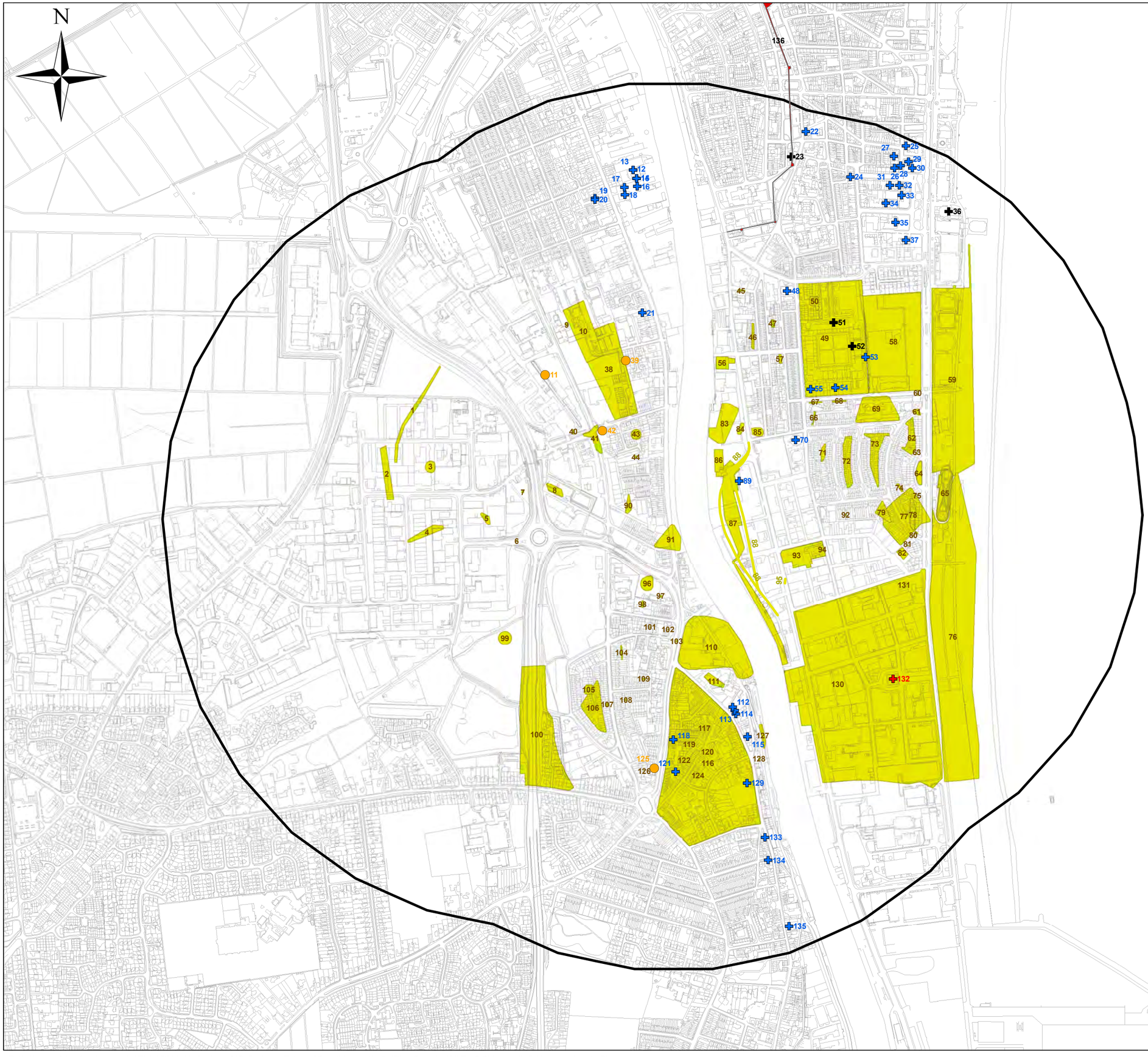
Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
117	MNF49505 (NHER)	TG 5249 0537	Air Raid Shelter	Two probable WWII air raid shelters are visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that any part of the shelters now survives 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 19th 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
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 15th 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 15th 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 '*The Bounds of Gorleston and Southtown*'.	HER	Post medieval	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
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
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 18th to late 19th 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
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,	Listed (Grade I)	Post medieval	High

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				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.			
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 19th 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 18th century and altered in the 20th 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
136	NHLE ref 1003782	TG 52560 06702 to TG 51779 08524	Town Walls	The Medieval Town Wall of Great Yarmouth runs from the river Bure to the banks of the River Yare and is about 23 feet (7m) high and 2238 (680m) long. It is constructed from knapped flint on a flagstone base, cut into a moat. Building started in 1284 and was completed in the late 14th century.	Scheduled Monument	Medieval	High

Appendix B

HERITAGE ASSET PLAN



KEY

- Undesignated Site Location
- Undesignated Site (Line)
- Undesignated Site (Region)
- 1KM Designated Boundary

Great Yarmouth Listed Building Grade

- I
- II
- II*
- Scheduled Monument (Town Walls)

Ver	Amendments	Originated by and date	Checked by and date	Approved by and date
A		IW 24/07/2017	KB 25/07/2017	RA 25/07/2017

Client

Project

Great Yarmouth Thrid River Corssing

Drawing Title

Heritage Assets Plan

Drawing No.

Appendix B

Scale @ A3 : 1:10,000

Purpose : Information

Path: \\cormsfsbsg01\shared\jobs\ENVADMIN\Hydradmin\GIS_Projects_External\GreatYarmouth_3rdRiverCrossing\MXD_GIS\Appendix B Heritage Assets Plan.mxd

Appendix H

HEALTH ASSESSMENT MATRIX

INTRODUCTION

This screening & scoping exercise has been undertaken so that potential health effects are identified and considered early in project development. The exercise identifies potentially affected populations, including vulnerable groups, in addition to aspects of the project which may give rise to effects on health. Where there is potential for effects on health, issues to be considered during scoping and subsequent assessment are also identified.

METHODOLOGY

Section 1 of the matrix sets out the project details and the information available at this stage of project development. For example, early in the project development information may include a route corridor, a range of road or non-road transport options and baseline desk-studies. As the project develops, more design details may be available in addition to environmental assessments.

Section 2 identifies a broad study area and communities likely to be affected. This can be refined later as the Proposed Scheme develops if required. This section identifies potential groups affected by health inequalities.

Section 3 screens health impacts in relation to road schemes. It is based on the London Healthy Urban Development Unit (HUDU) method for rapid assessment81. At this stage no assessment is undertaken and the matrix seeks only to identify potential negative health issues where a 'No' response is recorded (and positive for a 'Yes' response). Table 0.1 below sets out the responses which are recorded to each question. The final column identifies potential issues for scoping.

Matrix for Section 3

Response to Section 3	
N - No	A negative response indicates that there is potentially a negative effect on health. These effects in particular should be considered further at scoping. Reference should be made to other environmental topics where applicable.
Y - Yes	A positive response indicates that there is potentially a positive effect on health.
N/A	Some questions may not be applicable to a particular scheme, for instance because there is no open space.
?	The response is uncertain, possibly due to limited information at the stage of assessment. The questions can be revisited as the design and assessment progresses.

[81] NHS London, Healthy Urban Development Unit, January 2013, *HUDU Planning for Health Rapid Health Impact Assessment Tool.*

SCREENING

Section 1: Proposal Details

Name of project:	Great Yarmouth Third River Crossing Scheme		
Date of Screening	23/11/2017	Name of assessor:	Sheri Shai

Brief description of proposal:

The Great Yarmouth Third River Crossing is a proposed new bridge over the River Yare in Norfolk. In Yarmouth, there is an outer harbour (South Dense peninsula between the River Yare and the sea), providing England's premier offshore support port. The South Denes Business Park, Enterprise Zone and Great Yarmouth Energy Park are located at the southern end of the peninsula. There are two existing single carriageway lifting bridge, Breydon Bridge and Haven Bridge providing direct access to the northern and to the centre of peninsula.

The key issues of the two existing crossings at Great Yarmouth are:

- No crossings further south to provide direct access to the south of peninsula;
- Main industrial areas and deep water outer harbour are up to 4km from the nearest bridge; and
- Access to the seafront for all vehicles, cyclists and pedestrians are constrained at the northern end.

The Proposed Scheme aims to create a direct link into the southern part of the peninsula to improve access to the port, outer harbour, employment areas, seafront and residential areas.

The proposed Great Yarmouth Third River Crossing will provide a four lane high level bridge, tie-in to Suffolk Road via a roundabout to the west and traffic signals to the east at South Denes Road. There is a proposed demolition of an existing footbridge directly adjacent to the Southtown Common Recreation Ground.

Information used for screening:

Public Health England (PHE) Health Profiles (2016) (http://www.localhealth.org.uk/)

Great Yarmouth Borough Profile (2016) (https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=988&p=0)

Google Mapping Data (https://www.google.co.uk/maps/search/greatyarmouth)

Norfolk County Council Definitive Map, Great Yarmouth Borough Council (https://www.norfolk.gov.uk/out-and-about-in-norfolk/public-rights-of-way/map-and-statement-of-public-rights-of-way-in-norfolk/definitive-statements)

Norfolk Coast Cycleway (https://maps.norfolk.gov.uk/trails/?tc=PRO/905#)

Section 2: Populations Affected

Brief description of geographic area and populations affected

The Great Yarmouth Third River Crossing is located within the county of Norfolk.. The surrounding area is primarily urban. There are a number of commercial receptors within the 500m study area including Yarmouth Business Park and Harfrey's Industrial Estate, located to the north and west of the Proposed Scheme; a number of residential receptors within the 500m study area; and recreational receptors such as Southtown Common Recreation Ground located immediately to the south of the Proposed Scheme and Pleasure Beach located approximately 400m to the east of the Proposed Scheme. There is a primary school Great Yarmouth Primary Academy located approximately 250m north east. Two fire stations are located approximately 350m south and 400m north of the Proposed Scheme.

The Proposed Scheme lies within three districts in Great Yarmouth, including Nelson, Southtown and Cobholm and Claydon. In 2015, the total number of population were 23,103 people in the three districts (Nelson has a population of 9,370 people; Southtown and Cobholm have a population of 5,823; and Claydon has a population of 7,910).

Of this population, 50.3% of which are male and 49.7% are female (51.5% of male and 48.5% of female in Nelson; 51.9% male and 49.1% female in Southtown and Cobholm; and 48.4% male and 51.6% female in Claydon).

The majority of population in 2015 were age 25-64 year old age group (50.7%), followed by age under 16 year olds (20.7%) (Majority age group in Nelson were age 25-64 (51.8%) followed by under 16 (22.6%); majority age group in Southtown and Cobholm were age 25-64 (51.6%) followed by age under 16 (23.7%); and age 25-64 (48.9%) and followed by age under 16 (19.7%) in Claydon).

In 2015, there were a total of 12.1% of the population are classified as not 'White UK' followed by Black and Minority Ethnic Group (BME) with 4.7% and 2.48% of the population that cannot speak English well or at all (In Nelson, 20.6% of the population are classified as not 'White UK' followed by BME with 7.8% and 5.2% of the population that cannot speak English well or at all; In Southtown and Cobholm, 12.3% of the population are classified as not 'White UK' followed by BME with 4.3% and 2.2% of the population that cannot speak English well or at all; and In Claydon, 4% of the population are classified as not 'White UK' followed by BME with 2.2% and 0.4% of the population that cannot speak English well or at all).

In 2011, 86.59% of the population in the three districts were classified as 'White British'. The second largest group was 'White Other' with 7.38%, followed by 'African/Caribbean', 'Asian', 'Other' and White Irish' with 2.85%, 1.95%, 0.92% and 0.31% respectively. In general, Health and Care in the three districts in 2015 were significantly worse than England average, with 22.5% population in Nelson; 17.9% population in Southtown and Cobholm; and 24.1% population in Claydon with limited long term illness or disability.

The Index of Multiple Deprivation (IMD) 2015 is the official measure of relative deprivation. It measures a broad concept of deprivation using a combination of information relating to: Income; Employment Health and Disability; Education Skills and Training; Barriers to Housing and Services; and Crime and Living Environment to create an overall measure of deprivation. Great Yarmouth ranked 29th and scored 32.4 (Nelson scored 71.9; Southtown and Cobholm scored 45; and Claydon scored 41.3). The three districts are classified as significantly worse than England for Income Deprivation, Child Deprivation and Older People in Deprivation. Great Yarmouth also considered having the highest proportion of its Lower Super Output Areas (LSOAs) in Norfolk county, to be in most deprived 10% of LSOAs nationally. The study area is located within 1st and 2nd National Deprivation Decile rank (where 1 being the most deprived and 10 is least deprived). These indicate that the study area is severely deprived. Baseline data also indicates that health in the area is worse than the national average. Life expectancy and levels of physical activity are lower, obesity and incidence of cardiovascular disease and cancer higher (for under 75's). The health section of the scoping report has full details.

Are the following groups likely to be differentially affected: (also refer to EqIA if available)		
Group	Tick appropriate	Comment
Gender (incl pregnancy & maternity)	✓	Footpath No.3, 5, 6, 7 and 7a (in Parish of Great Yarmouth & Gorleston) is located within the study area where footpath No.5 is located within the proposed extent of works boundary. There are a number of bus stops located within the study area where three of them located within the proposed extent of works boundary. Closure and diversion for footpath and bus route could potentially occur during construction and the footbridge located immediately north of Southtown Common Recreation Ground would be removed permanently. Pregnant women and those with young families would be temporarily adversely affected due to the restricted access and public transport.
Religion & Belief	✓	The Redeemed Christian Church of God is situated approximately 200m south east of the Proposed Scheme. The proposed bridge may potentially anticipate a temporary adverse air quality and noise impact on users of the church during construction due to the close proximity of the church to the Proposed Scheme.
Ethnicity & Race		The population in the district of Nelson, Southtown and Cobholm and Claydon are predominantly 'White British'. The Proposed Scheme will not impact people differently depending on their ethnicity or race.
Age: Children and Young People: 0-19	✓	Great Yarmouth Primary Academy is located approximately 250m north east of the Proposed Scheme. Potential temporary adverse air quality and noise impacts are anticipated during construction due to the close proximity of the school to the Proposed Scheme.
Age: Older People: 50+	✓	No health facilities within the study area. Two nursing homes, Avery Lodge (approximately 300m north) and Frank Stone Court (approximately 350m north east) within the study area. Closure and diversion of the footpath and bus route could potentially occur during construction phase and footbridge located immediately north of Southtown Common Recreation Ground would be removed permanently. Older people would be temporary adversely affected due to the restricted access.
Disability	✓	Closure and diversion for footpath and bus route would potentially occur during construction and the footbridge located immediately north of Southtown Common Recreation Ground will be removed permanently, where disabled people would be temporarily adversely affected due to the restricted access and public transport.
People in areas of deprivation		It is considered unlikely that the Proposed Scheme will disproportionately affect people within the study area. The Proposed Scheme has the potential to increase connectivity between residential areas and employment areas, potentially increase local employment, training opportunities and tourist access.
Other (Public services)	✓	Two fire stations are located approximately 350m south and 400m north of the Proposed Scheme. Closure and diversion of roads could potentially occur during construction phase. A temporary adverse impact is anticipated due to the increase journey time which would need to be incorporated into a traffic management plan

Section 3: Screening for Health Impacts			
Screening Criteria	**Y/ N/ N/A?**	**Comment**	**Potential health issue for scoping (if N)**
Does the proposal enable and encourage walking?	Y	There may be a temporary adverse impact on pedestrians due to the permanent closure of footbridge and the temporary closure and diversion of footpath and bus stops. However, there will be new footway on the proposed bridge, two new signalised crossing (one of those to replace the demolished footbridge) and one new pedestrian crossing which would increase access near the Proposed Scheme vicinity during operation.	An increase in physical activity helps to prevent chronic diseases, reduce risk of premature death and improve mental health.
Does the proposal enable and encourage cycling?	Y	There may be a temporary adverse impact on cyclists using National Cycle Route 517 during construction phase due to the potential closure and diversion of cycle route. However, the proposed 2 way cycleway on the bridge will enable cyclist to access to the south of the peninsula directly and potentially enable shorter journey times during operation.	
Does the proposal include traffic management and/or safety measures to help reduce and minimise road injuries?	Y	There will be a proposed new roundabout and signal controlled junction located immediately to the east of the Proposed Scheme. This will potentially improve traffic management to reduce and minimise road injuries during operation.	Design can affect the risk of road traffic injuries.
Does the proposal provide access to public transport?	Y	There may be a temporary adverse impact on bus users due to the potential closure and diversion of bus route / bus stops. However, while the proposal does not include explicit provision for public transport, it will reduce congestion and therefore improve connectivity for motorists between nearby districts that have existing public transport facilities.	Opportunities for all groups to travel including those without access to a car,
Does the proposal connect with existing communities, i.e. layout and movement which avoids physical barriers and severance?	?	There will be an impact on residents living in properties located on Queen Anne's Road and Southtown Road due to the demolition work. The existing communities are currently connected by two existing Breydon Bridge and Haven Bridge. The Proposed Scheme will improve and provide a	Friendship and supportive networks in a community can help to reduce depression and levels of chronic illness as well as speed recovery after illness and improve wellbeing.

Section 3: Screening for Health Impacts			
		direct connection of existing communities, namely connecting Southtown and Cobholm and Claydon to Nelson.	Fragmentation of social structures can lead to communities demarcated by socio-economic status, age and/or ethnicity, which can lead to isolation, insecurity and a lack of cohesion.
Does the proposal provide access to healthcare services or facilities?	Y	There are a number of existing healthcare services and facilities in the nearby communities. The Proposed Scheme aim to improve connectivity and access for local residents.	Access to good quality health and social care, education and community facilities has an effect on human health.
Does the proposal provide access to other social infrastructure, e.g. schools, social care and community facilities?	Y	Operation of the third bridge will provide direct access and potentially minimise journey time for residents accessing social and recreational facilities, notably Southtown Common Recreation Ground (immediate to the south), Great Yarmouth Primary Academy (250m north east) and Pleasure Beach (400m east).	
Does the proposal provide access for people with mobility problems or a disability?	Y	There will be a temporary adverse impact for people with reduced mobility or disabilities during construction due to the potential closure and diversion of PRoW and bus route / stops. Appropriate diversion or alternative route should be provided and clear sign-posting. The proposed replacement of existing footbridge (stairs only access) to new signalised crossing will benefit people with mobility problems or disabilities during operation.	For those with mobility problems, including older people, poor access to local services could limit opportunities for social interaction and lead to isolation and depression.
Does the proposal aim to reduce construction impacts such as dust, noise, vibration and odours?	Y	It is unknown at this stage what measures will be in place to manage and mitigate construction impacts. Construction related impacts of the proposals, such as those relating to noise and air quality, will be assessed at a later stage and it is expected that they will be either mitigated or appropriately managed through the implementation of environmental management plans during construction.	The quality of the local environment can have a significant impact on physical and mental health (also see below)
Does the proposal reduce air pollution caused by traffic?	?	The impact on local air quality is not yet known. The Proposed Scheme will increase traffic at the crossing but will also reduce congestion in north of Great	Poor air quality is linked to incidence of chronic lung disease (chronic

Section 3: Screening for Health Impacts			
		Yarmouth by diverting a portion of the traffic to the third bridge.	bronchitis or emphysema) and heart conditions and asthma levels of among children.
Does the proposal minimise noise pollution caused by traffic?	?	The impact on local noise levels is not yet known. The Proposed Scheme will increase traffic at the crossing but will also reduce congestion by diverting a portion of the traffic to the third bridge.	Noise pollution can have a detrimental impact on health resulting in sleep disturbance, cardiovascular and psycho-physiological effects.
Does the proposal retain and enhance existing open space, natural vegetation and landscapes?	N/A	The current land use within the Proposed Scheme vicinity is urban area. The Proposed Scheme will retain the Southtown Common Recreation Ground.	Access to open/green space can lead to more physical activity and reduce levels of heart disease, strokes and other ill-health problems that are associated with both sedentary occupations and stressful lifestyles. Physical activity is particularly important for children's health. There is growing evidence that access to open spaces and nature can help to maintain or improve mental health.
Does the proposal improve access to natural and open spaces?	Y	The proposed replacement of existing footbridge (stairs only access) to new signalised crossing can benefit people with mobility problems or disabilities to access from the north to Southtown Common Recreation Ground.	
Does the proposal maintain or enhance biodiversity?	?	The ecological assessment has not yet been completed.	
Does the proposal incorporate elements to help design out crime?	?	There is insufficient design information available at this stage of the assessment.	Design that promotes natural surveillance and social interaction can help to reduce crime and the 'fear of crime', both of which impacts on mental wellbeing.
Does the proposal provide access to local employment and training opportunities, including temporary construction jobs?	Y	The Proposed Scheme aims to increase connectivity to employment areas, namely the South Dense Business Park, Enterprise Zone and Great Yarmouth Energy Park. It will potentially increase local employment and training opportunities. During construction phase, the Proposed Scheme can create job opportunities. A proportion of these workers could be from the local area, although this would not be confirmed until the construction contracts are confirmed at a later date.	Employment and income is a key determinant of health and wellbeing. Unemployment generally leads to poverty, illness and a reduction in personal and social esteem. Works aids recovery from physical and mental illnesses.

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Does the proposal make best use of existing land and material resources?	?	There is insufficient design information available at this stage of the assessment. However, waste and materials will be assessed as part of design.	Reducing or minimising waste including disposal, processes for construction as well as encouraging recycling at all levels can improve human health directly and indirectly by minimising environmental impact, such as air pollution.
Does the proposal incorporate sustainable urban drainage techniques?	Y	SuDs are proposed including collecting off-run from the bridge structure and hard surfaces; drainage ditches are to be configured; and the carriageway run-off will drain to SuDs features.	Increased flood risk can affect mental health.