Appendix G-4 Part 4 – Consultation Materials: Preliminary Environmental Information Report

Norfolk County Council

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Environmental Information Report
Volume III: Technical Appendix

GYTRC-WSP-EGN-XX-RP-EN-0003
AUGUST 2018

PUBLIC

Norfolk County **Council**

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Environmental Information Report Volume III: Technical Appendix

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APPENDIX 1A

REGULATION 32 TRANSBOUNDARY SCREENING

The Planning Inspectorate

Transboundary screening undertaken by the Planning Inspectorate (the Inspectorate) on behalf of the Secretary of State (SoS) for the purposes of Regulation 32 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 2017 EIA Regulations)	
Project name:	Great Yarmouth Third River Crossing
Address/Location:	Great Yarmouth, Norfolk – linking the A47 road at Hafrey's roundabout west of the River Yare with South Denes Road to the east of the River Yare via a new bridge.
Planning Inspectorate Ref:	TR010043
Date(s) screening undertaken:	First screening – 28 June 2018 following the Applicant's request for a scoping opinion

FIRST TRANSBOUNDARY SCREENING	
Document(s) used for transboundary Screening:	Great Yarmouth Third River Crossing Environmental Impact Assessment' ('the Scoping Report') March 2018

The Planning Inspectorate (the Inspectorate) on behalf of the Secretary of State (SoS) has considered the Proposed Development, which comprises a new dual carriageway on a bridge over the River Yare in Great Yarmouth to create a direct road link from the South Denes Peninsula to the strategic road network via the A47 Hafrey's roundabout, and is the subject of this transboundary screening. The Inspectorate has taken into account information contained in the Applicant's Scoping Report titled the '*Great Yarmouth Third River Crossing Environmental Impact Assessment Scoping Report'* dated March 2018 and has had regard to the location of the Proposed Development, its characteristics, and the environmental importance of the receiving environment.

The Inspectorate concludes that the Proposed Development **is unlikely to have a significant effect either alone or cumulatively on the environment in another European Economic Area State**. In reaching this conclusion the Inspectorate has identified and considered the Proposed Development's likely impacts including consideration of potential pathways and the extent, magnitude, probability, duration, frequency and reversibility of the impacts.

The Inspectorate considers that the likelihood of transboundary effects resulting from the Proposed Development is so low that it does not warrant completion of a formal transboundary screening matrix. However, this position will remain under review and will have regard to any new or materially different information coming to light which may alter that decision.

Transboundary screening undertaken by the Inspectorate on behalf of the SoS

Under Regulation 32 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 2017 EIA Regulations) and on the basis of the current information available from the Applicant, the Inspectorate is of the view that the Proposed Development is not likely to have a significant effect on the environment in another EEA State.

In reaching this view the Inspectorate has applied the precautionary approach (as explained in its Advice Note Twelve: Transboundary Impacts), and taken into account the information currently supplied by the Applicant.

Action:

No further action required at this stage.

Date: 28 June 2018

Note: The SoS' duty under Regulation 32 of the 2017 EIA Regulations continues throughout the application process.

Note:

The Inspectorate's screening of transboundary issues is based on the relevant considerations specified in the Annex to its Advice Note Twelve, available on our website at http://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/

Appendix 4A

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.

[redacted]
[redacted] Officer
[redacted]

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[redacted]
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

[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

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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

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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

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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

End

Historic England

EAST OF ENGLAND OFFICE

[redacted]
Norfolk County Council: Community and
Environment Services
County Hall
Martineau Lane
NORWICH
Norfolk
NR1 2DH

Direct Dial: 01223 582738

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 [redacted]

Historic England

EAST OF ENGLAND OFFICE

[redacted]

24 BROOKLANDS AVENUE, CAMBRIDGE, CB2 8BU

[redacted]

HistoricEngland.org.uk

Date: 06 October 2017
Our ref: 224829
Your ref: HI/MP/PKA018/GB

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BY EMAIL ONLY

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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]

Cc commercialservices@naturalengland.org.uk

Appendix 6A

AIR QUALITY CONSTRUCTION PHASE ASSESSMENT METHODOLOGY

APPENDIX 6A: AIR QULAITY CONSTRUCTION PHASE ASSESSMENT METHODOLOGY

6A.1 INTRODUCTION AND SCOPE OF THE ASSESSMENT

6A.1.1 Appendix 6A of the Preliminary Environmental Information Report (PEIR), outlines the guidance provided by the Institute of Air Quality Management (IAQM) for the assessment of air quality impacts arising from demolition and construction activities1, (herein referred to as "the Guidance"). The Guidance prescribes a five step process for undertaking this assessment as follows.

6A.2 STEP ONE: SCREEN THE NEED FOR A DETAILED ASSESSMENT

6A.2.1 An assessment of construction phase dust emissions will normally be required where there are:

- 'Human receptors' within 350m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and
- 'Ecological receptors' within 50m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

6A.2.2 The Guidance refers to a 'Human receptor', as any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM_{10} over a time period relevant to the air quality objectives, as defined in Defra technical air quality guidance[2].

6A.2.3 The Guidance refers to an 'Ecological receptor' as any sensitive habitat affected by dust soiling and includes locations with a statutory designation such as a Site of Specific Scientific Interest (SSSI), Special Area of Conservation (SACs), Special Protection Areas (SPAs) and RAMSAR sites, as designated under the RAMSAR convention.

6A.2.4 Where the need for a more detailed assessment is screened out, the Guidance concludes that the level of risk is 'negligible' and that any effects are unlikely to be significant.

6A.3 STEP TWO: ASSESS THE RISK OF DUST IMPACTS

6A.3.1 The Guidance states that the risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (Step Two (A)); and
- The sensitivity of the area to dust impacts (Step Two (B)) which is defined as low, medium or high sensitivity.

6A.3.2 These two factors are combined to determine the risk of dust impacts with no mitigation applied. Depending on the activities undertaken, risk category designations may be required for each of four construction activities defined by the Guidance; namely Demolition, Construction, Earthworks and Trackout.

[1] Institute of Air Quality Management (IAQM) (2014). Assessment of Dust from Construction and Demolition, IAQM

[2] Defra (2016) Local Air Quality Technical Guidance TG(16).

STEP TWO (A): DEFINE THE POTENTIAL DUST EMISSION MAGNITUDE

6A.3.3 The dust emission magnitude has been based on the scale of the anticipated works and is classified as 'Small', 'Medium', or 'Large' as identified for each construction activity from the criteria in Table 6A.1.

Table 6A.1 - Dust Emission Magnitude Criteria

Activity	Dust Emission Magnitude Criteria		
	Small	Medium	Large
Demolition	Total building volume less than 20,000m3, construction material with low potential for dust release (e.g. metal cladding or timber) demolition activities less than 10m above ground level; demolition during wetter months	Total building volume between 20,000m3 – 50,000m3, potentially dusty construction material; demolition activities between 10m and 20m above ground level	Total building volume more than 50,000m3, potentially dusty construction material (e.g. concrete); on-site crushing and screening; demolition activities more than 20m above ground level
Earthworks	Total site area less than 2,500m2; soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <20,000 tonnes, earthworks during wetter months	Total site area between 2,500m2 to 10,000m2; moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m - 8m in height, total material moved 20,000 tonnes – 100,000 tonnes	Total site area more than 10,000m2; potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds more than 8m in height, total material moved more than 100,000 tonnes
Construction	Total building volume less than 25,000m3; construction material with low potential for dust release (e.g. metal cladding or timber).	Total building volume between 25,000 m3 and 100,000m3; potentially dusty construction material (e.g. concrete), on- site concrete batching;	Total building volume More than 100,000m3; on-site concrete batching, sandblasting;
Trackout	Less than 10 HDV outward movements in any one day; surface material with low potential for dust release; unpaved road length less than 50m	Between 10 to 50 HDV outward movements in any one day; moderately dusty surface material (e.g. high clay content); unpaved road length between 50 and 100m	More than 50 HDV outward movements in any one day; potentially dusty surface material (e.g. high clay content); unpaved road length more than 100m

6A.3.4 Table 6A.1 details the risk of impacts for potential dust nuisance, health and ecosystem effects from demolition; earthworks; general construction activities and trackout, respectively. For the purposes of the Step Two (A) assessment, in accordance with the Guidance, it is assumed that no mitigation measures are applied, the dust emission magnitude is dependent on the available information on the construction phase and professional judgement.

6A.3.5 A summary of the dust emission magnitude assigned to each construction activity as part of this assessment is outlined in Table 6A.2.

Table 6A.2 - Dust Emission Magnitude Classification for Assessment

Activity	Dust Emission Magnitude	Justification
Demolition	Large	The construction demolition involves the removal of several buildings including 3 large panelled warehouses and associated hardstanding, seventeen two storey brick buildings, a footbridge. A worst case assumption that asbestos may be present within structures has been taken.
Earthworks	Large	The exact extent of Earthworks is unknown at the PEIR stage. However, due to the size of the Scheme and taking a worst case approach to the assessment, it is judged that Earthworks could produce high levels of dust and it has accordingly been included within the assessment.
Construction	Large	Although a detailed construction programme was not available at the PEIR stage, given the size of the Scheme and likelihood of onsite works, a worst case assumption that works have the potential to generate high levels of dust was taken.
Trackout	Large	At the PEIR stage, the exact number of construction vehicles utilised throughout the construction phase is unknown, nor the amount and length of unpaved roads that will be used. As a worst case estimate, it is assumed the Scheme will generate > 50 HDV outward movements per day divided across multiple site entrances and it is likely that there will be sections of unpaved road during construction.

STEP TWO (B): DEFINE THE SENSITIVITY OF THE AREA

6A.3.6 The sensitivity of the area takes into account a number of factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

6A.3.7 The significance of dust effects associated with the construction phase was defined using the criteria detailed in Table 6A.3, Table 6A.4 and Table 6A.5.

6A.3.8 The sensitivity is derived for each of the four considered activities and the highest level recorded as part of the assessment. (See *Box Six to Box Nine* of the Guidance).

Table 6A.3 - Sensitivity of the Area to Dust Soiling Effects of People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 6A.4 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table 6A.5 - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

6A.3.9 Table 6A.6 provides the method of defining the sensitivity of the area.

Table 6A.6 - Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Medium	Medium	Medium	Medium
Ecological	High (Statutory Ecological Sites)			

STEP TWO (C): DEFINE THE RISK OF IMPACT

6A.3.10 The dust emission magnitude determined using the criteria in Table 6A.1 and justified in Table 6A.2 has been combined with the sensitivity of the area determined through the implementation of Table 6A.3, Table 6A.4 and Table 6A.5 to determine the risk of impacts without mitigation.

6A.3.11 The matrices in Table 6A.7 provide a method of assigning the level of risk for each activity. This has been used in determining the level of mitigation that must be applied and discussed in Step Three. For those cases where the risk category is 'negligible', no mitigation measures beyond those required by legislation are required.

Table 6A.7 - Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Small	Medium	Large
Demolition			
Low	Negligible	Low Risk	Medium Risk
Medium	Low Risk	Medium Risk	High Risk
High	Medium Risk	Medium Risk	High Risk
Earthworks			
Low	Negligible	Low Risk	Low Risk
Medium	Low Risk	Medium Risk	Medium Risk
High	Low Risk	Medium Risk	High Risk
Construction			
Low	Negligible	Low Risk	Low Risk
Medium	Low Risk	Medium Risk	Medium Risk
High	Low Risk	Medium Risk	High Risk
Trackout			
Low	Negligible	Low Risk	Low Risk
Medium	Negligible	Low Risk	Medium Risk
High	Low Risk	Medium Risk	High Risk

6A.3.12 Table 6A.8 provides a summary of the risk of dust impacts for the four activities and allows for site-specific mitigation measures to be specified for inclusion in this assessment (see Step Three).

Table 6A.8 - Summary of Risk for Definition of Mitigation Measures

Sensitivity of Area	Summary of Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High Risk	High Risk	High Risk	High Risk
Human Health	Medium Risk	Medium Risk	Medium Risk	Medium Risk
Ecological	High Risk			

STEP THREE: SITE-SPECIFIC MITIGATION

6A.3.13 The dust risk categories for each of the four activities determined in Step Two should be used to define the appropriate, site-specific, mitigation measures to be adopted. The Guidance states that local authorities may have a Code for Construction Practice (CoCP), or equivalent document, that should be taken into account during the development of the mitigation measures and incorporated within the mitigation measures identified within the Guidance.

6A.3.14 The mitigation measures are divided into general measures applicable to all site and measures applicable specifically to demolition, earthworks, construction and trackout, for consistency with the assessment methodology. More information on the site-specific mitigation identified as part of this air quality assessment can be found in the section 6.6 of Chapter 6 of the PEIR.

STEP FOUR: DETERMINE SIGNIFICANT EFFECTS

6A.3.15 Once the risk of dust impacts has been determined in Step Two and the appropriate dust mitigation measures identified in Step Three, the final step has been to determine whether there are significant effects arising from the construction phase of the Scheme. This assessment is based on professional judgement and takes account of the significance of the effect of each of the four construction activities.

6A.3.16 For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. The Guidance states that this is normally possible. Hence the residual effect will normally be 'not significant'.

6A.3.17 The Guidance advises there may be cases where, for example, there is inadequate access to water for dust suppression to be effective, and even with other mitigation measures in place there may be a significant effect. Therefore, it is important to consider the specific characteristics of the site and the surrounding area to ensure that the conclusion of no significant effect is robust.

STEP FIVE: DUST ASSESSMENT REPORT

6A.3.18 The findings of the construction phase dust assessment are reported in Section 6.5 and 6.6 of Chapter 6 of the PEIR. This assessment includes:

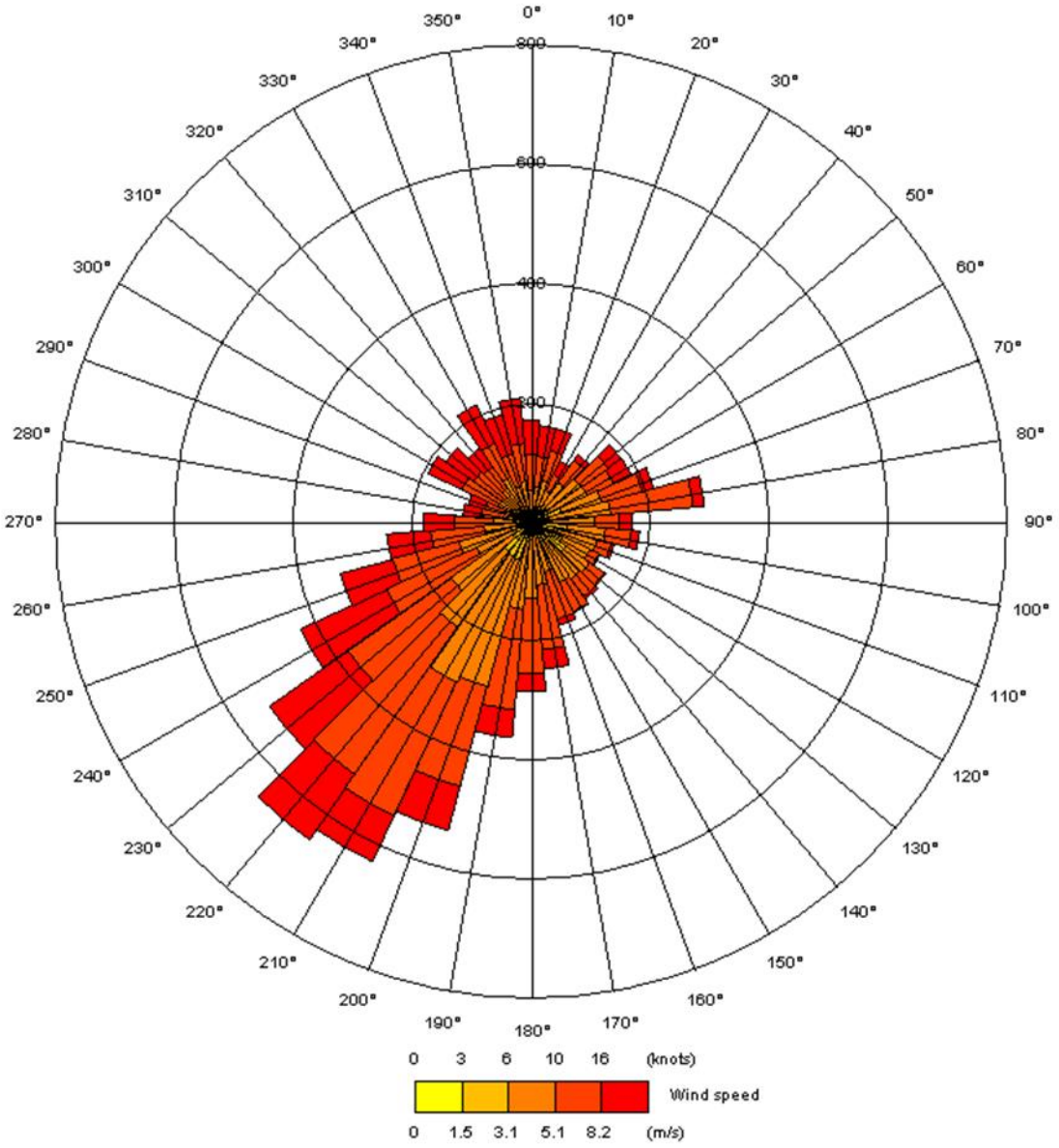
- A summary of dust emission magnitude and sensitivity of the study area;
- The potential risk of impacts associated with the construction phase, without mitigation; and
- Details of appropriate mitigation measures commensurate to the scale and nature of construction activities and locations; this will be applied via the full CoCP.

Appendix 6B

WIND ROSE

APPENDIX 6B: WIND ROSE

WIND ROSE 2016 WEYBOURNE METEOROLOGICAL DATA



Appendix 7A

ACOUSTIC TERMINOLOGY

APPENDIX 7A: ACOUSTICS TERMINOLOGY

7A.1.1 Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

7A.1.2 Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

7A.1.3 The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

7A.1.4 The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Table 7A.1 - Noise Terminology

Terminology	Description
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20 µPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20Log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m.
Façade	At a distance of 1 m in front of a large sound reflecting object such as a building façade.

Terminology	Description
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.

Table 7A.2 - Vibration Terminology

Terminology	Description
Displacement, velocity and acceleration	Vibration is an oscillatory motion. The magnitude of vibration can be defined in terms of displacement (how far from the equilibrium position that something moves), velocity (how fast something moves), or acceleration (the rate of change of velocity).
Amplification	A general term used to indicate the increase in noise or vibration, or the amount (in decibels) by which it is increased.
Transfer function	Transfer function of a vibrating system is the ratio of the output or response of the system to the input excitation, usually expressed as a complex function of frequency.
Vibration dose value (VDV)	This is a measure of the amount of vibration that is experienced over a specified period, and has been defined so as to quantify the human response to vibration in terms of comfort and annoyance. The Vibration Dose Value is used to assess the likely levels of adverse comment about vibration, and is defined mathematically as the fourth root of the time integral of the fourth power of the acceleration, after it has been frequency weighted to take into account the frequency response of the human body to a vibration stimulus. Measured in units of m·s-1.75
Peak Particle Velocity (PPV)	PPV is the maximum speed (in a given direction) of oscillation about a point of equilibrium. PPV is measured in three dimensional planes.
Peak Vector Sum (PVS)	The PVS is the square root of the sum of the square of the PPV values in all three vector dimensions. The PVS is always greater than the individual PPV vector values

Appendix 8A

PRELIMINARY ECOLOGICAL APPRAISAL

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Ecological Appraisal

October 2016

Produced for

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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*

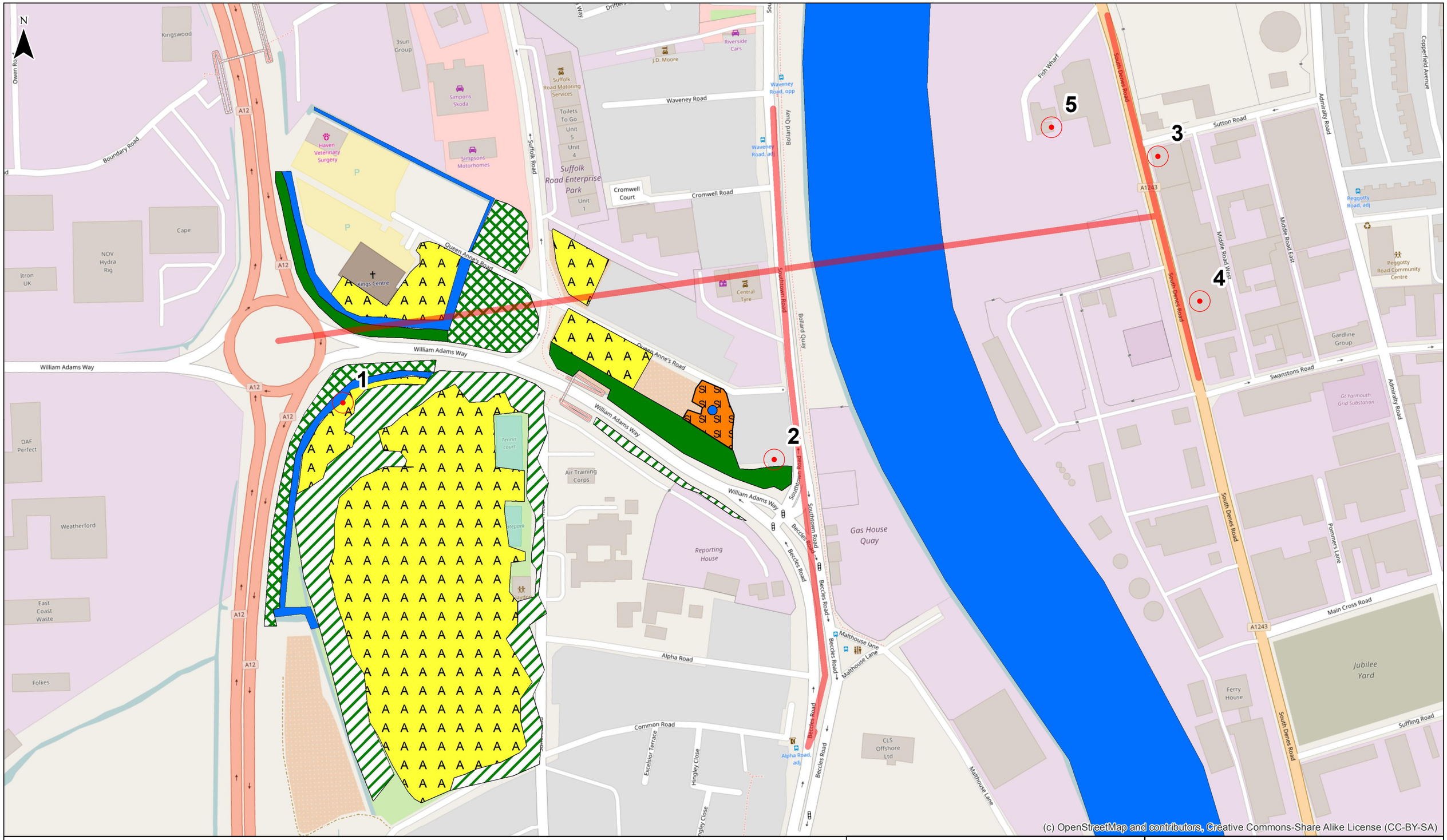
The buildings within the site are either to be purchased for demolition or will be subject to disturbance during the construction of the proposed scheme. It is recommended that further surveys are undertaken to confirm the presence or absence of bats within these buildings.

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	06/12/20 16	09/12/20 16	09/12/20 16

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 8B

PROTECTED SPECIES SURVEY 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			
Signature				
Checked by	Becky Bailey			
Signature				
Authorised by	Andy Bascombe			
Signature				
Project number				
Report number				
File reference				

CONTENTS

TABLES

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
Nathusius' 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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- CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.
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- HMSO (Her Majesty's Stationary Office) (2010). The Conservation of Habitats and Species Regulations 2010 as amended (the Habitat Regulations)
- Russ, J. (2012). British bat calls: A guide to species identification. Exeter: Pelagic Publishing.

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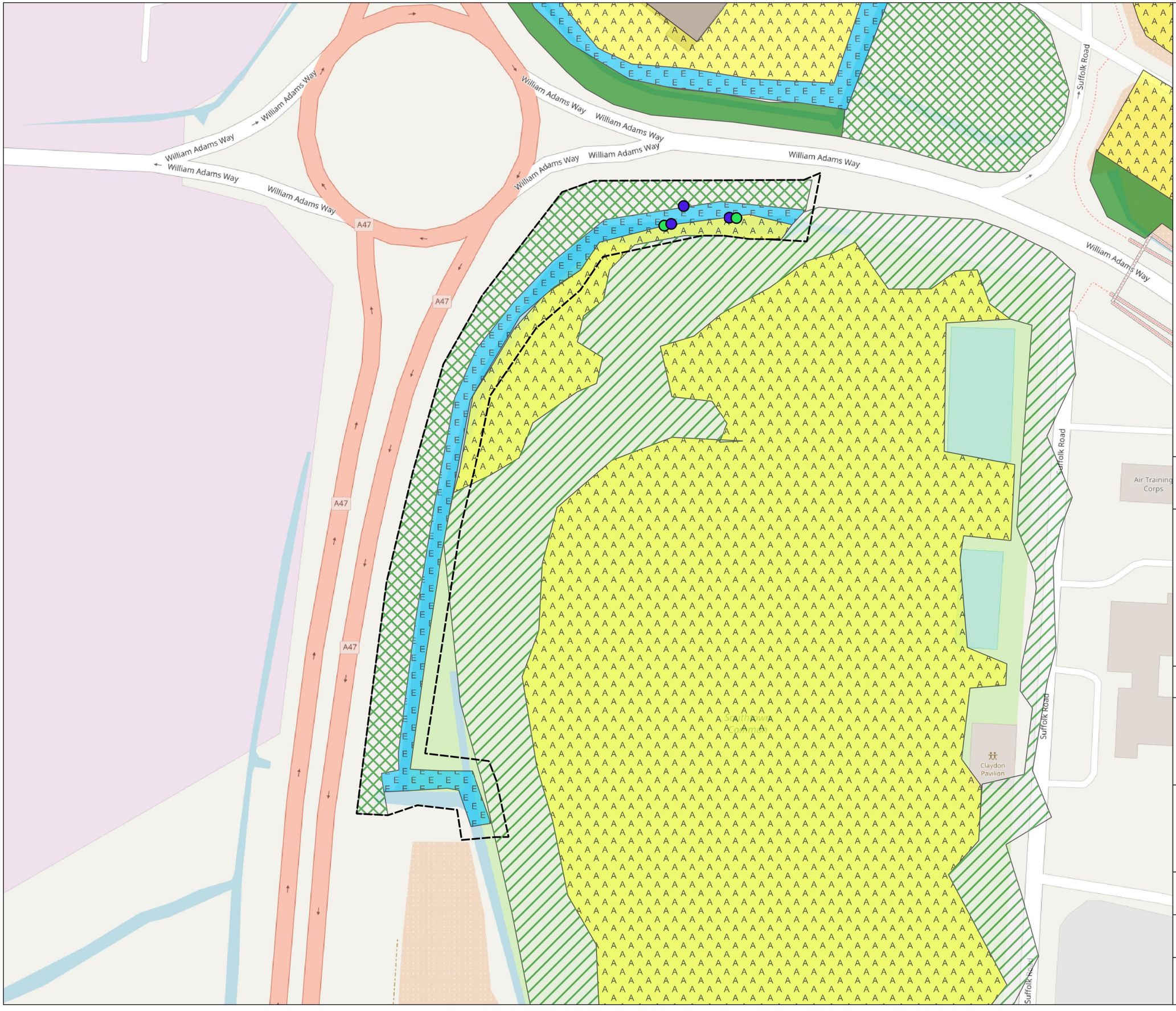

LEGEND:

- 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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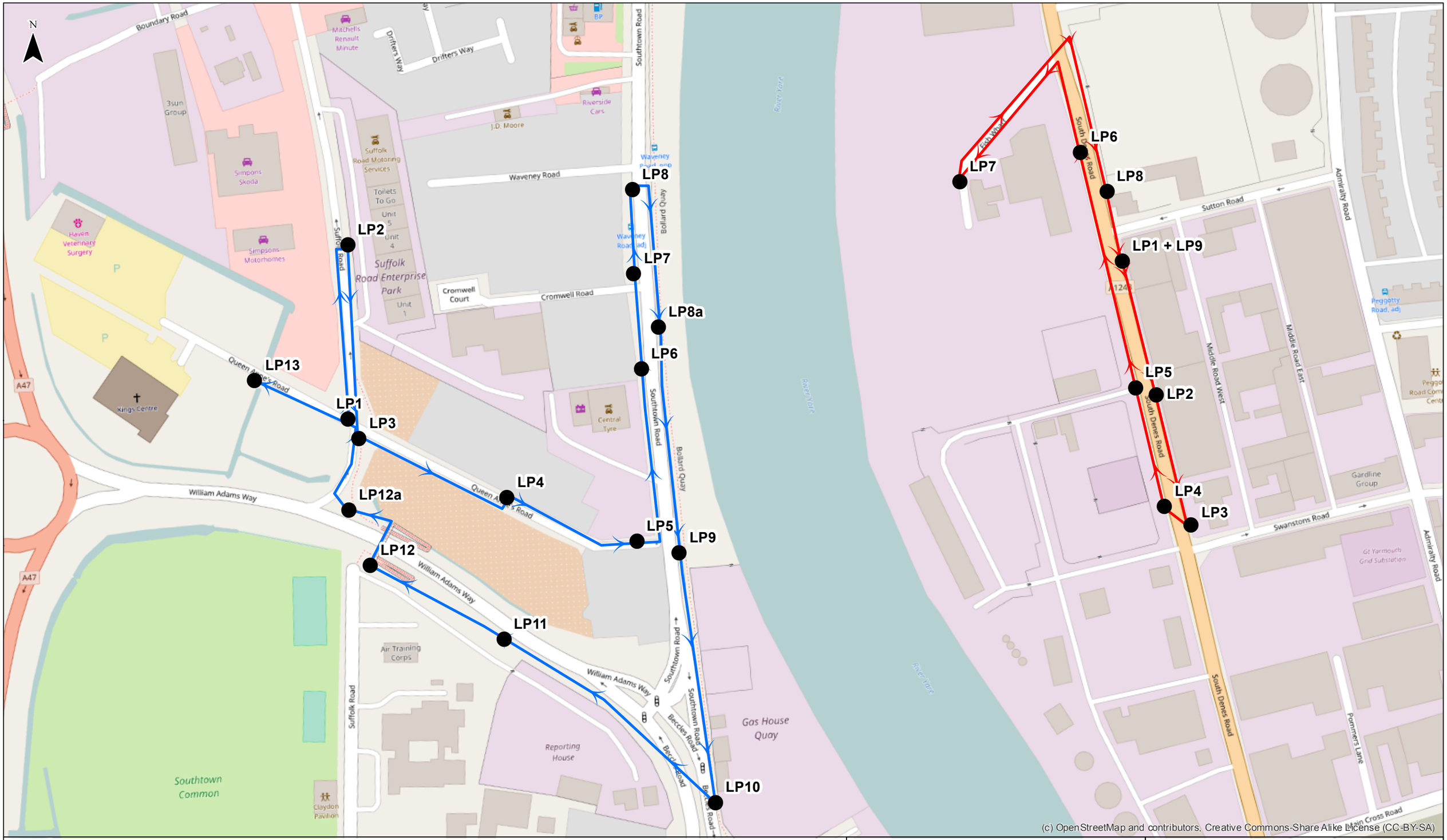
CLIENT: Norfolk County Council

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
Office	White Rose
Tel	020 7822 2497
Scale (at A3 size)	1:1,900
Purpose of Issue	Information
Drawing Number	Page 1 of 1

Appendix 9A

CULTURAL HERITAGE ASSET GAZETTEER

APPENDIX 9A: CULTURAL HERITAGE ASSET GAZETTEER

9A.1 INTRODUCTION

9A.1.1 The Cultural Heritage Asset Gazetteer is based on the data held in the National Heritage List for England (NHLE) and the Norfolk Historic Environment Record (NHER). 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 (World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Park and Garden, Registered Battlefield and Conservation Area). The study are for the road traffic signs extends 250m around the proposed locations for designated cultural heritage assets.

9A.1.2 The location of the cultural heritage assets is shown on Figures 9.1 to 9.3, presented in Volume II of the PEIR.

9A.1.3 An indication of the value of the cultural heritage assets is provided in the Tables below based on the assessment undertaken to date. It is expected that the assessment of the value of assets will change as the work continues for the preparation of the ES. The assessment of the value of cultural heritage assets involves 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) is undertaken in line with DMRB guidance, and in compliance with the NPPF and the following relevant professional guidelines.

9A.2 PROPOSED SCHEME

Table 9A.1 - Scheduled Monuments in the 1km Study Area

NHLE Number	Name	Easting	Northing	Value
1003782	Town walls	652572	307583	High
1003958	Nos 6, 7 and 8, Row 111, South Quay	652459	307195	High
1004020	Merchant's House, Row 117, South Quay	652462	307141	High
1017910	Greyfriars Franciscan friary	652398	307343	High

Table 9A.2 – Listed Buildings in the 1km Study Area

NHLE Number	Name	Grade	Easting	Northing	Value
1245560	THE TOLHOUSE	I	652496	307253	High
1245915	REMAINS OF THE CHURCH OF THE GREYFRIARS	I	652403	307330	High
1245919	ST GEORGES THEATRE	I	652612	307348	High
1246057	NELSONS MONUMENT	I	652999	305508	High
1245561	GREAT YARMOUTH POTTERIES	II*	652727	306909	High
1245800	CUSTOM HOUSE	II*	652406	307237	High
1245803	25, SOUTH QUAY	II*	652438	307190	High
1245917	OLD MERCHANTS HOUSE	II*	652462	307142	High
1245922	THE HIPPODROME	II*	653048	307119	High
1245983	ST NICHOLAS HOSPITAL MAIN BLOCK	II*	652890	306400	High
1245984	ST NICHOLAS HOSPITAL MAIN ENTRANCE RANGE	II*	652840	306464	High
1271278	OLD WHITE LION PUBLIC HOUSE	II*	652635	307081	High
1271608	THE WINTER GARDENS	II*	653148	306762	High
1096787	MAYFLOWER HOTEL (NUMBER 5) ST GEORGES HOTEL (NUMBERS 7-8)	II	652980	306784	Medium
1096789	GAS HOLDER	II	652739	306149	Medium
1096790	SOUTHTOWN AND GORLESTON METHODIST CHURCH	II	652411	305346	Medium
1096791	TOWER FISH CURING WORKS	II	652766	306976	Medium
1096804	REMAINS OF AUSTIN FRIARS PRIORY	II	652417	305260	Medium
1096805	DONNA DOONE HOTEL (NUMBERS 1, 1A AND 2) NEPTUNE HOTEL (NUMBERS 9-11) AND SIENNA LODGE HOTEL (NUMBERS 17-18)	II	653004	306878	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1096806	THE EMBASSY HOTEL (NUMBERS 38-41)	II	652991	306832	Medium
1096826	WOOD HALL HOTEL	II	652714	307151	Medium
1096827	CHURCH OF ST SPYRIDON	II	652726	307101	Medium
1096829	DOLPHIN PUBLIC HOUSE	II	652587	306039	Medium
1245556	9 AND 11, TOLHOUSE STREET	II	652505	307238	Medium
1245557	13, TOLHOUSE STREET	II	652509	307233	Medium
1245558	15, TOLHOUSE STREET	II	652511	307229	Medium
1245559	17 AND 19, TOLHOUSE STREET	II	652514	307221	Medium
1245563	3, 4 AND 5, WATERLOO ROAD	II	653041	306894	Medium
1245564	11-16, WELLINGTON ROAD	II	653002	306910	Medium
1245565	20, WELLINGTON ROAD	II	653002	306978	Medium
1245566	WELLINGTON ARCH	II	653020	306885	Medium
1245798	16, SOUTH QUAY	II	652396	307273	Medium
1245799	17, SOUTH QUAY	II	652394	307261	Medium
1245801	PORT AND HAVEN COMMISSIONERS OFFICES	II	652411	307225	Medium
1245802	23 AND 24, SOUTH QUAY	II	652434	307215	Medium
1245804	26 AND 27, SOUTH QUAY	II	652434	307180	Medium
1245805	31, SOUTHTOWN ROAD	II	652106	307083	Medium
1245806	32, SOUTHTOWN ROAD	II	652109	307076	Medium
1245807	BOUNDARY WALL TO SOUTH OF NUMBER 66 (NUMBER 66 NOT INCLUDED)	II	652201	306797	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1245808	BOUNDARY WALL TO NORTH OF NUMBER 67 (NUMBER 67 NOT INCLUDED)	II	652201	306794	Medium
1245809	83 AND 84, SOUTHTOWN ROAD	II	652328	306490	Medium
1245810	244, SOUTHTOWN ROAD	II	652281	306806	Medium
1245811	WORKSHOP RANGE N OF NO. 244A	II	652303	306872	Medium
1245812	UTILITY BLOCK IMMEDIATELY EAST OF NUMBER 244A	II	652313	306850	Medium
1245813	WORKSHOP RANGE NORTH OF NUMBER 244A	II	652303	306872	Medium
1245814	244B, SOUTHTOWN ROAD	II	652314	306828	Medium
1245815	245, SOUTHTOWN ROAD	II	652280	306827	Medium
1245816	271-277, SOUTHTOWN ROAD	II	652155	307134	Medium
1245817	CHURCH OF ST MARY	II	652146	307165	Medium
1245916	6, 7 AND 8, ROW 111	II	652458	307193	Medium
1245918	1, 2 AND 3, ST GEORGES PLAIN	II	652638	307289	Medium
1245920	PARK HOUSE (NUMBER 82)	II	652730	307331	Medium
1245921	RED FLEET HOUSE	II	652705	307342	Medium
1245980	9, QUEEN STREET	II	652370	307340	Medium
1245981	CHURCH OF ST JAMES	II	652716	306548	Medium
1245982	ST NICHOLAS HOSPITAL CSSD STORE	II	652778	306286	Medium
1245985	ST NICHOLAS HOSPITAL SOUTH BLOCK	II	652845	306289	Medium
1245986	ST NICHOLAS HOSPITAL WALLS AND RAILINGS	II	652926	306371	Medium
1246059	41-46, NELSON ROAD SOUTH	II	652885	306854	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1246580	CANNON BOLLARD, CANNON BOLLARD AT JUNCTION WITH ROW 116	II	652633	307212	Medium
1246583	CAVENDISH HOTEL	II	653051	306878	Medium
1246584	ROYAL HOTEL	II	653034	306937	Medium
1246585	MARITIME MUSEUM	II	653052	307202	Medium
1246587	123 AND 123A, KING STREET	II	652635	307157	Medium
1246588	126 AND 127, KING STREET	II	652626	307184	Medium
1246589	131, KING STREET	II	652619	307205	Medium
1246590	132, KING STREET	II	652615	307214	Medium
1246591	133, KING STREET	II	652614	307223	Medium
1246592	134 AND 134A, KING STREET	II	652613	307235	Medium
1246593	135, KING STREET	II	652613	307242	Medium
1246594	136, KING STREET	II	652603	307253	Medium
1246595	137 AND 138, KING STREET	II	652596	307259	Medium
1246596	139, KING STREET	II	652596	307265	Medium
1246597	LIBERTIES PUBLIC HOUSE	II	652593	307277	Medium
1246598	NUMBER 141 INCLUDING AREA RAILINGS	II	652598	307292	Medium
1246599	142, KING STREET	II	652591	307297	Medium
1246600	143, KING STREET	II	652593	307305	Medium
1246601	144, KING STREET	II	652582	307305	Medium
1246602	NUMBER 145 INCLUDING BASEMENT AREA RAILINGS IN FRONT	II	652579	307317	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1246603	NUMBER 148 INCLUDING RAILINGS TO DOORWAY	II	652570	307348	Medium
1246970	AHOY, MANBY HOUSE	II	652610	305354	Medium
1246971	95, HIGH ROAD	II	652579	305414	Medium
1246972	96, HIGH ROAD	II	652575	305424	Medium
1246973	PROVIDENCE VILLA	II	652570	305433	Medium
1246974	KOOLUNGA HOUSE	II	652608	305230	Medium
1246975	THE SHORT BLUE PUBLIC HOUSE	II	652721	304845	Medium
1246977	235, HIGH STREET	II	652665	305022	Medium
1246978	MILEPOST IN FRONT OF NUMBER 245 (NUMBER 245 NOT INCLUDED)	II	652657	305084	Medium
1271269	CARLTON HOTEL (NUMBERS 1-5)	II	653022	306805	Medium
1271271	33, KING STREET (See details for further address information)	II	652626	307285	Medium
1271272	34, KING STREET	II	652629	307281	Medium
1271273	CREDENCE HOUSE INCLUDING AREA RAILINGS	II	652645	307242	Medium
1271274	KINGS WINE BAR INCLUDING STEP RAILINGS	II	652646	307232	Medium
1271275	NUMBER 43 INCLUDING 2 STABLE RANGES TO REAR	II	652649	307222	Medium
1271276	NUMBER 44 INCLUDING RAILINGS TO STEPS	II	652648	307213	Medium
1271277	WORKING MENS CLUB	II	652679	307171	Medium
1271549	BARKING SMACK PUBLIC HOUSE	II	653053	307058	Medium
1271551	WINDMILL CINEMA	II	653054	306988	Medium
1271606	MASONIC ROYAL ASSEMBLY ROOMS	II	653006	306732	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1271607	SHADINGFIELD LODGE	II	653034	306684	Medium
1271612	5, SOUTH QUAY	II	652352	307348	Medium
1271613	6, SOUTH QUAY	II	652353	307337	Medium
1271614	7 AND 8, SOUTH QUAY	II	652358	307333	Medium
1271615	10, SOUTH QUAY	II	652372	307307	Medium
1271616	11, SOUTH QUAY	II	652374	307304	Medium
1271617	12, SOUTH QUAY	II	652383	307310	Medium
1271618	13 AND 14, SOUTH QUAY	II	652385	307292	Medium
1271805	WELLINGTON MEWS ARCH	II	653016	306832	Medium
1271806	CHURCH OF ST JOHN	II	652985	307172	Medium
1393268	UTILITY BLOCK IMMEDIATELY EAST OF NO.244A	II	652313	306850	Medium
1393653	YORK ROAD CENTRE (FORMER DRILL HALL)	II	652707	307236	Medium
1393704	FORMER GAS SHOWROOM	II	652646	307253	Medium
1393958	FAR EAST PRISONER OF WAR, WAR MEMORIAL	II	653115	307053	Medium
1436976	The Scenic Railway Roller Coaster at Great Yarmouth Pleasure Beach	II	653137	306001	Medium

Table 9A.3 - Conservation Areas in 1km Study Area

Name
Camperdown
Gorleston Extension
King Street
Seafront
Hall Quay and South Quay
St George's

Table 9A.4 - Non-Designated Heritage Assets in 500m Study Area

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
12936	Find Spot	Neolithic	Neolithic scraper	652222	306174	Medium
60518	Monument	Medieval	Late medieval timber-framed building, Burnt Lane	652449	305276	Medium
60531	Monument	Medieval	Site of Augustinian Friary, Gorleston on Sea	652505	305300	Medium
21361	Find Spot	Medieval to Post Medieval	Medieval and post medieval pottery	652564	306641	Low
4266	Monument	Medieval to Post Medieval	The site of the medieval Dominican or Blackfriars Friary	652600	306775	Medium
56257	Monument	Medieval to Post Medieval	Site of South Gate	652523	306700	Medium
30081	Monument	Medieval to Post Medieval	Multi-period finds	652657	307094	Low
15149	Monument	Post Medieval	Post medieval maltings, Gorleston on Sea	652523	305570	Low

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
21345	Monument	Post Medieval	Site of post medieval signal station and coastguard station	652987	306581	Low
28940	Monument	Post Medieval	Post medieval icehouse	652383	306655	Low
4328	Monument	Post Medieval	South Star Battery	653035	305944	Low
40075	Building	Post Medieval	Fellows Dry Docks	652352	306732	Low
43472	Monument	Post Medieval	Site of drain, probably post medieval, at Harfreys Industrial Estate, Southtown	651643	306061	Low
43637	Monument	Post Medieval	Site of a post medieval ropewalk at Great Yarmouth College, Southtown	652168	306440	Low
55098	Monument	Post Medieval	Late medieval pottery sherd and alluvial deposits	652641	305294	Low
35783	Monument	Post Medieval	Early 19th century boundary post at Gorleston on Sea	652360	305270	Low
55685	Building	Post Medieval to Cold War	Fishwharf Salt Stores	652531	306093	Low
55412	Building	Post Medieval to Cold War	Great Yarmouth Electricity Works	652758	305845	Low
12030	Building	Post Medieval to Modern	Southtown Arsenal	652323	306827	Low
27643	Monument	Post Medieval to Modern	Possible World War One hardstanding	652948	305440	Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
27701	Monument	Post Medieval to Modern	Site of World War Two air raid shelter and gasometer	652635	306171	Negligible
50508	Building	Post Medieval to Modern	South Quay Service Station	652550	306356	Low
13576	Monument	Post Medieval to Modern	Routes of Great Yarmouth urban railways	652364	307247	Low
13581	Monument	Post Medieval to Modern	Route of Midland and Great Northern Joint Railway (Great Yarmouth to Sutton Bridge)	601604	319784	Low
43305	Monument	Modern	Site of possible World War Two pillbox south of Boundary Road, Southtown	652007	306009	Negligible
13575	Monument	Modern	Route of Norfolk and Suffolk Joint Railway (Great Yarmouth to Lowestoft)	652385	302847	Low
33943	Monument	Modern	Modern sea wall and tramway installations	653106	307705	Low
43304	Monument	Modern	Site of World War Two road blocks on Boundary Road and Suffolk Road, Southtown	652194	306151	Negligible
19084	Monument	World War Two	World War Two Light Anti Aircraft Battery at Gorleston on Sea	652071	305377	Negligible
32655	Monument	World War Two	Site of World War Two light anti aircraft tower and other defences on Fishermans Wharf, Gorleston on Sea	652649	305356	Negligible
27364	Monument	World War Two	World War Two pillbox	652475	306767	Low/Negligible
27373	Monument	World War Two	World War Two air raid shelter	652668	306658	Low/Negligible
27602	Monument	World War Two	World War Two air raid shelters	652671	306805	Low/Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
27375	Monument	World War Two	World War Two air raid shelter	652677	306461	Low/Negligible
27387	Monument	World War Two	Site of World War Two surface air raid shelters at St James' Church, Queen's Road	652700	306574	Low/Negligible
27374	Monument	World War Two	World War Two air raid shelter	652788	306515	Low/Negligible
27319	Monument	World War Two	World War Two air raid shelters	653023	305846	Low/Negligible
27541	Monument	World War Two	World War Two site	653058	305556	Negligible
27639	Monument	World War Two	Probable World War Two fuel store	652848	305469	Negligible
27363	Monument	World War Two	Site of World War Two barrage balloon	652882	305333	Negligible
27363	Monument	World War Two	Site of World War Two barrage balloon	652882	305333	Negligible
27638	Monument	World War Two	Site of World War Two defences and military installations	652918	305509	Negligible
27645	Monument	World War Two	Site of World War Two seafront defences	653162	305648	Negligible
27658	Monument	World War Two	Site of World War Two seafront defences	653160	306362	Negligible
27678	Monument	World War Two	Site of World War Two road block	653065	306276	Negligible
27677	Monument	World War Two	Site of World War Two road block	653062	306224	Negligible
27675	Monument	World War Two	Site of World War Two road block	653063	306116	Negligible
27672	Monument	World War Two	Site of World War Two road block	653064	306000	Negligible
27670	Monument	World War Two	Site of World War Two road block	653054	305894	Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
27679	Monument	World War Two	Site of World War Two air raid shelters	652957	306232	Low/Negligible
27676	Monument	World War Two	Sites of World War Two air raid shelters	653049	306160	Low/Negligible
27674	Monument	World War Two	Site of World War Two air raid shelter	653068	306060	Low/Negligible
27673	Monument	World War Two	Sites of World War Two air raid shelters	653017	306021	Low/Negligible
27671	Monument	World War Two	Sites of World War Two air raid shelters	653055	305944	Low/Negligible
27669	Monument	World War Two	Site of World War Two air raid shelter	653038	305868	Low/Negligible
27695	Monument	World War Two	Sites of World War Two air raid shelters	652955	306095	Low/Negligible
27694	Monument	World War Two	Sites of World War Two air raid shelters	652878	306090	Low/Negligible
27693	Monument	World War Two	Sites of World War Two air raid shelters	652812	306115	Low/Negligible
27697	Monument	World War Two	Site of World War Two defences	652572	305820	Negligible
27698	Monument	World War Two	Site of World War Two building	652809	305856	Negligible
27649	Monument	World War Two	Site of World War Two air raid shelters	652972	305956	Low/Negligible
27699	Monument	World War Two	Site of World War Two air raid shelter	652872	305948	Low/Negligible
27692	Monument	World War Two	Site of World War Two air raid shelters	652786	306207	Low/Negligible
27690	Monument	World War Two	Site of World War Two air raid shelters	652855	306254	Low/Negligible
27691	Monument	World War Two	Site of World War Two air raid shelters	652791	306251	Low/Negligible
27700	Monument	World War Two	Site of World War Two bomb craters	652590	306180	Negligible
27712	Monument	World War Two	Site of World War Two buildings	652545	306195	Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
42355	Monument	World War Two	Site of World War Two anti invasion defences at junction of Queen Anne's Road and Southtown Road, Southtown	652394	305888	Negligible
43303	Monument	World War Two	Site of World War Two spigot mortar emplacement north of Waveney Road, Southtown	652310	306104	Negligible
43306	Monument	World War Two	World War Two military site south of Great Yarmouth College, Southtown	652231	306334	Negligible
43307	Monument	World War Two	Possible site of World War Two military activity at 127 to 131 Gordon Road, Southtown	652154	306672	Negligible
43310	Monument	World War Two	Site of World War Two hut at Gainsborough Court	652941	306689	Negligible
43311	Monument	World War Two	Site of World War Two structure at Seafield Close	652963	306564	Negligible
43375	Monument	World War Two	Site of World War Two military activity on St Nicholas Recreation Ground, Frank Stone Court and South Beach Parade car park	652995	306411	Negligible
43309	Monument	World War Two	Site of probable World War Two civil defence building or shelter at Selby Place	652592	306550	Low/Negligible
43379	Monument	World War Two	Site of World War Two air raid shelters between Pier Place and Queen's Road	652804	306629	Low/Negligible
43378	Monument	World War Two	Site of World War Two air raid shelters off Camden Road	652744	306675	Low/Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
27570	Monument	World War Two	World War Two road block across Burgh Road, Gorleston-on-Sea	651940	305217	Negligible
43301	Monument	World War Two	World War Two structures at fire station and Ferryside County Council offices, Southtown	652520	305505	Negligible
43312	Monument	World War Two	Site of a World War Two emergency water supply tank at 42-44 Suffolk Road, Gorleston-on-Sea	652234	305440	Negligible
42353	Monument	World War Two	Site of World War Two anti invasion defences at Southtown	652290	305977	Negligible
43581	Monument	World War Two	Site of World War Two air raid shelters at 14, 16, 21, 27 and what was formerly 30 Burnt Lane, Gorleston-on-Sea	652478	305252	Low/Negligible
43584	Monument	World War Two	Site of World War Two air raid shelters at 56, 60 and 63 Burnt Lane, and land behind Number 54, Gorleston-on-Sea	652440	305288	Low/Negligible
43583	Monument	World War Two	Site of World War Two air raid shelters at 10 and 11 Manby Road, Gorleston-on-Sea	652453	305333	Low/Negligible
43585	Monument	World War Two	Site of World War Two air raid shelters at 79 and 80 Burnt Lane, Gorleston-on-Sea	652494	305376	Low/Negligible
43582	Monument	World War Two	Site of World War Two air raid shelter at Clem-Ellen Cottages, Gorleston-on-Sea	652503	305313	Low/Negligible
43599	Monument	World War Two	Site of World War Two air raid shelter at 135 Suffolk Road, Gorleston-on-Sea	652333	305262	Low/Negligible
43595	Monument	World War Two	Site of World War Two air raid shelter at 24 Manor Road, Gorleston-on-Sea	652284	305453	Low/Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
43594	Monument	World War Two	Site of World War Two air raid shelters at 46 Common Road; 3, 15, 23 and 25 Harfrey's Road; and 20, 24, 34, 48, 50, 64 and 66 Suffolk Road, Gorlesto	652197	305435	Low/Negligible
43596	Monument	World War Two	Site of World War Two air raid shelters at 3 and 5 Manor Road, Gorleston-on-Sea	652331	305508	Low/Negligible
43597	Monument	World War Two	Site of World War Two air raid shelters at 21 Common Road and 11 Suffolk Road, Gorleston-on-Sea	652272	305580	Low/Negligible
27663	Monument	World War Two	World War Two bomb crater northeast of Town Lands, Southtown	651960	305618	Negligible
27571	Monument	World War Two	Site of probable World War Two bomb crater at 34 Burgh Road, Gorleston-on-Sea	652188	305229	Negligible
43589	Monument	World War Two	Probable World War Two bomb crater at Gas Distribution Station, Southtown	652340	305765	Negligible
43471	Monument	World War Two	World War Two bomb crater at Harfreys Industrial Estate, Southtown	651991	305879	Negligible
27580	Monument	World War Two	Site of World War Two bomb craters at Harfreys Industrial Estate, Southtown	651907	305938	Negligible
27579	Monument	World War Two	Site of World War Two bomb craters at Harfreys Industrial Estate, Southtown	651747	305898	Negligible
42532	Monument	World War Two	Site of World War Two bomb crater at Harfreys Industrial Estate, Southtown	651759	306077	Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
27578	Monument	World War Two	Site of World War Two bomb craters at Harfreys Industrial Estate, Southtown	651706	306218	Negligible
43477	Monument	World War Two	Site of World War Two bomb craters at Yarmouth Business Park, Southtown	652143	306172	Negligible
43615	Monument	World War Two	Site of World War Two bomb crater off Boundary Road, Southtown	652311	306164	Negligible
43616	Monument	World War Two	Site of World War Two bomb crater or spigot mortar emplacement at Great Yarmouth College, Southtown	652125	306458	Negligible
43587	Monument	World War Two	Site of World War Two air raid shelter at Gas Distribution Station, Southtown	652377	305731	Low/Negligible
43598	Monument	World War Two	Site of World War Two air raid shelter at 6 Common Road, Southtown	652348	305647	Low/Negligible
43586	Monument	World War Two	Site of probable World War Two air raid shelter at junction of Common Road and Beccles Road, Southtown	652419	305610	Low/Negligible
43629	Monument	World War Two	Site of possible World War Two air raid shelter at 1 Common Road, Southtown	652397	305641	Low/Negligible
43300	Monument	World War Two	Site of World War Two air raid shelter at Suffolk Close, Gorleston-on-Sea	652184	305480	Low/Negligible
43590	Monument	World War Two	Site of World War Two air raid shelter at 16 to 18 Alpha Road, Southtown	652328	305709	Low/Negligible
43588	Monument	World War Two	Site of World War Two industrial air raid shelters off Queen Anne's Road, Southtown	652093	306015	Low/Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
43478	Monument	World War Two	Site of World War Two air raid shelters on Ordnance Road	652697	306366	Low/Negligible
43479	Monument	World War Two	Site of World War Two air raid shelters on Exmouth Road	652623	306427	Low/Negligible
43377	Monument	World War Two	Site of World War Two surface-level air raid shelters behind houses on Mariners' Road	652579	306710	Low/Negligible
43480	Monument	World War Two	Site of World War Two air raid shelter at Great Yarmouth College and Edward Worlledge Middle School, Southtown	652084	306598	Low/Negligible
43621	Monument	World War Two	Site of possible World War Two air raid shelter at 132a Gordon Road, Southtown	652190	306686	Low/Negligible
19949	Monument	World War Two	World War Two pillbox at Gorleston on Sea	652010	305420	Low/Negligible
32661	Monument	World War Two	World War Two pillbox at Yarmouth Business Park, Southtown	652068	306324	Low/Negligible
43622	Monument	World War Two	Site of possible World War Two air raid shelter at 4 Tollgate Road, Southtown	652284	306363	Low/Negligible
27644	Monument	World War Two to Modern	Possible World War Two ambulance station	653027	305761	Negligible

9A.3 PROPOSED LOCATION OF ROAD TRAFFIC SIGNS

A47 SOUTH

Table 9A.5 – A47 South: Non-Designated Heritage Assets in 250m Study Area

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
19084	Monument	World War Two	World War Two Light Anti Aircraft Battery at Gorleston on Sea	652071	305377	Negligible
27570	Monument	World War Two	World War Two road block across Burgh Road, Gorleston-on-Sea	651940	305217	Negligible
43312	Monument	World War Two	Site of a World War Two emergency water supply tank at 42-44 Suffolk Road, Gorleston-on-Sea	652234	305440	Negligible
43595	Monument	World War Two	Site of World War Two air raid shelter at 24 Manor Road, Gorleston-on-Sea	652284	305453	Low/Negligible
43594	Monument	World War Two	Site of World War Two air raid shelters at 46 Common Road; 3, 15, 23 and 25 Harfrey's Road; and 20, 24, 34, 48, 50, 64 and 66 Suffolk Road, Gorleston	652197	305435	Low/Negligible
43597	Monument	World War Two	Site of World War Two air raid shelters at 21 Common Road and 11 Suffolk Road, Gorleston-on-Sea	652272	305580	Low/Negligible
27663	Monument	World War Two	World War Two bomb crater northeast of Town Lands, Southtown	651960	305618	Negligible
27571	Monument	World War Two	Site of probable World War Two bomb crater at 34 Burgh Road, Gorleston-on-Sea	652188	305229	Negligible
43618	Monument	World War Two	Site of World War Two air raid shelter at 91 Burgh Road, Gorleston on Sea	651897	305175	Low/Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
43300	Monument	World War Two	Site of World War Two air raid shelter at Suffolk Close, Gorleston-on-Sea	652184	305480	Low/Negligible
13575	Monument	Modern	Route of Norfolk and Suffolk Joint Railway (Great Yarmouth to Lowestoft)	652385	302847	Low
19949	Monument	World War Two	World War Two pillbox at Gorleston on Sea	652010	305420	Low/Negligible

GAPTON HALL ROAD

Table 9A.6 – Gapton Hall Road: Non-Designated Heritage Assets in 250m Study Area

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
32662	Monument	World War Two	World War Two Type 24 pillbox at New Cutt Farm, Great Yarmouth	651343	306647	Low/Negligible
34996	Monument	Post Medieval to Modern	Site of 19th century drainage mill	651400	306200	Low
13574	Monument	Post Medieval to Modern	Route of East Suffolk Railway (Yarmouth to Beccles)	647969	300071	Low
13575	Monument	Modern	Route of Norfolk and Suffolk Joint Railway (Great Yarmouth to Lowestoft)	652385	302847	Low
13581	Monument	Post Medieval to Modern	Route of Midland and Great Northern Joint Railway (Great Yarmouth to Sutton Bridge)	601604	319784	Low
42519	Monument	World War Two	Site of World War Two railway block at Southtown	651657	306692	Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
42521	Monument	World War Two	World War Two light anti aircraft battery south of New Cutt Farm, Great Yarmouth	651306	306521	Negligible
42531	Monument	World War Two	Site of possible World War Two structure west of the A47, Great Yarmouth	651504	306503	Negligible
43474	Monument	Medieval to Post Medieval	Probably post medieval drains on Gapton Marshes	650992	306114	Low
43475	Monument	Post Medieval	Drains, probably post medieval, on Gapton Marshes	651047	306486	Low
43472	Monument	Post Medieval	Site of drain, probably post medieval, at Harfreys Industrial Estate, Southtown	651643	306061	Low
27578	Monument	World War Two	Site of World War Two bomb craters at Harfreys Industrial Estate, Southtown	651706	306218	Negligible
43470	Monument	World War Two	Site of World War Two bomb crater or spigot mortar emplacement at Great Yarmouth College, Southtown	651469	306677	Negligible

Table 9A.7 – North Quay: Scheduled Monument in 250m Study Area

NHLE Number	Name	Easting	Northing	Value
1003782	Town walls	652572	307583	High

Table 9A.8 – North Quay: Listed Buildings in the 250m Study Area

NHLE Number	Name	Grade	Easting	Northing	Value
1096808	HARDYS	II	652332	307881.4	Medium
1096809	VICARAGE	II*	652439	307977.4	High
1096810	25, CHURCH PLAIN	II	652435	307959.4	Medium
1096811	SEWELL HOUSE	II	652437	307954.4	Medium
1096812	27, CHURCH PLAIN	II	652427	307953.4	Medium
1096813	CHURCH OF ST NICHOLAS	II*	652435	308036.4	High
1096814	CHURCHYARD GATES PIERS AND RAILINGS TO CHURCH OF ST NICHOLAS, CHURCHYARD RAILINGS TO CHURCH OF ST NICHOLAS	II	652354	308066.4	Medium
1096817	MEMORIAL TO DAVID BARTLEMAN WEST OF CHURCH OF ST NICHOLAS	II	652377	308026.4	Medium
1096818	MEMORIAL TO GEORGE BELOE SOUTH OF CHURCH OF ST NICHOLAS	II	652441	308002.4	Medium
1096819	PALMER TOMB 18 METRES WEST OF CHURCH OF ST NICHOLAS	II	652385	308047.4	Medium
1245562	VAUXHALL BRIDGE	II	652068	308021.4	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1245975	225, 226 AND 226A, NORTHGATE STREET	II	652386	308142.4	Medium
1245978	ST NICHOLAS (PRIORY) MIDDLE SCHOOL	I	652460.3	307985.3	High
1246006	3, 4 AND 5, NORTHGATE STREET	II	652323	308026.4	Medium
1246007	6, NORTHGATE STREET	II	652322	308037.4	Medium
1246008	7, NORTHGATE STREET	II	652312	308036.4	Medium
1246009	WHITE HORSE INN	II	652304	308072.4	Medium
1246010	14 AND 15, NORTHGATE STREET	II	652312	308084.4	Medium
1246011	POST OFFICE (NUMBER 17)	II	652323	308094.4	Medium
1246012	18 AND 19, NORTHGATE STREET	II	652332	308105.4	Medium
1246013	20 AND 20A, NORTHGATE STREET	II	652338	308112.4	Medium
1246014	220, 221 AND 222, NORTHGATE STREET	II	652403	308181.4	Medium
1246015	224, NORTHGATE STREET	II	652387	308154.4	Medium
1271265	2, HOWARD STREET SOUTH	II	652392	308175.4	Medium

Table 9A.9 – Fullers Way: Scheduled Monument in 250m Study Area

NHLE Number	Name	Easting	Northing	Value
1003782	Town walls	652572	307583	High

Table 9A.10 – Fullers Way: Listed Buildings in the 250m Study Area

NHLE Number	Name	Grade	Easting	Northing	Value
1096808	HARDYS	II	652332	307881.4	Medium
1096809	VICARAGE	II*	652439	307977.4	High
1096810	25, CHURCH PLAIN	II	652435	307959.4	Medium
1096811	SEWELL HOUSE	II	652437	307954.4	Medium
1096812	27, CHURCH PLAIN	II	652427	307953.4	Medium
1096813	CHURCH OF ST NICHOLAS	II*	652435	308036.4	High
1096814	CHURCHYARD GATES PIERS AND RAILINGS TO CHURCH OF ST NICHOLAS, CHURCHYARD RAILINGS TO CHURCH OF ST NICHOLAS	II	652354	308066.4	Medium
1096816	HEADSTONE 15 METRES NORTH-EAST OF CHURCH OF ST NICHOLAS	II	652496	308035.4	Medium
1096817	MEMORIAL TO DAVID BARTLEMAN WEST OF CHURCH OF ST NICHOLAS	II	652377	308026.4	Medium
1096818	MEMORIAL TO GEORGE BELOE SOUTH OF CHURCH OF ST NICHOLAS	II	652441	308002.4	Medium
1096819	PALMER TOMB 18 METRES WEST OF CHURCH OF ST NICHOLAS	II	652385	308047.4	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1096820	FISHERMENS HOSPITAL INCLUDING GATE PIERS AND RAILINGS	I	652449	307890.4	High
1096821	STATUE OF CHARITY IN COURTYARD OF FISHERMANS HOSPITAL	II	652440	307887.4	Medium
1245562	VAUXHALL BRIDGE	II	652068	308021.4	Medium
1245975	225, 226 AND 226A, NORTHGATE STREET	II	652386	308142.4	Medium
1245978	ST NICHOLAS (PRIORY) MIDDLE SCHOOL	I	652460.3	307985.3	High
1246006	3, 4 AND 5, NORTHGATE STREET	II	652323	308026.4	Medium
1246007	6, NORTHGATE STREET	II	652322	308037.4	Medium
1246008	7, NORTHGATE STREET	II	652312	308036.4	Medium
1246009	WHITE HORSE INN	II	652304	308072.4	Medium
1246010	14 AND 15, NORTHGATE STREET	II	652312	308084.4	Medium
1246011	POST OFFICE (NUMBER 17)	II	652323	308094.4	Medium
1246012	18 AND 19, NORTHGATE STREET	II	652332	308105.4	Medium
1246013	20 AND 20A, NORTHGATE STREET	II	652338	308112.4	Medium
1246014	220, 221 AND 222, NORTHGATE STREET	II	652403	308181.4	Medium
1246015	224, NORTHGATE STREET	II	652387	308154.4	Medium
1246047	68, MARKET PLACE	II	652456	307844.4	Medium
1246048	69, MARKET PLACE	II	652447	307848.4	Medium
1271265	2, HOWARD STREET SOUTH	II	652392	308175.4	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1271552	TWO NECKED SWAN PUBLIC HOUSE	II	652370	307847.4	Medium
1271553	7 AND 8, MARKET PLACE	II	652375	307837.4	Medium
1271554	13 AND 14, MARKET PLACE	II	652361	307805.4	Medium
1271555	MARKET TAVERN PUBLIC HOUSE	II	652372.6	307778.1	Medium
1271556	20, MARKET PLACE	II	652385	307757.4	Medium
1271557	21, MARKET PLACE	II	652385.8	307750.9	Medium
1271558	22 and 22A, MARKET PLACE	II	652381.7	307741.2	Medium

YARMOUTH WAY

Table 9A.11 – Yarmouth Way: Scheduled Monument in 250m Study Area

NHLE Number	Name	Easting	Northing	Value
1003782	Town walls	652572	307583	High
1003935	Medieval vaults under 50-56 Howard Street	652405	307435	High
1003958	Nos 6, 7 and 8, Row 111, South Quay	652459	307195	High
1004020	Merchant's House, Row 117, South Quay	652462	307141	High
1017910	Greyfriars Franciscan friary	652398	307343	High

Table 9A.12 – Yarmouth Way: Listed Buildings in the 250m Study Area

NHLE Number	Name	Grade	Easting	Northing	Value
1096826	WOOD HALL HOTEL	II	652714	307151	Medium
1096833	3, GREYFRIARS WAY	II	652383	307427	Medium
1096834	SHIP INN	II	652410	307389	Medium
1096835	GREYFRIARS HOUSE	II	652394	307414	Medium
1096836	29, HALL PLAIN	II	652351	307453	Medium
1245556	9 AND 11, TOLHOUSE STREET	II	652505	307238	Medium
1245557	13, TOLHOUSE STREET	II	652509	307233	Medium
1245558	15, TOLHOUSE STREET	II	652511	307229	Medium
1245559	17 AND 19, TOLHOUSE STREET	II	652514	307221	Medium
1245560	THE TOLHOUSE	I	652496	307253	High
1245798	16, SOUTH QUAY	II	652396	307273	Medium
1245799	17, SOUTH QUAY	II	652394	307261	Medium
1245800	CUSTOM HOUSE	II*	652406	307237	High
1245801	PORT AND HAVEN COMMISSIONERS OFFICES	II	652411	307225	Medium
1245802	23 AND 24, SOUTH QUAY	II	652434	307215	Medium
1245803	25, SOUTH QUAY	II*	652438	307190	High
1245804	26 AND 27, SOUTH QUAY	II	652434	307180	Medium
1245913	FASTOLFF HOUSE	II	652391	307502	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1245914	NUMBER 2 AND ATTACHED WAREHOUSE	II	652361	307463	Medium
1245915	REMAINS OF THE CHURCH OF THE GREYFRIARS	I	652403	307330	High
1245916	6, 7 AND 8, ROW 111	II	652458	307193	Medium
1245917	OLD MERCHANTS HOUSE	II*	652462	307142	High
1245918	1, 2 AND 3, ST GEORGES PLAIN	II	652638	307289	Medium
1245919	ST GEORGES THEATRE	I	652612	307348	High
1245920	PARK HOUSE (NUMBER 82)	II	652730	307331	Medium
1245921	RED FLEET HOUSE	II	652705	307342	Medium
1245980	9, QUEEN STREET	II	652370	307340	Medium
1246572	154, KING STREET	II	652540	307393	Medium
1246573	155, KING STREET	II	652530	307395	Medium
1246575	157 AND 157A, KING STREET	II	652528	307408	Medium
1246576	158, KING STREET	II	652529	307419	Medium
1246577	160, KING STREET	II	652517	307424	Medium
1246578	161, KING STREET	II	652516	307431	Medium
1246579	PEGGOTTYS PUBLIC HOUSE	II	652502	307432	Medium
1246580	CANNON BOLLARD, CANNON BOLLARD AT JUNCTION WITH ROW 116	II	652633	307212	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1246587	123 AND 123A, KING STREET	II	652635	307157	Medium
1246588	126 AND 127, KING STREET	II	652626	307184	Medium
1246589	131, KING STREET	II	652619	307205	Medium
1246590	132, KING STREET	II	652615	307214	Medium
1246591	133, KING STREET	II	652614	307223	Medium
1246592	134 AND 134A, KING STREET	II	652613	307235	Medium
1246593	135, KING STREET	II	652613	307242	Medium
1246594	136, KING STREET	II	652603	307253	Medium
1246595	137 AND 138, KING STREET	II	652596	307259	Medium
1246596	139, KING STREET	II	652596	307265	Medium
1246597	LIBERTIES PUBLIC HOUSE	II	652593	307277	Medium
1246598	NUMBER 141 INCLUDING AREA RAILINGS	II	652598	307292	Medium
1246599	142, KING STREET	II	652591	307297	Medium
1246600	143, KING STREET	II	652593	307305	Medium
1246601	144, KING STREET	II	652582	307305	Medium
1246602	NUMBER 145 INCLUDING BASEMENT AREA RAILINGS IN FRONT	II	652579	307317	Medium
1246603	NUMBER 148 INCLUDING RAILINGS TO DOORWAY	II	652570	307348	Medium
1246969	TOWN HALL	II*	652313	307426	High

NHLE Number	Name	Grade	Easting	Northing	Value
1271266	3, HOWARD STREET SOUTH	II	652376	307451	Medium
1271270	24 AND 24A, KING STREET	II	652534	307469	Medium
1271271	33, KING STREET (See details for further address information)	II	652626	307285	Medium
1271272	34, KING STREET	II	652629	307281	Medium
1271273	CREDENCE HOUSE INCLUDING AREA RAILINGS	II	652645	307242	Medium
1271274	KINGS WINE BAR INCLUDING STEP RAILINGS	II	652646	307232	Medium
1271275	NUMBER 43 INCLUDING 2 STABLE RANGES TO REAR	II	652649	307222	Medium
1271276	NUMBER 44 INCLUDING RAILINGS TO STEPS	II	652648	307213	Medium
1271277	WORKING MENS CLUB	II	652679	307171	Medium
1271278	OLD WHITE LION PUBLIC HOUSE	II*	652635	307081	High
1271609	1, 2 AND 2BQ, SOUTH QUAY	II	652331	307379	Medium
1271610	3, SOUTH QUAY	II	652336	307364	Medium
1271611	4, SOUTH QUAY	I	652352	307360	High
1271612	5, SOUTH QUAY	II	652352	307348	Medium
1271613	6, SOUTH QUAY	II	652353	307337	Medium
1271614	7 AND 8, SOUTH QUAY	II	652358	307333	Medium
1271615	10, SOUTH QUAY	II	652372	307307	Medium
1271616	11, SOUTH QUAY	II	652374	307304	Medium

NHLE Number	Name	Grade	Easting	Northing	Value
1271617	12, SOUTH QUAY	II	652383	307310	Medium
1271618	13 AND 14, SOUTH QUAY	II	652385	307292	Medium
1393653	YORK ROAD CENTRE (FORMER DRILL HALL)	II	652707	307236	Medium
1393704	FORMER GAS SHOWROOM	II	652646	307253	Medium
1393956	WORLD WAR II MEMORIAL	II	652656	307436	Medium
1393957	WORLD WAR I MEMORIAL INCLUDING GATE AND GATE PIERS	II	652679	307440	Medium

Table 9A.13 – Yarmouth Way: Non-Designated Heritage Assets in 250m Study Area

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
13375	Monument	Medieval to Post Medieval	Site of Great Yarmouth Castle	652555	307366	High
33475	Monument	Post Medieval to Modern	Grammar School Grounds	652849	307369	Low
36212	Monument	Medieval to Post Medieval	'Row 117', rear of Old Gallon Can Public House, South Quay	652465	307158	Low/Moderate
4299	Monument	Medieval to Post Medieval	Site of Town House and Old Staple Wool House, South Quay	652414	307216	Low/Moderate
4320	Find Spot	Medieval	Medieval mortar and medieval wall	652542	307249	Low
27361	Monument	World War Two	World War Two pillbox	652370	307233	Low/Negligible
27367	Monument	World War Two	World War Two air raid shelters	652481	307334	Low/Negligible

HER Ref	Heritage Asset Type	Period	Name	Easting	Northing	Value
27366	Monument	World War Two	World War two structure	652427	307319	Negligible
27368	Monument	World War Two	World War Two air raid shelter	652615	307054	Low/Negligible
27372	Monument	World War Two	Probable World War Two air raid shelter	652542	307089	Low/Negligible
27531	Monument	World War Two	World War Two air raid shelter	652439	307258	Low/Negligible
27532	Monument	World War Two	World War Two air raid shelters	652549	307214	Low/Negligible
27432	Monument	World War Two	World War Two structure	652770	307312	Low/Negligible
27589	Monument	World War Two	Site of World War Two air raid shelter	652742	307253	Low/Negligible
50289	Monument	Post Medieval	Site of 48a and 48b Deneside, Great Yarmouth	652658	307238	Low
55101	Monument	Post Medieval	Imported 16th and 17th century material and residual medieval artefacts	652683	307110	Low
13576	Monument	Post Medieval to Modern	Routes of Great Yarmouth urban railways	652364	307247	Low
22722	Monument	Medieval to Post Medieval	17th century foundations and medieval pottery from Row 113	652619	307253	Low
30081	Monument	Medieval to Post Medieval	Multi-period finds	652657	307094	Low

Appendix 9B

CULTURAL HERITAGE DESK-BASED ASSESSMENT

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

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Project no: 62240375-017
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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

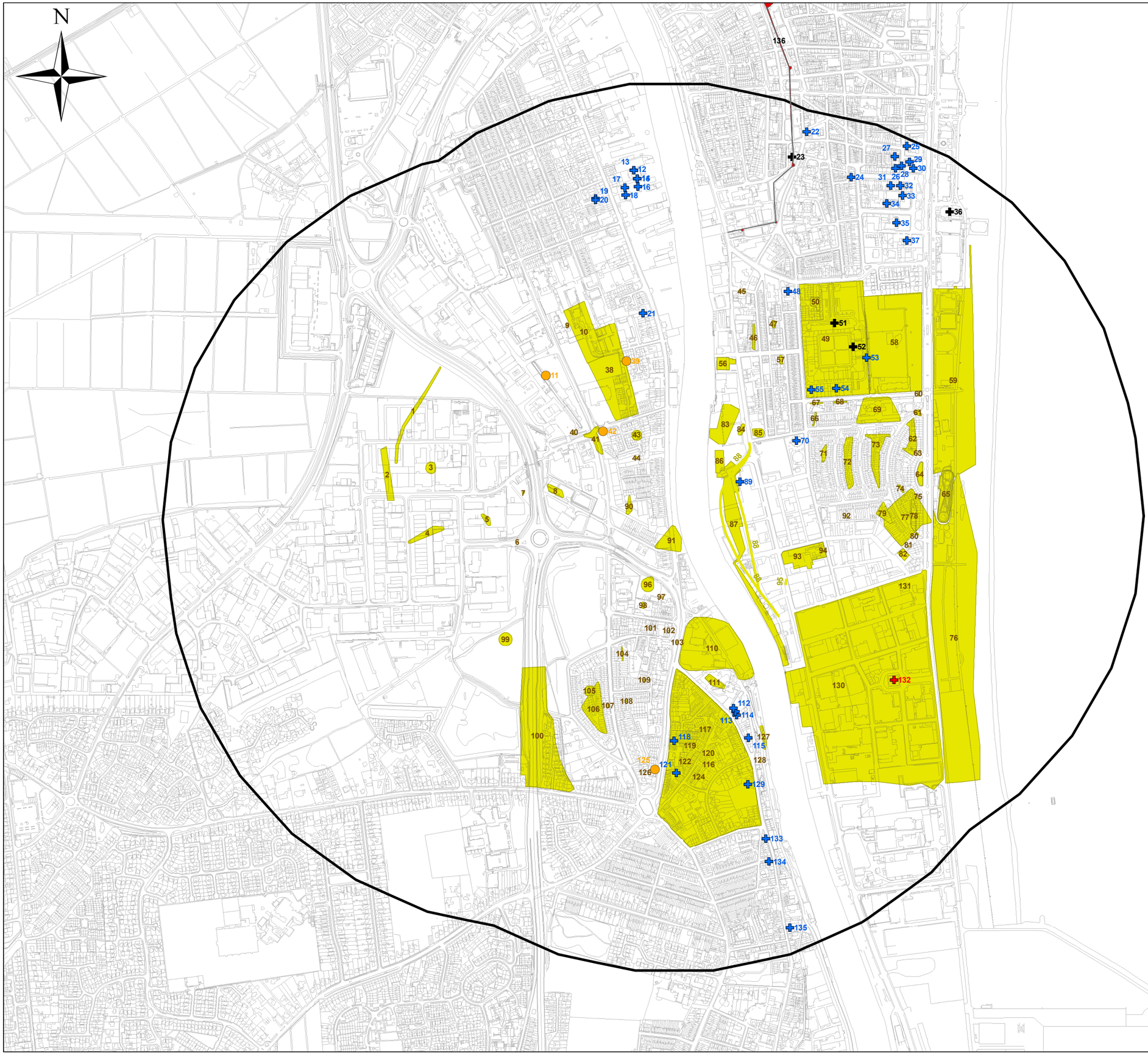
Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
117	MNF49505 (NHER)	TG 5249 0537	Air Raid Shelter	Two probable WWII air raid shelters are visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that any part of the shelters now survives 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 9C

GEOARCHAEOLOGICAL
FEASIBILITY STUDY

Third River Crossing, Great Yarmouth

Geoarchaeological Feasibility Study

1 INTRODUCTION

1.1.1 Wessex Archaeology have been commissioned by WSP to undertake a geoarchaeological feasibility study in support of the Environmental Impact Assessment for the proposed Third River Crossing, Great Yarmouth. The proposed scheme consists of a new bridge across the River Yare, with associated road improvements connecting the A12 and South Denes Road.

2 AIMS AND OBJECTIVES

2.1.1 The aims and objectives of the feasibility study are to;

- Define the geoarchaeological resource;
- Identify superficial geological deposits of geoarchaeological potential;
- Assess the potential impact of the proposed development, and;
- Recommend a strategy for further works to mitigate the impact of the proposed development on deposits with archaeological potential.

3 GEOARCHAEOLOGICAL BACKGROUND

3.1.1 The solid and superficial geology of Great Yarmouth has been mapped by the British Geological Survey (BGS) (BGS Geology of Britain viewer; Arthurton et al 1994) and is presented below in outline. Where age estimates are available these are either in millions of years ago (MA), thousands of years ago (Ka), and years before present (BP) within the Holocene epoch. These dates are supplemented, where known, with the relevant Marine Isotope Stage (MIS)

3.1 Solid Geology

3.1.2 The bedrock geology comprises dark green to weathered brown marine sands and gravels of the Crag Group, laid down between approximately 0.5 to 5 MA during the late Pliocene and early Pleistocene epochs.

3.2 Superficial geology

3.2.3 The superficial geology in the area of Great Yarmouth mostly covers the last 480,000 years of geological time, extending across the Middle (781-126ka), Late Pleistocene (126-11.7ka) and Holocene (11.7ka–present) epochs. Together these epochs form part of the Quaternary, a period covering the last 2.588MA and defined by repeated fluctuations between cold (glacial) and warm (interglacial) climate stages.

3.2.4 Large deposits of glacial till are mapped by the BGS both to the north and south of Great Yarmouth, comprising sandy till deposits of the Happisburgh Glacigenic Formation and patches of chalky sandy till of the Lowestoft Formations, both deposited during the Anglian Glaciation (MIS 12, 423–480 ka).

3.2.5 Across much of Great Yarmouth the deposits are mapped by the BGS as Breydon Formation, comprising Holocene alluvium and peat infilling the Yare Valley and tributaries. However, boreholes from the vicinity of the proposed development record sands and

gravels, most probably representing deposits of the Yare Valley Formation which underlie the Breydon Formation. The Yare Valley Formation extends as far as the River Ant to the North and the Waveney Valley to the south and predominantly overlies the pre-Anglian Crag deposits, and despite no definite age, is thought to date to the late Anglian (MIS 12) to Devensian (MIS 5-2) (Tizzard et al 2015).

3.2.6 The Yare Valley Formation is overlain by Holocene sediments of the Breydon Formation and North Denes Formation (Arthurton et al 1994). The Breydon Formation comprises a variable lateral and vertical sequence of estuarine clays and silts with subordinate sands, interbedded with peat. The Breydon Formation represent deposits forming under the influence of rising sea-levels. Alluvium represent mudflats and saltmarsh deposited during periods of sea-level rise with peats forming during periods of stable and/or falling sea levels when semi-terrestrial plant communities (e.g. tall herb swamp, fen woodland) encroached into the wetland.

3.2.7 The North Denes Formation, mapped by the BGS within Great Yarmouth to the east of the River Yare, comprises beach sands and gravels, flanked to the east towards the present coastline by blown sand and marine beach deposits. The blown sands probably correspond to a coastal barrier than is reported to have existed at Great Yarmouth in the first few centuries AD, extending as far south to Lowestoft (Arthurton et al 1994).

3.3 Geomorphology

3.3.3 The early Holocene geomorphology of the Great Yarmouth area has recently been modelled by Jordan et al (2016) based on 467 borehole records held by the BGS. The base of the early Holocene deposits in the area ranged between -30.46 to +7.61mOD, but within the site boundary this varies between topographic lows of -12mOD (northern limits of the site on the line of the A1243) and -6 to -8mOD (western limits of the site at the A12 and William Adams Way) to highs of -2m to 0mOD within the central sections of the site within the footprint of the proposed bridge crossing.

4 KEY GEOLOGICAL DEPOSITS

4.1 Introduction

4.1.1 Not all the geological deposits mapped by the BGS in the area of Great Yarmouth are likely to be encountered within the site boundary. Based on an examination of borehole records held by the BGS within the scheme model, and modelling of the early Holocene geomorphology (Jordan et al 2016), a series of key deposits are identified and outline below, with specific reference made to their geoarchaeological potential. Geoarchaeological potential is characterised on a scale of high, medium and low potential, summarised in **Table 1.** The depth of deposits is referred to either as metres below ground surface (mbgs) or metres ordnance datum (mOD).

4.2 Sands and gravels (North Denes Formation)

4.2.1 Sands and gravels of the North Denes Formation represent marine beach deposits, mapped by the BGS to the east of the River Yare and overlying Holocene estuarine clays, silts and peats of the Breydon Formation (Arthurton et al 1994). Shelly sands are recorded in boreholes to the east of the River Yare below made ground to a depth of approximately -6mOD. It is unclear from some descriptions in borehole records whether these sands are gravels also represent Pleistocene deposits of the Yare Valley Formation. Although the North Denes Formation is of low geoarchaeological potential, the deposits do have the potential to bury and preserve archaeology, although this may be largely eroded and reworked given the marine nature of the deposits.

4.3 Fine-grained alluvium (Breydon Formation)

4.3.1 Alluvium is a generalised term covering unconsolidated sediments transported by water in a non-marine environment (e.g. rivers and lakes). It has been used as a banner term including other sediment such as peat, which has different formation processes, but that often occur as distinct bands or discrete features within the alluvium. Both alluvium and peat are classified as part of the Breydon Formation, but are here considered separately because of their differing geoarchaeological potential. Pleistocene and Holocene sands and gravels are technically alluvium, but the term here is applied to fine-grained deposits of Holocene date.

4.3.2 Fine-grained is recorded in boreholes across the Site, represented by deposits of silt and clay, often with a subordinate sand component. Along the eastern banks of the River Yare deposits of clayey-silty sand are recorded below made ground to depths between -0.57 to -6.18mOD. The variable depth may reflect the presence of a deeper channel and topographic lows suggested by deposit modelling to the south of the Site (Jordan et al 2016, fig. 1). Deposits of alluvium to the east of the River Yare may also form part of the North Denes Formation.

4.3.3 Boreholes along both the eastern and western bank of the River Yare record deposits of alluvial clays, silts and sands interbedded with layers of black organic silty clay (BGS boreholes TG50BW809-893). Here the alluvium is variously sealed by made ground of between 0.75 to 3.6m thick, with the underlying alluvium outcropping between approximately 1-4mbgs, underlain by clayey-silty sands and sands and gravels. Where OD heights are available the surface of the alluvium at this location occurs at -1.27mOD (borehole TG50NW587).

4.3.4 Silty clay alluvial deposits are also recorded within boreholes along the western section of the Site, typically preserved beneath made ground at depths from 0.5mbgs and with a maximum recorded thickness of alluvium of approximately 2.5m.

4.3.5 Minerogenic alluvial deposits are not ideal for either palaeoenvironmental analysis or radiocarbon dating and are of low geoarchaeological potential. Organic material is both sparse and likely to have been transported by water over variable distances, included material eroded and redeposited from contexts of variable date. Palaeoenvironmental remains such as pollen are often poorly preserved and present in lower concentrations, often derived from large ill-defined source areas within the river catchment or tidally deposited, and with a reservoir component including pollen of varying age.

4.3.6 Deposits of organic silty clays recorded in several boreholes along the west and eastern banks of the River Yare suggest lower energy deposits, perhaps formed within a backswamp or marginal aquatic environment. Palaeoenvironment remains in these deposits may be better preserved and derive from a more localised source area; where present such deposits are of medium geoarchaeological potential

4.4 Peat (Breydon Formation)

4.4.1 Peat comprises partially decomposed organic matter preserved within waterlogged anaerobic (oxygen-free) conditions. In the context of the Breydon Formation, peat deposits would have developed under the background influence of sea-level rise, forming during periods of stable or falling sea-levels during which semi-terrestrial plant communities encroached into areas of former tidal mudflats and saltmarsh. Peat deposits in coastal contexts are typically a mid-Holocene phenomenon, representing a period of fluctuating sea-level tendencies.

4.4.2 Within the site boundary, peat deposits are widely identified in boreholes approximately 100 m to the west of the River Yare in the area of William Adams Way, Queen Anne's Road and the Suffolk Road. The surface of the peat is recorded (where OD heights are available) at depths of between -1.49mOD (BGS borehole TG50NW429) to -2.35mOD (BGS borehole TG50NW29), ranging from 0.6 to 1.1m thick and located between 2.5 to 4mbgs.

4.4.3 Where peat deposits are present they will be of high geoarchaeological potential. Peat deposits are ideal contexts for the preservation of plant micro and macrofossils and invertebrate remains that provide key data on past vegetation environments, climate, land-use and the impact of human communities on the landscape.

4.5 Pleistocene sands and gravels (Yare Valley Formation)

4.5.1 Sands and gravels are recorded in several boreholes within the Site boundary, varying in surface elevation (where OD heights are available) from between -2.6mOD (borehole TG50NW582) to -6.45mOD (borehole TG50NW29), and reaching depths of up to 15mbgs. Pleistocene sands and gravels of the Yare Formation are not present on BGS maps for Great Yarmouth (BGS Geology of Britain Viewer), but are present underlying the Holocene alluvium and peat of the Breydon Formation, and may correspond to River Terrace deposits of Anglian (MIS 12) to Devensian (MIS 5-2) date.

4.5.2 River terrace deposits are preserved as evidence of former floodplains, representing phases of aggradation and incision, typically comprising coarse grained fluvial sands and gravels. The sands and gravels grade into the underlying Crag deposits, the latter typically described as dense orange-brown silty fine to coarse sands and gravels.

4.5.3 Pleistocene sands and gravels have the potential for recovery of Palaeolithic artefacts and faunal remains, although likely to be largely eroded and redeposited, with potential for preservation of *in-situ* organic horizons of geoarchaeological significance.

4.6 Tills (Happisburgh Glacigenic Formation and Lowestoft Formation

4.6.1 Tills are poorly sorted sediments deposited directly by ice sheets and are mapped extensively to the immediate south of the Site, largely comprising Happisburgh Glacigenic Formation with small patches of the Lowestoft Formation. Both Formations were deposited during the Anglian glaciation (MIS 12, 423-480 ka). The Happisburgh Glacigenic Formation comprises a sandy till whilst the Lowestoft Formation is characterised as a chalky sandy till.

4.6.2 Description of sediments in BGS boreholes from within the Site boundary indicate where sandy deposits are present they typically contain a shelly and gravelly component, and are therefore likely to be marine in origin, rather than till. Till deposits are therefore considered unlikely to be present within the Site boundary, but where present are of a low geoarchaeological potential.

Table 1: Summary of the geoarchaeological potential of the key deposits types likely to be encountered within the Site boundary

Deposit type	Geoarchaeological potential
Sands and Gravels (*North Denes Formation*)	Low
Fine-grained minerogenic alluvium (*Breydon Formation*)	Low
Organic-rich fine-grained alluvium (*Breydon Formation*)	Medium
Peat (*Breydon Formation*)	High

Deposit type	Geoarchaeological potential
Sands and Gravels (*Yare Valley Formation*)	High (if thin organic layers and/or Palaeolithic artefacts present)
Tills (*Happisburgh Glacigenic* and *Lowestoft Formation*)	Low

5 IMPACT OF DEVELOPMENT

5.1 Bridge construction

5.1.1 Deposits of geoarchaeological interest are expected to be encountered within the maximum depth of pile foundations associated within both the bascule and swing bridge options. The western and eastern piled piers of the bascule bridge option reach a maximum depth of approximately -10 to -11mOD, and approximately -12 to -13mOD for pier piles of the swing bridge option. At these depths the foundations will fully penetrate the Holocene and late Pleistocene deposits into the underlying Crag Group bedrock.

5.1.2 Smaller foundation depths associated with elements of both designs will also penetrate to a depth of -3mOD, likely penetrating the Holocene deposits and surface of the late Pleistocene deposits. Deposit modelling suggests that the Holocene deposits are thinnest within the footprint of the proposed bridge, with the base of the Holocene sequence occurring at between -2m to 0mOD (Jordan et al 2016). Boreholes suggest deposits in this area is likely to be minerogenic alluvium, with possible subordinate layers of organic alluvium, overlying late Pleistocene sands and gravels.

5.2 Road network

5.2.1 Construction of new transport links to the west and east of the Third Bridge crossing has the potential to impact deposits of geoarchaeological interest if they are preserved at shallow depth. Deposits to the east of the River Yare will most likely comprise sands and gravels of the North Denes Formation of low geoarchaeological potential. However, to the west of the River Yare there is the potential to reveal peat deposits of high geoarchaeological potential, outcropping as part of the Breydon Formation between 2.5 to 4mbgs.

5.3 Mitigation

5.3.1 Strategies for mitigating impact to sensitive geoarchaeological deposits will take a structured approach, involving the following stages;

- Geoarchaeological review and assessment of ground investigation (GI) logs;
- GI logs will be assigned a high, medium or low priority status based on the geoarchaeological potential of the contained deposits;
- Specify boreholes to be retained for further geoarchaeological monitoring, recording and sampling;
- Geoarchaeologist attendance at geotechnical laboratory to monitor, record and sample deposits of geoarchaeological potential within retained boreholes;
- Samples from deposits of high geoarchaeological potential will be retained and recommended for subsequent programmes of geoarchaeological assessment and analysis.

5.3.2 Intact sleeved boreholes are preferred to maintain the stratigraphic integrity of deposits, reducing disturbance and contamination and maximising the geoarchaeological potential of the contained deposits.

6 REFERENCES

Arthurton, R S, Booth, S J, Morigi, A N, Abbott, M A W, Wood, C J, 1994, *Geology of the country around Great Yarmouth*. Memoir of the British Geological Survey, Sheet 162 (England and Wales).

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Appendix 11A

IMPACT ASSESSMENT CRITERIA FOR SURFACE WATER AND GROUNDWATER

APPENDIX 11A – IMPACT ASSESSMENT CRITERIA FOR SURFACE WATER & GROUNDWATER

Table 11A.1 - Receptor Importance / Sensitivity

Importance	Criteria	Example
Very High	Attribute has a high quality and rarity on regional or national scale	▪ Large or medium watercourses with pristine / near pristine water quality, i.e. Water Framework Directive (WFD) Class 'High'. ▪ Site protected/designated under EU or UK habitat legislation (Special Areas of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interests (SSSI), Water Protection Zone (WPZ), Ramsar site, species protected by EU legislation. ▪ Watercourses supporting a wide range of significant species and habitats sensitive to changes in suspended sediment concentrations and turbidity such as salmon or freshwater pearl mussels. Water dependent ecosystems of international/national biodiversity value. ▪ Water feature sediment regime provides a diverse mosaic of habitat types. ▪ Water feature includes varied morphological features (e.g. pools, riffles, bars, natural bank profiles) with no sign of channel modification. ▪ A watercourse or groundwater body and associated abstraction boreholes used for public water supply or private water supply serving >10 properties. ▪ Principal aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation. ▪ Source Protection Zone (SPZ) 1. ▪ Water body of high amenity value, including areas of bathing and where water emersion sports are regularly practised.
High	Attribute has a high quality and rarity on local scale	▪ Medium or small watercourses with minor degradation of water quality as a result of anthropogenic factors. Water body of good chemical and biological quality, i.e. WFD Class 'Good' ▪ Species protected under UK legislation ▪ Water dependent ecosystems of regional/county biodiversity value. Watercourses supporting some species and habitats sensitive to changes in suspended sediment concentrations and turbidity. ▪ Water feature sediment regime provides habitats suitable for species sensitive to changes in sediment concentration and turbidity. ▪ Water feature exhibiting a natural range of morphological features (e.g. pools, riffles, bars, varied natural river bank profiles), with limited signs of artificial modifications or morphological pressures.

Importance	Criteria	Example
		▪ A watercourse or groundwater body and associated abstraction boreholes supporting minor/non-critical public drinking water supplies, or private water supply serving 2-10 properties. ▪ Principal aquifer providing locally important resource or supporting river ecosystem. ▪ Source Protection Zone (SPZ) 2. ▪ Water body of a moderate amenity value including public parks, boating, non-contact water sports, popular footpaths adjacent to watercourses, or watercourses running through housing developments/town centres.
Medium	Attribute has a medium quality and rarity on local scale	▪ Small watercourses with degradation of water quality as a result of anthropogenic factors. WFD Class of 'Moderate'. ▪ Water dependent ecosystems of county/district biodiversity value. ▪ Watercourses supporting limited species and habitats sensitive to changes in suspended sediment concentrations and turbidity. ▪ Water feature sediment regime provides some habitat suitable for species sensitive to change in suspended sediment concentrations or turbidity. ▪ Water feature exhibiting some morphological features (e.g. pools, riffles and depositional bars). The channel cross-section is partially modified in places, with obvious signs of modification to the channel morphology. ▪ A watercourse or groundwater body and associated abstraction boreholes supporting a private water supply serving a single property, or for agricultural/industrial use. ▪ Aquifer with limited connection to surface water. ▪ Source Protection Zone (SPZ) 3. ▪ Water body of particular local social/cultural/educational interest. Water body of low amenity value with only casual access, e.g. along a road or bridge in a rural area.
Low	Attribute has a low quality and rarity on local scale	▪ Small, heavily modified watercourses or drains with poor water quality as a result of anthropogenic factors. ▪ Water of poor or bad chemical or biological quality, i.e. WFD Class of 'Poor' or 'Bad' ▪ Water dependent ecosystems of local/less than local biodiversity value. ▪ Watercourses which do not support any significant species and habitats sensitive to changes in suspended sediment concentrations and turbidity. ▪ Water feature sediment regime which provides very limited physical habitat for species sensitive to changes in suspended solids concentration or turbidity.

Importance	Criteria	Example
		▪ Water feature that has been extensively modified (e.g. by culverting, addition of bank protection or impoundments) and exhibits limited-to-no morphological diversity. The water feature is likely to have uniform flow, uniform banks and absence of bars. Insufficient energy for morphological change. ▪ Watercourses not supporting water abstractions. ▪ Borehole without abstractions. ▪ Non-Aquifer. ▪ Water body of no amenity value, seldom used for amenity purposes, in a remote or inaccessible area.

Table 11A.2 - Impact Magnitude

Magnitude	Criteria	Example
Major Adverse	Results in loss of attribute and / or quality and integrity of the attribute	▪ High risk of pollution to surface water during construction, significant temporary or long-term change in water quality, resulting in a permanent change in WFD status.Preventing attainment of target overall status of 'Good' in the absence of other factors unrelated to the scheme ▪ Failure of both soluble and sediment bound pollutants in HAWRAT and EQS routine runoff compliance failure ▪ Risk of pollution from accidental spillage during operation > 2% annually. ▪ Results in loss of feature(s) and failure of hydromorphological elements (morphology, quantity and dynamics of flow). Loss or damage to existing habitats. Significant/extensive alteration to channel planform and/or cross section. Significant shift away from baseline conditions with potential to alter natural fluvial processes at the catchment scale. ▪ Significant impacts on the water feature bed, banks and vegetated riparian corridor resulting in changes to sediment characteristics, transport processes, sediment load and turbidity. ▪ Permanent loss of surface water supply ▪ Loss of, or extensive change to, an aquifer / groundwater supported designated wetlands. ▪ Extensive change to pumping rate and water quality in abstraction wells. ▪ Potential high risk of pollution to groundwater from routine runoff (Method C score >250) ▪ High risk of pollution to groundwater during construction, significant temporary or long-term change in water quality, resulting in a permanent change in WFD status. Preventing attainment of target overall status of 'Good' in the absence of other factors unrelated to the scheme

Magnitude	Criteria	Example
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	▪ Moderate risk of pollution to surface water during construction, moderate temporary change in water quality, resulting in a temporary change of WFD status or contributing to preventing attainment of target overall status of 'Good' ▪ Failure of both soluble and sediment bound pollutants in HAWRAT routine runoff but compliance with EQS limits ▪ Risk of pollution from accidental spillage during operation > 1% annually. ▪ Some changes and impacts on the water feature bed, banks and vegetated riparian corridor resulting in some changes to sediment characteristics, transport processes, sediment load and turbidity. ▪ Some alteration to channel planform and/or cross section, including modification to bank profiles or the replacement of a natural bed. A shift away from baseline conditions with potential to alter natural fluvial processes. ▪ Temporary loss of water supply. ▪ Partial loss or change to an aquifer/ groundwater supported designated wetlands. ▪ Partial change to pumping rate and water quality in abstraction wells. ▪ Potential medium risk of pollution to groundwater from routine runoff (Method C score 150 - 250) ▪ Moderate risk of pollution to groundwater during construction, temporary or moderate long-term change in water quality, resulting in a temporary change in WFD status or contributing to preventing attainment of target overall status of 'Good'
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability	▪ Minor risk of pollution during construction to surface water, relatively minor temporary changes in water quality such that ecology is temporarily affected. Equivalent to a temporary minor, but measurable, change within WFD status class ▪ Failure of either soluble or sediment bound pollutants in HAWRAT routine runoff but compliance with EQS limits ▪ Risk of pollution from accidental spillage during operation > 0.5% annually. ▪ Limited impacts on the water feature bed, banks and vegetated riparian corridor resulting in limited (but notable) changes to sediment characteristics, transport processes, sediment load and turbidity. ▪ A small change or modification in the channel planform and/or cross section. Minimal shift away from natural fluvial baseline conditions with typically localised impacts. ▪ Temporarily reduced quality of water supply ▪ Temporary change to pumping rate and water quality in abstraction wells.

Magnitude	Criteria	Example
		▪ Potential low risk of pollution to groundwater from routine runoff (Method C score <150) ▪ Minor risk of pollution to groundwater during construction, temporary change in water quality with temporary effects on groundwater dependent systems. Equivalent to a temporary minor, but measurable, change within WFD status class
Negligible Adverse	Results in effect on attribute, but of insufficient magnitude to affect the use of integrity	▪ Negligible risk of pollution to surface water during construction, very slight temporary change in water quality with no discernible effect on watercourse ecology or water supply ▪ All elements of HAWRAT and EQS routine runoff assessments passed ▪ Risk of pollution from accidental spillage during operation < 0.5% annually ▪ Minimal or no measurable change from baseline conditions in terms of sediment transport, channel morphology and natural fluvial processes. Any impacts are likely to be highly localised. ▪ No measurable impact upon an aquifer. ▪ Negligible risk of pollution to ground water during construction, very slight temporary change in water quality with no discernible effect on dependent systems or water supply ▪ No measurable change to pumping rate and water quality in abstraction wells.
No Change	Results in no change to the receptor	▪ No predicted adverse or beneficial impact to the receptor.
Negligible Beneficial	Results in beneficial effect on attribute, but of insufficient magnitude to affect the use of integrity	▪ The scheme options may beneficially affect the integrity of the water environment, but this is not considered measurable. ▪ No measurable impact upon an aquifer.
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	▪ Potential for slight reduction in pollution to a surface water or groundwater body, but insufficient to cause noticeable benefit in quality, fishery productivity or biodiversity.
Moderate Beneficial	Results in moderate improvement of attribute quality	▪ Moderate improvement to a fishery / designated nature conservation site. Potential increase in the productivity of a fishery. ▪ Reduced pollution of a receiving water body, but insufficient to change the environmental status/classification, including water quality classification.
Major Beneficial	Results in major improvement of attribute quality	▪ Significant improvement to a fishery / designated nature conservation site. ▪ Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring.

Magnitude	Criteria	Example
		▪ Change to the environmental status/classification of a water feature, including water quality classification.

Appendix 11B

WATER ENVIRONMENT IMPACT TABLES

APPENDIX 11B – WATER ENVIRONMENT ASSESSMENT OF IMPACTS

11B.1 IMPACT ASSESSMENT FOR SURFACE WATER

Table 11B.1 - Construction Impacts

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
River Yare	Very high	Very high	Pollution to surface water due to increased generation and release of sediments and suspended solids;	None (CoCP measures not yet fixed)	Minor adverse - short term increase in sediment load but does not significantly impact on characteristics of large tidal river; already subject to high sediment loads at times. Sediment will be quickly dispersed through tidal flows	Moderate adverse	CoCP; Coffer dams	Minor adverse (CoCP not expected to significantly reduce likelihood and impact of sediment loads due to works taking place within and immediately adjacent to watercourse)	Moderate adverse
			Pollution to surface water due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP measures not yet fixed)	Moderate adverse - short term reduction in water quality when resuspended but will be diluted and dispersed; potential short term interruption to water supplies (if significant contamination and abstractions are present). Will not introduce new source of contamination although sediment may settle out elsewhere on river bed.	Large adverse	CoCP; Coffer dams; dredging disposal	Minor adverse. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from waterbody	Moderate adverse
			Pollution to surface water due to dust and debris associated with demolition works.	None (CoCP measures not yet fixed)	Minor adverse - short term increase reduction in water quality but does not significantly impact on characteristics of large tidal river; already subject to high sediment loads at times. Dust and debris will be quickly dispersed through tidal flows	Moderate adverse	CoCP	Minor adverse (CoCP should reduce likelihood of significant dust and debris entering watercourse through containment where necessary).	Moderate adverse
			Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP measures not yet fixed)	Moderate adverse - short term reduction in water quality but relatively quickly dispersed; potential short term interruption to water supplies (if significant contamination and abstractions are present). Some risk of pollution already exists	Large adverse	CoCP; coffer dams	Minor adverse - CoCP will reduce likelihood of significant pollution incident	Moderate adverse
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	None (details of temporary works unknown)	Minor adverse - potential for increased localised erosion but unlikely to be sufficient to alter the characteristics of the watercourse (heavily engineered channel). Hydrological regime very unlikely to be affected. Morphology not currently measured under WFD indicating not a key defining feature.	Moderate adverse	CoCP, design of coffer dams	Minor adverse - unlikely to be able to significantly reduce effects due to construction requirements	Moderate adverse
			Temporary loss or change to surface water supplies due to degradation of water quality	None (CoCP measures not yet fixed)	Minor adverse - potential short term interruption to water supplies (if significant abstraction and abstractions are present). Some risk of pollution already exists	Moderate adverse	CoCP, coffer dams, dredging disposal	Negligible adverse - mitigation will reduce likelihood of significant contamination, reducing potential for water quality to be reduced such that it	Slight adverse

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
								cannot be used for industrial uses	
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	None	No change - construction will works not expected to have any discernible change on flows in the River Yare	Neutral	None	No change	Neutral
River Bure	Very high	Very high	Pollution to surface water due to increased generation and release of sediments and suspended solids;	None (CoCP not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests significant increase in sediment load in River Bure is unlikely (TBC from modelling). Any increased sediment unlikely to impact on characteristics of tidal river; already subject to high sediment loads at times. Sediment will be quickly dispersed through tidal flows	Slight adverse	CoCP; Coffer dams, silt barriers	Negligible adverse (CoCP not expected to significantly reduce likelihood of sediment loads entering the River Yare due to works taking place within and immediately adjacent to watercourse)	Slight adverse
			Pollution to surface water due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP measures not yet fixed)	Minor adverse - potential short term reduction in water quality when resuspended in Yare but will be diluted and dispersed prior to reaching the River Bure; unlikely to cause potential short term interruption to water supplies (if significant contamination and abstractions are present). Will not introduce new source of contamination although sediment may settle out elsewhere on river bed.	Moderate adverse	CoCP; Coffer dams; dredging disposal; silt traps potentially. Potential removal of contaminated sediment if deposited in mud-flats	Negligible adverse. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from entering Yare. Further measures may be provided to limit sediment transferring upstream.	Slight adverse
			Pollution to surface water due to dust and debris associated with demolition works.	None (CoCP measures not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests significant reduction in water quality is unlikely. Unlikely to impact on characteristics of large tidal river; already subject to high sediment loads at times. Dust and debris will be quickly dispersed through tidal flows	Slight adverse	CoCP	Negligible adverse (CoCP should reduce likelihood of significant dust and debris entering watercourse through containment where necessary).	Slight adverse
			Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP measures not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests any significant reduction in water quality is unlikely and will be short term; unlikely any impacts will be significant enough to interrupt water supplies (if significant abstractions are present). Some risk of pollution already exists	Slight adverse	CoCP; coffer dams	Negligible adverse - CoCP will reduce likelihood of significant pollution incident	Slight adverse
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	None (details of temporary works unknown)	No change - no direct works to River Bure. Distance from Scheme suggests any change in flow patterns and velocities will not extend up to the Bure confluence. Hydrological regime very unlikely to be affected. Morphology not currently measured under WFD indicating not a key defining feature.	Neutral	CoCP, design of coffer dams	No change	Neutral

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Temporary loss or change to surface water supplies due to degradation of water quality	None (CoCP measures not yet fixed)	Negligible adverse - potential short term interruption to water supplies (if significant contamination and abstractions are present) but unlikely that contamination will be sufficient to affect water supplies from the River Bure. Some risk of pollution already exists. Will be short term only as pollutants are diluted and dispersed.	Slight adverse	CoCP, coffer dams, dredging disposal	No change - mitigation will reduce likelihood of significant contamination, reducing potential for water quality to be reduced such that it cannot be used	Neutral
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	None	No change - construction will works not expected to have any discernible change on flows in the River Yare (and River Bure)	Neutral	None	No change	Neutral
Breydon Water	Very high	Very high	Pollution to surface water (mud-flats) due to increased generation and release of sediments and suspended solids;	None (CoCP measures not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests significant increase in sediment load in River Yare at Breydon Water is unlikely (TBC from modelling) Any increased sediment unlikely to impact on characteristics & inter-tidal regime of mud-flats.	Slight adverse	CoCP; Coffer dams; silt barriers	Negligible adverse (CoCP not expected to significantly reduce likelihood of sediment loads entering the River Yare due to works taking place within and immediately adjacent to watercourse)	Slight adverse
			Pollution to surface water (mud-flats) due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP measures not yet fixed)	Moderate adverse - potential for deposition of contaminated sediment in mud-flats although likely to have been diluted and dispersed by tidal flows (TBC through modelling). Not considered likely to be sufficient to significantly affect character and use of Breydon Water (TBC from ecology). Will not introduce new source of contamination although sediment may settle out elsewhere on river bed.	Large adverse	CoCP; Coffer dams; dredging disposal; silt traps potentially. Potential removal of contaminated sediment if deposited in mud-flats	Negligible adverse. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from entering Yare. Further measures may be provided to limit sediment transferring upstream or removal if deposited	Slight adverse
			Pollution to surface water (mud-flats) due to dust and debris associated with demolition works.	None (CoCP measures not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests significant debris reaching & being deposited at Breydon Water is unlikely. Unlikely to impact on characteristics of mud-flats; already subject to high sediment loads at times. Dust and debris will be dispersed through tidal flows.	Slight adverse	CoCP	Negligible adverse (CoCP should reduce likelihood of significant dust and debris entering watercourse through containment where necessary).	Slight adverse
			Pollution to surface water (mud-flats) due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP measures not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests any significant reduction in water quality is unlikely and will be short term; . Some risk of pollution already exists	Slight adverse	CoCP, coffer dams	Negligible adverse - CoCP will reduce likelihood of significant pollution incident	Slight adverse
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	None (details of temporary works unknown)	No change - no direct works to Breydon Water. Distance from Scheme suggests any change in flow patterns and velocities will not extend up to Breydon Water. Hydrological regime very unlikely to be affected. Morphology not currently measured	Neutral	CoCP, design of coffer dams	No change	Neutral

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
					under WFD indicating not a key defining feature.				
			Temporary loss or change to surface water supplies due to degradation of water quality - N/A						
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - N/A						
Ditches and watercourses within 1km buffer (marshland upstream of Great Yarmouth)	Medium	Medium	Pollution to surface water due to increased generation and release of sediments and suspended solids;	None (CoCP measures not yet fixed)	No change - distance from Proposed Scheme suggests significant increase in sediment load is unlikely (TBC from modelling).	Neutral	CoCP; Coffer dams; silt barriers	No change (CoCP not expected to significantly reduce likelihood of sediment loads entering the River Yare due to works taking place within and immediately adjacent to watercourse)	Neutral
			Pollution to surface water due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP measures not yet fixed)	No change - potential short term reduction in water quality when resuspended in Yare but will be diluted and dispersed prior to reaching these watercourses; unlikely to cause potential short term interruption to water supplies (if significant contamination and abstractions are present). Will not introduce new source of contamination although sediment may settle out elsewhere on river bed.	Neutral	CoCP; Coffer dams; dredging disposal; silt traps potentially.	No change. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from entering Yare. Further measures may be provided to limit sediment transferring upstream.	Neutral
			Pollution to surface water due to dust and debris associated with demolition works.	None (CoCP measures not yet fixed)	No change - distance from Proposed Scheme suggests significant reduction in water quality is unlikely. Dust and debris will be dispersed through tidal flows prior to reaching these watercourses	Neutral	CoCP	No change (CoCP should reduce likelihood of significant dust and debris entering watercourse through containment where necessary).	Neutral
			Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP measures not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests any significant reduction in water quality is unlikely as contaminants will be diluted and dispersed and will be short term; unlikely any impacts will be significant enough to interrupt water supplies (if significant abstractions are present). Some risk of pollution already exists	Neutral	CoCP	No change - CoCP will reduce likelihood of significant pollution incident	Neutral
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	None (details of temporary works unknown)	No change - no direct works to watercourses. Hydrological regime very unlikely to be affected.	Neutral	CoCP, design of coffer dams	No change	Neutral

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Temporary loss or change to surface water supplies due to degradation of water quality	None (CoCP measures not yet fixed)	No change- unlikely that any contamination will be sufficient to affect water supplies from the watercourses (if abstractions are present). Some risk of pollution already exists. Will be short term only as pollutants are diluted and dispersed	Neutral	CoCP, coffer dams, dredging disposal	No change - mitigation will reduce likelihood of significant contamination, reducing potential for water quality to be reduced such that it cannot be used	Neutral
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	None	No change - construction will works not expected to have any discernible change on flows in these watercourses	Neutral	None	No change	Neutral
Ditches and watercourses within 1km buffer (within urban area of Great Yarmouth)	Low	Low	Pollution to surface water due to increased generation and release of sediments and suspended solids;	None (CoCP measures not yet fixed)	No change - distance from Proposed Scheme suggests significant increase in sediment load is unlikely (TBC from modelling).	Neutral	CoCP; Coffer dams; silt barriers	No change (CoCP not expected to significantly reduce likelihood of sediment loads entering the River Yare due to works taking place within and immediately adjacent to watercourse)	Neutral
			Pollution to surface water due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP measures not yet fixed)	No change - potential short term reduction in water quality when resuspended in Yare but will be diluted and dispersed prior to reaching these watercourses; unlikely to cause potential short term interruption to water supplies (if signficant contamination and abstractions are present). Will not introduce new source of contamination although sediment may settle out elsewhere on river bed.	Neutral	CoCP; Coffer dams; dredging disposal; silt traps potentially.	No change. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from entering Yare. Further measures may be provided to limit sediment transferring upstream.	Neutral
			Pollution to surface water due to dust and debris associated with demolition works.	None (CoCP measures not yet fixed)	No change - distance from Proposed Scheme suggests significant reduction in water quality is unlikely. Dust and debris will be dispersed through tidal flows prior to reaching these watercourses	Neutral	CoCP	No change (CoCP should reduce likelihood of significant dust and debris entering watercourse through containment where necessary).	Neutral
			Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP measures not yet fixed)	Negligible adverse - distance from Proposed Scheme suggests any significant reduction in water quality is unlikely as contaminants will be diluted and dispersed and will be short term; unlikely any impacts will be significant enough to interrupt water supplies (if significant abstractions are present). Some risk of pollution already exists	Neutral	CoCP	No change - CoCP will reduce likelihood of significant pollution incident	Neutral
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	None (details of temporary works unknown)	No change - no direct works to watercourses. Hydrological regime very unlikely to be affected.	Neutral	CoCP, design of coffer dams	No change	Neutral

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Temporary loss or change to surface water supplies due to degradation of water quality - N/A. Highly unlikely to be used for water supply						
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - - N/A. Highly unlikely to be used for water supply						
Ditches and watercourses in close proximity to Scheme - but not directly affected	Low	Low	Pollution to surface water due to increased generation and release of sediments and suspended solids;	None (CoCP measures not yet fixed)	Moderate adverse - potential for sediment to be washed into watercourses, temporarily increasing turbidity and affecting water quality	Slight adverse	CoCP; silt barriers	Negligible adverse (CoCP should be effective in reducing likelihood if significant sediment being washed into nearby water features)	Neutral
			Pollution to surface water due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP measures not yet fixed)	No change - potential short term reduction in water quality when resuspended in Yare but will be diluted and dispersed prior to reaching these watercourses; flows from the River Yare are unlikely to travel upstream to these watercourses. Very unlikely to be used for water supply due to small size and location.	Neutral	CoCP; Coffer dams; dredging disposal; silt traps potentially.	No change. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from entering Yare. Further measures may be provided to limit sediment transferring upstream.	Neutral
			Pollution to surface water due to dust and debris associated with demolition works.	None (CoCP measures not yet fixed)	Moderate adverse - potential for dust & debris to be washed into watercourses, temporarily increasing turbidity and affecting water quality	Slight adverse	CoCP	No change (CoCP should reduce likelihood of significant dust and debris entering watercourse through containment where necessary).	Neutral
			Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP measures not yet fixed)	Moderate adverse - potential for spillages to enter watercourses. Pollutants will be diluted and dispersed over time but may temporarily affect water quality. Some risk of pollution already exists. Unlikely to be used for water supply due to small size and location.	Slight adverse	CoCP	Negligible adverse - CoCP will reduce likelihood of significant pollution incident	Neutral
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	None (details of temporary works unknown)	No change - no direct works to watercourses. Hydrological regime very unlikely to be affected.	Neutral	N/A	No change	Neutral
			Temporary loss or change to surface water supplies due to degradation of water quality - N/A. Highly unlikely to be used for water supply						

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - - N/A. Highly unlikely to be used for water supply						
Ditches and watercourses at A47 roundabout directly affected by the Scheme	Low	Low	Pollution to surface water due to increased generation and release of sediments and suspended solids;	None (CoCP measures not yet fixed)	Moderate adverse - potential for sediment to be washed into watercourses, temporarily increasing turbidity and affecting water quality	Slight adverse	CoCP; silt barriers	Moderate adverse (CoCP not expected to significantly reduce likelihood and impact of sediment loads due to works taking place within and immediately adjacent to watercourse)	Slight adverse
			Pollution to surface water due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP measures not yet fixed)	No change - potential short term reduction in water quality when resuspended in Yare but will be diluted and dispersed prior to reaching these watercourses; flows from the River Yare are unlikely to travel upstream to these watercourses. Very unlikely to be used for water supply due to small size and location.	Neutral	CoCP; Coffer dams; dredging disposal; silt traps potentially.	No change. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from entering Yare. Further measures may be provided to limit sediment transferring upstream.	Neutral
			Pollution to surface water due to dust and debris associated with demolition works.	None (CoCP measures not yet fixed)	Moderate adverse - potential for dust & debris to be washed into watercourses, temporarily increasing turbidity and affecting water quality	Slight adverse	CoCP	Moderate adverse (CoCP not expected to significantly reduce likelihood and impact of debris loads due to works taking place within and immediately adjacent to watercourse (e.g. culvert works)	Slight adverse
			Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP measures not yet fixed)	Moderate adverse - potential for spillages to enter watercourses. Pollutants will be diluted and dispersed over time but may temporarily affect water quality. Some risk of pollution already exists. Unlikely to be used for water supply due to small size and location.	Slight adverse	CoCP	Minor adverse - CoCP will reduce likelihood of significant pollution incident but some risk remains where works take place within watercourses	Neutral
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	None (details of temporary works unknown)	Moderate adverse - temporary diversions, culverting, overpumping may be required. Likely to have significant change but temporary. Watercourses affected not significant to quality and status of wider WFD waterbody	Slight adverse	CoCP - maintain drainage routes	Moderate adverse - CoCP is unlikely to significantly reduce impact due to the works required	Slight adverse
			Temporary loss or change to surface water supplies due to degradation of water quality - N/A. Highly unlikely to be used for water supply						

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - - N/A. Highly unlikely to be used for water supply						
North Sea	Very high	Very high	Pollution to surface water due to increased generation and release of sediments and suspended solids;	None (CoCP not yet fixed)	Negligible adverse - short term increase in sediment load in Yare but quickly dispersed through tidal flows. Insignificant change once washed out to sea.	Slight adverse	CoCP; Coffer dams	Negligible adverse (CoCP not expected to significantly reduce likelihood and impact of sediment loads due to works taking place within and immediately adjacent to watercourse)	Slight adverse
			Pollution to surface water due to disturbance of contaminated sediments, resuspension in water column and eventual deposition	None (CoCP not yet fixed)	Moderate adverse - short term reduction in water quality when resuspended but will be diluted and dispersed; potential for subsequent deposition affecting bathing water if significant.	Large adverse	CoCP; Coffer dams; dredging disposal	Minor adverse. Sampling to identify contamination; coffer dams and disposal of dredged material will help to isolate contaminated sediment from waterbody	Moderate adverse
			Pollution to surface water due to dust and debris associated with demolition works.	None (CoCP not yet fixed)	Negligible adverse - short term reduction in water quality but negligible change once washed out to sea. Dust and debris will be quickly dispersed through tidal flows	Slight adverse	CoCP; coffer dams	No change (CoCP should recue likelihood of significant dust and debris entering watercourse through containment where necessary).	Neutral
			Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete	None (CoCP not yet fixed)	Moderate adverse - short term reduction in water quality; potential short term effect on bathing water (if significant contamination). Some risk of pollution already exists	Large adverse	CoCP	Minor adverse - CoCP will reduce likelihood of significant pollution incident	Moderate adverse
			Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or temporary in-channel structures	N/A					
			Temporary loss or change to surface water supplies due to degradation of water quality	N/A					
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	N/A					

Table 11B.2 – Operational Impacts

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
River Yare	Very high	Very high	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - discharge expected to meet HAWRAT & EQS level, large tidal river will dilute any residual contaminants. Effect depends on change in traffic flows; potential benefit where existing drainage systems do not include treatment	Slight adverse	N/A (details of treatment to be confirmed)	Negligible adverse	Slight adverse
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	Minor adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Large tidal river will dilute any contaminants	Moderate adverse	Spillage containment measures incorporated into drainage	Negligible adverse - risk of spillages entering watercourse are reduced	Slight adverse
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	None (details of bridge pier design not fixed)	Minor adverse - potential for increased localised erosion but unlikely to be sufficient to alter the characteristics of the watercourse (heavily engineered channel). Hydrological regime very unlikely to be affected. Morphology not currently measured under WFD indicating not a key defining feature.	Moderate adverse	Design of piers to reduce turbulence but flow velocities will remain affected leading to increased risk of scour (TBC with modelling)	Minor adverse - flow velocities at crossing remain likely to be affected locally	Moderate adverse
			Loss or change to surface water supplies due to degradation of water quality	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - potential slight deterioration in overall water quality but unlikely to be sufficient to affect potential water supplies (if present) - likely for industrial uses.	Slight adverse	N/A (details of treatment to be confirmed)	Negligible adverse	Slight adverse
			Loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	Drainage strategy maintains drainage routes	No change - Scheme not expected to have any discernible change on flows in the River Yare	Neutral	None	No change	Neutral
River Bure	Very high	Very high	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	No change - discharge expected to meet HAWRAT & EQS level, large tidal river will dilute any residual contaminants prior to Bure confluence. Effect depends on change in traffic flows; potential benefit where existing drainage systems do not include treatment	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Large tidal river will dilute any contaminants prior to Bure confluence	Neutral	Spillage containment measures incorporated into drainage	Negligible adverse - risk of spillages entering watercourse are reduced	Slight adverse

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	None (details of bridge pier design not fixed)	No change - bridge piers highly unlikely to affect flow regime & processes as far upstream as the Bure (TBC with modelling)	Neutral	Design of piers to reduce turbulence but flow velocities will remain affected leading to increased risk of scour (TBC with modelling)	No change - flow velocities at crossing remain likely to be affected locally	Neutral
			Loss or change to surface water supplies due to degradation of water quality	Appropriate treatment & SuDS incorporated into drainage system	No change - potential slight deterioration in overall water quality but highly unlikely to be sufficient to affect potential water supplies in Bure (if abstractions present) - likely for industrial uses.	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral
			Loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	Drainage strategy maintains drainage routes	No change - Scheme not expected to have any discernible change on flows in the River Yare	Neutral	None	No change	Neutral
Breydon Water	Very high	Very high	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	No change - discharge expected to meet HAWRAT & EQS level, large tidal river will dilute any residual contaminants prior to Breydon Water. Effect depends on change in traffic flows; potential benefit where existing drainage systems do not include treatment	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Large tidal river will dilute any contaminants prior to Breydon Water	Neutral	Spillage containment measures incorporated into drainage	Negligible adverse - risk of spillages entering watercourse are reduced	Slight adverse
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	None (details of bridge pier design not fixed)	No change - bridge piers highly unlikely to affect flow regime & processes as far upstream as Breydon Water (TBC with modelling)	Neutral	Design of piers to reduce turbulence but flow velocities will remain affected leading to increased risk of scour (TBC with modelling)	No change - flow velocities at crossing remain likely to be affected locally	Neutral
			Loss or change to surface water supplies due to degradation of water quality - N/A						
			Loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - N/A						
Ditches and watercourses within 1km buffer (marshland upstream of	Medium	Medium	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	No change - discharge expected to meet HAWRAT & EQS level, large tidal river will dilute any residual contaminants prior to confluence with these watercourses. Effect depends on change in traffic flows; potential	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
Great Yarmouth)					benefit where existing drainage systems do not include treatment				
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	No change - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Large tidal river will dilute any contaminants prior to these watercourses. Direct pathway for migration upstream unlikely	Neutral	Spillage containment measures incorporated into drainage	Negligible adverse - risk of spillages entering watercourse are reduced	Neutral
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	None (details of bridge pier design not fixed)	No change - bridge piers highly unlikely to affect flow regime & processes in upstream watercourses	Neutral	Design of piers to reduce turbulence but flow velocities will remain affected leading to increased risk of scour (TBC with modelling)	No change - flow velocities at crossing remain likely to be affected locally	Neutral
			Loss or change to surface water supplies due to degradation of water quality	Appropriate treatment & SuDS incorporated into drainage system	No change - potential slight deterioration in overall water quality but highly unlikely to be sufficient to affect potential water supplies in upstream watercourses(if abstractions present) - likely for agricultural uses.	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral
			Loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	Drainage strategy maintains drainage routes	No change - Scheme not expected to have any discernible change on flows	Neutral	None	No change	Neutral
Ditches and watercourses within 1km buffer (within urban area of Great Yarmouth)	Low	Low	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	No change - discharge expected to meet HAWRAT & EQS level, large tidal river will dilute any residual contaminants. Direct connectivity for migration upstream unlikely.	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	No change - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Large tidal river will dilute any contaminants. Direct connectivity for migration upstream unlikely.	Neutral	Spillage containment measures incorporated into drainage	Negligible adverse - risk of spillages entering watercourse are reduced	Neutral
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	None	No change - no direct works to watercourses. Hydrological regime will not be affected	Neutral	N/A	No change	Neutral

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Temporary loss or change to surface water supplies due to degradation of water quality - N/A. Highly unlikely to be used for water supply						
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - - N/A. Highly unlikely to be used for water supply						
Ditches and watercourses in close proximity to Scheme - but not directly affected	Low	Low	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	No change - discharge expected to meet HAWRAT & EQS level, large tidal river will dilute any residual contaminants. Direct connectivity for migration upstream unlikely.	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	No change - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Large tidal river will dilute any contaminants. Direct connectivity for migration upstream unlikely.	Neutral	Spillage containment measures incorporated into drainage	Negligible adverse - risk of spillages entering watercourse are reduced	Neutral
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	None	No change - no direct works to watercourses. Hydrological regime will not be affected	Neutral	N/A	No change	Neutral
			Temporary loss or change to surface water supplies due to degradation of water quality - N/A. Highly unlikely to be used for water supply						
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - - N/A. Highly unlikely to be used for water supply						
Ditches and watercourses at A47 roundabout directly affected by the Scheme	Low	Low	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	Minor adverse - discharge generally expected to meet HAWRAT & EQS level but potential slight deterioration in water quality if dilution is limited. Potential benefit if existing drainage systems do not include treatment	Neutral	N/A (details of treatment to be confirmed)	Minor adverse	Neutral

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	Moderate adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Potential deterioration in water quality where dilution is limited. Potential benefit if existing drainage systems do not include treatment	Slight adverse	Spillage containment measures incorporated into drainage	Minor adverse - risk of spillages entering watercourse are reduced	Neutral
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	Drainage routes maintained	Moderate adverse - increased culverting, diversion, potential engineered channels. But existing watercourses already altered and include culverting. Morphological quality of these watercourses insignificant to overall waterbody status	Slight adverse	Design of channels and culverts (oversized, natural beds etc) to reduce impacts	Moderate adverse - additional mitigation will reduce impact but increased culverting will still notable affect hydromorphological quality	Slight adverse
			Temporary loss or change to surface water supplies due to degradation of water quality - N/A. Highly unlikely to be used for water supply						
			Temporary loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure - - N/A. Highly unlikely to be used for water supply						
North Sea	Very high	Very high	Pollution to surface water due to contaminants contained in routine road runoff	Appropriate treatment & SuDS incorporated into drainage system	No change - discharge expected to meet HAWRAT & EQS level. Contaminants diluted an dispersed in open sea	Neutral	N/A (details of treatment to be confirmed)	No change	Neutral
			Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident. Diluted in open sea	Neutral	Spillage containment measures incorporated into drainage	No change - risk of spillages entering watercourse are reduced	Neutral
			Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications or in-channel structures	N/A					
			Loss or change to surface water supplies due to degradation of water quality	N/A					
			Loss or change to surface water supplies due to changes in drainage patterns or disruptions to supply infrastructure	N/A					

11B.2 IMPACT ASSESSMENT FOR GROUND WATER

Table 11B.3 – Construction Impacts

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
Crag Group Aquifer	High	High	Decrease in groundwater level and quality due to use of groundwater control measures	None (details of temporary works unknown)	Moderate adverse - short term, reversible reduction in groundwater levels and groundwater quality. Potential saltwater encroachment into aquifer as a result of dewatering during construction activities.	Slight adverse	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible. CoCP to identify appropriate mitigations to reduce direct impacts on groundwater level and quality as a result of dewatering	Negligible adverse	Slight adverse
			Disruption of groundwater flow due to use of groundwater control measures or due to construction process	None (details of temporary works unknown)	Minor adverse - short term, reversible reduction in groundwater flow and flow direction	Slight adverse	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible	Negligible adverse	Slight adverse
			Degradation of groundwater quality due to spillage or hazardous substances	None (details of temporary works unknown)	Minor adverse - short term reduction in water quality	Slight adverse	CoCP; coffer dams	Negligible adverse	Slight adverse
			Mobilisation and / or drawdown of pre-existing contamination	None (details of temporary works unknown)	Minor adverse - short term reduction in water quality when pre-existing contamination will be mobilised.	Slight adverse	CoCP;	Negligible adverse	Slight adverse
Blown Sand, North Denes Formation, Happisburgh Glacigenic Formation	Medium	Medium	Decrease in groundwater level due to use of groundwater control measures	None (details of temporary works unknown)	Minor adverse - short term, reversible reduction in groundwater levels	Slight adverse	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible.	Negligible adverse	Neutral
			Disruption of groundwater flow due to use of groundwater control measures or due to construction process	None (details of temporary works unknown)	Minor adverse - short term, reversible reduction in groundwater flow and flow direction	Slight adverse	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible	Negligible adverse	Neutral
			Degradation of groundwater quality due to spillage or hazardous substances	None (details of temporary works unknown)	Minor adverse - short term reduction in water quality	Slight adverse	CoCP; coffer dams	Minor adverse	Slight adverse
			Mobilisation and / or drawdown of pre-existing contamination	None (details of temporary works unknown)	Minor adverse - short term reduction in water quality when pre-existing contamination will be mobilised.	Slight adverse	CoCP;	Minor adverse	Slight adverse
Industrial abstraction boreholes	Medium	Medium	Decrease in groundwater level due to use of groundwater control measures	None (details of temporary works unknown)	Minor adverse - short term, reversible reduction in groundwater levels	Slight adverse	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible.	Negligible adverse	Neutral
			Disruption of groundwater flow due to use of groundwater control measures or due to construction process	None (details of temporary works unknown)	Minor adverse - short term, reversible reduction in groundwater flow and flow direction	Slight adverse	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible	Negligible adverse	Neutral
			Degradation of groundwater quality due to spillage or hazardous substances	None (details of temporary works unknown)	Minor adverse - short term reduction in water quality	Slight adverse	CoCP; coffer dams	Negligible adverse	Neutral
			Mobilisation and / or drawdown of pre-existing contamination	None (details of temporary works unknown)	Minor adverse - short term reduction in water quality when pre-existing contamination will be mobilised.	Slight adverse	CoCP;	Negligible adverse	Neutral

Table 11B.4 – Operational Impacts

Receptor	Current importance	Future importance	Impacts	Embedded mitigation	Impact magnitude	Significance	Additional mitigation	Residual impact magnitude	Residual significance
Crag Group Aquifer	High	High	Local decrease in groundwater level due to a decrease in recharge caused by the impermeable construction	None	Negligible adverse	Neutral	None	Negligible adverse	Slight adverse
			Local disruption of groundwater flow due to a decrease in recharge caused by the impermeable construction	None	Negligible adverse	Neutral	None	Negligible adverse	Slight adverse
			Local disruption of groundwater flow due to piles	None	Negligible adverse	Neutral	None	Negligible adverse	Slight adverse
			Degradation of groundwater quality due to spillage or hazardous substances	Appropriate treatment & SuDS incorporated into drainage system	Minor adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident.	Slight	Spillage containment measures incorporated into drainage	Negligible adverse	Slight adverse
			Degradation of groundwater quality due to contaminants contained in routine road runoff that infiltrate to the aquifer	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - discharge expected to meet HAWRAT & EQS level	Neutral	None	Negligible adverse	Slight adverse
Blown Sand, North Denes Formation, Happisburgh Glacigenic Formation	Medium	Medium	Local decrease in groundwater level due to a decrease in recharge caused by the impermeable construction	None	Negligible adverse	Neutral	None	Negligible adverse	Neutral
			Local disruption of groundwater flow due to a decrease in recharge caused by the impermeable construction	None	Negligible adverse	Neutral	None	Negligible adverse	Neutral
			Local disruption of groundwater flow due to piles	None	Negligible adverse	Neutral	None	Negligible adverse	Neutral
			Degradation of groundwater quality due to spillage or hazardous substances	Appropriate treatment & SuDS incorporated into drainage system	Minor adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident.	Slight	Spillage containment measures incorporated into drainage	Negligible adverse	Neutral
			Degradation of groundwater quality due to contaminants contained in routine road runoff that infiltrate to the aquifer	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - discharge expected to meet HAWRAT & EQS level	Neutral	None	Negligible adverse	Neutral
Industrial abstraction boreholes	Medium	Medium	Degradation of groundwater quality due to spillage or hazardous substances	Appropriate treatment & SuDS incorporated into drainage system	Minor adverse - normal treatment / SuDS features may not be sufficient to deal with spillage incident. Higher traffic flows and additional junctions may increase risk of spillage incident.	Slight	Spillage containment measures incorporated into drainage	Negligible adverse	Neutral
			Degradation of groundwater quality due to contaminants contained in routine road runoff that infiltrate to the aquifer	Appropriate treatment & SuDS incorporated into drainage system	Negligible adverse - discharge expected to meet HAWRAT & EQS level	Neutral	None	Negligible adverse	Neutral

Appendix 12A

HYDRAULIC ASSESSMENT TECHNICAL NOTE

Norfolk County Council

GREAT YARMOUTH THIRD CROSSING

Appendix 12A - Hydraulic Model Technical Note

HYDRAULIC TECHNICAL NOTE
JUNE 2018

INTERNAL

Norfolk County **Council**

GREAT YARMOUTH THIRD CROSSING

Appendix 12A - Hydraulic Model Technical Note

TYPE OF DOCUMENT (VERSION) INTERNAL

PROJECT NO. 70041951
OUR REF. NO. HYDRAULIC TECHNICAL NOTE

DATE: JUNE 2018

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Table text	Table text	Table text	Table text
Date	Table text	Table text	Table text	
Prepared by	Table text	Table text	Table text	
Signature				
Checked by	Table text	Table text	Table text	Table text
Signature				
Authorised by	Table text	Table text	Table text	Table text
Signature				
Project number	Table text	Table text	Table text	Table text
Report number	Table text			
File reference	Table text	Table text	Table text	Table text

CONTENTS

12A.1 INTRODUCTION

12A.1.1. This short technical note supports Chapter 12 of the Great Yarmouth Third River Crossing PEIR report and outlines the progress that has been made in assessing flood risk within Great Yarmouth as a precursor to the Flood Risk Assessment (FRA) that will be completed and form part of the ES for the scheme.

12A.1.2. Great Yarmouth is a coastal town on the East coast of England in Norfolk. The town is situated on the banks of the River Yare which is one of the main rivers draining much of the Norfolk Broads. Tidal defences line the river edge, providing protection from coastal flooding to the town. The river flows in a southerly direction, under two existing bridges spanning the harbour to an almost right angle turn to the sea boundary.

12A.1.3. The river divides the town in two, with the town centre, seafront and industrial areas and outer harbour located on the narrow, 4km long South Denes peninsula. There are two existing bridges connecting the peninsula to the A47, the main truck road connecting Great Yarmouth to Lowestoft and Norwich which are failing to provide enough capacity resulting in significant congestion. The scheme is intended to reduce traffic congestion to the main commercial and leisure hub and support future growth of the town.

12A.1.4. As part of the flooding assessment, a number of tasks have been carried out to date. These include collecting information necessary to complete the assessments, a detailed model review of an existing model, a hydraulic analysis of the tidal boundary and production of the inflow tidal levels, and a high level simulation of an actual event which resulted in widespread flooding on the 5th/6th December 2013. This technical note provides an overview of the work carried out thus far.

12A.2 MODELLING METHODOLOGY

12A.2.1. As part of the assessment, the Environment Agency (EA) provided a large 1D/2D model developed as part of the Great Yarmouth Flood Defences Framework For Action (GYFDFFA) which simulates the entire Broadlands network and contains over 4000 1D nodes. A comprehensive model review (Annex A) has been carried out which concluded that whilst the model is fit for its intended purpose, due to the size of the model and several dataset updates that are required, a new model for Great Yarmouth is required for this assessment to understand in detail the hydraulics at the scheme site on the River Yare.

12A.2.2. At this stage, a 2D TUFLOW hydraulic model has been partially developed to provide a high level assessment of the impact of the scheme on water levels and velocities in the River Yare. Figure 12A.1 shows the extent of the model domain in Great Yarmouth and shows the approximate location of the scheme in the model.

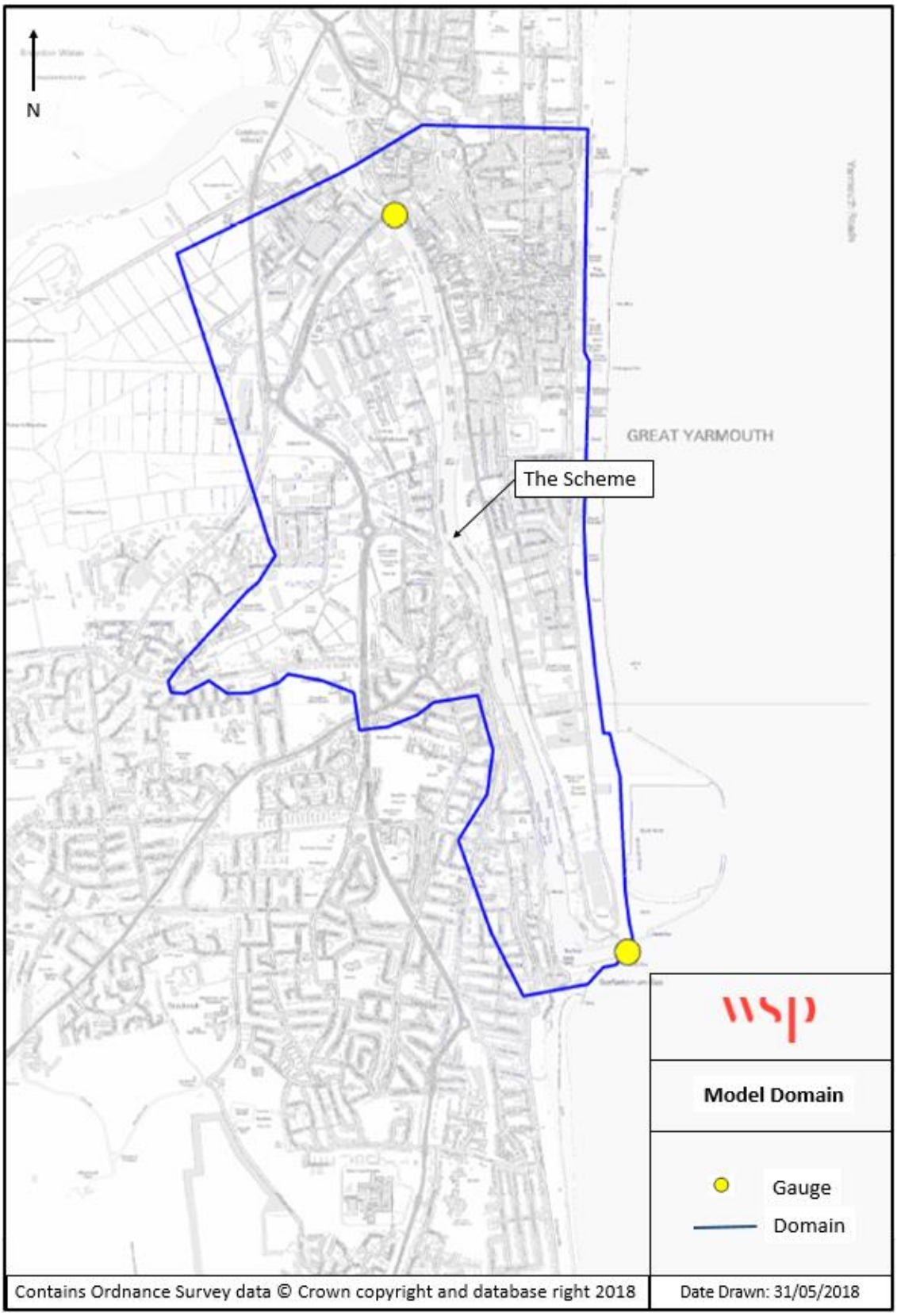

Figure 12A.1 - Model Domain

12A.3 HYDROLOGY

Overview

12A.3.1. The hydrology of Great Yarmouth has been analysed; the EA have specified the design events and climate change scenarios to be considered in this study. Tidal levels have been derived to define the eastern boundary of the hydraulic model that represents sea levels along the Great Yarmouth coast. EA guidance on estimating design sea levels[1] has been used to derive the tidal boundary used in the model.

12A.3.2. The EA has requested that three return period events are investigated in this assessment; 5% AEP, 0.5% AEP and 0.1% AEP. The three design events will be assessed for the present day (2018) and two climate change scenarios as required by the EA.

12A.3.3. A summary of the calculations undertaken to define the hydrological boundaries of the model is provided below with more detail provided in Annex B.

Tidal Curve Derivation

12A.3.4. The EA guidance[1] sets out a 10 step procedure to generate a tidal curve:

1. Check study location is outside of estuary boundaries;
2. Select an appropriate chainage point for extreme sea levels;
3. Select an annual exceedance probability peak sea level;
4. Consider allowance for uncertainty;
5. Identify base astronomical tide;
6. Convert levels to Ordnance Datum;
7. Identify surge shape to apply;
8. Produce the resultant design tide curve;
9. Sensitivity testing; and
10. Apply allowance for climate change.

12A.3.5. The procedure above makes use of several datasets which are provided as part of the guidance:

- Estuary Boundaries;
- ESLs from Open Coast (CFBD) Flood Risk Study, JBA 2014;
- Gauge Sites;
- Confidence Intervals; and
- Surge Shapes.

[1] SC060064/TR4: Practical Guidance Design Sea Levels and Open Coast (CFBD) Flood Risk Study (2014) JBA for the Environment Agency.

12A.3.6. The tidal curve has been derived using the process set out in Section 1.3.4. As discussed in detail in Annex B, the first four steps in the process make use of the datasets provided to obtain the required data for the site. The remaining steps require the manipulation of the data to obtain the tidal curve.

12A.3.7. The procedure uses the available data to create an astronomical tidal profile, in the assessment it was deemed appropriate to use the tidal curve from the gauge at Gorleston and scale to the required peaks in Table 12A.1 (ESLs). The existing model tidal curve was scaled to the ESLs using the surge shape for Great Yarmouth provided with the guidance. This procedure is explained in detail in Annex B.

12A.3.8. In order to consider the impact of and resilience to future flooding, the model has also been used to simulate future flood events with an allowance for climate change included. Climate change has been represented by increasing tidal levels only to represent sea level rise in the future. The design life of the Scheme is 120 years.

12A.3.9. In line with the recommendation from the EA, the climate change sea level rise has been defined as the worst case scenario following an assessment of five different guidance documents. The guidance documents recommended by the EA were:

- National Planning Policy Framework (NPPF)-Table 3;
- UK Climate Predictions 2009 (UKCP09) 50% High Emissions (HE);
- UKCP09 95% HE;
- UKCP09 95% Medium Emissions (ME); and
- Upper End, Adapting to Climate Change, 2016.

12A.3.10. An assumption has been made that the scheme is unlikely to be constructed before 2020; therefore for the climate change calculations it was deemed appropriate to calculate sea level rise between 2020 and 2140. None of the documentation stretches that far into the future, therefore the predictions were extrapolated using a linear method as agreed with the EA. The climate change sea level increase worst case scenario was 1.54m from the NPPF-table 3. This has been applied to the tidal curves representing the present day scenario in order to create tidal curves representing the climate change scenario for each design event.

12A.3.11. Due to the safety critical nature of the scheme, the EA have also requested that the design is assessed against the UKCP09 H++ estimates (high risk, low probability scenario) for sea level rise to assess a credible maximum scenario. However, the EA have stated that mitigation will not need to be provided up to the H++ scenario. The H++ allowances for change to relative mean sea level up to the year 2115 are provided within the EA's Adapting to Climate Change guidance. The data has been extrapolated using a linear approach to calculate the rate of sea level rise from 2116 to 2140 to cover the design life of the Scheme. The UK climate change predictions are in the process of being updated and expected to be released November 2018. The impact of this will be determined when more information is available. For details on the climate change calculations, see Annex B.

12A.3.12. The final ESLs are shown in Table 12A.1. The ESLs are provided by the EA, the climate change levels and H++ climate change levels have been calculated from these using the methods described above.

Table 12A.1 - Extreme Sea Levels

Event	5% AEP (mAOD)	0.5% AEP (mAOD)	0.1% AEP (mAOD)
ESL	2.84	3.5	4.03
Climate Change	4.38	5.04	5.57
H++ event Climate Change	5.94	6.6	7.13

12A.3.13. Figure 12A.2 shows the tidal curves that have been derived for use in this assessment.

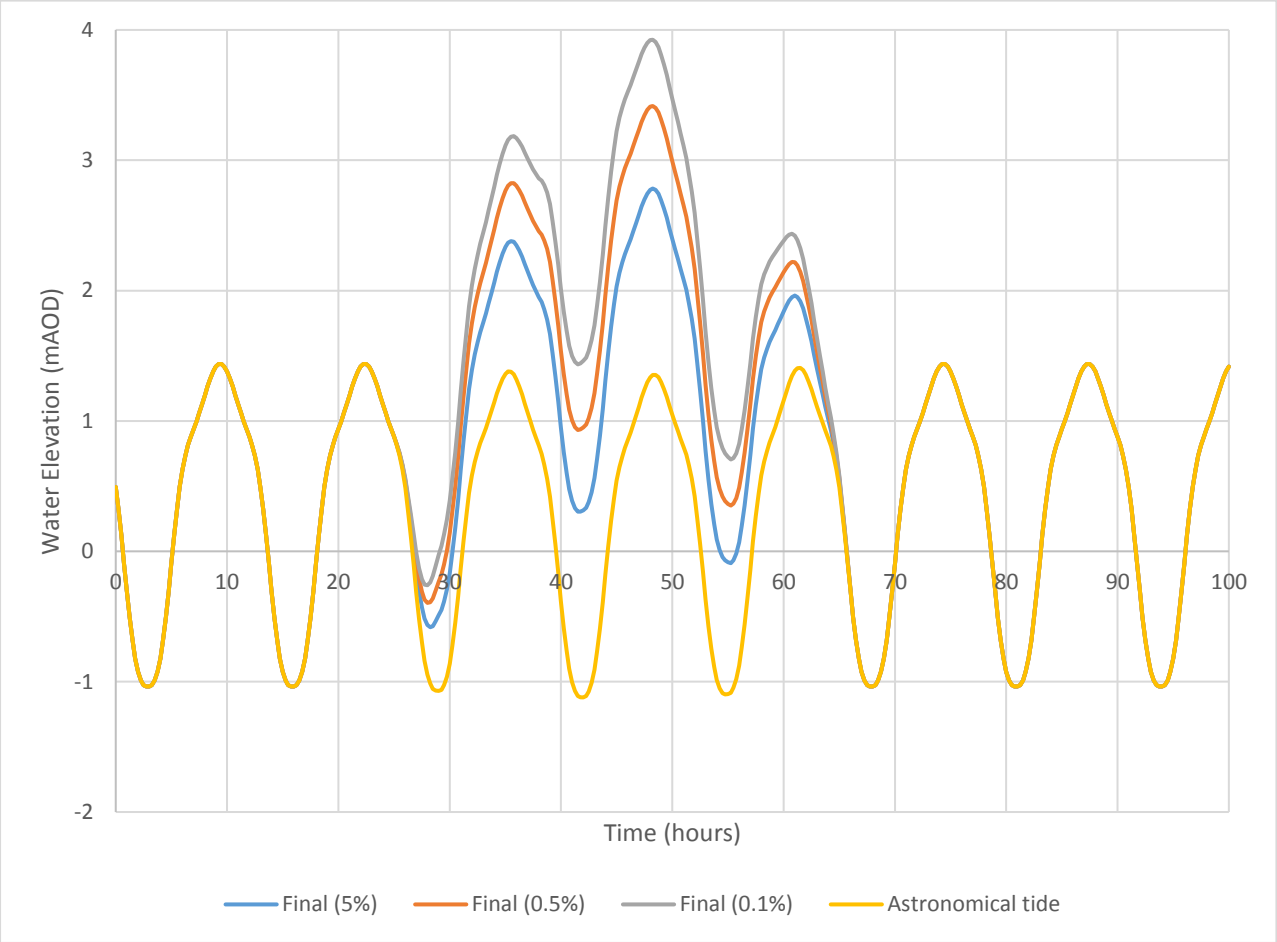

Figure 12A.2 - Extreme Sea Level Curves

12A.4 PRELIMINARY RESULTS

12A.4.1. The preliminary model has been used to simulate the 5th/6th December 2013 tidal event shown in Figure 12A.3. Inflow hydrographs have been specified at the gauge locations shown in Figure 12A.1 and the model has be used to resolve the flow patterns between. Widespread flooding was reported during the 5th/6th Dec 2013 event when a large part of Great Yarmouth was subjected to tidal inundation as the town's defences were breached. Gauge data from the EA has been used to create the event profile which is simulated in the hydraulic model. A check of the peak water level compared to the data from the Open Coast CFBD) Flood Risk Study (2014) completed by JBA on behalf of the EA shows that the event can be classified as approximately a 1% AEP event.

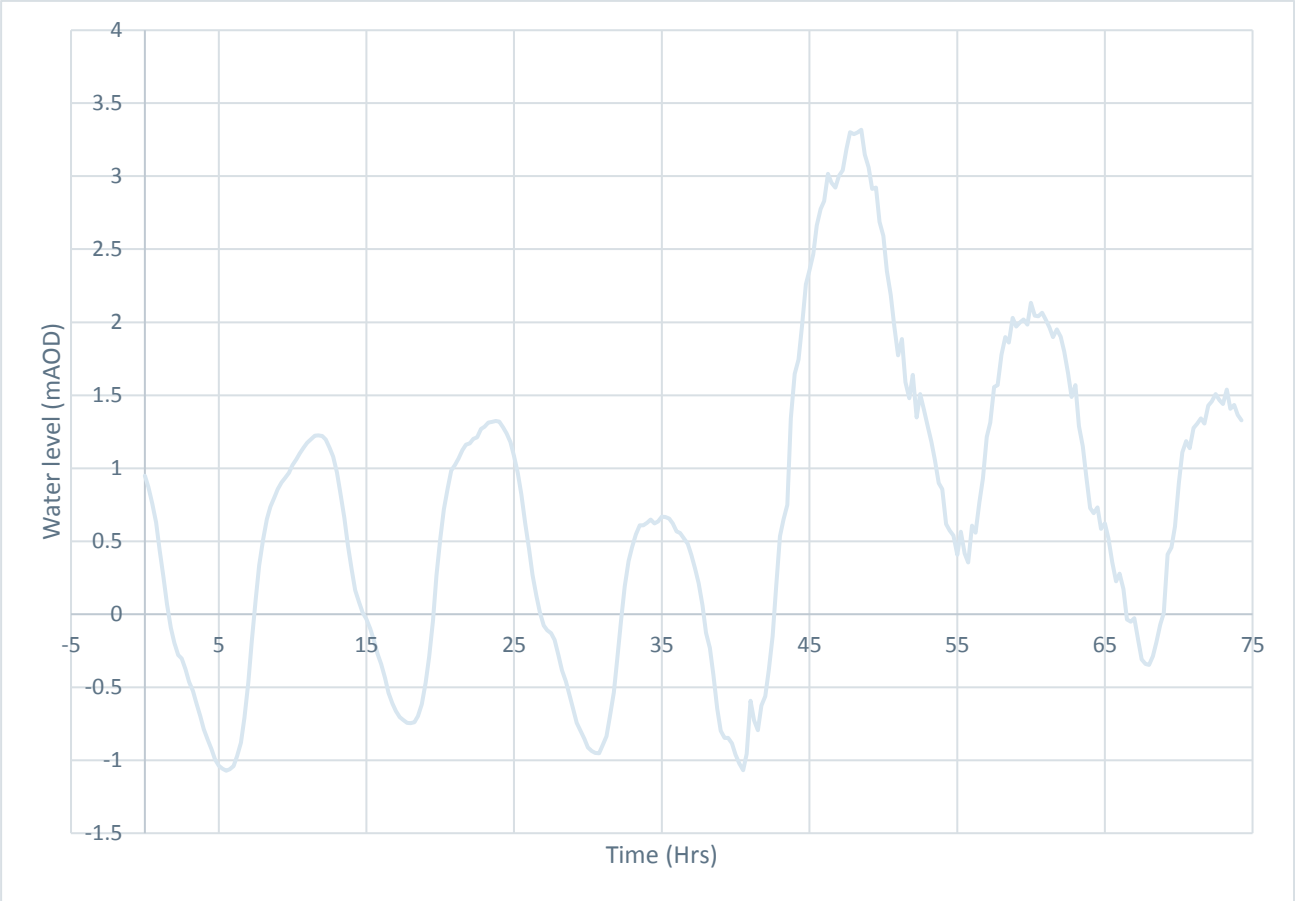

Figure 12A.3 - 2013 Event Tidal Curve

12A.4.2. Figure 12A.4 shows the flooding predicted by the model for the 2013 event. The event caused flooding to many parts of the town as the tidal surge impacted water levels up the River Yare and exceeded the existing defences. The figure shows that when the defence height is exceeded water flows around structures and inundates a large area of Great Yarmouth. At this stage, the model has not been calibrated and therefore the results are subject to change following a detailed verification process.

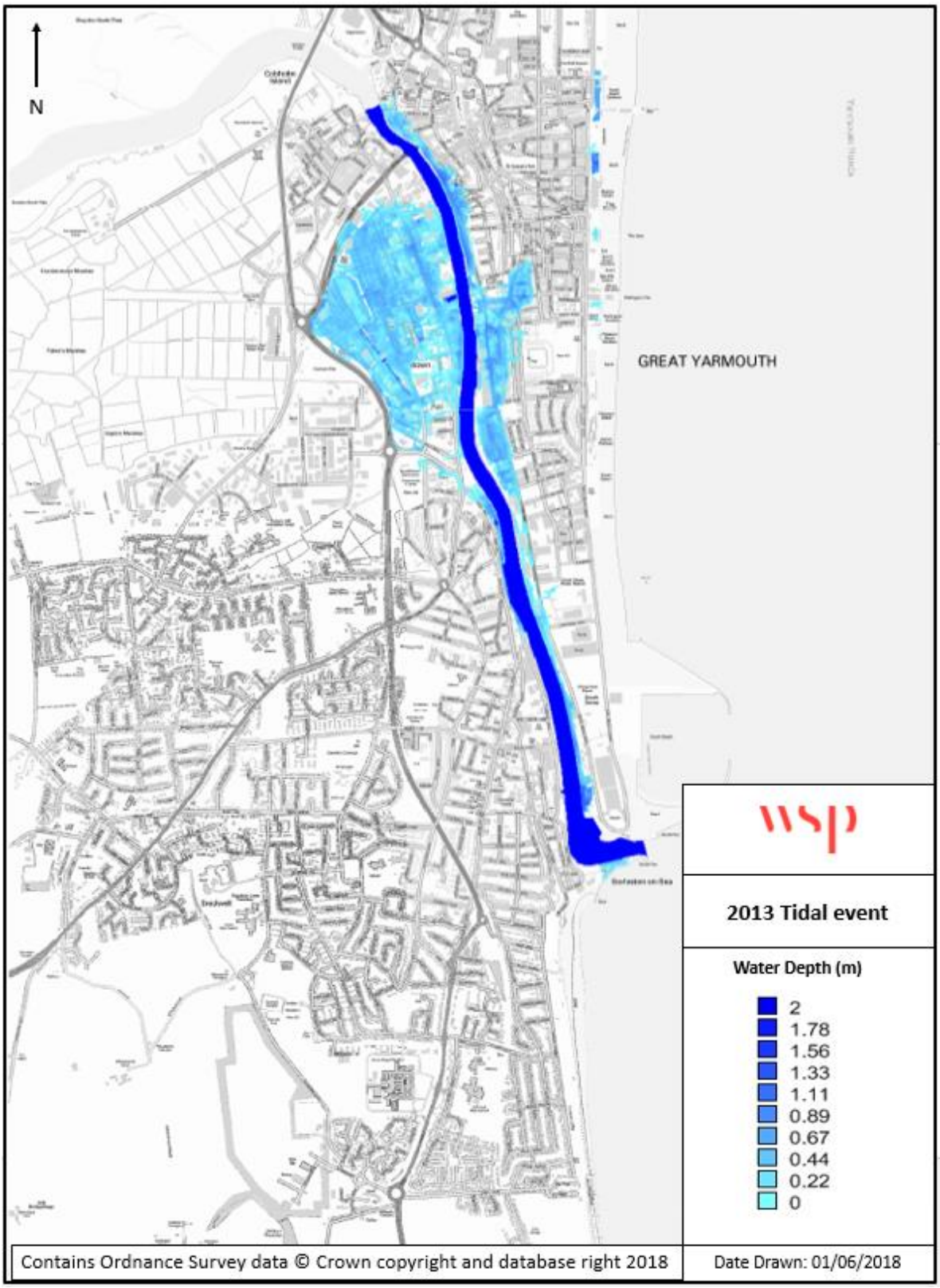

Figure 12A.4 - Baseline Flood Map for the 2013 Event

12A.5 CONCLUSIONS AND LIMITATIONS

12A.5.1. The work carried out thus far to assess the scheme for flooding impacts has included a detailed model review of an existing model which concluded that a smaller, bespoke model for Great Yarmouth was necessary. The initial data collection has been carried out and a model created to simulate the impact of the December 5th/6th tidal event has been built. Great Yarmouth was subjected to tidal inundation during the event and model predicts tidal inundation however checks need to be carried out to ensure the model extent matches reality in detail.

12A.5.2. The extreme sea level boundaries for 5% AEP, 0.5% AEP and the 0.1% AEP present day, Climate Change and High Emissions epochs have been created for input to the model. The extreme tidal peak levels are provided in Table 12A.1.

12A.5.3. There is a significant amount of work to be carried out prior to the full flooding assessment of the scheme to ensure the model is fit for purpose. This will include;

- Hydrological assessment of the boundary conditions;
- Sensitivity testing including roughness and boundary conditions;
- Verification of the model results to an actual event (5th December, 2013); and
- Detailed assessment of the impact of the Scheme investigating the change in water level, flood extent and hazard.

12A.5.4. At this stage the results from the model are preliminary and subject to change following a detailed calibration/verification exercise. No design decisions should be made based on the flood map presented in this technical note.

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Annex A

HYDRAULIC MODEL REVIEW

Great Yarmouth, Third River Crossing

Technical Note (Model Review Form)

Aug 2017

Produced for

Norfolk County Council

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Document Control Sheet

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Report Title	Environment Agency (EA) model review.
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Issue	Status	Author	Date	Check	Date	Authorised	Date
1	Draft	D Eddon	August 17	J Hunt	August 17	J Hunt	August 17

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Norfolk County Council		Electronic

1 Background to this review

Item:		Comment:
1.1	Review title:	Great Yarmouth 1d/2d ISIS-TUFLOW model
1.2	Review purpose:	**Context:** The review of the Environment Agency (EA) Great Yarmouth model provided to WSP in July '17 has been carried out to assess whether the model can be used to investigate the impacts of the proposed Great Yarmouth Third Crossing bridge on the water levels in the River Yare, Great Yarmouth. The Great Yarmouth model was originally developed from the Broadlands Environmental Service Limited (BESL) 1D model to assess the existing flood extent in the Great Yarmouth area by creating a 2D domain to simulate the flood plain. An updated version was used in the Great Yarmouth Flood Defences Framework for Action (GYFDFFA) project which contains the as-built representation of all the tidal defences in the harbour. The model provided by the EA to WSP is a 1D/2D ISIS-TUFLOW model which uses the as built defence elevation data and the tidal curve calculated in 2009, for this reason the 'present date scenario' was set in 2009. Along with the above mentioned hydraulic models, the following documents were also received by WSP: • Great Yarmouth Modelling Report, 2011 • GYRM_ISIS-TUFLOW_log_v6.xls – Model log. The model reviewed here is the most recent model for Great Yarmouth in the files received by WSP. The report states that the defences are set at design level and have not taken into account any deterioration in the intervening years. There are a number of return periods modelled (5yr,20yr,75yr,100yr,200yr,1000yr) therefore WSP has chosen to focus this review on the most recent 1 in 100 year present day model, noting that a later model with increased roughness has been included to simulate larger return periods (1000yr). The model is reviewed with the Great Yarmouth Third Crossing hydraulic assessment in mind. As a result, the majority of the 1D network of the Norfolk Broads is not reviewed in detail however comments are made where appropriate.
1.3	Reviewed	Model hydraulics and hydrology.
1.4	Review undertaken for:	Norfolk County Council
1.5	Review undertaken by:	Dan Eddon, WSP
1.6	Date of review:	August 2017

1.7	Review version (s):	GYMR_20100826_GM01.dat and all associated files.
1.8	Model produced by:	Halcrow Group Limited
1.9	Action levels	Recommendations are made with three priority levels as described below: Must be addressed as part of the current study Please follow recommendation if time allows Not strictly necessary in this case but good practice to consider for future studies na No action required
1.10	Study aims & objectives:	The aim of the current study is to assess the existing level of flood risk within Great Yarmouth and determine the impact of the proposed third crossing on flood risk within the town.
1.11	Area of interest:	The model simulated the Norfolk Broads in 1D representing the large storage areas using spill units and reservoirs. The Great Yarmouth area is represented using 1D channel units to simulate the harbour and 2D domain to simulate the surrounding flood plain. The specific area of interest in this review is the River Yare through Great Yarmouth and the surrounding floodplain.

2 Background to this review

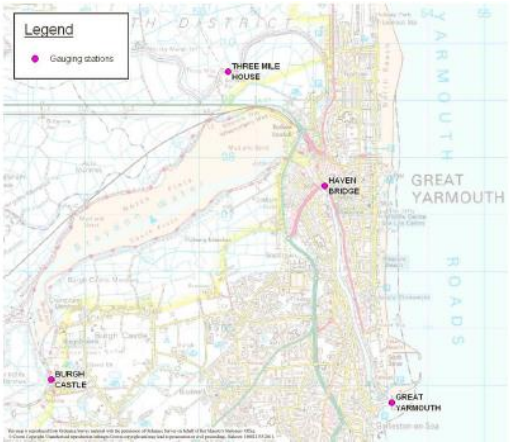
Subject document / file		Description	Version/Date	Filename	Reviewer's comments
2.1	Hydraulic model Guide	Modelling report provided with the model.	Final report issued in April 2011	GreatYarmouth_Report_2011-04-18_GM.doc	Note provides sufficient detail on the Great Yarmouth model development.
2.2	Flood estimation calculation record	N/A	N/A	N/A	The report references the tidal curve calculations stating that the derivation was carried out in 2009. It states that the process used gauge data to produce an astronomical tide and used the peak water levels from the Royal Haskoning 2007 Extreme Tide Level Report.
2.3	Model log Document	A model log is provided listing all the model files, both 1D and 2D for the simulations.	Last entry : 20/9/2010	GYRM_ISIS-TUFLOW_log_v6.xls	The model log document is provided for the model and the roughness patch model. However, in the model files there is a model; GYMR_20110617_GM03.DAT which is not included. It would be

				useful to obtain a description of this model. The model log does not appear to be up to date. It appears that additional models for the 2011 tidal curve update have also been supplied. Limited information is provided in the appendix of the report regarding this model. A comprehensive model log is recommended.

3 Model summary

Issue	Summary	Reviewer comments	Action
3.1 Software used, including versions	The model results have been included in the data and have been simulated on: - ISIS Version 3.4 with a numerical engine core version 6.4.0.52 - TUFLOW build 2009-07-DA-iSP Current software available to WSP: Flood Modeller VER= 4.2 TUFLOW = 2016-03-AD (License limited to 1000 1D nodes)	The model runs are simulated on outdated software versions which have been significantly updated. This review recommends using the most up to date modelling software versions in the Great Yarmouth Third Crossing assessment.	**Must do**
3.2 Return periods provided for review	A full range of return period models have been provided. - 5yr, 20yr, 75yr, 100yr, 200yr, 1000yr – 2009 - 5yr, 20yr, 75yr, 100yr, 200yr, 1000yr – 2109	na	na
3.3 Scenarios provided for review	The EA provided a number of scenarios - GYMR_20100826_GM01.DAT – standard model - GYMR_20100902_GM01.DAT – increased roughness	na	na
3.4 All model files provided for review?	Yes	na	na
3.5 Does the model run as provided?	Yes – according to the model log.	WSP cannot run the model as supplied due to the node limit on the software license. However, the model log states that the model runs and 1D and 2D results have been provided by the EA.	na

4 Hydrology

4.1	Hydrology – Methodology	The report discusses the procedure used to derive the tidal curve. It states that the Royal Haskoning, 2007 Extreme Sea level Report is used for the extreme water levels. Regional Net Sea Level Rise Allowances, Defra 2006 is used to provide the climate change increases. The report states that the river flow is insignificant in a flood event as the flood mechanism is predominately tidal. Therefore nominal base flows are provided for the fluvial sources.	A review of the tidal curve is recommended using the most up to date guidance. At the time of writing this review, it is recommended that the '*Coastal flood boundary conditions for UK mainland and islands, EA 2011'* is used for the extreme sea levels and surge shape. The climate change allowance should be obtained following the guidance in '*Adapting to Climate Change, EA 2016'*. It is also recommended that the EA be consulted during this procedure. The EA Extreme Sea Levels have recently been updated and these should be used in the third crossing study. Nominal fluvial base flows are considered appropriate for this application.	**Must do**
4.2	Gauging stations	There are four level gauges in Great Yarmouth as shown in Figure 1 taken from the model report.  FIGURE 1 - GAUGE LOCATIONS (HALCROW, 2011)	The model uses the Great Yarmouth tidal gauge to obtain the astronomical tide and compares the model simulation results to the three inland level gauges as validation.	N/A

4.3	Catchment delineation and catchment characteristics	River catchments are not critical in this model as the system is tidally driven. Catchment descriptors are used within FEH boundary units within the model but the flows are scaled by 0.001 to provide a nominal inflow.	N/A	na
4.4	River inflow peaks	River inflows are set at a nominal base flow.	N/A	na
4.5	Pooling Group	Statistical analysis was not undertaken.	N/A	na
4.6	Model inflows	The model uses a HT boundary at the coastal boundary in Great Yarmouth calculated using the procedure in the Royal Haskoning 2007 Extreme Sea Levels report. This method uses an astronomical tide profile which has been derived from the Great Yarmouth gauge at the harbour entrance. The astronomical tide is then scaled by the tidal surge profile which is provided in the Extreme Sea level report to the required water level. A number of FEH boundary units are used to simulate the fluvial sources in the 1D network. They use catchment descriptors to produce a hydrograph and then scaled by 0.001 to input a nominal flow.	The tidal boundary procedure is appropriate for use in this study however the tidal peaks should be updated (see 4.1). The method of using nominal fluvial base flows is appropriate in this case.	na

5 1D Domain - General

Issue		Summary	Reviewer comments	Action
5.1	Length of 1D domain(s)	The 1D model covers the Norfolk broads; a complex network of navigable rivers, lakes and low-lying wetlands. The River Yare and the major tributaries (Rivers Ant, Bure, Chet, Thurne and Waveney) are simulated in 1D totalling approximately 135lm of modelled reach. - River Yare : 42km - River Ant: 7.5km - River Chet: 6km - River Bure: 36km - River Thurne: 11km - River Waveney: 33km -	na	na
5.2	Node summary and model extent	4165 nodes in total. Each of the watercourses has an upstream inflow unit which has been calculated using FEH and scaled by 0.001 to produce a nominal inflow. Similarly, lateral boundaries are scaled in the same way.	na	na

		The model has one downstream boundary at Great Yarmouth. At this location, a tidal curve (see 4.1) is applied and routed though the 1D channel. The sea boundary at Lowestoft has not been included because it is assumed that the lock separating the Broads and the Harbour stops all water and Oulton Broad is sufficiently large to store flood water.		
5.3	Naming convention	Naming convention based on section and chainage, for example GY198 is 198 metres from the north sea in Great Yarmouth.	Suitable naming convention	na
5.4	Topographic/ Bathymetric survey	No survey was made available for use in this review.	It has not been possible to check the model geometry against survey data. This review recommends survey data for the bridge area should be obtained and will be required to assess the suitability of the LiDAR in the critical area. A bathymetric survey of the harbour should also be provided to create an accurate representation of the harbour channel.	**Must Do**

6 Hydraulics

<table>
<tr><th colspan="2">Issue</th><th>Summary</th><th>Reviewer comments</th><th>Action</th></tr>
<tr><td>6.1</td><td>Downstream boundary</td><td>Downstream boundary is the tidal curve.</td><td>This is appropriate.</td><td>Na</td></tr>
<tr><td>6.2</td><td>Channel width</td><td>The 1D cross section width in the ISIS model has been compared to the inactive code layer width throughout the 1D-2D linked reach, the 1D channel widths in ISIS are the same as the 1D channel width represented in 2D. WLL lines are used to show the 1D water levels in the 2D domain.</td><td>This is considered best practice.</td><td>Na</td></tr>
<tr><td>6.3</td><td>Manning’s N</td><td>At the stage of this review WSP does not have any information from the site regarding channel and floodplain materials. In the model, the roughness in the harbour channel in Great Yarmouth is set to 0.025, equivalent to a gravel bed. The roughness on the broads is set between 0.05 and 0.03.

A short section (400m) of the harbour near the tidal boundary has been increased to 0.035 in all model runs for stability in higher return periods (5yr,20yr,75yr,100yr,200yr,1000yr)

The 2D roughness values are presented in Table 1.

Table 1 – Roughness Values in 2D domain
<table><tr><th>Material</th><th>Roughness</th></tr><tr><td>Buildings</td><td>0.1</td></tr><tr><td>Manmade</td><td>0.04</td></tr><tr><td>Natural</td><td>0.06</td></tr><tr><td>Trees</td><td>0.08</td></tr></table></td><td>The roughness values in the 1D channel are appropriate in this situation. However, it is best practice to not use roughness patches if possible. It is therefore a recommendation of this review that the roughness patch at the harbour entrance is removed if possible.</td><td>Useful</td></tr>
<tr><td colspan="3"></td><td>The roughness values in the 2D domain are predominately appropriate however, the building representation should be increased to 1 and used in the conjunction with the stubby building method.</td><td>Must Do</td></tr>
</table>

6.4 Structures	There are no structures represented in the 1D domain or in the 2D domain in Great Yarmouth. There are a large number of spill units to represent the flow out of the channel onto the flood plains in the 1D only sections of the network.	It is recommended that sensitivity testing is carried out on Haven bridge in Great Yarmouth and if necessary it should be included in the final model. It is recommended to represent the energy loss through the bridge.	**Must Do**

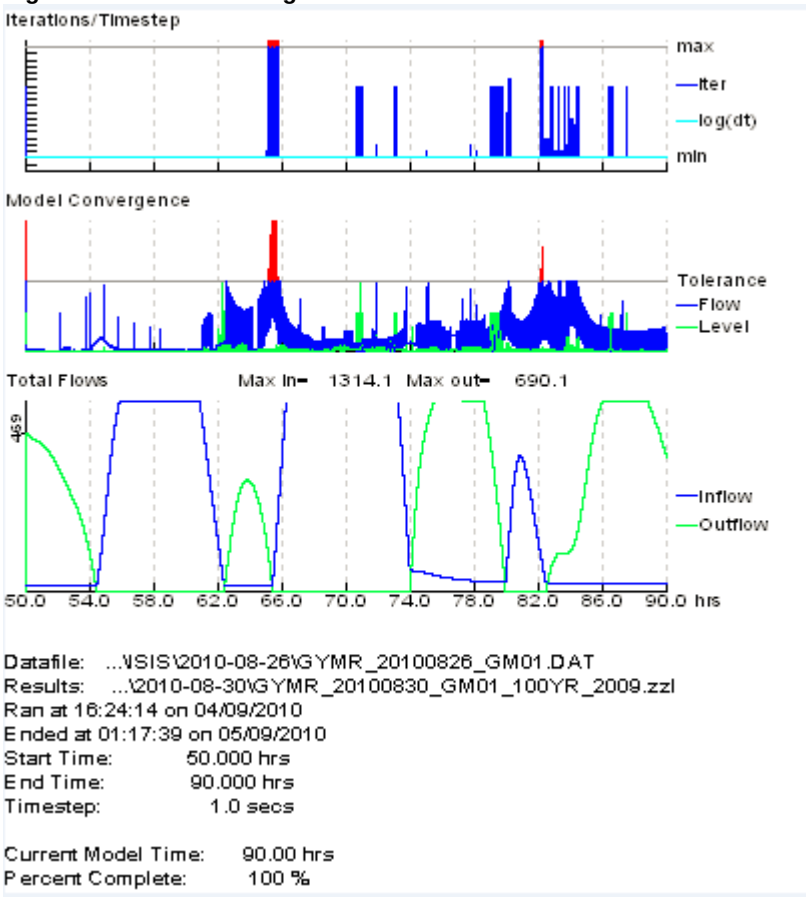
7 2D Domain - General

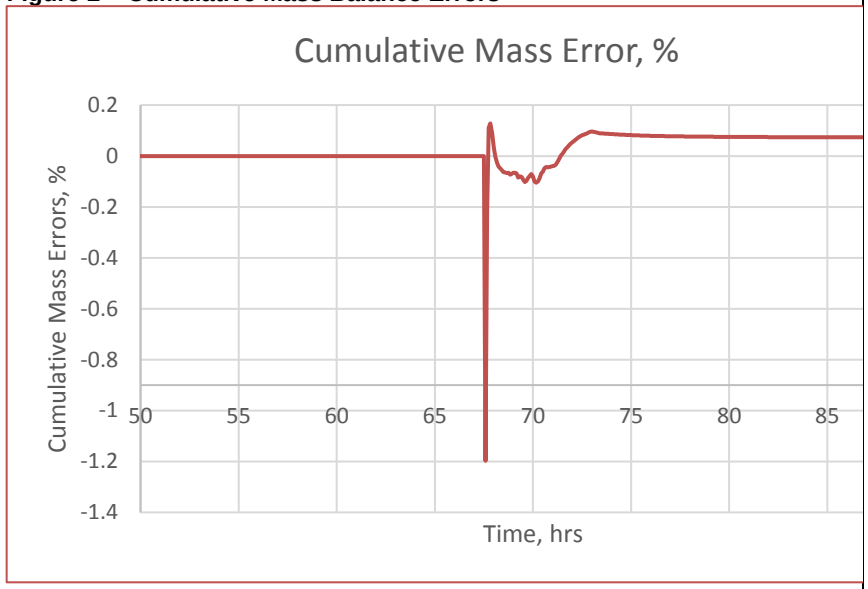
Issue	Summary	Reviewer comments	Action
7.1 General, Cell size(s), Suitable for study objectives?	10m grid size. The 2D grid simulates all Great Yarmouth, the River Yare and the land mass between the River Yare and the River Bure.	Cell size should be reduced if possible.	**Useful**
7.2 Base topography	The Grid is initially set up using 'Read MID Zpts': - 2d_zpt_SAR_GYMR_20100825_GM01.mid The zpts are based on Synthetic-Aperture Radar (SAR) data from EA.2002, which has now been partially superseded by LiDAR. LiDAR is read into the model where available. - 2d_zpt_LiDAR_GYMR_20100825_GM01.mid The LiDAR used 0.25, 0.50, 1 and 2 m LiDAR flown in August and October 2009 and covers the area near the coast.	It is recommended that the most up to date LiDAR dataset is used to create the surface. There is full LiDAR coverage 2D domain, there is no need to use SAR data within the model.	**Must Do**

7.3	Topographical Adjustment	The following adjustments were made to the topography: - 2d_zsh_bank_level_GYMR_20100826_GM01.MIF: remove Rivers to avoid low zpts. - 2d_zsh_roads_GYMR_20100826_GM01.mif: ensure roads are raised sufficiently. - 2d_zsh_flow_path_GYMR_20100827_GM01.MIF: subways only below Gapton Hall Road. - 2d_zpt_corr_GYMR_20100826_GM01.MID: correct occasional zpt at SX and river banks. - 2d_za_buildings_GYMR_20100825_GM01.MIF: raise building by 0.3m. - 2d_zsh_defences_GYMR_20100828_GM01.MIF: raise defences along river bank - 2d_zsh_additional_defences_GYMR_20100827_GM01.MIF: additional defences at Yarmouth, Abberton Farm and Gapton Hall Retail Park	Sensitivity testing on the Rivers zpts file is recommended. Updates in software since model inception may increase stability allowing modelling of smaller watercourses in the region within the 2D domain.	**Useful**
			Comparing the defence elevations to existing site information is recommended to ensure the most up to date defence elevations are used.	**Must Do**
7.4	Buildings representation	Buildings are represented by Mannings roughness value of 0.1 in conjunction with a 0.3m threshold level using the stubby building method.	The stubby building method is best practice however it is recommended that the roughness value is set at 1 to represent the slowing of flows through buildings.	**Useful**
7.5	1D-2D linking	There are several links between the 1D and 2D domains; - 2d_bc_sx_GYMR_20100826_GM01.MIF: boundary between reservoirs in ISIS and 2D TUFLOW domain - 2d_bc_hx_GYMR_20100827_GM01.MIF: Boundary between river and land (spill between 1D and 2D domains) There is two small Estry networks to simulate the flow under an overpass: - GYMR_20100830_GM01_100yr_2009.ecf	Boundaries appear to be stable and show no local significant mass balance errors.	Na
7.6	Abstraction units	The report states a number of pumps are used in Great Yarmouth in low lying areas which have been represented using abstraction units in the 2D domain.	This review recommends a review of current pumps in Great Yarmouth and if required update the operation of the abstraction units.	**Must Do**

8 Model Run Parameters and Model Performance

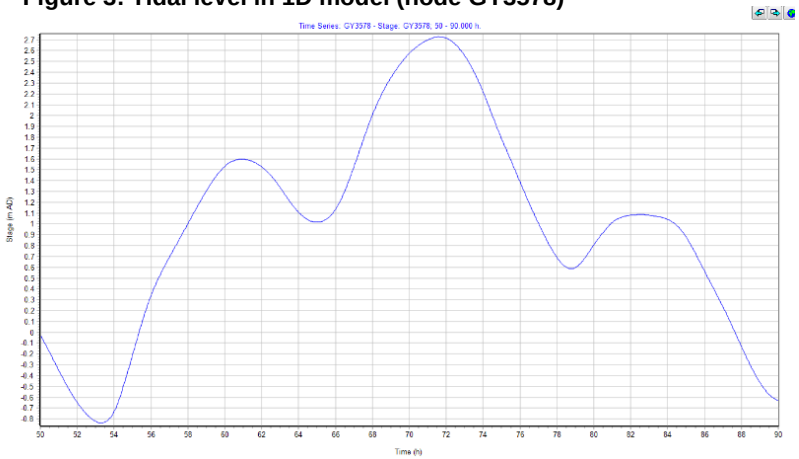
Issue		Summary	Reviewer comments	Action
8.1	Computational Time-step and run time	1s in 1D and 2s in 2D. (runtime 8:53:24)	This is considered suitable for model configuration. This can be decreased if the large events cause stability issues. Reducing the runtime would be preferable if possible.	**Good Practice**
8.2	Run parameters (amended from default)	Automated Priessmann slots applied to river sections Qtol is set at 0.03 Theta is set at 0.55 Other parameters are as default The model is run from restart files, GYMR_20100828_GM01_1000yr_2009.trf simulating 50hr to 90hrs.	Automated Priessmann slots are applied within the simulations provided for review. This option can mask errors in input data. Whilst these are not evident in data provided for this review, if the model runs without this option applied then it is recommended that this option is unchecked.	**Good Practice**
			The Qtol value should be reduced to default 0.01 if possible. Similarly Theta should be set to the default value of 0.7.	**Useful**

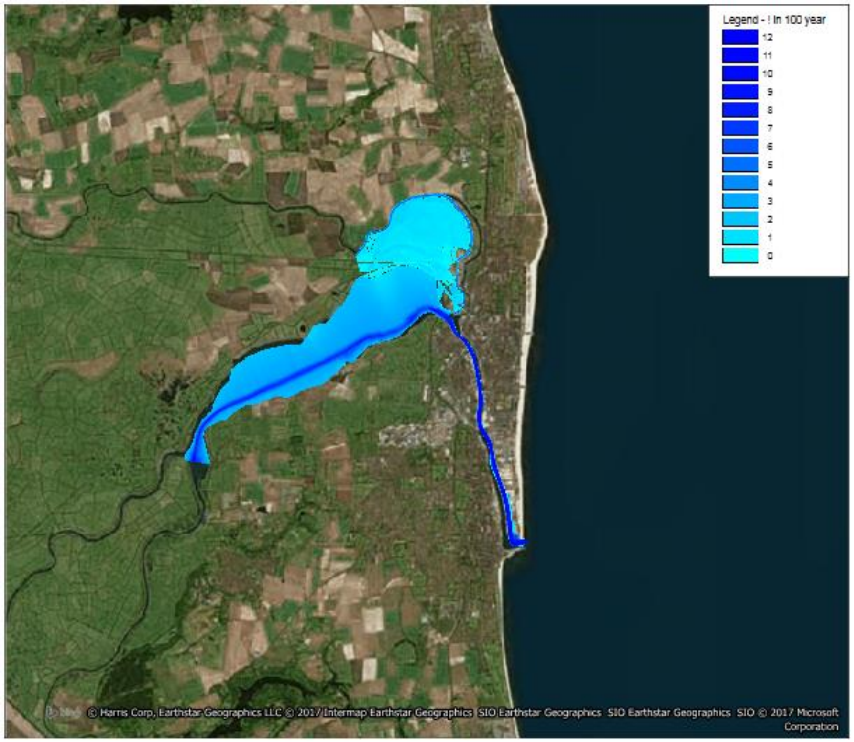
8.3	Convergence	ISIS model runs show that there are some instances of poor model convergence (figure 1). **Figure 1 – Model Convergence**  	The poor convergence is at the high water point. In a tidal model of this size, this is acceptable however it should be reduced if possible.	**Useful**

8.4	Mass errors (target ± 1% for fluvial models)	The cumulative mass error is less than ± 1% for the majority of the simulation, except a point during the high tide where the error reaches -1.2% (figure 2). **Figure 2 – Cumulative Mass Balance Errors**  	This is acceptable when considering tidal models in TUFLOW due to the influx of large volumes of water. However, it is recommended that the Cumulative Mass Error is reduced if possible. Additional checks should be made in larger events	**Useful**
8.5	Error Messages	58 Warnings prior to simulation; - XY: WARNING 2117 - Inactive 2D cell made active by 2D SX link.	na	

9 Model Results

For the purpose of this review, the results in the area surrounding Great Yarmouth will be considered. It is assumed that the rest of the 1D domain is providing a nominal flow only.

Issue		Summary	Reviewer comments	Action
9.1	1D water surface profile	The 1D water surface profile looks reasonable. The animation plot of the long section along the Great Yarmouth channel shows expected cyclical behaviour. Figure 3 shows a typical tidal curve in the harbour channel from the 1 in 100 year model results. **Figure 3: Tidal level in 1D model (node GY3578)** 	na	na
9.2	2D results	A validation procedure has been carried out and described in the model report. The conclusion showed that the model predicted the water level at the three in land gauge sites well, with slight variation at peak water level. A number of sensitivity tests have been carried out in an attempt to better represent the peak water levels at the gauges. Nothing tried had a realistic impact on the water levels, therefore it was decided that despite the overestimation of the water level, the model would continue to be used in the assessment. The flood map shows that the tidal defences in Great Yarmouth can protect the town in events up to the 1 in 100 year. The storage provided by the large lake to the north of the town is sufficient to store any additional water from the peak tide (Figure 4). Significant flood inundation is seen in the landmass between the Rivers Yare and Bure.	An investigation to assess the reasons for the mismatch in peak water levels is recommended and if possible create a better fix to actual data. A reduction in model output file sizes is recommended. For this size of model output every 15 minutes is reasonable.	**Must Do**

	The data output files are very large. One simulation approximately outputs 3.4GB of data for the 2D results maps. WLL lines are used to interpolate the 1D water levels in the 2D domain and are saved every 300 seconds (5 mins). **Figure 4 : 1 in 100 peak water levels flood map** 		

10 Audit Trials

Issue		Summary	Reviewer comments	Action
10.1 Logbook provided?		Log book listing most of the files used in the models up to the models run in 2008.	A log book has been provided for this model although it does not appear to be up to date. There is no information on a model produced in 2011. From an assessment of this model it appears to have a different tidal inflow. This review recommends that a comprehensive model log file should be produced as part of the ongoing assessment.	**Useful**
10.2 Suitable file naming, structure & management?		No	The model files are not saved in the recommended format. Each model is saved in a folder named after the date of the modification/simulation. This creates confusion when trying to find files for each model. This review recommends a project folder is set up in the standard Tuflow file structure and the results and any bespoke model files are saved in folders with appropriate names, not referencing the date the work was carried out.	**Must do**
10.3 Check files provided		Yes	na	na
10.4 Comments provided within model?		Some comments are in the model file.	The model has a limited number of comments that refer to the 1D BESL model. There is limited commenting on the updates carried out since.	na

11 Conclusions

Conclusions
This review note presents comments noted during the review and recommendations for required actions. Recommendations are made with three priority levels: **Must do** Must be addressed as part of the current study **(to be discussed and agreed)** • Update the tidal curve inflow using mode up-to-date peak levels; • Request gauge data from level gauges in study area; • Request/obtain survey data at the proposed bridge location; • Obtain existing bridge data and perform a sensitivity; • Update LiDAR to most recent; • Carry out an updated calibration procedure; • Reduce model output file sizes by reducing the output time; • Create standard folder structure and model log; • Review water pumping stations and update abstraction units if necessary; • Perform a roughness update and calibration; • Review and compare the existing defence levels. **Useful** • Remove roughness patches near the harbour entrance; • Reduce cell size; • Add rivers into the 2D domain and perform tests; • Reduce QTol to default (0.01) and Theta should be set to the default value of 0.7; • Reduce model convergence in 1D and Mass balance errors in 2D. **Good Practice** • Reduce overall runtime run time and output file size; • Remove Preissmann Slots.

Annex B

DESIGN SEA LEVEL CALCULATIONS

CALCULATION CONTROL SHEET
PROJECT: Great Yarmouth, Third Crossing
PART OF PROJECT: Design Sea Level Calculations
CALCULATION TITLE: Design Sea Level Calculations record
FILE LOCATION:

CALCULATION SUMMARY
This report provides a record of the calculations and decisions made during the derivation of the tidal boundary inflows using the recommendations in SC060064/TR4: Practical Guidance design sea levels and consultation with the Environment Agency (EA)
Purpose of Calculations To derive design tidal inflow for the sea boundary in the Great Yarmouth hydraulic model.

CHECKING AND REVIEW STATUS

Rev	Purpose	Author	Reviewed	Authorised	Date
1	Draft for model build	DE	JH	SH	December 17

REVISION HISTORY

Revision Ref./ Date Issued	Date	Purpose and description of Amendments	Issued to
1	04/06/2018	Draft for model build	

CONTENTS

1 Introduction

This document provides a record of the calculations and decisions made during design sea level estimation. It will often be complemented by more general hydrological information given in a project report. This version of the report is for when a single tidal boundary is required.

2 Method Statement

Item	Comments
Purpose of study Give an overview which includes: • Purpose of study • Approx. no. of tidal boundaries required	The Great Yarmouth Enterprise Zone has the potential to create 5000 new jobs by 2025, and there are plans for 2000 new homes and 20-30 hectares of employment development. As part of this ambition, a third river crossing is required to accommodate the additional traffic flow. As part of the Environmental Statement for the proposed third crossing over the River Yare in Great Yarmouth harbour, it will be necessary to undertake a Flood Risk Assessment (FRA) to ascertain the potential impact of the new bridge on water levels within the River Yare and flood risk to the surrounding area. This document presents the tidal curve calculation for the sea boundary in Great Yarmouth Harbour. This is achieved by combining extreme water level, astronomical tide profile and a surge shape. Each component is derived following the SC060064/TR4: Practical Guidance Design Sea Levels (EA, 2011).
Description of catchment Brief description of catchment, or reference to section in accompanying report	Great Yarmouth is a seaside town in Norfolk on the east coast of England. The River Yare flows through the centre of the town creating a commercial port with a number of large ship berths. Tidal defences line the river edge, providing protection from coastal flooding to the town. The river flows in a southerly direction, under two existing bridges spanning the harbour to an almost right angle turn to the sea boundary. The River Yare is one of the sea boundaries of the Broadlands rivers catchment and is tidally driven and the flooding mechanism has been shown to be tidal. The tidal boundary is approximately a 12 hour cycle which drives the water levels in the harbour and across the Norfolk Broads.
Flood estimates required	Flow hydrographs / peak flow estimates are required for present day (2018) scenario, climate change and H++ as request by the EA: - 20 (5% Annual Exceedance Probability (AEP)), 200 (0.5% AEP), 1000 (0.1% AEP); - 20 plus climate change (5% AEP + CC), 200 plus climate change (0.5% AEP + CC), 1000 plus climate change (0.1% AEP + CC); - 20 plus H++ Scenario (5% AEP + H++), 200 plus H++ Scenario (0.5% AEP + H++), 1000 plus H++ Scenario (0.1% AEP + H++).

Table 1: Overview of Study

What is the source of the sea level data? • Admiralty Tidal Time Charts • Gauge Data	There are 2 gauges within the proposed modelled area, Great Yarmouth (NGR TG534943822) at the harbour entrance and Haven Bridge (NGR TG521987513)

Table 2: Source of Sea Level Data

Watercourse	Station Name	Gauging authority number	Grid reference	Period of available data	Type of Data
River Yare	Great Yarmouth	T341504	TG534943822	14 years	Tidal (Level)
River Yare	Haven Bridge	T341506	TG521987513	14 years	Tidal (Level)
Comments	Data for the gauge is provided in two formats, checked daily average sea levels from the EA and 15 minute 'live data'. Additional information has been reviewed from the National Tidal and Sea Level Facility[1] at the main gauge in Lowestoft, approximately 12km south.				

Table 3: Site information

Item	Comments
Other Flow / levels gauging sites	Two other gauges outside of proposed study area, Three Mile House and Burgh Castle
Historic flood data	New reports of a significant flooding event on the 5th/6th December 2013 which saw tidal inundation as the peak water levels exceeded the tidal defences.
Flow data for events	No flow data is available.
Results from previous studies / models	-
Other data (e.g. Groundwater, tidal	-

Table 4: Other Data Available

[1] http://www.ntslf.org/data/realtime?port=Lowestoft

Item	Comments
Outline the method	The conceptual method chosen here follows the guidance; *SC060064/TR4: Practical Guidance design sea levels.* In April 2008, the Environmental Agency (EA) undertook a strategic overview of the coasts in England. The guidance was created for the EA project, *Coastal flood boundary conditions for UK mainland and Islands (*SC060064/TR2: Design sea levels[2]), with the aim to update and consolidate the outdated methods for producing tidal curves suitable for Flood Risk Assessments. The aims of the project were to: - Provide a consistent set of extreme sea levels around the coasts of England, Wales and Scotland. - Provide a means of generating total storm tide curves for use with the extreme sea levels. - Offer practical guidance on how to use these new datasets. This method is acknowledged as the best method for calculating the tidal curves in the UK using the most up-to-date method and the best data available. EA recommends its use for tidal curve derivation when undertaking Flood Risk Assessments. A recent update carried out by JBA[3] has provided updated extreme sea levels that will be used in this assessment.

Table 5: Sea Level Derivation Method

[2] Coastal flood boundary conditions for UK mainland and islands SC060064/TR2: Design sea levels, Environmental Agency, 2011

[3] Open Coast (CFBD) Flood Risk Study (2014), JBA

3 Tidal Curve Calculations

The extreme tidal curves are derived using the guidance from *SC060064/TR4: Practical Guidance Design Sea Levels.* All decisions and reasons are presented.

Ten Step procedure
1. Check study location is outside of estuary boundaries
2. Select an appropriate chainage point for extreme sea levels
3. Select an annual exceedance probability peak sea level
4. Consider allowance for uncertainty
5. Identify base astronomical tide
6. Convert levels to Ordnance Datum
7. Identify surge shape to apply
8. Produce the resultant design tide curve
9. Sensitivity testing
10. Apply allowance for climate change

Table 6: Guidance

The guidance is part of the larger project, *Coastal flood boundary conditions for UK mainland and islands, (Environmental Agency, 2011)* and is the best method currently available for tidal curve derivation in UK waters. As part of this project a number of additional datasets are provided:

Additional Data
Estuary Boundaries
Extreme Sea Levels
Gauge Sites
Confidence Interval
Surge Shapes.

Table 7: Additional Data sets

Following the guidance, the event tidal curves are generated.

3.1 Check Study Location is Outside of Estuary Boundaries

The guidance is valid only for areas outside of estuaries, and as such the first check is to make sure the boundary is not in a major estuary. As part of the *SC060064/TR4 guidance,* a shape file is provided with all major estuary locations highlighted, Figure 1 shows a comparison between the River Yare estuary boundary and the Great Yarmouth model tidal boundary.

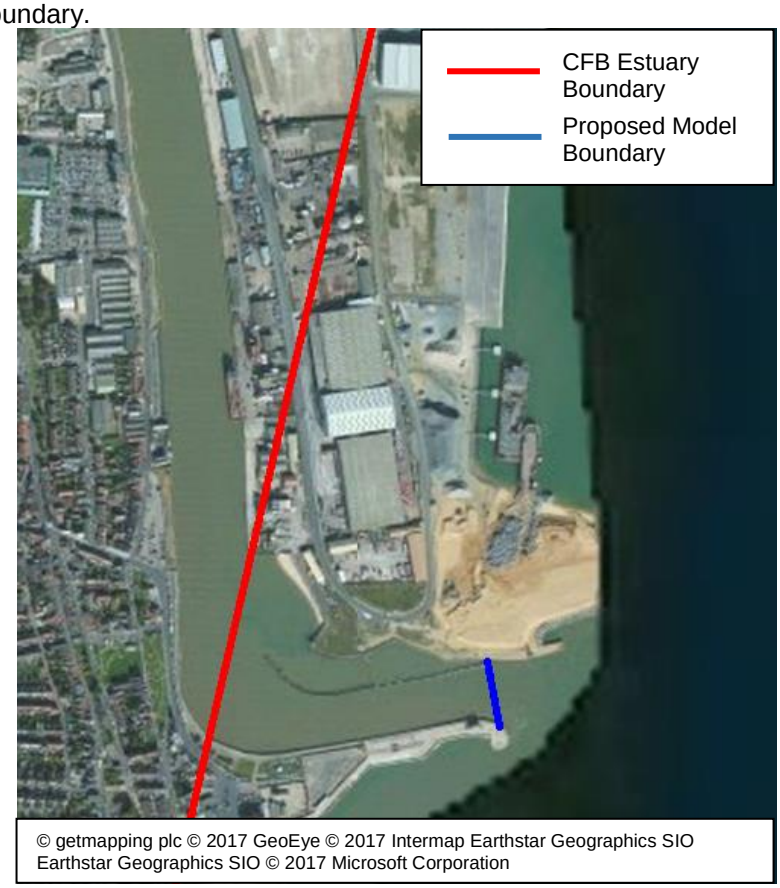


Figure 1: Estuary Boundary Check,

Figure 1 shows the estuary boundary of The River Yare in red and the proposed tidal boundary of the Great Yarmouth tidal model in blue. The tidal boundary is outside of the estuary, this shows the guidance is suitable for use in this application.

3.2 Select the Appropriate Chainage Point for Extreme Sea Levels

The guidance recommends that the extreme sea level node nearest to a perpendicular line drawn from the tidal boundary should be used to define the extreme sea levels for the site of interest. A perpendicular line drawn from the Great Yarmouth tidal boundary passes closest to 4150 chainage node as shown on Figure 2.

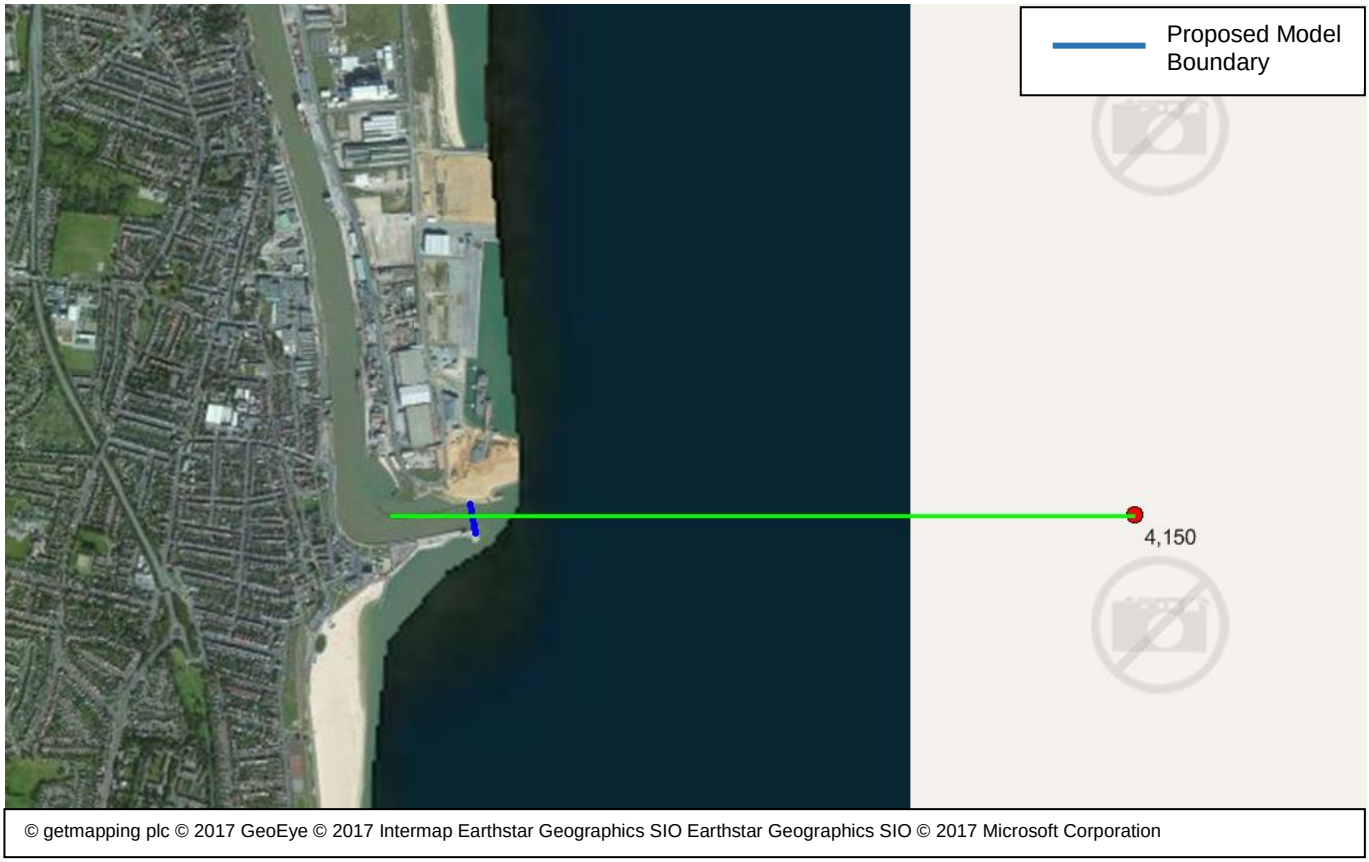


Figure 2: Chainage

3.3 Select an Annual Exceedance Probability Peak Sea Level

For each chainage node, an extreme sea level for the full range of return periods is provided in the additional data supplied alongside the guidance. The extreme sea levels modelled by JBA on behalf of the EA at node 4150 are provided in Table 8 for the events considered in this study.

AEP	Extreme sea levels (m AOD)
5%	2.84
0.5%	3.5
0.1%	4.03

Table 8: Extreme Sea Levels

3.4 Consider Allowance for Uncertainty

As part of the *SC060064/TR4* project, confidence in the extreme sea levels are provided as shown in Table 9 for the events considered in this study. The confidence levels are a measure of the potential error in the EA extreme sea level modelled results. The uncertainty is considered acceptable for this project. The EA require the scheme to be assessed against the high impact, low probability (H++) event. Modelling of the H++ event will demonstrate the sensitivity of the model to the levels forced at the tidal boundary.

AEP	Uncertainty (+/-m)
5%	0.2
0.5%	0.3
0.1%	0.4

Table 9: Uncertainty levels (node 4150)

3.5 Identify Base Astronomical Tide

The next stage of the tidal curve derivation is to identity the base astronomical tide. *SC060064/TR4* guidance states that the astronomical tide used for the tidal curve should have a peak between the Highest Astronomical Tide (HAT) and the Mean High Water Springs (MHWS). Table 10 shows the HAT and MHWS values for Lowestoft

from the National Tidal and Sea Level Facility[4] (NTSLF). This has been used as the HAT and MHWS were not available at the Gorleston gauge and the guidance recommends using the nearest gauge on the national network which in this case is Lowestoft. The tidal levels are provided in chart datum in Great Yarmouth harbour. Conversion to ordnance datum is to add -1.5m, this is carried out in part 3.6. This is because the gauge at Lowestoft is used to derive the astronomical tide.

HAT (mCD)	MHWS (mCD)
2.98	2.58

Table 10: HAT and MHWS for Lowestoft

The SC060064/TR4 guidance states that the Admiralty tidal tables should be used to estimate the astronomical tide. This step is unnecessary because Great Yarmouth has a tidal gauge in the harbour meaning that an astronomical tide can be obtained from recorded data.

Browsing the gauge data, a tidal profile with a peak tide of 2.85mCD was found at the Lowestoft gauge, it is deemed appropriate to use the HAT and MHWS as the guidance recommends the nearest suitable primary gauge. A check of the astronomical tide shows that the peak is within the HAT and MHWS range as recommended by the guidance. Figure 3 shows the astronomical tidal profile comparison to the HAT and MHWS.

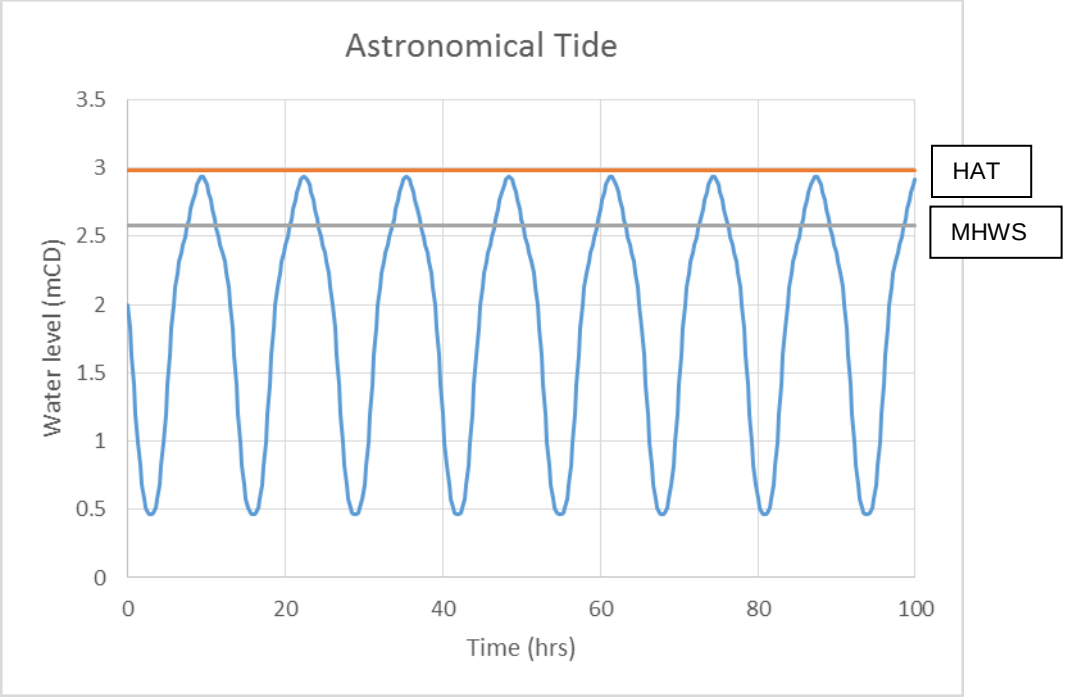


Figure 3: Astronomical tidal profile comparison

3.6 Convert Levels to Ordnance Datum

The tidal levels are quoted in chart datum and need to be converted to ordnance datum. A chart datum conversion is provided at key ports around the UK. In this case, the chart datum conversion is -1.5m. The data from the gauge site in Lowestoft is quoted in chart datum therefore this needs to be converted to ordnance datum to be comparable with the extreme sea levels and suitable for use in the hydraulic model.

3.7 Identify Surge Shape

As part of the *SC060064/TR4* project surge shapes were derived for key locations around the UK, the Lowestoft surge shape is number 9 in the Design_Surge_Shapes.xls provided with the guidance documentation.

[4] http://www.ntslf.org/tgi/portinfo?port=Lowestoft

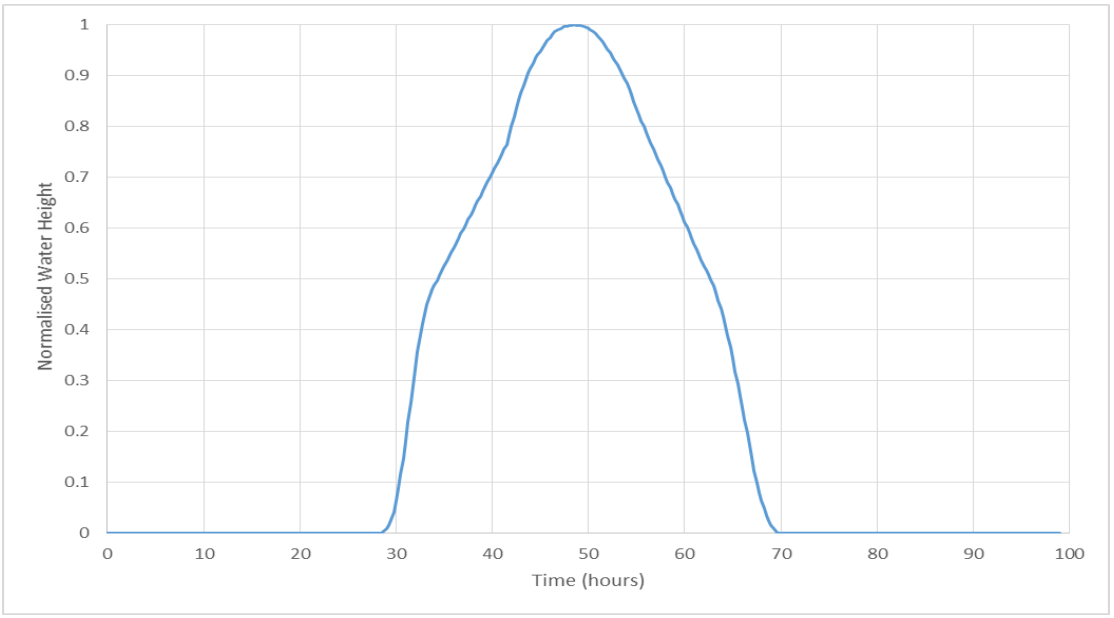


Figure 4: Shape 9 – Lowestoft Surge

Figure 4 shows the normalised surge shape at Lowestoft which is combined with the astronomical tidal profile to derive the design tide curve.

3.8 Produce the Resultant Design Tide Curve

The guidance states that the resultant design tide curve is derived by combining the extreme sea level, base astronomical tide and surge shape. The first process is to align the astronomical tide and surge shape peaks, in this case this is at 48.25 hours in line with the astronomical tidal curve.

Once the Astronomical tidal curve and surge shape are aligned, it is necessary to scale the astronomical tide to the required extreme sea level. To explain this procedure, the 0.5% AEP event will be used as an example. Firstly the difference between the required extreme sea level (3.5m AOD) and the astronomical peak (1.48m AOD) is calculated which in this example is 2.02m. As the surge shape is aligned with the peak water level time in the astronomical tidal curve, the maximum surge value of 1.0 occurs at the same time as the peak water level. The surge shape can now be scaled by the coefficient 2.02/1.0 = 2.02 m AOD, thus creating a surge height which can be added to the astronomical tidal curve resulting in the required peak water level for the event.

This procedure is carried out of each return period, scaling to the extreme sea level for a given design event (Table 8)

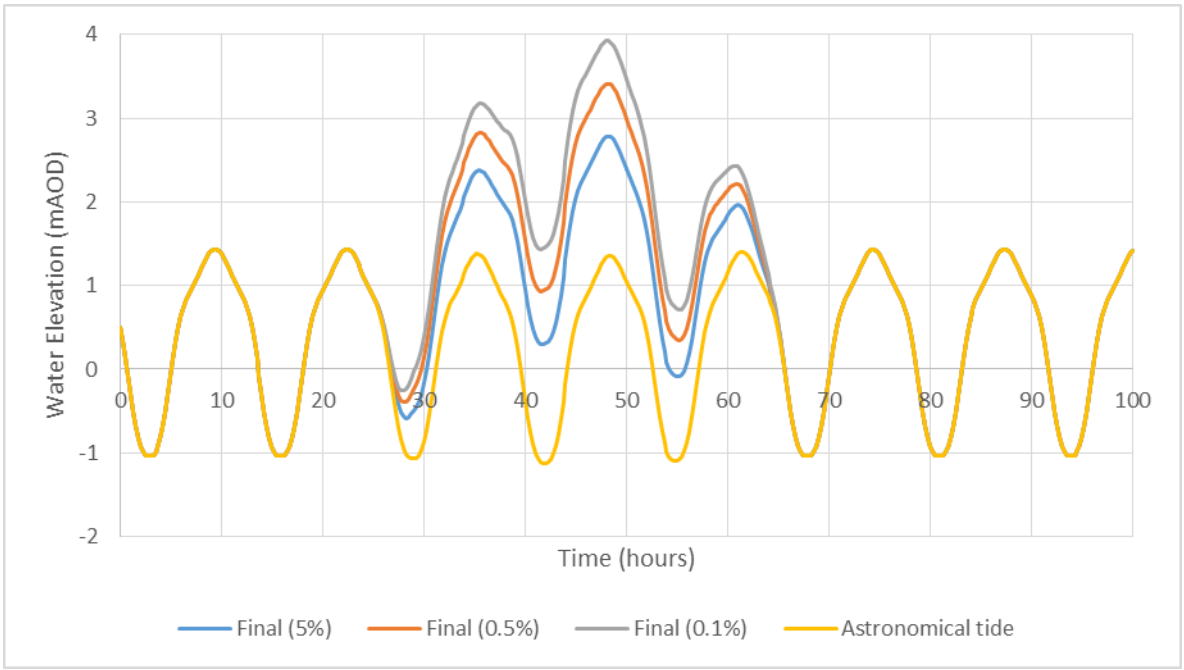


Figure 5: Final design event tidal curves

Figure 5 shows the final tidal curves for the 5% AEP, 0.5% AEP and 0.1% AEP events used in the model simulations.

3.9 Sensitivity Test

The guidance, *SC060064/TR4* requires the surge shape to be offset. This is to see the impacts of the surge arriving at a different time on the tidal curve. This is unnecessary for this study because the extreme tidal level remains at the same level which is the driving factor in tidal flooding. Other tests will be undertaken to determine the sensitivity of the model to certain parameters.

3.10 Climate Change Calculations

As the development is classed as Nationally Significant Infrastructure Project (NSIP) and 'safety critical' with a design life of 120 years, the EA have requested that the impact of the development is tested for climate change events. Following the advice presented in the National Policy Statement for National Networks[5] which states that if transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, climate change should be considered. Five different datasets shown in Table 11 have been assessed to ensure the worst case scenario for climate change for the available information is applied to the tidal curve.

Method	Climate increase
NPPF - Table 3	1.539m
UKCP09 50% HE	0.863m
UKCP09 95% HE	1.345m
UKCP09 95% ME	1.104m
Upper End	1.529m

Table 11: Climate change

The NPPF – Table 3 method is shown to be the largest increase at 1.539m as shown in Table 11. Table 12 shows the NPPF – Table 3.

NPPF – Table 3	1990 - 2025	2026 - 2055	2056- 2085	2086 - 2115	2116- 2140
East, East Midlands, London, South east	4	8.5	12	15	18
South West	3.5	8	11.5	14.5	17.5
North West, North east	2.5	7	10	13	16

Table 12: NPPF - Table 3

The East, East Midlands, London and the South east category is used in the derivation of climate change sea level rise. As the design life is beyond 2100, the high emissions sea level rise is calculated by extrapolating to the required year by extending the current data to 2140. An assumption has been made that the Great Yarmouth Third Crossing is unlikely to be constructed before 2020; therefore for the climate change calculations it was deemed appropriate to calculate sea level rise between 2020 and 2140.

The estimated sea level rise by 2140 is 1.539m.

As the development is considered safety critical, the EA have requested that the scheme is assessed against the high risk, low probability event (H++) scenario. However, mitigation for this scenario is not required, Table 13 shows the sea level rise in mm per year for the H++ scenario from *Adapting to Climate Change*[6]. As the guidance provides values up to 2115, the data is extrapolated using a linear approach to calculate the rate of sea level rise from 2116 to 2140 to cover the design life of the proposed development.

[5] National Policy Statement for National Networks, Department for Transport, 2014

[6] Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities

Change to relative mean sea level	Sea level rise mm/yr up to 2025	Sea level rise mm/yr 2026 to 2050	Sea level rise mm/yr 2051 to 2080	Sea level rise mm/yr 2081 to 2115	Sea level rise mm/yr 2116 to 2140
H++ Scenario	6	12.5	24	33	40

Table 13: Sea level rise, H++ scenario

Using Table 13, the total sea level rise for the H++ scenario is 3.1m based on 120 years from 2020-2140.

The climate change sea level increases are added to the astronomical tidal curve prior to the scaling process discussed above.

4 Conclusions

The extreme tidal levels in Table 14 have been derived following the guidance, *SC060064/TR4* and discussed in the previous section.

Table 14: Final calculated tidal peaks

Event	5% AEP (m AOD)	0.5% AEP (m AOD)	0.1% AEP (m AOD)
Present day extreme sea level (2018)	2.84	3.5	4.03
Climate change Scenario (based on NPPF – Table 3)	4.38	5.04	5.57
H++ event climate change	5.94	6.6	7.13

The final tidal curves generated will be used as the inflow boundary to the hydraulic model developed for the Great Yarmouth Third Crossing FRA. For the tidal curves for all events see Appendix 1.

4.1 Limitations

There are a number of limitations highlighted in the guidance documents. These are presented in table 14.

Limitation	Description
Extreme sea levels are considered accurate to one decimal place.	The extreme sea levels are considered accurate to one decimal place, two decimal places are provided only to differentiate between nodes on the chainage.
Extreme sea levels do not consider wave impacts	The sea level values presented include effects from the storm surge but do not include any impact on local sea level due to onshore wave action.

Table 15: Limitations of the tidal curve derivation method

The guidance document recognises flaws in the data used to produce the extreme sea levels, this is due to difficulty recording long-term sea level data. However, it is stated that this is the best possible method currently available and uses the most accurate initial conditions available. The limitations are considered acceptable for the accuracy required in a flood risk assessment therefore the extreme sea level curves will be used to assess flooding in Great Yarmouth due to the Third Crossing Development. The UK climate change prediction dataset is being updated and is due for release in November 2018, the impact of this realise will be considered if more information becomes available.

Appendix 1

Final tidal curves

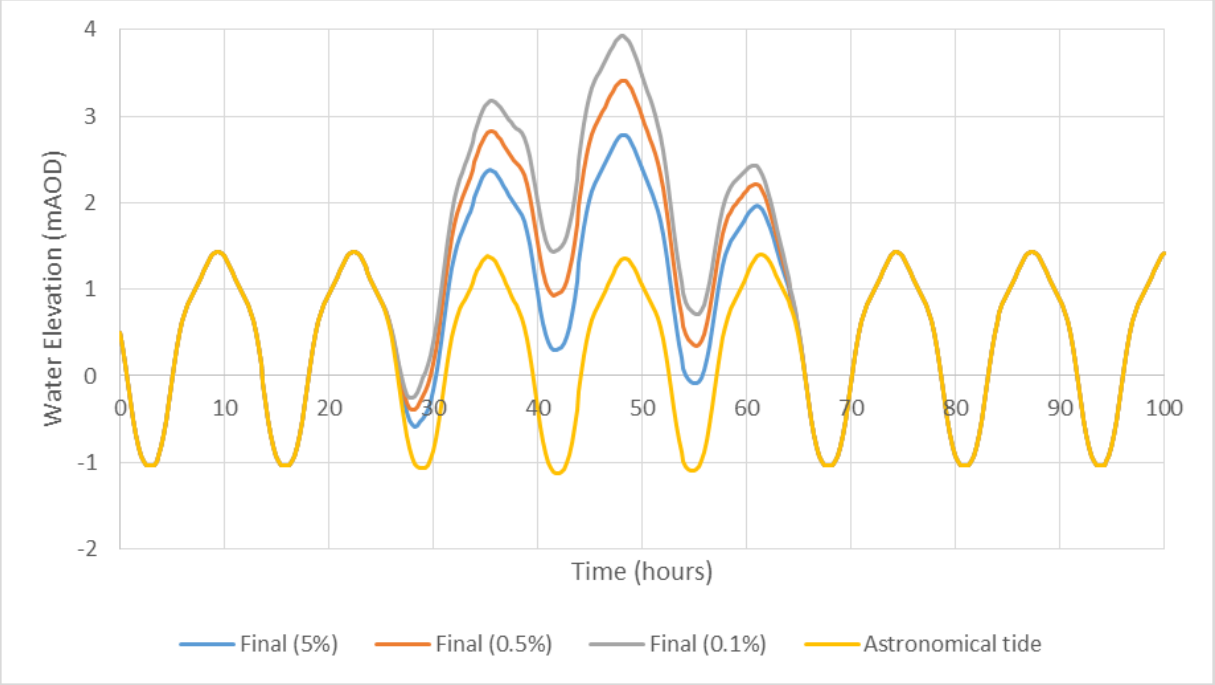


Figure A1: Final design event tidal curves

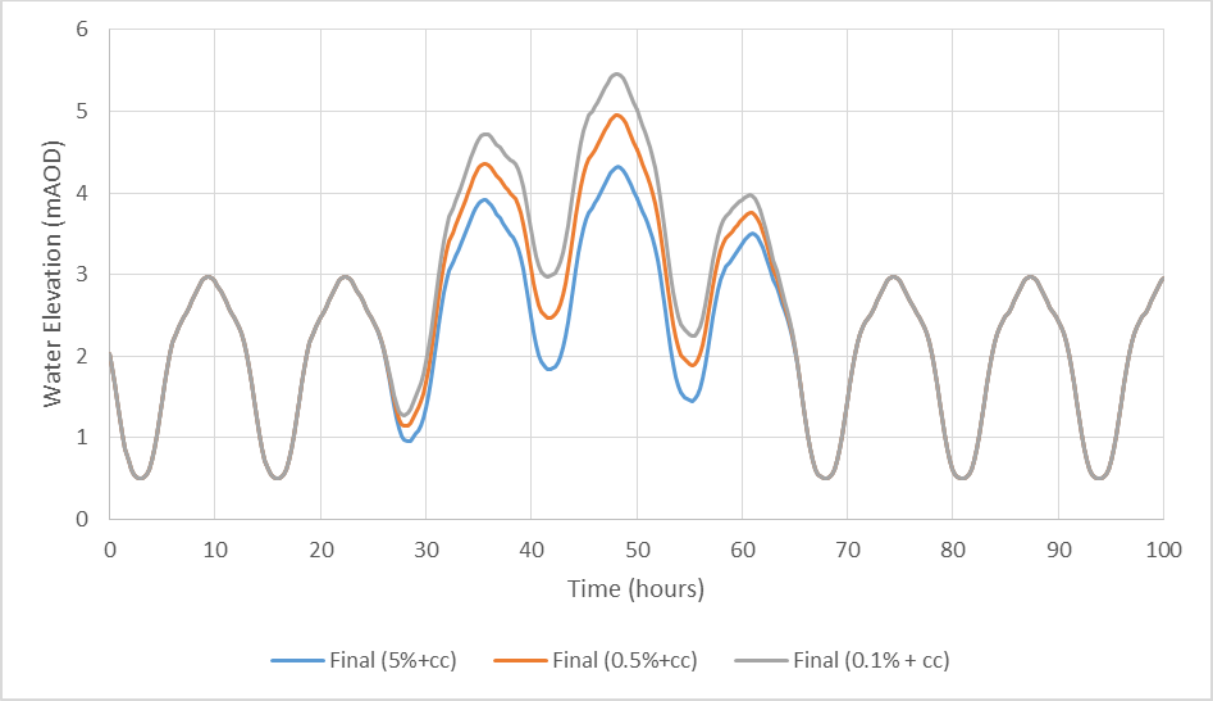


Figure A2: Final present day climate change scenario tidal curves (based on NPPF – table 3 sea level increase scenario)

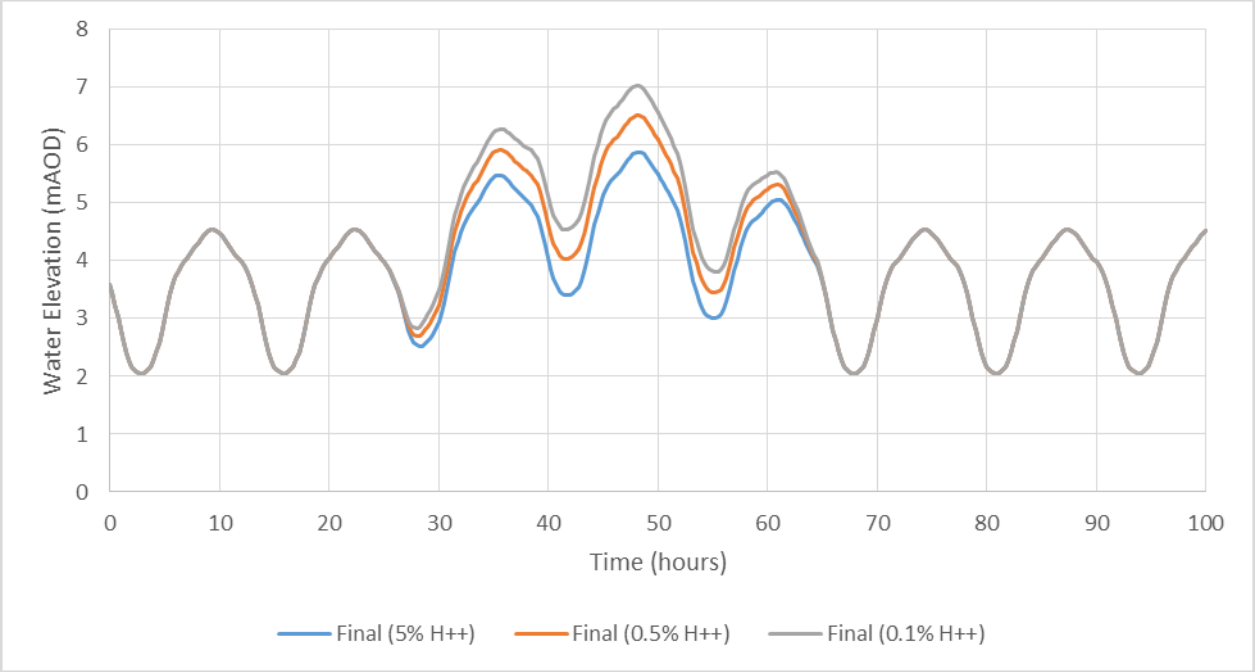


Figure A3: Final H++ scenario tidal curves

Appendix 14A

COMMUNITY FACILITIES WITHIN 2KM OF THE APPLICATION SITE

APPENDIX 14.A – COMMUNITY FACILITIES WITHIN 2KM OF THE APPLICATION SITE

Name	Type of facility	Direction from the Proposed Scheme	Distance from the Proposed Scheme
St James Church	Church	200 m	NE
Great Yarmouth Primary Academy	Primary School	243 m	NE
Trafalgar College	Secondary School	258 m	N
Edward Worlledge Ormiston Academy	Primary School	474 m	N
King Street	High Street	500 m	N
Wroughton Infant and Junior Academy	Primary School	679 m	S
St George's Primary & Nursery School	Primary School	763 m	NE
40 St Peter's Rd	Post Office	853 m	NE
Southtown Primary School	Primary School	870 m	N
St Johns Church	Church	890 m	NE
Great Yarmouth Central Library	Library	906 m	N
St Mary and St Peter Catholic Primary School	Primary School	959 m	S
John G Plummer & Associates	Dentist	988 m	N
High Street	High Street	1.03 km	S
Lynn Grove Academy	Secondary School	1.05 km	SW
Lidl	Shop	1.05 km	NW
The Lighthouse Medical Centre (a branch of East Norfolk Medical Practice)	GP	1.07 km	N
The Park Surgery	GP	1.09 km	N
Bupa Dental Care, Gorleston	Dentist	1.10 km	S
Tesco	Shop	1.12 km	NW
Regent Street	High Street	1.12 km	N
Nelson Medical Practice	GP	1.13 km	NW
Farmfoods	Shop	1.13 km	S
Crown Road Dental Care	Dentist	1.15 km	N
Park Baptist Church	Church	1.15 km	N
Gresham Care Home	Aged persons home	1.18 km	S
Regent Road	High Street	1.2 km	N
183 King St	Post Office	1.24 km	N
19-20 Regent Street	Post Office	1.26 km	N
Tesco	Shop	1.28 km	SW

Name	Type of facility	Direction from the Proposed Scheme	Distance from the Proposed Scheme
St Andrew's Church	Church	1.30 km	S
Iceland	Shop	1.31 km	N
Broad Row	High Street	1.32 km	N
Market Row	High Street	1.32 km	N
East Norfolk Sixth Form College	Sixth Form College	1.34 km	S
Iceland	Shop	1.36 km	S
Spar	Shop	1.36 km	N
Morrison's	Shop	1.37 km	S
The Tabernacle	Church	1.37 km	NW
118-120 High St, Gorleston-on-Sea	Post Office	1.39 km	S
Gorleston Library	Library	1.48 km	S
Kingdom Hall of Jehovah's Witnesses	Church	1.5 km	S
Central Healthcare Centre	GP	1.51 km	S
Millwood Surgery	GP	1.55 km	SW
John G Plummer & Associates	Dentist	1.56 km	S
Gorleston Medical Centre	GP	1.58 km	S
St Nicholas Priory CofE VA Primary School	Primary School	1.61 km	N
Cobholm Primary Academy	Primary School	1.61 km	NW
Stradbroke Primary Academy	Primary School	1.64 km	S
Alexandra House	Aged persons home	1.64 km	N
Aldi	Shop	1.64 km	N
Great Yarmouth and Waveney CDS	Dentist	1.65 km	S
Bethel Gospel Hall	Church	1.83 km	S
John G Plummer & Associates	Dentist	1.90 km	SW
Magdalen Way Post Office	Post Office	1.90 km	S
mydentist, Lowestoft Road, Gorleston-on-Sea	Dentist	1.94 km	S
The Abbeville	Aged persons home	1.95 km	N
1b St Catherines Way, Gorleston	Hospital	1.97 km	S
Lydia Eva Court	Aged persons home	1.98 km	S

Appendix 14B

RECREATIONAL FACILITIES WITHIN 2KM OF THE APPLICATION SITE

APPENDIX 14.B – RECREATIONAL FACILITIES WITHIN 2KM OF THE APPLICATION SITE

Name	Description	Direction from the Proposed Scheme	Distance from the Proposed Scheme
Playground East Community Centre	Play Area	30 m	E
Peggotty Road	Play Area	30 m	E
Suffolk Road Recreation Ground	Play Area	95 m	e
Admirals Quay Playground	Play Area	300 m	w
Admirals Quay	Play Area	300 m	NW
Anchor Court Play area	Play Area	330 m	NW
Anchor Court	Play Area	330 m	NW
Louise Close Playground	Play Area	360 m	NE
Louise Close	Play Area	360 m	N
St Nicholas Recreation Ground	Sports pitches	380 m	e
Sidney Close	Play Area	500 m	N
Blackfriars Road	Play Area	520 m	N
King Street	Play Area	580 m	N
Clarendon Close	Play Area	615 m	N
Blackfriars Road	Play Area	615 m	NE
Dorset Close	Play Area	750 m	N
Orford Close	Play Area	750 m	N
Sackville Close	Play Area	810 m	N
Meadow Park	Parks	875 m	S
Townshend Close	Play Area	900 m	N
Whimbrel Drive Recreation Ground	Sports pitches	935 m	SW
East Anglian Way	Play Area	950 m	S
Southtown Road	Play Area	950 m	N
Howard Street South	Play Area	970 m	N
Marina Leisure Centre	Sport centres	1.07 km	NE
St Georges Park	Parks	1.08 km	N
Coronation Road	Play Area	1.18 km	NW
Gorleston Recreation Ground	Sports pitches	1.29 km	s
Beavans Court	Play Area	1.30 km	NW

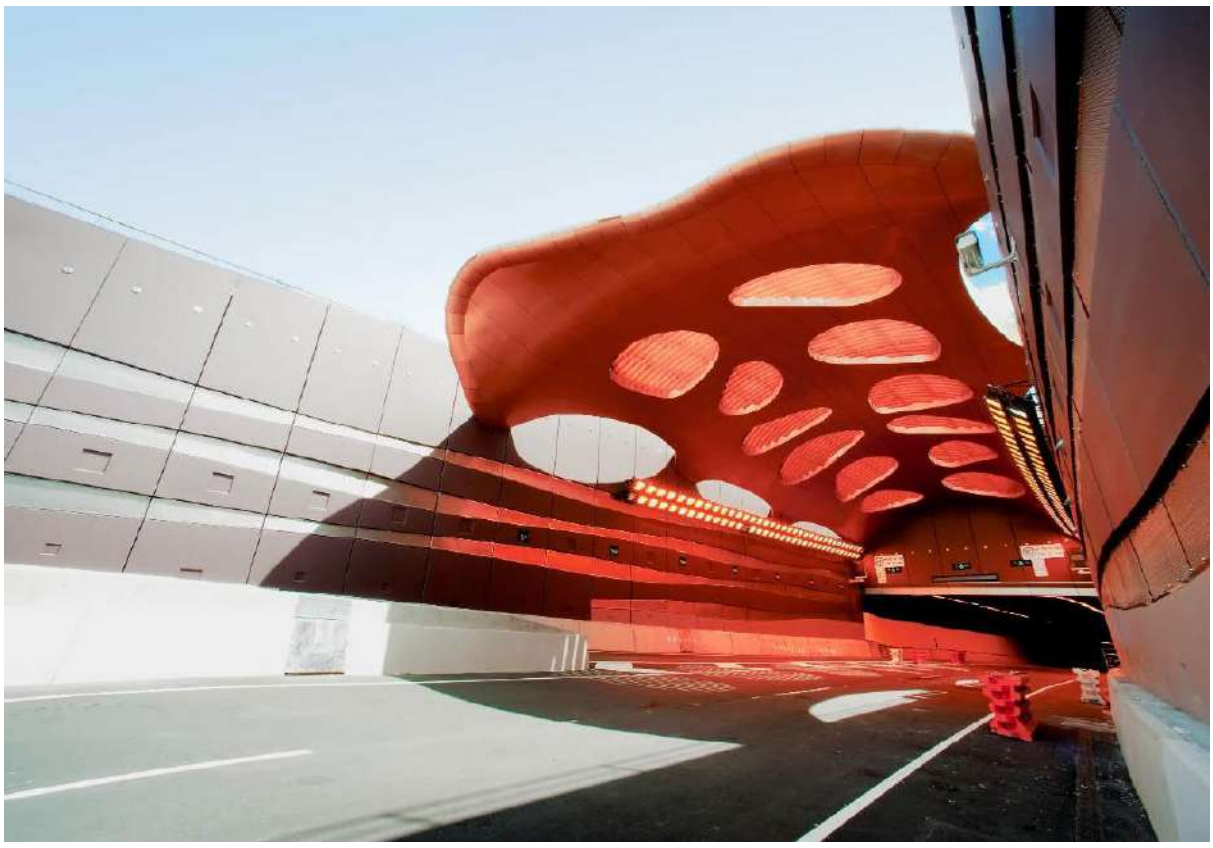
Name	Description	Direction from the Proposed Scheme	Distance from the Proposed Scheme
Hawthorn Road	Play Area	1.31 km	SW
Phoenix Pool & Gym	Sport centres	1.33 km	SW
Hunter Drive	Play Area	1.37 km	SW
Elder Green	Play Area	1.43 km	SW
Crittens Road	Play Area	1.48 km	NW
Pine Green	Play Area	1.50 km	SW
El Alamein Way Recreation Ground	Play Area	1.57 km	SW
Pier Plain	Play Area	1.63 km	S
Mill Road	Play Area	1.70 km	NW
Ferrier Road	Play Area	1.75 km	N
Wellesley Road Recreation Ground	Sports pitches	1.86 km	ne
Riverside Park	Parks	1.89 km	NW
Royal Sovereign Crescent	Play Area	1.91 km	SW
Mill Lane Playing Field	Play Area	1.92 km	SW

Appendix 16A

CONTAMINATED LAND DESK STUDY REPORT

GREAT YARMOUTH 3RD CROSSING

INTERPRETATIVE ENVIRONMENTAL DESK STUDY REPORT



GREAT YARMOUTH 3RD CROSSING

INTERPRETATIVE ENVIRONMENTAL DESK STUDY REPORT

FIRST ISSUE

62240375
6TH JULY 2017

WSP

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QUALITY MANAGEMENT

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APPENDICES

1 INTRODUCTION

1.1 TERMS OF REFERENCE

WSP Ltd were commissioned by Norfolk County Council (NCC) to prepare an Interpretative Environmental Desk Study in relation to the proposed Great Yarmouth Third Crossing. This report assesses the potential environmental risks, constraints and liabilities associated with the proposed development.

1.2 DEVELOPMENT PROPOSALS / LEGISLATIVE CONTEXT

The site will be subject to redevelopment works which will include a new bridge and associated highways and new junction arrangements.

The presence of contaminants which may pose a risk to human health or the environment is a material planning consideration. For planning it should be considered whether the site is suitable for its new use, and the responsibility for securing a safe development (including cumulative effects of pollution on health, and the potential sensitivity of the proposed development to adverse effects from pollution), rests with the developer and/or landowner. Planning is concerned with the site's proposed use not its current use.

Section 57 of the Environment Act 1995, adds Part 2A (ss.78A-18YC) to the Environmental Protection Act 1990 and contains the legislative framework for identifying and dealing with contaminated land. Where development is undertaken on land which may be affected by contamination, the National Planning Policy Framework, paragraphs 120 to 122 considers pollution and remediation.

1.3 SCOPE OF REPORT

The objective of this study is to assess the potential environmental risks, constraints and liabilities associated with the site in respect of potential redevelopment.

The scope of work comprises:-

- A site walkover undertaken by a suitably qualified Geo-Environmental Scientist,
- An interpretation of the information obtained from a Groundsure Report,
- A preliminary assessment of potential geo-environmental risks following the methodology of CLR11,
- Recommendations for further investigation/actions if required.

2 DESK STUDY RESEARCH

2.1 SITE LOCATION

The irregular shaped site is located either side of the River Yare, immediately south of Great Yarmouth town centre. The site is bounded to the north by Boundary Road and Newcastle Road, to the east by Exmouth Road and Admiralty Road, to the south by Swanston's Road and Alpha Road, and to the west by Harfrey's Road.

The site area covers approximately 43ha and is centered on National Grid reference 652320, 306005.

Drawing 62240375/016/OD/01 presents the site location and Drawing 62240375/016/OD/02 presents the study area boundary.

It should be noted that the study area boundary for this report covers a wider area than that indicated on Drawing 62240375/016/OD/02. This is to encompass a suitable Rochdale Envelope in the early stages of the project and will be refined as necessary as the project progresses.

2.2 SITE SETTING AND DESCRIPTION

A site walkover was undertaken by a qualified WSP Geo-Environmental Engineer on 12th July 2017. Photographs and a photograph location plan are presented in Appendix A.

The flat site is split into two unequal parts by the River Yare which flows from north to south through the site.

The eastern part of the site is densely developed, predominantly with commercial / industrial properties including oil / gas storage sites, an operating port facility with associated hard standing and warehouses / depots. Other uses include residential properties (predominantly in the northern part of the area), a petrol filling station and car dealership.

The western part of the site includes a hard standing quayside, the major A12 dual carriageway, William Adams Way highway, residential properties, commercial properties including car and caravan sales, a petrol station, oil and gas storage facilities, docks and port facilities; military properties (air training corps), community facilities and public open space and allotments.

No invasive species were noted during the walkover, however the survey was not undertaken by a trained ecologist.

2.3 ADJACENT LAND USE

The table below summarises the adjacent land uses.

Table 2.1 Summary of Adjacent Land Uses

Direction	Surrounding Land Use
North	Predominantly commercial / industrial with some residential properties on the west side of the river and predominantly residential properties with a few commercial properties on the east side of the river.
East	Predominantly residential properties with occasional commercial properties and a community centre.
South	Commercial / industrial properties on the east side of the river and residential properties, commercial properties and a recreation ground on the west side of the river.
West	Commercial / industrial properties.

2.4 ENVIRONMENTAL DESIGNATIONS AND ECOLOGY

The site is wholly located within a nitrate vulnerable zone. Two other environmentally sensitive areas are located within 500m of the site;-

- Outer Thames Estuary, 465m to the east,
- Broads, 392m to the west,

2.5 SITE HISTORY

The on-site history has been assessed from a review of historical Ordnance Survey maps from the GroundSure report presented in Appendix B. A summary is presented below. A more detailed site history, including the adjacent and surrounding land is presented in Appendix C.

For simplicity, the site has been split into two areas – east of the River Yare and west of the River Yare.

2.5.1 EASTERN SITE AREA

The earliest map provided by GroundSure dated 1883 indicates the eastern area of the site to be densely developed predominantly with commercial / industrial properties including a gasworks, boat building yard and an icehouse. Some residential properties were marked but generally the area is dominated by industry. This eastern area of the site has generally remained a commercial / industrial area up to the present day. Various industries have been present including fish canning, oilskin production, chemical factory and unspecified depots, warehouses and factories.

2.5.2 WESTERN SITE AREA

The earliest map provided by GroundSure dated 1883 indicates the western area of the site to be less developed than the eastern area. The majority of the development was present adjacent to the River Yare and comprised a mix of residential properties and commercial / industrial sites such as an iron works, rope walk, gas works and malthouses. Beyond, towards the western boundary was agricultural land.

By 1906, a railway line running north south was constructed towards the western boundary and by 1926 / 1927, formal gardens and allotments are present towards the centre of the site. A shoe factory is marked adjacent to Queen Anne's Road in 1949 and by 1966 is relabelled as a printing works.

By 1978 the railway line had been dismantled and commercial / industrial units had started to be developed in the far west of the site and beyond. By 1988 the former rail route had started to be redeveloped as a dual carriageway and by 2002 the current major highway routes had been established.

2.6 GEOLOGY

2.6.1 SUPERFICIAL

The British Geological Survey website (www.bgs.ac.uk) indicates the site is underlain by a variety of superficial deposits;-

- South west - peat of the Breydon Formation,
- North – clay and silt of the Breydon Formation,
- Eastern part beyond the River Yare – sand and gravel of the North Denes Formation.
- Within the River Yare - Clay and silt tidal river or creek deposits.

2.6.2 SOLID

The British Geological Survey website (www.bgs.ac.uk) indicates the bedrock underlying the site is sand and gravel of the Crag Group.

2.6.3 GROUND WORKINGS

GroundSure records a number of historical ground workings on site, all associated with the quay /wharf immediately adjacent to the River Yare.

2.6.4 BGS BOREHOLES

GroundSure records 107 borehole records within the site boundary but some are confidential and cannot be viewed on the BGS website – www.bgs.ac.uk. A summary of the locations within the likely route corridor is presented below.

Table 2.2 Table 1 - Example

BOREHOLE REF	LOCATION	SUMMARY
TG50NW27	Close to junction between William Adams Way and Suffolk Road.	Made ground to 2m depth overlying silt, sand and clay.
TG50NW164	Close to junction between William Adams Way and Suffolk Road.	Ash fill to approximately 4ft 6' depth overlying clay (with peat layers) sand and gravel.
TG50NW429	Close to junction between William Adams Way and Suffolk Road.	Fill to 1.05m depth overlying clay, sand, silt and peat.
TG50NW26	Close to junction between William Adams Way and Suffolk Road.	Made ground to 1,2m depth overlying silt, sand, clay (with peat) and gravel.
TG50NW185	Close to junction between William Adams Way and Suffolk Road.	Made ground to approximately 1ft depth overlying clay, silt, sand, peat and gravel.
TG50NW28	Close to junction between William Adams Way and Suffolk Road.	Topsoil overlying clay, peat and sand.
TG50NW472	William Adams Way close to A12 roundabout	Topsoil overlying clay, sand, silt and peat.
TG50NW29	Close to junction of Suffolk Road and Queen Annes Road.	Topsoil overlying clay, sand, silt and peat.
TG50NW184	Junction of Queen Annes Road and Suffolk Road.	Made ground to approximately 3ft 6 depth overlying clay, sand, silt , peat and gravel.
TG50NW4	Adjacent to Suffolk Road, north of Queen Annes Road	Made ground to 1.07m depth overlying clay, sand, silt, peat and gravel.
TG50NW582	Southtown Road, adjacent to the River Yare.	300mm thickness of asphalt and concrete over made ground to 2.2m depth. Underlying natural strata is sand and gravel,

BOREHOLE REF	LOCATION	SUMMARY
TG50NW587	Southtown Road, adjacent to the River Yare.	300mm thickness of asphalt and concrete over made ground to 3.0m depth. Underlying natural strata is silt, sand and gravel
TG50NW581	Southtown Road, adjacent to the River Yare.	200mm thickness of asphalt and concrete over made ground to 2.2m depth. Underlying natural strata is sand and gravel.
TG50NW586	Southtown Road, adjacent to the River Yare.	400mm thickness of asphalt and concrete over made ground to 2.2m depth. Underlying natural strata is silt (with peat), sand and gravel
TG50NW368	Quayside on the eastern side of the River Yare.	180mm thickness of reinforced concrete over made ground to 1.2m depth. Underlying natural strata is sand and silt.
TG50NW342	Quayside on the eastern side of the River Yare.	300mm thickness of reinforced concrete over made ground to 6.6m depth. Underlying natural strata is sand and gravel.
TG50NW344	Quayside on the eastern side of the River Yare.	300mm thickness of reinforced concrete over made ground to 1.0m depth. Underlying natural strata is sand and gravel.

2.7 HYDROGEOLOGY

The superficial deposits underlying the site to the east of the River Yare are classified as a Secondary (A) Aquifer with permeable layers. These are defined by the Environment Agency as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

The superficial deposits underlying the site to the west of the River Yare are classified as unproductive.

The underlying bedrock is classified as a Principal Aquifer. These are defined by the Environment Agency as layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

The GroundSure report indicates the site is not within a Source Protection Zone.

There are no groundwater abstraction points on site but there is one approximately 71m from the north-west corner;-

- Licence no. AN/034/0015/020 expires in 2030 and is authorised for a maximum daily volume of 210m^3 and an annual volume of 60,000m^3. The abstraction is authorised for laundry use.

2.8 HYDROLOGY

The River Yare is the only watercourse recorded on site and within 500m of the site.

There are no active surface water abstraction licences within 2km of the site. There is one historical abstraction licence 443m to the north that expired in 2015 (licence no. AN/034/0015/013)

There are no potable water abstraction licences within 2km of the site.

2.9 WASTE MANAGEMENT FACILITIES

No active Environment Agency landfill sites are present within 1km of the site.

One historic Environment Agency landfill site is present within 1km of the site;-

- Site reference WD709a, approximately 451m to the west. Licenced to accept inert, industrial, commercial and household waste and operated by Great Yarmouth Council. The last record of the site held by GroundSure is dated 1974.

No BGS/DoE non-operational landfill sites are present within 1km of the site.

No Local Authority recorded landfill sites within 1km of the site.

GroundSure records one Environment Agency licensed waste site onsite and eight sites within 250m (although there are multiple records for each);-

- On site (south west corner) - waste management licence 71429; EA/EPR/CP3094NZ/V003. Household, commercial and industrial waste transfer station for between 25,000t and 75,000t, operated by Thurtle Walter.
- 13m from the south west corner – waste management licence 71417; EA/EPR/FP3394NJ/A001. Household, commercial and industrial waste transfer station for less than 25,000t, operated by Folkes Plant and Aggregate Ltd.
- 53m from the south west corner – waste management licence 70532; EA/EPR/YP3229NB/A001. Special waste transfer station for greater than 75,000t, operated by Paul Clements.
- 108m from the south east corner – waste management licence 71491; EA/EPR/AB3801UE/S002. Asbestos waste transfer station. Licence surrendered in 2016.
- 150m from the south west corner – waste management licence 103802; EA/EPR/EB3535AM/V002. Inert and excavation waste transfer and treatment for less than 25,000t, operated by E E Green and Son Ltd.
- 163m from the north west corner – waste management licence 70505; EA/EPR/KP3898VU/V002. Special waste transfer station for less than 25,000t, operated by Biffa Waste Services Ltd.
- 183m from the north west corner – waste management licence 70536; EA/EPR/YP3799NF/V002. Special waste transfer station for less than 25,000t, operated by C+L Waste Oil Collection.
- 229m from the north west corner – waste management licence 70535; EA/EPR/YP3199NQ/S004. Special waste transfer station. Licence surrendered in 2007.

2.10 ENVIRONMENTAL PERMITS, INCIDENTS AND REGISTERS

Records of active environmental permits or registers on site and within 250m are detailed below.

2.10.1 PART A(1) AND IPPC AUTHORISED ACTIVITIES

No records on site, but there are three active records within 250m each with multiple entries;-

- 167m from the north west corner – Great Yarmouth Wm Resource Centre, EPR/zp3637rm. Operated by Augean North Sea Services Ltd. Records are present for three different processes – disposal or recovery of hazardous waste; disposal of greater than 50t / day of non-hazardous waste involving physio-chemical treatment; and temporary storage of hazardous waste.
- 187m from the northern boundary – Great Yarmouth Oil Reclaimation Facility, EPR/np3038mb, WP3437RY. Operated by C&L Waste Oil Collection. Records are present for two different processes - disposal or recovery of hazardous waste; and temporary storage of hazardous waste.

2.10.2 LIST 2 DANGEROUS SUBSTANCES INVENTORY SITES

No active records on site but one active record within 250m of the site is reported by GroundSure:-

- 44m from the north west corner – UK Waste Management Ltd, authorised for chromium, copper, lead, nickel, zinc discharged to the North Sea.

2.10.3 PART A(2) AND PART B ACTIVITIES AND ENFORCEMENTS

Three current permits are recorded on site and five current permits within 250m of the site;-

- Part B permit - L J Steward for unloading of petrol into storage at service station, South Quay Service Station Southgate Road.
- Part B permit - L J Steward for unloading of petrol into storage at service station, Southtown Road Service Station Southtown Road.
- Part B permit – CEBO (UK) Ltd for use of bulk cement at Gas House, Quay North, Malthouse Lane.

  There are a further five permits within 250m for various processes – use of bulk cement (4 permits) and one permit for 'other metal process'.

2.10.4 LICENSED DISCHARGE CONSENTS

There are four active consents on sites for discharge to the River Yare and three consents within 250m of the site for discharge to the River Yare. A number of on and offsite revoked records are reported by GroundSure but these are not listed here.

- Three onsite records relate to water company discharge - sewage discharge from storm overflow (two records) and sewage discharge pumping station (one record).
- One onsite record relates to a trade discharge for site drainage (contaminated surface water).
- Two offsite records – 41m east and 189m south east relate to sewage discharge for final / treated effluent (not water company related).
- One offsite record 203m to the south east relates to water company sewage discharge from storm overflow.

2.10.5 WATER INDUSTRY REFERRALS

Two on site records (Weatherford UK Ltd and Great Yarmouth Port Company) and two offsite records within 250m (Total Reclaim Systems Ltd 13m south east and Biffa Waste Services Ltd 167m north) are reported by GroundSure.

2.10.6 PLANNING HAZARDOUS SUBSTANCE CONSENTS AND ENFORCEMENTS

One approved record is reported on site for Transco Plc. No further details are provided.

2.10.7 COMAH AND NIHHS SITES

There are two on site records and one off site record;-

- British Gas historical NIHHS site located on the east side of the site.
- Asco UK Ltd current COMAH site located on site close to the southern boundary adjacent to the River Yare.
- Asco UK Ltd current COMAH site located 15m to the south adjacent to the east bank of the River Yare.

2.10.8 NATIONAL INCIDENTS RECORDING SYSTEM, LIST 2

Three on site pollution incidents and one off site incident within 250m are recorded;-

- The three on site incidents related to pollution from food and drink minor water impact), inorganic chemical or product (no impact) and tyres (minor land impact).
- The offsite incident was 230m to the south and related to solvents (minor air impact).

2.11 NATURAL GROUND HAZARDS

The table below summarises the natural ground subsidence findings presented in the GroundSure report.

Table 2.3 Summary of Natural Ground Hazards

Natural Hazard	Hazard Potential
Shrink Swell Clay	Negligible – majority of the site. Low – narrow corridor in the centre of the site associated with the River Yare.
Landslides	Very Low
Dissolution of Soluble Rocks	Negligible
Compressible Ground	Very Low – majority of the site. Moderate - narrow corridor in the centre of the site associated with the River Yare. Negligible – far eastern part of the site. High – Two distinct areas on the southern boundary to the west of the River Yare.
Collapsible Deposits	Negligible
Running Sand	Very Low - majority of the site. Moderate – narrow corridor in the centre of the site associated with the River Yare.

2.12 MINING, EXTRACTION AND NATURAL CAVITIES

The site is not in an area likely to be affected by historical mining, coal mining, non-coal mining, natural cavities, brine extraction, gypsum extraction, tin mining or clay mining.

2.13 RADON

The GroundSure report indicates the site is not in a radon affected area and any new buildings if required as part of the proposed development do not require radon protection measures.

2.14 PART 2A DETERMINATION

GroundSure does not record any sites determined as contaminated land under Part2A of the Environmental Protection Act 1990.

2.15 UNEXPLODED ORDNANCE

A review of the potential for unexploded ordnance (UXO) has been obtained from Zetica Ltd and is presented in Appendix D. The assessment indicates the Great Yarmouth area is a high bomb risk.

2.16 EXISTING REPORTS

WSP Ltd have not been made aware of any existing reports within the study area related to contaminated land.

2.17 BURIED SERVICES

A review of buried services is beyond the scope of this report but it should be noted that given the dense development history of the site, buried and overhead services are highly to be present. Any intrusive works undertaken in this area must take precautions to avoid contacting / damaging any services.

3 PRELIMINARY ASSESSMENT

3.1 GROUND MODEL

The site is generally level and densely developed. Published geology indicates superficial deposits comprise peat (south west), clay and silt (north), sand / gravel (east) and clay / silt tidal river / creek deposits within the River Yare. Bedrock underlying the site is sand and gravel of the Crag Group.

Historical mapping indicates the eastern half of the site, particularly the areas either side of the River Yare have been developed by industry since at least 1883. Some residential properties have been present and the far western area was developed later compared to the eastern part of the site. Identified historical industry includes 3 gasworks, boat building, icehouse, iron works, railways, malthouses, rope walk, saw mill / timber yard, allotments, oilskin works, fish caning, various unspecified depots, warehouses and factories, numerous unspecified sites with tanks, shoe factory and printing works. Many of these historical uses could have resulted in potentially significant sources of contamination being present.

3.2 POTENTIAL CONTAMINANT LINKAGES

3.2.1 POTENTIAL SOURCES

The table below summarises the potential sources of contamination.

Table 3.1 Potential Sources

Ref.	Primary Source	Expected Distribution	Likely Contaminants
S1	Potentially Contaminated Made Ground	Made ground is expected site wide, but contamination is likely to be in discontinuous pockets associated with differing historic industrial uses.	Heavy metals, asbestos, hydrocarbons, polychlorinated biphenyls, organotins and organochloride pesticides, ammonia, polyaromatic hydrocarbons, volatile and semi-volatile organic compounds.
S2	Potentially Contaminated Silt	Within the River Yare or immediately adjacent within the historic quayside area. Potential for mobilisation during the construction works or scoured due to changes in waterflow post construction.	Heavy metals, organotins, polychlorinated biphenyls, hydrocarbons, organochloride pesticides, ammonia, polyaromatic hydrocarbons, volatile and semi-volatile organic compounds.

3.2.2 POTENTIAL RECEPTORS

The table below details the potential receptors.

Table 3.2 Potential Receptors

Ref.	Receptor	Description
R1	Site users	Pedestrians and maintenance workers
R2	Adjacent site users	Residents (including children) and users of nearby properties (visitors and employees)
R3	Controlled waters	Principal and Secondary (A) aquifers and surface watercourses
R4	On site infrastructure / ecology	Buildings, foundations, buried services and ecology (eg trees and plants in landscaping areas)
R5	Marine ecology	Vertebrates and invertebrates within the River Yare and the adjacent sea.

3.2.3 POTENTIAL PATHWAYS

The table below details the potential pathways.

Table 3.3 Potential Pathways

Ref.	Pathway	Description
P1	Direct contact	Soil contaminants could come into direct contact with the site users.
P2	Ingestion	Soil derived contaminants could be ingested.
P3	Inhalation of fugitive dust	During dry dusty conditions, contaminated dust could be inhaled by site users and adjacent site users.
P4	Leaching and vertical / lateral migration of contaminants	Contaminants could leach and migrate into the underlying aquifers and the surface watercourse including as a result of construction activities such as piling.
P5	Migration and inhalation of landfill / ground gas	Ground / landfill gas could be generated by fill materials

3.3 RISK EVALUATION

Each potential contaminant linkage is identified in Table 3.3 below. This assumes redevelopment with no remediation. An evaluation of the risk that each contaminant linkage poses to the project has been undertaken in general accordance with CIRIA guidance document C552, 2001. Risk classification matrices are presented in Appendix D.

The evaluation and the resultant actions identified are based on the available information presented within this report. Once the final design is known it may be necessary to review the risk evaluation.

During development, there is a potential for short term risk to construction workers and the general public. These should be assessed and mitigated by the construction Con tractor under the CDM 2015 Regulations.

The table below details the potential pathways.

Table 3.4 Summary of Potential Contaminant Linkages

1. Hazard Identification	2. Hazard Assessment		3. Risk Estimation		4. Risk Evaluation	5. Managing the Risks
CONTAMINANT SOURCE	RECEPTOR	PATHWAY	CONSEQUENCE OF RISK BEING REALISED	PROBABILITY OF RISK BEING REALISED	CLASSIFICATION	DISCUSSION / ACTION REQUIRED
S1. Potentially Contaminated Made Ground	R1. Site Users	P1. Direct Contact	Medium	Unlikely	Low	From the previous uses across the site, an environmental ground investigation is considered necessary and is likely to be required by the Planners. It may be possible to incorporate this into any geotechnical investigation to assess ground conditions for foundation design, which may reduce costs.
		P2. Ingestion	Medium	Unlikely	Low	
		P3. Inhalation Of Fugitive Dust	Medium	Low	Moderate	
		P5. Migration And Inhalation Of Landfill / Ground Gas	Minor	Unlikely	Very Low	
	R2. Adjacent Site Users		Minor	Unlikely	Very Low	
		P3. Inhalation Of Fugitive Dust	Medium	Low	Moderate	
	R3. Controlled Waters	P4. Leaching And Vertical / Lateral Migration Of Contaminants	Severe	Likely	High	
	R4. Site Infrastructure	P1. Direct Contact	Mild	Likely	Moderate / Low	
	R5. Marine Ecology		Severe	Likely	High	
		P2. Ingestion	Severe	Likely	High	
		P4. Leaching And Vertical / Lateral Migration Of Contaminants	Severe	Likely	High	
S2. Potentially Contaminated Silt	R3. Controlled Waters	P4. Leaching And Vertical / Lateral Migration Of Contaminants	Severe	Likely	High	
	R4. Site Infrastructure	P1. Direct Contact	Mild	Low	Low	
	R5. Marine Ecology		Severe	Likely	High	

		P2. Ingestion	Severe	Likely	High	
		P4. Leaching And Vertical / Lateral Migration Of Contaminants	Severe	Likely	High	

3.4 POTENTIAL WASTE AND SUSTAINABILITY CONSIDERATIONS

The site is proposed to be redeveloped for a new bridge and associated highway. Detailed designs are not available at this stage, but surplus soils may be generated during the redevelopment works. It is possible that these would need to be disposed of offsite to a suitably licensed facility if they cannot be proven to meet the requirements for re-use within the development under a Materials Management Plan.

3.5 SAFETY, HEALTH AND ENVIRONMENTAL CONSIDERATIONS

With respect to any proposed ground investigation, the site should be classified in accordance with the SISG "Guideline Notes for the Safe Investigation by Drilling of Landfills and Contaminated Land''. This document makes recommendations for carrying out site investigation on landfills and potentially contaminated ground. Appendix IV of the guidance sets out a record of assessment for potentially contaminated sites, to be completed as part of the ground investigation contract.

Site personnel involved with any intrusive works, including site investigations or maintenance works should be appropriately qualified with experience of working on potentially contaminated sites. Those working in close proximity to fill materials should wear appropriate personal protective equipment. A reasonable standard of hygiene should be maintained.

4 CONCLUSIONS

4.1 KEY FINDINGS

The desk study has indicated that the site was reasonably well developed by the late 1800's with some residential properties but mostly commercial / industrial development, particularly the area immediately bounding the River Yare.

The site is expected to be underlain by demolition and fill material which could be contaminated. Ground gas / landfill gas may be generated by the fill material and could migrate to impact adjacent site users and infrastructure.

From the information reviewed above, contaminated made ground is expected but is unlikely to be sufficiently contaminated or sufficiently widespread to pose a significant constraint for an infrastructure project such as this.

Due to the potential for contaminated made ground and / or silts to be present on site derived from a variety of former industrial uses, the potential for environmental liabilities are considered to be; **high** for controlled waters and marine ecology receptors and in the range **Moderate** to **Very Low** for site users, adjacent site users and infrastructure receptors. The high risks are associated with the controlled waters and marine ecology receptors. It is unknown if remedial works have occurred during redevelopment at any of the potentially contaminative sites such as the iron works or the gas works and this could reduce the potential for environmental liabilities.

5 RECOMMENDATIONS

5.1 GROUND INVESTIGATION

A ground investigation is likely to be required to inform the Environmental Statement, the planning process and outline / detailed design. It is possible that, to reduce costs, works could be incorporated into a geotechnical investigation for foundation design. The ground investigation should include sampling and chemical testing of the major strata encountered including the silts within the Lake.

Any intrusive works must take into account the likelihood that asbestos and / or unexploded ordnance may be encountered.

5.2 URGENT ACTIONS

No urgent actions are considered necessary.

6 LIMITATIONS

Only publically accessible areas were assessed during the walkover.

This report is presented to Norfolk County Council in respect of the proposed Great Yarmouth and may not be used or relied on by any other person or by the client in relation to any other matters not covered specifically by the scope of this Report.

Notwithstanding anything to the contrary contained in the report, WSP Limited is obliged to exercise reasonable skill, care and diligence in the performance of the services required by Norfolk County Council and WSP 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.

This report has been prepared by WSP Limited. 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.

The brief includes an assessment of the previous site usage by review of the sources identified in this report. These effectively provide snapshots of the site through time and although a consistent sequence of site usage has been deduced from these records, the possibility of some activity carried out on the site not being identified on these records cannot be excluded.

New information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

BIBLIOGRAPHY

- British Geological Survey, www.bgs.ac.uk.
- BS5930, 2015. Code of Practice for Site Investigations, BSI.
- BS10175, 2011. Code of Practice for the Investigation of Potentially Contaminated Sites, BSI.
- C552, 2001. Contaminated Land Risk Assessment, A Guide to Good Practice, CIRIA/DETR.
- Department for Environment, Food and Rural Affairs and the Environment Agency, 2004. Model procedures for the management of land contamination (CLR11).
- Environment Agency, 2006: Underground, Under Threat, Groundwater Protection: Policy and Practice.
- Environment Agency; https://www.gov.uk/government/organisations/environment-agency

NOTES

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DESIGN: JM	WORK IN PROGRESS	
CHKD: NB	PRELIMINARY DRAWING	
APPD: DW	EXTERNAL ISSUE	✓
DATE: 24/7/17	AS-BUILT	
SUITABILITY		

CLIENT

Norfolk County Council

AGENT

wsp

SCHEME NAME

Great Yarmouth Third Crossing

DRAWING TITLE

Site Location

ORIG DRAWING SIZE: A3	DIMENSIONS: m
COPYRIGHT ©	SCALE: N/A
SCHEME REF No. 62240375	REVISION A

DRAWING NUMBER

PROJECT	ORIGINATOR	VOLUME
62230375 –	WSP -	EA

LOCATION	TYPE	ROLE	NUMBER
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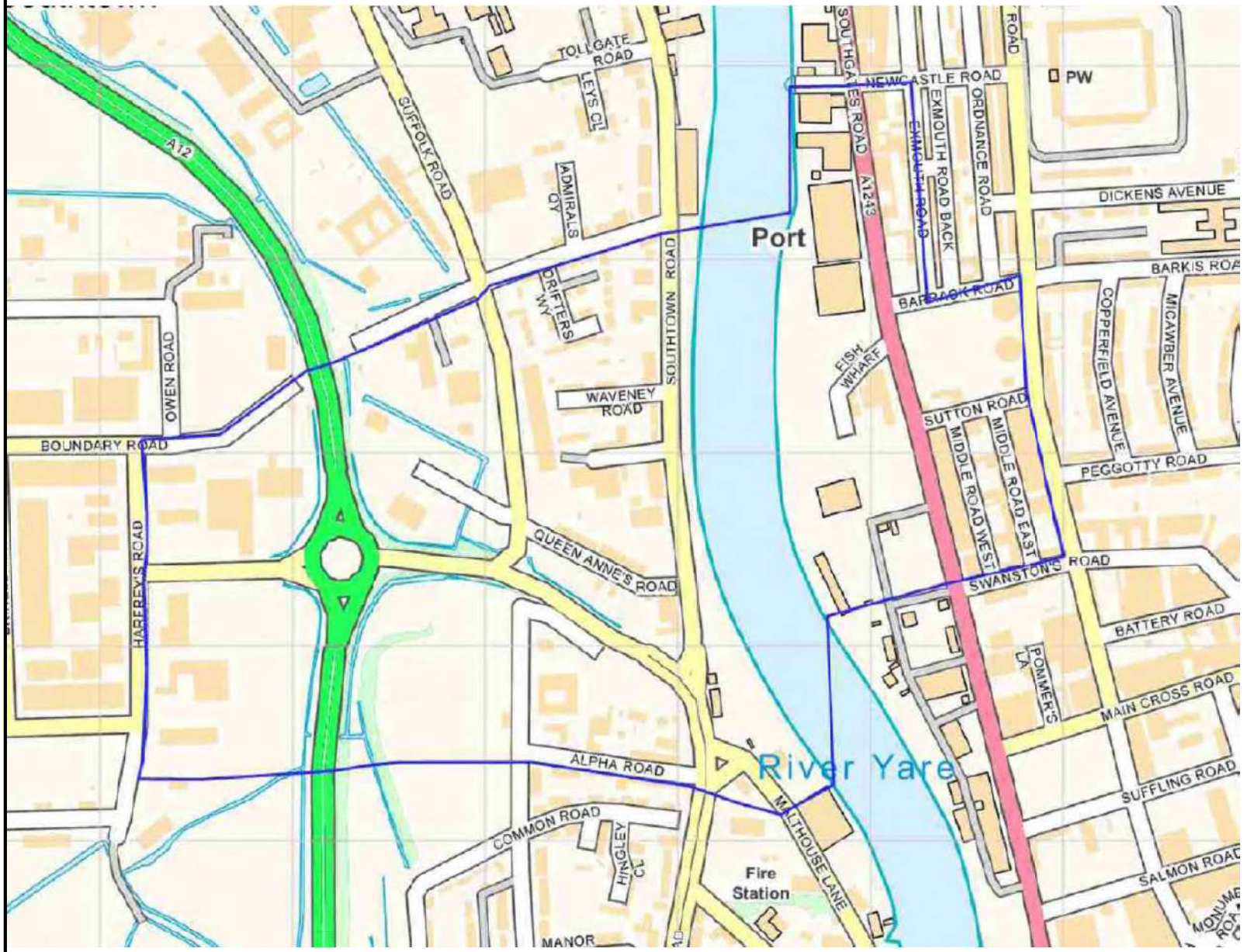

STUDY AREA BOUNDARY

REV	DETAILS	CHKD	APPD	DATE

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CHKD: NB	PRELIMINARY DRAWING	
APPD: DW	EXTERNAL ISSUE	✓
DATE: 24/7/17	AS-BUILT	
SUITABILITY		

CLIENT

Norfolk County Council

AGENT

wsp

SCHEME NAME

Great Yarmouth Third Crossing

DRAWING TITLE

Study Area Boundary

ORIG DRAWING SIZE: A3	DIMENSIONS: m
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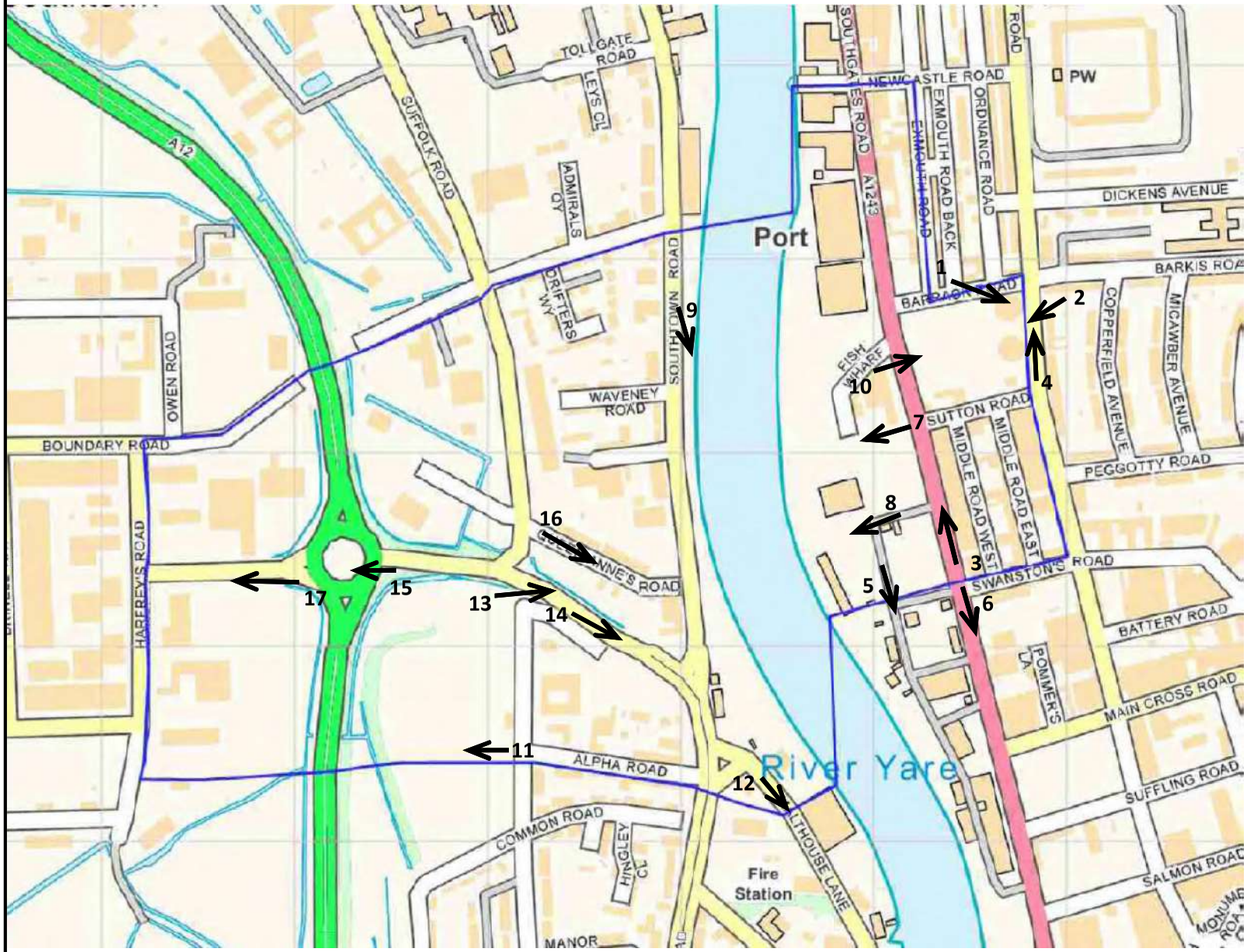
SCHEME REF No.	REVISION A

DRAWING NUMBER

PROJECT	ORIGINATOR	VOLUME
62230375	WSP	EA

LOCATION	TYPE	ROLE	NUMBER
A	DR	L	016/02

APPENDIX A - PHOTOS



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CHKD: NB	PRELIMINARY DRAWING	
APPD: DW	EXTERNAL ISSUE	✓
DATE: 24/7/17	AS-BUILT	
SUITABILITY		

CLIENT

Norfolk County Council

AGENT

wsp

SCHEME NAME

Great Yarmouth Third Crossing

DRAWING TITLE

Photograph Location Drawing

ORIG DRAWING SIZE: A3	DIMENSIONS: m
COPYRIGHT ©	SCALE: N/A
SCHEME REF No. 62230375	REVISION A

DRAWING NUMBER

PROJECT	ORIGINATOR	VOLUME

LOCATION	TYPE	ROLE	NUMBER

STUDY AREA BOUNDARY

APPENDIX A - PHOTO LOG

GREAT YARMOUTH THIRD CROSSING

PHOTOGRAPH LOG

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8

Photograph 9

Photograph 10

Photograph 11

Photograph 12

Photograph 13

Photograph 14

Photograph 15

Photograph 16

Photograph 17

APPENDIX B - GROUNDSURE REPORT

CENTREMAPS

Open Space, Upper Interfields,
Worcester, WR14 1UT

Groundsure Reference:	CMAPS-CM-636391-16287-030717EDR
Your Reference:	16287
Report Date	3 Jul 2017
Report Delivery Method:	Email - pdf

Enviro Insight

Address: ,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 01886 832972 quoting the above CENTREMAPS reference number.

Yours faithfully,

CENTREMAPS

Enc.
Groundsure Enviroinsight

Enviro Insight

Address:	,
Date:	3 Jul 2017
Reference:	CMAPS-CM-636391-16287-030717EDR
Client:	CENTREMAPS

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	16-Apr-2014
Grid Reference:	652320,306005
Site Size:	43.58ha

Report Reference: CMAPS-CM-636391-16287-030717EDR
Client Reference: 16287

Contents Page

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	104	25	64	92
1.2 Additional Information – Historical Tank Database	176	28	71	93
1.3 Additional Information – Historical Energy Features Database	92	33	37	53
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	28	2	30	8
1.6 Potentially Infilled Land	23	2	18	38

Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	21	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	1	0	0	1
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	2	2	5
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	3	2	5	6
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	1	0
2.1.8 Records of Licensed Discharge Consents	15	3	8	15
2.1.9 Records of Water Industry Referrals	2	1	1	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	1	0	1	0
2.2 Records of COMAH and NIHHS sites	2	1	0	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	3	0	1	9
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	0	1	0	1
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	0	0	0
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	2	0	11	1	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	2	3	15	5	5	5

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	106	47	167	Not searched
4.2 Records of Petrol and Fuel Sites	2	0	0	1
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	Yes
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology	0-500m
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	Yes
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	1	0	0	1
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	1	0	0
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	2	0	0	1	Not searched	Not searched

Section 6: Hydrogeology and Hydrology

	0-500m					
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	No	No
6.10 Detailed River Network entries within 500m of the site	1	0	0	0	Not searched	Not searched
6.11 Surface water features within 250m of the study site	Yes	Yes	Yes	Not searched	Not searched	Not searched

Section 7: Flooding

7.1 Are there any Enviroment Agency Zone 2 floodplains within 250m of the study site?	Yes
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	Yes
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	High
7.4 Are there any Flood Defences within 250m of the study site?	No
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Limited potential
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Low

Section 8: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	3
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
8.4 Records of Special Protection Areas (SPA)	0	0	0	1	0	1
8.5 Records of Ramsar sites	0	0	0	0	0	1
8.6 Records of Ancient Woodlands	0	0	0	0	0	0
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	1
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	1	0	1

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	1	1
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	1	0	0	0	0	1
8.14 Records of Green Belt land	0	0	0	0	0	0

Section 9: Natural Hazards

9.1 What is the maximum risk of natural ground subsidence?	High
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Low
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	Low
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	High
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Moderate
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining

10.1 Are there any coal mining areas within 75m of the study site?	No
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	No
10.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

11. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

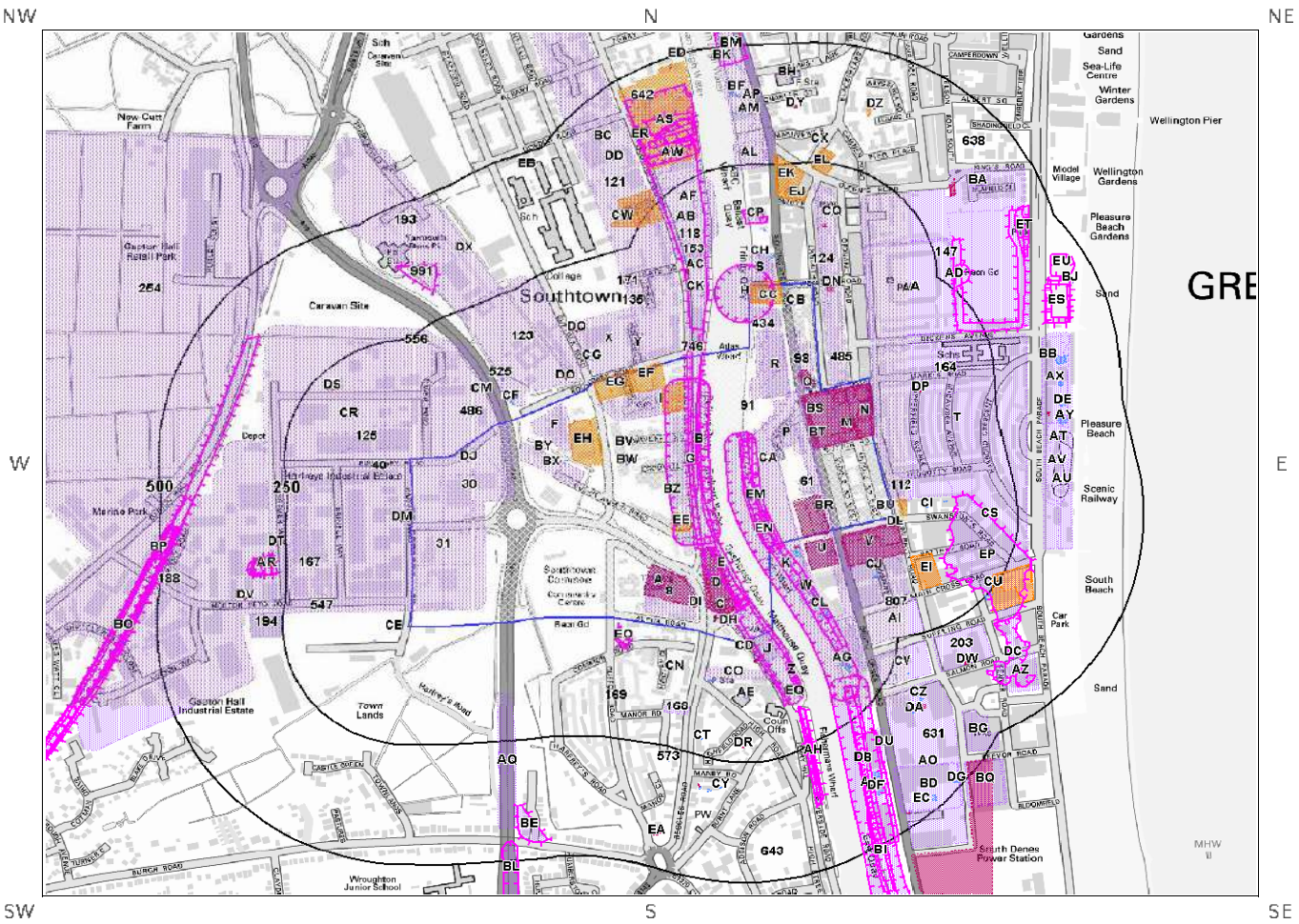
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Historical Land Use



Historical 1:10,000 and 1:10,560 scale mapping

Industrial Land Use

Potentially Infilled Land

Site Outline

Historical 1:2,500, 1:1,250 and 1:500 scale mapping

250
500
Search Buffers (m)

Energy Features

Petrol Stations

Tanks

Garages

1. Historical Industrial Sites

1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 285

ID	Distance [m]	Direction	Use	Date
1F	0	On Site	Unspecified Depot	1978
2BX	0	On Site	Sawmills	1904
3A	0	On Site	Unspecified Tank	1952
4A	0	On Site	Unspecified Tank	1978
5A	0	On Site	Unspecified Tank	1988
6A	0	On Site	Unspecified Tank	1938
7A	0	On Site	Gasometer	1904
8	0	On Site	Unspecified Commercial/Industrial	1978
9B	0	On Site	Quay	1978
10B	0	On Site	Quay	1988
11B	0	On Site	Quay	1952
12C	0	On Site	Unspecified Tank	1952
13C	0	On Site	Unspecified Tank	1884
14C	0	On Site	Unspecified Tanks	1946
15C	0	On Site	Gasometer	1904
16C	0	On Site	Unspecified Tanks	1938
17D	0	On Site	Unspecified Commercial/Industrial	1938
18C	0	On Site	Gasometer	1884
19D	0	On Site	Gas Works	1904
20D	0	On Site	Unspecified Commercial/Industrial	1946
21C	0	On Site	Unspecified Tank	1952
22D	0	On Site	Unspecified Commercial/Industrial	1952
23D	0	On Site	Gas Works	1884
24D	0	On Site	Quay	1904
25D	0	On Site	Quay	1946
26E	0	On Site	Quay	1988
27E	0	On Site	Quay	1978
28F	0	On Site	Unspecified Depot	1988
29I	0	On Site	Iron Works	1884
30	0	On Site	Unspecified Factory	1978
31	0	On Site	Unspecified Works	1978
32A	0	On Site	Gas Holder Station	1988

33EN	0	On Site	Unspecified Wharf	1988
34D	0	On Site	Quay	1938
35B	0	On Site	Quay	1938
36D	0	On Site	Quay	1938
37B	0	On Site	Quay	1938
38G	0	On Site	Quay	1946
39G	0	On Site	Quay	1904
40	0	On Site	Industrial Estate	1988
41H	0	On Site	Quay	1978
42H	0	On Site	Quay	1988
43I	0	On Site	Iron Works	1901
44C	0	On Site	Gasometers	1901
45D	0	On Site	Gas Works	1901
46J	0	On Site	Quay	1938
47J	0	On Site	Quay	1938
48J	0	On Site	Malthouses	1884
49J	0	On Site	Unspecified Works	1988
50J	0	On Site	Quay	1978
51J	0	On Site	Malthouse	1904
52J	0	On Site	Malthouse	1946
53K	0	On Site	Unspecified Wharf	1946
54K	0	On Site	Unspecified Wharf	1904
55K	0	On Site	Fish Wharf	1938
56L	0	On Site	Railway Sidings	1938
57DK	0	On Site	Unspecified Wharf	1978
58L	0	On Site	Railway Sidings	1904
59L	0	On Site	Railway Sidings	1946
60BR	0	On Site	Railway Sidings	1946
61	0	On Site	Unspecified Depot	1988
62EM	0	On Site	Unspecified Wharf	1884
63M	0	On Site	Unspecified Tank	1946
64M	0	On Site	Gasometer	1904
65M	0	On Site	Unspecified Tank	1938
66M	0	On Site	Unspecified Tank	1952
67M	0	On Site	Unspecified Tank	1884
68M	0	On Site	Gasometer	1901
69M	0	On Site	Unspecified Commercial/Industrial	1946
70M	0	On Site	Gas Works	1904
71N	0	On Site	Unspecified Tank	1988
72N	0	On Site	Unspecified Tank	1978
73M	0	On Site	Unspecified Commercial/Industrial	1938
74P	0	On Site	Unspecified Depot	1988
75M	0	On Site	Gas Works	1884
76M	0	On Site	Unspecified Commercial/Industrial	1952

77M	0	On Site	Gas Works	1901
78M	0	On Site	Unspecified Depot	1988
79M	0	On Site	Gas Holder Station	1978
80O	0	On Site	Unspecified Tanks	1946
81O	0	On Site	Gasometers	1904
82P	0	On Site	Railway Sidings	1952
83P	0	On Site	Railway Sidings	1978
84O	0	On Site	Unspecified Tanks	1938
85O	0	On Site	Unspecified Tank	1952
86O	0	On Site	Unspecified Tank	1952
87O	0	On Site	Gasometer	1884
88O	0	On Site	Gasometer	1901
89O	0	On Site	Unspecified Tank	1988
90O	0	On Site	Unspecified Tank	1978
91	0	On Site	Ice House	1901
92Q	0	On Site	Unspecified Tank	1904
93Q	0	On Site	Unspecified Tank	1946
94Q	0	On Site	Unspecified Tank	1938
95Q	0	On Site	Unspecified Tank	1884
96Q	0	On Site	Unspecified Tanks	1901
97Q	0	On Site	Unspecified Tank	1884
98	0	On Site	Unspecified Commercial/Industrial	1901
99R	0	On Site	Unspecified Warehouse	1978
100R	0	On Site	Boat Building Yard	1884
101R	0	On Site	Unspecified Warehouse	1988
102R	0	On Site	Boat Building Yards	1901
103J	0	On Site	Malthouses	1901
104S	0	N	Unspecified Stores	1901
105S	2	N	Unspecified Stores	1884
106DN	3	N	Rope Walk	1901
107T	5	E	Militia Barracks	1901
108N	5	E	Drill Shed	1901
109W	6	E	Unspecified Commercial/Industrial	1988
110T	7	E	Barracks	1904
111N	7	E	Drill Shed	1884
112	8	E	Hospital	1904
113U	10	S	Unspecified Works	1978
114U	10	S	Unspecified Works	1988
115X	10	N	Timber Yard	1988
116V	11	S	Unspecified Commercial/Industrial	1946
117V	12	S	Unspecified Depot	1978
118	12	N	Unspecified Mill	1952
119V	13	S	Unspecified Commercial/Industrial	1938

120V	15	S	Unspecified Works	1952
121	16	N	Barracks	1901
122CJ	17	S	Electric Works	1904
123	18	NW	Unspecified Depot	1978
124	20	E	Rope Walk	1884
125	25	N	Unspecified Warehouses	1978
126W	42	E	Fish Wharf	1952
127X	42	N	Engine House	1904
128Y	42	N	Engine House	1946
129Y	45	N	Engine House	1938
130AB	52	N	Dock	1946
131CO	53	S	Malthouse	1978
132CK	55	N	Sawmills	1884
133W	67	E	Railway Sidings	1884
134W	70	E	Unspecified Tank	1988
135	70	N	Rope Walk	1901
136Z	73	SE	Quay	1946
137Z	73	SE	Quay	1904
138AA	76	N	Hospital	1904
139AA	76	N	Hospital	1946
140AA	79	N	Hospital	1938
141AC	79	W	Sawmills	1904
142CL	80	E	Unspecified Tanks	1988
143AB	81	W	Sawmills	1938
144AC	81	W	Sawmills	1946
145AC	81	W	Sawmills	1901
146AA	81	N	Hospital	1884
147	82	N	Naval Hospital	1901
148AD	84	N	Hospital	1988
149AD	84	N	Hospital	1978
150AD	84	N	Hospital	1952
151AE	98	S	Fire Station	1978
152AE	98	S	Fire Station	1988
153	99	NW	Timber Yard	1884
154AC	100	NW	Timber Yard	1901
155AF	100	NW	Timber Shed	1978
156AF	100	NW	Timber Shed	1988
157AB	108	NW	Timber Yard	1904
158EP	117	E	Sand Pit	1884
159AG	119	E	Unspecified Commercial/Industrial	1988
160AB	121	NW	Timber Yard	1901
161EQ	124	SE	Quay	1988
162CP	127	N	Dry Docks	1904
163AB	130	NW	Timber Yard	1884
164	131	E	Barracks	1884

165AQ	146	S	Railway Sidings	1938
166AG	150	SE	Unspecified Tanks	1988
167	158	W	Unspecified Warehouses	1978
168	160	S	Corn Mill	1884
169	162	S	Corn Windmill	1901
170AJ	164	SE	Quay	1946
171	167	N	Rope Walk	1884
172AH	169	SE	Quay	1978
173AH	169	SE	Quay	1988
174AH	170	SE	Unspecified Quay	1901
175AH	172	SE	Quay	1904
176AH	172	SE	Quay	1946
177AF	174	NW	Boat Building Yard	1901
178AI	175	S	Unspecified Depot	1988
179AI	175	S	Unspecified Factory	1978
180AF	185	NW	Boat Building Yard	1884
181DB	188	SE	Quay	1978
182AJ	188	SE	Quay	1952
183AK	203	NE	Unspecified Ground Workings	1938
184AK	203	NE	Unspecified Ground Workings	1938
185CV	205	E	Unspecified Depot	1988
186AH	230	SE	Quay	1938
187AH	230	SE	Quay	1938
188	236	W	Industrial Estate	1988
189AL	239	N	Timber Yard	1901
190AW	240	NW	Unspecified Commercial/Industrial	1901
191AL	240	N	Timber Yard	1884
192AD	249	NE	Unspecified Pit	1901
193	250	N	Unspecified Depot	1978
194	252	W	Unspecified Warehouse	1978
195AM	258	N	Unspecified Commercial/Industrial	1988
196AM	258	N	Unspecified Commercial/Industrial	1978
197AN	259	N	Railway Sidings	1978
198AN	259	N	Railway Sidings	1988
199AO	261	SE	Unspecified Factory	1988
200AO	261	SE	Unspecified Factory	1978
201AP	264	N	Railway Sidings	1988
202AP	264	N	Railway Sidings	1978
203	266	S	Unspecified Factory	1952
204AR	269	W	Unspecified Pit	1901
205AQ	270	S	Railway Station	1938
206AQ	271	S	Railway Station	1946

207AQ	271	S	Railway Station	1904
208DF	277	SE	Quay	1988
209AR	279	W	Unspecified Pit	1884
210AR	280	W	Unspecified Pit	1904
211AR	280	W	Unspecified Pit	1946
212AR	291	W	Unspecified Heap	1938
213AR	291	W	Unspecified Heap	1938
214AS	295	N	Dry Dock	1988
215AS	295	N	Dry Dock	1978
216DU	296	SE	Paddock	1901
217AR	298	W	Unspecified Pit	1952
218AT	301	E	Unspecified Commercial/Industrial	1952
219AT	301	E	Unspecified Commercial/Industrial	1988
220AT	301	E	Unspecified Commercial/Industrial	1978
221AV	302	E	Railway Sidings	1946
222DC	303	SE	Refuse Heap	1884
223AU	311	E	Railway Sidings	1988
224AU	311	E	Railway Sidings	1978
225AV	311	E	Railway Sidings	1952
226AS	316	N	Dry Docks	1938
227AS	316	N	Dry Docks	1938
228AW	317	NW	Ice House	1901
229AS	329	N	Dry Docks	1904
230AS	329	N	Dry Docks	1946
231AX	332	E	Railway Sidings	1938
232AX	332	E	Unspecified Commercial/Industrial	1938
233AS	345	N	Unspecified Works	1952
234BB	351	E	Unspecified Tank	1938
235AS	362	NW	Timber Yard	1884
236AS	364	NW	Timber Yard	1901
237BP	367	W	Cuttings	1884
238AY	371	E	Unspecified Tank	1978
239AY	371	E	Unspecified Tank	1988
240BA	371	NE	Telegraph House	1901
241AZ	373	SE	Unspecified Works	1952
242AZ	373	SE	Unspecified Works	1978
243AZ	373	SE	Unspecified Works	1988
244BA	374	NE	Telegraph House	1884
245BB	375	E	Unspecified Tanks	1978
246BB	375	E	Unspecified Tanks	1988
247BC	378	NW	Unspecified Works	1978
248BC	378	NW	Unspecified Works	1988
249BD	379	SE	Ice Factory	1946

250BD	380	SE	Unspecified Factory	1952
251BD	381	SE	Ice Factory	1938
252BE	382	S	Unspecified Pit	1904
253BE	382	S	Unspecified Pit	1946
254	387	W	Marshes	1901
255BK	390	N	Railway Sidings	1884
256BF	394	N	Unspecified Tanks	1988
257BF	394	N	Unspecified Tanks	1978
258ET	397	NE	Unspecified Heap	1952
259BG	416	SE	Unspecified Works	1988
260BG	416	SE	Unspecified Works	1978
261BH	418	N	Fire Station	1978
262BH	418	N	Fire Station	1988
263BI	436	SE	Quay	1938
264BI	436	SE	Quay	1938
265BO	436	W	Cuttings	1901
266BJ	442	NE	Boat House	1938
267BJ	444	NE	Boat House	1946
268BK	448	N	Railway Sidings	1988
269BK	448	N	Railway Sidings	1978
270BM	448	N	Railway Sidings	1938
271BL	458	S	Unspecified Heap	1978
272BL	458	S	Unspecified Heap	1988
273BN	461	N	Quay	1904
274BM	461	N	Railway Sidings	1946
275BN	461	N	Quay	1946
276BM	461	N	Railway Sidings	1904
277BO	463	W	Cuttings	1938
278BO	464	W	Cuttings	1904
279BO	464	W	Cuttings	1946
280BP	469	W	Cuttings	1952
281BQ	474	SE	Net Works	1946
282BQ	475	SE	Net Works	1938
283BK	476	N	Railway Building	1938
284BQ	477	SE	Unspecified Works	1952
285BO	496	W	Cuttings	1952

1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary: 368

ID	Distance (m)	Direction	Use	Date
286BR	0	On Site	Tanks	1949
287BR	0	On Site	Tanks	1949
288M	0	On Site	Unspecified Tank	1927
289O	0	On Site	Unspecified Tank	1927
290O	0	On Site	Unspecified Tank	1949
291O	0	On Site	Unspecified Tank	1949
292O	0	On Site	Unspecified Tank	1966
293M	0	On Site	Unspecified Tank	1949
294M	0	On Site	Unspecified Tank	1949
295M	0	On Site	Unspecified Tank	1963
296M	0	On Site	Unspecified Tank	1927
297M	0	On Site	Unspecified Tank	1966
298M	0	On Site	Tanks	1949
299M	0	On Site	Tanks	1963
300M	0	On Site	Tanks	1949
301O	0	On Site	Gasometer	1887
302O	0	On Site	Unspecified Tank	1927
303O	0	On Site	Gasometer	1966
304O	0	On Site	Gasometer	1949
305O	0	On Site	Gasometer	1949
306O	0	On Site	Gasometer	1963
307O	0	On Site	Unspecified Tank	1927
308N	0	On Site	Tanks	1966
309N	0	On Site	Unspecified Tank	1966
310M	0	On Site	Gasometer	1887
311M	0	On Site	Unspecified Tank	1927
312M	0	On Site	Gasometer	1949
313M	0	On Site	Gasometer	1966
314M	0	On Site	Gasometer	1949
315M	0	On Site	Gasometer	1963
316M	0	On Site	Unspecified Tank	1927
317M	0	On Site	Unspecified Tank	1949
318M	0	On Site	Unspecified Tank	1963
319M	0	On Site	Unspecified Tank	1949
320N	0	On Site	Unspecified Tank	1949
321BT	0	On Site	Unspecified Tank	1966
322Q	0	On Site	Unspecified Tank	1966
323BS	0	On Site	Unspecified Tank	1966
324Q	0	On Site	Unspecified Tank	1927
325Q	0	On Site	Gasometers	1887
326L	0	On Site	Unspecified Tank	1949

327L	0	On Site	Unspecified Tank	1957
328L	0	On Site	Unspecified Tank	1949
329Q	0	On Site	Unspecified Tank	1966
330BS	0	On Site	Unspecified Tank	1963
331BS	0	On Site	Unspecified Tank	1949
332BT	0	On Site	Unspecified Tank	1949
333BT	0	On Site	Unspecified Tank	1963
334BT	0	On Site	Unspecified Tank	1949
335Q	0	On Site	Unspecified Tank	1963
336Q	0	On Site	Unspecified Tank	1949
337BS	0	On Site	Unspecified Tank	1949
338BS	0	On Site	Unspecified Tank	1963
339BS	0	On Site	Unspecified Tank	1949
340Q	0	On Site	Unspecified Tank	1963
341L	0	On Site	Unspecified Tank	1958
342Q	0	On Site	Unspecified Tank	1949
343N	0	On Site	Unspecified Tank	1963
344N	0	On Site	Unspecified Tank	1949
345O	0	On Site	Unspecified Tank	1927
346O	0	On Site	Gasometer	1966
347O	0	On Site	Gasometer	1949
348BS	0	On Site	Gas Works	1887
349O	0	On Site	Gas Holder	1996
350O	0	On Site	Gasometer	1963
351O	0	On Site	Gasometer	1949
352M	0	On Site	Gasometer	1966
353M	0	On Site	Gas Holder	1996
354N	0	On Site	Unspecified Tank	1949
355N	0	On Site	Unspecified Tank	1963
356BS	0	On Site	Gas Works	1963
357N	0	On Site	Gas Holder Station	1996
358BS	0	On Site	Gas Works	1949
359M	0	On Site	Gas Works	1966
360BU	0	On Site	Unspecified Tank	1968
361BU	0	On Site	Unspecified Tank	1968
362Q	0	On Site	Unspecified Tank	1949
363Q	0	On Site	Unspecified Tank	1949
364BS	0	On Site	Gas Works	1949
365N	0	On Site	Unspecified Tank	1949
366E	0	On Site	Unspecified Tank	1990
367BZ	0	On Site	Unspecified Tank	1990
368BW	0	On Site	Tanks	1990
369BV	0	On Site	Unspecified Tank	1990
370BV	0	On Site	Unspecified Tank	1990
371BW	0	On Site	Tanks	1990
372N	0	On Site	Gas Holder Station	1984

373M	0	On Site	Gas Holder	1984
374O	0	On Site	Gas Holder	1984
375N	0	On Site	Gas Holder Station	1990
376O	0	On Site	Gas Holder	1990
377M	0	On Site	Gas Holder	1990
378Q	0	On Site	Gasometers	1883
379O	0	On Site	Gasometer	1883
380O	0	On Site	Gas Works	1883
381M	0	On Site	Gasometer	1883
382O	0	On Site	Unspecified Tank	1905
383M	0	On Site	Unspecified Tank	1905
384BX	0	On Site	Unspecified Tank	1949
385BX	0	On Site	Unspecified Tank	1951
386BX	0	On Site	Unspecified Tank	1963
387BY	0	On Site	Unspecified Tank	1949
388BY	0	On Site	Unspecified Tank	1951
389BY	0	On Site	Unspecified Tank	1963
390BX	0	On Site	Unspecified Tank	1963
391BX	0	On Site	Unspecified Tank	1949
392BX	0	On Site	Unspecified Tank	1951
393BV	0	On Site	Unspecified Tank	1996
394BV	0	On Site	Unspecified Tank	1975
395BW	0	On Site	Tanks	1996
396BW	0	On Site	Tanks	1975
397A	0	On Site	Gasholder	1949
398A	0	On Site	Unspecified Tank	1958
399A	0	On Site	Gasholder	1968
400A	0	On Site	Unspecified Tank	1927
401A	0	On Site	Gasholder	1949
402A	0	On Site	Gasholder	1976
403A	0	On Site	Gasholder	1967
404BZ	0	On Site	Unspecified Tank	1976
405BZ	0	On Site	Unspecified Tank	1996
406E	0	On Site	Unspecified Tank	1968
407E	0	On Site	Unspecified Tank	1967
408E	0	On Site	Unspecified Tank	1996
409E	0	On Site	Unspecified Tank	1949
410E	0	On Site	Unspecified Tank	1949
411D	0	On Site	Tanks	1949
412D	0	On Site	Tanks	1949
413E	0	On Site	Unspecified Tank	1968
414E	0	On Site	Unspecified Tank	1967
415D	0	On Site	Unspecified Tank	1968
416D	0	On Site	Unspecified Tank	1967
417C	0	On Site	Gasometer	1949
418D	0	On Site	Unspecified Tank	1968

419D	0	On Site	Unspecified Tank	1967
420C	0	On Site	Tanks	1927
421C	0	On Site	Gasometers	1887
422D	0	On Site	Gas Works	1887
423C	0	On Site	Gasometer	1949
424C	0	On Site	Tanks	1958
425C	0	On Site	Gasometers	1949
426C	0	On Site	Gasometers	1968
427C	0	On Site	Gasometers	1967
428D	0	On Site	Gas Works	1949
429D	0	On Site	Gas Works	1968
430D	0	On Site	Gas Works	1949
431D	0	On Site	Gas Works	1967
432H	0	On Site	Unspecified Tank	1949
433H	0	On Site	Unspecified Tank	1963
434	0	On Site	Unspecified Tank	1966
435CA	0	On Site	Unspecified Tank	1949
436CA	0	On Site	Unspecified Tank	1966
437CA	0	On Site	Unspecified Tank	1963
438CA	0	On Site	Unspecified Tank	1949
439CB	0	On Site	Unspecified Tank	1963
440BR	0	On Site	Unspecified Tank	1949
441BR	0	On Site	Unspecified Tank	1958
442BR	0	On Site	Unspecified Tank	1957
443BR	0	On Site	Unspecified Tank	1949
444BY	0	On Site	Unspecified Tank	1949
445BX	0	On Site	Unspecified Tank	1949
446BX	0	On Site	Unspecified Tank	1949
447CB	0	On Site	Unspecified Tank	1949
448BZ	0	On Site	Unspecified Tank	1986
449A	0	On Site	Gas Holder Station	1986
450A	0	On Site	Gas Holder	1986
451BW	0	On Site	Tanks	1986
452BV	0	On Site	Unspecified Tank	1986
453C	0	On Site	Gasometers	1883
454D	0	On Site	Gas Works	1883
455CB	0	On Site	Unspecified Tank	1927
456CB	0	On Site	Unspecified Tank	1966
457CB	0	On Site	Unspecified Tank	1949
458H	0	On Site	Unspecified Tank	1928
459H	0	On Site	Unspecified Tank	1949
460CC	0	On Site	Unspecified Tank	1928
461CC	0	On Site	Unspecified Tank	1905
462CD	9	S	Unspecified Tank	1968
463CD	10	S	Unspecified Tank	1968
464K	21	S	Tanks	1990

465K	22	S	Tanks	1984
466K	24	S	Tanks	1990
467CE	30	W	Unspecified Tank	1990
468CE	30	W	Unspecified Tank	1985
469CF	30	NW	Tanks	1996
470CF	30	NW	Unspecified Tank	1990
471CF	30	NW	Unspecified Tank	1990
472V	32	S	Unspecified Tank	1949
473V	33	S	Unspecified Tank	1949
474CF	38	NW	Unspecified Tank	1986
475V	38	S	Tanks	1958
476U	39	S	Tanks	1968
477CF	39	NW	Unspecified Tank	1975
478U	39	S	Tanks	1968
479V	39	S	Tanks	1957
480CF	40	NW	Unspecified Tank	1990
481CF	40	NW	Unspecified Tank	1990
482U	40	S	Tanks	1981
483U	40	S	Tanks	1990
484U	40	S	Tanks	1984
485	44	E	Unspecified Tank	1966
486	44	NW	Unspecified Tank	1980
487CG	46	N	Tanks	1996
488CG	47	N	Tanks	1990
489CG	47	N	Tanks	1990
490S	53	N	Tanks	1996
491S	55	N	Tanks	1966
492S	55	N	Tanks	1984
493S	55	N	Tanks	1990
494CH	62	N	Unspecified Tank	1949
495CH	62	N	Unspecified Tank	1949
496CH	62	N	Unspecified Tank	1963
497CI	70	E	Tanks	1949
498CE	70	SW	Unspecified Tank	1964
499CE	70	SW	Unspecified Tank	1955
500CI	70	E	Tanks	1949
501W	71	E	Tanks	1990
502CE	71	SW	Unspecified Tank	1978
503CE	73	SW	Unspecified Tank	1990
504CE	73	SW	Unspecified Tank	1985
505CM	73	NW	Unspecified Tank	1978
506CJ	74	S	Unspecified Tank	1927
507CK	79	W	Tanks	1951
508CK	79	W	Tanks	1963
509CK	80	W	Unspecified Tank	1949
510CK	80	W	Unspecified Tank	1949

511CK	80	W	Unspecified Tank	1949
512CL	80	E	Tanks	1990
513CL	80	E	Tanks	1984
514CM	82	NW	Unspecified Tank	1975
515CJ	87	S	Tanks	1958
516CJ	87	S	Tanks	1968
517CJ	87	S	Tanks	1949
518CJ	87	S	Tanks	1949
519CJ	87	S	Tanks	1968
520CJ	87	S	Tanks	1957
521CN	87	S	Unspecified Tank	1958
522CN	87	S	Unspecified Tank	1949
523CN	88	S	Unspecified Tank	1949
524CO	90	S	Unspecified Tank	1968
525	91	NW	Unspecified Tank	1975
526CO	91	S	Unspecified Tank	1967
527CO	91	S	Unspecified Tank	1976
528CL	94	E	Tanks	1990
529CI	107	E	Unspecified Tank	1957
530CI	107	E	Unspecified Tank	1968
531CI	107	E	Unspecified Tank	1949
532CI	107	E	Unspecified Tank	1949
533CI	107	E	Unspecified Tank	1968
534CI	107	E	Unspecified Tank	1958
535CP	111	N	Unspecified Tank	1949
536CP	112	N	Unspecified Tank	1963
537CP	112	N	Unspecified Tank	1949
538CJ	112	S	Unspecified Tank	1968
539CJ	112	S	Unspecified Tank	1968
540CJ	112	S	Unspecified Tank	1981
541CJ	113	S	Unspecified Tank	1984
542CQ	145	N	Tanks	1966
543CQ	145	N	Tanks	1975
544CR	149	NW	Unspecified Tank	1980
545CR	149	NW	Unspecified Tank	1985
546AG	150	SE	Tanks	1990
547	170	W	Unspecified Tank	1990
548AG	174	SE	Unspecified Tank	1990
549CS	191	E	Unspecified Tank	1981
550CS	191	E	Unspecified Tank	1990
551CS	191	E	Unspecified Tank	1984
552CS	191	E	Unspecified Tank	1968
553CS	192	E	Unspecified Tank	1968
554CT	215	S	Unspecified Tank	1927
555CT	215	S	Unspecified Tank	1905
556	230	NW	Unspecified Tank	1985

557CU	244	SE	Unspecified Tank	1968
558CU	244	SE	Unspecified Tank	1968
559CU	248	SE	Tanks	1968
560CU	248	SE	Tanks	1968
561CU	251	SE	Unspecified Tank	1958
562CU	251	SE	Unspecified Tank	1949
563CU	252	SE	Unspecified Tank	1957
564CU	252	SE	Unspecified Tank	1949
565CV	258	E	Tanks	1981
566CV	259	E	Tanks	1968
567CV	259	E	Tanks	1949
568CV	259	E	Tanks	1958
569CV	259	E	Tanks	1957
570CV	259	E	Tanks	1968
571CV	259	E	Tanks	1949
572CV	260	E	Tanks	1984
573	276	S	Unspecified Tank	1927
574CU	283	SE	Unspecified Tank	1968
575CU	283	SE	Unspecified Tank	1964
576CU	283	SE	Unspecified Tank	1971
577CW	285	NW	Unspecified Tank	1928
578CW	285	NW	Unspecified Tank	1887
579CW	285	NW	Unspecified Tank	1905
580CV	286	E	Unspecified Tank	1958
581CV	286	E	Unspecified Tank	1949
582CV	287	E	Unspecified Tank	1957
583CV	287	E	Unspecified Tank	1949
584CX	292	N	Unspecified Tank	1975
585CX	292	N	Unspecified Tank	1966
586CX	292	N	Unspecified Tank	1990
587CX	292	N	Unspecified Tank	1990
588CY	304	S	Unspecified Tank	1968
589CY	304	S	Unspecified Tank	1972
590CY	304	S	Unspecified Tank	1968
591CY	304	S	Unspecified Tank	1990
592CY	311	S	Unspecified Tank	1949
593CY	314	S	Unspecified Tank	1949
594CY	314	S	Unspecified Tank	1953
595CY	314	S	Tanks	1972
596CZ	321	SE	Unspecified Tank	1981
597CZ	322	SE	Unspecified Tank	1984
598DA	326	SE	Tanks	1967
599DA	326	SE	Tanks	1968
600CZ	328	SE	Unspecified Tank	1981
601CZ	330	SE	Unspecified Tank	1984
602AM	358	N	Tanks	1928

603DB	364	SE	Unspecified Tank	1927
604DB	366	SE	Unspecified Tank	1967
605AY	367	E	Unspecified Tank	1970
606DC	371	SE	Unspecified Tank	1981
607DC	371	SE	Unspecified Tank	1990
608DC	371	SE	Unspecified Tank	1984
609DD	373	NW	Tanks	1968
610DD	374	NW	Tanks	1987
611DD	374	NW	Tanks	1987
612BB	374	E	Unspecified Tank	1963
613BB	374	E	Unspecified Tank	1949
614BB	375	E	Unspecified Tank	1949
615DE	376	E	Unspecified Tank	1949
616AX	376	E	Unspecified Tank	1990
617DE	376	E	Unspecified Tank	1963
618DE	376	E	Unspecified Tank	1949
619AX	377	E	Unspecified Tank	1963
620AX	377	E	Unspecified Tank	1949
621DD	377	NW	Tanks	1968
622DD	377	NW	Tanks	1968
623AX	377	E	Unspecified Tank	1949
624AX	377	E	Unspecified Tank	1970
625BB	388	E	Tanks	1990
626BB	389	E	Unspecified Tank	1970
627BF	392	N	Tanks	1968
628DD	393	NW	Unspecified Tank	1968
629DD	394	NW	Unspecified Tank	1987
630DD	394	NW	Unspecified Tank	1987
631	395	SE	Unspecified Tank	1990
632DF	398	SE	Tanks	1976
633BF	412	N	Unspecified Tank	1987
634BF	412	N	Unspecified Tank	1987
635AJ	416	SE	Tanks	1976
636AJ	416	SE	Tanks	1976
637BF	422	N	Unspecified Tank	1968
638	429	NE	Unspecified Tank	1905
639BH	438	N	Unspecified Tank	1954
640BH	438	N	Unspecified Tank	1966
641BH	439	N	Unspecified Tank	1963
642	439	NW	Unspecified Tank	1968
643	445	S	Unspecified Tank	1905
644BD	467	SE	Unspecified Tank	1949
645EC	467	SE	Unspecified Tank	1949
646BD	468	SE	Tanks	1968
647BD	472	SE	Tanks	1990
648BD	477	SE	Tanks	1949

649BD	478	SE	Tanks	1949
650DG	479	SE	Tanks	1968
651DG	479	SE	Tanks	1967
652BQ	487	SE	Tanks	1967
653ED	493	N	Unspecified Tank	1968

1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary: 215

ID	Distance (m)	Direction	Use	Date
654DH	0	On Site	Electricity Substation	1976
655DH	0	On Site	Electricity Substation	1968
656DH	0	On Site	Electricity Substation	1967
657DH	0	On Site	Electricity Substation	1986
658DH	0	On Site	Electricity Substation	1976
659DH	0	On Site	Electricity Substation	1949
660DH	0	On Site	Electricity Substation	1968
661D	0	On Site	Gas Works	1949
662D	0	On Site	Gas Works	1967
663D	0	On Site	Gas Works	1949
664D	0	On Site	Gas Works	1968
665C	0	On Site	Gasometers	1887
666C	0	On Site	Gasometers	1967
667C	0	On Site	Gasometer	1949
668C	0	On Site	Gasometers	1968
669C	0	On Site	Gasometers	1949
670C	0	On Site	Gasometer	1949
671DI	0	On Site	Electricity Substation	1996
672A	0	On Site	Gas Distribution Station	1996
673DI	0	On Site	Electricity Substation	1976
674A	0	On Site	Gas Distribution Station	1976
675DI	0	On Site	Electricity Substation	1967
676A	0	On Site	Gas Distribution Station	1990
677A	0	On Site	Gas Holder Station	1986
678DI	0	On Site	Electricity Substation	1990
679DI	0	On Site	Electricity Substation	1968
680A	0	On Site	Gasholder	1949
681A	0	On Site	Gasholder	1967
682A	0	On Site	Gasholder	1976
683A	0	On Site	Gas Holder	1986

684A	0	On Site	Gasholder	1949
685A	0	On Site	Gasholder	1968
686D	0	On Site	Electricity Substation	1996
687D	0	On Site	Electricity Substation	1990
688L	0	On Site	Electricity Works	1968
689L	0	On Site	Electricity Works	1968
690L	0	On Site	Electricity Works	1981
691L	0	On Site	Electricity Works	1984
692DJ	0	On Site	Electricity Substation	1980
693DJ	0	On Site	Electricity Substation	1978
694M	0	On Site	Gas Works	1887
695DH	0	On Site	Electricity Substation	1986
696DH	0	On Site	Electricity Substation	1996
697DH	0	On Site	Electricity Substation	1990
698N	0	On Site	Gas Holder Station	1996
699M	0	On Site	Gasometer	1887
700DH	0	On Site	Electricity Substation	1967
701DH	0	On Site	Electricity Substation	1949
702D	0	On Site	Gas Works	1887
703DI	0	On Site	Electricity Substation	1986
704F	0	On Site	Electricity Substation	1986
705F	0	On Site	Electricity Substation	1996
706M	0	On Site	Gas Holder	1996
707N	0	On Site	Electricity Substation	1996
708O	0	On Site	Gasometer	1887
709O	0	On Site	Gasometer	1949
710O	0	On Site	Gasometer	1966
711O	0	On Site	Gasometer	1949
712O	0	On Site	Gas Holder	1996
713O	0	On Site	Gasometer	1949
714O	0	On Site	Gasometer	1966
715O	0	On Site	Gasometer	1963
716O	0	On Site	Gasometer	1949
717Q	0	On Site	Gasometers	1887
718M	0	On Site	Gas Works	1963
719M	0	On Site	Gas Works	1966
720M	0	On Site	Gasometer	1963
721M	0	On Site	Gasometer	1949
722M	0	On Site	Gasometer	1949
723M	0	On Site	Gasometer	1966
724M	0	On Site	Gasometer	1966
725F	0	On Site	Electricity Substation	1990
726O	0	On Site	Gasometer	1963
727M	0	On Site	Gas Holder	1984
728O	0	On Site	Gas Holder	1984
729C	0	On Site	Gasometers	1883

730N	0	On Site	Gas Holder Station	1990
731O	0	On Site	Gas Holder	1990
732M	0	On Site	Gas Holder	1990
733N	0	On Site	Electricity Substation	1990
734D	0	On Site	Gas Works	1883
735DJ	0	On Site	Electricity Substation	1985
736M	0	On Site	Gas Works	1949
737M	0	On Site	Gas Works	1949
738Q	0	On Site	Gasometers	1883
739O	0	On Site	Gasometer	1883
740O	0	On Site	Gas Works	1883
741M	0	On Site	Gasometer	1883
742F	0	On Site	Electricity Substation	1990
743N	0	On Site	Gas Holder Station	1984
744N	0	On Site	Electricity Substation	1984
745DJ	0	On Site	Electricity Substation	1978
746	10	N	Electricity Substation	1951
747DK	13	S	Electricity Substation	1981
748DK	13	S	Electricity Substation	1990
749DK	13	S	Electricity Substation	1984
750V	13	S	Electricity Works	1949
751DL	13	S	Electricity Substation	1949
752U	14	S	Electricity Works	1968
753DL	14	S	Electricity Works	1968
754DL	14	S	Electricity Works	1968
755U	14	S	Electricity Works	1968
756DL	15	S	Electricity Works	1981
757DL	15	S	Electricity Works	1984
758V	15	S	Electricity Works	1949
759DL	15	S	Electricity Substation	1949
760U	15	S	Electricity Works	1981
761U	15	S	Electricity Works	1984
762U	15	S	Electricity Works	1990
763DM	18	W	Electricity Substation	1978
764DM	20	W	Electricity Substation	1985
765DM	20	W	Electricity Substation	1990
766DN	28	E	Electricity Substation	1996
767DN	29	E	Electricity Substation	1990
768DN	29	E	Electricity Substation	1984
769DO	34	NW	Electricity Substation	1996
770DO	35	NW	Electricity Substation	1986
771DO	35	NW	Electricity Substation	1990
772DO	35	NW	Electricity Substation	1990
773DO	35	NW	Electricity Substation	1975
774DO	35	NW	Electricity Substation	1968
775CO	39	SE	Electricity Substation	1968

776CO	39	SE	Electricity Substation	1968
777CO	39	SE	Electricity Substation	1984
778CO	39	SE	Electricity Substation	1981
779Y	59	N	Electricity Substation	1986
780Y	59	N	Electricity Substation	1990
781Y	64	N	Electricity Substation	1975
782Y	67	N	Electricity Substation	1996
783DP	98	E	Electricity Substation	1990
784DP	98	E	Electricity Substation	1984
785DP	99	E	Electricity Substation	1949
786DP	99	E	Electricity Substation	1996
787DP	99	E	Electricity Substation	1949
788CQ	110	N	Electricity Substation	1990
789CQ	110	N	Electricity Substation	1984
790DQ	112	N	Electricity Substation	1986
791DQ	112	N	Electricity Substation	1990
792DQ	112	N	Electricity Substation	1990
793DQ	113	N	Electricity Substation	1996
794CQ	118	N	Electricity Substation	1996
795CQ	120	N	Electricity Substation	1975
796CQ	120	N	Electricity Substation	1990
797CQ	120	N	Electricity Substation	1990
798AC	120	W	Electricity Substation	1949
799AC	121	W	Electricity Substation	1949
800AC	121	W	Electricity Substation	1975
801AC	121	W	Electricity Substation	1951
802AC	121	W	Electricity Substation	1968
803AC	124	W	Electricity Substation	1986
804AC	124	W	Electricity Substation	1990
805AC	124	W	Electricity Substation	1990
806AC	125	W	Electricity Substation	1996
807	180	S	Electricity Substation	1990
808DS	210	NW	Electricity Substation	1978
809DR	214	S	Electricity Substation	1968
810DR	214	S	Electricity Substation	1990
811DR	214	S	Electricity Substation	1967
812DR	214	S	Electricity Substation	1976
813DS	215	NW	Electricity Substation	1978
814DS	215	NW	Electricity Substation	1980
815DS	215	NW	Electricity Substation	1985
816DT	267	W	Electricity Substation	1985
817DT	267	W	Electricity Substation	1990
818DU	290	SE	Electricity Substation	1990
819DU	291	SE	Electricity Substation	1968
820DU	291	SE	Electricity Substation	1976
821DU	291	SE	Electricity Substation	1967

822CY	308	S	Electricity Substation	1972
823CY	312	S	Electricity Substation	1990
824BA	327	NE	Electricity Substation	1949
825DV	328	W	Electricity Substation	1985
826DV	328	W	Electricity Substation	1990
827DV	328	W	Electricity Substation	1978
828BA	328	NE	Electricity Substation	1975
829BA	328	NE	Electricity Substation	1954
830BA	331	NE	Electricity Substation	1949
831BA	333	NE	Electricity Substation	1990
832BA	333	NE	Electricity Substation	1990
833CZ	333	SE	Electricity Substation	1976
834DW	335	SE	Electricity Substation	1968
835DW	335	SE	Electricity Substation	1981
836DW	335	SE	Electricity Substation	1984
837DW	335	SE	Electricity Substation	1990
838DW	336	SE	Electricity Substation	1968
839AY	349	E	Electricity Substations	1970
840AY	349	E	Electricity Substation	1949
841AY	349	E	Electricity Substation	1949
842AM	358	N	Electricity Substation	1954
843AM	359	N	Electricity Substation	1949
844AM	359	N	Electricity Substation	1949
845DX	361	NW	Electricity Substation	1978
846DX	361	NW	Electricity Substation	1980
847DX	361	NW	Electricity Substation	1985
848DY	366	N	Electricity Substation	1975
849DY	366	N	Electricity Substation	1990
850DY	366	N	Electricity Substation	1990
851ER	368	NW	Electricity Substation	1968
852AS	370	NW	Electricity Substation	1987
853AS	370	NW	Electricity Substation	1987
854AS	370	NW	Electricity Substation	1990
855AS	381	NW	Electricity Substation	1987
856AS	381	NW	Electricity Substation	1987
857AS	381	NW	Electricity Substation	1990
858DZ	383	N	Electricity Substation	1990
859DZ	383	N	Electricity Substation	1975
860EA	426	S	Electricity Substation	1972
861EA	426	S	Electricity Substation	1990
862EB	466	N	Electricity Substation	1990
863EB	466	N	Electricity Substation	1987
864EB	466	N	Electricity Substation	1987
865EC	470	SE	Electricity Substation	1990
866	476	SE	Electricity Works	1990
867ED	479	N	Electricity Substation	1990

868BK	480	N	Electricity Substation	1990

1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary: 0

Database searched and no data found.

1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 68

ID	Distance (m)	Direction	Use	Date
869I	0	On Site	Garage	1963
870EE	0	On Site	Garage	1976
871EE	0	On Site	Garage	1967
872EE	0	On Site	Garage	1986
873EF	0	On Site	Garage	1975
874EF	0	On Site	Garage	1968
875EG	0	On Site	Garage	1975
876EG	0	On Site	Garage	1968
877EE	0	On Site	Garage	1990
878I	0	On Site	Garage	1951
879I	0	On Site	Garage	1949
880I	0	On Site	Garage	1986
881I	0	On Site	Garage	1990
882I	0	On Site	Garage	1975
883I	0	On Site	Garage	1968
884EE	0	On Site	Garage	1968
885EF	0	On Site	Garage	1986
886EF	0	On Site	Garage	1968
887EH	0	On Site	Garage	1996
888I	0	On Site	Garage	1996
889CC	0	On Site	Garage	1996
890EE	0	On Site	Garage	1996
891EH	0	On Site	Garage	1986
892EH	0	On Site	Garage	1990
893EH	0	On Site	Garage	1990

894CC	0	On Site	Garage	1966
895CC	0	On Site	Garage	1990
896CC	0	On Site	Garage	1984
897BU	15	E	Motor Repair Works	1968
898BU	16	E	Motor Repair Works	1968
899EI	93	SE	Garage	1958
900EI	93	SE	Boat Repair Yard	1968
901EI	94	SE	Boat Repair Yard	1968
902EI	126	SE	Garage	1957
903EI	126	SE	Garage	1949
904EJ	170	N	Garage	1990
905EJ	172	N	Garage	1975
906EJ	172	N	Garage	1966
907EK	177	N	Garage	1975
908EK	177	N	Garage	1954
909EK	189	N	Garage	1966
910EK	193	N	Garage	1949
911EK	194	N	Garage	1990
912EK	194	N	Garage	1990
913EK	199	N	Garage	1949
914EK	200	N	Garage	1963
915CW	219	NW	Garage	1963
916CW	223	NW	Garage	1987
917CW	223	NW	Garage	1987
918EL	227	N	Garage	1966
919EL	227	N	Garage	1954
920EL	228	N	Garage	1990
921EL	232	N	Garage	1963
922CW	232	NW	Garage	1949
923CW	232	NW	Garage	1968
924CW	232	NW	Garage	1957
925CU	234	SE	Garage	1971
926CU	235	SE	Garage	1990
927CU	241	SE	Garage	1964
928CU	241	SE	Garage	1968
929EL	261	N	Garage	1990
930EL	261	N	Garage	1990
931AS	286	N	Shipbuilding and Repairing Yard	1987
932AS	286	N	Shipbuilding and Repairing Yard	1987
933AS	286	N	Shipbuilding and Repairing Yard	1990
934DZ	365	N	Garage	1954
935DZ	365	N	Garage	1949
936DZ	365	N	Garage	1963

1.6 Potentially Infilled Land

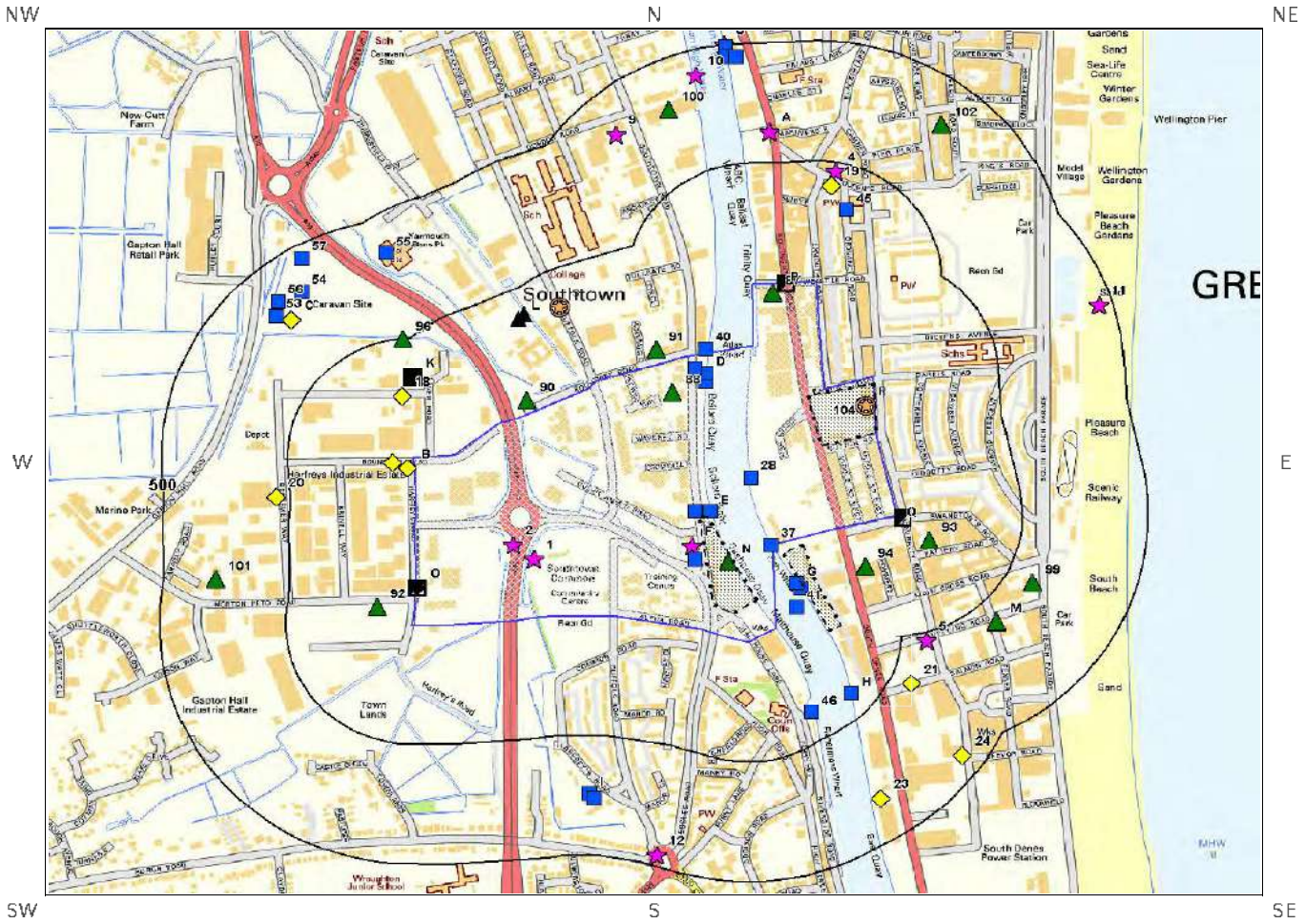
Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 81

The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
937J	0	On Site	Quay	1938
938J	0	On Site	Quay	1938
939K	0	On Site	Unspecified Wharf	1946
940J	0	On Site	Quay	1978
941DK	0	On Site	Unspecified Wharf	1978
942D	0	On Site	Quay	1904
943D	0	On Site	Quay	1946
944E	0	On Site	Quay	1978
945E	0	On Site	Quay	1988
946D	0	On Site	Quay	1938
947D	0	On Site	Quay	1938
948EM	0	On Site	Unspecified Wharf	1884
949B	0	On Site	Quay	1952
950EN	0	On Site	Unspecified Wharf	1988
951B	0	On Site	Quay	1988
952B	0	On Site	Quay	1978
953B	0	On Site	Quay	1938
954B	0	On Site	Quay	1938
955G	0	On Site	Quay	1946
956K	0	On Site	Unspecified Wharf	1904
957G	0	On Site	Quay	1904
958H	0	On Site	Quay	1978
959H	0	On Site	Quay	1988
960EO	15	S	Pond	1884
961EO	15	S	Pond	1901
962AB	52	N	Dock	1946
963Z	73	SE	Quay	1946
964Z	73	SE	Quay	1904
965EP	117	E	Sand Pit	1884
966EQ	124	SE	Quay	1988
967CP	127	N	Dry Docks	1904
968AJ	164	SE	Quay	1946
969AH	169	SE	Quay	1988
970AH	169	SE	Quay	1978
971AH	172	SE	Quay	1904
972AH	172	SE	Quay	1946
973AJ	188	SE	Quay	1952
974DB	188	SE	Quay	1978

975AK	203	NE	Unspecified Ground Workings	1938
976AK	203	NE	Unspecified Ground Workings	1938
977AH	230	SE	Quay	1938
978AH	230	SE	Quay	1938
979AD	249	NE	Unspecified Pit	1901
980AR	269	W	Unspecified Pit	1901
981DF	277	SE	Quay	1988
982AR	279	W	Unspecified Pit	1884
983AR	280	W	Unspecified Pit	1904
984AR	280	W	Unspecified Pit	1946
985AR	291	W	Unspecified Heap	1938
986AR	291	W	Unspecified Heap	1938
987AS	295	N	Dry Dock	1988
988ER	295	N	Dry Dock	1978
989AR	298	W	Unspecified Pit	1952
990DC	303	SE	Refuse Heap	1884
991	306	NW	Pond	1952
992ER	316	N	Dry Docks	1938
993ER	316	N	Dry Docks	1938
994AS	329	N	Dry Docks	1904
995AS	329	N	Dry Docks	1946
996BP	367	W	Cuttings	1884
997ES	371	E	Pond	1938
998ES	372	E	Pond	1946
999BE	382	S	Unspecified Pit	1946
1000BE	382	S	Unspecified Pit	1904
1001ES	385	E	Pond	1988
1002ES	385	E	Pond	1978
1003ET	397	NE	Unspecified Heap	1952
1004EU	421	NE	Boating Lake	1988
1005EU	421	NE	Boating Lake	1978
1006BI	436	SE	Quay	1938
1007BI	436	SE	Quay	1938
1008BO	436	W	Cuttings	1901
1009BL	458	S	Unspecified Heap	1988
1010BL	458	S	Unspecified Heap	1978
1011BN	461	N	Quay	1904
1012BN	461	N	Quay	1946
1013BO	463	W	Cuttings	1938
1014BO	464	W	Cuttings	1946
1015BO	464	W	Cuttings	1904
1016BP	469	W	Cuttings	1952
1017BO	496	W	Cuttings	1952

2. Environmental Permits, Incidents and Registers Map



- Site Outline
- Search Buffers (m) — 250 / 500
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- Hazardous Substance Consents and Enforcements

2. Environmental Permits, Incidents and Registers

2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

21

The following Part A(1) and IPPC Authorised Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
113K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: DISPOSAL OR RECOVERY OF HAZARDOUS WASTE WITH A CAPACITY EXCEEDING 10 TONNES PER DAY INVOLVING PHYSICO-CHEMICAL TREATMENT	Permit Number: JP3336EE Original Permit Number: RP3636SR EPR Reference: - Issue Date: 15/1/2014 Effective Date: 15/1/2014 Last date noted as effective: 2017-04-01 Status: Superceded
114K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: DISPOSAL OR RECOVERY OF HAZ WASTE WITH CAPACITY EXCEEDING 10 TONNES PER DAY INVOLVING BLENDING OR MIXING PRIOR TO SUBMISSION TO ANY OF THE OTHER ACTIVITIES LISTED IN THIS SECTION OR IN SECTION 5.1	Permit Number: JP3336EE Original Permit Number: RP3636SR EPR Reference: - Issue Date: 15/1/2014 Effective Date: 15/1/2014 Last date noted as effective: 2017-04-01 Status: Superceded
115K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: DISPOSAL OF > 50 T/D NON-HAZARDOUS WASTE (> 100 T/D IF ONLY AD) INVOLVING PHYSICO-CHEMICAL TREATMENT	Permit Number: JP3336EE Original Permit Number: RP3636SR EPR Reference: - Issue Date: 15/1/2014 Effective Date: 15/1/2014 Last date noted as effective: 2017-04-01 Status: Superceded

ID	Distance (m)	Direction	NGR	Details	
116K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: TEMPORARY STORAGE OF HAZ WASTE NOT UNDER S 5.2 PENDING ACTIVITIES LISTED IN S 5.1, 5.2, 5.3 AND PARAGRAPH (B) OF THIS SECTION WITH A TOTAL CAPACITY > 50 TONNES, EXCL TEMP STORAGE WHERE GENERATED	Permit Number: JP3336EE Original Permit Number: RP3636SR EPR Reference: - Issue Date: 15/1/2014 Effective Date: 15/1/2014 Last date noted as effective: 2017-04-01 Status: Superceded
117K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: ASSOCIATED PROCESS	Permit Number: JP3336EE Original Permit Number: RP3636SR EPR Reference: - Issue Date: 15/1/2014 Effective Date: 15/1/2014 Last date noted as effective: 2017-04-01 Status: Superceded
118K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: DISPOSAL OR RECOVERY OF HAZARDOUS WASTE WITH A CAPACITY EXCEEDING 10 TONNES PER DAY INVOLVING PHYSICO-CHEMICAL TREATMENT	Permit Number: JP3336EE Original Permit Number: RP3636SR EPR Reference: - Issue Date: 15/1/2014 Effective Date: 15/1/2014 Last date noted as effective: 2017-04-01 Status: Superceded
119K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: OTHER WASTE DISPOSAL; WASTE OILS >10 T/D	Permit Number: RP3636SR Original Permit Number: RP3636SR EPR Reference: - Issue Date: 29/6/2006 Effective Date: 29/6/2006 Last date noted as effective: 2017-04-01 Status: Superceded
120K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: OTHER WASTE DISPOSAL; NON-HAZARDOUS WASTE >50T/D BY PHYSICO-CHEMICAL TREATMENT	Permit Number: RP3636SR Original Permit Number: RP3636SR EPR Reference: - Issue Date: 29/6/2006 Effective Date: 29/6/2006 Last date noted as effective: 2017-04-01 Status: Superceded
121K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: OTHER WASTE DISPOSAL; HAZARDOUS WASTE >10T/D	Permit Number: RP3636SR Original Permit Number: RP3636SR EPR Reference: - Issue Date: 29/6/2006 Effective Date: 29/6/2006 Last date noted as effective: 2017-04-01 Status: Superceded
122K	167	N	651840 306180	Operator: Biffa Waste Services Ltd Installation Name: Great Yarmouth Wm Resource Centre Epr/rp3636sr Process: OTHER WASTE DISPOSAL; HAZARDOUS WASTE >10T/D	Permit Number: RP3636SR Original Permit Number: RP3636SR EPR Reference: - Issue Date: 29/6/2006 Effective Date: 29/6/2006 Last date noted as effective: 2017-04-01 Status: Superceded

ID	Distance (m)	Direction	NGR	Details	
123K	167	N	651840 306180	Operator: Augean North Sea Services Limited Installation Name: Great Yarmouth Wm Resource Centre Epr/zp3637rm Process: DISPOSAL OR RECOVERY OF HAZ WASTE WITH CAPACITY EXCEEDING 10 TONNES PER DAY INVOLVING BLENDING OR MIXING PRIOR TO SUBMISSION TO ANY OF THE OTHER ACTIVITIES LISTED IN THIS SECTION OR IN SECTION 5.1	Permit Number: ZP3637RM Original Permit Number: ZP3637RM EPR Reference: - Issue Date: 28/4/2016 Effective Date: 28/4/2016 Last date noted as effective: 2017-04-01 Status: Transfer Effective
124K	167	N	651840 306180	Operator: Augean North Sea Services Limited Installation Name: Great Yarmouth Wm Resource Centre Epr/zp3637rm Process: DISPOSAL OF > 50 T/D NON-HAZARDOUS WASTE (> 100 T/D IF ONLY AD) INVOLVING PHYSICO-CHEMICAL TREATMENT	Permit Number: ZP3637RM Original Permit Number: ZP3637RM EPR Reference: - Issue Date: 28/4/2016 Effective Date: 28/4/2016 Last date noted as effective: 2017-04-01 Status: Transfer Effective
125K	167	N	651840 306180	Operator: Augean North Sea Services Limited Installation Name: Great Yarmouth Wm Resource Centre Epr/zp3637rm Process: TEMPORARY STORAGE OF HAZ WASTE NOT UNDER S 5.2 PENDING ACTIVITIES LISTED IN S 5.1, 5.2, 5.3 AND PARAGRAPH (B) OF THIS SECTION WITH A TOTAL CAPACITY > 50 TONNES, EXCL TEMP STORAGE WHERE GENERATED	Permit Number: ZP3637RM Original Permit Number: ZP3637RM EPR Reference: - Issue Date: 28/4/2016 Effective Date: 28/4/2016 Last date noted as effective: 2017-04-01 Status: Transfer Effective
126K	167	N	651840 306180	Operator: Augean North Sea Services Limited Installation Name: Great Yarmouth Wm Resource Centre Epr/zp3637rm Process: ASSOCIATED PROCESS	Permit Number: ZP3637RM Original Permit Number: ZP3637RM EPR Reference: - Issue Date: 28/4/2016 Effective Date: 28/4/2016 Last date noted as effective: 2017-04-01 Status: Transfer Effective
127K	167	N	651840 306180	Operator: Augean North Sea Services Limited Installation Name: Great Yarmouth Wm Resource Centre Epr/zp3637rm Process: DISPOSAL OR RECOVERY OF HAZARDOUS WASTE WITH A CAPACITY EXCEEDING 10 TONNES PER DAY INVOLVING PHYSICO-CHEMICAL TREATMENT	Permit Number: ZP3637RM Original Permit Number: ZP3637RM EPR Reference: - Issue Date: 28/4/2016 Effective Date: 28/4/2016 Last date noted as effective: 2017-04-01 Status: Transfer Effective
128L	187	NW	652050 306300	Operator: C & L Waste Oil Collection Limited Installation Name: Great Yarmouth Oil Reclamation Facility Epr/np3038mb Process: DISPOSAL OR RECOVERY OF HAZARDOUS WASTE WITH A CAPACITY EXCEEDING 10 TONNES PER DAY INVOLVING PHYSICO-CHEMICAL TREATMENT	Permit Number: WP3437RY Original Permit Number: NP3038MB EPR Reference: - Issue Date: 27/4/2016 Effective Date: 27/4/2016 Last date noted as effective: 2017-04-01 Status: Effective

ID	Distance (m)	Direction	NGR	Details	
129L	187	NW	652050 306300	Operator: C & L Waste Oil Collection Limited Installation Name: Great Yarmouth Oil Reclamation Facility Epr/np3038mb Process: TEMPORARY STORAGE OF HAZ WASTE NOT UNDER S 5.2 PENDING ACTIVITIES LISTED IN S 5.1, 5.2, 5.3 AND PARAGRAPH (B) OF THIS SECTION WITH A TOTAL CAPACITY > 50 TONNES, EXCL TEMP STORAGE WHERE GENERATED	Permit Number: WP3437RY Original Permit Number: NP3038MB EPR Reference: - Issue Date: 27/4/2016 Effective Date: 27/4/2016 Last date noted as effective: 2017-04-01 Status: Effective
130L	192	NW	652060 306310	Operator: C & L Waste Oil Collection Limited Installation Name: C & L Waste Oil Collection Process: RECOVERY OF WASTE; CLEANING/REGENERATING CARBON ETC BY REMOVING SCHEDULED SUBSTANCES	Permit Number: NP3038MB Original Permit Number: NP3038MB EPR Reference: - Issue Date: 17/10/2007 Effective Date: 17/10/2007 Last date noted as effective: 2011-08-08 Status: Effective
131L	192	NW	652060 306310	Operator: C & L Waste Oil Collection Limited Installation Name: Great Yarmouth Oil Reclamation Facility Epr/np3038mb Process: TEMPORARY STORAGE OF HAZ WASTE NOT UNDER S 5.2 PENDING ACTIVITIES LISTED IN S 5.1, 5.2, 5.3 AND PARAGRAPH (B) OF THIS SECTION WITH A TOTAL CAPACITY > 50 TONNES, EXCL TEMP STORAGE WHERE GENERATED	Permit Number: FP3934ER Original Permit Number: NP3038MB EPR Reference: - Issue Date: 10/12/2013 Effective Date: 10/12/2013 Last date noted as effective: 2017-04-01 Status: Superceded
132L	192	NW	652060 306310	Operator: C & L Waste Oil Collection Limited Installation Name: Great Yarmouth Oil Reclamation Facility Epr/np3038mb Process: OTHER WASTE DISPOSAL; WASTE OILS >10 T/D	Permit Number: NP3038MB Original Permit Number: NP3038MB EPR Reference: - Issue Date: 17/10/2007 Effective Date: 17/10/2007 Last date noted as effective: 2017-04-01 Status: Superceded
133L	192	NW	652060 306310	Operator: C & L Waste Oil Collection Limited Installation Name: Great Yarmouth Oil Reclamation Facility Epr/np3038mb Process: DISPOSAL OR RECOVERY OF HAZARDOUS WASTE WITH A CAPACITY EXCEEDING 10 TONNES PER DAY INVOLVING PHYSICO-CHEMICAL TREATMENT	Permit Number: FP3934ER Original Permit Number: NP3038MB EPR Reference: - Issue Date: 10/12/2013 Effective Date: 10/12/2013 Last date noted as effective: 2017-04-01 Status: Superceded

2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

2

The following List 1 Dangerous Substance Inventory Site records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
14O	0	On Site	651850 305740	Name: Weatherford Uk Limited Status: Not Active Receiving Water: Na	Authorised Substances: Mercury (other), Cadmium
15C	376	NW	651600 306300	Name: Biffa Waste Services Ltd Status: Active Receiving Water: Na	Authorised Substances: Mercury (other), Cadmium, Carbon tetrachloride, Aldrin, Dieldrin, Endrin, Hexachlorobenzene, Hexachlorobutadiene, Trichlorobenzene, Total DDT

2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

9

The following List 2 Dangerous Substance Inventory Site records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
16B	15	W	651830 305990	Name: Great Yarmouth Cardboard Box Company Status: Not Active Receiving Water: Na	Authorised Substances: pH
17B	44	W	651800 306000	Name: U K Waste Management Limited Status: Active Receiving Water: North Sea	Authorised Substances: Chromium, Copper, Lead, Nickel, Zinc
18	129	N	651820 306140	Name: Edeco Petroleum Services Ltd Status: Not Active Receiving Water: Na	Authorised Substances: pH
19	200	N	652670 306580	Name: Blackfriars Brewery Status: Not Active Receiving Water: Na	Authorised Substances: pH
20	278	W	651570 305930	Name: Superior Linen Service Ltd Status: Not Active Receiving Water: Na	Authorised Substances: pH
21	294	SE	652830 305540	Name: Asco Uk Ltd Status: Not Active Receiving Water: Na	Authorised Substances: pH

ID	Distance (m)	Direction	NGR	Details	
22C	376	NW	651600 306300	Name: Biffa Waste Services Ltd Status: Active Receiving Water: Na	Authorised Substances: Arsenic, Chromium, Copper, Cyanide, Dichlorvos, Lead, Nickel, pH, Tributyltin, Triphenyltin, Zinc, Atrazine & Simazine, Azinphos-methyl, Endosulphan, Fenitrothion, Malathion, Trifluralin, Phenol
23	414	SE	652770 305300	Name: Co-operative Cleaners Ltd Status: Active Receiving Water: Na	Authorised Substances: pH
24	456	SE	652930 305390	Name: C-mac Microcircuits Limited Status: Not Active Receiving Water: Na	Authorised Substances: pH

2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

16

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
87	0	On Site	652554 306353	Address: L J Steward, South Quay Service Station, Southgate Road, N1 3HU Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
88	0	On Site	652355 306146	Address: L J Steward, Southtown Road Service Station, Southtown Road, NR31 0JZ Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
89N	0	On Site	652465 305791	Address: CEBO (UK) Ltd, Gas House Quay North, Malthouse Lane, Gorleston, Norfolk, NR31 0GY Process: Use of Bulk Cement Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
90	24	NW	652066 306129	Address: Cemex UK Materials Ltd, Boundary Road, NR31 0LW Process: Use of Bulk Cement Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
91	26	N	652324 306236	Address: Jewson, Boundary Road, Great Yarmouth, Norfolk, NR31 0JY Process: timber process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
92	74	W	651771 305697	Address: C & H Quickmix Ltd, Morton Peto Road, Great Yarmouth, Norfolk, NR31 0LT Process: Use of Bulk Cement Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified

ID	Distance (m)	Direction	NGR	Details	
93	86	SE	652865 305835	Address: British Metal Treatments Ltd, 40 Battery Road, Great Yarmouth, NR30 3NN Process: Other Metal Processes Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
94	94	S	652738 305781	Address: Haliburton Manufacturing & Services Ltd, Berth 1A, South Denes Road, Great Yarmouth, NR30 3PF Process: Use of Bulk Cement Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
95K	165	N	651839 306178	Address: UK Waste Management, Bessemer Way, Great Yarmouth, Norfolk, NR31 0LX Process: waste oil burning process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
96	245	N	651821 306257	Address: Hope Construction Materials, Harfreys Industrial Estate, Bessemer Way, Great Yarmouth, NR31 0LX Process: Use of Bulk Cement Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
97M	299	SE	652998 305667	Address: East Bilney Coachworks Ltd, Fenner Road, Great Yarmouth, Norfolk, NR30 3PS Process: Respraying of Road Vehicles process Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
98M	300	SE	652998 305666	Address: Halls Group Ltd, Operate at Fenner Road, Great Yarmouth, NR30 3PS Process: Respraying of Road Vehicles process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
99	305	SE	653069 305748	Address: Constitution Motors Ltd, South Beach Parade, Great Yarmouth, NR30 3QN Process: Waste oil Burner Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
100	395	NW	652348 306736	Address: Yeoman Bulk Cargoes, Yeoman Wharf, Southtown Road, Great Yarmouth, Norfolk, NR31 0JJ Process: bulk handling of coal Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
101	398	W	651449 305756	Address: Coastground Ltd, Morton Peto Road, Great Yarmouth, Norfolk, NR31 0LT Process: Metal coating process Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
102	405	NE	652889 306703	Address: Baldwin, Albert Road, Great Yarmouth, NR30 3HP Process: waste oil burning process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified

2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

1

The following RAS Licence (3 or 4) records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Address	Operator	Type	Permission Number	Dates	Status
134K	167	N	651840 306180	Tube Care Inspection Ltd, Bessemer Way,harfeys Industrial Estate, Great Yarmouth, Norfolk, NR31 0LX	Tube Care Inspection Ltd	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	BS0329	Date of Approval:20/5/2002 Effective from:20/5/2002 Last date of update:2015-01-01	Revoked/cancelled

2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

41

The following Licensed Discharge Consents records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
25D	0	On Site	652420 306190	Address: BOUNDARY RD PS SSO, BOUNDARY RD, GREAT YARMOUTH, NR31 Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AW4TS1735 Permit Version: 2	Receiving Water: River Yare Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 13/12/1991 Effective Date: 13-Dec-1991 Revocation Date: 15/10/1999
26D	0	On Site	652420 306170	Address: BOUNDARY ROAD STORM PUMPING STATION, GREAT YARMOUTH, NORFOLK, NR31 0JY Effluent Type: SEWAGE DISCHARGES - STW STORM OVERFLOW/STORM TANK - WATER COMPANY Permit Number: AEETS12173 Permit Version: 1	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/10/1999 Effective Date: 15-Oct-1999 Revocation Date: -
27D	0	On Site	652420 306170	Address: BOUNDARY ROAD STORM PUMPING STATION, GREAT YARMOUTH, NORFOLK, NR31 0JY Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS03291/12173 Permit Version: 1	Receiving Water: RIVER YARE Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 21/10/2002 Effective Date: 16-Oct-2002 Revocation Date: 16/10/2002
28	0	On Site	652510 305970	Address: SUTTON ROAD OUTFALL, GREAT YARMOUTH Effluent Type: SEWAGE DISCHARGES - UNSPECIFIED - WATER COMPANY Permit Number: AW4TS1389 Permit Version: 1	Receiving Water: River Yare T Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 14/10/1987 Effective Date: 14-Oct-1987 Revocation Date: 30/06/1994

ID	Distance (m)	Direction	NGR	Details	
29E	0	On Site	652430 305900	Address: SOUTHTOWN/COBHAM OUTFALL, SOUTHTOWN ROAD, GREAT YARMOUTH, NORFOLK, NR31 0LF Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS03293/12171 Permit Version: 1	Receiving Water: R.YARE Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 21/02/2003 Effective Date: 27-Jan-2003 Revocation Date: 01/04/2005
30E	0	On Site	652430 305900	Address: SOUTHTOWN/COBHAM OUTFALL, SOUTHTOWN ROAD, GREAT YARMOUTH, NORFOLK, NR31 0LF Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: AEETS12171 Permit Version: 2	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 24/03/2005 Effective Date: 01-Apr-2005 Revocation Date: -
31E	0	On Site	652430 305900	Address: SOUTHTOWN/COBHAM OUTFALL, SOUTHTOWN ROAD, GREAT YARMOUTH, NORFOLK, NR31 0LF Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12171 Permit Version: 2	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 24/03/2005 Effective Date: 01-Apr-2005 Revocation Date: -
32E	0	On Site	652430 305900	Address: SOUTHTOWN/COBHAM OUTFALL, SOUTHTOWN ROAD, GREAT YARMOUTH, NORFOLK, NR31 0LF Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS03293/12171 Permit Version: 1	Receiving Water: R.YARE Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 21/02/2003 Effective Date: 27-Jan-2003 Revocation Date: 01/04/2005
33E	0	On Site	652430 305900	Address: SOUTHTOWN/COBHAM OUTFALL, SOUTHTOWN ROAD, GREAT YARMOUTH, NORFOLK, NR31 0LF Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12171 Permit Version: 1	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/10/1999 Effective Date: 15-Oct-1999 Revocation Date: 31/03/2005
34E	0	On Site	652400 305900	Address: SOUTHTOWN COMMON OUTFALL DRAINAGE S, GREAT YARMOUTH, NR31 Effluent Type: MISCELLANEOUS DISCHARGES - SURFACE WATER Permit Number: AW4TS348X Permit Version: 1	Receiving Water: River Yare Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 25/01/1963 Effective Date: 25-Jan-1963 Revocation Date: 07/06/1991
35E	0	On Site	652430 305900	Address: SOUTHTOWN/COBHAM OUTFALL, SOUTHTOWN ROAD, GREAT YARMOUTH, NORFOLK, NR31 0LF Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12171 Permit Version: 1	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/10/1999 Effective Date: 15-Oct-1999 Revocation Date: 31/03/2005
36E	0	On Site	652430 305900	Address: SOUTHTOWN/COBHAM OUTFALL, SOUTHTOWN ROAD, GREAT YARMOUTH, NORFOLK, NR31 0LF Effluent Type: SEWAGE DISCHARGES - UNSPECIFIED - WATER COMPANY Permit Number: AW4TS1387 Permit Version: 1	Receiving Water: River Yare T Status: REVOKED (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 14/10/1987 Effective Date: 14-Oct-1987 Revocation Date: 22/03/2002
37	0	On Site	652550 305830	Address: FISH WHARF OUTFALL, GREAT YARMOUTH Effluent Type: SEWAGE DISCHARGES - UNSPECIFIED - WATER COMPANY Permit Number: AW4TS1385 Permit Version: 1	Receiving Water: River Yare T Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 14/10/1987 Effective Date: 14-Oct-1987 Revocation Date: 16/02/1998

ID	Distance (m)	Direction	NGR	Details	
38F	0	On Site	652400 305800	Address: GT YARMOUTH CORPORATION, BOUNDARY ROAD Effluent Type: SEWAGE DISCHARGES - UNSPECIFIED - WATER COMPANY Permit Number: AW4TS721X Permit Version: 1	Receiving Water: River Yare Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 09/07/1971 Effective Date: 09-Jul-1971 Revocation Date: 16/02/1998
39D	0	On Site	652400 306200	Address: YEOMAN WHARF, SOUTHTOWN RD, GREAT YARMOUTH, NORFOLK, NR31 0JX Effluent Type: TRADE DISCHARGES - SITE DRAINAGE (CONTAM SURFACE WATER, NOT WASTE SIT Permit Number: PRETS8519 Permit Version: 1	Receiving Water: tidal River Yare Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 25/10/1993 Effective Date: 25-Oct-1993 Revocation Date: -
40	8	N	652420 306240	Address: BOUNDARY ROAD PS SSO, BOUNDARY ROAD, GREAT YARMOUTH, NR31 Effluent Type: SEWAGE DISCHARGES - STW STORM OVERFLOW/STORM TANK - WATER COMPANY Permit Number: AW4TS1735 Permit Version: 1	Receiving Water: River Yare Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 08/11/1988 Effective Date: 08-Nov-1988 Revocation Date: 12/12/1991
41	41	E	652600 305700	Address: SOUTH DENES RD, GT.YARMOUTH, NORFOLK (FERRY STEPS PLANT) Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: PR4TS385 Permit Version: 1	Receiving Water: Tidal River Yare Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 24/03/1986 Effective Date: 24-Mar-1986 Revocation Date: -
42G	43	E	652600 305750	Address: YARMOUTH MARINE BASE, SOUTH DENES, GT YARMOUTH, NR30 3LX Effluent Type: TRADE DISCHARGES - SITE DRAINAGE Permit Number: PRETS4620 Permit Version: 1	Receiving Water: Tidal River Yare Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 16/12/1991 Effective Date: 16-Dec-1991 Revocation Date: -
43G	53	E	652610 305740	Address: FISH WHARF PS, GREAT YARMOUTH Effluent Type: MISCELLANEOUS DISCHARGES - EMERGENCY DISCHARGES Permit Number: AEETS2306 Permit Version: 1	Receiving Water: Tidal R Yare Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 02/01/1990 Effective Date: 02-Jan-1990 Revocation Date: 30/04/1992
44G	53	E	652610 305740	Address: FISH WHARF PS, GREAT YARMOUTH Effluent Type: MISCELLANEOUS DISCHARGES - EMERGENCY DISCHARGES Permit Number: AEETS1650 Permit Version: 1	Receiving Water: - Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/09/1990 Effective Date: 15-Sep-1990 Revocation Date: 08/04/1991
45	159	N	652700 306530	Address: SALMON ROAD, GREAT YARMOUTH, NR30 3QS Effluent Type: SEWAGE DISCHARGES - UNSPECIFIED - WATER COMPANY Permit Number: AW4TS1374 Permit Version: 1	Receiving Water: River Yare T Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 14/10/1987 Effective Date: 14-Oct-1987 Revocation Date: 16/02/1998
46	189	SE	652630 305480	Address: FISHERMEN'S QUAY, GORLESTON, GT.YARMOUTH. Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: PR4TS137 Permit Version: 1	Receiving Water: The Tidal River Yare Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 23/04/1985 Effective Date: 23-Apr-1985 Revocation Date: -

ID	Distance (m)	Direction	NGR	Details	
47H	203	SE	652710 305520	Address: SUFFLING ROAD PUMPING STATION, SUFFLING ROAD, GREAT YARMOUTH, NORFOLK, NR30 3PQ Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12169 Permit Version: 1	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/10/1999 Effective Date: 15-Oct-1999 Revocation Date: 22/02/2002
48H	203	SE	652710 305520	Address: SUFFLING ROAD PUMPING STATION, SUFFLING ROAD, GREAT YARMOUTH, NORFOLK, NR30 3PQ Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: AEETS12169 Permit Version: 2	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 23/02/2002 Effective Date: 23-Feb-2002 Revocation Date: -
49H	203	SE	652710 305520	Address: SUFFLING ROAD PUMPING STATION, SUFFLING ROAD, GREAT YARMOUTH, NORFOLK, NR30 3PQ Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12169 Permit Version: 2	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 23/02/2002 Effective Date: 23-Feb-2002 Revocation Date: -
50H	203	SE	652710 305520	Address: SUFFLING ROAD PUMPING STATION, SUFFLING ROAD, GREAT YARMOUTH, NORFOLK, NR30 3PQ Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12169 Permit Version: 1	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/10/1999 Effective Date: 15-Oct-1999 Revocation Date: 22/02/2002
51I	371	S	652190 305310	Address: ATCHIN TAN, HARFREYS ROAD, GORLESTON, GT.YARMOUTH, NORFOLK Effluent Type: UNSPECIFIED Permit Number: PRELF03747 Permit Version: 1	Receiving Water: - Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 30/10/1990 Effective Date: 30-Oct-1990 Revocation Date: 01/10/1996
52I	381	S	652200 305300	Address: HARFREYS ROAD, GT YARMOUTH, NORFOLK Effluent Type: UNSPECIFIED Permit Number: PR4LF268 Permit Version: 1	Receiving Water: Soakaway Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 27/09/1985 Effective Date: 27-Sep-1985 Revocation Date: 01/10/1996
53	403	NW	651570 306310	Address: GAPTON HALL TRAVELLERS SITE, GAPTON HALL ROAD, GREAT YARMOUTH, NORFOLK, NR31 0NL Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: PRENF19844 Permit Version: 1	Receiving Water: DITCH TRIB OF TIDAL R. YARE Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 24/02/2006 Effective Date: 24-Feb-2006 Revocation Date: -
54	412	NW	651620 306360	Address: CVAN SITE GAPTONHALL RD, GREAT YARMOUTH, NORFOLK Effluent Type: MISCELLANEOUS DISCHARGES - SURFACE WATER Permit Number: PRENF07708 Permit Version: 1	Receiving Water: Trib River Yare Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 06/02/1991 Effective Date: 06-Feb-1991 Revocation Date: -

ID	Distance (m)	Direction	NGR	Details	
55	422	NW	651787 306440	Address: POLICE CUSTODY CENTRE, THAMESFIELD WAY, GREAT YARMOYTH, ., NORFOLK, NR31 0DH Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: EPREP3120GR Permit Version: 1	Receiving Water: TRIB OF THE RIVER YARE Status: NEW ISSUED UNDER EPR 2010 Issue date: 12/08/2010 Effective Date: 12-Aug-2010 Revocation Date: -
56	423	NW	651574 306340	Address: GAPTON HALL ROAD & LAND OF A12, GREAT YARMOUTH, NORFOLK, NR31 0LZ Effluent Type: SEWAGE & TRADE COMBINED - UNSPECIFIED Permit Number: PRENF20271 Permit Version: 1	Receiving Water: TRIB RIVER YARE Status: NEW CONSENT, (WATER INDUSTRY ACT 1991, SECTION 166) Issue date: 31/08/2006 Effective Date: 31-Aug-2006 Revocation Date: -
57	473	NW	651620 306430	Address: GAPTON HALL TRAVELLERS SITE, GAPTON HALL ROAD, GREAT YARMOUTH, NORFOLK, NR31 0NL Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: PRENF19845 Permit Version: 1	Receiving Water: DITCH TRIB OF TIDAL R. YARE Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 24/02/2006 Effective Date: 24-Feb-2006 Revocation Date: -
58J	474	N	652480 306850	Address: BRYANTS QUAY SPS, GREAT YARMOUTH Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: AW4TS1408 Permit Version: 1	Receiving Water: River Yare T Status: REVOKED (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 14/10/1987 Effective Date: 14-Oct-1987 Revocation Date: 22/03/2002
59J	475	N	652460 306850	Address: BRYANTS QUAY OUTFALL, GREAT YARMOUTH Effluent Type: SEWAGE DISCHARGES - UNSPECIFIED - WATER COMPANY Permit Number: AW4TS1388 Permit Version: 1	Receiving Water: River Yare T Status: REVOKED (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 14/10/1987 Effective Date: 14-Oct-1987 Revocation Date: 22/03/2002
60J	495	N	652460 306870	Address: BRYANTS QUAY PUMPING STATION, SOUTH QUAY, GREAT YARMOUTH, NORFOLK, NR30 2RW Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12175 Permit Version: 2	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 11/01/2000 Effective Date: 11-Jan-2000 Revocation Date: -
61J	495	N	652460 306870	Address: BRYANTS QUAY PUMPING STATION, SOUTH QUAY, GREAT YARMOUTH, NORFOLK, NR30 2RW Effluent Type: SEWAGE DISCHARGES - STW STORM OVERFLOW/STORM TANK - WATER COMPANY Permit Number: AEETS12175 Permit Version: 2	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 11/01/2000 Effective Date: 11-Jan-2000 Revocation Date: -
62J	495	N	652460 306870	Address: BRYANTS QUAY PUMPING STATION, SOUTH QUAY, GREAT YARMOUTH, NORFOLK, NR30 2RW Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12175 Permit Version: 1	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/10/1999 Effective Date: 15-Oct-1999 Revocation Date: 10/01/2000

ID	Distance (m)	Direction	NGR	Details	
63J	495	N	652460 306870	Address: BRYANTS QUAY PUMPING STATION, SOUTH QUAY, GREAT YARMOUTH, NORFOLK, NR30 2RW Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS12175 Permit Version: 1	Receiving Water: TIDAL RIVER YARE Status: POST NRA LEGISLATION WHERE ISSUE DATE > 31-AUG-89 (HISTORIC ONLY) Issue date: 15/10/1999 Effective Date: 15-Oct-1999 Revocation Date: 10/01/2000
64J	495	N	652460 306870	Address: BRYANTS QUAY PUMPING STATION, SOUTH QUAY, GREAT YARMOUTH, NORFOLK, NR30 2RW Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS03290/12175 Permit Version: 1	Receiving Water: RIVER YARE Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 01/10/2002 Effective Date: 05-Sep-2002 Revocation Date: 01/10/2002
65J	495	N	652460 306870	Address: BRYANTS QUAY PUMPING STATION, SOUTH QUAY, GREAT YARMOUTH, NORFOLK, NR30 2RW Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: AEETS03290/12175 Permit Version: 1	Receiving Water: RIVER YARE Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY ENV ACT 1995) Issue date: 01/10/2002 Effective Date: 05-Sep-2002 Revocation Date: 01/10/2002

2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

4

The following Water Industry Referral records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Address	Permission reference	Local Authority	First Date Received	Last Date Received	Status
135 O	0	On Site	WEATHERFORD UK LIMITED, HARFREY'S ROAD, HARFREY'S IND EST, GREAT YARMOUTH, NORFOLK, NR31 0LS	CA3653	GREAT YARMOUTH BOROUGH COUNCIL	01-Jul-2010	08-Oct-2016	EFFECTIVE
136 P	0	On Site	GREAT YARMOUTH PORT COMPANY, ATLAS TERMINAL, SOUTHGATES ROAD, GREAT YARMOUTH, NORFOLK, NR30 3LL	SCE0092C2	NORFOLK	01-Jan-2015	08-Oct-2016	EFFECTIVE
137 Q	13	SE	TOTAL RECLAIM SYSTEMS LIMITED, TOTAL RECLAIM HOUSE, ADMIRALTY ROAD, GREAT YARMOUTH, NORFOLK, NR30 3PU	SCE0097C2	NORFOLK	04-Jan-2013	08-Oct-2016	EFFECTIVE
138 K	167	N	BIFFA WASTE SERVICES LTD, BESSEMER WAY, HARFEYS IND EST, GREAT YARMOUTH, NORFOLK, NR31 0LX	BL8830	GREAT YARMOUTH BOROUGH COUNCIL	01-Jun-2003	08-Oct-2016	EFFECTIVE

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

2

The following records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Application Reference Number	NGR	Application Status	Application Date	Address	Details	Details of Enforcement Action
139R	0	On Site	No Details	652738 306121	Approved	No Details	Transco Plc, Southgates Road, Great Yarmouth, NR30 3DR	No Details	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
140S	171	NW	HSC/0001	652131 306327	Historical Consent	20/06/1994	Ventureforth Estates Ltd, Ventureforth House, Great Yarmouth Business Park, Suffolk Road, Great Yarmouth	Storage of ammonium nitrate.	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified

2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 3

The following COMAH & NIHHS Authorisation records provided by the Health and Safety Executive are represented as polygons or buffered points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Company	Address	Operational Status	Tier
104	0	On Site	British Gas	British Gas, Southgates Road, Great Yarmouth	Historical NIHHS Site	-
105N	0	On Site	Asco UK Limited	Asco UK Limited, Gas House Quay, Southtown Road, Great Yarmouth, Norfolk, NR30 3LX	Current COMAH Site	COMAH Lower Tier Operator
106G	15	S	ASCO UK Limited	ASCO UK Limited, Great Yarmouth, South Denes, Great Yarmouth, Norfolk, NR30 3LX	Current COMAH Site	COMAH Lower Tier Operator

2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

13

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
1	0	On Site	652080 305800	Incident Date: 23-Mar-2002 Incident Identification: 67348 Pollutant: General Biodegradable Materials and Wastes Pollutant Description: Food and Drink	Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
2	0	On Site	652038 305831	Incident Date: 17-Sep-2003 Incident Identification: 190491 Pollutant: Inorganic Chemicals/Products Pollutant Description: Other Inorganic Chemical or Product	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
3F	0	On Site	652393 305828	Incident Date: 22-Aug-2003 Incident Identification: 184276 Pollutant: Specific Waste Materials:Specific Waste Materials Pollutant Description: Tyres:Vehicles and Vehicle Parts	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)
4	230	N	652677 306610	Incident Date: 19-Jul-2003 Incident Identification: 175140 Pollutant: Organic Chemicals/Products Pollutant Description: Solvents	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
5	268	S	652860 305630	Incident Date: 03-Nov-2002 Incident Identification: 118445 Pollutant: Sewage Materials Pollutant Description: Storm Sewage	Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
6A	314	N	652546 306692	Incident Date: 22-Nov-2001 Incident Identification: 44483 Pollutant: Atmospheric Pollutants and Effects:Contaminated Water Pollutant Description: Smoke:Firefighting Run-Off	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
7A	314	N	652546 306692	Incident Date: 22-Nov-2001 Incident Identification: 44483 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Smoke	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
8A	314	N	652546 306692	Incident Date: 22-Nov-2001 Incident Identification: 44483 Pollutant: Contaminated Water Pollutant Description: Firefighting Run-Off	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
9	412	NW	652242 306687	Incident Date: 05-Apr-2002 Incident Identification: 69833 Pollutant: General Biodegradable Materials and Wastes Pollutant Description: Animal and Vegetable Oil	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
10	447	N	652400 306810	Incident Date: 10-Jan-2002 Incident Identification: 51678 Pollutant: Oils and Fuel Pollutant Description: Gas and Fuel Oils	Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)

ID	Distance (m)	Direction	NGR	Details	
11	471	E	653200 306330	Incident Date: 21-Nov-2002 Incident Identification: 122176 Pollutant: Oils and Fuel Pollutant Description: Mixed/Waste Oils	Water Impact: Category 1 (Major) Land Impact: Category 1 (Major) Air Impact: Category 4 (No Impact)
12	477	S	652323 305182	Incident Date: 11-Sep-2001 Incident Identification: 30255 Pollutant: Agricultural Materials and Wastes Pollutant Description: Solid Manure	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
13J	500	N	652457 306874	Incident Date: 16-Nov-2002 Incident Identification: 121239 Pollutant: Sewage Materials Pollutant Description: Crude Sewage	Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)

2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

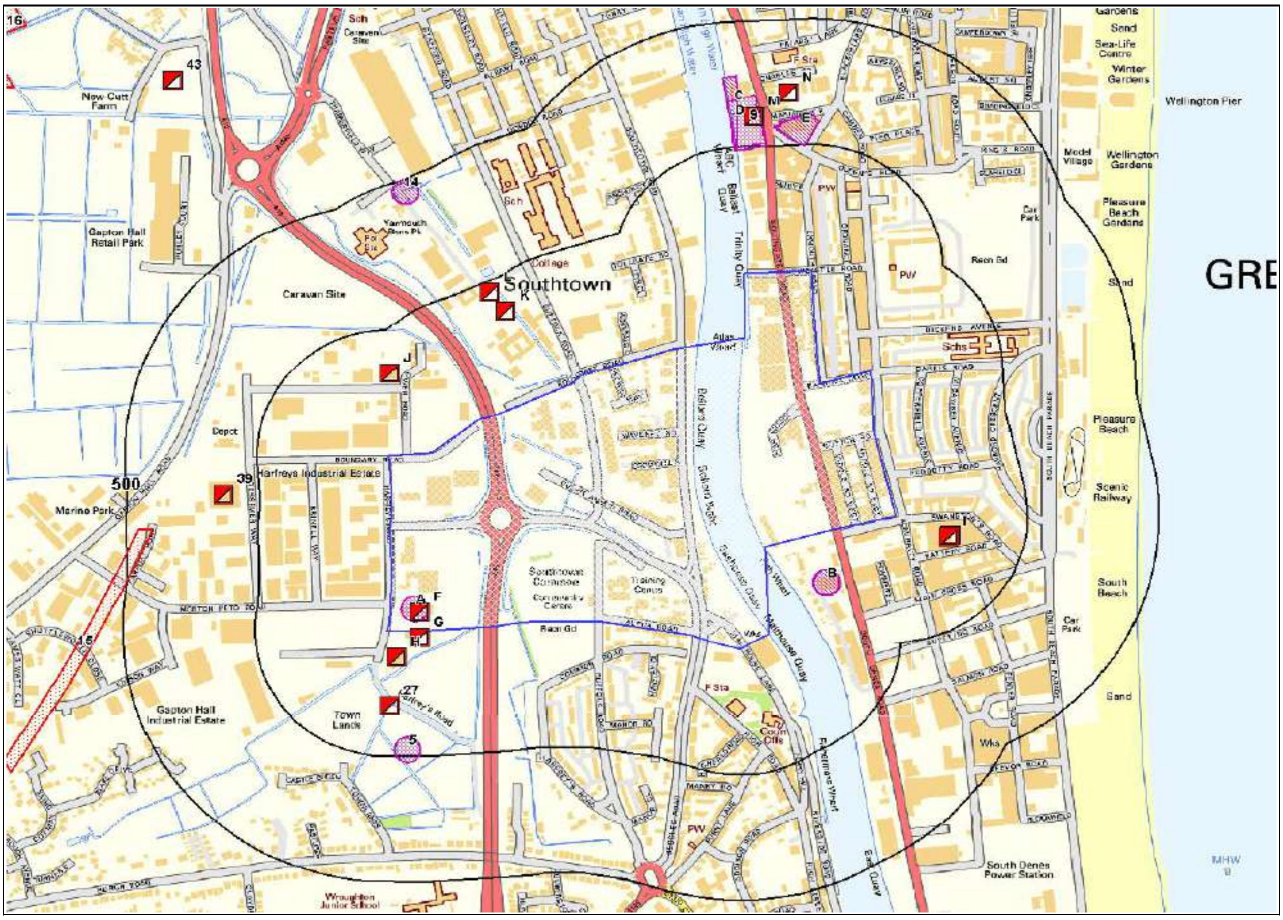
Database searched and no data found.

2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? 0

Database searched and no data found.

3. Landfill and Other Waste Sites Map



Site Outline

250 / 500 Search Buffers (m)

EA/NRW Active Landfill

EA/NRW Historic Landfill

BGS / DoE Survey Landfill

Historic and Planned Waste Sites

EA/NRW Licensed Waste Site

Local Authority/Historical Mapping Landfill Records

3. Landfill and Other Waste Sites

3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

2

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
15	451	W	651200 305600	Site Address: Gapton Hall Site, Between Harfeys Road and Burgh Road, Great Yarmouth Waste Licence: - Site Reference: WD 709a Waste Type: Inert, Industrial, Commercial, Household Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: County Council Licence Holder: Great Yarmouth Council First Recorded: 30-Jun-1973 Last Recorded: 31-Dec-1974
16	1020	NW	650900 307300	Site Address: Cobholm Tip, Farm Lane, Humberstone, Great.Yarmouth, Norfolk Waste Licence: Yes Site Reference: WD 506, WR 764, NFK/LS/060/0 Waste Type: Inert, Industrial, Commercial, Household Environmental Permitting Regulations (Waste) Reference: AZ1/L/VIN001	Licence Issue: 02-Jan-1974 Licence Surrendered: Licence Holder Address: Humberstone Farm, Southtown, Great Yarmouth, Norfolk Operator: Gt Yarmouth Borough Council Licence Holder: W H Vincent First Recorded: 31-May-1905 Last Recorded: 31-Dec-1995

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

0

Database searched and no data found.

3.2 Other Waste Sites

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

14

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details		
1A	0	On Site	651890 305707	Type of Site: Waste Recycling Centre Site Address: East Coast Waste,Harfreys Road, Harfreys Industrial Estate, GREAT YARMOUTH, Norfolk, NR31 0LS	Planning Application Reference: 06/07/0901/F Date: -	Further Details: Scheme comprises raise roof of waste recycling centre. An application (ref: 06/07/0901/F) for detailed planning permission was granted by Great Yarmouth B.C. Planning decision obtained Data Source: Historic Planning Application Data Type: Point
2A	0	On Site	651890 305707	Type of Site: Waste Recycling Centre Site Address: East Coast Waste,Harfreys Road, Harfreys Industrial Estate, GREAT YARMOUTH, Norfolk, NR31 0LS	Planning Application Reference: 06/07/0901/F Date: -	Further Details: Scheme comprises raise roof of waste recycling centre. An application (ref: 06/07/0901/F) for detailed planning permission was granted by Great Yarmouth B.C. Planning decision obtained Data Source: Historic Planning Application Data Type: Point

ID	Distance (m)	Direction	NGR		Details	
3B	74	S	652669 305759	Type of Site: Waste Transfer Station Site Address: 52 South Denes Road, GREAT YARMOUTH, Norfolk, NR30 3PR	Planning Application Reference: 6/95/593/F Date: -	Further Details: Comprises the installation of four new tanks totalling 82,000 gals for a new waste transfer station. Scheme comprises the installation of four new tanks totalling 82,000 gals for a new waste transfer station to control waste and cleaning within a containment area. This will include security fencing, loading areas and bollards. NEW INFORMATION: We are now advised that the land will be sold with the advantage of planning approval. An application (ref: 6/95/593/F) for Detailed Planning permission was submitted to Great Yarmouth B.C. on 3rd July 1995. Data Source: Historic Planning Application Data Type: Point
4B	74	S	652670 305759	Type of Site: Waste Transfer Station Site Address: ASCO UK Ltd, South Denes Road, GREAT YARMOUTH, Norfolk, NR30 3QF	Planning Application Reference: 06/98/0582/F Date: 01/05/1999	Further Details: Construction of a waste transfer station. The work will involve the construction of a waste transfer station which will include a recycling centre. Also included is a main storage building with roller shutters, laboratory, changing rooms, mess and powerwash bays, portable buildings, toilets, offices and storage tanks. An application (ref: 06/98/0582/F) for Detailed Planning permission was granted by Great Yarmouth B.C. on 4th September 1998. Data Source: Historic Planning Application Data Type: Point

ID	Distance (m)	Direction	NGR	Details		
5	212	S	651877 305425	Type of Site: Waste Transfer Station Site Address: Harfreys Road Industrial Site, GREAT YARMOUTH, Norfolk, NR30	Planning Application Reference: 98/0011 Date: 01/05/1998	Further Details: Improvements to works included 4 bulk storage tanks 2 x 5,000 gallons and 1 x 10,000 gallons and 1 x 12,000 gallons. Relocation of canopy tent and re-concreting of part of the yard with a new drainage system. Improvements to works included 4 bulk store tanks 2 x 5,000 gallons and 1 x 10,000 gallons and 1 x 12,000 gallons. Relocation of canopy tent and re-concreting of part of the yard with a new drainage system. NEW INFORMATION: Detailed plans approved by Norfolk County Council on the 3rd March,1998. An application (ref: 98/0011) for Detailed Planning permission was granted by Great Yarmouth B.C. on 3rd March 1998. Data Source: Historic Planning Application Data Type: Point
6D	242	N	652491 306670	Type of Site: Scrap Iron Works Site Address: N/A	Planning Application Reference: N/A Date: 1967	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
7C	242	N	652495 306663	Type of Site: Scrap Iron Works Site Address: N/A	Planning Application Reference: N/A Date: 1987	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
8C	242	N	652495 306663	Type of Site: Scrap Iron Works Site Address: N/A	Planning Application Reference: N/A Date: 1987	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
9	242	N	652527 306675	Type of Site: Scrap Iron Works Site Address: N/A	Planning Application Reference: N/A Date: 1975	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
10D	242	N	652527 306675	Type of Site: Scrap Iron Works Site Address: N/A	Planning Application Reference: N/A Date: 1966	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
11E	249	N	652613 306663	Type of Site: Scrap Metal & Paper Merchants Site Address: N/A	Planning Application Reference: N/A Date: 1954	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
12E	249	N	652613 306663	Type of Site: Scrap Metal & Paper Merchants Site Address: N/A	Planning Application Reference: N/A Date: 1966	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
13E	250	N	652613 306663	Type of Site: Scrap Metal & Paper Merchants Site Address: N/A	Planning Application Reference: N/A Date: 1963	Further Details: N/A Data Source: Historic Mapping Data Type: Polygon

ID	Distance (m)	Direction	NGR	Details	
14	450	N	651873 306538	Type of Site: Recycling Centre (Conversion) Site Address: Premier Recycling, Thamesfield Way, Great Yarmouth Business Park, GREAT YARMOUTH, Norfolk, NR31 0DN	Planning Application Reference: 06/06/0399/F Date: -	Further Details: Scheme comprises change of use to allow for metal recycling operations to be included into allowed uses. An application (ref: 06/06/0399/F) for Detailed Planning permission was submitted to Great Yarmouth B.C. on 5th May 2006. Data Source: Historic Planning Application Data Type: Point

3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

35

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
17F	0	On Site	651900 305700	Site Address: Lindgreat Yard, Harfreys Road, Great Yarmouth, Norfolk, NR31 0LS Type: Household, Commercial & Industrial Waste T Stn Size: >= 25000 tonnes < 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: THU005 EPR reference: - Operator: Thurtle Walter Waste Management licence No: 71429 Annual Tonnage: 25000.0	Issue Date: 08/04/2005 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Lindgreat Yard Correspondence Address: Mr Gary Thrurtle, Lindgreat Yard, Harfreys Road, Great Yarmouth, Norfolk, NR31 0LS
18F	0	On Site	651900 305700	Site Address: W T Waste, Harfreys Road, Harfreys Ind Est, Great Yarmouth, Norfolk, NR31 0LS Type: Household, Commercial & Industrial Waste T Stn Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: THU005 EPR reference: EA/EPR/CP3094NZ/V003 Operator: Thurtle Walter Waste Management licence No: 71429 Annual Tonnage: 25000.0	Issue Date: 08/04/2005 Effective Date: - Modified: 27/10/2014 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: W T Waste Correspondence Address: -
19G	13	S	651900 305650	Site Address: Folkes Plant And Aggregate, Harfrey's Road, Harfrey's Industrial Est, Great Yarmouth, Norfolk, NR31 0LS Type: Household, Commercial & Industrial Waste T Stn Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: FOL001 EPR reference: EA/EPR/FP3394NJ/A001 Operator: Folkes Plant & Aggregate Ltd Waste Management licence No: 71417 Annual Tonnage: 24999.0	Issue Date: 13/07/2005 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Folkes Plant And Aggregate Correspondence Address: -

ID	Distance (m)	Direction	NGR	Details	
20G	13	S	651900 305650	Site Address: Land Off Harfreys Road, Harfreys Indus Est, Great Yarmouth, Norfolk, NR31 9PY Type: 75kte HCl Waste TS + treatment Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: FOL001 EPR reference: EA/EPR/FP3394NJ/V002 Operator: Folkes Plant & Aggregates Limited Waste Management licence No: 71417 Annual Tonnage: 24999.0	Issue Date: 13/07/2005 Effective Date: - Modified: 22/10/2014 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Folkes Transfer Station Correspondence Address: -
21G	13	S	651900 305650	Site Address: Harfrey's Road, Harfrey's Industrial Est, Great Yarmouth, Norfolk, NR31 0LS Type: Household, Commercial & Industrial Waste T Stn Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: FOL001 EPR reference: - Operator: Folkes Plant & Aggregate Limited Waste Management licence No: 71417 Annual Tonnage: 24999.0	Issue Date: 13/07/2005 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Folkes Plant And Aggregate Correspondence Address: W. A. S. Ltd, P O Box 151, Lowestoft, Suffolk, NR32 3ZQ
22H	53	S	651857 305610	Site Address: Hafreys Industrial Estate, Hafreys Road, Great Yarmouth, Norfolk, NR31 0JR Type: Special Waste Transfer Station Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MRP001 EPR reference: - Operator: Clements P Waste Management licence No: 70532 Annual Tonnage: 0.0	Issue Date: 04/01/1990 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: 74, Southdown Road, Great Yarmouth, Norfolk, NR31 0JR
23H	53	S	651857 305610	Site Address: Harfreys Industrial Estate, Harfreys Road, Great Yarmouth, Norfolk, NR31 0LS Type: Special Waste Transfer Station Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MRP001 EPR reference: EA/EPR/YP3299NB/A001 Operator: Clements Paul Waste Management licence No: 70532 Annual Tonnage: 62500.0	Issue Date: 04/01/1990 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: -
24I	108	SE	652900 305850	Site Address: Hendee House, Battery Road, Great Yarmouth, Norfolk, NR30 3NN Type: Asbestos Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: EAS147 EPR reference: EA/EPR/AB3801UE/S002 Operator: East Coast Insulations Limited Waste Management licence No: 71491 Annual Tonnage: 0.0	Issue Date: 10/11/2006 Effective Date: 14/11/2013 Modified: 17/03/2011 Surrendered Date: 03/05/2016 Expiry Date: - Cancelled Date: - Status: Surrendered Site Name: Hendee House Correspondence Address: -

ID	Distance (m)	Direction	NGR	Details	
25I	108	SE	652900 305850	Site Address: Hendee House, Battery Road, Great Yarmouth, Norfolk, NR30 3NN Type: Asbestos Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: LEA002 EPR reference: EA/EPR/VP3494NV/V002 Operator: Mr Rodney John Lear And Mrs Pamela Margaret Lear Waste Management licence No: 71491 Annual Tonnage: 3650.0	Issue Date: 10/11/2006 Effective Date: - Modified: 17/03/2011 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Hendee House Correspondence Address: -
26I	111	E	652905 305855	Site Address: Hendee House, Battery Road, Great Yarmouth, Norfolk, NR30 3NW Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: LEA002 EPR reference: VP3494NV/A001 Operator: R J Lear And P M Lear Waste Management licence No: 71491 Annual Tonnage: 3650.0	Issue Date: 10/11/2006 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Hendee House, Battery Road Correspondence Address: -
27	150	S	651843 305513	Site Address: Hafrey's Road Transfer Station, Harfrey's Road, Townlands, Great Yarmouth, Norfolk, NR31 8JL Type: Inert & excavation Waste TS + treatment Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: GRE397 EPR reference: EA/EPR/EB3535AM/V002 Operator: E E Green & Son Ltd Waste Management licence No: 103802 Annual Tonnage: 74999.0	Issue Date: 23/01/2012 Effective Date: - Modified: 01/05/2015 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Harfrey's Road Transfer Station Correspondence Address: -
28J	163	N	651844 306177	Site Address: Unit 2, Bessemer Way, Hafreys Industrial Estate, Great Yarmouth, NR31 0LX Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: UKW001 EPR reference: - Operator: U K Waste Management Ltd Waste Management licence No: 70505 Annual Tonnage: 0.0	Issue Date: 01/05/1992 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: Head Office, Coronation Road, Cressex, High Wycombe, HP12 3TZ
29J	163	N	651844 306177	Site Address: Unit 2, Bessemer Way, Hafreys Industrial Estate, Great Yarmouth, Norfolk, NR31 0LX Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: UKW003 EPR reference: EA/EPR/KP3898VU/V002 Operator: Biffa Waste Services Ltd Waste Management licence No: 70505 Annual Tonnage: 4999.0	Issue Date: 01/05/1992 Effective Date: - Modified: 02/04/2012 Surrendered Date: 0 Expiry Date: - Cancelled Date: - Status: Modified Site Name: Biffa Waste Services Ltd Correspondence Address: -

ID	Distance (m)	Direction	NGR	Details	
30J	163	N	651844 306177	Site Address: Unit 2, Bessemer Way, Hafreys Industrial Estate, Great Yarmouth, Norfolk, NR31 0LX Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: AUG012 EPR reference: EA/EPR/EB3001TS/T001 Operator: Augean North Sea Services Limited Waste Management licence No: 70505 Annual Tonnage: 4999.0	Issue Date: 01/05/1992 Effective Date: 19/04/2016 Modified: 02/04/2012 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Transferred Site Name: Great Yarmouth Waste Management Resoucre Centre Correspondence Address: -
31K	183	NW	652062 306301	Site Address: Yarmouth Business Park, Suffolk Road, Great Yarmouth, Norfolk, NR31 0ER Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MIT001 EPR reference: EA/EPR/YP3799NF/V002 Operator: Mitchell Cliff Waste Management licence No: 70536 Annual Tonnage: 5000.0	Issue Date: 03/09/1991 Effective Date: - Modified: 26/01/2006 Surrendered Date: 0 Expiry Date: - Cancelled Date: - Status: Modified Site Name: C + L Waste Oil Collection Correspondence Address: -
32K	183	NW	652062 306301	Site Address: Yarmouth Business Park, Thamesfield Way, Great Yarmouth, Norfolk, NR31 0DN Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MIT001 EPR reference: EA/EPR/YP3799NF/V003 Operator: Mitchell C B Waste Management licence No: 70536 Annual Tonnage: 5000.0	Issue Date: 03/09/1991 Effective Date: - Modified: 10/05/2016 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Great Yarmouth Oil Reclamation Facility Correspondence Address: -
33L	229	NW	652033 306339	Site Address: Yarmouth Business Park, Suffolk Road, Great Yarmouth, Norfolk, NR31 0ER Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MRE001 EPR reference: - Operator: Brown E W Waste Management licence No: 70535 Annual Tonnage: 0.0	Issue Date: 03/09/1991 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: Brookfields Business Centre, Cottenham, Cambridge, CB4 8PS
34L	229	NW	652033 306339	Site Address: Yarmouth Business Park, Suffolk Road, Great Yarmouth, Norfolk, NR31 0ER Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MA001 EPR reference: - Operator: Malary Environmental Services Ltd Waste Management licence No: 70535 Annual Tonnage: 0.0	Issue Date: 03/09/1991 Effective Date: 01/07/2004 Modified: 01/07/2004 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Yarmouth Business Park Correspondence Address: D Stapleton, Brookfield Business Centre, Unit B1, Twenty Pence Road, Cottenham, Cambridge, CB4 8PS

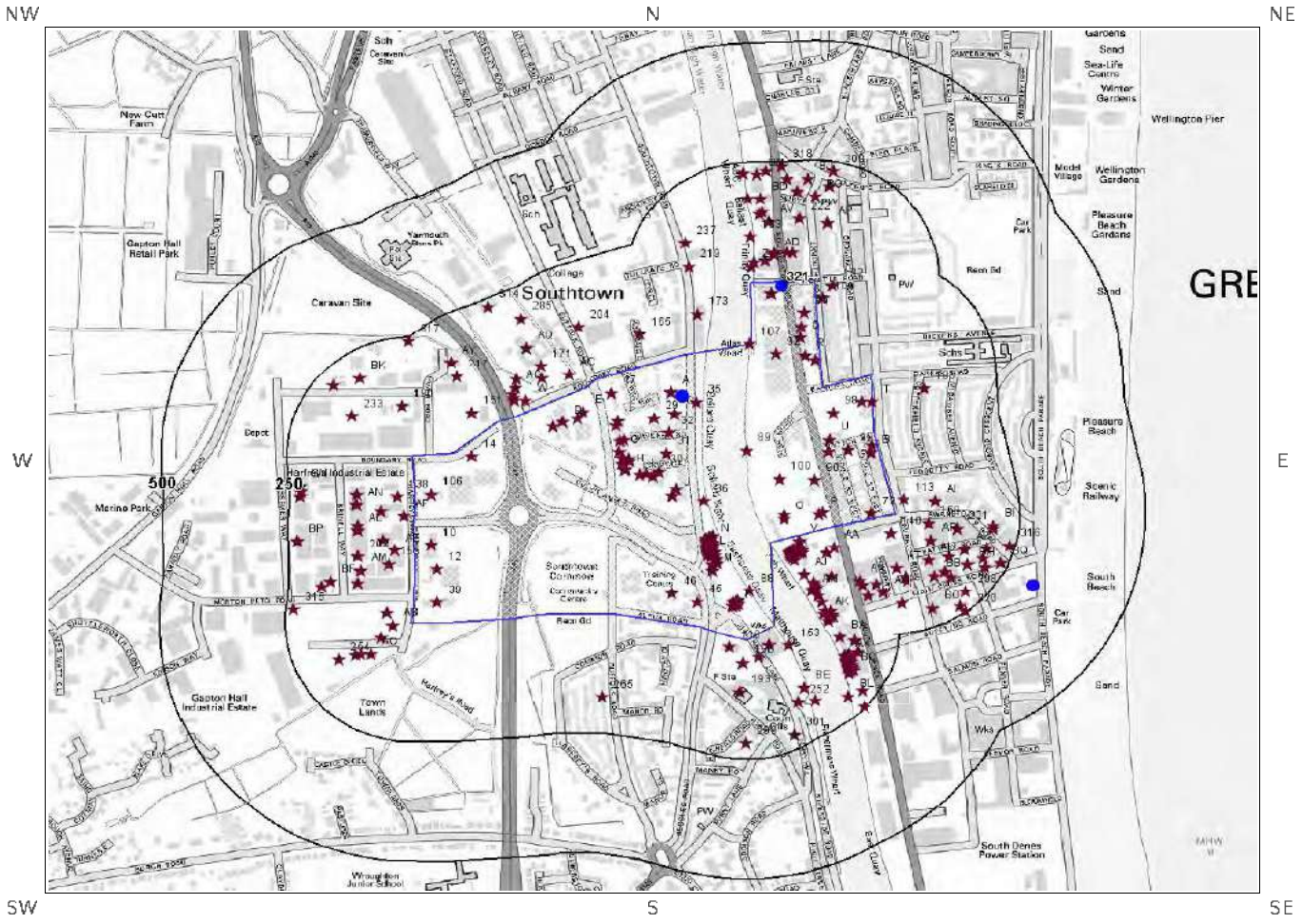
ID	Distance (m)	Direction	NGR	Details	
35L	229	NW	652033 306339	Site Address: Yarmouth Business Park, Suffolk Road, Great Yarmouth, Norfolk, NR31 0ER Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MAL001 EPR reference: EA/EPR/YP3199NQ/S004 Operator: Malary Ltd Waste Management licence No: 70535 Annual Tonnage: 0.0	Issue Date: 03/09/1991 Effective Date: 23/11/2006 Modified: 01/07/2004 Surrendered Date: 14/03/2007 Expiry Date: - Cancelled Date: - Status: Surrendered Site Name: Yarmouth Business Park Correspondence Address: -
36L	229	NW	652033 306339	Site Address: Yarmouth Business Park, Suffolk Road, Great Yarmouth, Norfolk, NR31 0ER Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MA001 EPR reference: - Operator: Malary Environmental Services Ltd Waste Management licence No: 70535 Annual Tonnage: 0.0	Issue Date: 03/09/1991 Effective Date: 01/07/2004 Modified: 01/07/2004 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Yarmouth Business Park Correspondence Address: Brookfield Business Centre, Unit B1, Twentypence Road, Cottenham, Cambridge, CB4 8PS
37M	310	N	652531 306688	Site Address: 132b, South Quay, Great Yarmouth, Norfolk, NR30 3LD Type: Metal Recycling Site (mixed MRS's) Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MAY001 EPR reference: EA/EPR/AP3999NE/V002 Operator: Mayer Parry (East Anglia) Ltd Waste Management licence No: 70493 Annual Tonnage: 78000.0	Issue Date: 23/08/1993 Effective Date: - Modified: 11/12/1992 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Great Yarmouth Correspondence Address: -
38M	310	N	652531 306688	Site Address: South Quay, Great Yarmouth, Norfolk, NR30 3LD Type: Metal Recycling Site (mixed MRS's) Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MAY001 EPR reference: - Operator: Mayer Parry East Anglia Ltd Waste Management licence No: 70493 Annual Tonnage: 0.0	Issue Date: 23/08/1993 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: 111, Fordham Road, Snailwell, Newmarket, Suffolk, CB8 7ND
39	319	W	651529 305936	Site Address: Bessemer Way, Hafreys Industrial Estate, Great Yarmouth, Norfolk, NR31 0LX Type: Household, Commercial & Industrial Waste T Stn Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: TRA001 EPR reference: EA/EPR/YP3699NT/S002 Operator: Transmit Containers Ltd Waste Management licence No: 70534 Annual Tonnage: 432.0	Issue Date: 06/12/1990 Effective Date: - Modified: - Surrendered Date: 14/11/2003 Expiry Date: - Cancelled Date: - Status: Surrendered Site Name: Great Yarmouth Correspondence Address: -

ID	Distance (m)	Direction	NGR	Details	
40N	354	N	652597 306735	Site Address: G A Car Spares, 127/129, South Quay, Great Yarmouth, Norfolk, NR30 3LD Type: Vehicle Depollution Facility <5000 tps Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: ALL136 EPR reference: EA/EPR/JB3537RX/A001 Operator: Allard Michael Waste Management licence No: 104491 Annual Tonnage: 4999.0	Issue Date: 31/07/2012 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: G A Car Spares Correspondence Address: -
41N	354	N	652597 306735	Site Address: G & A Car Spares, 127 - 129, South Quay, Great Yarmouth, Norfolk, NR30 3LD Type: Vehicle Depollution Facility <5000 tps Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: GAC002 EPR reference: EA/EPR/CB3702FS/V002 Operator: G & A Car Spares Limited Waste Management licence No: 104491 Annual Tonnage: 4999.0	Issue Date: 31/07/2012 Effective Date: 06/06/2015 Modified: 18/08/2016 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: G & A Car Spares Correspondence Address: -
Not shown	766	W	651080 305911	Site Address: D&j Metals, Vanguard Road, Gapton Hall Ind Est, Great Yarmouth, Norfolk, NR31 0NT Type: Metal Recycling Site (mixed MRS's) Size: >= 25000 tonnes < 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: DOU001 EPR reference: EA/EPR/RP3099NN/A001 Operator: Mr Douglas Victor Gray And Mr John Gray Waste Management licence No: 70504 Annual Tonnage: 24999.0	Issue Date: 22/02/1995 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: -
43	853	NW	651432 306761	Site Address: Land / Premises At, High Mill Link Road, Cobholm, Great Yarmouth, Norfolk, NR31 0DL Type: Metal Recycling Site (Vehicle Dismantler) Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: DOC001 EPR reference: EA/EPR/KP3694NT/A001 Operator: Docwra Mike Waste Management licence No: 71385 Annual Tonnage: 2499.0	Issue Date: 25/11/2004 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Mike Docwra Car Breakers Correspondence Address: -
Not shown	874	W	650971 305888	Site Address: Vanguard Road, Gapton Hall Ind Est, Great Yarmouth, Norfolk, NR31 0NT Type: Metal Recycling Site (mixed MRS's) Size: >= 25000 tonnes < 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: DOU001 EPR reference: - Operator: D & J Metals Waste Management licence No: 70504 Annual Tonnage: 0.0	Issue Date: 22/02/1995 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: Vanguard Road, Gapton Hall Ind. Est, Great Yarmouth, Norfolk, NR31 0NT

ID	Distance (m)	Direction	NGR	Details	
Not shown	874	W	650971 305888	Site Address: Vanguard Road, Gapton Hall Ind Estate, Great Yarmouth, Norfolk, NR31 0NT Type: Household, Commercial & Industrial Waste T Stn Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: GRA001 EPR reference: - Operator: Gray Douglas Victor Waste Management licence No: 71237 Annual Tonnage: 0.0	Issue Date: 13/11/1998 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: Vanguard Road, Gapton Hall Ind Estate, Great Yarmouth, Norfolk, NR31 0NT
Not shown	874	W	650971 305888	Site Address: Land / Premises At, Vanguard Road, Gapton Hall Ind Estate, Great Yarmouth, Norfolk, NR31 0NT Type: 75kte HCl Waste TS + asbestos Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: GRA001 EPR reference: EA/EPR/DP3699LH/V003 Operator: Gray Douglas Victor Waste Management licence No: 71237 Annual Tonnage: 24999.0	Issue Date: 13/11/1998 Effective Date: - Modified: 19/03/2009 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: D And J Metals Correspondence Address: -
Not shown	1329	SE	653041 304410	Site Address: Technical Waste Management Centre, South Denes Road, Great Yarmouth, Norfolk, NR30 3LY Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: ASC002 EPR reference: - Operator: A S C O (U K) Ltd Waste Management licence No: 71257 Annual Tonnage: 0.0	Issue Date: 24/01/2001 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: Offshore Supply Base, South Denes Road, Great Yarmouth, Norfolk, NR30 3LY
Not shown	1329	SE	653041 304410	Site Address: Technical Waste Management Centre, South Denes Road, Great Yarmouth, Norfolk, NR30 3LY Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: ASC002 EPR reference: - Operator: A S C O (U K) Ltd Waste Management licence No: 71257 Annual Tonnage: 24999.0	Issue Date: 24/01/2001 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Great Yarmouth Correspondence Address: Offshore Supply Base, South Denes Road, Great Yarmouth, Norfolk, NR30 3LY
Not shown	1329	SE	653041 304410	Site Address: Technical Waste Management Centre, South Denes Road, Great Yarmouth, Norfolk, NR30 3LY Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: ENV230 EPR reference: EA/EPR/QP3898NL/T002 Operator: Enviroco Ltd Waste Management licence No: 71257 Annual Tonnage: 24999.0	Issue Date: 24/01/2001 Effective Date: 13/03/2008 Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Transferred Site Name: Great Yarmouth Correspondence Address: -

ID	Distance (m)	Direction	NGR	Details	
Not shown	1359	SE	653066 304389	Site Address: Great Yarmouth Technical Waste Management Centre, Berths 2-4, South Denes Road, Great Yarmouth, Norfolk, NR30 3QF Type: Physical Treatment Facility Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: ENV230 EPR reference: EA/EPR/PP3532UT/V005 Operator: Enviroco Limited Waste Management licence No: 71257 Annual Tonnage: 24999.0	Issue Date: 24/01/2001 Effective Date: 13/03/2008 Modified: 25/01/2016 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Great Yarmouth Technical Waste Management Centre Correspondence Address: -
Not shown	1359	SE	653066 304389	Site Address: Great Yarmouth Technical Waste Management Centre, Berths 2-4, South Denes Road, Great Yarmouth, Norfolk, NR30 3QF Type: Physical Treatment Facility Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: ENV230 EPR reference: EA/EPR/PP3532UT/V004 Operator: Enviroco Ltd Waste Management licence No: 71257 Annual Tonnage: 24999.0	Issue Date: 24/01/2001 Effective Date: 13/03/2008 Modified: 16/05/2013 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Great Yarmouth Technical Waste Management Centre Correspondence Address: -

4. Current Land Use Map



Site Outline

Search Buffers (m)
250
500

Current Industrial Sites

Petrol & Fuel Sites

Electricity Transmission Cables

Gas Transmission Pipelines

4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 320

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1H	0	On Site	Simpsons Skoda	652263 305982	Simpsons Skoda, Unit 1, Suffolk Road, Great Yarmouth, NR31 0LN	New Vehicles	Motoring
2D	0	On Site	3 Sun Group	652140 306084	3 Sun Group, 3sun House, Boundary Road, Great Yarmouth, NR31 0FB	Electronic Equipment	Industrial Products
3A	0	On Site	Kirkley Tyres & Wheels	652355 306146	Kirkley Tyres & Wheels, 126, Southtown Road, Great Yarmouth, NR31 0JZ	Vehicle Repair, Testing and Servicing	Repair and Servicing
4A	0	On Site	BP Service Station	652355 306146	BP Service Station, 126, Southtown Road, Great Yarmouth, NR31 0JZ	Petrol and Fuel Stations	Road and Rail
5B	0	On Site	Stalwart Signs & Industrial Supplies Ltd	652752 306021	Stalwart Signs & Industrial Supplies Ltd, Anglian House, Admiralty Road, Great Yarmouth, NR30 3DY	Special Purpose Machinery and Equipment	Industrial Products
6B	0	On Site	Discount Sheds & Stables	652752 306021	Discount Sheds & Stables, Anglian House, Admiralty Road, Great Yarmouth, NR30 3DY	Garden Goods	Consumer Products
7F	0	On Site	Suffolk Road Motoring Services	652250 306086	Suffolk Road Motoring Services, Unit 8-9, Suffolk Road, Great Yarmouth, NR31 0LN	Vehicle Repair, Testing and Servicing	Repair and Servicing
8C	0	On Site	J D Moore	652362 306101	J D Moore, 128, Southtown Road, Great Yarmouth, NR31 0LA	Vehicle Repair, Testing and Servicing	Repair and Servicing
9C	0	On Site	Southtown Cars	652362 306101	Southtown Cars, 128, Southtown Road, Great Yarmouth, NR31 0LA	Secondhand Vehicles	Motoring
10	0	On Site	L G Perfect	651878 305826	L G Perfect, Harfreys Road, Great Yarmouth, NR31 0JL	Vehicle Repair, Testing and Servicing	Repair and Servicing
11R	0	On Site	Afordable Cars	652621 306224	Afordable Cars, 41a, Southgates Road, Great Yarmouth, NR30 3LL	Secondhand Vehicles	Motoring
12	0	On Site	Weatherford UK	651890 305776	Weatherford UK, Harfreys Road, Great Yarmouth, NR31 0LS	Special Purpose Machinery and Equipment	Industrial Products
13E	0	On Site	Pumping Station	652180 306105	Pumping Station, NR31	Water Pumping Stations	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
14	0	On Site	Electricity Sub Station	651959 306013	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
15D	0	On Site	Depot	652121 306075	Depot, NR31	Container and Storage	Transport, Storage and Delivery
16E	0	On Site	Electricity Sub Station	652169 306091	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
17	0	On Site	Mitchells Renault	652238 306144	Mitchells Renault, Suffolk Road, Great Yarmouth, NR31 0LN	Vehicle Repair, Testing and Servicing	Repair and Servicing
18F	0	On Site	Warehouse	652246 306076	Warehouse, NR31	Container and Storage	Transport, Storage and Delivery
19G	0	On Site	Warehouse	652253 306022	Warehouse, NR31	Container and Storage	Transport, Storage and Delivery
20G	0	On Site	Works	652254 306045	Works, NR31	Unspecified Works Or Factories	Industrial Features
21G	0	On Site	Depot	652257 305997	Depot, NR31	Container and Storage	Transport, Storage and Delivery
22G	0	On Site	Warehouse	652260 306010	Warehouse, NR31	Container and Storage	Transport, Storage and Delivery
23G	0	On Site	Tank	652262 306047	Tank, NR31	Tanks (Generic)	Industrial Features
24H	0	On Site	Works	652265 305985	Works, NR31	Unspecified Works Or Factories	Industrial Features
25H	0	On Site	Tank	652271 306007	Tank, NR31	Tanks (Generic)	Industrial Features
26I	0	On Site	Warehouse	652293 305974	Warehouse, NR31	Container and Storage	Transport, Storage and Delivery
27I	0	On Site	Works	652306 305976	Works, NR31	Unspecified Works Or Factories	Industrial Features
28I	0	On Site	Works	652320 305970	Works, NR31	Unspecified Works Or Factories	Industrial Features
29	0	On Site	Works	652322 306092	Works, NR31	Unspecified Works Or Factories	Industrial Features
30	0	On Site	Depot	652330 305980	Depot, NR31	Container and Storage	Transport, Storage and Delivery
31	0	On Site	Works	652345 306019	Works, NR31	Unspecified Works Or Factories	Industrial Features
32	0	On Site	Works	652351 306061	Works, NR31	Unspecified Works Or Factories	Industrial Features
33J	0	On Site	Peter Doidge	652359 305931	Peter Doidge, Southtown Road, Great Yarmouth, NR31 0LA	Vehicle Parts and Accessories	Motoring
34J	0	On Site	Tank	652366 305943	Tank, NR31	Tanks (Generic)	Industrial Features
35	0	On Site	Quay	652406 306126	Quay, NR31	Moorings and Unloading Facilities	Water
36	0	On Site	Quay	652420 305919	Quay, NR31	Moorings and Unloading Facilities	Water
37J	0	On Site	Depot	652358 305931	Depot, NR31	Container and Storage	Transport, Storage and Delivery
38G	0	On Site	Tank	652272 306002	Tank, NR31	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
39	0	On Site	East Coast Waste	651890 305707	East Coast Waste, Harfreys Road, Great Yarmouth, NR31 0LS	Construction and Tool Hire	Hire Services
40A	0	On Site	Southtown Service Station	652355 306146	Southtown Service Station, 126, Southtown Road, Great Yarmouth, NR31 0JZ	Petrol and Fuel Stations	Road and Rail
41K	0	On Site	Tank	652479 305698	Tank, NR31	Tanks (Generic)	Industrial Features
42K	0	On Site	Tank	652477 305700	Tank, NR31	Tanks (Generic)	Industrial Features
43K	0	On Site	Tank	652482 305704	Tank, NR31	Tanks (Generic)	Industrial Features
44K	0	On Site	Tank	652489 305704	Tank, NR31	Tanks (Generic)	Industrial Features
45	0	On Site	Electricity Sub Station	652408 305708	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
46	0	On Site	Gas Distribution Station	652358 305726	Gas Distribution Station, NR31	Gas Features	Infrastructure and Facilities
47L	0	On Site	Tank	652428 305809	Tank, NR31	Tanks (Generic)	Industrial Features
48M	0	On Site	Electricity Sub Station	652438 305774	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
49L	0	On Site	Tank	652437 305786	Tank, NR31	Tanks (Generic)	Industrial Features
50M	0	On Site	Tank	652448 305789	Tank, NR31	Tanks (Generic)	Industrial Features
51L	0	On Site	Tank	652447 305798	Tank, NR31	Tanks (Generic)	Industrial Features
52L	0	On Site	Tank	652435 305804	Tank, NR31	Tanks (Generic)	Industrial Features
53L	0	On Site	Tank	652434 305820	Tank, NR31	Tanks (Generic)	Industrial Features
54L	0	On Site	Tank	652428 305805	Tank, NR31	Tanks (Generic)	Industrial Features
55L	0	On Site	Tank	652439 305805	Tank, NR31	Tanks (Generic)	Industrial Features
56L	0	On Site	Tank	652439 305825	Tank, NR31	Tanks (Generic)	Industrial Features
57L	0	On Site	Tank	652425 305831	Tank, NR31	Tanks (Generic)	Industrial Features
58L	0	On Site	Tank	652432 305811	Tank, NR31	Tanks (Generic)	Industrial Features
59L	0	On Site	Tank	652435 305811	Tank, NR31	Tanks (Generic)	Industrial Features
60L	0	On Site	Tank	652439 305812	Tank, NR31	Tanks (Generic)	Industrial Features
61L	0	On Site	Tank	652427 305815	Tank, NR31	Tanks (Generic)	Industrial Features
62L	0	On Site	Tank	652431 305816	Tank, NR31	Tanks (Generic)	Industrial Features
63L	0	On Site	Tank	652425 305824	Tank, NR31	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
64L	0	On Site	Tank	652429 305825	Tank, NR31	Tanks (Generic)	Industrial Features
65L	0	On Site	Tank	652439 305832	Tank, NR31	Tanks (Generic)	Industrial Features
66L	0	On Site	Tank	652430 305832	Tank, NR31	Tanks (Generic)	Industrial Features
67N	0	On Site	Tank	652433 305836	Tank, NR31	Tanks (Generic)	Industrial Features
68N	0	On Site	Tank	652425 305840	Tank, NR31	Tanks (Generic)	Industrial Features
69N	0	On Site	Tank	652434 305841	Tank, NR31	Tanks (Generic)	Industrial Features
70N	0	On Site	Tank	652437 305846	Tank, NR31	Tanks (Generic)	Industrial Features
71O	0	On Site	Broadland Fuels	652580 305882	Broadland Fuels, Fishwharf, Great Yarmouth, NR30 3LX	Fuel Distributors and Suppliers	Household, Office, Leisure and Garden
72O	0	On Site	Depot	652581 305889	Depot, NR30	Container and Storage	Transport, Storage and Delivery
73	0	On Site	Works	652752 305893	Works, NR30	Unspecified Works Or Factories	Industrial Features
74K	0	On Site	Tank	652485 305706	Tank, NR31	Tanks (Generic)	Industrial Features
75L	0	On Site	Tank	652434 305832	Tank, NR31	Tanks (Generic)	Industrial Features
76K	0	On Site	Tank	652489 305711	Tank, NR31	Tanks (Generic)	Industrial Features
77L	0	On Site	Tank	652426 305819	Tank, NR31	Tanks (Generic)	Industrial Features
78L	0	On Site	Tank	652443 305812	Tank, NR31	Tanks (Generic)	Industrial Features
79N	0	On Site	Tank	652432 305845	Tank, NR31	Tanks (Generic)	Industrial Features
80L	0	On Site	Tank	652443 305805	Tank, NR31	Tanks (Generic)	Industrial Features
81K	0	On Site	Tank	652484 305700	Tank, NR31	Tanks (Generic)	Industrial Features
82L	0	On Site	Tank	652424 305835	Tank, NR31	Tanks (Generic)	Industrial Features
83K	0	On Site	Tank	652484 305710	Tank, NR31	Tanks (Generic)	Industrial Features
84N	0	On Site	Tank	652429 305836	Tank, NR31	Tanks (Generic)	Industrial Features
85P	0	On Site	Works	652649 305892	Works, NR30	Unspecified Works Or Factories	Industrial Features
86P	0	On Site	Electricity Sub Station	652658 305895	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
87K	0	On Site	Tank	652479 305707	Tank, NR31	Tanks (Generic)	Industrial Features
88	0	On Site	Gashouse Quay	652510 305731	Gashouse Quay, NR31	Moorings and Unloading Facilities	Water
89	0	On Site	Fish Wharf	652506 306025	Fish Wharf, NR30	Moorings and Unloading Facilities	Water

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
90	0	On Site	Works	652640 305962	Works, NR30	Unspecified Works Or Factories	Industrial Features
91S	0	On Site	BP Service Station	652554 306353	BP Service Station, Southgates Road, Great Yarmouth, NR30 3LL	Petrol and Fuel Stations	Road and Rail
92	0	On Site	Warehouse	652564 306228	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
93Q	0	On Site	Depot	652613 306262	Depot, NR30	Container and Storage	Transport, Storage and Delivery
94Q	0	On Site	Score Group Plc	652614 306284	Score Group Plc, 33-36, Southgates Road, Great Yarmouth, NR30 3LL	Seals, Tapes, Taps and Valves	Industrial Products
95	0	On Site	Works	652619 306314	Works, NR30	Unspecified Works Or Factories	Industrial Features
96R	0	On Site	Depot	652643 306215	Depot, NR30	Container and Storage	Transport, Storage and Delivery
97U	0	On Site	Depot	652670 306047	Depot, NR30	Container and Storage	Transport, Storage and Delivery
98	0	On Site	Depot	652678 306104	Depot, NR30	Container and Storage	Transport, Storage and Delivery
99	0	On Site	Factory	652708 306026	Factory, NR30	Unspecified Works Or Factories	Industrial Features
100	0	On Site	Depot	652571 305965	Depot, NR30	Container and Storage	Transport, Storage and Delivery
101T	0	On Site	Electricity Sub Station	652755 306127	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
102B	0	On Site	Works	652755 306035	Works, NR30	Unspecified Works Or Factories	Industrial Features
103S	0	On Site	South Quay Service Station	652554 306353	South Quay Service Station, Southgates Road, Great Yarmouth, NR30 3LL	Petrol and Fuel Stations	Road and Rail
104T	0	On Site	Gas Holder Station	652734 306128	Gas Holder Station, NR30	Gas Features	Infrastructure and Facilities
105U	0	On Site	H S Fishing 2000 Ltd	652669 306023	H S Fishing 2000 Ltd, Sutton Road, Great Yarmouth, NR30 3NA	Fish, Meat and Poultry Products	Foodstuffs
106	0	On Site	Noritake Itron	651879 305932	Noritake Itron, Vantage House, Harfreys Road, Great Yarmouth, NR31 0LS	Electrical Components	Industrial Products
107	2	N	Atlas Wharf	652511 306249	Atlas Wharf, NR30	Moorings and Unloading Facilities	Water
108V	11	S	Electricity Sub Station	652611 305835	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
109	13	E	Factory	652657 306344	Factory, NR30	Unspecified Works Or Factories	Industrial Features
110	22	S	C L S Offshore	652471 305612	C L S Offshore, Maltings House, Malthouse Lane, Gorleston, Great Yarmouth, NR31 0GY	Special Purpose Machinery and Equipment	Industrial Products
111AF	23	W	Electricity Sub Station	651824 305887	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
112W	24	NW	Tank	652066 306129	Tank, NR31	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
113	24	E	Southgates UK	652817 305922	Southgates UK, Oilmar House, Admiralty Road, Great Yarmouth, NR30 3NG	Vehicle Repair, Testing and Servicing	Repair and Servicing
114V	24	S	Tank	652599 305818	Tank, NR30	Tanks (Generic)	Industrial Features
115V	25	S	Tank	652595 305816	Tank, NR30	Tanks (Generic)	Industrial Features
116V	25	S	Tank	652604 305818	Tank, NR30	Tanks (Generic)	Industrial Features
117V	25	S	Tank	652608 305819	Tank, NR30	Tanks (Generic)	Industrial Features
118V	26	S	Tank	652613 305820	Tank, NR30	Tanks (Generic)	Industrial Features
119V	26	S	Tank	652592 305814	Tank, NR30	Tanks (Generic)	Industrial Features
120V	28	S	Tank	652597 305813	Tank, NR30	Tanks (Generic)	Industrial Features
121V	29	S	Tank	652594 305812	Tank, NR30	Tanks (Generic)	Industrial Features
122V	29	S	Tank	652590 305810	Tank, NR30	Tanks (Generic)	Industrial Features
123V	30	S	Tank	652609 305815	Tank, NR30	Tanks (Generic)	Industrial Features
124V	30	S	Tank	652615 305816	Tank, NR30	Tanks (Generic)	Industrial Features
125V	30	S	Tank	652605 305813	Tank, NR30	Tanks (Generic)	Industrial Features
126V	31	S	Tank	652599 305811	Tank, NR30	Tanks (Generic)	Industrial Features
127Y	31	SE	Works	652551 305617	Works, NR31	Unspecified Works Or Factories	Industrial Features
128V	32	S	Tank	652612 305813	Tank, NR30	Tanks (Generic)	Industrial Features
129W	33	NW	Tank	652044 306129	Tank, NR31	Tanks (Generic)	Industrial Features
130Z	33	N	Trinity Quay	652515 306411	Trinity Quay, NR30	Moorings and Unloading Facilities	Water
131X	34	S	Tank	652592 305806	Tank, NR30	Tanks (Generic)	Industrial Features
132	34	E	Electricity Sub Station	652676 306372	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
133X	35	S	Tank	652610 305810	Tank, NR30	Tanks (Generic)	Industrial Features
134X	35	S	Tank	652616 305811	Tank, NR30	Tanks (Generic)	Industrial Features
135AB	37	W	Tank	651803 305659	Tank, NR31	Tanks (Generic)	Industrial Features
136X	37	S	Tank	652599 305805	Tank, NR30	Tanks (Generic)	Industrial Features
137X	37	S	Tank	652594 305803	Tank, NR30	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
138	37	W	Fine Line Communications	651811 305928	Fine Line Communications, Logic House, Harfreys Road, Great Yarmouth, NR31 0LS	Radar and Telecommunications Equipment	Industrial Products
139W	38	NW	Tank	652042 306134	Tank, NR31	Tanks (Generic)	Industrial Features
140	38	S	Electricity Sub Station	652793 305851	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
141AC	39	NW	Electricity Sub Station	652153 306184	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
142AE	41	W	Harfreys Industrial Estate	651806 305816	Harfreys Industrial Estate, NR31	Business Parks and Industrial Estates	Industrial Features
143Y	41	SE	Electricity Sub Station	652529 305593	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
144AA	41	S	Tank	652680 305822	Tank, NR30	Tanks (Generic)	Industrial Features
145X	42	S	Tank	652597 305799	Tank, NR30	Tanks (Generic)	Industrial Features
146Z	42	N	Travelling Crane	652520 306420	Travelling Crane, NR30	Travelling Cranes and Gantries	Industrial Features
147Z	45	N	Trinity House Depot	652542 306423	Trinity House Depot, NR30	Container and Storage	Transport, Storage and Delivery
148X	45	E	Tank	652600 305795	Tank, NR30	Tanks (Generic)	Industrial Features
149W	46	NW	Tank	652040 306142	Tank, NR31	Tanks (Generic)	Industrial Features
150	47	S	Eastern Monitoring Services	652498 305580	Eastern Monitoring Services, Malthouse Lane, Gorleston, Great Yarmouth, NR31 0GW	Electronic Equipment	Industrial Products
151	48	NW	Tank	651959 306104	Tank, NR31	Tanks (Generic)	Industrial Features
152AA	49	S	Works	652665 305810	Works, NR30	Unspecified Works Or Factories	Industrial Features
153	49	SE	Malthouse Quay	652589 305617	Malthouse Quay, NR31	Moorings and Unloading Facilities	Water
154AB	52	W	C A H Quickmix	651791 305685	C A H Quickmix, Morton Peto Road, Great Yarmouth, NR31 0LT	Concrete Products	Industrial Products
155	53	W	S S C S	651794 305786	S S C S, Harfreys Road, Great Yarmouth, NR31 0LS	Lifting and Handling Equipment	Industrial Products
156AC	55	NW	K S D Fabrication Ltd	652099 306177	K S D Fabrication Ltd, Yarmouth Business Park, Thamesfield Way, Great Yarmouth, NR31 0DN	Metals Manufacturers, Fabricators and Stockholders	Industrial Products
157AD	56	N	Tank	652560 306435	Tank, NR30	Tanks (Generic)	Industrial Features
158AG	57	NW	Works	652045 306156	Works, NR31	Unspecified Works Or Factories	Industrial Features
159AD	59	N	Tank	652560 306438	Tank, NR30	Tanks (Generic)	Industrial Features
160AD	61	N	E U	652597 306440	E U, 19, Southgates Road, Great Yarmouth, NR30 3LJ	Vehicle Parts and Accessories	Motoring

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
161AD	61	N	Works	652585 306441	Works, NR30	Unspecified Works Or Factories	Industrial Features
162AD	62	N	Tank	652560 306441	Tank, NR30	Tanks (Generic)	Industrial Features
163AJ	63	E	Hardy Craske Fuels	652619 305765	Hardy Craske Fuels, Old Customs House Marine Base, Great Yarmouth, NR30 3LX	Fuel Distributors and Suppliers	Household, Office, Leisure and Garden
164AE	63	W	Atam Group Ltd	651783 305837	Atam Group Ltd, Unit B, Harfreys Road, Great Yarmouth, NR31 0LS	Civil Engineers	Engineering Services
165	67	N	Electricity Sub Station	652293 306269	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
166AB	67	SW	Tank	651779 305633	Tank, NR31	Tanks (Generic)	Industrial Features
167AF	68	W	C & M Hydraulics	651779 305896	C & M Hydraulics, Da Vinci House, Harfreys Road, Great Yarmouth, NR31 0LS	Hydraulic Engineers	Engineering Services
168	72	E	P K M Sign Studios	652869 305873	P K M Sign Studios, 15, Swanston's Road, Great Yarmouth, NR30 3NQ	Signs	Industrial Products
169AG	73	NW	Conveyor	652047 306175	Conveyor, NR31	Conveyors	Industrial Features
170AH	77	E	Tank	652635 305731	Tank, NR30	Tanks (Generic)	Industrial Features
171	79	NW	Mast	652096 306202	Mast, NR31	Telecommunications Features	Infrastructure and Facilities
172AH	80	E	Tank	652638 305733	Tank, NR30	Tanks (Generic)	Industrial Features
173	81	N	Warehouse	652408 306312	Warehouse, NR31	Container and Storage	Transport, Storage and Delivery
174AH	82	E	Tank	652639 305748	Tank, NR30	Tanks (Generic)	Industrial Features
175AH	84	E	Tank	652641 305745	Tank, NR30	Tanks (Generic)	Industrial Features
176AH	84	E	Tank	652642 305735	Tank, NR30	Tanks (Generic)	Industrial Features
177AH	86	E	Tank	652643 305741	Tank, NR30	Tanks (Generic)	Industrial Features
178AI	86	E	Wing Mirrors World	652881 305918	Wing Mirrors World, Unit 9, Swanston's Road, Great Yarmouth, NR30 3NQ	Vehicle Parts and Accessories	Motoring
179AI	86	E	Spray N Go	652881 305918	Spray N Go, Unit 9, Swanston's Road, Great Yarmouth, NR30 3NQ	Vehicle Repair, Testing and Servicing	Repair and Servicing
180AH	87	E	Tank	652645 305737	Tank, NR30	Tanks (Generic)	Industrial Features
181AH	89	E	Tank	652647 305721	Tank, NR30	Tanks (Generic)	Industrial Features
182AR	91	SE	Works	652873 305837	Works, NR30	Unspecified Works Or Factories	Industrial Features
183	96	N	Ballast Quay	652513 306474	Ballast Quay, NR30	Moorings and Unloading Facilities	Water
184AH	97	E	Tank	652656 305707	Tank, NR30	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
185AJ	99	S	Works	652674 305761	Works, NR30	Unspecified Works Or Factories	Industrial Features
186AK	99	E	Tank	652659 305683	Tank, NR30	Tanks (Generic)	Industrial Features
187AK	102	E	Tank	652662 305688	Tank, NR30	Tanks (Generic)	Industrial Features
188AO	103	SW	J W Munnings Ltd	651759 305598	J W Munnings Ltd, 1 Munnings Court, Harfreys Road, Great Yarmouth, NR31 0LS	Construction and Tool Hire	Hire Services
189	104	E	Electricity Sub Station	652859 306156	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
190	107	N	Simmons Edeco Europe Ltd	651821 306118	Simmons Edeco Europe Ltd, Bessemer Way, Great Yarmouth, NR31 0LX	Special Purpose Machinery and Equipment	Industrial Products
191AK	107	E	Warehouse	652668 305668	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
192AK	109	E	Tank	652669 305675	Tank, NR30	Tanks (Generic)	Industrial Features
193	109	S	Gorlerston Fire Station	652491 305518	Gorlerston Fire Station, Fire Station, High Road, Gorleston, Great Yarmouth, NR31 0PJ	Fire Brigade Stations	Central and Local Government
194AM	109	W	S P P Digital	651738 305773	S P P Digital, Morton Peto Road, Great Yarmouth, NR31 0LT	Published Goods	Industrial Products
195AT	112	S	Nelson Works	652803 305778	Nelson Works, NR30	Unspecified Works Or Factories	Industrial Features
196AK	112	E	Tank	652672 305678	Tank, NR30	Tanks (Generic)	Industrial Features
197AK	112	E	Tank	652672 305688	Tank, NR30	Tanks (Generic)	Industrial Features
198AL	113	W	Maverick Engineering Ltd	651732 305857	Maverick Engineering Ltd, 9-11, Brinell Way, Great Yarmouth, NR31 0LU	Industrial Engineers	Engineering Services
199AL	113	W	L V Shipping Ltd	651732 305857	L V Shipping Ltd, 9-11, Brinell Way, Great Yarmouth, NR31 0LU	Distribution and Haulage	Transport, Storage and Delivery
200AL	113	W	East Coast Pipe	651732 305867	East Coast Pipe, Unit 8, Brinell Way, Great Yarmouth, NR31 0LU	Electrical Equipment Repair and Servicing	Repair and Servicing
201AM	114	W	Survitec Survival Craft	651732 305747	Survitec Survival Craft, Unit 16, Brinell Way, Great Yarmouth, NR31 0LU	Marine Engineers and Services	Engineering Services
202	114	W	Softstart UK	651732 305803	Softstart UK, 14, Brinell Way, Great Yarmouth, NR31 0LU	Electrical Equipment Repair and Servicing	Repair and Servicing
203AK	116	E	Tank	652676 305681	Tank, NR30	Tanks (Generic)	Industrial Features
204	116	N	Electricity Sub Station	652172 306284	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
205AN	118	W	Enterprise Rent-A-Car	651731 305910	Enterprise Rent-A-Car, Units 4-5, Brinell Way, Great Yarmouth, NR31 0LU	Vehicle Hire and Rental	Hire Services
206AK	118	E	Tank	652678 305677	Tank, NR30	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
207AU	118	SE	Works	652869 305796	Works, NR30	Unspecified Works Or Factories	Industrial Features
208AN	118	W	Applus R T D	651730 305932	Applus R T D, 1-2, Brinell Way, Great Yarmouth, NR31 0LU	Industrial Engineers	Engineering Services
209AN	119	W	Stuga	651730 305911	Stuga, Unit 4, Brinell Way, Great Yarmouth, NR31 0LU	Tools Including Machine Shops	Industrial Products
210AO	120	SW	Hubble	651739 305598	Hubble, 2 Munnings Court, Harfreys Road, Great Yarmouth, NR31 0LS	General Construction Supplies	Industrial Products
211AS	121	S	Regional Scaffolding	652729 305752	Regional Scaffolding, Canada Buildings, South Denes Road, Great Yarmouth, NR30 3PF	Construction and Tool Hire	Hire Services
212AP	122	N	Electricity Sub Station	652667 306502	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
213AP	123	N	Electricity Sub Station	652667 306503	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
214AQ	125	NW	Barford Hire Ltd	652068 306240	Barford Hire Ltd, Yarmouth Business Park, Suffolk Road, Great Yarmouth, NR31 0ER	Vehicle Hire and Rental	Hire Services
215AQ	125	NW	Pat's Floorings	652068 306240	Pat's Floorings, Yarmouth Business Park, Thamesfield Way, Great Yarmouth, NR31 0DN	Construction Completion Services	Construction Services
216AV	127	N	Works	652551 306505	Works, NR30	Unspecified Works Or Factories	Industrial Features
217	127	NW	Survitec Group	651930 306180	Survitec Group, Unit 8, Owen Road, Great Yarmouth, NR31 0NA	Workwear	Industrial Products
218AO	128	SW	M D F Transport Ltd	651729 305597	M D F Transport Ltd, 3 Munnings Court, Harfreys Road, Great Yarmouth, NR31 0LS	Distribution and Haulage	Transport, Storage and Delivery
219	128	W	Electricity Sub Station	652391 306411	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
220AR	129	E	Pinstripe Distribution Ltd	652925 305861	Pinstripe Distribution Ltd, Midas Building, Swanston's Road, Great Yarmouth, NR30 3NQ	Distribution and Haulage	Transport, Storage and Delivery
221	129	E	Gold Cockerel Books	652925 305861	Gold Cockerel Books, Midas Building, Swanston's Road, Great Yarmouth, NR30 3NQ	Published Goods	Industrial Products
222	130	N	Works	652610 306511	Works, NR30	Unspecified Works Or Factories	Industrial Features
223AS	130	S	A B Trade Supplies	652734 305743	A B Trade Supplies, Canada Building, South Denes Road, Great Yarmouth, NR30 3PF	General Construction Supplies	Industrial Products
224BA	132	E	Electricity Sub Station	652691 305634	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
225AT	132	S	Hy-tek Engineering Services Ltd	652821 305760	Hy-tek Engineering Services Ltd, 3, Main Cross Road, Great Yarmouth, NR30 3PD	Precision Engineers	Engineering Services

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
226A T	132	S	Toucam Engineers Ltd	652821 305760	Toucam Engineers Ltd, 3, Main Cross Road, Great Yarmouth, NR30 3PD	Fuel Distributors and Suppliers	Household, Office, Leisure and Garden
227A S	136	S	Displaypro	652764 305744	Displaypro, Display House, Main Cross Road, Great Yarmouth, NR30 3NZ	Office and Shop Equipment	Industrial Products
228A U	140	SE	Depot	652909 305803	Depot, NR30	Container and Storage	Transport, Storage and Delivery
229A T	141	S	Works	652826 305753	Works, NR30	Unspecified Works Or Factories	Industrial Features
230B E	142	SE	Crane	652620 305528	Crane, NR31	Travelling Cranes and Gantries	Industrial Features
231A V	144	N	Warehouse	652532 306522	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
232A V	146	N	S T M Rewinds Ltd	652536 306524	S T M Rewinds Ltd, A B C Wharf, Southgates Road, Great Yarmouth, NR30 3LQ	Vehicle Repair, Testing and Servicing	Repair and Servicing
233	148	NW	Tank	651721 306097	Tank, NR31	Tanks (Generic)	Industrial Features
234B B	153	SE	Warehouse	652881 305762	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
235A X	153	SE	Tank	652701 305595	Tank, NR30	Tanks (Generic)	Industrial Features
236A W	155	S	Depot	652777 305728	Depot, NR30	Container and Storage	Transport, Storage and Delivery
237	156	NW	Subsea Protection Systems	652383 306461	Subsea Protection Systems, Holmes Wharf 225, Southtown Road, Great Yarmouth, NR31 0JJ	Concrete Products	Industrial Products
238A W	156	S	Warehouse	652748 305720	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
239A X	156	SE	Tank	652705 305597	Tank, NR30	Tanks (Generic)	Industrial Features
240A Y	157	NW	Survival-one	651919 306209	Survival-one, Performance House Unit 6-7, Owen Road, Great Yarmouth, NR31 0NA	Special Purpose Machinery and Equipment	Industrial Products
241A U	157	SE	Nelson Works	652901 305772	Nelson Works, NR30	Unspecified Works Or Factories	Industrial Features
242A Y	157	NW	P V S Holdings	651919 306209	P V S Holdings, Unit 6 &7 Owen Road, Great Yarmouth, NR31 0NA	Garden Goods	Consumer Products
243A Z	158	SE	Micro Engineering Ltd	652939 305818	Micro Engineering Ltd, Battery Road, Great Yarmouth, NR30 3NN	Precision Engineers	Engineering Services
244A Z	158	SE	B W Refrigeration & Air Conditioning Ltd	652939 305818	B W Refrigeration & Air Conditioning Ltd, Battery Road, Great Yarmouth, NR30 3NN	Construction Completion Services	Construction Services
245A X	159	SE	Tank	652706 305593	Tank, NR30	Tanks (Generic)	Industrial Features
246A X	159	SE	Tank	652703 305586	Tank, NR30	Tanks (Generic)	Industrial Features
247A X	160	E	Tank	652709 305598	Tank, NR30	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
248AX	162	SE	Tank	652707 305588	Tank, NR30	Tanks (Generic)	Industrial Features
249AX	162	SE	Tank	652704 305582	Tank, NR30	Tanks (Generic)	Industrial Features
250BA	162	E	D P Services & Supplies Ltd	652720 305626	D P Services & Supplies Ltd, Ferry House, South Denes Road, Great Yarmouth, NR30 3PJ	Container and Storage	Transport, Storage and Delivery
251BA	162	E	Ebrex UK Ltd	652720 305626	Ebrex UK Ltd, Ferry House, South Denes Road, Great Yarmouth, NR30 3PJ	Distribution and Haulage	Transport, Storage and Delivery
252	163	SE	Great Yarmouth	652608 305498	Great Yarmouth, A1243 South Denes Road And Riverside Road, Barrack Estate, NR31	Ferries and Ferry Terminals	Water
253AX	163	SE	Tank	652711 305594	Tank, NR30	Tanks (Generic)	Industrial Features
254	163	SW	East Coast Insulations Ltd	651695 305587	East Coast Insulations Ltd, Munnings Court, Harfreys Road, Great Yarmouth, NR31 0LS	Recycling, Reclamation and Disposal	Recycling Services
255AX	165	SE	Tank	652709 305584	Tank, NR30	Tanks (Generic)	Industrial Features
256AX	165	SE	Tank	652706 305578	Tank, NR30	Tanks (Generic)	Industrial Features
257AX	165	SE	Tank	652712 305590	Tank, NR30	Tanks (Generic)	Industrial Features
258AX	168	SE	Tank	652712 305585	Tank, NR30	Tanks (Generic)	Industrial Features
259BF	168	W	D N V Gl	651679 305750	D N V Gl, Cooke House, Morton Peto Road, Great Yarmouth, NR31 0LT	Marine Engineers and Services	Engineering Services
260AX	168	SE	Tank	652707 305575	Tank, NR30	Tanks (Generic)	Industrial Features
261AX	168	SE	Tank	652710 305580	Tank, NR30	Tanks (Generic)	Industrial Features
262AX	170	SE	Tank	652707 305570	Tank, NR30	Tanks (Generic)	Industrial Features
263AX	171	SE	Tank	652714 305581	Tank, NR30	Tanks (Generic)	Industrial Features
264AX	171	SE	Tank	652711 305575	Tank, NR30	Tanks (Generic)	Industrial Features
265	172	S	Advanced Machinery Relocations Ltd	652217 305508	Advanced Machinery Relocations Ltd, 18, Suffolk Road, Gorleston, Great Yarmouth, NR31 0QB	Construction Completion Services	Construction Services
266BB	173	SE	Equipment Supply Co G Y Ltd	652911 305759	Equipment Supply Co G Y Ltd, Nelson Works, Main Cross Road, Great Yarmouth, NR30 3NZ	General Construction Supplies	Industrial Products
267AX	173	SE	Tank	652711 305572	Tank, NR30	Tanks (Generic)	Industrial Features
268BC	174	SE	Tank	652709 305566	Tank, NR30	Tanks (Generic)	Industrial Features
269BC	174	SE	Tank	652715 305576	Tank, NR30	Tanks (Generic)	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
270BD	175	N	Warehouse	652533 306553	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
271AX	175	E	Factory	652727 305602	Factory, NR30	Unspecified Works Or Factories	Industrial Features
272BD	175	N	Abc Wharf	652508 306553	Abc Wharf, NR30	Moorings and Unloading Facilities	Water
273BG	175	N	Works	652643 306558	Works, NR30	Unspecified Works Or Factories	Industrial Features
274BE	176	SE	Landing Stage	652643 305502	Landing Stage, NR31	Moorings and Unloading Facilities	Water
275BC	176	SE	Tank	652712 305567	Tank, NR30	Tanks (Generic)	Industrial Features
276AX	177	SE	Tank	652716 305573	Tank, NR30	Tanks (Generic)	Industrial Features
277BC	177	SE	Tank	652710 305562	Tank, NR30	Tanks (Generic)	Industrial Features
278BC	179	SE	Tank	652713 305564	Tank, NR30	Tanks (Generic)	Industrial Features
279BC	179	SE	Tank	652710 305558	Tank, NR30	Tanks (Generic)	Industrial Features
280BH	179	SE	Warehouse	652945 305786	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
281AX	179	SE	Tank	652717 305569	Tank, NR30	Tanks (Generic)	Industrial Features
282BC	181	SE	Tank	652717 305565	Tank, NR30	Tanks (Generic)	Industrial Features
283AW	185	S	Electricity Sub Station	652814 305705	Electricity Sub Station, NR30	Electrical Features	Infrastructure and Facilities
284BF	185	W	S M S Auto Care Ltd	651661 305738	S M S Auto Care Ltd, Unit 2 Cooke House, Morton Peto Road, Great Yarmouth, NR31 0LT	Vehicle Repair, Testing and Servicing	Repair and Servicing
285	186	NW	C & L Waste Oil Collection Ltd	652057 306302	C & L Waste Oil Collection Ltd, Yarmouth Business Park, Thamesfield Way, Great Yarmouth, NR31 0DN	Recycling, Reclamation and Disposal	Recycling Services
286BG	187	N	J R Pitchers Ltd	652606 306568	J R Pitchers Ltd, 5, Selby Place, Great Yarmouth, NR30 3LG	Vehicle Repair, Testing and Servicing	Repair and Servicing
287BK	195	NW	Tube Care Inspection Ltd	651736 306176	Tube Care Inspection Ltd, Bessemer Way, Great Yarmouth, NR31 0LX	General Construction Supplies	Industrial Products
288AZ	197	E	Kingsway Tyres	652982 305819	Kingsway Tyres, Battery Road, Great Yarmouth, NR30 3NN	Vehicle Parts and Accessories	Motoring
289BI	197	E	Shopkit	652995 305867	Shopkit, Unit 1-3, Swanston's Road, Great Yarmouth, NR30 3NQ	Precision Engineers	Engineering Services
290BH	198	SE	Warehouse	652975 305799	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
291BI	198	E	Depot	652996 305861	Depot, NR30	Container and Storage	Transport, Storage and Delivery
292BG	199	N	Queen's Road Business Centre	652671 306579	Queen's Road Business Centre, NR30	Business Parks and Industrial Estates	Industrial Features

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
293BL	208	SE	Quay	652707 305509	Quay, NR30	Moorings and Unloading Facilities	Water
294BO	211	S	Depot	652877 305695	Depot, NR30	Container and Storage	Transport, Storage and Delivery
295BH	212	SE	Warehouse	652980 305780	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
296BJ	213	N	Works	652628 306595	Works, NR30	Unspecified Works Or Factories	Industrial Features
297BJ	215	N	Pertwee & Back Ltd - Ford	652585 306594	Pertwee & Back Ltd - Ford, Southgates Road, Great Yarmouth, NR30 3LF	Vehicle Repair, Testing and Servicing	Repair and Servicing
298	216	SE	Kirklands Ltd	652942 305730	Kirklands Ltd, Kirklands House, Main Cross Road, Great Yarmouth, NR30 3NZ	Workwear	Industrial Products
299	216	S	Electricity Sub Station	652504 305411	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
300BK	218	NW	Electricity Sub Station	651684 306162	Electricity Sub Station, NR31	Electrical Features	Infrastructure and Facilities
301	220	SE	Carl J Harrison Piano Services	652601 305428	Carl J Harrison Piano Services, 3, Ferry Hill, Gorleston, Great Yarmouth, NR31 0PD	Sports and Leisure Equipment Repair	Repair and Servicing
302BL	221	SE	Depot	652736 305522	Depot, NR30	Container and Storage	Transport, Storage and Delivery
303BM	225	N	Warehouse	652525 306603	Warehouse, NR30	Container and Storage	Transport, Storage and Delivery
304BN	228	W	D T S Solutions	651619 305949	D T S Solutions, Unit 17, Bessemer Way, Great Yarmouth, NR31 0LX	Radar and Telecommunications Equipment	Industrial Products
305BM	228	N	Wharf	652498 306605	Wharf, NR30	Moorings and Unloading Facilities	Water
306BN	228	W	Engraphics Ltd	651619 305939	Engraphics Ltd, Unit 16, Bessemer Way, Great Yarmouth, NR31 0LX	Signs	Industrial Products
307BN	230	W	Smart Buy Tools	651619 305928	Smart Buy Tools, Unit 15, Bessemer Way, Great Yarmouth, NR31 0LX	Tools Including Machine Shops	Industrial Products
308	230	N	Great Yarmouth Coach Works	652677 306610	Great Yarmouth Coach Works, 15, Queens Road, Great Yarmouth, NR30 3HT	New Vehicles	Motoring
309BO	232	SE	C & C Sheds & Timber	652931 305700	C & C Sheds & Timber, Suffling Road, Great Yarmouth, NR30 3QP	Garden Goods	Consumer Products
310BM	233	N	Works	652544 306611	Works, NR30	Unspecified Works Or Factories	Industrial Features
311BP	233	W	Securicom Services	651612 305834	Securicom Services, Unit 6, Bessemer Way, Great Yarmouth, NR31 0LX	Electronic Equipment	Industrial Products
312BP	233	W	Id Asbestos Ltd	651612 305834	Id Asbestos Ltd, Unit 6, Bessemer Way, Great Yarmouth, NR31 0LX	Recycling, Reclamation and Disposal	Recycling Services
313BQ	235	SE	Lacons Brewery	653011 305789	Lacons Brewery, The Courtyard, Main Cross Road, Great Yarmouth, NR30 3NZ	Alcoholic Drinks	Foodstuffs

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
314	235	NW	B L I Technologies Ltd	651991 306327	B L I Technologies Ltd, Northland Energy Services UK Limited Yarmouth Business Park, Suffolk Road, Great Yarmouth, NR31 0ER	Distribution and Haulage	Transport, Storage and Delivery
315	236	W	Scantech Offshore	651605 305692	Scantech Offshore, Scantech House, Morton Peto Road, Great Yarmouth, NR31 0LT	Special Purpose Machinery and Equipment	Industrial Products
316	237	E	Yarmouth Rewinds	653027 305826	Yarmouth Rewinds, Swanston's Road, Great Yarmouth, NR30 3NQ	Vehicle Repair, Testing and Servicing	Repair and Servicing
317	241	N	Hopper	651835 306254	Hopper, NR31	Hoppers and Silos	Farming
318	242	N	Nelson Garage	652574 306621	Nelson Garage, Southgates Road, Great Yarmouth, NR30 3LF	Vehicle Repair, Testing and Servicing	Repair and Servicing
319BL	246	SE	Depot	652739 305488	Depot, NR30	Container and Storage	Transport, Storage and Delivery
320	247	SE	Depot	652942 305689	Depot, NR30	Container and Storage	Transport, Storage and Delivery

4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 3

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
321	0	On Site	652574 306370	BP	South Quay Service Station, Southgates Road, Southgates Road, Trinity Square, Great Yarmouth, Norfolk, NR30 3LL	No	Open
322A	0	On Site	652377 306137	BP	Southtown Service Station, 126, Southtown Road, Southtown Road, Great Yarmouth, Norfolk, NR31 0JZ	No	Open
323BQ	314	SE	653075 305741	Obsolete	South Beach Service Station, South Beach Parade, South Beach Parade, Great Yarmouth, Norfolk, NR30 3QN	Not Applicable	Obsolete

4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site: 0

Database searched and no data found.

4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.
