Appendix G-1 – Consultation Materials: Consultation Leaflet

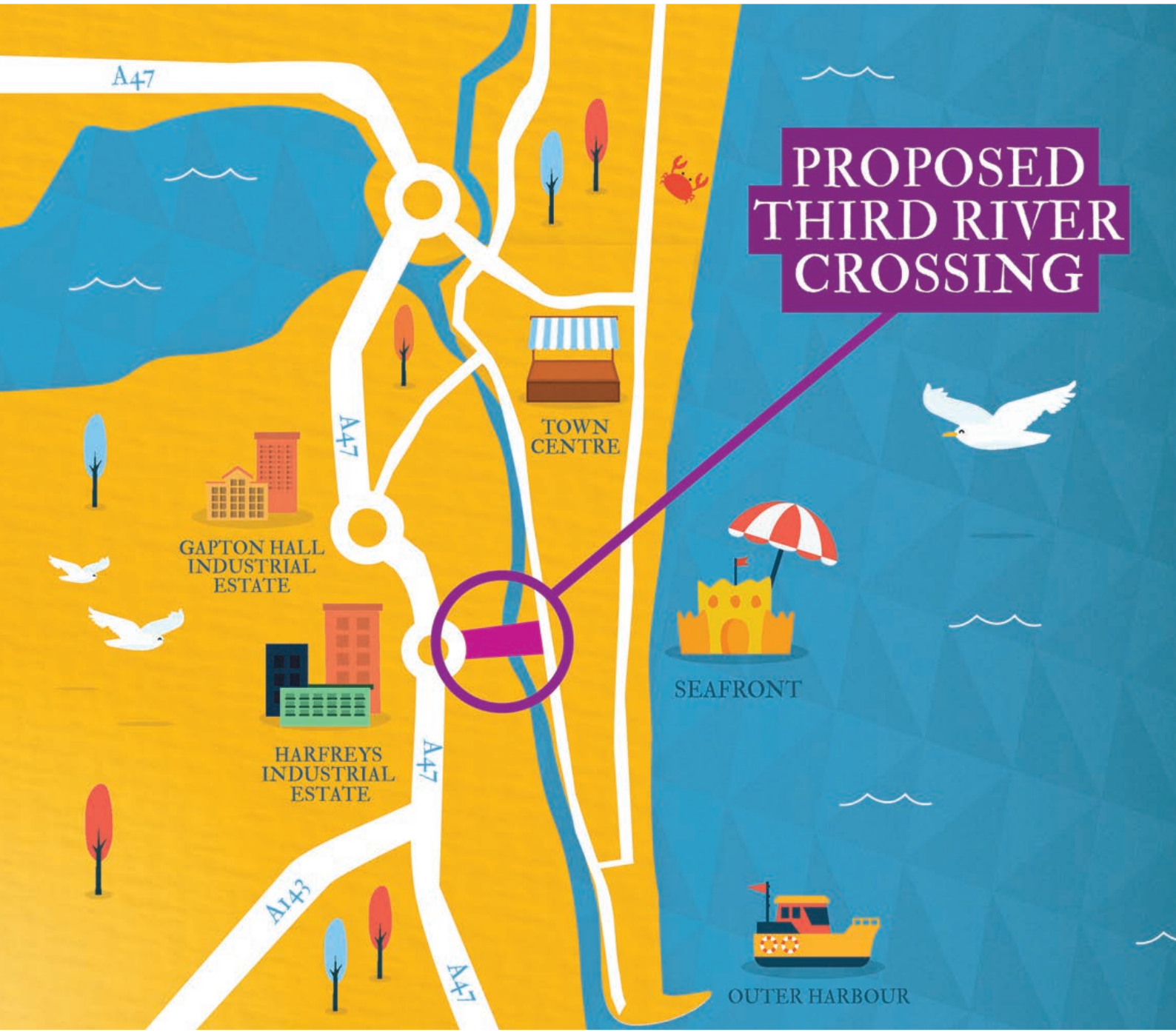
Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

20 August 2018 to 5 October 2018

Norfolk County Council is seeking your views on our proposals for a new bridge in Great Yarmouth.

The significance of this scheme means we need a special type of permission called a Development Consent Order (DCO) to build and operate the new bridge. A DCO would remove the need for planning permission and other consents. As a result this statutory consultation is a very important part of the process.



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Information about the project will be on display at the exhibitions detailed below or you can come to speak to staff and respond to the consultation in person at the four consultation events.

Venue	Exhibition Dates	Consultation Event
Great Yarmouth Library - Tolhouse Street, Great Yarmouth, NR30 2SH	Monday 20 August to Saturday 25 August	Saturday 25 August (10am to 4:30pm)
Priory Centre - Priory Plain, Great Yarmouth, NR30 1NW	Tuesday 28 August to Saturday 1 September*	Thursday 30 August (10am to 9pm)
Gorleston Library - Lowestoft Road, Gorleston-on-Sea, Great Yarmouth, NR31 6SG	Monday 3 September to Saturday 8 September	Tuesday 4 September (10am to 8pm)
Kings Centre - 30 Queen Annes Road, Southtown, Great Yarmouth, NR31 0LE	Tuesday 11 September to Saturday 15 September	Wednesday 12 September (10am to 8pm)

*** Please note the exhibition at the Priory Centre is not available to view between 12:45pm and 4pm on Wednesday 29 August and Friday 31 August.**

If you are unable to visit the exhibitions or consultation events then copies of the consultation documents are also available to view between 20 August and 5 October at:

- the above locations during normal opening hours
- Great Yarmouth Borough Council, Town Hall, Hall Plain, Great Yarmouth, NR30 2QF
- Archive Centre, County Hall, Martineau Lane, Norwich, NR1 2DQ
- Norfolk County Council's website at www.norfolk.gov.uk/3rc

The consultation documents include a Consultation Brochure and Questionnaire, FAQs, and information on environmental effects, the design process and traffic modelling.

Find out more and tell us what you think of our proposals by:

- Completing a questionnaire form at the exhibition/events or on-line at www.norfolk.gov.uk/3rc
- Emailing comments to: gy3rc-st3consultation@norfolk.gov.uk
- Writing to **'Freepost Plus RTCL-XSTT-JZSK, Norfolk County Council, GY3RC, Ground floor - south wing, County Hall, Martineau Lane, Norwich NR1 2DH'**

The deadline for responses to this consultation is 23:59hrs on 5 October 2018

Appendix G-2 – Consultation Materials: Consultation Brochure

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

20 August 2018 to 5 October 2018

We need your views on the proposed new bridge over the River Yare in Great Yarmouth.

This brochure sets out our proposals for the Third River Crossing. A questionnaire is available for you to feedback your comments and views.

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If you need this report in large print, audio, Braille, alternative format or in a different language please email gy3rc-st3consultation@norfolk.gov.uk or telephone 0344 8008020 and we will do our best to help.

www.norfolk.gov.uk/3rc

Norfolk County Council

Introduction

The Third River Crossing scheme involves the construction, operation and maintenance of a new bridge over the River Yare in Great Yarmouth.

The crossing links the A47 at Harfrey's Roundabout with South Denes Road.

In Spring 2019 Norfolk County Council intends to make an application to the Secretary of State for a Development Consent Order for the Third River Crossing.

We are proposing a double leaf bascule bridge (a type of lifting bridge - similar in operation to the existing Haven Bridge). Although the height and horizontal alignment of the bridge deck is already fixed, we would like to retain some flexibility regarding the range of structure design and opening mechanisms being considered (see pages 6 and 7).

Before making this application we would like your views on the scheme that we propose to submit.

Why do we need the Third River Crossing?

The objectives of the Third River Crossing are:

- To support Great Yarmouth as a centre for the offshore renewable energy, oil and gas industries and to enhance the port's role as an international gateway
- To help create new jobs by improving transport links between the port and the main road network
- To support the regeneration of Great Yarmouth, including the town centre and seafront
- To improve local access by reducing congestion and improving journey time reliability
- To improve safety and remove heavy traffic from unsuitable routes within the town centre
- To improve access to the Great Yarmouth peninsula for pedestrians, cyclists and buses
- To protect and improve the environment, and minimise the impact of the scheme on local people and places

Project funding

Norfolk County Council submitted a bid for a funding contribution to the Department for Transport (DfT). The submission to DfT set out the project cost as approximately £120m. The Autumn Budget 2017 allocated a Government contribution of £98m towards the scheme. The remaining cost will be locally funded and is likely to come from a range of sources.

Progress to date and future timeline

Progress to date

2003 to 2009

Initial scheme assessment work	**Different options reviewed and assessed, including different alignments and a tunnel option**	**Public consultation on Great Yarmouth and Gorleston Area Transportation Strategy**	**Preferred route decision confirmed**

2009 to 2015

Purchase of properties to safeguard land

2015 to 2016

Secured funding from the New Anglia Local Enterprise Partnership	**Secured funding from the Department for Transport (DfT) to prepare an outline business case (the bid for scheme funding)**

2016 to 2017

Assessment of options for crossing	**Stage 1 and 2 public consultations**	**Development and submission of the funding bid to the DfT to design and construct the scheme. £98 million funding contribution granted by DfT**

2018

Decision by the Secretary of State that the Third River Crossing is nationally significant and requires a special type of permission called a Development Consent Order	**Further development of scheme prior to this consultation**

Future timeline

5 October 2018	**Deadline for responses to this consultation**
Spring 2019	**Development Consent Order application submitted**
Summer 2019	**Development Consent Order public examination**
Spring/Summer 2020	**Development Consent Order decision by the Secretary of State**
Late 2020	**Start of construction**
Early 2023	**Scheme completed and open**

This consultation

This consultation is **Stage 3** of a three stage consultation process:

Dates	Stage	Purpose
November 2016 - January 2017	Stage 1 Initial engagement consultation	This was a non-statutory consultation to understand views on congestion, share emerging proposals and understand level of support
September – October 2017	Stage 2 Scheme development consultation	This was a non-statutory consultation to provide an update on progress and understand views on the bridge development work so far
August – October 2018	Stage 3 Statutory pre-application consultation	This is the statutory consultation to present details of the proposed scheme and obtain views on it before making an application for a Development Consent Order

This is the current consultation

The key findings from Stage 1:

- Congestion in Great Yarmouth is considered a serious issue
- The Third River Crossing would make journeys faster
- Congestion would be reduced by the new crossing

The key findings from Stage 2:

- Support for the scheme remains high
- There is overall support for the proposed scheme of a bascule bridge at 4.5m clearance
- A key concern relates to how the bridge affects port business and the passage of vessels on the river
- The consultation identified a number of suggestions regarding how the scheme could be improved

Why are we consulting?

The Secretary of State has determined that the Third River Crossing is a project of national significance for the purposes of the Planning Act 2008.

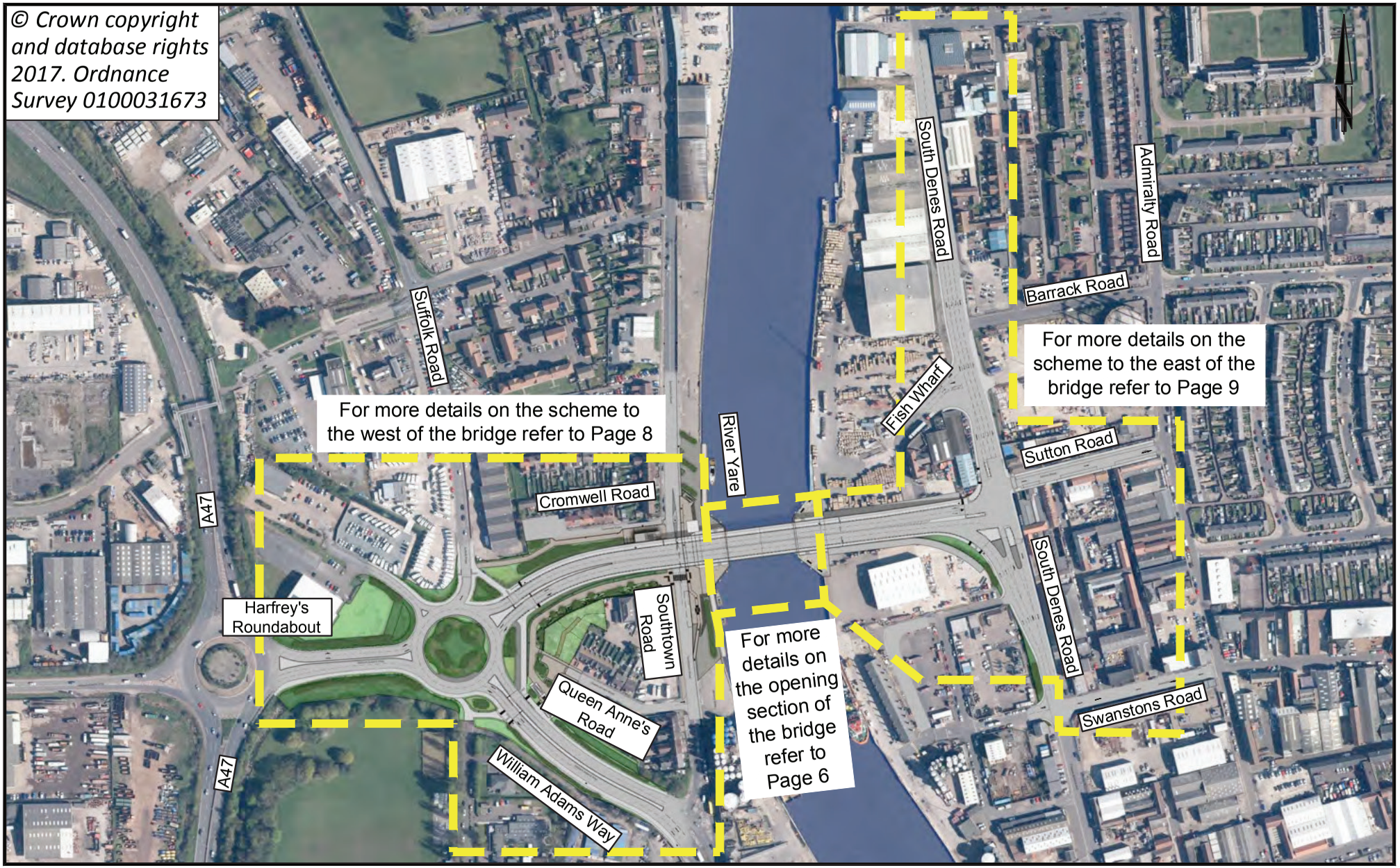
This means that the project requires a special type of permission, called a Development Consent Order, to construct, operate and maintain it.

Under the Planning Act 2008 we have to carry out a statutory consultation before we apply for a Development Consent Order. This is the current consultation and your responses to this will help us develop the scheme.

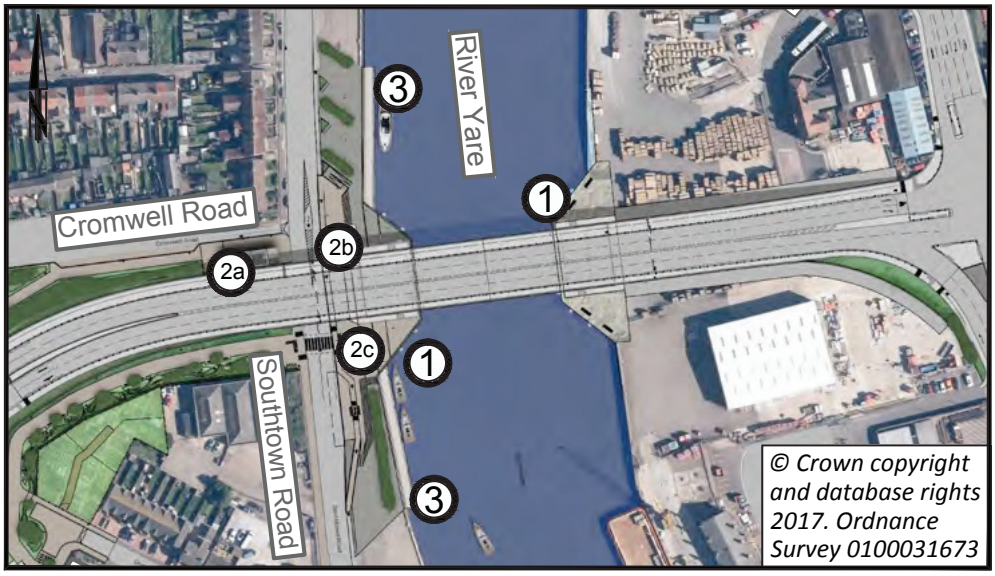
A key feature of a Development Consent Order is that it replaces the need for planning permission and various other consents/orders which a project would normally need. Therefore this consultation is a very important opportunity to express views on the scheme.

You can find out more on how to comment and have your say on page 17.

Main scheme overview plan



The opening section of the bridge



The new bridge needs to open to allow the passage of boats and large vessels along the river. The Stage 2 Consultations in Summer 2017 helped confirm our view that the best solution for an opening bridge is to provide a bascule bridge with two sections or 'leaves' that lift. The bridge would have a clearance of 4.5m over the water at high tide when in the lowered position.

Depending on the type of bascule bridge, the bridge may need structures extending into the river to accommodate the opening mechanism **(1).** A control tower structure located next to the bridge would enable the 24/7 operation of the opening span. Three provisional locations have been identified for the control tower depending on the type of bascule bridge chosen. These are shown as **(2a), (2b)** and **(2c).** Please see page 7 for more information on the possible types of bascule bridge.

Barriers with flashing signs will be provided to prevent access onto the bridge whilst it opens. A waiting berth suitable for small vessels on either side of bridge will allow for moorings of vessels waiting for the bridge to open **(3).**

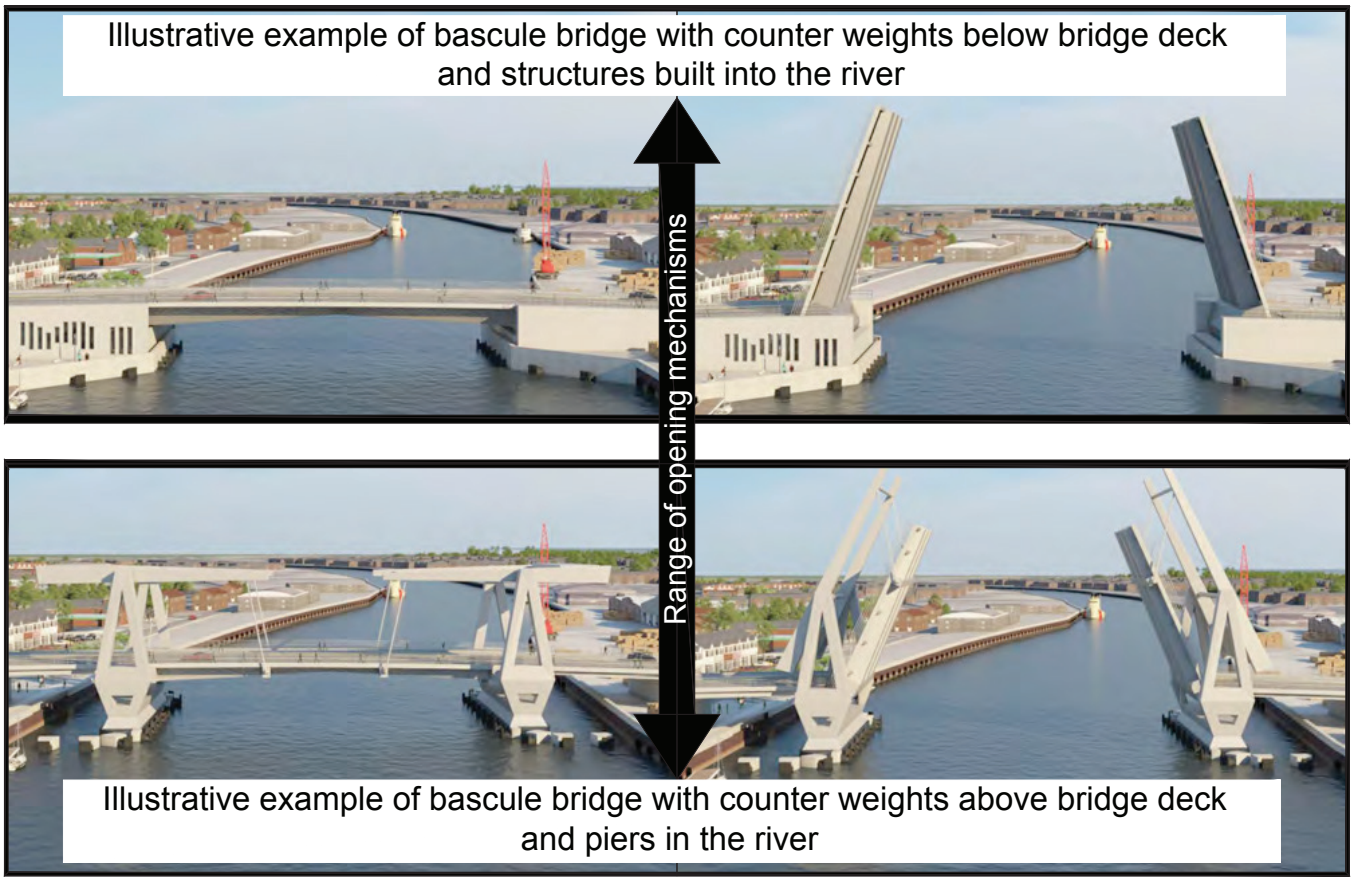
Key facts about the bridge	
Estimated number of openings on a typical day (in 2023)	15 (based upon our assessment of predicted river traffic)
Anticipated total length of time the bridge is closed to road traffic on a typical day	82 minutes (approximate average of 5 minutes 30 seconds per opening)
Total time each day the bridge is open to traffic/pedestrians/cyclists	22 hours 38 minutes
Time to open bridge as a result of power failure or hydraulic failure	It will take a maximum of 1 hour to open the bridge
Marine operations	The bridge will open for commercial vessels when required and for recreational vessels by arrangement

Bascule bridge options

We are proposing a double leaf bascule bridge. After assessment this type of structure is the most appropriate at delivering the benefits of the scheme. The height and horizontal alignment of the bridge deck is already fixed. However, at present we would like to retain some flexibility regarding the type of opening mechanism to allow contractor innovation and hopefully reduce cost.

We have produced indicative visualisations below to show the range of opening mechanisms being considered.

The environmental assessments undertaken to date have taken account of this range of opening mechanisms by assessing a 'worst case'. The opening mechanism would be fixed when we submit our application for a Development Consent Order. **We welcome your views on the illustrative designs but please note the final design may be different to those shown below.**



The final choice on the opening mechanism will be made by Norfolk County Council. In making this decision the following will need to be considered:

- Operation times to ensure minimal delay to marine and road traffic
- Constructability (how easy it is to build)
- Cost, including future maintenance
- Safety and maintenance
- Impact on vessel navigation on River Yare
- Impact on surrounding land uses and port operations
- Aesthetic appeal and appropriateness to its surroundings / visual impact
- Environmental impacts
- Comments made during this consultation
- Reliability

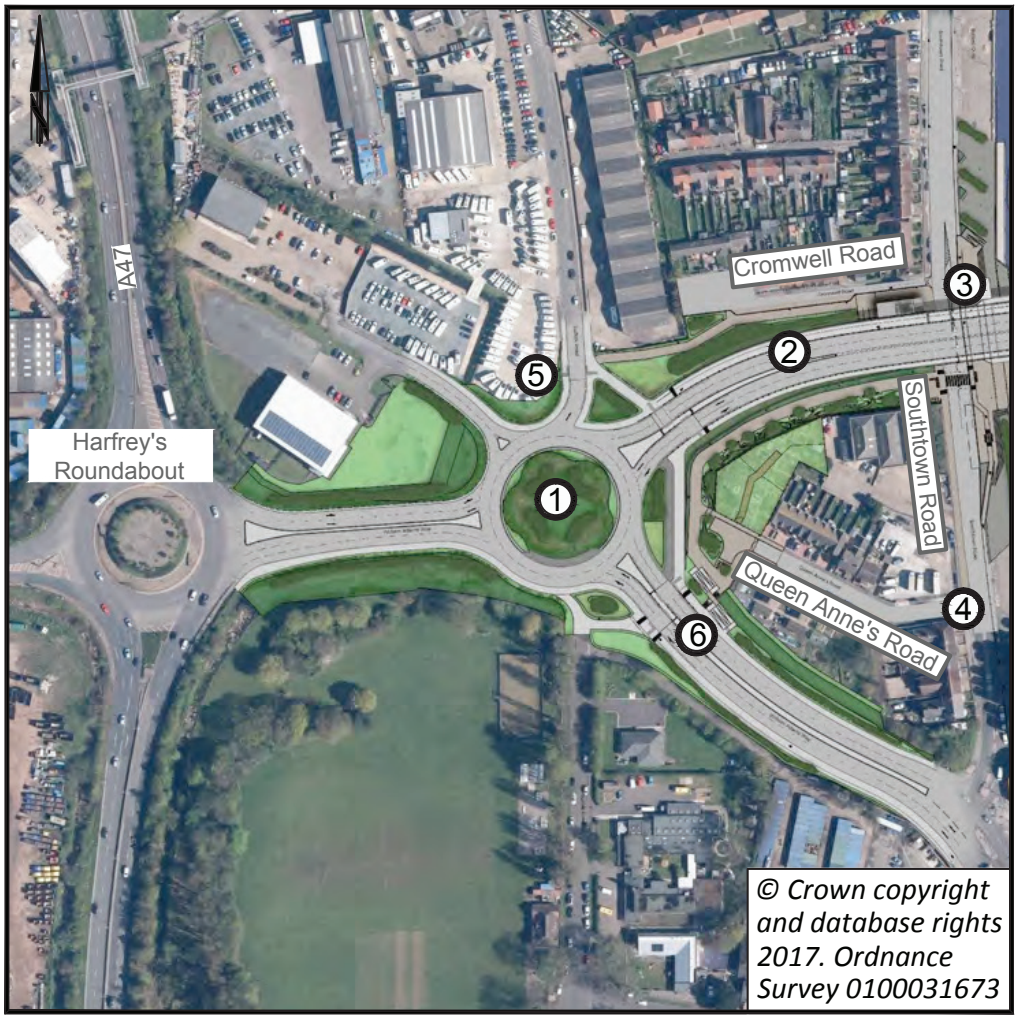
Proposals on west side of the bridge

On the west side of the bridge the scheme involves a new dual carriageway road linking the A47 at Harfrey's Roundabout to the bridge crossing.

A new five arm roundabout **(1)** on William Adams Way would be provided at the junction with Suffolk Road, allowing access to the Kings Centre and to provide a new dual carriageway road **(2)** onto the bridge.

A new bridge would be provided over Southtown Road **(3).**

Queen Anne's Road would be closed at its junction with Suffolk Road and a new junction provided onto Southtown Road **(4).**



A new pedestrian crossing would be provided on Suffolk Road **(5).**

The footbridge on William Adams Way would be removed and replaced by a new crossing for pedestrians and cyclists **(6).**

Key facts about the western side

Height	The new roundabout on William Adams Way **(1)** would sit approximately 2 metres above the surrounding existing ground levels The new dual carriageway road would rise up to approximately 7.2 metres above Southtown Road **(3)** The bridge approach embankments would be retained by reinforced earth or retaining walls
Gradients	A maximum gradient of 5% (1 in 20) would be provided on the bridge approaches

Proposals on east side of the bridge

On the east side of the bridge the scheme involves a new dual carriageway road linking South Denes Road to the bridge crossing.

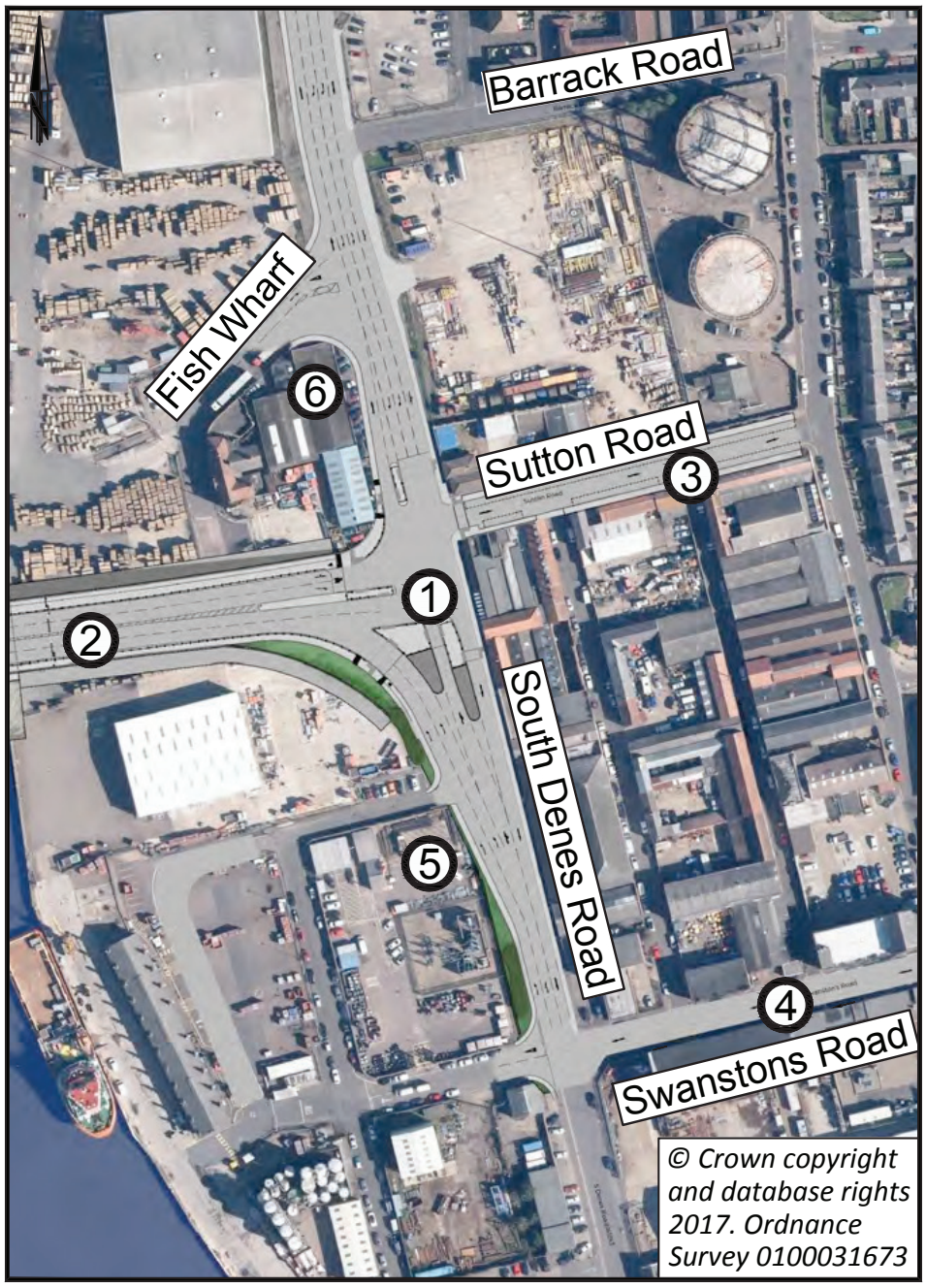
A new signal controlled junction would be provided at the junction of South Denes Road with Sutton Road **(1).** South Denes Road would be widened to the side closest to the river on its approaches to this junction.

A new dual carriageway road **(2)** would be provided from this junction onto the bridge.

The one way systems on Sutton Road **(3)** and Swanstons Road **(4)** would be reversed.

New access arrangements would be provided to and from the existing quayside areas near the bridge **(5).**

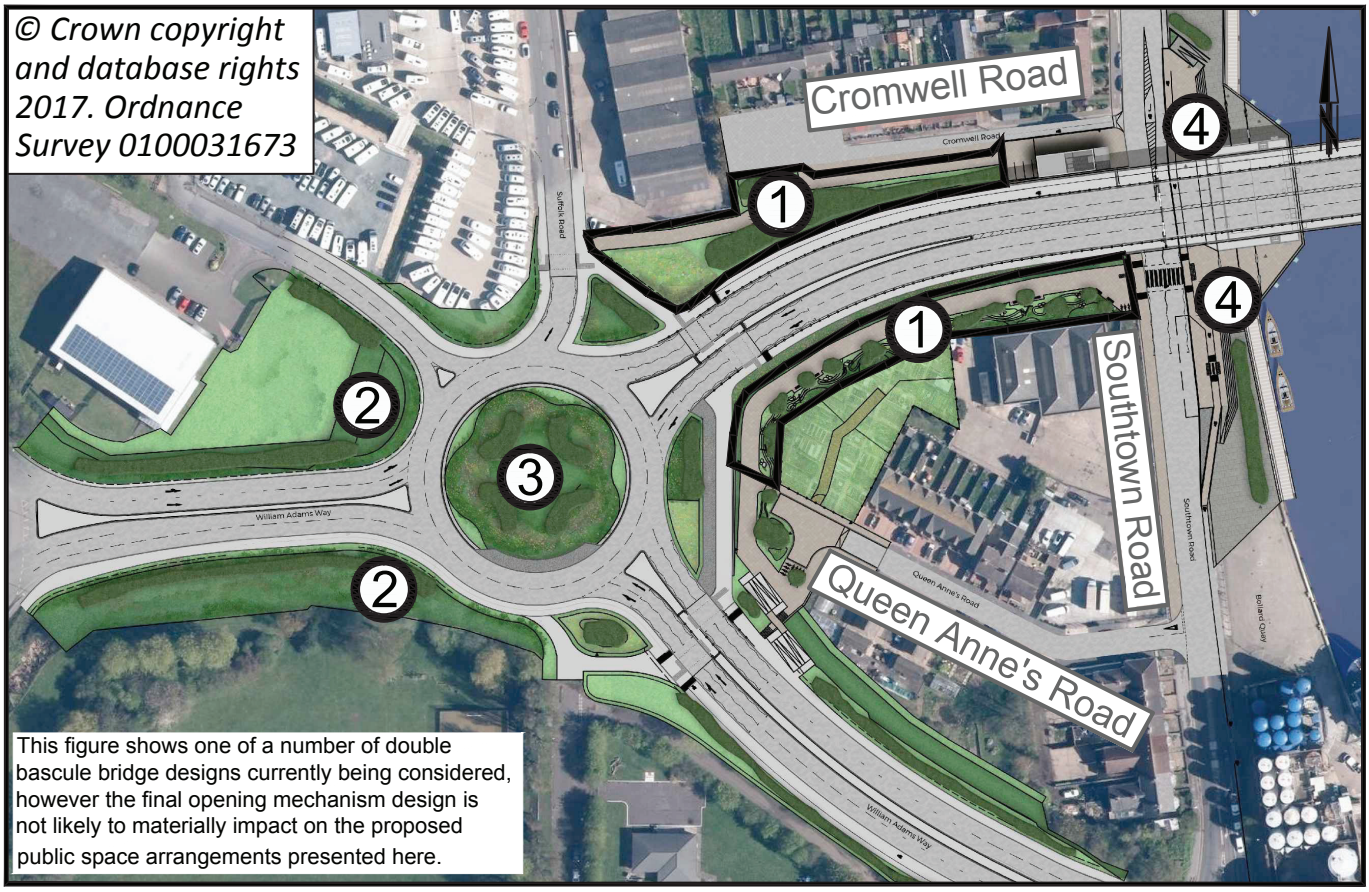
Revisions to the junction of Fish Wharf with South Denes Road **(6)** would be required.



Key facts about the eastern side	
Height	The signal controlled junction with South Denes Road **(1)** would be at existing ground level
Gradients	A maximum gradient of 5% (1 in 20) would be provided on the bridge approaches

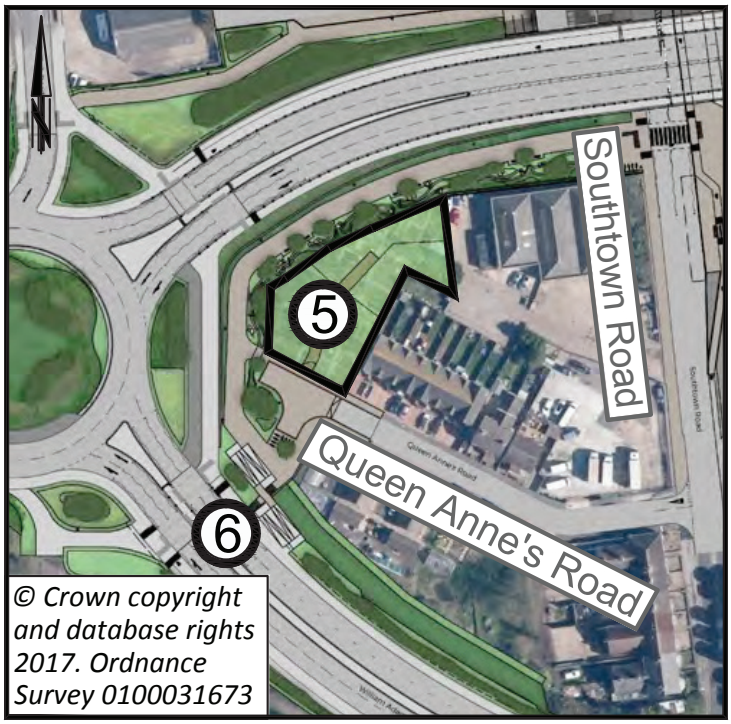
Public space improvements

As part of the scheme proposals we intend to provide a number of public space improvements within the land required for the scheme. These include the provision of new areas of public routes **(1)** and areas of landscaped space **(2)** (including the centre of the new roundabout on William Adams Way **(3)**). The area around the bridge at Bollard Quay provides the opportunity to consider a new public space, forming an important interchange for pedestrians and cyclists **(4).**



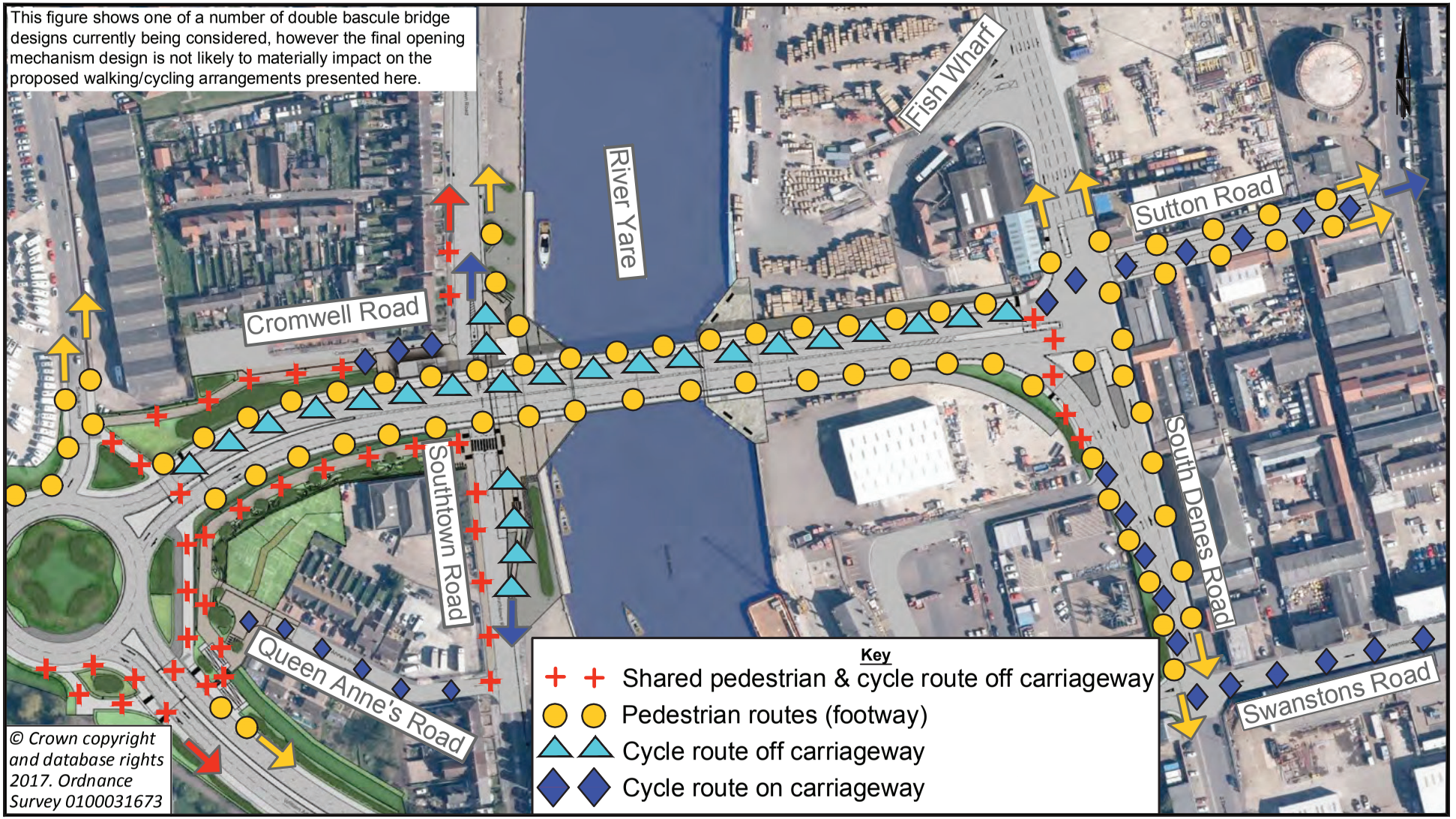
The Third River Crossing scheme requires land from the existing allotment sites. A new location for the existing allotment site on the north of Queen Anne's Road has been identified **(5).**

Steps/ramps up to William Adams Way are proposed **(6).**



Walking/cycling routes

The design of the proposed highway alignment and bridge approach creates an opportunity to develop routes for walkers and cyclists that connect Southtown Road with South Denes Road. The proposed routes for walkers and cyclists are shown on the plan below.



Lighting, parking and vessel berths

Lighting

We intend to install lighting on and around the new bridge. The lighting design will be developed further during detailed design, to incorporate both the architectural lighting of the crossing and also the public space areas that have been identified. The lighting scheme will utilise specialised lighting to minimise obtrusive light and to mitigate any light pollution onto the River Yare and avoid any impacts to navigation.

Waiting and Parking Restrictions

Between the new roundabout on William Adams Way and the new traffic signalled junction on South Denes Road the bridge and its approach road would have the following parking restrictions:

- no waiting at any time
- no loading/unloading at any time

Changes to waiting/parking restrictions on other roads are being developed and will be included in the application for a Development Consent Order.

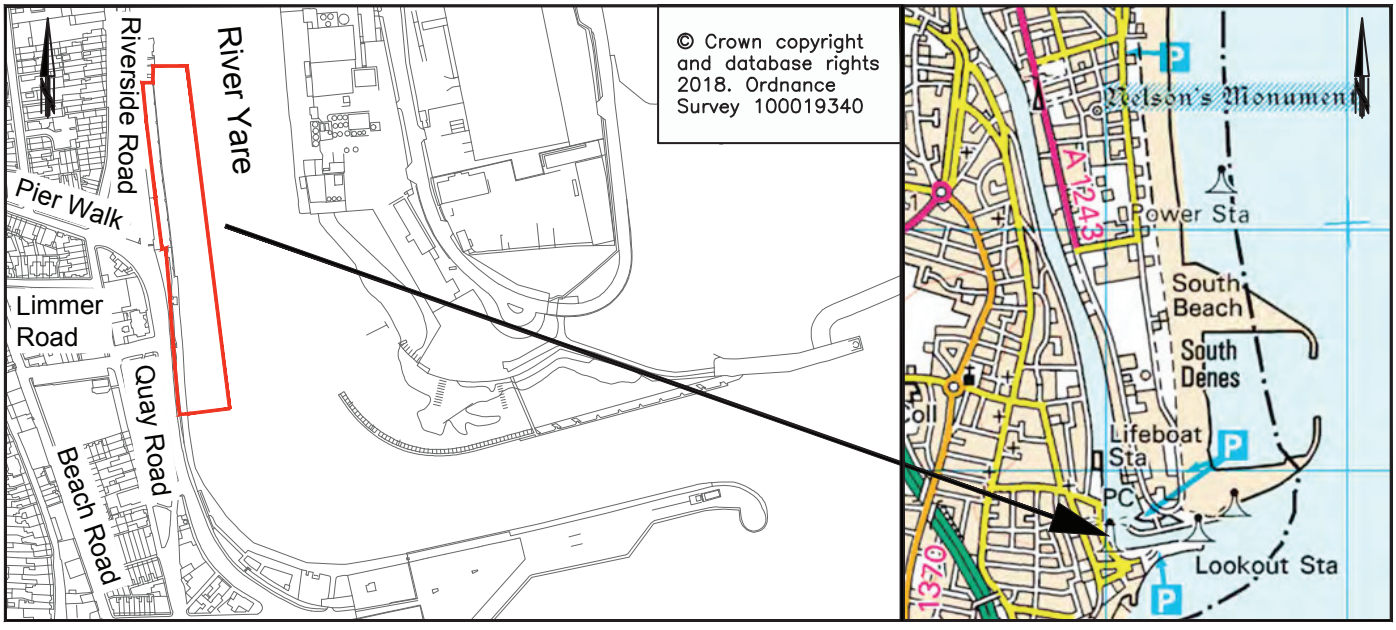
River Vessel Berthing Facilities

Page 6 of this document describes the proposals for waiting facilities to the north and south of the bridge for small vessels.

Consideration is being given to a potential large commercial vessel waiting facility, for use in the event that the bridge fails to operate. The proposed location for this facility is shown below.

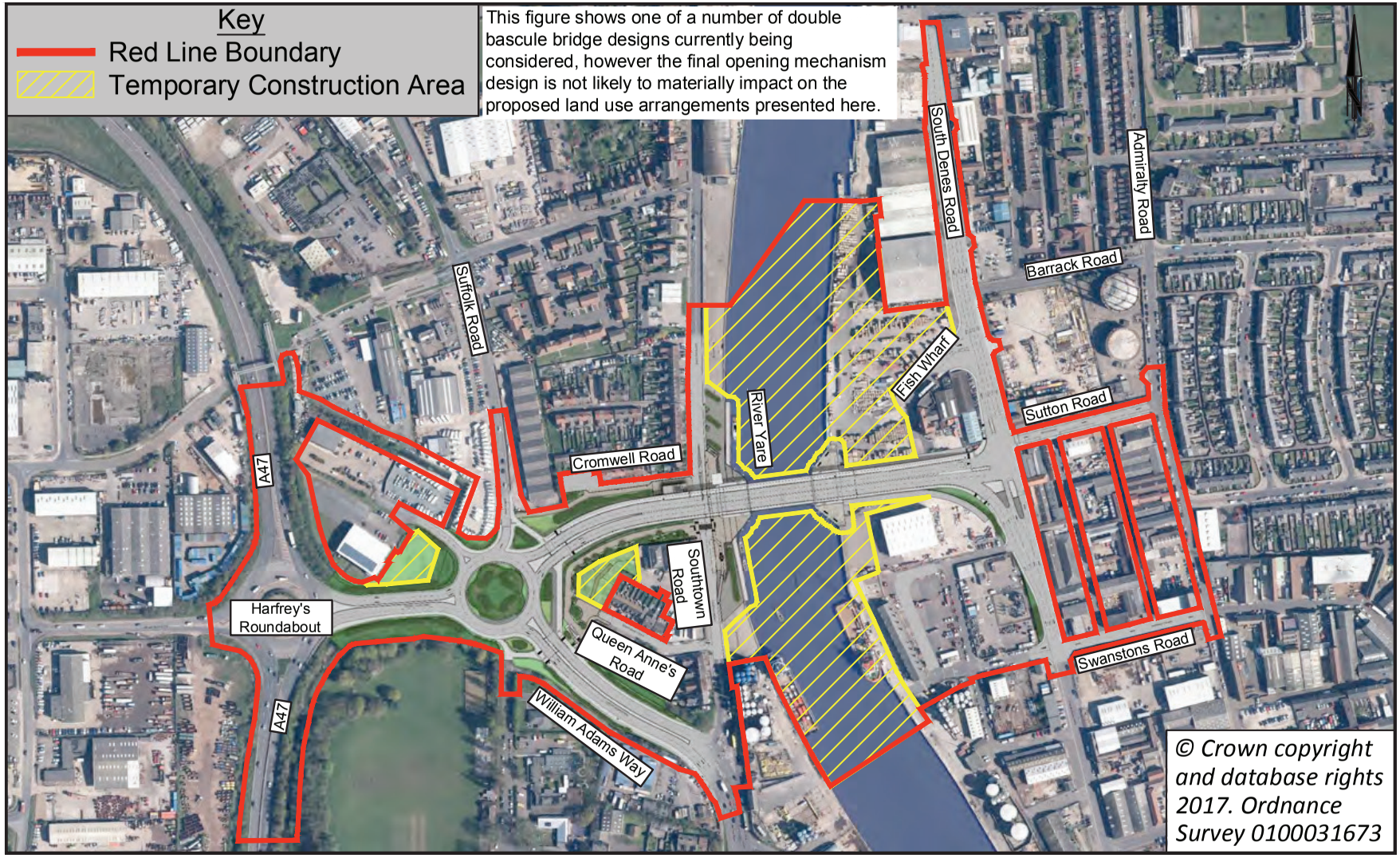
The facility would be designed to accommodate all commercial vessels greater than 30m in length that are capable of using the River Port. It would only be provided for temporary mooring while the bridge was restored to an operational condition and no port facilities would be provided at the location.

The need for this facility will be confirmed in the application for the Development Consent Order.



Land

The area of the proposed development site is shown by the red line below. This includes the area of the permanent scheme, areas required temporarily during construction and areas where works will be required to private property.

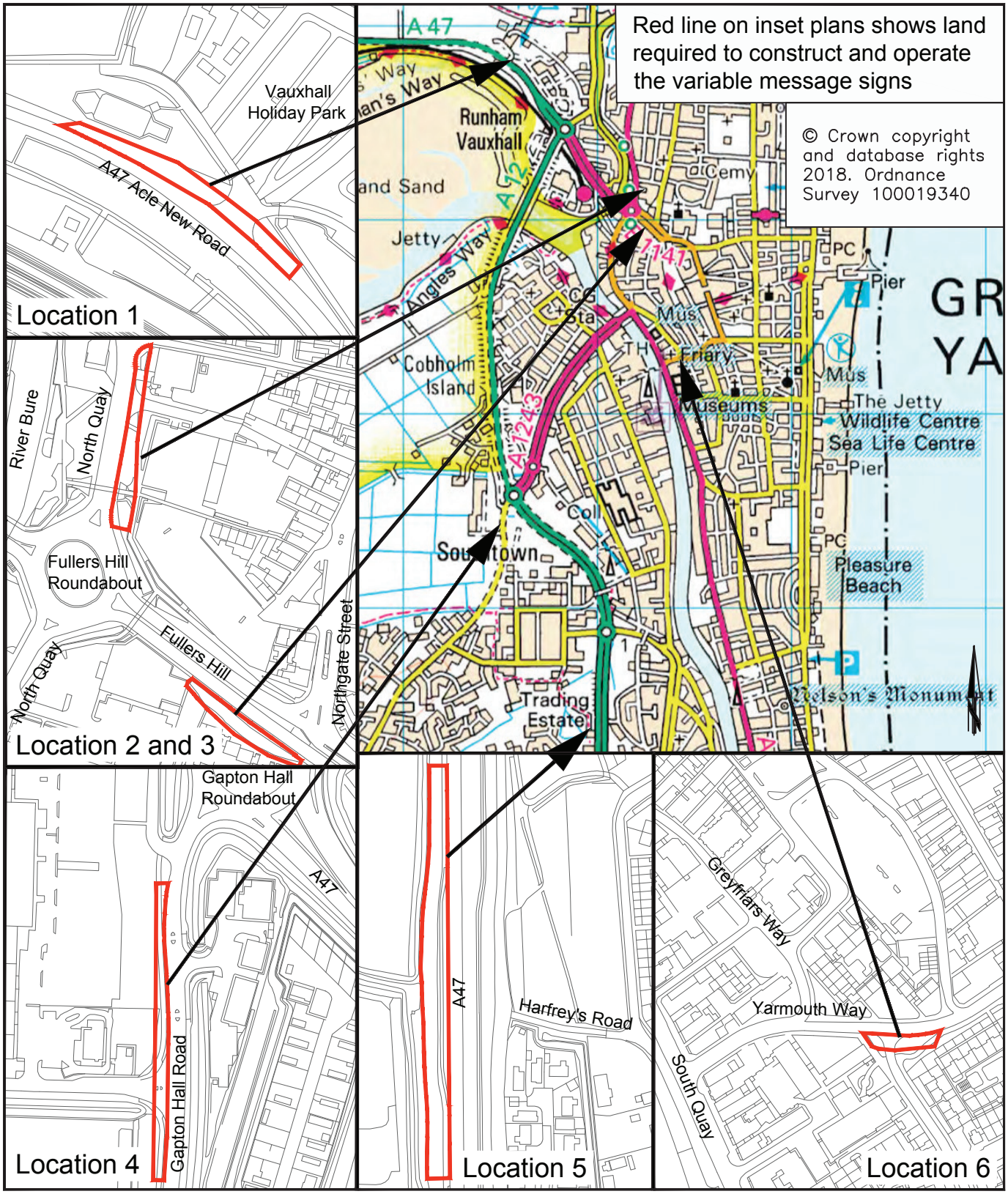


Where we do not already own or control the land, we have started negotiations with the relevant landowners. However, as part of our application for a Development Consent Order we intend to apply for powers which would allow us to acquire land and rights over land compulsorily (subject to payment of compensation) if it has not been possible to acquire by agreement.

Variable Message Signs

We are proposing to install a number of electronic variable message signs to assist the movement of traffic around Great Yarmouth in response to the status of the Third River Crossing. These will warn drivers when the proposed new bridge is closed to traffic, and will help to manage traffic on the approach to the scheme and within the town centre.

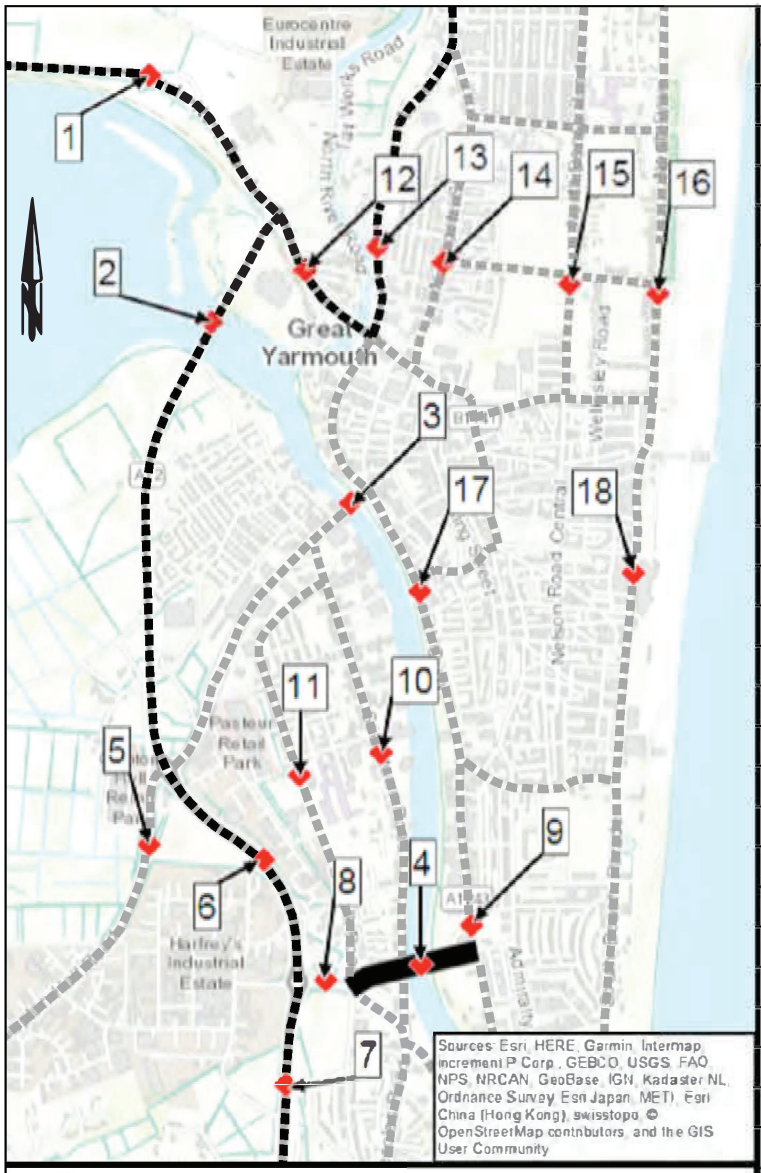
The locations of these are shown below. Each requires small areas of land to provide them.



Traffic impacts

We have used computer modelling software to assess the potential impacts of the proposed scheme on traffic flows. The model has been used to develop forecasts for traffic in the envisaged opening year of 2023 and in 2038.

The plan below shows the traffic flow forecasts obtained from the model.



Key

GY3RC Scheme Location

Count Locations

2018	2023 without GY3RC	2038 without GY3RC	2023 with GY3RC	2038 with GY3RC
Figures shown are 2 Way Average Daily Flow (24hrs)				

1 - A47 - Acle New Road				
18300	19000	21800	19200	22200
2 - A47 - Breydon Bridge				
31400	33900	39200	30600	35000
3 - A1243 - Haven Bridge				
21900	24100	30300	12100	18600
4 - Third River Crossing				
0	0	0	19400	21700
5 - Gapton Hall Road				
16900	15700	18900	13300	16300
6 - A47 - south Gapton Hall Roundabout				
35300	40200	45200	31900	36800
7 - A47 - south Harfreys Roundabout				
34800	39700	45800	41600	46300
8 - William Adams Way				
13400	14000	15400	21700	19600
9 - Southgates Road				
5000	7000	8600	13500	14800
10 - Southtown Road				
10600	10200	12200	7400	9800
11 - Suffolk Road				
3400	4100	5500	3600	4300
12 - A149 - New Acle Road				
27800	29200	35500	24500	28400
13 - A149 - Lawn Avenue				
19100	20200	22000	20000	21700
14 - Northgate Street				
7900	8500	11000	8000	10200
15 - Nelson Road North				
5200	5500	6500	5800	6800
16 - North Drive				
6600	7200	8700	7300	9200
17 - A1243 - South Quay				
14700	16300	18500	9100	11400
18 - Marine Parade				
6600	7300	8900	7800	10100

We have created a separate briefing note about our transport modelling which describes the process we have used to produce the data in this document. This is available to view on Norfolk County Council's website (www.norfolk.gov.uk/3rc), at the public consultation events and locations set out on page 18. You can also obtain a copy by emailing us at gy3rc-st3consultation@norfolk.gov.uk.

Environmental impacts

The nature and scale of the scheme is such that it requires a formal Environmental Impact Assessment. Specific consideration of the scheme's effects on sites protected by the Habitats Directive is also required. We will submit an Environmental Statement with our application for a Development Consent Order. This Environmental Statement will set out our full assessment of the environmental impacts of the Third River Crossing, including its effects on the Habitats Directive sites.

Some of the topics assessed in the forthcoming Environmental Statement will include:

- **Air quality** – will assess the changes in concentrations of vehicle emissions as a result of the scheme. The assessment will also evaluate the potential dust created during construction
- **Noise and vibration** – will assess the changes in noise and vibration as a result of vehicle movements associated with the scheme. The assessment will also evaluate noise and vibration as a result of construction activities
- **Ecology** – considers effects of the scheme on species, habitats and protected sites, including the River Yare, which forms part of the Outer Thames Estuary Special Protection Area.
- **Geology and soils** – considers the effects to the underlying geology, contaminated land and unexploded ordnance
- **Townscape and visual impact** – considers the visual impacts in the surrounding local area, which is expected to be greatest once the bridge is open
- **Cultural heritage** – considers the impacts on archaeology, monuments and historic buildings
- **Drainage and flood risk** – considers the effects to surface and ground water quality, as well as the potential for the scheme to increase flood risk
- **People and communities** – considers the effects of land take, impacts on people and businesses and also the employment opportunities and economic activity that may be created

At the time of this consultation we are still currently assessing the impacts, and this process will need to continue as the scheme proposals are refined and finalised following this consultation.

We have produced a Preliminary Environmental Information Report (PEIR) which provides information on the potential environmental effects of the scheme using information that is currently available to us. We have also produced a non-technical summary of the PEIR.

Both the PEIR and its non technical summary are available to view on Norfolk County Council's website (www.norfolk.gov.uk/3rc), at the public consultation events and locations set out on page 18. You can also get a copy by emailing us at gy3rc-st3consultation@norfolk.gov.uk.

Responding to this consultation

We would like to hear your views on our proposals for the Third River Crossing.

You can respond to this consultation by:

- Completing a questionnaire on line at www.norfolk.gov.uk/3rc
- Completing the paper questionnaire that accompanies this brochure and posting it to **Freepost Plus RTCL-XSTT-JZSK, Norfolk County Council, GY3RC, Ground floor - south wing, County Hall, Martineau Lane, Norwich NR1 2DH**
- Emailing comments to gy3rc-st3consultation@norfolk.gov.uk
- Writing to **Freepost Plus RTCL-XSTT-JZSK, Norfolk County Council, GY3RC, Ground floor - south wing, County Hall, Martineau Lane, Norwich NR1 2DH**
- You do not need to use a stamp if you are using the above Freepost address. However, if you want to help the council save money please use a stamp and send to this address: **Great Yarmouth Third River Crossing Stage 3 Consultation, Infrastructure Delivery Team, Norfolk County Council, County Hall, Martineau Lane, NR1 2DH.**

The deadline for responses to this consultation is 23:59 hrs on 5th October 2018.

If you have any queries regarding the consultation please email gy3rc-st3consultation@norfolk.gov.uk or phone 0344 800 8020. However, please could all responses to the consultation be made in writing using one of the methods outlined above.

How we will use your responses

We will record all comments received during the consultation period and the project team will carefully consider these. We will produce a consultation report that will include your comments and an explanation of how they have helped influence the scheme. This consultation report will form part of the documents we submit with our application for a Development Consent Order.

The questionnaire that accompanies this brochure does not request identifying information such as your name or email address. It asks for a postcode so that we can understand where people's responses are coming from. The information from the questionnaire will be used solely for purposes in connection with the pre-application consultations, DCO application process, assessment and determination of the application and otherwise in connection with the further development of the scheme.

Where personal details are received as part of this consultation (e.g. from email and letter responses) these will be held securely and will not be disclosed to any third parties except where the County Council is required to do so by law (e.g. where required to do so following a Freedom of Information Act request).

All data including personal data is kept securely and stored in a password protected electronic format. Paper copies of documents received will be stored in secure cabinets. Please read Norfolk County Council's privacy notice for further information as to how your data is used and your rights - www.norfolk.gov.uk/gdpr.

How to find out more

The consultation documents will be available to view at the following places between 20 August 2018 and 5 October 2018:

- Great Yarmouth Library, Tolhouse Street, Great Yarmouth, NR30 2SH
- Gorleston Library, Lowestoft Road, Gorleston-on-Sea, Great Yarmouth, NR31 6SG
- Kings Centre, 30 Queen Annes Road, Southtown, Great Yarmouth, NR31 0LE
- Great Yarmouth Town Hall, Hall Plain, Great Yarmouth, NR30 2QF
- Priory Centre, Priory Plain, Great Yarmouth, NR30 1NW
- The Archive Centre, County Hall, Martineau Lane, Norwich, NR1 2DQ

They are also available to view on Norfolk County Council's website (www.norfolk.gov.uk/3rc). The consultation documents include:

- This brochure
- Preliminary Environmental Information Report (PEIR)
- Non-technical summary of the PEIR
- Design process summary
- Frequently asked questions and answers
- Non-technical note on transport modelling

In addition consultation events, which will be staffed to allow interested parties to hold face-to-face discussions with the project team, are being held at the following venues.

Venue	Date	Time
Great Yarmouth Library, Tolhouse Street, Great Yarmouth, NR30 2SH	Saturday 25 August 2018	10am to 4:30pm
Priory Centre, Priory Plain, Great Yarmouth, NR30 1NW	Thursday 30 August 2018	10am to 9pm
Gorleston Library, Lowestoft Road, Gorleston-on-Sea, Great Yarmouth, NR31 6SG	Tuesday 4 September 2018	10am to 8pm
Kings Centre, 30 Queen Annes Road, Southtown, Great Yarmouth, NR31 0LE	Wednesday 12 September 2018	10am to 8pm

IN TRAN communication for all

If you need this report in large print, audio, Braille, alternative format or in a different language please email gy3rc-st3consultation@norfolk.gov.uk or telephone 0344 8008020 and we will do our best to help.

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Appendix G-3 – Consultation Materials: Consultation Questionnaire

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

20 August 2018 to 5 October 2018

Your views on the proposals for the Great Yarmouth Third River Crossing are important.

The content of this questionnaire is as follows:

1:	The need for the Third River Crossing scheme
2:	Our proposals for the opening section of the bridge
3:	Our proposals for the western side of the bridge
4:	Our proposals for the eastern side of the bridge
5:	Our proposals to improve public spaces
6:	Our proposals for walkers and cyclists
7:	Our proposals for electronic signs to manage traffic during bridge openings
8:	Whether the Third River Crossing scheme will improve traffic congestion and improve journey times in Great Yarmouth
9:	The impact of the Third River Crossing scheme on marine and port operations
10:	The likely environmental impact of the Third River Crossing scheme
11:	Other comments you may have
12:	Information about you

Have your say: You can feedback your views on our proposals:

Online: www.norfolk.gov.uk/3rc

By email: gy3rc-st3consultation@norfolk.gov.uk

By post: Freepost Plus RTCL-XSTT-JZSK, Norfolk County Council, GY3RC, Ground floor - south wing, County Hall, Martineau Lane, Norwich NR1 2DH

You do not need to use a stamp if you are using the above Freepost address. However, if you want to help the council save money please use a stamp and send to this address: **Great Yarmouth Third River Crossing Stage 3 Consultation, Infrastructure Delivery Team, Norfolk County Council, County Hall, Martineau Lane, Norwich NR1 2DH**

The questionnaire will be confidential and does not request identifying information such as your name or email address. All data is stored in a password protected electronic format – please read Norfolk County Council's privacy notice for further information as to how your data is used and your rights.

All comments we receive during the consultation period will be documented and carefully considered by the project team. We will produce a report that will include a summary of the key themes coming out of your feedback and explain how these have helped influence the scheme. We will submit this consultation report alongside our application for development consent.

If you have any questions about this survey please contact the project team using the contact details to the left.

The deadline for responses is 23:59 hrs on 5 October 2018.

Norfolk County Council

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

1. The consultation brochure (page 2) sets out why we think the Third River Crossing is needed. **Do you agree this scheme is needed?**

Strongly disagree ☐ Disagree ☐ Neither agree or disagree ☐ Agree ☐ Strongly agree ☐

Please tell us why you said this by writing in the box below:

2. The consultation brochure (pages 6 and 7) shows our proposals for the opening section of the bridge over the river. **Do you agree with the proposals for this?**

Strongly disagree ☐ Disagree ☐ Neither agree or disagree ☐ Agree ☐ Strongly agree ☐

Please tell us why you said this by writing in the box below:

2a. The consultation brochure (page 7) shows information on opening mechanisms for the bridge. **If you have any views on the opening mechanism please write them in the box below:**

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

3. The consultation brochure (page 8) shows our proposals for the western side of the bridge.
If you have any comments on these proposals please write them in the box below:

4. The consultation brochure (page 9) shows our proposals for the eastern side of the bridge.
If you have any comments on these proposals please write them in the box below:

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

5. The consultation brochure (page 10) shows our proposals to improve public spaces in the area of the scheme. **If you have any comments on these proposals please write them in the box below:**

6. The consultation brochure (page 11) shows our proposals for walking and cycling routes. **If you have any comments on these proposals please write them in the box below:**

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

7. The consultation brochure (page 14) shows our proposals for electronic signs to manage traffic during the opening of the bridge. **If you have any comments on these proposals please write them in the box below.**

8. One of the objectives of the Third River Crossing is to reduce traffic congestion in Great Yarmouth and improve journey times to/from the South Denes peninsula. The consultation brochure (page 15) details the results of work undertaken to date to produce traffic modelling forecasts.

Do you agree the proposed scheme will achieve this objective?

Strongly disagree ☐ Disagree ☐ Neither agree or disagree ☐ Agree ☐ Strongly agree ☐

Please tell us why you said this by writing in the box below:

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

9. One of the objectives of the Third River Crossing is to minimise the impact on marine and port operations.

Do you agree the proposed scheme will achieve this objective?

Strongly disagree ☐ Disagree ☐ Neither agree or disagree ☐ Agree ☐ Strongly agree ☐

Please tell us why you said this by writing in the box below:

10. The consultation brochure (page 16) and supporting materials explain the environmental impacts being assessed as part of the scheme during construction and during operation.
If you have any comments on these possible impacts please write them below:

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

11. If you have any other comments about the Third River Crossing proposals please write them below:

Great Yarmouth Third River Crossing

Stage 3 (Statutory pre-application) Consultation

12. Please provide some information about yourself. Completing this section is optional but it does help us understand the context of the responses.

12a. Are you answering this questionnaire predominantly as a...? **(Please select one only):**

Car driver ☐ Walker ☐ Cyclist ☐

River user (leisure) ☐ River user (commercial) ☐

Other, please write here: _____

12b. Please tick all that apply:

I live in Great Yarmouth ☐ I have a business in Great Yarmouth ☐

I work in Great Yarmouth ☐ I am a visitor to Great Yarmouth ☐

Other, please write here: _____

12c. The postcode for where I live is: _____

12d. The postcode for my business (if applicable) is: _____

We will treat your postcode with respect. We will only use it to understand where people's responses are coming from. As we don't know your name or house number we cannot use it to identify you.

This questionnaire does not request identifying information such as your name or email address. It asks for a postcode so that we can understand where people's responses are coming from. The information from the questionnaire will be used solely for purposes in connection with the pre-application consultations, DCO application process, assessment and determination of the application and otherwise in connection with the further development of the scheme.

All data, including any personal data that is provided, is kept securely and stored in a password protected electronic format. Paper copies of documents received will be stored in secure cabinets. Please read Norfolk County Council's privacy notice for further information as to how your data is used and your rights - www.norfolk.gov.uk/gdpr.

The deadline for responses is 23:59 hrs on 5 October 2018.

Appendix G-4 Part 1 – Consultation Materials: Preliminary Environmental Information Report

Norfolk County Council

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Environmental Information Report - Volume I: Written Statement

GYTRC-WSP-EGN-XX-RP-EN-0001
August 2018

Public

Norfolk County **Council**

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Environmental Information Report - Volume I: Written Statement

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70046035
OUR REF. NO. GYTRC-WSP-EGN-XX-RP-EN-0001

DATE: AUGUST 2018

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QUALITY CONTROL

Issue/revision	First issue	Revision A	Revision A.1	Revision A.2
Remarks	Draft for client review	Revision A for Issue	Update following final review by nplaw	Update to Appendix Reference
Date	28 June 2018	02 August 2018	10 August 2018	13 August 2018
Prepared by	Jonathan Davey	Jonathan Davey	Jonathan Davey	Jonathan Davey
Signature				
Checked by	Matt Whalley	Marcus Wood	Marcus Wood	Marcus Wood
Signature				
Authorised by	Matt Whalley	Marcus Wood	Marcus Wood	Marcus Wood
Signature				
Project number	70046035	70046035	70046035	70046035
Report number	GYTRC-WSP-EGN-XX-RP-EN-0001/P01	GYTRC-WSP-EGN-XX-RP-EN-0001/A	GYTRC-WSP-EGN-XX-RP-EN-0001/A.1	GYTRC-WSP-EGN-XX-RP-EN-0001/A.2
File reference	Table text\\uk.wspgroup.com\central data\Projects\62240xxx\62240375 - GYTRC\02 WIP\EI EIA and flood risk\03 Document\00 PEIR			

CONTENTS

GLOSSARY

Term	Definition
The Applicant	Norfolk County Council (in its capacity as Highway Authority as promoter of the Proposed Scheme)
Application Site	The proposed development site that falls within the red line boundary, figure 2.3.
The APFP Regulations	The Infrastructure Planning (Applications - Prescribed Forms and Procedure) Regulations (2009)
Bridge lowered	Position of the bascule bridge where it is closed to vessels and open to motor vehicles.
Bridge raised	Position of the bascule bridge where it is closed to motor vehicles and open to vessels.
Crossing	The combined double leaf bascule bridge and the Southtown Road Bridge bridge structure (i.e. from roundabout to junction)
Double leaf bascule bridge	Opening span and mechanism needed to operate the bridge
The EIA Regulations	Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
The Highways and Railways NSIP Order	The Highway and Railway (Nationally Significant Infrastructure Project) Order 2013
Large vessel waiting facility	Provision of a large vessel waiting facility, if deemed necessary following risk assessment, at a remote location south of the crossing, including any dredging, quay strengthening, fendering and mooring alterations required
NCC	Norfolk County Council (other than in its Highway Authority role as promoter of the Proposed Scheme)
New dual carriageway road	Description of road type on the crossing
NPS	National Policy Statement
NPS for Ports	National Policy Statement for Ports
NPS NN	National Policy Statement for National Networks
Opening span	Length of bridge structure that opens
The Planning Act	The Planning Act 2008, as amended
Proposed Scheme	Great Yarmouth Third River Crossing project
Proposed Scheme Boundary	The boundary of the proposed development site delineated by the red line boundary, as presented in Figure 2.3
Small vessel waiting facilities	Provision of small vessel waiting facilities to the north and south of the crossing, either as floating pontoons or additional fendering to the existing berths, including any dredging and quay strengthening works that may be required.
SoS	Secretary of State
Southtown Road Bridge	Bridge structure over Southtown Road
Study Area	The boundary/extents of a specific assessment

ACRONYMS

Acronym	Definition
AADT	Average Annual Daily Traffic
ADMS	Atmospheric Dispersion Model System
AEP	Annual Exceedance Probability
ANPR	Automatic Number Plate Recognition
AQMA	Air Quality Management Areas
ATC	Automatic Traffic Counts
BCR	Benefit to Cost Ratio
BGL	Below Ground Level
BGS	British Geological Survey
BOD	Biological Oxygen Demand
BS	British Standard
CCME	Canadian Sediment Quality Guidelines for the Protection of Aquatic Life
CDE	Construction, Demolition and Excavation
CEFAS	Centre for Environment Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute for Ecological and Environmental Management
CIRIA	Construction Industry Research and Information Association
CoPA	Control of Pollution Act 1974
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
dB	Decibel
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DO	Dissolved Oxygen
DoS	Degree of Saturation
EA	Environment Agency
EAST	Early Assessment Sifting Tool
EFT	Emission Factor Toolkit
EHOs	Environmental Health Officers
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standards
ES	Environmental Statement

Acronym	Definition
EU	European Union
FRA	Flood Risk Assessment
GHG	Greenhouse Gas
GIS	Geographic Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GP	General Practitioners
GQA	General Quality Assessment
GQA	General Quality Assessment
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GYBC	Great Yarmouth Borough Council
GYTRC	Great Yarmouth Third River Crossing
HAWRAT	Highways Agency Water Risk Assessment Tool
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicles
HLC	Historic Landscape Characterisation
HUDU	Healthy Urban Development Unit
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
ICD	Inscribed Circle Diameter
IEMA	Institute of Environmental Management and Assessment
IMD	Indices of Multiple Deprivation
IROPI	Imperative reasons of over-riding public interest
JNCC	Joint Nature Conservation Committee
LAQM	Local Air Quality Management
LOAEL	Lowest-observed-adverse-effect level
LSOAs	Lower Layer Super Output Areas
MCC	Manual Classified Count
MMP	Materials Management Plan
NAEI	National Atmospheric Emissions Inventory
NCC	Norfolk County Council
NERC	Natural Environment and Rural Communities
NHER	Norfolk Historic Environment Record
NIA	Noise Important Areas
NIR	Noise Insulation Regulations 1975
NPS	Norfolk Property Services
NPSNN	National Policy Statement for National Networks

Acronym	Definition
NPPF	National Planning Policy Framework (2018)
NOEL	No Observed Effect Level
NOx	Nitrogen Oxides
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Project
O3	Ozone
OAR	Option Assessment Report
OBC	Outline Business Case
ONS	Office of National Statistics
OS	Ordnance Survey
PAH	Polyaromatic Hydrocarbons
PCM	Pollution Climate Mapping
PEA	Preliminary Ecological Appraisal
PEIR	Preliminary Environmental Information Report
PEL	Probable Effect Levels
PHE	Public Health England
PM10	Particulate Matter to 10 microns
PM2.5	Particulate Matter to 2.5 microns
PNPS	National Policy Statement for Ports
PPG	National Planning Practice Guidance
PRA	Preliminary Risk Assessment
PRC	Practical Reserve Capacity
ProPG	Professional Planning Guidance
PRoW	Public Rights of Way
RFC	Ratio of Flow to Capacity
RSI	Road Side Interview
SAC	Special Areas of Conservation
SOAEL	Significant Observed Adverse Effect Level
SPA	Special Protection Area
SPZ	Source Protection Zones
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
tCO2e	Tonnes of Carbon Dioxide Equivalents
TEL	Threshold Effect Levels
THI	Townscape Heritage Initiative

Acronym	Definition
UK	United Kingdom
UKCP09	UK Climate Change Projections
UNFCCC	United Nations Framework Convention on Climate Change
UXO	Unexploded Ordnance
VMS	Variable Message Sign
WFD	Water Framework Directive
ZTV	Zone of Theoretical Visibility

1 INTRODUCTION

1.1 PURPOSE OF THE PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

1.1.1. WSP has been appointed by the Applicant to prepare preliminary environmental information to facilitate the Environmental Impact Assessment (EIA) of the proposed Great Yarmouth Third River Crossing project (the Proposed Scheme). This preliminary environmental information is presented within this Preliminary Environmental Information Report (PEIR).

1.1.2. This PEIR is formed of the following three volumes:

- Volume I: Written Statement (provided within this report)
- Volume II: Figures and Plans
- Volume III: Technical Appendices

1.1.3. This structure is described in further detail in Section 1.4.

1.1.4. The role of this PEIR is to provide consultees with preliminary information, sufficient to enable them to develop an informed view of the likely significant environmental effects of the Proposed Scheme in the context of the current emerging design.

1.1.5. This PEIR accompanies the Applicant's pre-application consultation and publicity under sections 42, 47 and 48 of the Planning Act 2008 ('the Planning Act')[1] which present the current design of the Proposed Scheme.

1.1.6. It is emphasised that the information presented within this PEIR is 'preliminary' and that the preferred design is evolving: it will be reviewed having regard to consultation responses, further technical analysis and other material considerations.

1.1.7. The Applicant is therefore actively seeking the comments of consultees and stakeholders, in relation to this information, through pre-application consultation. There are opportunities to provide feedback either through the website at the consultation events, via the dedicated mailbox, or by post. Further information is provided by the consultation materials and on the project website[2]. The Applicant will take all comments into consideration both in refining the design of the Proposed Scheme and the EIA.

1.1.8. The information presented within this PEIR presents the emerging preliminary assessment and conclusions on the likely significant environmental effects of the Proposed Scheme. Where there is uncertainty about the degree or nature of the impact that is anticipated, any relevant assumptions made are identified. In addition, if the uncertainty is likely to be reduced in the period between consultation and publication of the ES, relevant processes and studies that are to be undertaken have been identified.

[1] All references to legislation in this PEIR are to be taken to be references to that legislation as amended at the date of this PEIR

[2] https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-yarmouth/third-river-crossing

1.2 OVERVIEW OF THE PROPOSED SCHEME

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

1.2.2. The Proposed Scheme involves the construction, operation and maintenance of a new bascule bridge highway crossing of the River Yare in Great Yarmouth. The Proposed Scheme would include the following:

- A double leaf bascule bridge providing an opening span for vessel movement. This includes structures to support and accommodate operational requirements of the opening mechanism, including counterweights either at, above or below the bridge deck;
- New substructures to support the double leaf bascule bridge within the existing quays either side of the river and within the river itself, potentially requiring new temporary or permanent “knuckle” walls or cofferdams in the waterway to accommodate their construction;
- A new five-arm roundabout connecting the new crossing with Suffolk Road, William Adams Way and the western end of Queen Anne’s Road;
- A single span bridge over Southtown Road, with either reinforced earth embankments or embankments retained by reinforced earth walls, or a combination of these, joining that bridge to the new roundabout at William Adams Way3;
- Reinforced earth walls joining the new single span bridge over Southtown Road to the double leaf bascule bridge; and
- Either reinforced earth embankments or embankments retained by reinforced earth walls, or a combination of these, joining the new double leaf bascule bridge to South Denes Road.
- The closure of Queen Anne’s Road at its junction with Suffolk Road, and the opening of a new priority junction onto Southtown Road providing access to the Queen Anne’s Road residential area;
- Revised access arrangements for existing businesses onto the local highway network including, potentially, a new structure to allow vehicular access under the proposed crossing on the eastern bank subject to agreement with affected businesses and landowner;
- Dedicated provision for cyclists and pedestrians which ties into existing networks.
- A control tower structure located in proximity to the crossing on the western side of the river. The control tower will facilitate the 24/7 operation of the opening span of the new double leaf bascule bridge;
- The demolition of an existing pedestrian bridge on William Adams Way;
- Associated changes, modifications and/or improvements to the existing local highway network as informed by traffic modelling. This could include improvements within the existing highway boundary to some existing junctions within the red line boundary, in addition to amended parking arrangements.

[3] If a bridge with counterweights above the deck is constructed, the double-leaf bascule bridge and the single-span bridge over Southtown Road could be combined into a single, longer, structure, without separation between these two parts.

- Additional signage to assist the movement of traffic in response to network conditions and the openings / closings of the double leaf bascule bridge;
- The relocation of existing allotments to compensate for an area to be lost as a result of the Proposed Scheme; and
- New public realm, landscape, ecology and sustainable drainage improvements;

1.2.3. A detailed description of the Proposed Scheme is presented within Chapter 2 of this report.

1.3 LEGISLATIVE AND POLICY CONTEXT FOR THE SCHEME

1.3.1. In a Direction made under section 35 of the Planning Act dated 26th February 2018, the Secretary of State (SoS) confirmed that he was satisfied that the Proposed Scheme was nationally significant and directed that the Proposed Scheme, together with any matters associated with it, was to be treated as development for which development consent is required. The SoS was of the opinion that the Proposed Scheme was nationally significant for the following reasons:

- "*The Port has a nationally significant role in the renewable energy sector and the offshore gas and oil industry and the scheme will substantially improve connectivity and resilience for port activities;*
- *The scheme will support the delivery of existing and potential renewable energy [Nationally Significant Infrastructure Projects] NSIPs; and the*
- *Supports the Port's role as an International Gateway*".

1.3.2. It was also noted that, in addition, "*the scheme will improve the offer of the Port through better connectivity to the Enterprise Zone*".

1.3.3. The consequence of the Direction is that the Proposed Scheme is now subject to the consenting regime comprised in the Planning Act and associated subordinate legislation (including the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('the EIA Regulations'). The Proposed Scheme therefore cannot proceed unless the SoS decides to grant development consent by making a Development Consent Order (DCO) under section 114 of the Planning Act. The Applicant thus intends to submit an application for a DCO in Spring 2019.

PRE-APPLICATION STATUTORY CONSULTATION AND PUBLICITY

1.3.4. The Planning Act requires that applicants for NSIPs undertake consultation and publicity before making an application for a DCO. The measures required are, in summary, as follows:

- Section 42 requires consultation with prescribed consultees (e.g. Natural England, Environment Agency, Historic England), specified local authorities, and persons with specified interests in the land to which the Applicants' application for a DCO will relate;
- Section 47 requires consultation with the local community in accordance with a Statement of Community Consultation; and
- Section 48 requires publicity of the proposed application.

ENVIRONMENTAL IMPACT ASSESSMENT

1.3.5. The process and content of EIA is summarised in Regulations 5(1) and (2) of the EIA Regulations. In essence, EIA is a process through which the environmental effects of development are identified, assessed and taken into account in deciding whether the development should be consented. Central to the process is the preparation of an "environmental statement" and the carrying out of associated procedural steps including consultation,

publicity and notification.

1.3.6. Only limited categories of development require EIA. Schedules 1 and 2 of the EIA Regulations, define specified categories of development which will automatically require EIA (Schedule 1 development) and also developments (Schedule 2 development) which will require EIA if they are "*likely to have significant effects on the environment by virtue of factors such as its nature, size or location*". The Proposed Scheme does not fall within any category of Schedule 1 development, but it does constitute Schedule 2 development as it comprises the "*construction of roads (unless included in Schedule 1)*".

1.3.7. The need for an EIA is therefore dependent on whether the Proposed Scheme would be likely to have significant effects on the environment, taking into account specified matters including the selection criteria at Schedule 3 of the EIA Regulations.

1.3.8. The Applicant concluded that the Proposed Scheme had the potential for significant effects upon the environment. The Applicant therefore notified the SoS on 3rd April 2018 that it proposed to provide an Environmental Statement (ES) in relation to the Proposed Scheme. The effect of this notification is to determine for the purposes of the EIA Regulations that the Proposed Scheme is EIA Development[4] and therefore requires EIA.

1.3.9. In addition, the Applicant submitted an EIA Scoping Report[5] on 3rd April 2018, requesting a Scoping Opinion[6] for the Proposed Scheme from the SoS pursuant to EIA Regulation 10(1) as to what should be included in an ES for the Proposed Scheme. The Scoping Opinion[6] was issued on the 17th of May 2018. Both the EIA Scoping Report[5] and Scoping Opinion[6] are published on the Planning Inspectorate's website and can be accessed online at https://infrastructure.planninginspectorate.gov.uk/projects/eastern/great-yarmouth-third-river-crossing/.

1.3.10. This PEIR has been informed by the Scoping Opinion[6].

1.3.11. PEI is defined in the Regulation 12 (2) of the EIA Regulations as:

"information referred to in regulation 14(2) [which specifies the content of an ES] *which (a) has been compiled by the applicant; and (b) is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and of any associated development)*".

1.3.12. Regulation 12 (1) requires that the Statement of Community Consultation prepared pursuant to section 47 of the Planning Act must set out how the applicant intends to publicise and consult on the PEI.

NATIONAL POLICY STATEMENTS

1.3.13. National Policy Statements (NPS) are produced by the UK Government. They set out the Government's policies and objectives for the development of Nationally Strategic Infrastructure Projects (NSIPs) and are produced for different types of infrastructure development. The NPS for National Networks (NPS NN)[7] and the NPS for Ports[8] are pertinent to the Proposed Scheme. The Planning Act gives great weight to NPS: section 104 provides that where an NPS has effect in relation to development for which an DCO application has been made, the SoS must decide the application in accordance with the NPS unless specified matters apply.

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[4] See EIA Regulations 6(1),6(2)(a) and 8(1)(b)
[5] WSP (2018) Great Yarmouth Third River Crossing Environmental Impact Assessment Scoping Report. 70041951-ENV-EIA-Scoping/A. Available at https://infrastructure.planninginspectorate.gov.uk/projects/eastern/great-yarmouth-third-river-crossing/ [Verified July 2018]
[6] Planning Inspectorate (May 2018) Scoping Opinion: Great Yarmouth Third River Crossing, Case Reference TR010043. Available at https://infrastructure.planninginspectorate.gov.uk/projects/eastern/great-yarmouth-third-river-crossing/ [Verified July 2018]
[7] Department for Transport 2015. National Policy Statement for National Networks
[8] Department for Transport 2012. National Policy Statement for Ports

National Policy Statements for National Networks

1.3.14. The NPS NN was designated by the SoS for Transport in January 2015 and sets out the Government's policy for nationally significant road and rail networks, together with the information that should be provided alongside any application for Development Consent in order to satisfy their requirements.

1.3.15. The NPS NN has therefore informed the assessments provided within this PEIR and where relevant the NPS NN is referenced and appraised within the relevant chapters.

National Policy Statements for Ports

1.3.16. The NPS for Ports was designated by the SoS for Transport in January 2012 and it sets out the Government's policy for ports and associated development such as road and rail links which are included within new Port proposals.

1.3.17. The Scheme does not provide for port development however, due to its proximity, it is possible that aspects of the scheme could affect the existing port operations/facilities at Great Yarmouth i.e. vessel movements. Where aspects of the NPS for Ports for Ports are pertinent to aspects of the Proposed Scheme, assessments will be appropriately referenced.

COMMUNITIES AND LOCAL GOVERNMENT; PRE-APPLICATION GUIDANCE

1.3.18. In March 2015 the Department for Communities and Local Government (DCLG) published a statutory guidance document on the pre-application process for NSIPs[9]. Section 50(3) of the Planning Act requires the Applicant to have regard to this guidance in complying with the consultation, publicity and other pre-application requirements of the Act. The purposes of the guidance are to:

- "*advise users of the* (Planning Act) *regime on the processes involved in the pre-application stage*;
- *guide applicants as to how the pre-application requirements of the Planning Act should be fulfilled and provide some advice on best practice*;
- *inform other users of the regime, including consultees, of their roles in the pre-application process and to let them know what is expected of applicants at this stage*; *and*
- *help ensure that the regime is transparent and accessible to all".*

PLANNING INSPECTORATE ADVICE NOTES

1.3.19. The Planning Inspectorate has published a series of non-statutory Advice Notes to inform developers, consultees, the public and other interested parties about a range of procedural matters in relation to the Planning Act process. Not all of these Advice Notes are pertinent to the PEIR, although those that are relevant, and have informed the environmental assessment process for the Proposed Scheme, are discussed further below.

Advice Note Seven[10]

1.3.20. This Advice Note details the procedural requirements that apply to NSIPs which are EIA development and provides clarity on the role and purpose of PEIR.

[9] Ministry of Housing, Communities and Local Government March 2015. Planning Act 2008: guidance on the pre application process for minor infrastructure projects. Available here. Last Accessed June 2018.
[10] The Planning Inspectorate, Advice Note 7: Preliminary Environmental Information, Screening and Scoping V6. December 2017.

1.3.21. Advice Note Seven recognises that the degree of information that is available within a PEIR is dependent upon the stage in the design process at which consultation takes place. Within this PEIR, the Applicant has therefore presented information on the likely significant effects associated with the development of the Proposed Scheme, and where further studies and assessments remain, these have been clearly indicated.

Advice Note Nine[11]

1.3.22. This Advice Note provides guidance on the use of the 'Rochdale Envelope'; a term used to describe those elements of a scheme that have not yet been finalised but yet can be constrained within certain limits and parameters hence allowing a determination of likely significant effects to be presented in the ES.

1.3.23. When using the Rochdale Envelope to apply for flexibility within a DCO application, the Advice Note advises that the developer should use a worst case approach to identifying likely significant effects and should incorporate mitigation accordingly within the parameters of their scheme. Greater information is included within Chapter 6 of this PEIR on how the Applicant intends to make use of the Rochdale Envelope in the consenting process for the Proposed Scheme

Advice Note Seventeen[12]

1.3.24. This Advice Note sets out the recommended approach to Cumulative Effects Assessment (CEA) for NSIP projects, including guidance on the relative weight to be applied to other developments depending upon how progressed they are through the consenting process.

1.3.25. Greater information on the CEA is included within Chapter 20.

Advice Note Eighteen[13]

1.3.26. Advice Note Eighteen is a recently published guidance document on the approach to coordinating the requirements of the Water Framework Directive (WFD) with the EIA process.

1.4 SCOPE OF ASSESSMENT

1.4.1. As stated above, PEI is defined by Regulation 12 (2) of the EIA Regulations as: such information "referred to in regulation 14(2)" as is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the Proposed Project. Regulation 14(2), together with Schedule 4, defines and specifies, in detail, the required content of an ES. It follows that although PEI is not required to be a draft or preliminary ES, it is appropriate for it to have an equivalent scope to the extent necessary and appropriate in the context of the current state of resolution of the Proposed Scheme and the required objective of enabling the consultation bodies to develop an informed view.

1.4.2. Table 1.1 provides a breakdown of the information specified in Schedule 4 and where this information will be located in this PEIR.

Table 1.1 – Location of Required Information within the PEIR

	Required Information	Location within this PEIR
1	Description of the development, including in particular:	

[11] The Planning Inspectorate. Advice Note 9. Rochdale Envelope. July 2018
[12] The Planning Inspectorate. Advice Note 17. Cumulative Effects Assessment. December 2015
[13] The Planning Inspectorate. Advice Note 18. The Water Framework Directive. June 2017

	Required Information	Location within this PEIR
	(a) a description of the location of the development	Chapter 2: Description of the Site and the Surrounding Area
	(b) a description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases	Chapter 2: Description of the Proposed Scheme.
	(c) a description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used	Chapter 2: Description of the Proposed Scheme
	(d) an estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced during the construction and operation phases.	Chapter 5: Approach to EIA and Technical Chapters 6 – 17
2	A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Chapter 3: Consideration of Alternatives.
3	A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge	Chapter 5: Approach to EIA and Technical Chapters 6 – 17
4	A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.	Technical Chapters 6 – 17
5	A description of the likely significant effects of the development on the environment resulting from, inter alia	
	the construction and existence of the development, including, where relevant, demolition works;	Technical Chapters 6 – 17
	the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources;	Technical Chapters 8, 11, 15, 16
	the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;	Technical Chapters 6, 7, 10, 11, 13, 16
	the risks to human health, cultural heritage or the environment (for example due to accidents or disasters);	Technical Chapters 6 - 17
	the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;	Chapter 16: Cumulative Effects

	Required Information	Location within this PEIR
	the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;	Chapter 15: Climate Change
	the technologies and the substances used.	Technical Chapters 6 – 17
6	A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.	Technical Chapters 6 – 17
7	A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.	Technical Chapters 6 – 17
8	A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU(3) of the European Parliament and of the Council or Council Directive 2009/71/Euratom(4) or UK environmental assessments may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.	Chapter 2: Description of the Proposed Scheme. Technical Chapters 6 – 17
9	A non-technical summary of the information provided under paragraphs 1 to 8	Non-Technical Summary
10	A reference list detailing the sources used for the descriptions and assessments included in the environmental statement.	All chapters

1.4.3. The scope of the ES will be informed by the Scoping Opinion and supporting Scoping responses[6]. Technical chapters within this PEIR incorporate the comments of the Planning Inspectorate on behalf of the SoS in the Scoping Opinion[6]. These chapters should be read together with the introductory chapters of this PEIR (Chapters 1-5, as well as Chapter 18, Assessment of Cumulative Effects).

1.4.4. In order to satisfy the requirements of the EIA Regulations, the emerging EIA will assess (i) Risks of Major Accidents and/or Disasters; (ii) Transboundary Effects; (iii) Residues and Emissions. With the exception of transboundary effects, these assessments have not been progressed as part of the PEIR, due to the availability of design information at this preliminary stage of the Proposed Scheme. These assessments will be progressed as design information becomes available and will be presented within the ES.

Risks of Major Accidents and/or Disasters

1.4.5. The ES will include a description and assessment (where relevant) of the likely significant effects resulting from accidents and disasters applicable to the Proposed Scheme. The assessment will aim to:

(i) evaluate the likelihood of an occurrence and the Proposed Scheme's susceptibility to potential major accidents and hazards;

(ii) consider the vulnerability of the Proposed Scheme to a potential accident or disaster; and

(iii) consider Proposed Scheme's potential to cause an accident or disaster.

1.4.6. The assessment will specifically assess significant effects resulting from the risks to human health, cultural heritage or the environment. Any measures that will be employed to prevent and control significant effects will be presented in the ES.

1.4.7. Where appropriate, the assessment will identify measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.

Transboundary Effects

1.4.8. On the 28 June 2018, transboundary screening was undertaken by the Planning Inspectorate on behalf of the SoS for the purposes of Regulation 32 of EIA Regulations. This is presented in Appendix 1A.

1.4.9. This screening exercise considered the information presented within the EIA Scoping Report[5] and gave regard to the location of the Proposed Scheme, its characteristics, and the environmental importance of the receiving environment.

1.4.10. As part of the screening exercise the Planning Inspectorate identified and considered the Proposed Scheme's likely impact of the proposed scheme, including consideration of potential pathways and the extent, magnitude, probability, duration, frequency and reversibility of the effects. Their screening concluded that the Proposed Scheme is unlikely to have a significant effect either alone or cumulatively on the environment in another European Economic Area State.

1.4.11. The Inspectorate considers that the likelihood of transboundary effects resulting from the Proposed Schemes so low that it does not warrant completion of a formal transboundary screening matrix. It is noted that 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.

Residues and Emissions

1.4.12. In accordance with the requirements of the EIA Regulations, the ES will specify the residues and emissions that arise as a result of the Proposed Scheme. This will include an estimate, by type and quantity, of expected residues and emissions. In providing this information, ES will specifically reference aspect chapters relating to water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities, and types of waste produced during the construction and operation phases, where relevant. These assessments have yet to be progressed, due to the availability of design information at this preliminary stage of the Proposed Scheme . Information about residues and emissions will become available as the above aspect chapters are progress. This information will be presented in within the ES.

Effects upon Maritime Activities

1.4.13. The scope of the EIA includes assessments of the potential impact of the Proposed Scheme upon maritime activities. Table 1.2 provides a list of the assessments to be undertaken where this information will be presented within ES.

Table 1.2 – Assessments of Maritime Effects

Assessment	Location within the ES
Impacts of lighting: A stand-alone lighting assessment will be produced to support the DCO application. This report will be used to assess the impacts of the proposed artificial lighting, including light spill onto the navigation channel.	Chapter 10: Townscape and Visual impacts
Hydromorphological assessment: A hydromorphological assessment will be undertaken which will include sediment transport modelling of the Proposed Scheme to understand the impact of the presence of the bridge infrastructure on the hydromorphology of the River Yare. It will discuss the potential effects on river bed scour/erosion and sediment deposition patterns.	Chapter 11: Water Environment.
Generation of employment opportunities: Once operational, it is anticipated the Proposed Scheme is anticipated to lead to an increase in economic activity due to the greater connectivity afforded. An assessment of employment opportunities will be undertaken and will consider the potential effects on enhanced access for local businesses, the port and industrial estates.	Chapter 14: People and Communities
Land-take, severance and disruption to marine businesses and associated activities: For the assessment of effects on marine commercial businesses and activities, this will focus on land-take, severance and disruption to operations within the River Yare and Port operations. Vessel Simulation Modelling will be undertaken that allows a virtual navigation of a vessel through the River Yare to test how the Proposed Scheme interacts with Port operations, albeit this has not been progressed at this stage of the Proposed Scheme. In addition, a Navigational Risk Assessment will also be prepared and used to inform the ES	Chapter 14: People and Communities

Other Supporting DCO Deliverables

1.4.14. In addition to the above, the ES and DCO application will also be supported by the following documents, which will be presented either as standalone reports, or as an appendix to the final ES:

- Environmental Statement (Non-Technical Summary);
- Natural Environmental Constraints Plan;
- Water Bodies in a 'River Basin Management Plan' Plan;
- Assessment of Nature Conservation;
- Arboricultural Assessment;
- Habitats Regulations Assessment;
- Heritage Environmental Constraints Plan;
- Assessment of Historic Environment;
- Archaeological Written Scheme of Investigation;
- Statutory Nuisance Statement;
- Flood Risk Assessment;
- Navigational Risk Assessment;
- Lighting Assessment;
- Equalities Impact Assessment;

- Mitigation Schedule / Mitigation Commitments Register;
- Outline Code of Construction Practice;
- Framework Construction Environmental Management Plan (CEMP);

1.5 THE STRUCTURE OF THE PEIR

1.5.1. As previously stated, this PEIR is formed of three volumes. This report presents Volume I the Written Statement, the contents of which is presented at the start of the report.

1.5.2. The Written Statement is supported by Volume II: Plans and Figures. The majority of Figures are presented within Volume II, although there are some which have been included within the written text where appropriate. Table 1.3 - Summary of Figures presented a summary of the figures provided in support of the PEIR, the chapter that they relate to and their location.

1.5.3. The Written Statement is also supported by Technical Appendices, which are presents as Volume III. Table 1.4 - Volume III: Technical Appendices presents a summary of the Technical Appendices provided.

Table 1.3 - Summary of Figures

Figure	Figure Title	Location
Chapter 1: Introduction		
No figures included		
Chapter 2: Proposed Scheme		
Figure 2.1	Location of the Proposed Scheme	Volume II
Figure 2.2	Strategic Location for the Proposed Scheme	Volume I (embedded in text)
Figure 2.3	Red Line boundary for the Proposed Scheme	Volume II
Figure 2.4	Proposed Scheme draft highway arrangement	Volume II
Figure 2.5	Proposed Scheme draft land use arrangement	Volume II
Figure 2.6	Bascule Bridge Option 1 - Simple Trunnion Conceptual General Arrangement	Volume II
Figure 2.7	Bascule Bridge Option 2 - Balance Beam Trunnion Conceptual General Arrangement	Volume II
Figure 2.8	Southtown Road Bridge Conceptual General Arrangement	Volume II
Figure 2.9	Proposed Drainage Strategy	Volume II
Chapter 3: Assessment of Alternatives		
Figure 3.1	Extract from 2007 Scheme Assessment Report showing the broad study area and proposed bridge and tunnel corridors	Volume I (embedded in text)
Chapter 4: Consultation		
No figures included		
Chapter 5: Assessment Approach		
No Figures included		
Chapter 6: Air Quality		

Figure	Figure Title	Location
Figure 6.1	Construction Phase Assessment Study Area	Volume II
Figure 6.2	Operational Phase Assessment Study Area	Volume II
Figure 6.3	Passive NO2 Monitoring Sites	Volume II
Chapter 7: Acoustic		
Figure 7.1	Provisional Operational Noise Study Area	Volume II
Figure 7.2	Baseline Noise Survey Monitoring Locations	Volume II
Chapter 8: Nature Conservation		
Figure 8.1	Main Study Area	Volume II
Figure 8.2	Extended Study Area	Volume II
Figure 8.3	Bat Survey Area	Volume II
Figure 8.4	Water Vole Survey Area	Volume II
Figure 8.5	Bird Survey Area	Volume II
Figure 8.6	Statutory Designated Sites	Volume II
Chapter 9: Cultural Heritage		
Figure 9.1	Designated Heritage Assets	Volume II
Figure 9.2	Non Designated Heritage Assets	Volume II
Figure 9.3	Heritage Assets at VMS Locations	Volume II
Chapter 10: Townscape and Visual Impacts		
Figure 10.1	Photographic Viewpoints	Volume II
Figure 10.2	Photographic viewpoints	Volume II
Figure 10.3	Study Area	Volume II
Chapter 11: Road Drainage and the Water Environment		
Figure 11.1	Study Area for the Water Environment	Volume II
Chapter 12: Flood Risk		
Figure 12.1	Flood Risk Study Area	Volume II
Figure 12.1	EA Flood Map for Planning	Volume II
Chapter 13: Climate Change		
No figures included		
Chapter 14: People and Communities		
No figures included		
Chapter 15: Materials		
Figure 15.1	Waste Hierarchy	Volume I (embedded in text)

Figure	Figure Title	Location
Figure 15.2	Transfer, material recovery and metal recycling in the East of England	Volume I (embedded in text)
Figure 15.3	East of England Remaining Landfill Capacity (2000/1-2016)	Volume I (embedded in text)
Chapter 16: Geology and Soils		
No figures included		
Chapter 17: Traffic and Transport		
Figure 17.1	Study Area	Volume II
Figure 17.2	Community facilities and cycle routes plan	Volume II
Chapter 18: Cumulative Effects		
No figures included		
Chapter 19: Schedule of Environmental Commitments		
No figures included		
Chapter 20: References and Glossary		
No figures included		

Table 1.4 - Volume III: Technical Appendices

Appendix	Appendix Title
Chapter 1: Introduction	
Appendix 1A	Regulation 32 Transboundary Screening
Chapter 2: Proposed Scheme	
No Appendix included	
Chapter 3: Assessment of Alternatives	
No Appendix included	
Chapter 4: Consultation	
Appendix 4A	Informal Consultation Responses
Chapter 5: Assessment Approach	
No Appendix included	
Chapter 6: Air Quality	
Appendix 6A	Construction Phase Assessment Methodology
Appendix 6B	Wind Rose
Chapter 7: Acoustic	
Appendix 7A	Acoustic Terminology
Chapter 8: Nature Conservation	
Appendix 8A	Preliminary Ecological Appraisal
Appendix 8B	Protected Species Survey Report

Appendix	Appendix Title
Chapter 9: Cultural Heritage	
Appendix 9A	Cultural Heritage Asset Gazetteer
Appendix 9B	Cultural Heritage Desk Study
Appendix 9C	Geo-Archaeological Feasibility Study
Chapter 10: Townscape and Visual Impacts	
No Appendix included	
Chapter 11: Road Drainage and the Water Environment	
Appendix 11A	Impact Assessment Criteria for Surface Water & Groundwater
Appendix 11B	Impact Assessment for Surface Water
Chapter 12: Flood Risk	
Appendix 12A	Hydraulic Assessment Technical Note
Chapter 13: Climate Change	
No Appendix Included	
Chapter 14: People and Communities	
Appendix 14A	Community facilities within 2km of the Application Site
Appendix 14B	Open / recreational spaces within 2km of the Application Site
Chapter 15: Materials	
No Appendix included	
Chapter 16: Geology and Soils	
Appendix 16A	Contaminated Land Desk Study Report
Chapter 17: Traffic and Transport	
Appendix 17A	Preliminary Transport Assessment
Chapter 18: Cumulative Effects	
No Appendix included	
Chapter 20: References and Glossary	
No Appendix included	

2

PROPOSED SCHEME

2 PROPOSED SCHEME

2.1 INTRODUCTION

2.1.1. This Chapter presents the current description of the Great Yarmouth Third River Crossing (hereafter referred to as "the Proposed Scheme") at the consultation stage. Any other descriptions presented within this PEIR document represent a summary of, or are subsidiary to, this chapter. This Chapter is supported by Figures 2.1 – 2.7.

a. Figure 2.1 shows the location of the Proposed Scheme

b. Figure 2.2 shows the strategic location of the Proposed Scheme;

c. Figure 2.3 shows the red line boundary for the Proposed Scheme (including land required permanently, temporarily for construction, and over which rights are sought for maintenance);

d. Figure 2.4 presents the Proposed Scheme draft highway arrangement, as currently envisaged;

e. Figure 2.5 presents the Proposed Scheme draft land use arrangement, as currently envisaged;

f. Draft cross sections of the carriageway, and plan and elevation of the proposed illustrative double-leaf bascule bridge concepts, as currently envisaged (see paragraphs 2.3.10 – 2.3.13), are presented in Figures 2.6 – 2.7 respectively;

g. Figure 2.8 presents the Concept General Arrangement for the Southtown Road Bridge;

h. The proposed draft drainage strategy, as currently envisaged, is presented in Figure 2.9;

2.2 PROPOSED SCHEME LOCATION AND NEED FOR THE PROPOSED SCHEME

2.2.1. Figure 2.1, shows the location of the Proposed Scheme. Great Yarmouth is located at the mouth of the River Yare, one of the main waterways providing access to the Norfolk Broads. The river bisects Great Yarmouth, with the town centre, seafront, industrial areas and outer harbour located on the narrow 4km long, South Denes peninsula between the river and the sea, isolated from the rest of the town. To the south of the River Yare, Gorleston-on-Sea is just a few hundred metres away as the crow flies, but over 7km distance by road.

2.2.2. Figure 2.2 shows the strategic location of the Proposed Scheme. The approximate position of the Proposed Scheme is marked in blue.

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

2.2.4. The national significance and need for the Proposed Scheme derives from the considerable improvement in connectivity and resilience it will deliver to the Great Yarmouth Port ("the Port"), which itself has a nationally significant role in the renewable energy sector and the offshore gas and oil industry. The Proposed Scheme objectives are as follows:

- To support Great Yarmouth as a centre for both offshore renewable energy and the offshore oil and gas industry, enabling the delivery of renewable energy NSIPs and enhancing the port's role as an international gateway;

- To improve access and strategic connectivity between Great Yarmouth port and the national road network thereby supporting and promoting economic and employment growth (particularly in the Enterprise Zone);
- To support the regeneration of Great Yarmouth, including the town centre and seafront, helping the visitor and retail economy;
- To improve regional and local access by enhancing the resilience of the local road network, reducing congestion and improving journey time reliability;
- To improve safety and to reduce road casualties and accidents, in part by reducing heavy traffic from unsuitable routes within the town centre;
- To improve access to and from the Great Yarmouth peninsula for pedestrians, cyclists and buses, encouraging more sustainable modes of transport and also reducing community severance; and
- To protect and enhance the environment by reducing emissions of greenhouse gases and minimising the environmental impact of the Proposed Scheme.

2.2.5. The Department for Transport's (DfT) recently published study Transport Infrastructure for our Global Future: A Study of England's Ports Connectivity[14] ("the DfT Study") states that "at present around 95% of all goods entering and leaving the UK are moved by sea and the UK port sector directly contributes £1.7billion to the UK economy". The DfT Study also notes that "if our ports are to continue to thrive then the national, regional and local infrastructure supporting them has to be effective and efficient". The DfT Study further recognises that renewable energy sectors are closely linked to the port industry and that "port access will be an issue for their supply chains and their employees".

2.2.6. Great Yarmouth's proximity to the Strategic Road Network (SRN) plays an important role in relation to the Port, and the Proposed Scheme is identified in the DfT Study as a Port Connectivity Project. The Autumn Budget 2017[15] pledged a contribution of £98 million towards the Proposed Scheme's £120 million programme budget.

2.2.7. The Port, South Denes Business Park, Enterprise Zone and Great Yarmouth Energy Park are located towards the southern end of the peninsula. Supporting this area is a key objective of both the New Anglia Strategic Economic Plan (SEP) (2014)[16] and Great Yarmouth Local Plan Adopted Core Strategy 2013-2030[17] . Furthermore, the relationship between the provision of essential infrastructure and economic growth is well documented; most notably in the NPS NN[18] , the Department for Business, Energy & Industrial Strategy's White Paper Industrial Strategy: Building a Britain fit for the Future (2017)[19] and in the DfT Study.

[14] Department for Transport (April 2018), Transport Infrastructure for our Global Future, A Study of England's Port Connectivity https://www.gov.uk/government/publications/transport-connectivity-to-ports-review-of-the-current-status-and-future-infrastructure-recommendations

[15] https://www.gov.uk/government/publications/autumn-budget-2017-documents

[16] New Anglia new Enterprise Partnership for Norfolk and Suffolk (2014) New-Anglia-Strategic-Economic-Plan. https://newanglia.co.uk/wp-content/uploads/2017/10/New-Anglia-Strategic-Economic-Plan.pdf

[17] Great Yarmouth Borough Council (2015) Great Yarmouth Local Plan: Adopted Core Strategy 2013-2030 https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1884&p=0

[18] Department for Transport (2104) National Policy Statement for National Networks https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

[19] Department for Business, Energy & Industrial Strategy (2017) Industrial Strategy: Building a Britain Fit for the Future https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

2.2.8. The Department of Transport's publication Action for Roads[20] (2013) identifies capacity issues on the A47 past Great Yarmouth to Lowestoft and predicts that congestion will be severe on that entire section of the road by 2040 (also pointed in Appendix A of the NPS NN).

2.2.9. This evidence further confirms the need for a third crossing, as under the current situation the only access from the SRN to the Port and employment areas is via the Haven Bridge or Breydon Bridge located at the northern end of the peninsula. Neither bridges are considered suitable to accommodate the Port's on-going use and projected growth.

2.2.10. The mix of Port-related and local traffic congestion, particularly on the Haven Bridge, is attributed to delays and unreliable end to end journey times; ultimately Great Yarmouth has become to be perceived as remote, potentially discouraging inward investment. Alternative transport modes such as bus users, cyclists and pedestrians often have long, indirect journeys, discouraging sustainable commuting.

2.2.11. In the Outline Business Case[21] , the Proposed Scheme was demonstrated by an adjusted Benefit Cost Ratio (BCR) of 3.5 , meaning the proposal shows high value for money.

2.2.12. By creating a more efficient connection, the Proposed Scheme will address the congestion and severance within Great Yarmouth, accommodate future growth and improve strategic connectivity between the town, the Port and the Strategic Road Network, which in turn will facilitate the establishment of the Port as a centre for offshore oil and gas industries and its role as an International gateway. Without a new crossing the full potential for growth in the Enterprise Zone and Port may not be fully realised.

[20] Department for Transport (July 2013), Action for Roads, A Network for the 21st Century https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/212590/action-for-roads.pdf

[21] Mouchel (2017) Great Yarmouth Third River Crossing: Outline Business Case

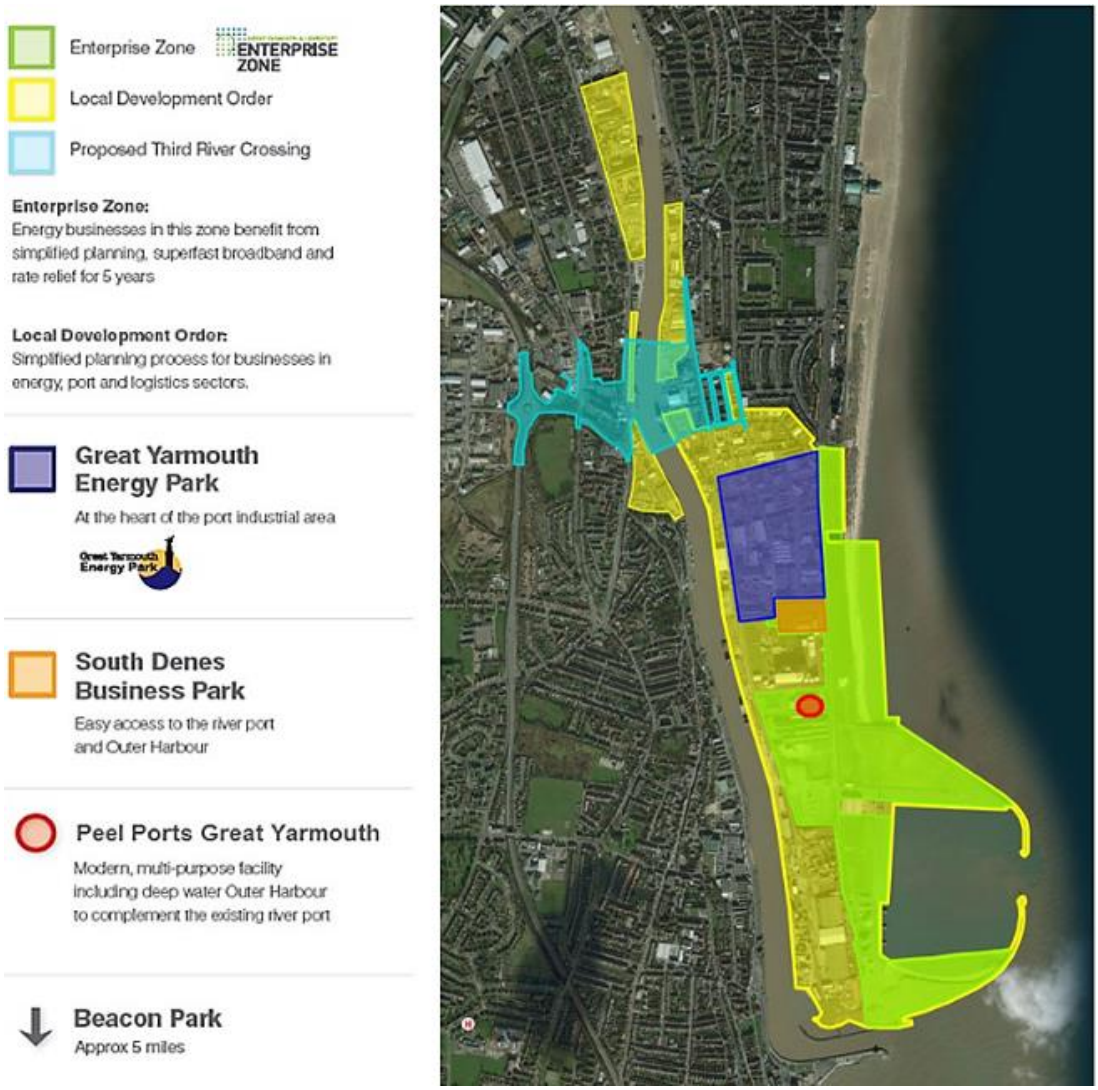


Figure 2.2: Strategic Location of the Proposed Scheme

2.3 MAIN DESIGN CONSIDERATIONS

THE PROPOSED SCHEME

2.3.1. The Proposed Scheme involves the construction, operation and maintenance of the new crossing of the River Yare in Great Yarmouth. The Proposed Scheme consists of a new dual carriageway road across the river, linking the A47 at Harfrey's Roundabout on the western side to the A1243 South Denes Road on the eastern side. The Proposed Scheme will feature an opening span double leaf bascule bridge across the river, which may involve the construction of two new 'knuckles' that extend the quay wall into the river. The Proposed Scheme will also have a clear span over Southtown Road on the western side of the river as it rises to the crest of the new crossing."

2.3.2. If constructed, the Proposed Scheme is currently envisaged to include a new dual carriageway road, crossing the River Yare in an east-west orientation, comprising of:

- A double leaf bascule bridge providing an opening span for vessel movement. This includes structures to support and accommodate operational requirements of the opening mechanism, including counterweights either at, above or below the bridge deck;
- New substructures to support the double leaf bascule bridge within the existing quays either side of the river and within the river itself, potentially requiring new temporary or permanent "knuckle" walls or cofferdams in the waterway to accommodate their construction;
- A new five-arm roundabout connecting the new crossing with Suffolk Road, William Adams Way and the western end of Queen Anne's Road;
- A single span bridge over Southtown Road, with either reinforced earth embankments or embankments retained by reinforced earth walls, or a combination of these, joining that bridge to the new roundabout at William Adams Way22;
- Reinforced earth walls joining the new single span bridge over Southtown Road to the double leaf bascule bridge; and
- Either reinforced earth embankments or embankments retained by reinforced earth walls, or a combination of these, joining the new double leaf bascule bridge to South Denes Road.
- The closure of Queen Anne's Road at its junction with Suffolk Road, and the opening of a new priority junction onto Southtown Road providing access to the Queen Anne's Road residential area;
- Revised access arrangements for existing businesses onto the local highway network including, potentially, a new structure to allow vehicular access under the proposed crossing on the eastern bank subject to agreement with affected businesses and landowner;
- Dedicated provision for cyclists and pedestrians which ties into existing networks;
- A control tower structure located in proximity to the crossing on the western side of the river. The control tower will facilitate the 24/7 operation of the opening span of the new double leaf bascule bridge;
- The demolition of an existing pedestrian bridge on William Adams Way;

[22] If a bridge with counterweights above the deck is constructed, the double-leaf bascule bridge and the single-span bridge over Southtown Road could be combined into a single, longer, structure, without separation between these two parts.

- Associated changes, modifications and/or improvements to the existing local highway network as informed by traffic modelling. This could include improvements within the existing highway boundary to some existing junctions within the red line boundary, in addition to amended parking arrangements.
- Additional signage to assist the movement of traffic in response to network conditions and the openings / closings of the double leaf bascule bridge;
- The relocation of existing allotments to compensate for an area to be lost as a result of the Proposed Scheme; and
- New public realm, landscape, ecology and sustainable drainage improvements;

2.3.3. Works to facilitate the construction, operation and maintenance of the above elements including:

- Creation of temporary construction sites and accesses from the public highway;
- Provision of new utilities and services and the diversion of existing utilities;
- Provision of drainage infrastructure, lighting and landscaping;
- Demolition of a number of existing residential and commercial / business properties;
- Provision of small vessel waiting facilities to the north and south of the crossing, either as floating pontoons or additional fendering to the existing berths, including any dredging and quay strengthening works that may be required;
- Provision of a large vessel waiting facility, if deemed necessary following risk assessment, at a remote location south of the crossing, including any dredging, quay strengthening, fendering and mooring alterations required; and
- Such ancillary, incidental and consequential changes and/or improvements as are required and permitted.

LIMITS OF DEVIATION

2.3.4. As discussed in Chapter 1, the 'Rochdale Envelope' provides for robust environmental assessment of Nationally Significant Infrastructure projects (NSIPs) with 'limits of deviation' for the design parameters of the Proposed Scheme.

2.3.5. The preliminary limits of deviation assessed in this PEIR are set out in Table 2.1. The identification and extent of the preliminary limits of deviation are subject to ongoing design and review, and will be confirmed in the Environmental Statement submission.

Table 2.1: Preliminary Limits of Deviation

Item	Parameters
Cofferdams (steel piled)	Two steel piled cofferdams, one along each quay, may be required and have been assessed. This will enable construction of bascule chambers (in the case of a structure with counterweights at or below deck level) or of piers within the river (in the case of a structure with counterweights above deck level) and will form the protective knuckles (if required) in the permanent condition.
Control tower	A maximum height of 20 metres (m) Above Ordnance Datum (AOD).
Western roundabout Diameter (ICD)	The western roundabout has an ICD of 70m and a tolerance of +5m and -5m

Item	Parameters
Road gradient	A maximum of 5%.
Finished road level tolerance	The finished road level has a tolerance of +500 millimetres (mm) and -500 mm from that presented on Figures 2.6 and 2.7.
Finished Proposed Scheme tolerance	Within the Red Line Boundary.
Double leaf bascule bridge clearance over water	A minimum of 4.5m clearance above Mean High Water Spring Level (MHWSL) to the underside of the double leaf bascule bridge when lowered. Unlimited headroom (air draught) to be provided when the bascule bridge is raised.
Navigable channel width	A minimum navigable channel width of 50m.
Double leaf bascule bridge deck	A maximum height of 9.24m above MHWSL (including +500 and -500mm tolerance on road level).
Double leaf bascule bridge road lighting columns	A maximum setback of 7.70m from the edge of carriageway when located within the defined working design envelope of the bridge structure.
Southtown Road bridge	Minimum clearance of **5.3m** above existing road level for traffic in accordance with the Design Manual for Roads and Bridges (DMRB)

DESIGN STANDARDS AND CROSS SECTIONS

2.3.6. The new crossing will be designed using the Design Manual for Roads and Bridges (DMRB) which has informed the proposed limits of deviation in Table 2.1, and is currently being designed to have a:

- Design speed of 30mph (50kph);
- Carriageway width of 15.4m (2 x 3.65m wide traffic lanes in each direction, with a 0.8m hatched median); and
- A provisional 4.5m width segregated footway and cycleway to the north, and a minimum 2.0m footway to the south.

2.3.7. The minimum carriageway cross-sections to be provided are further detailed in Table 2.2: Minimum Carriageway Widths below:

Table 2.2: Minimum Carriageway Widths

Road Name	Carriageway Width	Central Reserve Width	Footway Width	Segregated Footway Cycle Way Width
Proposed Link over River Yare	15.4m minimum inclusive of central reserve	0.8m minimum width. A minimum width of 3.0m to be provided at crossing points	2.0m minimum on the southern side of road	4.5m minimum comprising a 3m cycleway and a 1.5m footway on the northern side of the road
Proposed Link between Harfrey's Roundabout and Proposed Roundabout	16.4m minimum inclusive of central reserve	1.8m minimum and widened as necessary for splitter islands	N/A	3.0m minimum shared footway / cycleway from the tie-in of Adam's Way at Harfrey's Roundabout to the proposed toucan crossing on the realigned William Adam's Way
Link from proposed roundabout onto William Adams Way	17.6m minimum inclusive of central reserve	3.0m minimum width	2.5m minimum footway on the northern side of the road	4.5m minimum comprising of a 3.0m cycleway and a 1.5m footway on the southern side of the road

2.3.8. These elements are shown in Figure 2.4.

STRUCTURES AND EARTHWORKS

2.3.9. The exact type and form of the double leaf bascule bridge is subject to further design development, in particular with regards to the position of the counterweights required to balance the weight of the bridge deck and reduce energetic requirements during operation.

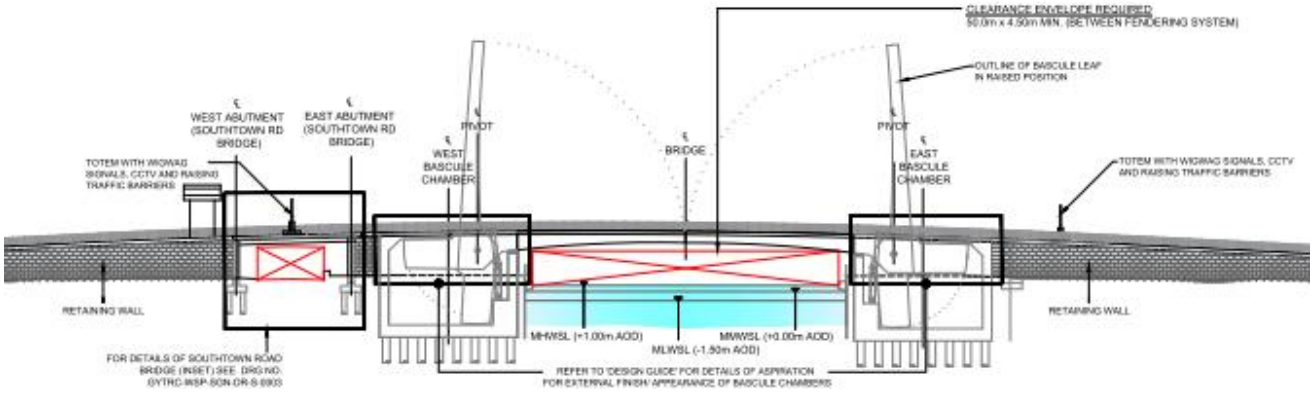
2.3.10. If counterweights are installed at or below deck level, the proposed double leaf bascule bridge may require two bascule chambers in order to accommodate their movement. If required, these will be accommodated within steel sheet-piled knuckle walls, extending into the River Yare from the quays along both banks. The requirement for, and exact shape, form and design of these knuckle walls will be subject to further confirmation and design and will be presented in the Environmental Statement.

2.3.11. If counterweights are installed above the deck level, chambers and permanent 'knuckles' may not be required as there would be sufficient space to accommodate their movement above ground. However, temporary sheet piled cofferdams may still be required to enable the construction of the piers within the River Yare.

2.3.12. Two illustrative opening mechanism designs have been prepared to reflect the arrangements outlined above in paragraph 2.3.11 and 2.3.12 (and shown in Figures 2.4 and 2.5 and Plates 3.1 and 3.2). It is important to note that these possible designs do not reflect an 'either / or' scenario, rather they reflect the ends of a range from which a working design envelope has been defined. The final design of the opening mechanism will be made by the Applicant within that working envelope, taking into account a number of issues, including contractor innovation and construction cost. To ensure that the opening mechanism is adequately assessed in this PEIR, the assessments contained herein consider the 'worst case' of both illustrative designs when combined. As an example, Chapter 10, Townscape and Visual Impacts, assesses a maximum structure height of the open bridge position of 44.5m Above Ordnance Datum (AOD), rather than assessing both the maximum height dimensions of the above deck counterweights (44.5m AOD) and the at, or below, deck counterweights (40.9m AOD).

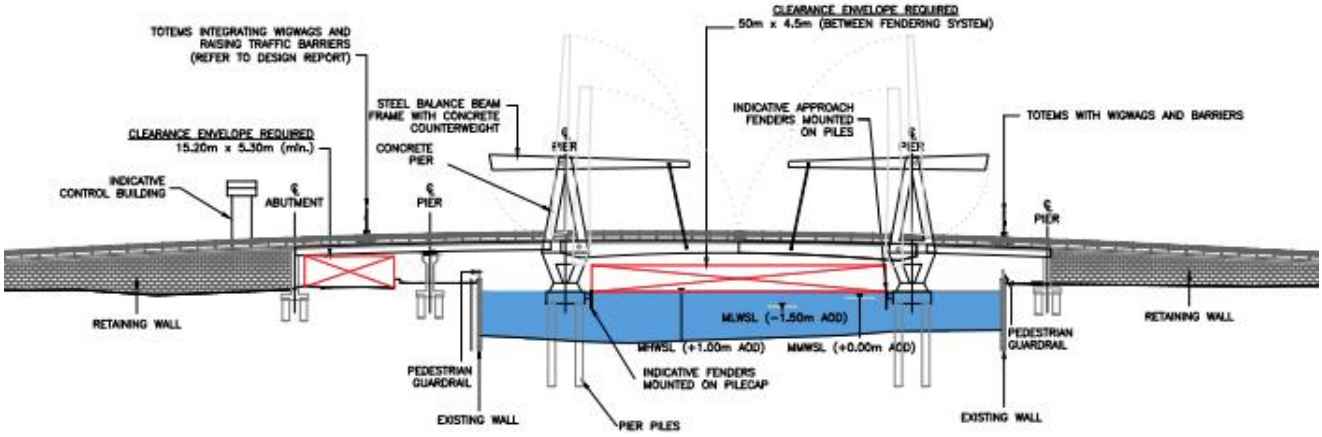
2.3.13. When lowered, the bridge will have a clearance of no less than 4.5m above the Mean High Water Spring level (MHWSL), which will enable smaller boats to pass under the bridge (as shown in Plate 3.1 and Plate 3.2 below). The bridge profile provides a higher actual clearance in the middle of the river that will be confirmed with the development of the design. Higher clearance values would have to be prohibitively high to significantly reduce the frequency of opening of the double leaf bascule bridge. This would have required excessively steep approach road gradients or, alternatively in order to avoid such steep gradients, significant additional work would have been required to raise the level of adjacent roads tying into the new road over the crossing, with an associated increase in land take.

Plate 2.1: Indicative profile of the proposed bascule bridge in the lowered position (counterweights at or below bridge deck level)



Note the profile of the bridge when it is raised is shown in dashed grey outline.

Plate 2.2: Indicative profile of the proposed bascule bridge in the lowered position (counterweights above bridge deck level)



Note the profile of the bridge when it is raised is shown in dashed grey outline.

2.3.14. The new crossing design currently includes a footway provision on either side of the carriageway with one side being wider to accommodate a segregated cycleway as well. The consideration of the provision of a footway and cycleway on both sides of the new crossing, as an alternative, is subject to further investigation and engagement with the stakeholders.

2.3.15. The proposed clear navigation width is of at least 50m between fenders. This is shown on Plate 2.1 and Plate 2.2 and discussed in greater detail in Chapter 15. Plate 2.1 and Plate 2.2 also shows infinite air draught will be provided for the full distance between fenders when the bridge is raised and open to marine vessels.

2.3.16. In consultation with Great Yarmouth Port Company (GYPC), vessel simulation modelling has been undertaken to confirm the effects of setting the navigation channel width at a minimum of 50m between fenders.

2.3.17. It is proposed that the new double leaf bascule bridge will require a control tower with a maximum height of 20m AOD. The location and detail of this structure will be determined in consultation with GYPC in the ongoing design process, although three provisional locations for the tower have been identified, all of which are in proximity to the crossing on the western side of the river, as shown on Figure 2.4.

2.3.18. A series of fenders will be provided within the river to provide protection to the double leaf bascule bridge structure against impact from ships. The fenders will be designed for the range of vessels expected to transit the bridge – they will likely comprise either unit element or cone fenders with low friction (Ultra-High Molecular Weight Polyethylene) facing panels.

2.3.19. It is anticipated that all the material for the new earthworks/embankments will need to be imported.

MAIN JUNCTION ARRANGEMENTS

2.3.20. Presented in Figure 2.4 are roundabout arrangements at the west of the Proposed Scheme and a signalised junction at the east of the Proposed Scheme. Whilst the design of junctions is well advanced, the final designs to be assessed in the Environmental Statement may differ in detail from those presented here following completion of the final Transport Assessment.

THE WESTERN JUNCTION

2.3.21. Paragraph 2.3.3 above provides an overview of the Proposed Scheme. In relation to the highway works to the western and eastern junctions, the existing junction of William Adams Way with Suffolk Road proposes a new 5-arm roundabout that will link to the existing A47 Harfrey's Roundabout through a realigned dualled section of William Adams Way. One of the arms of the new roundabout will link into a new dual carriageway road across the River Yare, and will oversail Southtown Road.

2.3.22. The other arms on the new roundabout provide accesses to The Kings Centre on Queen Anne's Road, Suffolk Road and the south eastern realigned dual section of William Adam's Way. Controlled pedestrian and cycle crossing facilities will be incorporated.

THE EASTERN JUNCTION

2.3.23. On the eastern section of the road crossing, the proposed link over the River Yare links into a new signalised junction with South Denes Road. The direction of operation of Sutton Road and Swanston's Road will be reversed to ensure efficient operation. Controlled crossing facilities will be incorporated, the final design of which will be presented in the Environmental Statement.

ACCESS TO PROPERTIES

2.3.24. One of the five arms of the proposed western roundabout will connect to the west side of Queen Anne's Road, providing all movements with access to the Kings Centre and the veterinary clinic.

2.3.25. A new priority junction on Southtown Road will provide access to the residential area at the eastern side of Queen Anne's Road.

2.3.26. The existing Perenco access onto South Denes Road will be permanently stopped up to enable construction of the Proposed Scheme, and access to their site via the northern-most Fish Wharf junction will also be severed by the new crossing. The permanent and temporary footprint of the Proposed Scheme will reduce the land they have available to operate their business. Alternative access arrangements and operational layouts within their site are being discussed with both Perenco and ASCO including potentially, a new structure to allow vehicular access under the proposed crossing on the eastern bank subject to agreement with the affected businesses and landowner.

DRAINAGE

2.3.27. An indicative drainage design is shown on Figure 2.9 that shows how drainage could be managed within the Proposed Scheme, and is described further below.

2.3.28. Outline approval is currently being sought from the relevant Risk Management Authorities with regards to the high level Drainage Strategy, however this is yet to be obtained. What has currently been proposed may therefore be susceptible to alterations based on liaison outcomes. However, the 'key principles' (paragraph 2.3.28 and 'general drainage design' (paragraph 2.3.29) points are expected to remain the same.

2.3.29. Key principles include:

- Discharge rates and volumes into receiving waterbodies/systems will be limited as close as reasonably practical to the greenfield runoff scenario, for the 1 in 100 year plus climate change event. Where this is not obtainable, it will be ensured that post development runoff rates and volumes will not exceed existing scenario values;
- All runoff will be adequately treated before entering receiving waterbodies/systems;
- Attenuation will be included within all spaces available;
- Sustainable Urban Drainage Systems (SuDS) will be included where possible;
- Drainage and landscape design will be incorporated where possible; and
- All storage sized to store runoff from a 1 in 100 year storm + climate change with a six hour duration storm.

2.3.30. General drainage design principles include:

- It is likely that verges and footways will either drain to the carriageway or drain to a SuDS feature within the verge (e.g. swale) and then discharge into the carriageway drainage system;
- There will be various watercourse realignments, culvert replacements and culvert extensions within the proposed drainage works. These will be agreed with the Internal Drainage Board (IDB) and other stakeholders;
- The proposed drainage network will be constructed in accordance with:
  - NCC's standard drawings;
  - The Manual of Contract Documents for Highway Works (MCHW) Highway Construction details; and
  - Sewers for Adoption (edition to be agreed with Anglian Water); and
- Provision must be made to contain any accidental spillages by providing penstocks upstream of any feature; and
- Future maintenance will be considered as part of the design.

Area 1

2.3.31. For the western side of the Proposed Scheme (if a centreline is taken from the highest level of the proposed River Yare spanning bridge deck) the first instance will be to discharge into the ordinary watercourses. Liaison is currently being undertaken with the Waveney, Lower Yare & Lothingland IDB to obtain ordinary watercourse discharge consent.

2.3.32. Runoff from the carriageway will be collected by the highway drainage (most likely highway gully & manhole system) and discharged into the attenuation feature Pond 1 (see Figure 2.9). The size, type and location of Pond 1 is to be confirmed. Pond 1 will discharge into the existing watercourse via a restriction device to reduce the rate/volume to a value acceptable to the IDB.

2.3.33. Pond 1 will have a permanent depth of water to allow for pollution treatment before discharging into the ordinary watercourse.

2.3.34. Alternative discharge strategies for the western side of the Proposed Scheme are also being explored; these include full discharge into the River Yare main river and a split discharge to the main river and ordinary watercourses, in case agreement cannot be reached with the IDB. These other potential options are being discussed with the relevant authorities.

Area 2

2.3.35. Runoff from the carriageway will be collected by the highway drainage and discharge into the underground attenuation feature Storage 2 which will be located within the roundabout central island. The size, type and location of Storage 2 is to be confirmed. Storage 2 will discharge into the replacement culvert via a restriction device to reduce the rate/volume to a value acceptable to the IDB.

2.3.36. A proprietary device will be installed upstream of Storage 2 so that all runoff can be treated before it enters the attenuation feature.

2.3.37. The highway drainage provision within the roundabout circulatory area will most likely be combined kerb drainage or gully & manhole system.

2.3.38. The River Yare double leaf bascule bridge deck drainage provision will be determined at detailed design stage. The options will include a piped or kerb system incorporated within the bridge deck or a collection system at the outer extents of the bridge deck (an at source collection system is currently preferred).

2.3.39. The Southtown Road single span bridge deck will be drained via a combined kerb system.

2.3.40. The remaining carriageway areas within Area 2 will have a highway gully and manhole system or combined kerb drainage to collect the runoff.

2.3.41. As with Area 1, alternative discharge strategies are being explored for Area 2 in case agreement cannot be reached with the IDB.

Area 3

2.3.42. For the eastern side of the crossing, the expectation is that drainage will discharge into the existing Anglian Water (AW) combined sewer on South Denes Road restricted at an existing rate or a rate specified by AW. Liaison is currently being undertaken with AW to obtain discharge consent.

2.3.43. It is expected that oversized pipes will be required to attenuate the rate & volume before the proposed system discharges into the AW network. This is due to available storage space being limited.

2.3.44. A restriction device will be installed upstream of the AW network connection.

2.4 OTHER DESIGN ELEMENTS

LIGHTING

2.4.1. The full extent of the Proposed Scheme will be lit in accordance with BS5489-1:2013 Code of Practice for the design of road lighting and public amenity areas, and also the relevant NCC road lighting specifications. Provisional lighting classes and luminaire mounting heights have been agreed with NCC.

2.4.2. The lighting design will be developed further during detailed design, to incorporate both the architectural lighting of the crossing and also the public realm areas that have been identified. The lighting scheme will utilise LED luminaires with specialised optics in proximity to the waterways to minimise obtrusive light as well as the installation of cowls to mitigate any light pollution onto the River Yare. Discussions will continue with Peel Ports and The Applicant to ensure their requirements are considered and a suitable design developed that does not affect the safety of their operations.

TECHNOLOGY

2.4.3. Variable Message Signs (VMS) will be provided to assist the movement of traffic in response to the double leaf bascule bridge status. The proposed signage locations, as indicated on Figure 2.3, have been informed by a review of the Great Yarmouth road network to determine locations where signs can reduce congestion on the approach to the crossing and in the town centre.

ROAD RESTRAINT

2.4.4. New road restraints will be provided for the full length of the new crossing using metal barrier systems at the outer edge of the structure. Vehicle parapets 1.4m in height including for fall prevention and to deter climbing over, will be provided along both edges of the bridge and along approach retaining walls. These comply with relevant standards, and DMRB requirements as far as is reasonably practicable, safe, and permitted by the Technical Approval Authority.

2.4.5. Additionally, metal guardrails will be provided along both sides of the carriageway to segregate pedestrians and cyclists from other road users on the approaches to the rising barriers preventing access to the bascule section of the crossing. This enables separate rising barriers to be provided on the carriageway and on the footway/cycleway, and will assist in optimising the lifting sequence to minimise delay.

LANDSCAPING

2.4.6. The Proposed Scheme will include hard and soft landscaping where it is necessary to mitigate any identified environmental effects, and to enhance the setting of the Proposed Scheme so that is fully integrated into the wider townscape. Current proposals are shown on Figure 2.5, however these are subject to ongoing design development to ensure the necessary mitigation identified by the Environmental Statement is provided, before being finalised for the DCO application. The proposals aim to enhance non-motorised users (NMUs) networks and connections to ensure safety, continuity and convenience around the Proposed Scheme.

2.4.7. The Proposed Scheme reduces severance between the communities, employment, and destinations on either side of the River Yare through the addition of the third crossing. Where possible and appropriate, the design enhances the experience of NMUs to encourage sustainable modes of transport to make this lifestyle choice more attractive and convenient.

2.4.8. The area around the bridge support structure at Bollard Quay on the western side of the River Yare provides the opportunity for a new public space, forming an important node for pedestrians and cyclists in this area. The type of mechanism developed for the double leaf bascule bridge, and the impact and footprint upon Bollard Quay, will further inform the design of the public space and connecting NMU routes. The public space will also be designed to allow access for maintenance to the crossing.

2.4.9. The western approach to the crossing features NMU routes north and south of the embankment structures, to enhance connectivity between Southtown Road and destinations west of this area including Suffolk Road, the allotments, and Southtown Common. There is an opportunity for these routes to enhance these areas of the Proposed Scheme, the experience for NMUs, and provide bio-diversity benefits through varied planting and tree species. These routes facilitate access maintenance for the approach embankments when necessary. As these routes will be primarily traffic-free (except maintenance access when required) and there is an opportunity for planting to be considered, they are hereafter referred to as 'green NMU routes' to differentiate from the standard footway routes provided elsewhere on the Proposed Scheme.

2.4.10. The planting strategy for the green NMU routes, to be developed in detailed design, will be diverse with native species to reflect the surrounding Norfolk County area and to benefit bio-diversity. A mix of native and ornamental planting will attract wildlife and visually enhance these areas. The species chosen will consider the need to simplify maintenance and management regimes.

2.4.11. To replace allotments affected by the Proposed Scheme, a plot has been allocated north of Queen Anne's Road, to ensure this amenity remains within the vicinity of its current location. The proposed plot is of a comparable area and will include 4 individual plots with appropriate facilities provided so far as is practicable as part of the Proposed Scheme. The 'Mind' community space will be reinstated within a smaller footprint adjacent to the base of the embankment of the widened and elevated William Adams Way. The relocated allotments, and existing 'Mind' community space will be accessible from the southern green NMU route which frames this area, and also from Queen Anne's Road for vehicles.

NMU CROSSINGS

2.4.12. The eastern junction will provide signalised crossings at every arm of the junction except Sutton Road. The crossings on both approaches from the A1243 South Denes Rd will be a pedestrian only puffin crossing, and a crossing will also be located on the bridge approach. All controlled crossings will be staggered and a waiting area in the central reservation will be provided.

2.4.13. Controlled toucan crossings for pedestrians and cyclists will be provided at the William Adams Way southeast (to replace an existing pedestrian bridge which will be demolished), and the bridge approaches to the western roundabout. Both will be signalised and staggered with a waiting area in the central reservation.

2.4.14. An uncontrolled crossing across Southtown Road for pedestrians and cyclists will also be provided.

2.4.15. A new signalised crossing will also be located on Suffolk Road, north of the new roundabout.

2.4.16. The NMU route on the north-western side of the crossing approach connects Southtown Road users to Suffolk Road and onto the bridge deck to cross to the eastern side. The northern side of the crossing will have a segregated cycleway and footway to tie into these connections.

2.5 CONSTRUCTION

2.5.1. Subject to the Development Consent Order (DCO) being made in line with anticipated timescales, it is envisaged that construction of the Proposed Scheme will commence in Autumn / Winter 2020 and will open in early 2023.

2.5.2. Mobilisation for the Proposed Scheme could commence in Spring 2020, subject to confirmation of the DCO, enabling site office and compound facilities to be established and advanced works such as site clearance activities, ecological mitigation and the diversion of the utilities to be undertaken prior to the main start of works where possible.

2.5.3. Ecological and cultural heritage mitigation works will be carried out in accordance with a Construction Environmental Management Plan (CEMP). Where possible, ecological and cultural heritage works will be completed in advance of construction works under the supervision of suitably qualified specialists. Work that impacts upon protected species will be subject to a mitigation/conservation licence(s) from Natural England. Where required, these licences will be in place prior to the commencement of work, and work will be undertaken in line with the mitigation requirements and conditions of the licence(s).

2.5.4. Land will only be released for construction once the ecological and cultural heritage works have been completed. All areas of the site will be signed off by the relevant environmental or archaeological specialists prior to work commencing.

2.5.5. Visual and noise mitigation, where identified, will be constructed as soon as practicably possible to minimise local disturbance. Further information is provided in Chapters 7 (Acoustics) and Chapter 10 (Townscape and Visual Impacts) of this PEIR.

2.5.6. Temporary drainage arrangements will be constructed ahead of the construction works commencing to ensure that surface run-off will not directly enter existing water courses. All private water supplies will be identified with landowners and clearly marked on the site and contract drawings.

2.5.7. Construction access and haulage roads will be constructed to ensure access is available to meet both the earthworks, structure construction and surfacing programmes.

2.5.8. Landscaping works will be undertaken as soon as practicable upon completion of the earthworks. The optimum amount of planting will be undertaken at the end of the first year of construction. All landscaping works will be subject to an appropriate maintenance period.

2.5.9. The site will be secured progressively, in accordance with the sequence of work as planned, with permanent fencing being erected (including any specified netting) wherever possible. Local roads will be maintained as far as is practicable and diversions will be completed prior to stopping up.

2.5.10. The programme of construction works will have regard to best practice and takes into account the need to avoid, where practicable, disruption to local communities and the environmental effects of construction. Working hours will reflect the need to complete the construction works as quickly and effectively as possible, whilst minimising the disturbance to local communities. Earthworks operations will be programmed between 07:00 and 19:00 Monday to Friday and 07:00 and 13:00 on Saturdays. Extended hours of working (e.g. Sundays and overnight works) may be required, for example, to construct tie-ins to side roads. All working hours will be discussed and agreed with the Environmental Health Officer (EHO) prior to starting the construction works.

2.6 OPERATION AND MAINTENANCE

2.6.1. Operation of the double leaf bascule bridge will be the responsibility of NCC as the Highway Authority. The day to day operator has not yet been agreed however discussions are currently ongoing with the Great Yarmouth Port Company to carry out this role. It is anticipated that the proposed double leaf bascule bridge will be operated on demand for commercial vessels and by agreement for recreational vessels at set times when requested in advance. The double leaf bascule bridge is expected to be operational 24 hours per day and 365 days per year.

2.6.2. Whilst the opening arrangements for the double leaf bascule bridge have yet to be agreed, it is envisaged that the bridge will open on average an estimated 15 times a day. Modelling has assumed that each opening will take approximately 5.5 minutes including vessel passage time, meaning that the crossing will be closed to traffic for approximately 82 minutes on a typical day.

2.6.3. Maintenance of the Proposed Scheme will be the responsibility of NCC as the Highway Authority, and will involve routine, planned maintenance and system checks, as well as reactive maintenance and repairs.

2.7 DECOMMISSIONING

2.7.1. The Proposed Scheme bascule bridge will be designed to have a life of at least 120 years in accordance with the requirements of BS EN 1990:2002 Eurocode – Basis of Structural Design.

2.7.2. Any decommissioning would be likely to be completed in less time than the construction of the Proposed Scheme and, whilst the Applicant has no plans to decommission and remove the Proposed Scheme, were it to be removed, it would be likely to require a similar degree of plant, equipment and disturbance within the navigation channel to that predicted during construction.

2.7.3. Given that the Applicant has no plans to decommission the Proposed Scheme, and as the environmental constraints in the mid-22nd Century cannot be reasonably predicted, further consideration of decommissioning is not considered appropriate (although please refer to Chapter 15 where greater information on the nature of the materials used in construction and how their suitability will be assessed is included).

3

ASSESSMENT OF ALTERNATIVES

3 ASSESSMENT OF ALTERNATIVES

3.1 INTRODUCTION

3.1.1. This section outlines the alternative scheme options that have previously been considered. Section 14(2)(d) of the EIA Regulations states that an ES should include "*a description of the reasonable alternatives studied by the applicant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment*", In Schedule 4, the EIA Regulations state that an ES must include: "*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects".*"

3.1.2. The Applicant has opted to provide this information within the PEIR to provide as much information as possible on the rationale behind the design and to present the decision making process that has been followed. Further detail will be provided in the ES.

3.1.3. This section has been informed by OBC Report[23] and the two supporting Option Assessment Reports (OAR) were prepared in 2016[24] and 2017[25]. These detail the option selection process that was applied to the Proposed Scheme. The proposed options for the scheme were subject to a further sifting process to identify the final three preferred options which were then taken forward for consideration in an Environmental Options Assessment Report[26] (EOAR), prepared in 2017 and summarised in Section 3.6.

3.2 DEVELOPING OPTIONS

STAGE 1 (2007)

3.2.1. A Stage 1 Scheme Assessment Report was commissioned in 2007 in order to understand existing constraints and potential engineering solutions available for the provision of a crossing of the River Yare in Great Yarmouth.

3.2.2. Within the 2007 Scheme Assessment Report, a broad area of interest was identified for the proposed scheme. This was determined through consideration of the following:

- The predicted number of bridge openings at various points on the river. The Stage 1 Assessment concluded that an opening structure placed at the southern end of the area of interest would have to open 4000 times a year for the large vessels, with additional openings for pleasure craft. If the bridge was placed at the northern extremity of the area of interest this would reduce to 2000 times a year, with additional openings for pleasure craft.
- The potential impact of a new structure upon the navigation of the river. Any structure on a curve of the river would require a larger clear span, which would incur greater cost.
- The need to minimise any impact on existing built development.

[23] Mouchel (2017). Technical Report. Great Yarmouth Third River Crossing, Outline Business Case. Available here.
[24] Mouchel (2016). Technical Report. Great Yarmouth Third River Crossing, Supporting Document 1 – 2016 Options Assessment Report. Available here.
[25] Mouchel (2017). Technical Report. Great Yarmouth Third River Crossing, Support Document 2 – 2017 Final Options Assessment Report. Available here.
[26] Mouchel (2017). Technical Report. Great Yarmouth Third River Crossing, Supporting Document 12 – Environmental Options Assessment Report. Available here.

3.2.3. On this basis the study area for the scheme was defined. This is shown in Figure 3.1 below, which presents an extract from the 2007 Scheme Assessment Report. Within the area of interest, three proposed corridors were identified for bridge and tunnel options. These are also presented in Figure 3.1. The 2007 Scheme Assessment Report concluded that, due to the existing trunk road layout and physical constraints placed by surrounding development, the only economically viable tie-in with the trunk road network was at the Harfreys Roundabout on the A47.

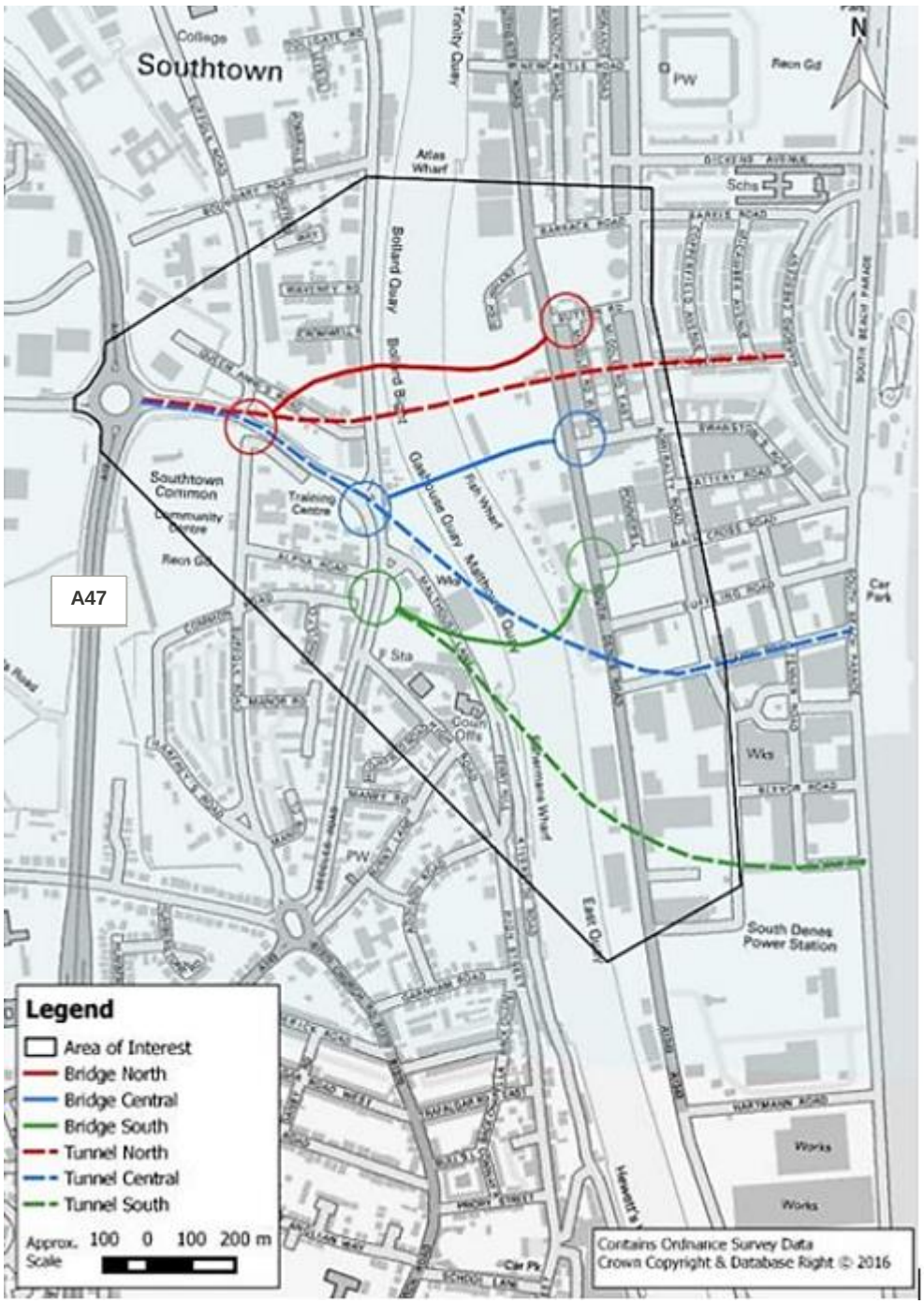


Figure 3.1 – Extract from 2007 Scheme Assessment Report showing the broad study area and proposed bridge and tunnel corridors

3.2.4. For each of the three route alignments, a high and low level bridge option as well as options for a tunnel were developed. This produced nine options in total.

3.2.5. At Stage 1, cost estimates were prepared for options in the northern and southern corridors only, as it this was considered sufficient to obtain an indication of the value for money of a third crossing scheme. This concluded that there was relatively little difference between the costs of high level and low level bridges, but the tunnel options were significantly more expensive than any of the bridge options.

3.2.6. In addition, an Environmental Assessment was undertaken at Stage 1 and considered all nine route options. It reported that the scheme would have numerous impacts on the local environment, some being beneficial and some adverse. For example, each of the routes would lead to a minor adverse impact on air quality. The report found that there were many aspects of construction that would cause disruption to aspects of the natural environment, most notably noise and vibration, water quality and drainage and ecology.

3.2.7. Three of the options identified at Stage 1 were tested using the Great Yarmouth SATURN model (northern alignment opening bridge, central alignment tunnel and southern alignment opening bridge). The key findings showed that either bridge options would carry more traffic (and hence provide more traffic relief) than the tunnel option. An economic assessment was also undertaken using TUBA, with accident benefits calculated using COBA. Of all the options tested show a positive benefit cost ratio:

- Bridge (northern location): 4.3
- Bridge (southern location): 4.9
- Tunnel (central location): 2.2

3.2.8. The Stage 1 Assessment showed that a third river crossing would be feasible, and that either a bridge or a tunnel could produce benefits in excess of its costs. A bridge would be less expensive and therefore produce a significantly better benefit- cost ratio than a tunnel.

3.2.9. The Stage 1 Assessment concluded that the following be included at the start of the Stage 2 scheme assessment process:

- High level opening bridge
- Low level opening bridge
- Immersed tube tunnel

3.2.10. The Stage 1 Assessment determined that the exact route alignment would depend on the cost (environmental, social and economic) of the alignment.

STAGE 2 (2009)

3.2.11. A Stage 2 Scheme Assessment Report was commissioned to develop options further. Different types of crossing were considered, which included a fixed bridge, swing bridge, lifting bridge, bascule bridge and a tunnel. Following a detailed investigation of these options (described in a Structural Options working paper[27]), three options (two bridge options on the shortest alignment and an improved tunnel option) were shortlisted for further assessment work:

- Bridge Option 1 – Bascule bridge with roundabout on Southtown Road;
- Bridge Option 2 – Bascule bridge with t- junction on Southtown Road; and

[27] Great Yarmouth Third River Crossing, Structural Options Working Paper (Mott MacDonald for Norfolk County Council January 2009

- Tunnel option- Tunnel from A47 north east onto Southgates Road

3.2.12. Results from the economic assessment carried out in the OAR stage showed that although the economic benefits of the tunnel option would be nearly as high as those for the bridge options, its cost would be much higher at three times that of the bridge. The resulting Benefit to Cost Ratio (BCR) was less than 2.0, confirming that a tunnel option is unlikely to become a viable solution. Both bridge options have a BCR of greater than 4, offering very high value for money (Table 3.1).

Table 3.1 - Cost and CBR of options

Option	Bridge Option 1	Bridge Option 2	Tunnel
Cost (2015)	£121.676 million	£112.301 million	£375.828 million
Cost benefit Ratio	4.5	4.8	1.5

3.2.13. The Stage 2 Scheme Assessment Report found that a bridge in the southern corridor would offer the greatest monetised benefits and, because it was also likely to be the least expensive option, would generate the highest BCR. Further to this, detailed data on commercial vessel movements within the inner harbour were used to determine the likely number of bridge openings required for different locations. It was concluded that a bridge on the shortest route across the river, would require about six openings each day. Further south, the number of openings would be greater. Further north, the cost of construction would be higher.

3.2.14. The OAR concluded that the crossing should be located between Hatfrey's Roundabout and South Denes Road.

3.2.15. Based on this location, a list of 40 options was subsequently produced based on different criteria including the location, form and geometry of the western and eastern tie-ins to the local road network, bridge height and carriageway standard. These 40 options were predominantly variants at three different tie-in locations.

3.3 OPTION SELECTION PROCESS

SIFTING PROCESS

3.3.1. The 40 identified options were put through an initial sift in order to narrow down to a selection of preferred options. This approach quickly reduced the initial list of options by removing those that did not make significant contributions to meeting the defined objectives; did not resolve the identified problems; or were not deliverable or feasible.

3.3.2. For each objective and identified problem, a score was allocated based on the anticipated impact of the option being assessed. The total score for each option was then calculated by summing the individual scores for each function, thus enabling a comparison between options.

3.3.3. The long list then became nine primary options (listed below) following the initial sift which were variants of three different western tie-in forms and locations outlined in the OAR.

EARLY ASSESSMENT SIFTING TOOL

3.3.4. DfT's Early Assessment Sifting Tool (EAST) is a decision support tool that has been developed to quickly summarise and present evidence on options in a clear and consistent format. It provides decision makers with relevant, high level, information to help them form an early view of how options perform and compare.

3.3.5. EAST has been designed to be consistent with Transport Business Case principles and follows the same five cases as the DfT Business Case model.

3.3.6. The nine options (listed in Table 3.2) which successfully met the evaluation criteria within the initial sifting process were taken forward to the final stage of sifting, using the EAST decision support tool. This assessment identified the high level economic, environmental and social impacts of all nine options based on DfT's five case

model approach. Reviewing the schemes performance across all of the cases is the preferred approach, and therefore a Red/Amber/Green (RAG) score was applies to each of the nine options to provide a visual guide (Table 3.2).

3.3.7. NB: On Wednesday 1st March 2017, the A12 between Great Yarmouth and Lowestoft became part of the A47. The work ensures that the A47 is a continuous trunk road between Peterborough and Lowestoft, while the A12 is a continuous trunk road between Ipswich and London.

Table 3.2 - Preferred Options Table

Option	Width	Tie in location (west)	Tie in form (west)	Tie in location (east)	Tie in form (east)	Cost (£M)
4	single carriageway	A12 Harfrey's Roundabout tie-in	Existing four-arm roundabout	South Denes	T- junction	£65
5	dual carriageway	A12 Harfrey's Roundabout tie-in	Existing four-arm roundabout	South Denes	T- junction	£102
6	three-lane carriageway	A12 Harfrey's Roundabout tie-in	Existing four-arm roundabout	South Denes	T- junction	£87
31	single carriageway	Suffolk Road	New four-arm roundabout	South Denes	T- junction	£62
32	dual carriageway	Suffolk Road	New four-arm roundabout	South Denes	T- junction	£97
33	three-lane carriageway	Suffolk Road	New four-arm roundabout	South Denes	T- junction	£83
37	single carriageway	Southtown Road tie-in	At grade junction	South Denes	T- junction	£62
38	dual carriageway	Southtown Road tie-in	At grade junction	South Denes	T- junction	£95
39	three-lane carriageway	Southtown Road tie-in	At grade junction	South Denes	T- junction	£81

3.4 DISCOUNTING OF INITIAL OPTIONS

3.4.1. Having selected nine options, it was necessary to identify which did not represent realistic solutions. The need for the selected scheme to perform well across economic, environmental and social indicators required a process of sifting and discarding of options to ensure that final options made a significant contribution to achieving scheme objectives.

3.4.2. The DfT Early Assessment Sifting Tool (EAST) was applied to reduce nine options down to the final three. The shortlisted options were subjected to preliminary operational testing using both SATURN and Paramics Discovery model platforms. Of the nine options, the following outlines the preliminary findings from the sifting assessments:

- Following the option assessment and findings from the preliminary operational performance testing, Options 32, 33 and 37 were recommended to be carried forward to next stage for further appraisal.
- Both options 32 and 33 met all specific, intermediate and operational objectives of the scheme and addressed a balance of benefits to both the local and strategic road network. Option 37, which is a two-lane low bridge that ties in at-grade to Southtown Road, was to be carried forward as the low-cost option. Testing showed that all key indicators suggest that option 32 performed better than either option 33 or 37.

- Option 39 would be expected to experience comparable over capacity queuing issued at the AM and PM peak traffic time, and was therefore discarded

- SATURN model outputs for option 38 indicated that whilst the travel time and distance is likely to be reduced in comparison to the 'do nothing' scenario, there may be significant over-capacity queuing issues that arise

- Structurally, low level bridge options (38, 39) involve complicated construction methods that are relatively expensive.

- Options 4, 5 and 6 tie-in at Harfrey's roundabout and were ruled out because of significant drawbacks to the wider road network and by not meeting specific operational objectives (to achieve a balance between the needs of road and river traffic and to minimise environmental impact, compulsory purchase and demolition of residential and commercial property).

- Despite performing well during the junction assessment, Option 31 was not taken forward because the four and three lane variants (Options 32 and 33) that tie in to the same location on Suffolk Road are expected to deliver better resilience to the network and to provide more benefits to the local road network as opposed to a two-lane carriageway standard.

3.5 FINAL OPTIONS ASSESSMENT

3.5.1. Following the discounting of options stage, three final design options were identified as:

- Preferred Option 32 - Suffolk Road tie-in to the west (four lane high level bridge, roundabout as west tie in and traffic signals to the east at South Denes Road);

- Alternative Option 33 - Suffolk Road tie-in to the west (three lane high level bridge, roundabout as west tie in and traffic signals to the east at South Denes Road); and

- Alternative Option 37 - Southtown Road tie in to the west (Single Carriageway two lane low level bridge with traffic signal junctions to the west and the east at South Denes Road).

3.5.2. A summary of further appraisal work undertaken for options 32, 33 and 37 are outlined in the following sections. This included an environmental assessment as outlined in the Options Environmental Appraisal Report (EOAR)[28], summarised in Section 3.6.

Saturn Model Updates

3.5.3. Saturn Model outputs relating to overall journey times, distance travelled, queuing and total trips on the network for morning, evening and inter peak periods for 2030 are summarised in Table 3.3.

3.5.4. The results show that Option 32 has a marginal benefit overall in respect of the total distance travelled in the modelled road network.

[28] Mouchel. Great Yarmouth Third River Crossing Environmental Options Appraisal Report, 2017

Table 3.3 - Do min- v Options 32, 33 and 37 (2030) forecast year

Period	Scenario	Total Distance Travelled (pcukm)	Total Travel Time (pcuhr)	Total trips on the network (pcu*)
AM	Do min			
	Option 32	44920.6	1387.6	14809.5
	Option 33	44988.9	1380.9	14809.5
	Option 37	44857.4	1407.7	14809.5
IP	Do min			
	Option 32	49019.8	1676.7	17208.2
	Option 33	48129.3	1746.7	17208.2
	Option 37	48271.5	1869.4	17208.2
PM	Do min			
	Option 32	51424.8	1851.1	17401
	Option 33	51484.5	1853.4	17401
	Option 37	51490.1	2198.2	17401
*pcu: passenger car units				

Queuing Lengths

3.5.5. Table 3.4 shows the predicted maximum queue lengths for the three options. All key indicators suggest that Option 32 performs better than either Option 33 or 37.

Table 3.4 - 2023 Max queue (m) for Average Case Scenario and Worst-Case Scenario

ACS 2023	Option 32	Option 33	Option 37		WCS2023	Option 32	Option 33	Option 37
Western Side	154	341	407		Western Side	296	329	424
Eastern Side	189	182	397		Eastern Side	245	249	445

3.5.6. Table 3.5 shows the forecast journey time and distance savings for 2023.

Table 3.5 - Forecast Journey Time and Distance Savings 2023

2023	Vehicles	Total Distance (m)	Reduction (m)	Total Journey Time (s)	Reduction (s)
Do min	109,170	284,144,403	-	30,656,804	-
Option 32	109,267	277,221,279	6,923,124	29,375,070	1,281,734
Option 33	109,281	277,366,867	6,777,536	29,400,413	1,256,391
Option 37	109,246	276,572,017	7,572,386	30,231,789	425,016

3.5.7. Table 3.6 shows the forecast journey times and distance savings for 2038.

Table 3.6 - Forecast Journey Time and Distance Savings 2038

2038	Vehicles	Total Distance (m)	Reduction (m)	Total Journey Time (s)	Reduction (s)
Do min	121,984	319,680,152	-	40,219,537	-
Option 32	122,756	313,060,558	6,619,593	35,786,851	4,432,686
Option 33	122,738	312,980,112	6,700,039	35,872,101	4,347,436
Option 37	122,424	312,103,104	7,577,048	38,090,568	2,128,968

Cost

3.5.8. Table 3.7 outlines the predicted costs for each option.

Table 3.7 - Estimated Scheme Cost

Option	Estimated Cost
32	£96,538,000
33	£82,604,665.67
37	£61,513,841

3.6 ENVIRONMENTAL OPTIONS ASSESSMENT

3.6.1. The EOAR was prepared in 2017, to support the OBC. The primary objective of the appraisal was to assess the impacts on the environment for options 32, 33 and 37.

3.6.2. The methodology adopted for the environmental impact appraisal was informed by the guidance provided in the relevant chapters of TAG Unit A3 (WebTAG guidance for Environmental Impact Appraisals). Additionally, some assessment of the potential environmental impact and effect of the options used guidance contained within the Design Manual for Roads and Bridges (DMRB) Volume 11.

3.6.3. To inform the Environmental Impact Appraisal, desk based data gathering was undertaken for each of the environmental disciplines, which include noise, air quality, greenhouse gases, landscape, townscape, biodiversity, historic environment and the water environment. It is noted that contaminated land, human health and population were not assessed within this report. A preliminary ecology survey was undertaken to inform the scope of ecology surveys. Due to the absence of appropriate traffic data for the options, a proportionate air quality and noise assessment was undertaken to inform the appraisal. This comprises a qualitative analysis of the likely effects using available information, such as potential number of sensitive receptors (e.g. properties and sensitive areas).

3.6.4. The findings of the assessments are summarised below. The appraisal scoped out the need for assessing impacts on greenhouse gases as it was deemed that this would not present a material change on the optioneering process. Given the urban nature of the Proposed Scheme, it was concluded that the townscape sub discipline adequately considered the potential impacts in relation to the setting and that the landscape sub discipline would not be directly relevant to the decision-making process. Accordingly, the landscape sub discipline was scoped out of the overall appraisal.

Noise:

3.6.5. For all scheme options, there are 663 sensitive receptor buildings and no Noise Important areas within the 300m study area.

3.6.6. The EOAR concluded, overall, receptors close to the all three options would experience an increase in noise as a result of increased traffic flow. Option 37 was located marginally further away from sensitive receptors, and therefore could be expected to result in the lowest impact of the proposed options.

Air Quality:

3.6.7. The appraisal indicated that options 32 and 33 would have a greater number of potentially sensitive receptors situated within 200m of their design footprint than option 37. Due to the predicted reduction in traffic on the existing road links around the existing bridge, along with the absence of an AQMA in the vicinity, an overall neutral local air quality impact was considered most likely for each option.

Townscape:

3.6.8. The majority of townscape impacts were predicted to have a neutral effect for all options. The bridge in its temporary open position, however, would be an evident feature of Great Yarmouth's contextual townscape as a skyline feature. The assessment concluded that this would not fundamentally change the associated character of the river corridor, or how the town is perceived in context with its surrounding landscape.

Biodiversity:

3.6.9. All options passed through several areas of habitat that are suitable for breeding birds, as well as several buildings which may have suitable bat roosts within them that could be affected. The appraisal determined that, once suitable mitigation has been implemented, the effect of all options on biodiversity should not exceed slight adverse.

Historic Environment:

3.6.10. The EOAR deemed that all options would have a moderate adverse effect upon the setting of two listed buildings due to their proximity to the options. Additionally, the construction of all options would have a major adverse effect upon any unknown sub-surface archaeological remains.

Water Environment:

3.6.11. All three of the options were located entirely within floodplain cited as Flood Zone 3, and were deemed to be a significant adverse effect upon the water environment as a result of impacts to the floodplain. However, no effects upon the permeability of surrounding land and aquifer recharge were anticipated. The overall effect of all options on the water environment was deemed to be moderate adverse.

SUMMARY OF ENVIRONMENTAL OPTIONS ASSESSMENT REPORT

3.6.12. Table 3.8 provides a summary of the potential environmental impacts of each option.

Table 3.8 - Summary of Environmental Appraisal

Environmental Discipline	Option 32	Option 33	Option 37
Noise*	N/A	N/A	N/A
Air Quality*	N/A	N/A	N/A
Greenhouse gases	Scoped Out	Scoped Out	Scoped Out
Landscape	Scoped Out	Scoped Out	Scoped Out

Environmental Discipline	Option 32	Option 33	Option 37
Townscape	Neutral	Neutral	Neutral
Historic Environment	Moderate Adverse	Moderate Adverse	Moderate Adverse
Biodiversity	Slight Adverse	Slight Adverse	Slight Adverse
Water Environment	Moderate Adverse	Moderate Adverse	Moderate Adverse
*A WebTAG impact assessment had not been undertaken at this stage of the appraisal process for noise and air quality as the options are at the same crossing point, making the outcome of a distributional impact immaterial to the optioneering process..			

3.7 CONCLUSION OF THE OPTIONS SELECTION PROCESS

3.7.1. Considering the finding of the Option Selection process and the EOAR, Option 32 was chosen as the Preferred Option for the scheme. The results showed that Option 32 was forecast to provide the greatest potential benefit in terms of total travel distance and time saved across the modelled road network. In addition, Option 32 was also forecast to present the best operational performance at the junctions adjacent to the bridge, with the lowest levels of queueing and most efficient dissipation of these queues once the bridge re-opens for vehicular traffic.

4

CONSULTATION

4 CONSULTATION

4.1 CONSULTATION TO DATE

INFORMAL CONSULTATION

4.1.1. The Applicant has been undertaking consultations on The Proposed Scheme since 2009.

4.1.2. The most recent consultations have followed a three-stage process, as discussed in the Applicant's Statement of Community Consultation and summarised below:

Stage 1 (November 2016 – January 2017)

- Initial engagement, non-statutory consultation
  The purpose of this stage was to invite and assess views on congestion within Great Yarmouth and the surrounding area, to share emerging proposals and to understand the level of support for the Proposed Scheme.

- Nearly 500 individuals responded[29], including local residents and business representatives. Responses were as follows:
  - 71% of respondents said traffic congestion in Great Yarmouth was either a serious or very serious issue;
  - 79% either strongly agreed or agreed that the third river crossing would make their journey times shorter;
  - 80% either strongly agreed or agreed that congestion would be greatly reduced by a new river crossing; and
  - 81% said they would be very likely or likely to use a third river crossing.

Stage 2 (September 2017 – October 2017)

- Scheme development, non-statutory consultation
  The purpose of this stage was to invite and assess views on the Proposed Scheme development work so far.

- The consultation responses showed an overall support for the scheme, with the majority of respondents saying that:
  - congestion in Great Yarmouth is either a serious or a very serious issue;
  - the Third River Crossing would make their journey times shorter; or
  - congestion would be greatly reduced by the new crossing.

4.1.3. As part of this process, the Applicant undertook non- statutory consultation in advance of preparation of the EIA Scoping Report[5]. This was based upon information presented in the Outline Business Case and Options Assessment Report. Stage 2 consultation responses were received from Historic England, Natural England, the

[29] https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-yarmouth/third-river-crossing/public-consultation-on-third-river-crossing (accessed 20/07/2018)

Broads Authority and the Environment Agency (EA) in October and November 2017, ahead of undertaking EIA Scoping. These consultation responses are presented in Appendix 4A.

Stage 3 (Planned for August 2018 – October 2018)

- Statutory pre-application consultation
  The purpose of this stage will be to provide updated details on the Proposed Scheme and to invite and assess views on it, before an application for a DCO is submitted.

4.1.4. Stages 1 and 2 allowed the Applicant to take into account the comments from local people and other parties, allowing for development of the proposals. Stage 3 will inform further refinements of these proposals, prior to DCO application submission, and will welcome comments from anyone wishing to express a view. The Applicant, in its Statement of Community Consultation, states that Stage 3 will specifically seek views on:

- the principle of, need for and design of the Proposed Scheme (including alternative ways of meeting the need);
- detailed proposals for the Proposed Scheme including bridge alignment, junction layouts, works on existing roads and side roads, and design details;
- preliminary environmental information relating to the construction, operation and maintenance of the Proposed Scheme (provided by the PEIR and the non-technical summary);
- potential impacts of the Proposed Scheme on traffic (and possible mitigation measures); and
- potential impacts of the Proposed Scheme on port related activities and river vessel movements.

EIA SCOPING

4.1.5. The following organisations were consulted by Applicant when preparing the EIA Scoping Report[5].

- Planning Inspectorate;
- NCC Planning Department;
- NCC Archaeological Officer;
- NCC Landscape Officer;
- NCC County Ecologist;
- Marine Management Organisation (MMO);
- Historic England;
- Environment Agency;
- Peel Ports; and
- Highways England.

4.1.6. The following organisations have provided responses to the EIA Scoping Report[5]:

- Anglian Water Services Limited;
- Environment Agency;
- ESP Gas Group Limited;
- Forestry Commission;
- Fulcrum Pipelines Limited;
- Great Yarmouth Port Authority;

- Harlaxton Energy Networks Limited;
- Health & Safety Executive;
- Marine Management Organisation;
- Maritime and Coastguard Agency;
- National Grid;
- Natural England;
- Norfolk County Council;
- Public Health England;
- Royal Mail;
- South Norfolk Council;
- Trinity House;
- Waveney Lower Yare & Lothing and Internal Drainage Board;
- Historic England; and
- Great Yarmouth Borough Council.

4.1.7. These scoping responses are provided within in Appendix 2 of the Scoping Opinion[6]. Responses from Historic England and Great Yarmouth Borough Council were received after the statutory deadline and were therefore not include within the Scoping Opinion[6]. Nevertheless, the scoping responses have also been published on the Planning Inspectorates website alongside the Scoping Opinion[6].

4.2 STATUTORY PRE-APPLICATION CONSULTATION AND PUBLICITY

4.2.1. Part 5, Chapter 2 of the Planning Act requires an applicant for a DCO to undertake consultation and publicity prior to submitting their application. Accordingly, between August and October 2018, the Applicant will undertake the following in accordance with the requirements of the Planning Act and the EIA regulations.

(i) Section 42 consultation with prescribed consultees, specified local authorities and those with specified interests in the land (the first two categories are also the "consultation bodies" for the purposes of the EIA Regulations);

(ii) Section 47 consultation with the local community in accordance with the Applicant's Statement of Community Consultation. As required by Regulation 12(1) of the EIA Regulations, the statement explains how the Applicant will publicise and consult on the PEIR; and

(iii) Section 48 publicity (by notice) of the proposed application for a DCO. A copy of the notice will be sent to prescribed bodies in accordance with Regulation 13(1) of the EIA Regulations.

4.2.2. Before a DCO application is accepted, the SoS must be satisfied that the applicant has complied with the requirements of Part 5 Chapter 2 of the Planning Act. The pre-application consultation and publicity is thus a key part of the process of seeking a DCO.

4.2.3. The Applicant will take into account representations received in response to the pre-application consultation and publicity in refining and resolving the Proposed Scheme, and in preparing the Environmental Statement required to accompany the application for a DCO.

4.2.4. The PEIR and accompanying non-technical summary will be sent (in electronic form) to all persons consulted under section 42. Paper copies will be provided on request and the documents will also be available to view on the Applicant's website. The PEIR and accompanying non-technical summary will also be available at Public Exhibitions being held. These will provide an opportunity for the public to view and comment on the scheme proposals, including the PEIR.

5

ASSESSMENT APPROACH

5 ASSESSMENT APPROACH

5.1 INTRODUCTION

5.1.1. This chapter presents the overarching approach to be applied to the PEI. EIA is a process that identifies the likely significant environmental effects of a proposed development. It ensures that effects are properly considered as part of the design development process and that adverse effects are adequately mitigated. EIA assists in decision-making so that environmental factors can be given due weight. EIA also helps the Applicant to avoid, minimise and compensate for adverse environmental effects. EIA provides an opportunity for iterative feedback throughout the design process providing a mechanism to take into account environmental effects within the design process. The results of the PEI and responses to it will inform the Environmental Statement (ES) that will be submitted with the DCO application.

5.2 LEGISLATION AND GUIDANCE

5.2.1. Regulation 14 (2) of the EIA Regulations sets out the content which the ES must, as a minimum, include. The overarching purpose of the EIA process is to identify, describe and assess the direct and indirect significant effects of the proposed development (including operational effects) on the aspects of the environment specified in Regulation 5(2)(a) to (e).

5.2.2. In this context PEI has a distinct limited role, being designed to facilitate later stages of the EIA process. Regulation 12(2) defines the PEI as being such information as is referred to in Regulation 14(2) as is reasonably required for the consultation bodies to develop an informed view of the likely significant effects of the Proposed Scheme (which in turn will facilitate the preparation of the ES). It is also relevant to note that PEI is required to be prepared at the pre-application stage alongside statutory consultation and publicity: a stage when, as is necessary for the consultation to have substantive value, the design and other details of the Proposed Scheme have not been fully resolved. This in turn limits the finality and detail which can be achieved in identification and assessment of effects in the PEI. It follows that whilst the present PEIR generally follows the anticipated format and structure of the ES, it is not (and is not required to function as) a draft ES.

5.2.3. In addition, the Design Manual for Roads and Bridges (DMRB)[30] provides guidance for all aspects of the planning, design and assessment of major road schemes. The guidance in Volume 11 specifically addresses environmental assessment and identifies impacts and effects, which can be anticipated where a major road scheme is being introduced into the environment, although it is acknowledged that the DMRB predates the current EIA Regulations. The guidance has been used, where relevant to assist the assessment team in establishing which impacts and effects could potentially occur, and the specific nature of them for the Proposed Scheme. Where it is concluded that assessment is required, there is a description of the assessment considered appropriate and methods of assessment which are to be adopted.

5.3 ASSESSING THE EXISTING BASELINE

5.3.1. Environmental effects are described in the PEIR in terms of the extent of predicted change to the baseline condition. The baseline is generally taken to be the environmental conditions that are prevalent at the time that the assessment and supporting survey works are undertaken. Baseline environmental conditions, have been identified through:

- desk-based review of existing and available data; or
- on site surveys, intrusive investigations and modelling where considered necessary.

[30] Highways England. Design Manual for Roads and Bridges. Volume 11. Available here.

5.3.2. For each environmental aspect topic, the EIA will clearly define (i) sources of information; (ii) limitations pertaining to the baseline information or to the collation process

5.3.3. For some aspect topics it is appropriate to consider the future baseline associated with the Proposed Scheme, such as Traffic and Transport, Air Quality and Acoustics. This is determined by modelling the predicted future conditions, with and without the Proposed Scheme. These methods are described further within the individual aspect chapters.

5.3.4. During the EIA process, each environmental aspect topic has prepared a baseline section for the PEIR. Each aspect topic will determine relevant resources and sensitive receptors. These can include (but are not limited to) (i) sensitive ecological receptors; (ii) conservation and landscape designations (iii) structures or artefacts of heritage/archaeological value; (iv) watercourses; (v) people (vi) residential dwellings, (vii) places of employment; and (viii) other community facilities, such as education facilities, care homes, hospitals, places of worship.

5.3.5. The baseline sections will be updated throughout the EIA process, as new information emerges in line with the emerging design, emerging survey results, and through the consultation processes.

5.3.6. The ES will therefore have the objective of identifying and assessing which potential effects of the Proposed Scheme on the environment are likely to be significant, both positive and negative and, irrespective of duration. Direct effects will be assessed, together with (where relevant) indirect, secondary, cumulative and transboundary effects. Where possible, effects will be assessed quantitatively and mitigating measures and features will be considered.

5.4 DETERMINING STUDY AREA

5.4.1. Each environmental aspect topic will be responsible for defining the study area for their impact assessments. The study area will vary for each discipline and is driven by the nature of the existing environmental baseline. It is recognised that some effects only impact on a defined area whereas other effects are more widespread.

5.4.2. The spatial scope for the EIA includes (but is not limited to):

- the footprint of the proposed works including areas required for construction, enabling works and mitigation;
- the footprint of the traffic model where traffic flows are used for the transport assessment, air quality air quality assessment and noise assessments;
- the presence of European conservation designations; a wider study area of 3km has been applied to fully assess the effects upon these designations;
- the manner in which effects are likely to be propagated (effects of flooding and sediment transport could extend far beyond the Proposed Scheme Boundary);

5.5 TIMING AND DURATION OF WORKS

5.5.1. The EIA will consider the timing of the effects as well as the duration over which likely significant effects may occur. It will address effects arising from the construction, temporary and permanent land take and operation of the scheme as follows:

- Construction effects that may arise directly from construction activities (e.g. piling) and from the temporary use of land (e.g. construction sites), or from associated changes in traffic movements (e.g. diversions); and
- operational effects that may arise from the new infrastructure and traffic flows.

5.5.2. For the purposes of the EIA, the base year for assessments is given as 2018, with an opening year of 2023. The temporal scope may vary for specific disciplines but will generally extend from commencement of construction works to 15 years after the opening of the Proposed Scheme.

5.6 DETERMINING EFFECT SIGNIFICANCE

5.6.1. The ES will have the objective of identifying and assessing which potential effects of the Proposed Scheme on the environment are likely to be significant, both beneficial and adverse and irrespective of duration. Direct effects will be assessed, together with (where relevant) indirect, secondary, cumulative and transboundary effects (as states in Section 1.4, screening has been undertaken by the Planning Inspectorate on behalf of the SoS and concluded that the proposed scheme was unlikely to have a significant effect either alone or cumulatively on the environment in another EEA state). Where possible, effects will be assessed quantitatively and mitigating measures and features will be considered.

5.6.2. The significance of effects will be assessed within the ES using the following criteria as appropriate to the effect concerned:

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

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

5.6.4. It is proposed that the methodology and criteria used for the EIA be based upon the approach published in Volume 11, Section 2, Part 5 of the DMRB (HA 205/08)[31], updated as necessary to take account of the 2017 EIA Regulations. Where individual topics depart from this approach, the alternative methodologies and terminology will be provided within the relevant chapter.

5.6.5. Environmental value/sensitivity and impact magnitude detailed within HA 205/08[31] are reproduced in Table 5.1 - Environmental Value (or Sensitivity) and Typical Descriptors and Table 5.2 - Magnitude of Impact and Typical Descriptors respectively.

Table 5.1 - Environmental Value (or Sensitivity) and Typical Descriptors

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

[31] Highways England. Design Manual for Roads and Bridges. Volume 11. Available here

Table 5.2 - Magnitude of Impact and Typical Descriptors

Magnitude of impact	Typical criteria descriptors
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No Change	No change as a result of the proposed scheme

5.6.6. Using the level of sensitivity (value) and the magnitude of an impact, the significance of an effect can be determined using the Significance Matrix presented in Table 5.3. Using this approach, it is possible that a major adverse impact on a feature or site of low sensitivity will be of lesser significance than the same magnitude of impact on a feature or site of high sensitivity. Unless otherwise stated in the individual assessment, effects deemed to be of moderate, large or very large significance are deemed to be significant effects.

5.6.7. Table 5.3 presents the matrix, upon which the significance of effects will be determined. A description of the significance levels is presented in Table 5.4. Both tables are based upon the significance matrix and significance descriptions published by the DMRB in HA 205/08[31].

Table 5.3 - Significance of Effect Matrix

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

Table 5.4 - Descriptors of the Significance of Effect Categories

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

5.7 MITIGATION AND RESIDUAL EFFECTS

5.7.1. The ES will evaluate the measures required to avoid, minimise or offset the significant adverse effects of the Proposed Scheme. As previously stated, this will include engagement with the designers throughout the design process. This process of iterative feedback will promote effective mitigation design and will help reduce significant environmental effects to a practicable minimum.

5.7.2. Where significant effects are identified as part of the EIA, mitigation measures will be proposed to avoid or reduce these effects. Where measures are integral to the design and the applicant has committed to their implementation, mitigation will be termed “embedded mitigation”.

5.7.3. Where significant effects remain after application of mitigation, they are termed residual effects. The significance of residual effects will be assessed within the ES.

6

AIR QUALITY

6 AIR QUALITY

6.1 INTRODUCTION

6.1.1. This chapter of the PEIR provides preliminary information as it relates to the Proposed Scheme to date and to data currently available and gathered at this point of the assessment process.

6.1.2. The level of air pollution adjacent to roads and within urbanised areas is typically a function of vehicle emissions. Emissions of nitrogen oxides (NO_x, including nitrogen dioxide, NO_2) and particulate matter (PM_{10} and $PM_{2.5}$)[32] from vehicles are of greatest concern with respect to human health. Concentrations of these pollutants are subject to air quality standards, established by UK legislation[33] for the protection of human health.

6.1.3. There is the potential for impacts to regional emissions, including those of NO_x, PM_{10} and carbon dioxide (CO_2), as a result of changes to vehicle flow characteristics across the roads affected by the Proposed Scheme.

6.1.4. The air quality impact assessment will also consider potential air quality impacts associated with emissions relating to the construction phase of the Proposed Scheme, with a focus on construction dust emissions. Where applicable, this chapter outlines the appropriate mitigation measures that are required to negate and/or minimise potentially significant air quality effects.

6.1.5. It is supported by Figure 6.1 to 6.3 and Appendices 6A to 6B.

STUDY AREAS

6.1.6. The study area for the assessment of construction phase dust emissions and associated potential local air quality impacts (the Construction Study Area) is defined by the location of sensitive receptors identified within 350m of the Proposed Scheme Boundary as specified in step one of the guidance on the assessment of dust from demolition and construction from the Institute of Air Quality Management (IAQM)[34], as shown in Figure 6.1. Included in the redline boundary is large vessel waiting facility has been designated for vessels to wait in should the bridge be closed in an emergency or inoperable, when further information on the design is available the waiting facility will be considered in an updated construction assessment to be presented within the ES.

6.1.7. The local air quality assessment study area is dependent on traffic data and is yet to be defined. The study area will encompass sensitive receptors identified within 200m of roads that will be affected by the implementation of the Proposed Scheme (the Operational Study Area), with reference to the criteria given by the Design Manual for Roads and Bridges (DMRB, HA207/07)[35]. The assessment will focus on predicted changes in concentrations of NO_2, PM_{10} and $PM_{2.5}$ at those receptor locations that are immediately adjacent to the affected road network and junctions included in the study area, where the effects of changes in vehicle emissions associated with the Proposed Scheme would likely be highest.

6.1.8. The final selection of sensitive receptors to be included in the Operational Study Area will be determined once the affected road network is known. This will be confirmed within the ES. However, based on the traffic model network identified by the Proposed Scheme Transport Planner, Figure 6.2 presents the property locations that are considered to represent receptors most susceptible to changes in vehicle emissions. Further information on the definition of an affected road is given in Paragraph 6.3.18.

[32] PM_{10} assessed as the fraction of airborne particles of mean aerodynamic diameter less than 10 micrometres. $PM_{2.5}$ assessed as the fraction of airborne particles with an aerodynamic diameter less than 2.5 micrometres.
[33] HMSO, 2010, Air Quality Standards Regulations 2016.
[34] Institute of Air Quality Management (IAQM) (2014) Assessment of Dust from Construction and Demolition, IAQM
[35] Highways Agency (2007) Design Manual for Roads and Bridges HA 207/07, Volume 11, Section 3, Part 1 Air Quality

6.1.9. The regional emissions assessment study area will include affected roads as defined by the criteria given in the Design Manual for Roads and Bridges (DMRB, HA207/07)[35]. The assessment will consider the changes in emissions of NO_x, PM_{10}, $PM_{2.5}$ and CO_2 as a result of operation of the Proposed Scheme. Further information on the criteria defining affected roads for regional assessment is given in Paragraph 6.3.30.

LIMITATIONS

6.1.10. The information contained herein is intended to inform consultation responses at this stage. A more detailed assessment of likely significant impacts as a result of the Proposed Scheme on identified sensitive receptors will be undertaken at subsequent stages to inform the ES.

6.1.11. Any gaps in information identified at this PEIR stage will be considered and addressed along with specific mitigation measures as part of the assessments for production of the ES.

6.2 DIRECTIVES, STATUTES AND RELEVANT POLICIES

6.2.1. The following Directives and Regulations have informed the conduct of the assessments.

DIRECTIVES

European Ambient Air Quality Directive 2008

6.2.2. The 2008 Ambient Air Quality Directive (2008/50/EC as amended by Directive 2015/1480/EC))[36] is the primary driver for managing and improving air quality for each member state of the EU. The Directive sets legally binding limit values for concentrations in ambient (outdoor) air of pollutants that can impact public health, including NO_2 and particulates (PM_{10} & $PM_{2.5}$).

6.2.3. EU limit values are set for individual pollutants and comprise a concentration value, an averaging time over which it is to be measured, the number of allowed exceedances per year (if any), and a date by which it must be achieved. Some pollutants (e.g. PM_{10}) have more than one limit value covering different averaging times.

LEGISLATION

Air Quality Standards Regulations (England)

6.2.4. In relation to England the 2008 Directive was transposed into domestic law by the Air Quality Standards Regulations 2010, as amended in 2016.

6.2.5. The responsibility for meeting the prescribed air quality limit values is devolved to the national administrations. In England, the SoS for Environment, Food, and Rural Affairs has responsibility for adhering to the limit values, whilst the Department for Environment, Food and Rural Affairs (Defra) co-ordinate the assessment of compliance with limit values and development of Air Quality Plans for the UK (last updated in 2017).

6.2.6. Under the 2017 Air Quality Plan[37], certain local authorities are required under the Environment Act to undertake feasibility studies to identify options to deliver compliance with EU limit values. Great Yarmouth Borough Council was not included in the list of authorities required to do this.

The Environmental Protection Act 1990

[36] The European Parliament and the Council of the European Union (2008). Ambient Air Quality Directive (2008/50/EEC)
[37] Air Quality Plan for Nitrogen Dioxide (NO^2) in the UK 2017. Policy Paper

6.2.7. The Environmental Protection Act (EPA) (Section 79, Chapter 43, Part III - Statutory Nuisance and Inspections), contains a definition of what constitutes a 'statutory nuisance' and places a duty on Local Authorities to detect any such nuisances within their area. Dust, steam, odour, or other effluvia arising from construction works, together with smoke, fumes, and gasses emitted from premises could amount to a statutory nuisance if 'prejudicial to health or a nuisance'.

POLICY AND GUIDANCE

National Policy Statement for National Networks

6.2.8. NPS NN provides planning guidance for promotors of nationally significant infrastructure projects on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the SoS.

6.2.9. The NPS NN Chapter 5, Generic Impacts, Air Quality states the requirement for an Environmental Statement (ES) where "*the impacts of the project (both on and off-scheme) are likely to have significant air quality effects in relation to meeting EIA requirements and / or affect the UKs ability to comply with the Air Quality Directive, the applicant should undertake an assessment of the impacts of the proposed project as part of the environmental statement.'* The ES should describe;

- *'existing air quality levels';*
- *'forecasts of air quality at the time of opening, assuming that the Proposed Scheme is not built (the future baseline) and taking account of the impact of the Proposed Scheme'; and*
- *'any significant air quality effects, their mitigation and any residual effects, distinguishing between the construction and operation stages and taking account of the impact of road traffic generated by the project'.*

6.2.10. The applicant's assessment should be consistent with Defra's published future national projections of air quality based upon evidence of future emissions, traffic and vehicle fleet.

6.2.11. In addition to information on the likely significant effects of a project in relation to EIA, the SoS must be provided with a judgement on the risk as to whether the project would affect the UK's ability to comply with *the EU Ambient Air Quality Directive*[36]. This will be included in the ES.

National Policy Statement for Ports

6.2.12. The Ports NPS requires applicants to consider the effects of a project during both the construction and operational phases upon air quality taking into account the existing air quality levels.

Local Air Quality Management

6.2.13. Under Part IV of the Environment Act 1995[38], the UK Government and the devolved administrations are required to prepare and publish a national Air Quality Strategy. The most recent version of the Strategy was published in 2007[39] and establishes the UK's air quality standards and objectives, in addition to providing guidance, where needed, on air quality action planning at national, regional and local scales.

6.2.14. Air quality standards are concentrations recorded over a given averaging period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutants on health and the

[38] HMSO (1995) Environment Act 1995

[39] Department for Environment, Food and Rural Affairs (Defra) (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, London: HMSO

environment. An objective is the target date on which exceedances of a standard must not exceed a prescribed number.

6.2.15. Local authorities in England are required to review air quality within their jurisdiction, under *Part IV of the Environment Act 1995*, and designate air quality management areas (AQMAs) where air quality standards or objectives are not being met (or will not be within a specified period). Local authorities are then required to prepare assessments and action plans, and the SoS has default powers.

Relevant UK Air Quality Objectives and EU Limit Values

6.2.16. The national air quality objectives and European Directive limit values that the UK must comply with, specifically for traffic-related pollutants NO_2, PM_{10}, and $PM_{2.5}$, are presented in Table 6.1 - National (England) air quality objectives and European Directive limit values. The respective UK objective and EU limit value concentration standards and averaging periods are numerically identical for each pollutant, based on air quality standards set for the protection of human health. For NO_x, the objective and limit value is set for the protection of ecosystems and vegetation.

Table 6.1 - National (England) air quality objectives and European Directive limit values

Pollutant	Objective/ Limit Value Concentration	Concentration Measured As	Date to be achieved by:	
			UK Air Quality Strategy Objective	EU Ambient Air Quality Directive
Nitrogen Dioxide (NO2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005	01.01.2010
	40 µg/m^3	Annual mean	31.12.2005	01.01.2010
Particulate Matter (PM10)	40 µg/m^3	Annual mean	31.12.2004	01.01.2005
	50 µg/m3 not to be exceeded more than 35 times a year	24-hour mean	31.12.2004	01.01.2005
Particulate Matter (PM2.5)	25 µg/m^3	Annual mean	2020	01.01.2015
Nitrogen oxides (NOx)*	30 µg/m^3	Annual mean	31.12.2000	19.07.2001
*For the protection of ecosystems and vegetation				

United Nations Economic Commission for Europe Critical Loads

6.2.17. The United Nations Economic Commission for Europe (UNECE) defines the critical load for nitrogen deposition as "*a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on sensitive elements of the environment do not occur according to present knowledge*"[40].

6.2.18. The UNECE provides critical load values for nutrient nitrogen deposition as a range based upon the habitat type, the critical load is used as a component of the assessment to identify the ecological impacts of the Proposed Scheme.

Guidance Informing Assessment of the Significance of the Proposed Scheme upon Local Air Quality

6.2.19. The following guidance documents set out the circumstances of when an assessment may be required providing details of the information required to undertake such an assessment and the steps required to assess the significance of a scheme upon Local Air Quality. Where relevant the criteria provided in the following guidance will be applied to the ES.

- Design Manual for Roads and Bridges (DMRB) HA207/07 Air Quality[41]
- Institute of Air Quality Management (IAQM) Land Use Planning and Development Control Planning for Air Quality (2017)[42].

Risk Assessment related to Compliance with the EU Directive on Ambient Air Quality

6.2.20. Highways England IAN 175/13[43] provides advice on conducting risk assessment related to compliance with the EU Directive on ambient air quality. The IAN is withdrawn pending the issue of new guidance; however, the compliance risk assessment for the Proposed Scheme will be conducted following the methodology of IAN 175/13 in the absence of updated guidance.

6.3 ASSESSMENT METHODOLOGY

6.3.1. The PEIR assessment considers the available data at the time of writing, information on the baseline air quality and scheme specific air quality monitoring data within the area covered by the traffic modelling for environmental disciplines are presented. The policy and guidance appropriate to the assessment of the impact of the scheme upon local and regional air quality is discussed and a preliminary assessment of construction phase dust emissions and the associated potential local air quality impacts based upon the construction and demolition information currently available is presented in detail in Appendix 6A; this assessment will be updated within the ES. The approach to be the Operational Air Quality Assessment is discussed; the Operational Air Quality Assessment, Regional Air Quality Assessment and assessment of implications for compliance with the EU Ambient Air Quality Directive as a result of the operation of the scheme will be presented in the ES.

[40] Atmospheric Pollutant Information System (APIS) http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm#_Toc279788050 as accessed 25/05/18
[41] Highways Agency 2007. Design Manual for Roads and Bridges Volume 11, Section 3, Part 1 Air Quality
[42] Institute of Air Quality Management 2015. Guidance on land-use planning and development control: Planning for Air Quality.
[43] Highways Agency 2013. Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for user of DMRB Volume 11, Section 3, Part 1 'Air Quality'.

BASELINE ENVIRONMENT

6.3.1. The 2017 Air Quality Annual Status Report (ASR)[44] published by Great Yarmouth Borough Council was reviewed to establish baseline air quality conditions within the likely Operational Study Area based upon the area that has been included in traffic modelling, the Operational Study Area will be defined in the ES. The ASR provides the annual mean NO_2 monitored levels at a number of monitoring sites relevant to the Proposed Scheme location. In addition, a scheme specific baseline NO_2 monitoring survey was completed between August 2017 and January 2018 to inform the review of existing conditions.

6.3.2. Background air pollutant concentrations corresponding to the 1 km^2 grid squares covering the Operational Study Area were obtained from Defra's published national pollutant mapping data[45]. Background concentrations for 2018 and 2023 were obtained to represent current and future baseline air quality conditions within the assessment scenarios.

6.3.3. Ordnance Survey (OS) mapping and address layer data were used to identify potentially sensitive receptors in proximity to the Proposed Scheme and surrounding area.

CONSTRUCTION PHASE ASSESSMENT

6.3.4. The assessment of local air quality impacts due to the release of fugitive dust, including particulates, during the construction phase will be undertaken in accordance with the methodology detailed in the Institute of Air Quality Management (IAQM) guidance[34], with reference to DMRB HA207/07. Full details of the construction assessment methodology are provided in Appendix 6A.

6.3.5. In terms of emissions from construction vehicles on the local road network and associated traffic management measures, DMRB HA 207/07 states that these should be considered where construction is predicted to last for more than 6 months. The criteria provided by DMRB HA207/07 stipulates that further assessment of vehicle emissions is required where a change in vehicle flow volume of 1,000 annual average daily traffic (AADT) movements or more is expected, or the heavy-duty vehicle (HDV) flow will change by 200 AADT or more.

6.3.6. Specific information on traffic management measures, the exact location of construction site entrances, and the number of vehicle movement's related construction were not available at the time of assessment. The availability of this information will be revisited in the ES and, where applicable, this will be incorporated into the construction phase assessment.

6.3.7. The construction phase air quality assessment has therefore focussed on potential impacts associated with fugitive dust and particulate emissions from the following types of activity that will occur throughout the works:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (dust generating material which leaves the site via attachment to vehicle tyres).

6.3.8. Dust impacts associated with annoyance due to soiling will be assessed, in addition to potential human health effects due to an increase in exposure to PM_{10} and $PM_{2.5}$, and potential harm to identified ecological receptors. Factors including the scale and nature of the activity, in addition to the sensitivity of the area will be considered when assessing the risk of impacts which are determined prior to assigning mitigation measures.

[44] Great Yarmouth Borough Council (2017). 2017 Air Quality Annual Status Report (ASR).

[45] Defra (2017).UK Air Background Mapping data for local authorities, 2015 based background maps available at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015, as accessed 28/05/18.

6.3.9. The Construction Study Area has been defined by the location of sensitive receptors identified within 350m of the Proposed Scheme alignment; this being the worst case maximum distance from source to receptor for any construction activities that could be a source of dust emissions, as defined by the screening criteria within the IAQM guidance on the assessment of dust from demolition and construction.

6.3.10. The demolition element of the construction phase assessment will be prepared once the finalised extent of the existing structures to be removed is known. The volume of material being demolished and the nature of the material is key to making an assessment of the potential risk of dust emissions from demolition activities. The findings of the assessment will be incorporated as a component of *step two* of the assessment as detailed in Appendix 6A, paragraph 6.3.7. Based upon preliminary information on demolition, a risk rating of *high* has been applied.

6.3.11. The outcomes of the construction phase assessment are used to define appropriate mitigation measures that should be implemented through the full Construction Environmental Management Plan (CEMP), which the contractor will be required to work to and will be commensurate to the scale and duration of the activities. The potential for significant effects with respect to both fugitive dust and exhaust emissions will be assessed with the assumption that the recommended mitigation measures are in place during construction.

Significance Criteria

6.3.12. The significance of any dust emissions from the construction of the Proposed Scheme is assessed in accordance with guidance provided by the IAQM.

6.3.13. Step four of the IAQM guidance states that *"…For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation."*

6.3.14. The outcomes of the construction dust assessment are used to define appropriate mitigation measures to reduce the possibility of adverse effects from the construction phase of the project and, as such, does not identify specific assessment significance criteria.

6.3.15. The IAQM guidance states that *"in the context of construction impacts any effect will usually be adverse, however professional judgement is required to determine whether this adverse effect is significant based on the evidence presented" and that "it is anticipated that with the implementation of effective site-specific mitigation measures the environmental effect will not be significant in most cases".*

OPERATION PHASE ASSESSMENT

6.3.16. The assessment of local air quality and regional emissions impacts associated with operation of the Proposed Scheme will be informed by the approaches detailed in DMRB HA207/07[35] and relevant Highways England Interim Advice Notes (IAN's) with reference to respective Defra air quality technical guidance[46] and IAQM guidance.

Local Air Quality Assessment

6.3.17. The local air quality assessment will focus on the following scenarios, for which traffic data will be provided to facilitate atmospheric dispersion modelling of vehicle emissions:

- Base year (2018)
- Opening year (2023) without Proposed Scheme (Do Minimum); and
- Opening year (2023) with Proposed Scheme (Do Something).

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

6.3.18. Screening of the Do Minimum and Do Something traffic data will be completed to identify affected road links that adhere to the following criteria as provided by DMRB HA207/07[35]:

- Road alignment will change by 5 m or more; or
- Daily traffic flows will change by 1,000 AADT or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more.

6.3.19. Based on the advice of the project Transport Planning consultant on the likely traffic flow changes as a result of the Proposed Scheme and the changes in road alignment proposed as part of the Proposed Scheme design, a detailed assessment of local air quality is warranted, with reference to the respective DMRB traffic screening criteria.

6.3.20. Emissions inventory databases for each pollutant (NO_x, PM_{10}, $PM_{2.5}$) will be developed for all three of the above scenarios using Defra's latest emission factor toolkit[47] (currently EFT v8.0.1), which accounts for vehicle flow characteristics, such as:

- Link flow volumes as annual average daily traffic (AADT);
- Link average speed (km/hr);
- Vehicle breakdown (e.g. percentage HDVs); and
- Link length.

6.3.21. Each scenario emissions database will be entered to an atmospheric dispersion model (ADMS-Roads v4.1) to enable prediction of pollutant concentrations at the identified sensitive receptor locations. The modelling exercise will utilise hourly sequential meteorological data from the most representative observation site within proximity to the Proposed Scheme.

6.3.22. The base year dispersion model results will be verified with reference to Defra's technical air quality guidance[46]. Model verification requires analysis of model outputs versus monitored data for equivalent locations within the study area. Therefore, the results of a scheme-specific baseline air quality monitoring (see Paragraph 6.4.8) will be used facilitate verification.

Sensitive Receptor Identification

6.3.23. There is the potential for vehicle emissions to impact local concentrations of air pollutants at sensitive receptors situated within the likely Operational Study Area. The finalised Operational Study Area, based upon the screening of traffic data, will be defined in the ES.

6.3.24. According to DMRB HA207/07[35], the influence of vehicle emissions on ambient air quality is negligible beyond 200m of the respective road source, predominantly due to horizontal and vertical atmospheric mixing. As such, a desk-based review of potentially sensitive receptors to air quality was undertaken using OS mapping to identify those located within 200m of the Proposed Scheme alignment and associated affected links.

6.3.25. Sensitive receptors as defined in the Design Manual for Roads and Bridges (DMRB) Section 11.3.1 (DMRB HA207/07[35]) include:

- Residential dwellings;

[47] Defra 2018. Emission Factors Toolkit available at https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

- Designated ecological sites;
- Locations of the young and elderly;
- Hospitals; and
- Schools.

6.3.26. The sensitive receptors most susceptible to changes in air quality as a result of the Proposed Scheme are likely to be those situated closest to the identified affected roads within the study area.

6.3.27. Designated ecological sites (Ramsar, SPAs, SACs or SSSIs) will be assessed with reference to the DMRB HA207/07[35] Annex F, which provides the relevant assessment procedure.

Significance Criteria

6.3.28. The results of the local air quality impact assessment will be evaluated with reference to IAQM Guidance. This Guidance describes the magnitude of incremental concentration change (Do Minimum versus Do Something) at each individual sensitive receptor as a proportion of a relevant Air Quality Assessment Level (AQAL). In this assessment, the AQALs are the annual mean NO_2, PM_{10} and $PM_{2.5}$ objectives. The incremental change at each receptor is examined in the context of the total predicted annual mean concentration and its relationship with the AQAL. This allows an impact descriptor to be assigned to each receptor, with the overall significance of the effects of any impacts assigned by professional judgement.

Regional Emissions Assessment

6.3.29. The regional emissions assessment will focus on total annual mass emissions of NO_x, PM_{10}, $PM_{2.5}$, and carbon dioxide (CO_2) associated with the aforementioned opening-year scenarios, in addition to:

- Design year (2038) without the Proposed Scheme (Do Minimum); and
- Design year (2038) with the Proposed Scheme Do Something).

6.3.30. Screening of the Do Minimum and Do Something traffic data was undertaken to identify affected road links that adhere to the following criteria as provided by DMRB HA207/07[35]:

- A change of more than 10% in AADT; or
- A change of more than 10% to the number of heavy duty vehicles; or
- A change in daily average speed of more than 20 km/hr.

6.3.31. Traffic data for the identified affected road links in each scenario will be entered to Defra's EFT v8, enabling the calculation of total annual mass emissions of the respective vehicle exhaust species. This will allow the magnitude of change of total mass emissions associated with the operation of the Proposed Scheme to be predicted.

6.3.32. There are no relevant published significance criteria in relation to regional emissions assessments and DMRB HA207/07[35] acknowledges that changes in regional emissions associated with road schemes such as the Proposed Scheme are expected to be small within the context of national emissions. However, regional and national emissions data published by the National Atmospheric Emissions Inventory (NAEI) will be utilised to provide context to the predicted change in emissions during the operational phase of the Proposed Scheme.

Assessing Implications for UK Compliance with the EU Ambient Air Quality Directive

6.3.33. The Defra Pollution Climate Mapping (PCM) model is used to fulfil the UK's requirements to report on the concentrations of particular pollutants in the atmosphere to the EU. The PCM model contains key road sources across the UK for which projected representative roadside pollutant concentrations are published. Highways England Interim Advice Note IAN 175/13[43] provides guidance on how to assess the risk from a road development upon compliance with the EU Directive on Ambient Air Quality and Clean Air for Europe (2008/50/EC). IAN

175/13 has a status of 'withdrawn' pending an update, however, in the absence of updated or an alternative guidance, it is still considered appropriate to apply it to the assessment to be presented in the ES.

6.4 BASELINE ENVIRONMENT

LOCAL AIR QUALITY MANAGEMENT REVIEW

6.4.1. A review of the latest LAQM report published by GYBC[48] confirms that there are no Air Quality Management Area (AQMAs) declared within the District and with no requirement for GYBC to progress to a detailed assessment of air quality for any pollutant.

LOCAL AIR QUALITY MONITORING

6.4.2. GYBC operated an automatic continuous air quality monitor at Gorleston to monitor levels of NO_2 and PM_{10} within Great Yarmouth until it was decommissioned in 2016. A continuous monitor was subsequently installed at South Denes and is now operational, measuring concentrations of NO_2, PM_{10} and $PM_{2.5}$. The Gorleston continuous monitor was situated to the south of the Proposed Scheme to the west of the River Yare close to Malthouse Lane approximately 410 m to the south west of the Proposed Scheme. The new South Denes monitor is situated to the east of the River Yare close to Fenner Road, approximately 570 m to the south east of the Proposed Scheme.

6.4.3. The annual mean PM_{10} and NO_2 concentrations at these locations, as presented in Table 6.2 - Local Authority PM10 Automatic Monitoring Results and Table 6.3 - Local Authority NO2 Automatic Monitoring Results below, demonstrate that there have not been any exceedances of the respective air quality objective's (40 µg/m^3) for the period reviewed (2012-2016).

Table 6.2 - Local Authority PM10 Automatic Monitoring Results

Site ID	Monitoring Type	Monitoring Site	X,Y	PM_{10} Annual Mean Concentration (µg/m^3)				
				2012	2013	2014	2015	2016
CM1 Gorleston	Automatic	Urban Background	652498,305600	19.9*	20.7*	16.6*	16.8*	15.5*
CM2 South Denes	Automatic	Urban Background	652983,305664	Monitoring started December 2017, the average hourly measurement to date is 25.5 µg/m^3				
Annual mean objective				**40**				

*Values represent annualised concentrations derived by GYBC as per Technical Guidance LAQM.TG16.

Table 6.3 - Local Authority NO_2 Automatic Monitoring Results

Site ID	Monitoring Type	Monitoring Site	X,Y	NO_2 Annual Mean Concentration (µg/m^3)				
				2012	2013	2014	2015	2016
CM1 Gorleston	Automatic	Urban Background	652498,305600	18.8*	18.2*	17.1*	16.8*	14.5*
CM2 South Denes	Automatic	Urban Background	652983,305664	Monitoring started December 2017, the average hourly measurement to date is 13.9 µg/m^3				

[48] Great Yarmouth Borough Council 2017. Air Quality Updating and Screening Assessment

Annual mean objective	40
*Values represent annualised concentrations derived by GYBC as per Technical Guidance LAQM.TG16.	

6.4.4. GYBC also operates a network of 15 passive NO_2 diffusion tubes located across 12 monitoring sites, adjacent to roads that are likely to be affected by the Proposed Scheme, as detailed in Figure 6.3.

6.4.5. The annual mean NO_2 concentrations at these locations, as presented in Table 6.4 - Local Authority NO2 Diffusion Tube Monitoring Results below, demonstrate that there have not been any exceedances of the respective air quality objective (40 µg/m^3) for the period reviewed (2012-2016).

6.4.6. The maximum monitored annual mean concentrations recorded in 2016 were 33.2 µg/m^3 at a site located adjacent to Bridge Road located to the west of the existing bascule bridge over the River Yare and 33.7 µg/m^3 at a site located adjacent to South Quay on the approach to the existing Haven bridge.

Table 6.4 - Local Authority NO_2 Diffusion Tube Monitoring Results

Site ID	Site Type	X,Y	NO_2 Annual Mean Concentration (µg/m^3)				
			2012	2013	2014	2015	2016
DT1	Roadside	652053,308188	25.8	22.1	22.0	21.9	21.1
DT2	Roadside	652079,307828	24.8	24.0	24.1	22.5	21.2
DT3a	Roadside	652104,307665	25.6	25.4	26.9	25.4	24.4
DT3b	Roadside	652104,307665	27.7	N/A	N/A	N/A	N/A
DT5	Roadside	652092,307419	38.8	37.5	37.8	37.4	33.2
DT6	Roadside	652520,306862	25.1	25.3	23.5	23.8	22.9
DT7	Roadside	652569,306537	26.4	25.8	25.6	24.4	22.2
DT4	Roadside	652611,306223	23.8	20.8	22.9	20.9	20.3
DT8a	Urban Background	652492,305612	18.5	18.2	17.8	16.0	17.7
DT8b	Urban Background	652492,305612	18.3	14.3	16.9	16.3	17.7
DT8c	Urban Background	652492,305612	17.8	17.2	15.4	15.7	17.1
DT9	Roadside	652066,307874	20.0	20.2	18.7	19.9	18.5
DT10	Roadside	652326,307376	33.2	34.0	30.6	32.8	33.7
DT11	Roadside	652490,307174	28.8	N/A	N/A	31.6	27.4
DT12	Roadside	651993,307370	N/A	N/A	N/A	N/A	24.9
Annual mean objective			**40**				
2017 monitoring data has been provided by GYBC and will be included in the ES							

SCHEME SPECIFIC MONITORING

6.4.7. Monitoring for NO_2 has been undertaken at a number of locations in Great Yarmouth, as shown in Figure 6.3, which were sited specifically in relation to the Proposed Scheme. The monitoring locations were agreed with GYBC and the survey commenced in August 2017 and continued until January 2018. The annualised mean monitoring data collected are summarised in Table 6.5 - Summary of Scheme Specific NO2 Diffusion Tube Monitoring.

6.4.8. All monitored values are well below the respective annual mean NO_2 objective, with the highest concentrations observed along Nottingham Way and St Peters Road (WSP12 and WSP7), a route running between Marine Parade and South Quay, which is one of the approach roads to the existing crossing over the River Yare.

Table 6.5 - Summary of Scheme Specific NO_2 Diffusion Tube Monitoring

Site	Location Description	X	Y	Annualised mean NO_2 Concentration for 2017 ($\mu g/m^3$)*
WSP1	Runham Rd	651935	308536	26.6
WSP2	School Rd	651964	308314	23.8
WSP3	Northgate Street	652340	308077	23.9
WSP4	Priory Gardens	652491	307941	20.3
WSP5	Nelson Rd/ N Jury St	652842	307991	25.7
WSP6	Nelson Rd/ N Trafalgar St	652850	307378	26.4
WSP7	Nelson Rd N/ St Peters Rd	652873	307074	30.8
WSP8	Queens Rd	652756	306572	22.3
WSP9	Admiralty Rd	652769	306047	21.3
WSP10	Sutton Rd	652658	306040	23.2
WSP11	Southgates Rd	652611	306229	22.2
WSP12	S Quay Nottingham Way	652468	307090	32.8
WSP13	Yarmouth Way	652459	307304	28.5
WSP14	Stonecutters Way	652178	307619	25.7
WSP15	Greyfriars Way	652371	307422	27.9
WSP16	Trafalgar College	651732	306714	26.2
WSP17	Gaton Hall Rd	651531	306309	22.2
WSP18	Vincent Close	651517	307179	23.2
WSP19	Mill Rd	651627	307643	14.5
WSP20	Bridge Rd	652016	307412	22.4
WSP21	Southtown Rd	652042	307298	18.4
WSP22	Station Rd	651865	306968	18.7
WSP23	Southtown Rd 2	652231	306856	23.6
WSP24	Boundary Rd	652373	306231	24.1
WSP25	Cromwell Rd	652386	306036	24.5
WSP26	Queen Anne's Rd	652360	305868	19.6
WSP27	Queen Anne's Rd 2	652166	305970	22.4
WSP28	Southtown Rd 3	652408	305818	29.4
WSP29	Manby Rd	652404	305357	21.8
WSP30	Burgh Rd	652309	305188	21.6
WSP31	Alpha Rd	652396	305674	18.7
WSP32	A143	652071	304949	29.8
WSP33	Plane Rd	651959	304891	16.2

Site	Location Description	X	Y	Annualised mean NO_2 Concentration for 2017 ($\mu g/m^3$)*
WSP34	Lynn Grove	651514	304700	18.1
WSP35	Beccles Rd	651224	304384	19.6
WSP36	Baliol Rd	652306	304368	12.1
WSP37	Middleton Rd	652270	303862	18.2
WSP38	Brasenose Avenue	652278	302742	21.7
WSP39	Horsley Drive	651967	301967	10.7
WSP40	Cormorant Rd	650866	305188	15.4
WSP41	Norwich Lakenfields Colocation	623681	307013	13.1
Annual mean objective				40
*Concentrations have been bias adjusted and annualised based on data retrieved for 5 months of monitoring. The 6th month of monitoring data was not analysed due to sample loss in transit to the laboratory.				

6.4.9. Scheme-specific monitoring of PM_{10} and $PM_{2.5}$ was not undertaken as the monitoring data published by GYBC (see Table 6.2 and Table 6.3) for years 2012-2016 demonstrated that urban background levels of PM_{10} have remained consistently well below the respective annual mean objective. GYBC has recently commissioned a new continuous air quality monitoring station at South Denes, which will provide additional measurements for PM_{10} and $PM_{2.5}$, the data from which could be incorporated into the model verification procedure for local air quality assessment.

BACKGROUND POLLUTANT CONCENTRATIONS

6.4.10. Defra publishes modelled background air pollutant data for the UK, based on a 1 km^2 grid[49], which accounts for a multitude of local emissions sources including road vehicles, industrial installations, domestic heating and other transport modes, in addition to regional sources and imported emissions. The modelled background data are available for year's 2015 to 2030 inclusive.

6.4.11. Existing operations at the Peel Ports (PP) Port of Great Yarmouth generate funnel emissions and dust. The funnel emissions are included within the Defra Local Air Quality Management (LAQM) background maps.

6.4.12. For the purposes of reviewing the existing background and predicted future background levels, the maximum, minimum and average annual mean concentrations of each pollutant (NO_2, PM_{10}, $PM_{2.5}$) based on the 1 km^2 grids encompassing the Proposed Scheme and surrounding area are presented in Table 6.6.

[49] Defra Background Mapping, UK Air available at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015 as viewed on 29/05/18

Table 6.6 - Defra Mapped Background Annual Mean Concentrations for Each Pollutant in Base (2018) and Opening (2023) Years

Pollutant	2018 Background Concentration (µg/m^3)			2023 Background Concentration (µg/m^3)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
NO_2	15.2	7.2	9.1	13.0	6.2	7.9
NO_X	21.2	9.4	12.1	17.9	8.1	10.4
PM_{10}	18.6	10.4	13.4	18.2	10.1	13.1
$PM_{2.5}$	14.1	7.1	9.0	13.7	6.8	8.7

6.4.13. The predicted current and future background concentrations presented in Table 6.6 are well below the respective health –based annual mean objective concentrations for NO_2 (40 µg/m^3), PM_{10} (40 µg/m^3), and $PM_{2.5}$ (25 µg/m^3). Similarly, the annual mean NO_x EU limit value (30 µg/m^3), set for the protection of vegetation and ecosystems, is not predicted to be exceeded.

POLLUTION CLIMATE MAPPING

6.4.14. A number of Defra PCM links are likely to overlap the identified affected road network considered within the local air quality assessment including the following roads classified as PCM links;

- A1243;
- A47 (including either side of the existing crossing over the River Yare);
- A143;
- Pasteur Road (to the west of the existing crossing over the River Yare);
- Acle New Road;
- North Quay;
- Lawn Avenue and
- Caister Road.

6.4.15. Once the identified Operational Study Area to be presented in the ES is confirmed through the screening of traffic data for the local air quality assessment, the extent of PCM links to be included in the compliance assessment, as detailed in Paragraph 6.2.20, can be identified and reported in the ES.

POTENTIALLY SENSITIVE RECEPTORS (LOCAL AIR QUALITY ASSESSMENT)

The local air quality assessment will likely include the receptor locations that are considered to be most susceptible to changes in vehicle emissions as a result of the operational scheme. At this stage, in the absence of a defined Operational Study Area, indicative numbers of potentially sensitive receptors based upon a review of properties located within 50m of the likely affected road links are outlined in Table 6.7. The approach of modelling the most sensitive and worst-case receptor locations has been agreed with GYBC Environmental Health[50].

[50] Telephone conversation between WSP Senior Air Quality Consultant and GYBC Environmental Health Officer on 22/06/18.

6.4.16. In terms of ecologically sensitive receptors, the Outer Thames Estuary Special Protection Area (SPA) includes the River Yare area within which the Proposed Scheme will be located. Natural England will be consulted on the most appropriate level of assessment for the Outer Thames Estuary SPA regarding changes in air quality and the sensitivity of the site to changes in nitrogen deposition. The SPA is designated for the conservation of foraging areas for wild birds.

6.4.17. The Breydon Water Site of Special Scientific Interest (SSSI), SPA, and RAMSAR are situated adjacent to the A47, which could be identified as a potentially affected road. Similarly, the Great Yarmouth North Denes SSSI and SPA are situated adjacent to North Drive, which could form potentially affected road links. This will be reviewed in the ES once the Operational Study Area is confirmed and, if appropriate, both sites will be included in the ecological assessment for air quality impacts.

Table 6.7 - Identified Potentially Sensitive Receptor Locations

Receptor Type	Count
Residential (within 50m)	16,975*
Designated ecological sites (within 200m)**	6
Education (within 200m)	39
Health care (Hospitals, Residential Care Homes etc.) (within 200m)	102

* The final number of sensitive receptors to be included in the local air quality assessment will be confirmed once the Operational Study Area has been identified.
**As defined by HA207/07 (SACs, SCI's, cSCIs, SPAs, SSSI's and Ramsar sites).

6.5 PREDICTED EFFECTS

CONSTRUCTION PHASE ASSESSMENT: DUST EFFECTS

6.5.1. Construction works have the potential to generate fugitive dust emissions during earthworks and construction activities, as well as from the trackout of dust and dirt by vehicles onto public highways. Dust emissions can cause annoyance through soiling of buildings and surfaces and/or adversely impact human health.

6.5.2. Potential construction phase air quality impacts assessed in this section are considered prior to the application of site-specific mitigation measures. However, the contractor for the Proposed Scheme will be required to implement mitigation measures within the full CEMP, which will include the measures as outlined in Section 6.6.

6.5.3. Major construction activities that are likely to be required during construction of the Proposed Scheme include, but may not be limited to, the following:

- Demolition;
- Site clearance;
- Topsoil strip;
- Excavation;
- Landscaping;
- Material import/export;
- Temporary stockpile of resources;
- Construction of compounds and access points; and
- Construction of road/bridge and footpath.

6.5.4. The main potential air quality impacts that may arise from the aforementioned activities are;

- Dust deposition, resulting in the soiling of surfaces and water (chapter 11);
- Dust plumes, affecting visibility and amenity; and
- Elevated ambient PM_{10} concentrations due to fugitive dust releases.

6.5.5. The potential for sensitive receptors to be affected is dependent on the scale and locations of the dust generating activities, the nature of the activity, and local meteorological conditions.

6.5.6. There are existing sensitive receptors located within 350m of the Proposed Scheme Boundary and approach roads, where the aforementioned activities could occur. The nearest sensitive residential receptors are located within <20m of the current Proposed Scheme boundary.

6.5.7. Distance bandings contained within Table 3, Table 4 and Table 5 of Appendix 6A were analysed based on the redline boundary (Figure 6.1). The number and location of existing 'human' receptors from the Proposed Scheme boundary are detailed in Table 6.8 - Receptor Count within 350m of Earthworks and Construction Activities.

Table 6.8 - Receptor Count within 350m of Earthworks and Construction Activities

Distance Bandings				
Distance from construction boundary (m)	**Sensitive Receptor Count**			
	Residential	**Educational**	**Medical**	**Total**
<20	149*	1	0	132
20-50	185	2	0	187
50-100	457	0	1	458
100-200	1602	1	7	1610
200-350	2635	5	4	2644
*Count excludes 20 residential properties to be demolished as part of the proposed scheme.				

6.5.8. There is one statutory designated ecological site within 50m of the Proposed Scheme boundary, the Outer Thames Estuary SPA, which includes the River Yare. This site will be considered as part of the construction phase dust assessment completed the ES, given that the approach to assessing potential impacts at the SPA will be subject to the outcomes of a consultation with Natural England.

6.5.9. The Port of Great Yarmouth is situated close to the Proposed Scheme boundary, and there is the potential for operations at the Port to be adversely affected by construction dust. Therefore, when considering appropriate mitigation, the operations at the Port should be accounted for as being potentially sensitive to construction dust.

6.5.10. The highest risk receptors are those that are located downwind of potential dust-generating construction activities. A wind rose derived from 2016 data recorded at the coastal Weybourne meteorological station, which is situated 56 km to the northeast of the Proposed Scheme, demonstrates a prevailing south-westerly wind. Therefore, those receptors located within 50m to the northeast and east of the aforementioned construction activities are more likely to be affected by fugitive dust releases. As the precise location of dust generating activities within the construction site is not known at this stage, a conservative approach is taken assuming that these activities could be occurring up to the Application Site boundary. A wind rose showing the recorded data is presented in Appendix 6B.

6.5.11. The effects of construction dust generated during dry conditions could lead to annoyance through dust deposition and also localised increases in PM_{10} concentrations with the potential to adversely affect human health. The urban background annual mean PM_{10} concentration for the study area –from the Gorleston automatic monitoring station is 15.5 µg/m^3 (2016), which is well below the annual mean limit value of 40 µg/m^3. Therefore, it is unlikely that the short-term construction operations would cause the daily (50 µg/m^3) or annual

mean (40 µg/m^3) objectives to be either approached or exceeded at sensitive receptors near to the construction area.

6.5.12. The overall risk of construction dust impacts occurring; namely annoyance due to soiling (deposition) and impacts to human health, in the absence of mitigation, is detailed in Appendix 6A and was undertaken with reference to the IAQM guidance document.

6.5.13. The risks of dust soiling and human health impacts caused by the Proposed Scheme construction activities were identified to be *medium to high* and mitigation would be required to minimise the risk of impact, as outlined in Section 6.6.

OPERATION PHASE ASSESSMENT

Local Air Quality Assessment

6.5.14. The Operational Study Area is yet to be defined, given that the Proposed Scheme traffic data is still under development. Once these data are available, the affected road network and associated sensitive receptor locations to be included in the local air quality assessment will be confirmed. This will facilitate a detailed atmospheric dispersion modelling study with reference to DMRB HA207/07[35] and associated technical guidance, thus enabling an assessment of likely significant effects on local air quality at identified sensitive receptors to be reported in the ES. The assessment will focus on changes to total annual mean concentrations of NO_2, PM_{10}, and $PM_{2.5}$.

6.5.15. The outcomes of the dispersion modelling study will also enable the assessment of air quality effects associated with ecologically sensitive receptors and the potential impact of the operational scheme on PCM compliance. Ecologically sensitive receptors will be considered in the Operational Study Area where situated within 200m of an affected road.

Regional Emissions Assessment

6.5.16. Similarly, the regional emissions study area will be defined once the traffic data are available. Once identified, the predicted change in total annual mass emissions of NO_x, PM_{10}, and CO_2 will be assessed and reported in the ES.

6.6 PROPOSED MITIGATION

CONSTRUCTION PHASE

6.6.1. In the absence of mitigation, construction of the Proposed Scheme is considered to represent a *medium* to *high* risk with respect to potential dust impacts at nearby sensitive receptors. As such, a number of mitigation measures are recommended, with reference to IAQM guidance, that are commensurate to the scale and nature of the proposed construction activities.

6.6.2. The mitigation measures focus on controlling fugitive releases of construction phase dust and will be implemented by the contractor through the full CEMP. Such measures include, but may not be limited to:

- Dust generating activities (e.g. cutting, grinding and sawing) will be minimised and weather conditions considered prior to conducting potentially dust emitting activities;
- Fine material will not be stockpiled to an excessive height in order to prevent exposure to wind and/or dust nuisance;
- Roads and accesses will be kept clean;
- Where possible, plant will be located away from site boundaries that are close to residential areas;

- Water will be used as a dust suppressant, where applicable;
- Drop heights from excavators to crushing plant will be kept to a minimum;
- Distances from crushing plant to stockpiles will be kept to the minimum practicable to control dust generation associated with the fall of materials;
- Skips will be securely covered;
- Soiling, seeding, planting or sealing of completed earthworks will be completed as soon as reasonably practicable following completion of earthworks;
- Dust suppression and the maintenance of the surface of access routes will be appropriate to avoid dust as far as practicable, taking into account the intended level of trafficking;
- Wheel wash facilities to minimise trackout of dust;
- Material will not be burnt on site; and
- Engines will be switched off when not in operation.

6.6.3. The interim CEMP will stipulate the following to ensure the aforementioned mitigation is implemented effectively, continually monitored and updated accordingly:

- Identification of a nominated Environmental Site Manager;
- Notification procedures where potentially significant dust generating activities are required;
- Method statements for the control of dust in such locations;
- Management procedures to ensure issues are addressed should they be raised by the public; and
- Dust monitoring equipment should be deployed in order to monitor the dust levels at the construction site.

6.6.4. The mitigation measures will reduce both the magnitude and duration of fugitive dust releases throughout the construction phase. With these measures in place, the residual dust impact will be, at worst, slight adverse at the highest risk receptors located downwind and within 50m of construction activities.

6.6.5. Any such impacts are expected to be intermittent and temporary for the duration of the respective activities and therefore would not constitute a significant environmental effect.

OPERATION PHASE

6.6.6. At this stage, an assessment of likely significance and the need for mitigation measures associated with the operation of the Proposed Scheme on local air quality cannot be made. This will be provided within the ES.

6.7 CONCLUSIONS AND EFFECTS

BASELINE

6.7.1. Air quality monitoring undertaken by GYBC and scheme-specific monitoring has demonstrated that NO_2 concentrations are greatest in the vicinity of the approaches to Haven Bridge in the town centre. However, there were no monitored exceedances of the annual mean objective for NO_2 throughout Great Yarmouth.

6.7.2. Background air quality in Great Yarmouth is good, with NO_2, PM_{10} and $PM_{2.5}$ annual mean background concentrations reported to be below the respective objective values.

6.7.3. There are no Air Quality Management Areas (AQMA) designated within Great Yarmouth.

CONSTRUCTION PHASE

6.7.4. The construction phase air quality assessment has demonstrated that, in the absence of mitigation, the scale and nature of the proposed works, excluding demolition, represent a *medium* to *high* risk of dust related impacts. The highest risk sensitive receptors are those located within 50m and downwind of potential dust-generating activities. The background PM_{10} concentrations are well below the annual mean objective concentration of 40 µg/m^3 for the protection of human health.

6.7.5. Appropriate mitigation measures are recommended, which will be implemented via the interim CEMP to prevent or minimise potential fugitive dust emissions. With these measures in place, the residual dust impact will be, at worst, slight adverse at the highest risk receptors.

6.7.6. Any such impacts are expected to be intermittent and temporary for the duration of the respective activities only and would not constitute a significant environmental effect.

OPERATIONAL PHASE

6.7.7. At this stage, an assessment of likely significance and the need for mitigation measures associated with the operation of the Proposed Scheme on local air quality cannot be made. This will be provided within the ES.

6.8 ASSESSMENTS STILL TO BE COMPLETED

6.8.1. The construction assessment described in this chapter will be updated in the ES to account for the latest information that is available with regard to proposed construction activities.

6.8.2. An operation phase assessment of local air quality and regional emissions, based upon finalised traffic data, will be completed following the approach outlined in Section 6.3. The findings of this will be presented in the ES.

7

ACOUSTICS

7 ACOUSTICS

7.1 INTRODUCTION

7.1.1. This chapter provides preliminary information with regard to noise and vibration as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process

7.1.2. With regard to noise and vibration impacts resulting from the Proposed Scheme, this chapter outlines the currently available information, including relevant policy and guidance, the assessment method and the baseline environment. The assessments still to be completed include the construction and operation phase quantified assessments. The scope of this chapter relates to human response to noise and vibration; impacts on ecological sensitive receptors are considered within the Chapter 8 Nature Conservation.

7.1.3. During the construction of the Proposed Scheme there will be temporary noise and vibration impacts caused by machinery and equipment. The construction assessment will be based on the guidance detailed in BS 5228-1[51] and BS 5228-2[52], further guidance being taken from applicable local and national guidance documents.

7.1.4. Once the Proposed Scheme is completed and open to traffic, the operational noise and vibration impacts will be experienced. The assessment will be based on the detailed methodology of the Design Manual for Roads and Bridges Volume 11 Section 3 Part 7 HD 213/11 Revision 1[53] (HD 213/11).

7.1.5. At this stage of the Proposed Scheme, where information for a detailed construction noise assessment is not yet available, the assessment has involved:

- Defining the assessment methodology;
- Description of likely construction activities;
- Identification of Noise Sensitive Receptors (NSR) close to the working area boundaries; and
- Description of BPM mitigation measures.

7.1.6. In addition, where information for a detailed construction vibration assessment is not yet available, the assessment has involved:

- Defining the assessment methodology;
- Identification of likely vibration generating activities;
- Identification of NSR close to the vibration working area boundaries; and
- Description of BPM mitigation measures.

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

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

[53] The Highways Agency, Scottish Government, Welsh Assembly Government and the Department for Regional Development Northern Ireland (2011), Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7, HD 213/11 revision 1. Noise and Vibration

7.1.7. Where information for an operational noise and vibration assessment is not yet available, the assessment has involved:

- Defining the assessment methodology; and
- Identification of NSR within a provisional Study Area.

7.1.8. This report is necessarily technical in nature, to assist the reader, a glossary of acoustic terminology is provided in Appendix 7A.

STUDY AREAS

7.1.9. A provisional Study Area for operational noise is a 1.6 km buffer around the Proposed Scheme and bypassed routes, as shown in Figure 7.1. It is not yet possible to define the operational phase Study Area in line with HD213/11[53], as this requires traffic data for the Proposed Scheme, which is not currently available.

7.1.10. A provisional Study Area for operational vibration is a 40m buffer around all roads within the provisional operational noise Study Area.

LIMITATIONS

7.1.11. This chapter of the PEIR provides preliminary information and is based on data currently available at this point of the assessment process.

7.1.12. The information is intended to inform consultation responses. A more detailed and quantified assessment of likely significant impacts will be completed and included in the ES.

7.1.13. Any gaps in information identified at this PEIR stage will be considered and addressed along with specific mitigation measures as part of the assessments for the production of the ES.

7.2 RELEVANT POLICES

7.2.1. The policies relevant to this assessment address the national priorities with regards to noise and vibration from developments and their impact on the human and natural environment. Their aim is to control the activities likely to lead to both temporary and permanent increases in noise and vibration and their associated environmental impacts.

7.2.2. National policy emphasises the need to avoid noise giving rise to impacts on health and quality of life as a result of the construction and operation of developments. It stresses the need to reduce noise at source and where this is not possible, highlights the need for measures to reduce noise levels between the source of the noise and the receptor.

NATIONAL POLICY

National Planning Policy Framework (2018) and the Noise Policy Statement for England (NPSE)[54]:

7.2.3. The guidance contained within these documents that is most relevant to the assessment of road traffic noise is contained within the Explanatory Note to the NPSE, which introduces the concept of noise ‘Effect Levels’ as follows:

[54] Department for Environment, Food and Rural Affairs (2010). Noise Policy for England (NPSE). [online] available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf (Accessed June 2018)

- NOEL - No Observed Effect Level - This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise;
- LOAEL - Lowest Observable Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected; and
- SOAEL - Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

7.2.4. None of these three levels are defined numerically in the NPSE, and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent a SOAEL for noise is acknowledged and the NPSE asserts that not stating specific SOAEL values provides policy flexibility in the period until further evidence and guidance is published.

National Planning Practice Guidance (PPG)[55]

7.2.5. The Government's web-based Planning Practice Guidance (PPG)55 includes a table which summarises the noise exposure hierarchy and offers examples of outcomes relevant to the NOEL, LOAEL and SOAEL effect levels described in the NPSE, the table is reproduced in

7.2.6. Table 7.1 - Noise Exposure Hierarchy. The term Unacceptable Adverse Effect (UAE) level is introduced which equates to noise perceived as "noticeable and very disruptive". The PPG states that UAEs should be prevented.

[55] Department for Communities and Local Government (2012). National Planning Policy Framework Planning Practice Guidance. [online] Available at https://www.gov.uk/government/collections/planning-practice-guidance Accessed June 2018

Table 7.1 - Noise Exposure Hierarchy

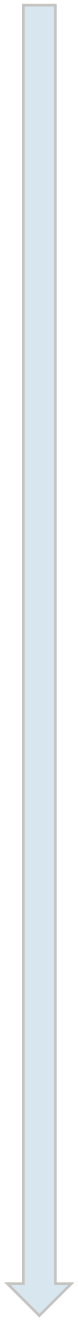
Perception	Examples of Outcomes	Increasing Effect Level	Action	Increasing Noise Level
Not noticeable	No Effect	No Observed Effect	No specific measures required	
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required	
Lowest Observed Adverse Effect Level				
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum	
Significant Observed Adverse Effect Level				
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid	
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent	

Table source: PPG Paragraph: 005

National Policy Statement for National Networks

7.2.7. The NPS NN provides planning guidance for promoters of nationally significant infrastructure projects on the road and rail networks. It states that developments must be undertaken in accordance with the statutory requirements for noise and that due regard must be given to the relevant sections of the NPSE and the updated National Planning Policy Framework (NPPF)[56].

7.2.8. The document also confirms that for most national network projects, the relevant Noise Insulation Regulations (NIR) will apply.

National Policy Statement for Ports

7.2.9. The NPS for Ports requires an applicant to assess the noise generating aspects of a development on the marine and terrestrial environment including noise sensitive areas and noise sensitive species which has been informed by the existing marine and terrestrial noise environment. These assessments should then identify any measures that are included to mitigate the effects of noise.

RELEVANT GUIDANCE DOCUMENTS

BS 5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites (BS 5228)

7.2.10. Part 1[51] Noise and Part 2[52] Vibration sets out a methodology for assessing construction impacts on sensitive receptors.

7.2.11. Further details of the technical content of BS 5228 and how it will be applied to the assessment of construction noise and vibration from the Proposed Scheme are set out in the Assessment Methodology section.

Calculation of Road Traffic Noise (CRTN)

7.2.12. The former Department of Transport/Welsh Office technical memorandum Calculation of Road Traffic Noise (CRTN) sets out a standardised method for the calculation of noise from road traffic.

7.2.13. The factors which may influence road traffic noise levels can be divided into three groups:

- Road related factors - gradient and surface type;
- Traffic related factors - flow, speed and the proportion of heavy duty vehicles; and
- Propagation factors – the distance between the road and the receptor location and either the type of ground cover between the road and receptor location or the presence of screening (i.e. barriers or buildings).

7.2.14. The propagation of noise is also covered in CRTN and can influence the noise levels at receptor locations.

Design Manual for Roads and Bridges (DMRB)

7.2.15. The DMRB Volume 11, Section 3, Part 7, HD 213/11 Revision 1 Noise and Vibration (HD 213/11)[53] sets out a methodology for assessing road traffic noise and vibration.

7.2.16. Further details of the technical content of HD 213/11 and how it will be applied to the assessment of traffic noise from the Proposed Scheme are set out in the Assessment Methodology section.

[56] Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework

7.3 ASSESSMENT METHODOLOGY

7.3.1. NPSE guidance has been incorporated in both the operation and construction assessment methods.

CONSTRUCTION PHASE

7.3.2. The assessment of predicted noise impacts takes into account the guidance set out in the NPSE and the guidance contained within BS 5228.

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

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

7.3.5. The assessment will focus on potential impacts associated with different phases of construction which generate noise and vibration, the works required for a scheme of this type would typically include:

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

7.3.6. Consultation with NCC and GYDC will be undertaken in order to agree an appropriate level of assessment.

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

7.3.8. The criteria for the assessment of potential significance of noise effects is presented in Table 7.2- Construction Noise Thresholds of Potential Adverse Effects at Dwellings, LAeq,T (dB). Ambient noise is the all-encompassing noise in a given situation at a given time, usually composed of sound from many sources near and far, but excluding site (construction) noise. Site noise is the noise originating from the construction site. Total noise ($L_{Aeq,T}$) is ambient noise plus site noise.

Table 7.2- Construction Noise Thresholds of Potential Adverse Effects at Dwellings, LAeq,T (dB)

Period	Time	LOAEL	SOAEL
Daytime weekday, Saturdays, Sundays	07:00 - 19:00	70	75
Night-time	23:00 - 07:00	50	55

Note 1: A significant effect is indicated where total noise level (pre-construction ambient noise plus site noise) exceeds LOAEL or SOAEL for a period of ten or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any six consecutive months.

Note 2: If the pre-construction ambient noise is greater than LOAEL and less than SOAEL, then a potential observed effect is indicated if the total noise level (pre-construction ambient plus site noise) for the period increases by more than 3 dB, and subject to the SOAEL limit. A potential significant observed effect is indicated if the total noise level (pre-construction ambient plus site noise) exceeds the SOAEL.

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

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

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

7.3.11. Where pre-construction ambient noise levels are significantly different than levels given in Table 7.2, then the Table 7.2 levels will be modified.

7.3.12. Vibration impacts during construction works are most frequently related to piling activities. BS 5228-2 provides a range of empirical piling vibration data as well as a prediction methodology.

7.3.13. TRL Report 429 contains data acquired from various other highway construction activities. This data indicates that vibration level typically falls to imperceptible level at a distance of 50 m from the activity.

7.3.14. The criteria for the assessment of potential significance of vibration effects is presented in Table 7.3 - Construction Vibration Thresholds of Potential Adverse Effects at Dwellings, PPV (mm/s)

Table 7.3 - Construction Vibration Thresholds of Potential Adverse Effects at Dwellings, PPV (mm/s)

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

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

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

7.3.17. Where construction noise or vibration levels are expected to exceed the SOAEL after the contractor has applied BPM to the provision of mitigation, special dispensation may be sought to complete required works; the contractor may apply to the local authority for prior consent under Section 61 of the CoPA.

7.3.18. Structural damage resulting from construction and demolition vibration is rare. Table 7.4, taken from BS 5228-2, provides guide vibration values, above which in cosmetic damage may occur.

Table 7.4 Transient Vibration Guide Values for Cosmetic Damage to Buildings

Building Type	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above

Building Type	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
NOTE 1: Values referred to are at the base of the building.		
NOTE 2: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.		

Table source: BS 5228-2 Table B.2[52]

OPERATION

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

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

7.3.21. The proposed approach for this assessment is to use HD 213/11 to classify the magnitude of effect for given increases or decreases in noise level. Then to use NPSE guidance to consider whether the impacts are significant based on absolute noise level.

7.3.22. To consider the impacts of road schemes in the context of the NPSE, it is necessary to define noise levels above which noise increases may be regarded as significant, these are given in Table 7.5 - Traffic noise levels and significance.

Table 7.5 - Traffic noise levels and significance

Effect Level	Traffic Noise Level, $L_{A10,18h}$ (dB)* façade level
NOEL	≤54.4
LOAEL	54.5 to 67.5
SOAEL	≥67.5

7.3.23. The adopted threshold value for the SOAEL is based on the 'Relevant Noise Level', as set out in the Noise Insulation Regulations 1975 (NIR). This is the level of noise that would (provided that other criteria are met) trigger entitlement to the provision of sound insulated glazing (and, where necessary, ventilation) for residential properties located within 300 m of a new road scheme. The Relevant Noise Level specified in the NIR is 68 dB $L_{A10,18h}$, although the regulations require that noise levels calculated to be between 67.5 and 67.9 dB are rounded up to 68 dB.

7.3.24. The adopted threshold value for the LOAEL is based on guidance contained within the WHO Guidelines for Community Noise. This states that the lowest observed threshold for the onset of community annoyance occurs for situations where the outside free-field noise level exceeds 50 dB $L_{Aeq,16h}$ (07.00 to 23.00 hours). This uses a different noise measure, $L_{Aeq,16h}$ which is used as a general measure of noise from all sources, and time period to that used to quantify road traffic noise, $L_{A10,18h}$ (06.00 to 24.00 hours). Where road traffic noise dominates conversion from $L_{Aeq,16h}$ to $L_{A10,18h}$ uses the relationship set out in TAG Unit A3 Environmental Impact Appraisal ($L_{Aeq,16h} = L_{A10,18h} - 2$ dB) with a further addition of 2.5 dB applied to account for the conversion from a free-field noise level to a façade noise level (in accordance with CRTN).

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

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

- ≥ ±1 dB $L_{A10,18h}$ in the Do-Minimum Opening Year to Do-Something Opening Year (short term); and
- ≥ ±3 dB $L_{A10,18h}$ in the Do-Minimum Opening Year to Do-Something Design Year (long term).

7.3.27. In addition to the above, in the long term an increase of 1 dB $L_{A10,18h}$ where the Do-Minimum Opening Year noise level is already above the SOAEL is considered a potentially significant change. In other words, a lower magnitude of impact is applied where road traffic noise levels are particularly high.

7.3.28. The approach taken for this assessment is to analyse the change in all noise levels for both short-term and long-term scenarios. Where no individual change exceeds the thresholds given in 7.3.26 above, then it is assumed that there would most likely be no significant adverse effect. However, where noise levels exceed the stated thresholds, this provides an indication that there is potential for a significant adverse effect which triggers the need to consider mitigation. In these instances, the predicted noise levels will be considered in more detail and, where necessary, mitigation measures will be explored.

7.3.29. Where long term significant adverse effects are identified, the traffic flow data for the Do-Minimum Design Year scenario will be interrogated to assist in determining whether the effects are as a result of the Proposed Scheme itself, or are rather a result of general traffic growth or other developments.

7.3.30. Table 7.6 summarises the classification of magnitude of noise impacts associated with short- and long-term changes in noise levels, using the scales set out in HD213/11; and a semantic scale using the terms, *No Change*, *Slight*, *Low*, *Medium* and *High*. Both adverse and beneficial changes are considered in the assessment. However, only noise increases are considered to be significant.

Table 7.6 - Classification of Magnitude of Noise Impacts

Magnitude of Impact	Short-term Noise Change, $L_{A10,18h}$ (dB)	Long-term Noise Change, $L_{A10,18h}$ (dB)
No change	0.0	0.0
Negligible	0.1 – 0.9	0.1 – 2.9
Minor	1.0 – 2.9	3.0 – 4.9
Moderate	3.0 – 4.9	5.0 – 9.9
Major	5.0+	10.0+

7.3.31. In order to reconcile the different assessment methodologies set out in the NPSE[54] and HD213/11[53], consideration has been given to the current convention, as set out in Table 5.4 in Chapter 5.

7.3.32. For the purposes of classifying the overall noise impact against this semantic scale, the guidance contained within the NPSE and HD 213/11 has been combined as shown in Table 7.7 and Table 7.8. Table 7.7 relates to the potential short-term impact (based on Do-Something compared against Do-Minimum in the opening year of the Proposed Scheme) and Table 7.8 relates to the potential long-term impact (based on Do-Something in the future assessment year, taken to be 15 years after the opening year compared against Do-Minimum in the year of opening). The overall impact classification (negligible, minor, moderate or major) applies to situations where there is a beneficial impact as well as to situations where there is an adverse impact.

7.3.33. When the HD 213/11 magnitude of noise impacts are combined with the NPSE significance criteria In Table 7.7 and Table 7.8, 'Noise Level' refers to the Do-Something $L_{A10,18h}$ (06.00 to 24.00 hours) road traffic façade noise level predicted at 1 m from the sensitive receptor building.

Table 7.7 - Significance criteria for operational traffic noise based on short-term noise change

Noise Increase, $L_{A10,18h}$ dB	Noise Level < LOAEL	Noise Level > LOAEL and < SOAEL	Noise Level > SOAEL
<0.9	Negligible	Negligible	Negligible
1.0 – 2.9	Negligible	Minor	Minor
3.0 – 4.9	Negligible	Moderate	Moderate
>5.0	Negligible	Major	Major

Table 7.8 - Significance criteria for operational traffic noise based on long-term noise change

Noise Increase, $L_{A10,18h}$ dB	Noise Level < LOAEL	Noise Level > LOAEL and < SOAEL	Noise Level > SOAEL
<0.9	Negligible	Negligible	Negligible
1.0 – 2.9	Negligible	Negligible	Minor
3.0 – 4.9	Negligible	Minor	Moderate
5.0 – 9.9	Negligible	Moderate	Major
>10.0	Negligible	Major	Major

7.3.34. Based on the above, and in line with the goals of the NPSE, the provision of noise mitigation will aim to:

- Reduce, where practicably possible, Minor, Moderate or Major significant increases, where the absolute noise level is above LOAEL; and
- Avoid Minor, Moderate or Major significant increases, where the absolute noise level is above SOAEL.

7.3.35. Mitigation measures are required to perform to an acceptable level in traffic, road safety, economic and other environmental terms.

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

7.4 BASELINE ENVIRONMENT

SENSITIVE RECEPTORS

7.4.1. In accordance with HD 213/11 and BS 5228-1, NSRs to be considered in this assessment include residential dwellings, schools, hospitals and community facilities.

7.4.2. Using OS AddressBase Plus data, 16,504 residential receptors and 372 other sensitive receptors are identified within the provisional Study Area. All receptors are considered to be of high sensitivity.

7.4.3. Other sensitive receptors located close to the Proposed Scheme include:

- The Kings Centre, Queen Anne's Road;
- Great Yarmouth and Waveney Mind Community Allotments;
- Great Yarmouth and Gorleston Allotment Association Allotments;
- Great Yarmouth Community Hub, Suffolk Road;
- Shine Alpha Centre, Alpha Road;
- Avery Lodge Nursing Home, Southtown Road;
- St. James Church, Admiralty Road; and
- Great Yarmouth Primary Academy, Dickens Avenue.

7.4.4. The Outer Thames Estuary SPA designated area is within the provisional Study Area. However, the scope of this chapter relates to human response to noise and vibration. Impacts on ecologically sensitive receptors are considered within the Chapter 8 Nature Conservation.

DEFRA NOISE IMPORTANT AREAS

7.4.5. Defra Noise Important Areas (NIA) are locations where the 1% of the population are affected by the highest noise levels from major roads according to the results of Defra's strategic noise maps.

7.4.6. There are six NIAs within the provisional Study Area:

- NIA 4985 - Asset owner NCC;
- NIA 4986 - Asset owner NCC;
- NIA 4987 - Asset owner NCC;
- NIA 4989 - Asset owner Highways England;
- NIA 4990 - Asset owner Highways England; and
- NIA 11282 - Asset owner Highways England.

EXISTING NOISE CLIMATE

7.4.7. Baseline noise surveys were completed in March and April 2018. Weekday surveys were done between 26 March and 27 March 2018; and a weekend survey was done between 21 April and 22 April 2018.

7.4.8. The noise survey is used to identify existing noise sources which are not taken into account in the operational noise assessment, for example, air traffic, industrial/commercial activities.

7.4.9. Noise monitoring locations were selected to be representative of sensitive receptors located close to the development. The survey positions and measurement timing were agreed with GYBC. The survey dates were chosen to be representative of normal conditions, local road works and any maintenance activities were avoided.

7.4.10. Noise measurements were taken in accordance with the general guidance in BS 7445-2[57] and based on the shortened measurement procedure set out in CRTN. The shortened measurement procedure requires that measurements of L_{A10} are undertaken during three consecutive hours between the hours of 10:00 and 17:00 on a normal working day. The $L_{A10,18h}$ is estimated from these measurements by taking an arithmetic average of

[57] The British Standards Institution (1991), BS 7445-1:2003 Description and measurement of environmental noise. Part 1: Guide to quantities and procedures.

the three results and subtracting 1 dB. Each daytime measurement was 15 minutes long. The measurements are considered to be representative of the hourly noise level.

7.4.11. Measurements were taken in free-field conditions and at a height of 1.5 m above local ground level.

7.4.12. Short-term attended noise measurements were taken at six locations, detailed in Table 7.9 - Baseline Noise Survey Locations and Figure 7.2.

Table 7.9 - Baseline Noise Survey Locations

Measurement ID	Location	Closest NSR	Distance between NSR and construction boundaries
L01	Beccles Road	3 Alpha Road	18 m
L02	Queen Anne's Road	12 Queen Anne's Road	0 m
L03	Southtown Road	145 Southtown Road	0 m
L04	Cromwell Road	10 Cromwell Road	0 m
L05	South Denes Road	1 South Denes Road	0 m
L06	Southgates Road	31 Southgates Road	0 m

7.4.13. Long-term unattended noise measurements were not taken as representative and secure locations were not available.

7.4.14. The sound level meters were field calibrated before and after the surveys, with no significant calibration drift observed. Details of the equipment used, including the expiry dates of their laboratory calibration, are shown in Table 7.10 - Equipment Details.

Table 7.10 - Equipment Details

Type	Make	Model	Serial Number	Certificate Number	Calibration Expiry
Duo 2					
SLM	01 dB	Stella Dou	10618	20/09/2019	SLM
Microphone	01 dB	G.R.A.S 40CD	162008	20/09/2019	Microphone
Pre-amplifier	01 dB	G.R.A.S Type 21	10627	20/09/2019	Pre-amplifier
Calibrator	01 dB	01 dB Cal	3494010	21/09/2018	Calibrator
Solo 2					
SLM	01 dB	METRAVIB	61332	14/02/2019	SLM
Microphone	01 dB	METRAVIB MCE 212	57685	14/02/2019	Microphone
Pre-amplifier	01 dB	METRAVIB 21 S	14425	14/02/2019	Pre-amplifier
Calibrator	01 dB	01 dB Cal	3494010	21/09/2018	Calibrator

7.4.15. Weather conditions were recorded during the noise surveys and are summarised below:

- 13:30 Monday 26 March 2018
  Temperature 7°C, south westerly wind, 0.3 m/s average (max. 1.0 m/s), humidity 85%, no precipitation, 50% cloud cover, road surfaces dry.

- 21:45 Monday 26 March 2018
  Temperature 5°C, south westerly wind, 1.2 m/s average (max. 1.9 m/s), humidity 45%, scattered clouds, road surfaces dry.

- 10:45 Tuesday 27 March 2018
  Temperature 6°C, no wind direction to report, 0.2 m/s average (max. 0.9 m/s), humidity 60%, clear skies, road surfaces dry.

- 14:05 Saturday 21 April 2018
  Temperature 16°C, westerly wind, humidity 80%, light winds and dry conditions clear skies, road surfaces dry.

- 21:00 Sunday 22 April 2018
  Temperature 12°C, south easterly wind, humidity 80%, 0.8 m/s average (max 1.6 m/s) and dry conditions clear skies, road surfaces dry.

7.4.16. Summaries of the attended measurements at each location during the weekday and weekend period are given in Table 7.11 to table 7.16.

7.4.17. At Locations 1, 2, 3 and 4 in the vicinity of Harfrey's Roundabout, the dominant noise sources during all periods was from vehicles on local roads. Secondary noise sources included more distant road traffic noise, seagull calls, domestic activities and emergency service sirens.

7.4.18. At Locations 5 and 6 on South Denes, the dominant noise sources during the day was from vehicles on local roads including regular HGV movements and intermittent commercial/industrial activities. During the weekend evening measurements police sirens dominated the noise levels. And during the night the dominant noise source was again from vehicles on local roads.

Table 7.11 - Summary of measured noise levels at Location 1, free-field

Period	Time	Duration	Noise Level (dB)			
			L_{Aeq}	L_{AFmax}	L_{A90}	L_{A10}
Weekday	13:00 - 15:00	3 x 15 min	66.0	81.2	59.0	68.9
	20:48 - 21:03	1 x 15 min	62.3	73.1	49.9	66.7
	00:36 - 00:51	1 x 15 min	58.0	74.3	45.1	62.6
Weekend	12:25 - 14:00	3 x 15 min	64.5	79.8	55.2	67.7
	21:18 - 21:33	1 x 15 min	60.4	71.8	48.5	64.2
	00:37 - 00:52	1 x 15 min	59.8	71.8	45.0	65.3

Table 7.12 - Summary of measured noise levels at Location 2, free-field

Period	Time	Duration	Noise Level (dB)			
			L_{Aeq}	L_{AFmax}	L_{A90}	L_{A10}
Weekday	13:15 - 16:15	3 x 15 min	53.8	69.9	49.5	55.4

Period	Time	Duration	Noise Level (dB)			
			L_{Aeq}	L_{AFmax}	L_{A90}	L_{A10}
	21:07 - 21:22	1 x 15 min	56.3	80.1	48.7	55.6
	00:58 - 01:13	1 x 15 min	44.8	57.2	42.8	48.0
Weekend	13:08 - 14:55	3 x 15 min	59.5	87.8	53.5	59.5
	20:55 - 21:11	1 x 15 min	53.6	63.4	48.9	56.3
	00:58 - 01:13	1 x 15 min	49.7	66.9	41.9	50.9

Table 7.13 - Summary of measured noise levels at Location 3, free-field

Period	Time	Duration	Noise Level (dB)			
			L_{Aeq}	L_{AFmax}	L_{A90}	L_{A10}
Weekday	13:00 - 16:00	3 x 15 min	69.1	84.2	56.2	72.7
	21:37 - 21:52	1 x 15 min	62.6	76.9	45.9	67.0
	01:37 - 01:52	1 x 15 min	57.8	79.0	46.4	55.1
Weekend	12:17 - 14:15	3 x 15 min	67.9	86.6	54.1	71.2
	20:52 - 21:07	1 x 15 min	65.2	82.0	48.3	69.3
	01:18 - 01:33	1 x 15 min	61.7	77.9	44.6	65.2

Table 7.14 - Summary of measured noise levels at Location 4, free-field

Period	Time	Duration	Noise Level (dB)			
			L_{Aeq}	L_{AFmax}	L_{A90}	L_{A10}
Weekday	13:00 - 16:00	3 x 15 min	50.8	66.1	46.3	52.3
	21:32 - 21:47	1 x 15 min	43.9	54.3	41.0	45.7
	01:20 - 01:35	1 x 15 min	39.1	47.4	37.4	40.4
Weekend	12:36 - 14:32	3 x 15 min	52.3	65.7	48.5	54.3
	21:09 - 21:24	1 x 15 min	48.5	68.1	43.4	47.7
	01:36 - 01:51	1 x 15 min	42.0	55.1	37.0	44.0

Table 7.15 - Summary of measured noise levels at Location 5, free-field

Period	Time	Duration	Noise Level (dB)			
			L_{Aeq}	L_{AFmax}	L_{A90}	L_{A10}
Weekday	10:00 - 13:00	3 x 15 min	70.7	88.4	55.7	74.7
	22:01 - 22:16	1 x 15 min	59.9	77.1	42.6	61.2
	02:04 - 02:19	1 x 15 min	52.1	77.7	37.1	42.2
Weekend	14:05 - 16:15	3 x 15 min	65.4	83.5	49.0	69.6
	21:43 - 21:58	1 x 15 min	64.3	81.5	49.8	67.1
	02:09 - 02:24	1 x 15 min	56.4	79.4	44.0	49.6

Table 7.16 - Summary of measured noise levels at Location 6, free-field

Period	Time	Duration	Noise Level (dB)			
			L_{Aeq}	L_{AFmax}	L_{A90}	L_{A10}
Weekday	10:00 - 12:00	3 x 15 min	72.4	86.8	56.7	76.1
	02:23 - 02:38	1 x 15 min	62.9	86.1	46.9	56.4
Weekend	14:24 - 16:35	3 x 15 min	68.3	86.6	46.7	72.7
	21:45 - 22:00	1 x 15 min	69.3	92.7	47.5	68.1
	02:28 - 02:43	1 x 15 min	51.9	75.4	39.2	52.4

7.5 PREDICTED EFFECTS

CONSTRUCTION PHASE

7.5.1. Noise and vibration from construction activities can cause disturbance to people living and working in the vicinity of, and to those working on, the site. Noise and vibration can interfere with activities and processes in buildings; in extreme circumstances it can be a hazard to health and very high vibration can cause damage to buildings.

7.5.2. The assessment will focus on potential impacts associated with different phases of construction which generate noise and vibration, the works required for a scheme of this type would typically include:

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

7.5.3. The risk and severity of potential construction impacts occurring is typically a function of the proximity of the activity to receptor, and the nature and duration of the activity. The highest risk receptors are those that are located closest to construction activities.

7.5.4. There are existing sensitive receptors located within 300 m of the construction boundaries. The nearest sensitive residential receptors are located within <20m of the current Proposed Scheme boundary.

7.5.5. The number and location of sensitive receptors from Proposed construction boundary are detailed in Table 17.7. The count of properties is based on OS AddressBase data classification, a single building may contain several properties, e.g. flats.

Table 7.17 - Receptor Count within 300 m of Construction Boundaries

Distance from Construction boundaries (m)	Sensitive Receptor Count			
	Residential	Educational	Medical	Total
<20	149*	1	0	132
20-50	185	2	0	187
50-100	457	0	1	457
100-200	1602	1	7	1610
200-300	1681	4	3	1688
* Count excludes 20 residential properties to be demolished as part of the proposed scheme.				

OPERATION PHASE

7.5.6. Once the Proposed Scheme is built and open to vehicles, traffic noise and vibration can cause disturbance to people living and working near the Proposed Scheme and the surrounding area.

7.5.7. The operational Study Area is yet to be defined, given that the Proposed Scheme traffic data is currently under development. Once this data is available, the affected road network and associated sensitive receptor locations to be included in the assessment will be confirmed.

7.5.8. As an indication of the potential impact, receptor counts split into distance bands are given in Table 7.18 - Receptor Count within 300 m of Proposed Scheme Carriageway Edge. The distance bands are calculated from the carriageway edge of new or improved routes associated with the Proposed Scheme. This is done because typically it is the immediate areas around the Proposed Scheme which experience adverse noise impacts. Receptors located closer to the Proposed Scheme are expected to experience higher adverse impact. The count of properties is based on OS AddressBase data classification, a single building may contain several properties, e.g. flats.

Table 7.18 - Receptor Count within 300 m of Proposed Scheme Carriageway Edge

Distance from Proposed Scheme Carriageway Edge (m)	Sensitive Receptor Count			
	Residential	Educational	Medical	Total
<50	109*	1	0	92
50-100	240	1	0	241
100-150	280	1	0	281
150-200	245	0	0	245
200-250	214	0	0	214
250-300	245	1	0	246

* Count excludes 20 residential properties to be demolished as part of the proposed scheme.

7.5.9. The Outer Thames Estuary SPA, which includes the River Yare, will be considered as part of the operation phase noise and vibration assessment completed in the ES, the approach to assessing potential impacts in the SPA will be subject to the outcome of a consultation with Natural England. The scope of this chapter relates to human response to noise and vibration, impacts on ecological sensitive receptors are considered within the Chapter 8 Nature Conservation.

7.6 PROPOSED MITIGATION

CONSTRUCTION PHASE

7.6.1. The majority of construction noise and vibration impacts will be suitably controlled following Best Practicable Means (BPM), whereby the Contractor will employ appropriate measures to control and minimise adverse effects associated with noise and vibration resulting from on-site activities, so that significant impacts are avoided. These will include:

- Maintaining good public relations with people living and working in the vicinity of the site. Effective communication should be established, keeping local residents informed of the type and timing of works involved. Effective methods of keeping local residents informed include leaflet drops, posters, public meetings, exhibitions and guided site visits;
- Provision of contact details for a site representative;
- Noise and vibration complaints arising will be dealt with pro-actively and subsequent resolutions are communicated to the complainant;
- Prior notice given to local residents for operations that are particularly noisy or generate high levels of vibration;
- Careful planning of construction activities and selection of plant to reduce noise emissions;
- The use of temporary screening (such as Heras mounted acoustic barriers or site hoarding) where appropriate;
- Locating static noisy plant in use as far away from NSRs as is feasible for the particular activity;
- Using suitable equipment and ensuring such equipment is properly maintained and operated by trained staff;
- Using silenced equipment where possible, in particular silenced power generators, if night-time power generation is required for site security or lighting;
- Ensuring that vehicles and mobile plant are well maintained such that loose body fittings or exhausts do not rattle or vibrate;
- Engine compartments should be closed when equipment is in use and the resonance of body panels and cover plates reduced through the addition of suitable dampening materials.
- Ensuring plant machinery is turned off when not in use;
- Speed limits on access roads for HGVs and ensuring that vehicles do not park or queue for long periods outside NSRs with engines running unnecessarily;
- Generators and water pumps required for 24-hour operation should be silenced and/or screened as appropriate;

- Crane spindles, pulley wheels, telescopic sections and moving parts of working platforms should be adequately lubricated in order to prevent undue screeching and squealing;
- Where possible, the use of mains electricity rather than generators.

7.6.2. It is recommended that periodic noise monitoring is undertaken to compare construction noise levels with the thresholds for sensitive receptors set out in Table 12-18 and Table 12-19. The monitoring will be undertaken by a suitably competent person. The instrumentation will conform to the requirements for integrating averaging sound level meters, preferably of Type 1 as specified in BS 7580-1: 1997 (or Class 1 specified in BS EN 61672-1: 2013, but at east of Type 2 as specified in BS 7580-2: 1997 (or Class 2 specified in BS EN 61672-1: 2013), with verification of conformity being undertaken by periodic testing in accordance with these standards. In addition to the periodic testing, sound calibrators (preferably conforming to BS EN 60942: 2003, class 1) will be used whenever monitoring takes place; typically, before and after each measurement session.

7.6.3. Where vibratory construction activities are predicted to cause significant levels of vibration at nearby receptors, vibration monitoring may also be necessary.

7.6.4. A CoCP will be prepared and implemented to control noise emissions from the construction site, so that significant impacts are avoided, and will include the following:

- Arrangements for communicating construction details, and likely noisy activities, with local communities and residents, including points of contact;
- Detailed methodologies for each construction activity;
- Detailed programmes for each phase of construction;
- Identification of the construction activities likely to generate the highest levels of noise, based on working areas;
- Prediction of noise levels from these activities following method given in BS 5228-1;
- Identification, in consultation with NCC/GYBC, of appropriate hours of working and construction noise limits;
- An assessment of predicted impacts against the agreed construction noise limits;
- Identification of appropriate noise mitigation measures; and
- Noise monitoring and reporting procedures.

OPERATION PHASE

7.6.5. At this stage, an assessment of likely significance and the need for mitigation measures associated with the operation of the scheme cannot be made. This will be provided within the ES.

7.7 CONCLUSIONS AND EFFECTS

BASELINE

7.7.1. Baseline noise surveys were completed in March and April 2018 at six locations in the vicinity of the Proposed Scheme. Attended noise surveys were completed during the day, evening and night; and covered a weekday and weekend period.

7.7.2. There are six NIAs within the provisional operational noise Study Area. The noise making authority for three NIAs is NCC and Highways England is the noise making authority for the remaining three NIAs.

CONSTRUCTION PHASE

7.7.3. At this stage, a quantitative assessment of likely significance and the need for mitigation measures associated with the construction has not been made. This will be provided within the ES.

7.7.4. The highest risk sensitive receptors are those located closest to noise and vibration generating activities.

7.7.5. Appropriate mitigation measures are recommended, which will be implemented via the interim CoCP to reduce and minimise potential noise and vibration impacts.

7.7.6. Any such impacts are expected to be intermittent and temporary for the duration of the respective activities only and it is not anticipated that construction related noise and vibration will constitute a significant effect.

OPERATION PHASE

7.7.7. At this stage, an assessment of likely significance and the need for mitigation measures associated with the operation of the Proposed Scheme cannot be made. This will be provided within the ES.

7.8 ASSESSMENTS STILL TO BE COMPLETED

7.8.1. The construction assessment described in this chapter will be updated in the ES to account for the latest information that is available regarding proposed construction activities.

7.8.2. An operation phase assessment, based upon finalised traffic data, will be completed following the approach outlined in Section 7.3. The findings of this will be presented in the ES.

8

NATURE CONSERVATION

8 NATURE CONSERVATION

8.1 INTRODUCTION

8.1.1. This chapter provides preliminary information with regard to biodiversity and nature conservation as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. It is supported by Figures 8.1 – 8.6 and Appendices 8A and 8B.

8.1.2. The assessment of this topic area considered potential effects relating to the following aspects:

- Statutory and non-statutory designated sites;
- Important or protected habitats; and
- Legally protected species and/or species of conservation concern.

STUDY AREA

8.1.3. The study area for the proposed assessment is comprised of three different levels as informed by legislation and guidance (see Section 8.2 below):

- Main – 500m from the Proposed Scheme Boundary (presented in Figure 8.1). This study area has been used for assessing habitats and suitability for protected species (hereafter referred to as 'Main Study Area');
- Broad – 2km from the Proposed Scheme boundary (presented in Figure 8.1). This study area is used for a desk study of international and national statutory nature conservation designations, non-statutory nature conservation designations and records of protected and/or notable habitats and species (hereafter referred to as 'Broad Study Area'; and
- Extended – up to 30km from Proposed Scheme boundary (presented in Figure 8.2). This study area has been used to extend the Broad Study Area where there are potential hydrological connections present and to take into account international nature conservation designations where bats are listed as a qualifying species (hereafter referred to as 'Extended Study Area').

LIMITATIONS

8.1.4. This chapter of the PEIR provides preliminary information as it relates to the Proposed Scheme to date and to data currently available and gathered at this point of the assessment process.

8.1.5. The information contained herein is intended to inform consultation responses at this stage. A more detailed assessment of potential significant effects as a result of the Proposed Scheme on identified sensitive receptors will be undertaken at subsequent stages to inform the ES.

8.1.6. Any gaps in information identified at this PIER stage will be considered and addressed along with specific mitigation measures as part of the assessments for the production of the ES.

8.1.7. At the time of writing, the following surveys were either in progression or pending:

- Breeding bird surveys, with a particular focus on black redstart *Phoenicurus ochruros*;
- Bird vantage point surveys, focussing on the River Yare;
- Internal and external inspections for bat species on properties due to be demolished;
- Repeat water vole *Arvicola amphibius* surveys; and
- Surveys of aquatic ecology.

8.2 DIRECTIVES, STATUTES AND RELEVANT POLICIES

8.2.1. Ecological features receive protection through legislation and planning policy. Legislation and planning policy relevant to the Proposed Scheme will be identified following a determination of ecological receptors relevant to the Proposed Scheme following completion of the surveys that are proposed.

8.2.2. The appraisal has been compiled with reference to the following relevant nature conservation legislation, planning policy and the UK Biodiversity Framework from which the protection of sites, habitats and species is derived in England.

The Conservation of Habitats and Species Regulations (Habitats Regulations) 2017

8.2.3. The EC Habitats Directive (92/43/EEC) and EC Birds Directive (2009/147/EC) are transposed into UK law via the Conservation of Habitats and Species Regulations 2017, referred to as the Habitats Regulations. All species listed under Annex IV of the Habitats Directive are subject to a strict protection and are known as European Protected Species (EPS). Certain EPS are also listed under Annex II of the Habitats Directive and are afforded protection by the establishment of core areas of habitat known as Special Areas of Conservation (SAC). The effect of proposed developments on SACs is regulated by means of the requirement to carry out Habitats Regulations Assessment (HRA).

8.2.4. The Birds Directive seeks to maintain populations of all wild bird species across their natural range (Article 2). All bird species listed under Annex I of the Birds Directive are rare or vulnerable and afforded protection by the classification of Special Protection Areas (SPAs), these are also designated to protect all regularly occurring migratory species, paying special attention with regard to the protection of wetlands, particularly those of international importance (Article 4). The requirement to carry out HRA also applies to SPAs.

The Wildlife and Countryside Act (WCA) 1981 (as amended)

8.2.5. Under the WCA (England and Wales) all birds, their nests and eggs (with exception of species listed under Schedule 2) are protected by the WCA. It is an offence to intentionally kill, injure, or take any wild bird, take or destroy their eggs or to damage or destroy the nest of any wild bird (but only, with specified exceptions, whilst being built, or in use). In addition, species listed on Schedule 1 of the act are afforded special protection year-round, regardless of whether they are nesting or not.

8.2.6. Animal species listed at Schedule 5 of the WCA, which includes species of reptile native to the UK, are afforded either full or partial protection against the killing, injuring or taking, the possession or control of individuals (live or dead) and the damage, destruction, disturbance or obstruction of places of shelter or protection.

8.2.7. Section 14 of the WCA also makes provision for the control of invasive non-native animal and plant species and makes it illegal to allow these species to spread in the wild.

8.2.8. In addition, section 13 of the WCA makes it an offence (subject to exceptions) to pick, uproot, trade in, or possess (for the purposes of trade) any wild plant listed in Schedule 8, and prohibits the unauthorised intentional uprooting of such plants.

Countryside and Rights of Way (CRoW) Act 2000

8.2.9. The CRoW Act has amended the WCA in England and Wales, strengthening the protection afforded to Sites of Special Scientific Interest (SSSI) and the legal protection for threatened species.

The Natural Environment and Rural Communities (NERC) Act 2006

8.2.10. Section 41 of the Act provides for the publication of a list of living organisms and habitats that are of principal importance for the conservation of biodiversity in England. The list guides public authorities who are required by section 40 to have regard to the purpose of conserving biodiversity in the exercise of their functions.

The Wild Mammals (Protection) Act 1996

8.2.11. The Wild Mammals Act is designed to prohibit specified forms of animal cruelty and makes it an offence to intent to inflict unnecessary suffering on a wild mammal through such acts as mutilation, beating or drowning.

The UK Post-2010 Biodiversity Framework (2011-2020)[58]

8.2.12. This Framework lists the UK's most threatened species and habitats and sets out targets and objectives for their management and recovery. The UK Biodiversity Action Plan (BAP) process is delivered nationally, regionally and locally and should be used as a guide for decision-makers to have regards for the targets set by the framework and the goals they aim to achieve. The UK BAP has now been replaced by the UK Post-2010 Biodiversity Framework, however, it contains useful information on how to characterise important species assemblages and habitats which is still relevant (UK Post-2010 Biodiversity Framework, 2012).

Biodiversity 2020: A strategy for England's wildlife and ecosystem services[59]

8.2.13. This document provides a strategy on the implementation of international legislation and provides a strategic plan for biodiversity policy for terrestrial, aquatic and marine habitats.

The National Planning Policy Framework (July 2018)[60]

8.2.14. The revised NPPF (which replaced the previous 2012 NPPF on 24 July 2018) policy concerning the conservation and protection of the natural environment requires that decision making should seek to minimise impacts on, and provide net gains for biodiversity. This includes the establishment of ecological networks that are resilient to existing and future pressures (paragraph 170).

The National Planning Policy Statement for National Networks

8.2.15. The NPS NN sets out the need for, and Government's policies to deliver, NSIPs on the national road and rail networks in England. It provides planning guidance for NSIPs on the road and rail networks, and the basis for the examination by the Examining Authority and for the primary decision-making process by the SoS.

8.2.16. The NPS NN states that for projects that are subject to the Environmental Impact Assessment Directive, that a full Environmental Statement taking into account impacts on biodiversity must be prepared.

8.2.17. Furthermore, the NPS NN states that any scheme must establish whether there are likely to be impacts on a Natura 2000 site covered under the Habitats Regulations prior to the granting of a DCO.

National Policy Statement for Ports

8.2.18. The NPS for Ports sets out the Government's strategy for new port infrastructure to meet current and future needs. It determines the approach planning decision-makers should take with respect to ports and port infrastructure proposals.

[58] JNCC and DEFRA (on behalf of the Four Countries' Biodiversity Group). 2012. UK Post- 2012 Biodiversity Framework, July 2012. Available from http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf

[59] DEFRA (2011). Biodiversity 2020: A Strategy for Englands Wildlife and ecosystem services. [online] Available here https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services Accessed June 2018

[60] Ministry of Housing, Communities and Local Government (July 2018) National Planning Policy Framework. Available here:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf

8.2.19. The NPS for Ports requires investigation into the effects of the project on marine ecology, biodiversity and protected sites, and to take into account discharges to water and physical modifications of the water environment that may affect ecological resources. Consideration should be made of the effects of noise on sensitive marine resources and the Environment Agency, Natural England and the Marine Management Organisation should be consulted as necessary.

8.2.20. In Paragraph 5.1.22, the NPS for Ports states that capital dredging requirements will need to be subject to assessment within the ES.

Norfolk Biodiversity Action Plan[61].

8.2.21. The Norfolk Biodiversity Action Plan identifies objectives and targets to promote and protect biodiversity within the county during the development planning process.

8.3 ASSESSMENT METHODOLOGY

8.3.1. The assessment will be based on the methods outlined in the following guidance:

- DMRB Volume 11, Section 3, Part 4 Ecology and Nature Conservation[62];
- IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment, Highways Agency (2010)[63];
- Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2016)[64]; and
- Guidelines for the Ecological Impact Assessment in Britain and Ireland: Marine and Costal published by Chartered Institute of Ecology and Environmental Management (CIEEM) (2010[65]).

8.3.2. Establishment of the baseline environment for nature conservation has involved a review of the existing information relating to designated and non-designated sites, habitats and fauna.

8.3.3. In addition to the guidance detailed above, the assessment of ecological impacts has been undertaken in accordance with the following guidance:

- Institute of Environmental Assessment (IEA) (1995) Guidelines for Baseline Ecological Assessment (Ref 1.21)[66];
- Highways Agency (2001) Design Manual for Roads and Bridges (DMRB) Volume 10 Section 4 Nature Conservation (Ref 1.22)[67];

[61] Norfolk Biodiversity Action Plan (BAP) (1999) Available at http://www.norfolkbiodiversity.org/actionplans/
[62] DMRB (1993) Design manual for roads and bridges (DMRB) Volume 11 Environmental Assessment [online] available at: http://www.standardsforhighways.co.uk/dmrb/vol11/section3.htm (Accessed November 2017).
[63] Highways England (2010). Interim Advice Note 130/10 - Ecology and Nature Conservation: Criteria for Impact Assessment Interim Advice Note 130/10. Highway England
[64] Chartered Institute of Ecology and Environmental Management (2006) Guidelines for Ecological Impacts Assessment in the United Kingdom CIEEM. Winchester. Ratcliffe, D.A (Ed.) (1977) A Nature Conservation Review. Cambridge University Press
[65] Chartered Institute of Ecology and Environmental Management (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal.
[66] Institute of Environmental Assessment (1995) Guidelines for Baseline Ecological Assessment. First Edition published by E & FN Spon, London UK
[67] Highways Agency 2001. Design Manual for roads and Bridges Volume 11, Section 4 Nature Conservation.

- Highways Agency Best Practice in Enhancement of Highways Design for Bats[68] (Ref 1.23); and
- Highways Agency (Oct 2008) IAN 116/08 Nature Conservation Advice in Relation to Bats (Ref 1.24)[69].

8.3.4. A number of surveys have been, or will be, undertaken (detailed in Table 8.3) and are proposed to verify and update baseline information related to habitats and fauna and where the results of these surveys are available they are presented in this PEIR chapter. The species-specific surveys are:

- Black redstart breeding surveys;
- Breeding bird surveys;
- Vantage point surveys for birds;
- Bat roost surveys: building inspections and emergence/re-entry surveys; and
- Water vole surveys.

8.3.5. The surveys proposed to be undertaken have been discussed with Natural England and NCC and additional representation has been made in the Scoping Opinion[6].

8.3.6. Characterisation of ecological impact is a process that starts with the 'evaluation of ecological resources', which identifies the most valuable resources that may be impacted by the Proposed Scheme.

8.3.7. The value given to an ecological receptor takes into account any statutory or non-statutory designations, the intrinsic value of the receptor and whether it supports legally protected or notable species. Consideration will be given to the value of the species or habitat and its conservation status at a geographic level taking population size, life cycle, rarity and/or distribution into account. Each ecological resource will be assessed as being valuable, or potentially valuable, within a geographic frame of reference as set out in Table 1 of IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment. The resource valuation will be further informed by CIEEM Guidelines.

8.3.8. Once the evaluation of ecological resources has been carried out, the assessment will identify potential biophysical changes arising from proposed activities during the construction and operation of the Proposed Scheme that may affect receptors. In accordance with the DMRB and CIEEM, this will take account of design mitigation measures only (i.e. in the absence of any other mitigation), thus providing clear information regarding the unmitigated impacts to inform the identification of appropriate mitigation and/or compensation requirements.

8.3.9. Characterisation of ecological impacts upon each receptor requires the determination of a range of parameters as shown in Table 8.1 – Characterisation of ecological impacts on each receptor developed from IAN 130/10) to inform the determination of impact significance. These criteria take account of both direct loss of habitat and ecological resources through land take, and perceived indirect impacts such as pollution and habitat fragmentation.

[68] Highways Agency, March 2006. Best practice in enhancement of highway design for bats literature review. [online[Available at http://webarchive.nationalarchives.gov.uk/20120810191207/http://www.highways.gov.uk/knowledge_compendium/assets/documents/Portfolio/Best%20Practice%20in%20Enhancement%20of%20Highway%20Design%20for%20Bats%20-%20775.pdf

[69] Highways Agency 2008. Interim Advice Note 116/08 Nature Conservation in Relation to Bats

Table 8.1 – Characterisation of ecological impacts on each receptor

Impact Character	Description
SI – Sign	Positive (Beneficial) or Negative (Adverse).
PO – Probability of Occurring	Certain, Probable, Unlikely.
CO – Complexity	Direct, Indirect, Cumulative.
EC – Extent	Area measures and percentage of total (e.g. area of habitat/ territory lost).
SZ – Size	Description of level of severity of influence (e.g. complete loss, number of animals affected).
RE – Reversibility	Reversible or Not Reversible (can the effect be reversed, whether or not this is planned?).
DU – Duration	Permanent (P) or Temporary (T) in ecological terms. Where differing timescales are determined in relation to the life-cycle of the receptor, these should be defined.
TF – Timing and Frequency	Important seasonal and/ or life-cycle constraints and any relationship with frequency considered.

8.3.10. Having characterised impacts, proposals for mitigation, compensation and enhancement will be considered, with the aim of avoiding or reducing the significance of impacts. Subsequent to the mitigation proposals, the overall residual significance of impacts on each receptor will be assessed.

8.3.11. Using the receptor value ascertained from Table 1 of IAN 130/10 and the characterisation impact table from Table 8.1 – Characterisation of ecological impacts on each receptor , it is possible to assign an 'overall significance category'. Table 3 of IAN 130/10 illustrates the approach taken to relating significant impacts at different levels of value.

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

8.4 BASELINE ENVIRONMENT

8.4.1. A desk study, Phase 1 Habitat survey and species-specific surveys for breeding birds, black redstarts, bats and water vole have been undertaken to date to identify changes to known biodiversity resources and include both designated and non-designated sites.

8.4.2. The surveys are being undertaken with reference to the following guidance:

- TAG Unit A3 Chapters 5 and 9 (which also references DMRB Volume 11 and Section 3 Part 4)[70];
- Chartered Institute for Ecology and Environmental Management (CIEEM) (2016) Guidelines for Ecological Impact Assessment in the UK. CIEEM, Winchester[64];

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

- DMRB Volume 11 Section 4 Assessment of the Implications (of Highways and/or Road Projects) on European Sites (including Appropriate Assessment)[67];
- Bibby, C., N. Burgess, D. Hill and S. Muste (2000). Bird Census Techniques: 2nd edition. Academic Press;
- Collins, J. (Ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) The Bat Conservation Trust, London; and
- Strachan, R. and Moorhouse, T. (2006). Water Vole Conservation Handbook, 2nd Edition. Wildlife Conservation Research Unit (WildCRU), Oxford University.

DESK BASED STUDIES

Statutory Designated Sites

8.4.3. The desk-based search established that there is one internationally designated statutory nature conservation designation within the Broad Study Area. This is the Outer Thames Estuary Special Protection Area (SPA) (see Figure 8.6). It covers an area of c. 3,924km^2, classified for the protection of wintering red-throated diver. This area supports the largest aggregations of wintering red-throated diver in the UK, 38% of the GB population. The foraging areas protected for little tern *Sternula albifrons* and common tern *Sterna hirundo*, enhance the protection afforded to their feeding and nesting areas in the adjacent coastal SPAs.

8.4.4. It is noted that the River Yare and the River Bure are now included within the Outer Thames Estuary SPA. The extension was proposed in 2016 and formally implemented in 2017. The reason for the inclusion of the River Yare channel in the extended SPA, to abut the eastern boundary of the existing Breydon Water SPA, and the lower River Bure, was to provide continuous SPA coverage for common terns foraging from the latter SPA. In the Scoping Report[5] the following designated sites within the Extended Study Area were identified as requiring consideration and this has informed the Extended Study Area:

- Breydon Water SPA, Ramsar and Site of Special Scientific Interest (SSSI), located approximately 2.2km to the north/northwest of the Proposed Scheme;
- Great Yarmouth North Denes SPA and SSSI, located approximately 3.2km north/northeast of the Proposed Scheme; and
- The Broads National Park, located approximately 1km to the northwest of the Proposed Scheme.

Non-Statutory Designated Sites

8.4.5. There are no non-statutory designated sites within the Broad Study Area.

8.4.6. Breydon Water, located approximately 2.2km to the north/northwest of the Proposed Scheme is also designated as an RSPB Reserve, in additional to the statutory designations detailed in Paragraph 8.4.5.

Species Records

8.4.7. A review of desk study data has established records of the following protected species within the Broad Study Area:

- Records of seven species of bat (common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, Nathusius' pipistrelle *Pipistrellus nathusii,* Daubenton's bat *Myotis daubentonii*, noctule *Nyctalus noctula*, serotine *Eptesicus serotinus* and brown long-eared bat *Plecotus auritus*). Brown long-eared bat, noctule and soprano pipistrelle are also listed as target species on the Norfolk Biodiversity Acton Plan (BAP);
- Records of otter *Lutra lutra*, water vole *Arvicola amphibious* and badger *Meles meles*. Otter and water vole are also both included on the Norfolk BAP;

- Records of natterjack toad *Epidalea calamita*, common lizard *Zootoca vivipara* and slow worm *Anguis fragilis*; and

- A large number of bird species, including 50 species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) which are protected at all times of the year. Sixteen species of bird are included on the Norfolk BAP, including little tern and swift *Apus apus*.

8.4.8. The desk study data also included records of several priority species (S41 NERC Act as amended) that have been recorded within the Broad Survey Area. These include European hedgehog *Erinaceous europaeus*, brown hare *Lepus europaeus*, common toad *Bufo bufo* and goat moth *Cossus cossus*. These species are afforded no formal protection within the UK but must be taken into consideration during the planning phase.

FIELD STUDIES

Habitats

8.4.9. The type and extent of habitats identified within the Main Study Area are described in Table 8.2 and shown in the Great Yarmouth Third River Crossing Preliminary Ecological Appraisal [PEA] Report[71] (Mouchel, 2016) (Appendix 8A).

Table 8.2 – Habitats Present within the Main Study Area

Habitat	Description
Amenity grassland	Southtown Common recreation ground lies to the south of William Adams Way. This area contains amenity grassland dominated by perennial rye-grass *Lolium perenne*, with some white clover *Trifolium repens*, ribwort plantain *Plantago lanceolata* and common dandelion *Taraxacum officinale* also present.
Allotments	The area to the east of Suffolk Road contains several allotments which, in addition to scattered native tree species, contained varieties of arable crops and introduced garden plants.
Hardstanding and Buildings	The area to the east of the river Yare is well built up with roads, industrial buildings and concrete storage space for materials being shipped. Butterfly bush *Buddleja davidii*, creeping thistle *Cirsium arvense* and ragwort *Jacobaea vulgaris* were seen to be growing amongst the concrete.
Hedgerow	There are several species poor hedgerows surrounding properties east of the River Yare.
Ditch	The north and west of Southtown Common is bordered by a ditch containing standing water. The banks are covered by common nettle *Urtica dioica*, bramble *Rubus fruticosus*, great willowherb *Epilobium hirsutum*, dog rose *Rosa canina* and creeping thistle. To the north of William Adams Way and to the west of Suffolk road, is a wet ditch and associated scrub habitat. The ditch passes under William Adams Way and runs north away from the road. The area around the ditch contains willow *Salix* sp., great willowherb, bramble, common nettle, hawthorn *Crataegus monogyna*, poplar *Populus* sp. and field bindweed *Convolvulus arvensis* and hogweed *Heracleum sphondylium*.
River	The proposed bridge will cross the River Yare. At this location the river is tidally influenced. Mud and silt, typically associated with this habitat are likely to support benthic invertebrate communities and fish stocks. Common terns *Sterna hirundo* are known to forage on the River Yare. This stretch of the Yare is in use as a working port.

[71] Mouchel 2016. Great Yarmouth Third River Crossing Preliminary Ecological Appraisal Produced for Norfolk County Council

Habitat	Description
Scattered trees	A mixture of broadleaf trees are present in the margins of Southtown Common, as well as bordering William Adams Way to the north and south. Pedunculate oak *Quercus robur*, beech *Fagus sylvatica*, poplar *Populus* spp., willow *Salix* spp., hawthorn *Crataegus* spp., sweet chestnut *Castanea sativa* and horse chestnut *Aesculus hippocastanum* are all present alongside ash *Fraxinus excelsior* and elder *Sambucus nigra*.

Species

8.4.10. A summary of species potential and results of surveys undertaken to date within are provided in Table 8.3 – Species Surveys Proposed and Undertaken.

Table 8.3 – Species Surveys Proposed and Undertaken

Species	Description
Aquatic Ecology	The River Yare has the potential to support a range of aquatic species and communities including fish and benthic invertebrates. Aquatic ecological assessment work, including fish trawl surveys are yet to commence, however it has been identified as a future survey requirement. Discussions with Natural England, the Environment Agency and the Marine Management Organisation (MMO) are ongoing in relation to surveys in respect of the marine environment.
Bats	Thirteen structures were assessed for their suitability to support roosting bats during August 2017 (described within the Protected Species Survey Report, presented in Appendix 8B). Ten were assessed as having Low Roost Suitability, and two as having Negligible Roost Suitability. One building was inaccessible. Further surveys, comprising internal inspections and dusk emergence/dawn re-entry surveys will be undertaken and the results, along with any subsequent mitigation measures required, will be incorporated into the ES. Foraging habitats such as open water, domestic gardens and allotments within the vicinity of the Proposed Scheme were fragmented and unconnected. This foraging habitat is of low suitability for use by foraging and commuting bats. Two transects were undertaken in July and August 2017. No bats were recorded along Transect 1. This was likely to be a result of the absence of vegetation and high levels of artificial lighting. One species of bat, common pipistrelle, was recorded along Transect 2. Four commuting passes were recorded along the northern edge of Southtown Common, where it meets William Adams Way. No bat foraging activity was recorded.
Badgers	No evidence of badger was recorded during the survey work undertaken. There are no habitats suitable for badger within the Main Survey Area. Accordingly, no further surveys will be undertaken for this species.
Otter	The main channel of the River Yare, through the centre of the Survey Area, is canalised and with no suitable locations for otter holts. It is therefore unlikely that this species could be affected by the Proposed Scheme and no further surveys will be undertaken for this species.
Water vole	A ditch is present on the northern and western edge of Southtown Common. A water vole survey, undertaken in August 2017 (described within the Protected Species Survey Report, presented in Appendix 8B), recorded feeding remains and water vole droppings along this section of the ditch. Although the ditch continues to the north of William Adams Way, this could not be surveyed as access to the channel and banks could not be safely achieved. Further surveys for water vole will be undertaken following a change in the scheme alignment since the previous surveys were undertaken. The results of these surveys will be reported in the ES.

Species	Description
Other mammals	The habitats within the footprint of the Proposed Scheme, including residential gardens and an area of allotments on Queen Anne's Road are suitable habitat for hedgehog, although no evidence of hedgehog was recorded during the survey work undertaken. Measures to mitigate the impact of the Proposed Scheme on hedgehogs will be included within the ES. Further surveys for hedgehogs will not be undertaken.
Amphibians	There is a small pond located roughly within the centre of the Main Survey Area, adjacent to William Adams Way and Queen Anne's Road (approximate Ordnance Survey grid reference: TG523058). The pond and the surrounding habitat, which comprises grassland, scrub and woodland, is suitable for amphibians. In addition, a ditch is present within the Survey Area, located on the northern and western edge of Southtown Common. At the time of survey, the ditch contained standing water. The ditch and adjacent terrestrial habitat within Southtown Common is also suitable for amphibians. Both the pond and the ditch were subject to a Habitat Suitability Index (HSI) assessment in September 2016 to assess suitable for great crested newts *Triturus cristatus*. The ditch scored 0.49 and the pond scored 0.52 which corresponds as 'poor' and 'below average' suitability. These scores indicate that great crested newts are unlikely be present in these waterbodies, and therefore further surveys will not be undertaken.
Reptiles	The majority of habitats within the footprint of the Proposed Scheme comprise either short or open sward grassland, or concrete urban areas which are of negligible value for reptiles. The allotments south of Queen Anne's Road (approximate Ordnance Survey grid reference: TG523058) provide suitable habitat for reptiles, including a mix of tall ruderal vegetation and long sward grassland, with areas of compost and logs which could be used as refugia. However, this habitat is limited in extent, subject to frequent disturbance and surrounded by entirely by urban development with no connectivity to other suitable habitats within the wider area. Accordingly, the suitability of this habitat for reptiles is limited such that should reptiles be present, it is likely that they will occur in low numbers only. Measures to mitigate the impact of the Proposed Scheme on reptiles will be included within the ES. Further surveys for reptiles will not be undertaken.
Birds	Trees, areas of scrub and a number of buildings within and adjacent to the Proposed Scheme are suitable for use by breeding birds. Breeding bird surveys, comprising transect and vantage point surveys, are ongoing through 2018. These surveys will provide information on the assemblage of species using the habitats within the Main Study Area, including bird species that may be using the River Yare. The mosaic of urban areas with scattered ruderal vegetation and scrub is suitable for black redstart Phoenicurus ochruros. Dedicated surveys for this species are ongoing throughout 2018.

8.5 PREDICTED EFFECTS

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

8.5.2. Taking into account the intended design form and likely construction requirements of the Proposed Scheme, and the data derived from desk studies, the PEA and the species-specific surveys undertaken to date, impacts which could result from implementation and future use of the Proposed Scheme have been identified. These are described below and will form the focus of the assessments which are yet to be undertaken and will be reported within the ES, alongside any mitigation measures which may be required.

8.5.3. CONSTRUCTION

- Killing, injuring and disturbance of protected species during construction;
- Temporary reduction in water quality through sedimentation caused by construction works within the River Yare, with consequent effects upon habitats, aquatic species and conservation designations;
- Contamination of watercourses through accidental spillage of fuels/chemicals with consequent effects upon aquatic habitats, aquatic species and conservation designations;
- Contamination of watercourses as a result of mobilisation of existing ground contamination. Consequent effects upon aquatic habitats, aquatic species and conservation designations;
- Potential contamination of nearby habitats, watercourses and designated sites as a result of a reduction in air quality (including construction related dust).
- The works may disturb foraging and commuting bats using affected habitats. This is considered to be a minor effect on bats as the works are of temporary duration and bat activity is low throughout the area of works.
- Floodlighting used during nights works (if required) could disturb bats or prevent them from using, or cause severance of, regular commuting routes or foraging areas.

8.5.4. OPERATION

- Direct loss of habitat through land-take;
- Direct loss of the river banks/aquatic habitats, through the construction of the bridge structure, including areas that fall within the Outer Thames Estuary SPA;
- Potential for effects upon the Conservation Objectives of the SPA for bridge works, in terms of any piers, which will be located within the SPA;
- Fragmentation of retained habitats and/or severance of wildlife corridors;
- Wildlife fatalities as a direct result of severance of foraging routes, breeding sites or territories;
- Contamination of watercourses and/or waterbodies associated with road related run-off. Consequent effects upon aquatic habitats aquatic species and conservation designations;
- Disturbance of nocturnal animals, such as bats, where road lighting introduces a new light source;
- Disturbance of wildlife as a result of increased noise and vibration; and

8.5.5. Pursuant to the Conservation of Habitats and Species Regulations 2017[72] an assessment will be undertaken of the Proposed Scheme's effects on the Breydon Water SPA and Ramsar site, the Great Yarmouth North Denes SPA and the Outer Thames Estuary SPA (including the River Yare SPA) (the European Sites). It is proposed that Information relating to HRA will not be duplicated in the ES but will be cross-referenced within the ecology chapter as appropriate.

[72] S.I. 2017/1012

8.6 PROPOSED MITIGATION

8.6.1. Mitigation measures will be included within the interim CoCP that will accompany the ES and will be secured through the full CEMP. The opportunity for these will be considered following consultation and will be presented in the ES.

GENERAL MEASURES

8.6.2. At this PEIR stage, prior to completion of internal inspection surveys and emergence/re-entry surveys, it is not possible to determine the impact of the Proposed Scheme on bats. Mitigation and enhancement measures will be informed as appropriate by the results of these surveys and presented in the ES.

8.6.3. Fish trawl surveys are due to be undertaken in conjunction with the benthic ecology surveys. The effect of the Proposed Scheme on fish passage, and any mitigation measures required, will be presented in the ES.

8.6.4. Further mitigation and enhancements will be proposed after the completion of surveys.

8.6.5. Generic measures adopted as best practice to avoid predicted effects of degradation of terrestrial habitats, watercourses and species adjacent to work sites include the following:

- All site works should be carried out in accordance with best environmental working practices e.g. CIRIA publications.
- Polluting materials should not be stored in works areas located within areas of significant biodiversity value, particularly within 50m of watercourses.
- Methods to minimise/prevent contamination of the watercourses during the construction works should be implemented in accordance with most recent guidance.
- As many trees as possible should be retained. Essential tree surgery to the crown or roots of trees should be undertaken in accordance with British Standard (BS) 3998:2010 Tree Work Recommendations and appropriate Arboricultural Association advice notes, along with the protection of trees.
- Works that disturb drainage features should include measures to mitigate adverse effects or reinstate drainage to ensure the features retain their correct working function.
- The presence of significant ecological receptors has implications for the timing of the development work. The avoidance of periods of particular sensitivity is considered best practice and should be considered.
- All trenches and work excavations should be covered overnight or fenced off to prevent animals becoming trapped, and trenches should include an earth ramp to allow animals to climb out.
- A watching brief should be maintained throughout the works. If any protected species are found, a clerk of works or ecologist should advise how best to proceed.
- Areas of verge that are temporarily disturbed should be re-instated after completion of the works. Habitats should be encouraged to regenerate naturally.
- In view of the current national issue with the fungal infection of ash trees by *Chalara fraxinea*, a walkover survey for signs of ash dieback is recommended prior to works within areas containing ash or which require the felling of ash trees. If infected ash trees are identified, appropriate bio-security advice issued by Highways England and the Forestry Commission should be followed.

CONSTRUCTION

8.6.6. In order to minimise the risk of disturbing breeding birds, the removal of woody vegetation should be undertaken outside of the breeding season (typical breeding 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.

8.6.7. Given the known presence of water vole within the Application Site, it is likely that mitigation measures will include measures to avoid incidental mortality during site clearance or construction and provision of replacement habitat to compensate for habitat lost to the footprint of the Proposed Scheme. The results of the update surveys and details of the proposed mitigation strategy will be reported in the ES.

8.6.8. Suitable habitat for reptiles is limited and isolated within the Main Study Area such that large populations of reptiles are unlikely to be present. During construction, it is possible, though unlikely, that individual animals may be present in these isolated areas of suitable habitat. Precautionary measures as follows are at this stage considered likely to be effective to ensure that individual animals are not affected during the works.

- Reptiles will be excluded from the proposed works area through habitat manipulation and natural refugia removal.
- Habitat manipulation will involve strimming the vegetation within the works area prior to commencement of works to reduce the vegetation to a sward height that would encourage reptiles to move offsite and into adjacent areas. This should be undertaken when reptiles are active, i.e. between mid-April to mid-October when the temperature is at least 12ºC

8.6.9. The habitats within and around the Main Study Area are suitable to support hedgehogs. A watching brief will be maintained during the works to protect individual hedgehogs that may be present.

OPERATION

8.6.10. New planting should aim to restore the ecological value of the soft estate where affected, and should aim to enhance the local biodiversity where possible. This could include re-instating and re-linking severed linear wildlife corridors with new planting. Consideration should be given to the inclusion of locally sourced native plant species within planting proposals and the application of sensitive management and monitoring regimes.

8.6.11. Swifts and black redstarts are species for which enhancement may be possible, subject to further design. The results of the breeding bird surveys, which are currently being undertaken, will inform the need for mitigation and identify opportunities for further enhancement.

8.7 CONCLUSIONS AND EFFECTS

8.7.1. A Habitat Regulations assessment will be undertaken to determine whether the Proposed Scheme will have an adverse effect on the integrity of the European sites identified within the Broad and Extended Study Areas. Until this stage of assessment is completed, insufficient information is available to reach conclusions on the impact on these sites.

8.7.2. No habitats of ecological importance or with legal protection have been identified within the Main Study Area, although as stated in this chapter, a benthic ecology survey is still to be undertaken. As assessment of the likely effects of the Proposed Scheme on these habitats will be undertaken after these surveys are complete.

8.7.3. The assessments undertaken within the survey data collected to date have not identified any significant impact on hedgehogs, amphibians or reptiles. At this current stage of the assessment, there is insufficient information available to assess the effects upon bats, breeding birds, fish and water vole.

8.8 ASSESSMENTS STILL TO BE COMPLETED

8.8.1. Surveys for the following species and habitats are ongoing and will be presented within the ES along with conclusions on the nature of any significant effect upon them:

- Additional bats (internal inspections and dusk emergence/dawn re-entry surveys);
- Breeding birds (transect and vantage point surveys);
- Benthic ecology;
- Fish trawls; and
- Water vole.

9

CULTURAL HERITAGE

9 CULTURAL HERITAGE

9.1 INTRODUCTION

9.1.1. This chapter provides preliminary information with regard to cultural heritage as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. It is supported by Figures 9.1 - 9.3 and Appendix 9A, 9B and 9C.

9.1.2. For the purposes of this assessment, the Proposed Scheme refers to the main area of works as presented in Figures 2.4, 2.5 and 2.6. Six outlying sites for the installation of VMS and vessel waiting facilities in the River Yare are addressed separately where appropriate.

9.1.3. The preliminary assessment in relation to cultural heritage has focused on:

- Establishment of the baseline environment relative to archaeological remains, historic buildings and historic landscapes; and
- Identification and description of predicted impacts on identified assets and resources.

STUDY AREA

9.1.4. The study area which has been adopted for the assessment of cultural heritage features extends to:

(i) 1km around the Proposed Scheme for designated assets (World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Park and Gardens, Registered Battlefields and Conservation Areas), presented in Figure 9.1;

(ii) 500m around the Proposed Scheme for non-designated cultural heritage assets, presented in figure 9.2; and

(iii) 250m around the proposed locations of the VMS signs and vessel waiting facilities, for designated cultural heritage assets presented in Figure 3a – 3g.

9.2 DIRECTIVES, STATUTES AND RELEVANT POLICES

NATIONAL LEGISLATION

Ancient Monuments and Archaeological Areas Act 1979

9.2.1. Ancient Monuments are heritage assets which can be either Scheduled Monuments (SM) or "any other monument which in the opinion of the SoS is of public interest by reason of the historic, architectural, traditional, artistic or archaeological interest attaching to it". The Act states that consent must be obtained from the SoS for works of demolition, destruction, damage, removal, repair or alteration that to a SM or assets being considered for adoption as an SM.

9.2.2. Development affecting the setting of a SM is dealt with wholly under the planning system (where the effect on setting is a material consideration) and does not require Scheduled Monument Consent. SMC. Geophysical prospection (including the use of a metal detector) on a Scheduled Monument requires prior consent from Historic England.

The Planning (Listed Buildings and Conservation Areas) Act 1990

9.2.3. The Act sets out the legal requirements for the control of works to listed buildings. Grade I buildings are those of exceptional interest. Grade II* are particularly significant buildings of more than special interest. Grade II are buildings of special interest, which warrant every effort being made to preserve them.

9.2.4. Once listed, Listed Building Consent must be obtained from the local planning authority before works to demolish, alter or extend a listed building can be carried out. In considering applications for consent the authority must 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.

9.2.5. The Act imposes a duty on Local Planning Authorities to determine which parts of their area are areas of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance, and to designate these areas as Conservation Areas. Consent must be obtained under the TCPA 1990 for the demolition of buildings in a Conservation Area, and when exercising any functions under the planning acts (including the grant of planning permission for new development), local planning authorities and the SoS (as the case may be) must pay special attention to the desirability of preserving or enhancing the character or appearance of conservation areas. In addition, when considering whether to grant planning permission for development which affects a listed building or its setting, special regard must be had to the desirability of preserving the building or its setting or any features of special architectural or historic interest. These statutory duties apply in addition to the relevant policies in part 16 of the NPPF[73]..

Section 33 Planning Act 2008

9.2.6. It should be noted that where development requires a DCO under the Planning Act 2008, section 33 disapplies the need for Scheduled Monument Consent, Listed Building Consent or planning permission for the development. However, the objectives of these regulatory controls and associated policies remain an important consideration in the assessment of an application for a DCO.

NATIONAL POLICY

National Policy Statement for National Networks

9.2.7. The NPS NN states the requirements that the SoS has for DCO applications. The NPS clarifies that a heritage asset can be a building, monument, site, place, area or landscape and that the significance of the asset is a factor both its physical presence as well as its setting.

9.2.8. Within an Environmental Statement, an applicant is required to "*undertake an assessment of any likely significant heritage impacts of the proposed project ….and describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance*."

National Policy Statement for Ports

9.2.9. The PNPS states the requirements for Port and related infrastructure. Similar to the NPS NN, an applicant is required to provide a description of the significance of affected heritage assets affected by a proposed development and the level of detail should be proportionate to the importance of the heritage asset.

National Planning Policy Framework 2018[74]

9.2.10. The Government issued the revised NPPF in July 2018 and further guidance is provided in the Planning Policy Guidance. Chapter 16 brings together the way plan making and decision making should adopt a positive strategy to ensure the conservation and enjoyment of the historic environment and how to approach consideration of the potential impacts of development on such assets. The strategy should take into account the '*desirability of new*

[73] Ministry of Housing, Communities and Local Government (July 2018) National Planning Policy Framework. Available here:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf

[74] Ministry of Housing, Communities and Local Government (July 2018) National Planning Policy Framework. Available here:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf

development making a positive contribution to local character and distinctiveness' (paragraph 185). It also requires that a high level of detail should be provided when considering proposals with the potential to affect heritage assets. In determining applications, account should be taken of the desirability of sustaining and enhancing the significance of heritage assets, the positive contribution that conservation of heritage assets can make to sustainable communities, and the desirability of new development making a positive contribution to local character and distinctiveness (paragraph 192).

9.2.11. When considering the impact of a proposal on a heritage asset, great weight should be given to its conservation (paragraph 193). Justification for any harm should be clear and convincing (paragraph 194). Where any harm to the significance of a designated heritage asset would be less than substantial, the harm should be weighed against the public benefits of the proposal. Proposals involving substantial harm to (or total loss of) significance should be refused unless it can be demonstrated that the harm or loss is necessary to achieve substantial public benefit that outweighs that harm or loss (paragraphs 195 and 6).

Local Policy

9.2.12. The Great Yarmouth Local Plan: Core Strategy[75] was adopted in 2015 and sets out the overall planning strategy for the Borough until 2030. The Council's approach to managing the historic environment is addressed in Policy CS10 – Safeguarding local heritage assets[76] and in the Saved Policies from the 2001 Great Yarmouth Borough-Wide Local Plan - BNV2: Areas of archaeological significance and BNV8 Buildings of local importance[77].

9.3 ASSESSMENT METHODOLOGY

9.3.1. The preliminary assessment examines four topic areas:

- Archaeological assets: materials created or modified by past human activities, which include a wide range of visible and buried artefacts, field monuments, structures and landscape features. This includes areas which have been identified as being of archaeological potential;
- Built heritage assets: architectural, designated or other structures with historical value (significance), such as listed buildings;
- The historic landscapes; and
- Palaeoenvironmental assets.

9.3.2. The preliminary assessment is informed by:

(i) Historic Environment Good Practice Advice in Planning Policy Notes 2-3 managing significance and setting;

(ii) DMRB, Volume 11, Section 3, Part 2; Appendix 8 (DMRB: HA208/07)[78]; and

[75] Great Yarmouth Local Plan Core Strategy 2013-2030. Adopted December 2015. [online] Available at https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1884&p=0

76 https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1884&p=0

77 https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1585&p=0

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

(iii) Volume 5, Section 1, Part 2 (TA37/93)[79] and Chartered Institute for Archaeologists standards and guidance documents (refs).

9.3.3. For ease of reference, summary findings regarding identified individual heritage assets are presented in DMRB Annexes 5, 6 and 7 tabular format although the contribution of immediate, wider and extended setting, including association with other heritage assets, and the contribution these factors make to significance is presented in other sections of this chapter. The tables include consideration of the value (significance) of archaeological remains, historic landscapes, built heritage and set out the assessed magnitude of impact and significance of effect of the Proposed Scheme after mitigation has been taken into account.

ESTABLISHMENT OF THE BASELINE ENVIRONMENT

9.3.4. The identification and description of the baseline environment has used data from the following sources:

- Data has been gathered on designated heritage assets from the National Heritage List for England (NHLE)[80];
- Details of non-designated heritage assets have been gathered from the Norfolk Historic Environment Record (NHER)[81];
- Information on Conservation Areas held by Great Yarmouth Borough Council[82];
- A preliminary assessment of the potential of the study area presented in the Cultural Heritage Desk-based Assessment (WSP 2017), presented in Appendix 9B;
- Geoarchaeological Feasibility Study (Wessex Archaeology 2018), Presented in appendix 9C.

9.3.5. Initial value assessments have been made for each cultural heritage asset following the guidance set out in DMRB volume 11, Section 3, Part 2 (HA 208/07)[78].

VALUE OF CULTURAL HERITAGE ASSETS

9.3.6. Assessment of the value of cultural heritage assets will involve consideration of the heritage interest of the asset to this and future generations. That interest may be archaeological, architectural, artistic or historic, and may derive not only from the asset's physical presence, but also from its setting, and from individual or group qualities, either directly or potentially. These are professional judgements, but they are also guided by legislation, national policies, acknowledged standards, designations, criteria and priorities. The assessment of value (also referred to as significance) will be undertaken in line with DMRB guidance, and in compliance with the NPPF and the following relevant professional guidelines: Chartered Institute for Archaeologists (CIfA) Standard and Guidance for Historic Environment Desk-based Assessment (2017)[83] and CIfA Code of Conduct (2014)[84].

9.3.7. The DMRB recommends the adoption of six ratings for value in relation to archaeological remains and built heritage: very high, high, medium, low, negligible and unknown. Definitions for each rating are outlined in Table 9.1 - Factors for assessing the value of archaeological remains.

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[79] Highways Agency 1993. Scheme Assessment Reporting Part 2, TA37/93. [online] Available at http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol5/section1/td3793.pdf (Accessed June 2018.

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

[81] Norfolk Historic Environmental Record. [online] Available https://www.norfolk.gov.uk/libraries-local-history-and-archives/archaeology-and-historic-environment/historic-environment-record. Accessed May 2018

82 https://www.great-yarmouth.gov.uk/conservation-areas

[83] Chartered Institute for Archaeologists (2017) Standard Guidance for Historic Environment Desk Based Assessment [online] Available at: http://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf Accessed January 2018

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

Table 9.1 - Factors for assessing the value of archaeological remains

Value	Criteria: Built Heritage	Criteria: Archaeology	Criteria: Historic Landscape
Very High	Structures inscribed as of universal importance as World Heritage Sites Other buildings of recognised international importance	World Heritage Sites (including nominated sites) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives	World Heritage Sites inscribed for their historic landscape qualities. Historic landscapes of international value, whether designated or not. Extremely well preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s).
High	Scheduled Monuments with standing remains Grade I and II* Listed Buildings Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the category Conservation Areas containing very important buildings Undesignated structures of clear national importance	Scheduled Monuments (including proposed sites) Undesignated assets of schedulable quality and importance Assets that can contribute significantly to acknowledged national research objectives	Designated historic landscapes of outstanding interest. Undesignated landscapes of outstanding interest. Undesignated landscapes of high quality and importance, and of demonstrable national value. Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s).
Medium	Grade II Listed Buildings Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations Conservation Areas containing buildings which contribute significantly to their historic character Historic Townscape or built-up areas with important historic integrity in their buildings, or built settings (e.g. including street furniture and other structures)	Designated or undesignated assets that contribute to regional research objectives	Designated special historic landscapes. Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional value. Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s).
Low	Locally Listed Buildings Historic (unlisted) buildings of modest quality in their fabric or historical association Historic Townscape or built-up areas of limited historic integrity in their buildings, or built settings (e.g. including street furniture and other structures)	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	Robust undesignated historic landscapes. Historic landscapes with importance to local interest groups. Historic landscapes whose value is limited by poor preservation and/or poor survival of contextual associations.

Value	Criteria: Built Heritage	Criteria: Archaeology	Criteria: Historic Landscape
Negligible	Buildings of no architectural or historical note; buildings of an intrusive character	Assets with very little or no surviving archaeological interest	Landscapes with little or no significant historical interest.
Unknown	Buildings with some hidden (i.e. inaccessible) potential for historic significance	The value of the site has not been ascertained	The value of the historic landscape has not been ascertained.

MAGNITUDE OF IMPACT

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

9.3.9. The DMRB recommends the adoption of six ratings for magnitude of impact: no change, negligible, minor adverse, moderate and major. Factors for assessing the magnitude of impact are summarised in Table 9.2 – Factors for assessing the magnitude of impact.

Table 9.2 – Factors for assessing the magnitude of impact

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

SIGNIFICANCE OF EFFECT

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

9.3.11. The DMRB recommends the adoption of five ratings for significance of effect: neutral, slight, moderate, large and very large. The matrix used for establishing significance of effect is presented in Table 5.3.

SETTING ASSESSMENT

9.3.12. In order to determine the magnitude of impact and the significance of effects on a heritage asset due to a change in setting, an assessment is required in order to determine how the setting contributes to the significance of the heritage asset.

9.3.13. The definition of setting used here is taken from the revised NPPF: "*The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral".*' (Annex 2). Historic England in their Setting of

Heritage Assets: Historic Environment Good Practice Advice in Planning[85] that the importance of setting lies in what it contributes to the significance of the heritage asset. This depends on a wide range of physical elements within, as well as perceptual and associational attributes pertaining to, the heritage asset's surroundings.

9.3.14. Historic England discuss several other general considerations including: cumulative change; change over time; appreciating setting; buried assets and setting; designated settings; setting and urban design; and setting and economic and social viability and has provided a stepped approach to the assessment and importance of setting to heritage assets. Following Step 1, which is the initial identification of the heritage assets the subsequent steps comprise:

- Step 2: Assessing whether, how and to what degree the settings make a contribution to the cultural heritage significance of the heritage assets.
- Step 3: Assessing the effect of a proposed development on the setting, and the resulting implications for the cultural heritage significance of the heritage asset(s).
- Step 4: Maximising enhancement and minimising harm (mitigation).

9.3.15. Step 2: In assessing whether, how and to what degree the settings make a contribution to the cultural heritage significance of the heritage assets, a number of potential attributes of a setting are considered.

9.3.16. The attributes of setting contribute to its sensitivity and its contribution to the significance of the asset. Table 2 presents examples of definitions for the sensitivity of settings but these should not be seen as exhaustive.

Table 9.3 - Step 2 - Definitions of Sensitivity for the Settings of Heritage Assets

Examples of sensitivity of settings	Contribution to significance of the asset
A defined setting that is contemporary with and historically and functionally linked with the heritage asset, may contain other heritage assets of international or national importance, has a very high degree of indivisibility with the asset and makes a very substantial contribution to both the significance of the heritage asset and to the understanding and appreciation of the significance of the asset	Very substantial (very high)
Contemporary with and historically and functionally linked with the heritage asset, with minor alterations (in extent and/or character), has a high degree of intervisibility with the asset and which makes a substantial contribution to both the significance of the heritage asset and to the understanding and appreciation of the significance of the asset.	Substantial (high)
Contemporary with and/or historically and/or functionally linked with the heritage asset but with alterations which may detract from the understanding of the heritage asset, and/or with a moderate degree of indivisibility with the asset and/or which makes a moderate contribution to the significance of the heritage asset and/or a moderate contribution to the understanding and appreciation of the significance of the asset.	Moderate (medium)
Largely altered so that there is very little evidence of contemporaneous and/or historic and/or functional links with the heritage asset, and/or with a low degree of indivisibility with the asset and/or which makes a minor contribution to both the significance of the heritage asset and to the understanding and appreciation of the significance of the asset.	Minor (low)

[85] Historic England (2017) The Setting of Heritage Assets (2nd edition)

9.3.17. Step 3: Having assessed the contribution of the setting to the cultural heritage significance of the asset, the effect of a proposed development on the setting can be determined by consideration of the potential attributes of a proposed development affecting setting.

9.3.18. Once the sensitivity and contribution of the setting has been determined and the potential attributes of a proposed development identified, the level of harm or beneficial impact of a proposed development needs to be evaluated. The criteria for assessing the level of harm is presented below (Table 9.5 - Step 3 - Criteria for Assessment of the level of harm/benefit on the setting of a heritage asset). This presents definitions of varying scales of harm or benefit to the contribution of the setting.

Table 9.5 - Step 3 - Criteria for Assessment of the level of harm/benefit on the setting of a heritage asset

Level of Harm and Benefit	Guideline Criteria
Major beneficial	The contribution of setting to the cultural heritage asset's significance is considerably enhanced as a result of the development; a lost relationship between the asset and its setting is restored, or the legibility of the relationship is greatly enhanced. Elements of the surroundings that detract from the asset's cultural heritage significance or the appreciation of that significance are removed.
Moderate beneficial	The contribution of setting to the cultural heritage asset's significance is enhanced to a clearly appreciable extent as a result of the development; as a result, the relationship between the asset and its setting is rendered more readily apparent. The negative effect of elements of the surroundings that detract from the asset's cultural heritage significance or the appreciation of that significance is appreciably reduced.
Minor beneficial	The setting of the cultural heritage asset is slightly improved as a result of the development, slightly improving the degree to which the setting's relationship with the asset can be appreciated.
Negligible	The setting of the cultural heritage asset is changed by the development in ways that do not alter the contribution of setting to the asset's significance.
Minor harm (Minor Adverse) Less than substantial harm	The contribution of the setting of the cultural heritage asset to its significance is slightly degraded as a result of the development, but without adversely affecting the interpretability of the asset and its setting; characteristics of historic value can still be appreciated, the changes do not strongly conflict with the character of the site, and could be easily reversed to approximate the pre-development conditions.
Harm (Moderate Adverse) Less than substantial harm	The contribution of the setting of the cultural heritage asset to its significance is reduced appreciably as a result of the development. Relevant setting characteristics can still be appreciated but less readily.
Substantial harm (Major Adverse)	The contribution of the setting of the cultural heritage asset to its significance is effectively lost or substantially reduced as a result of the development, the relationship between the asset and its setting is no longer readily appreciable.

9.3.19. Changes may occur to the settings of an asset that neither affect their contribution to the cultural heritage significance of the asset, nor the extent to which its cultural heritage significance can be experienced. In such instances, it will be considered that there is no impact upon setting

9.4 BASELINE ENVIRONMENT

9.4.1. All designated and non-designated heritage assets within the study area are listed in the gazetteer presented within Appendix 9.1

9.4.2. No World Heritage Sites, Registered Battlefields, Registered Parks or Gardens or Protected Wreck sites have been identified within 1km of the Proposed Scheme.

9.4.3. The Grade II listed Dolphin Public House (NHLE 1096829), an early 20th century building, is located within the Proposed Scheme boundary.

9.4.4. Designated heritage assets (see Figure 9.1) in the wider (1km) Study Area consist of:

- Four Scheduled Monuments;
  - Town Walls (NHLE 1003782);
  - Nos 6, 7, and 8, Row 111 South Quay (NHLE 1003958, and also Grade II Listed Building NHLE 1245916);
  - Merchant's House, Row 117, South Quay (NHLE 1004020, see also Grade II* below); and
  - Greyfriars Franciscan Friary (NHLE 1017910).
- Four Grade I Listed Buildings;
  - The Tollhouse (NHLE 1245560);
  - Remains of the Church of the Greyfriars (NHLE 1245915);
  - St Georges Theatre (NHLE 1245919); and
  - Nelson's Monument (NHLE 1246057).
- Eight Grade II* Listed Buildings;
  - Great Yarmouth Potteries (NHLE 1245561);
  - Custom House (NHLE 1245800);
  - 25, South Quay (NHLE 1245803);
  - Old Merchant House (NHLE 1245917, see also Scheduled Monument above);
  - The Hippodrome (NHLE 1245922);
  - St Nicholas Hospital Main Entrance Range (NHLE 1245984);
  - Old White Lion Public House (NHLE 1271278); and
  - The Winter Gardens (NHLE 1271608).
- 102 Grade II Listed Buildings, including;
  - Hotels and Public Houses;
  - Residential properties;
  - Churches;
  - Public and Leisure facilities; and
  - Industrial buildings.
- Six Conservation Areas;
  - Camperdown;
  - Gorleston Extension;
  - King Street;
  - Seafront;
  - Hall Quay and South Quay; and
  - St George's.

9.4.5. There are a further 119 non-designated heritage assets recorded on the NHER in the 500m study area (see Figure 9.2). Eight lie within the Proposed Scheme:

- The Route of Norfolk and Suffolk Joint Railway (HER 13575);

- Routes of Great Yarmouth urban railways (HER 13576);
- Site of World War Two defences (HER 27967) – evidence from aerial photographs from the late 1940s of fencing and barbed wire along with several small buildings;
- Site of late 19th century icehouse and three salt stores (HER 55685);
- Site of World War II craters (HER 27700 and 43589); and
- Site of World War II anti invasion defences at Southtown (HER 42355 and 42353).

9.4.6. The vast majority of these assets in the Study Area represent World War II structures, camps and bomb crater sites, with the remaining sites comprising finds and structures which reflect the important Naval and shipping history of the town. The majority of the remaining recorded assets date to the post medieval period. Within the wider study are there is evidence of buried urban and riverfront remains dating to the Medieval period, as well as a single findspot of a Neolithic scraper (HER 12936).

9.4.7. A deposit model for soils in Great Yarmouth has been created by the Great Yarmouth Archaeological Map project using data from 142 boreholes which were drilled by the Norfolk County Laboratory. The model shows that the area where Great Yarmouth now stands started out as the mouth of a large estuary. Since the last Ice Age, a south bound current has laid a spit of sand across the north of the estuary, from the north end to the south. The sand spit blocked off the estuary, leading to the formation of the peat in the Broads. The sand spit was breached by the sea, and left as either a low tidal island or a shoal until about 1300 years ago, gradually rising to become permanently dry. When it was first occupied, probably at some point during the tenth century, it was a low-lying sand bank about 1m above sea level. Throughout the first centuries of habitation, large drifts of windblown sand buried dwellings and shifted sand dunes, and by the time the walls were built around the medieval town in the 13th and 14th centuries the ground level was over 1m higher.

9.4.8. The boreholes and evidence from archaeological excavations in the area suggest the presence of buried medieval shorelines (evidence of this has been found just outside the 500m study area at the site of the Power Station during its construction).

9.4.9. The medieval walled town lies to the north of the Proposed Scheme options, just outside the 500m study area. The boundary of the medieval town is represented by the well-preserved remains of the defensive walls, built in the 13th century and now designated as a Scheduled Monument (NHLE 1003782). The southern end of the town wall lies approximately 350m north of the Proposed Scheme and extends for distance of around 2km northwards. Just inside the walls, within the 500m study area, lies the site of the 13th century Dominican or Blackfriars Friary (HER 4266). Approximately 500m north of this site, just within the 1km study area, is the Scheduled Monument Greyfriars Franciscan friary, also established in the 13th century (NHLE 1017910). A third ecclesiastical site, an Augustinian Friary, is located 250m to south of Proposed Scheme (HER 60531). The presence of these establishments demonstrates the importance of the medieval settlement of Great Yarmouth.

9.4.10. Within the study area, the remains of boats have been found on an earlier buried shoreline at around 3m below the current ground level. An old landing place was also recorded below the Town Hall site in 1887. All of the above suggests that buried medieval deposits may survive deep below the current ground level on either side of the River Yare within the study area.

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

9.4.12. The town was first bombed during World War I in 1915 (the first aerial bombardment in the UK) however, the majority of wartime features date to World War II. During this time the town suffered extensive bombing by the Luftwaffe as it was one of the last significant places German bombers could drop bombs before returning to base. Despite this, two-thirds of the medieval town wall survived. World War II sites within the inner study area include air raid shelters Anti-Aircraft batteries, pill boxes, gun emplacements, barbed wire obstructions, blast walls, beach defences, anti-tank defences and military camps. There are also at least 12 recorded bomb craters.

The presence of these known bomb craters and historic bombing activity suggests a significant risk of unexploded ordnance, particularly in softer riverbed deposits.

9.4.13. The former Norfolk and Suffolk Joint Railway, which follows the route of the A47, was opened in 1903 and was in use until 1970. Three sections of the former route of the Great Yarmouth urban railway lie on the east side of the River Yare. The urban railway was constructed from the mid-19th century and were used until the late 1920s.

BUILT HERITAGE

9.4.14. The majority of the built heritage remains within the study area are listed buildings. The area has undergone substantial industrial redevelopment in the 20th century. Earlier buildings are now isolated, although still maintain visual and/or transport links to the wharfs and river. The listed buildings consist of a mixture of uses, but a number of these are related to the Naval Hospital which dates from 1806 and was built to treat the sick and wounded from the North Sea Fleet which was engaged in war with France (NHLE 1245982 to 1245986). Great Yarmouth was an important naval base throughout the Napoleonic Wars, and Admiral Lord Horatio Nelson is known to have landed at Great Yarmouth on three occasions. Following Nelson's death, funds were raised to erect a monument in the town, 30 years before a monument was erected in Trafalgar Square. The monument is also a Grade I listed building, and lies within the study area (NHLE 1246057). It is 144 feet high and can be seen from some parts of the study area.

9.4.15. One built heritage asset lies within the Proposed Scheme Boundary, the Grade II Dolphin Public House (NHLE 1096829), which will be retained. Residential properties are located within the Proposed Scheme which correspond to buildings shown on the late 19th century Ordnance Survey Map, including those along Queen Anne's Road and Southtown Road which are to be demolished as part of the Proposed Scheme. Further assessment is required to determine whether these may appropriately be categorised as cultural heritage assets.

9.4.16. The Proposed Scheme does not lie within a Conservation Area.

HISTORIC LANDSCAPES

9.4.17. 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 NCC 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.

9.4.18. Based on a preliminary study, the historic landscape of the study area is dominated by the late 19th and 20th century residential, industrial and commercial townscape, with the largely modern riverfront and harbour. The beach front is very strongly differentiated from the surrounding townscape with its 19th and 20th century leisure and tourist-focused landscape. These combined landscape types illustrate the evolution of Great Yarmouth in the recent past but are not readily indicative of the medieval or early post medieval history of the town. There are some indications of the earlier history of the settlement preserved in the street layout in the northern parts of town around Market Street.

PALAEOENVIRONMENTAL DEPOSITS

9.4.19. An appraisal of the palaeoenvironmental resource has been undertaken by Wessex Archaeology and is presented in full in Appendix 9C.

9.4.20. The early Holocene geomorphology of the Great Yarmouth area has recently been modelled by Jordan et al[86] 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.

9.4.21. Based on an examination of borehole records held by the BGS within the scheme model, and modelling of the early Holocene geomorphology[87], a series of key deposits are identified and outlined below, with specific reference made to their geoarchaeological potential

Sands and Gravels (North Denes Formation)

9.4.22. 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[88]. 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.

Fine-Grained alluvium (Breydon Formation)

9.4.23. 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.

9.4.24. Fine-grained deposits are 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[89]. Deposits of alluvium to the east of the River Yare may also form part of the North Denes Formation.

9.4.25. 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).

9.4.26. 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.

9.4.27. 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

[86] Jordan, H., Holbrook, H and Lawley, R. 2016. Early Holocene geomorphology of the Great Yarmouth area, Norfolk, UK. *Journal of Maps* 12, 122-130.
[87] Jordan et al. 2016.
[88] 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).
[89] Jordan et al 2016, fig. 1

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.

9.4.28. 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. Palaeoenvironmental 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.

Peat (Breydon Formation)

9.4.29. 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.

9.4.30. Within the Proposed Scheme 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.

9.4.31. 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.

Pleistocene sands and gravels (Yare Valley Formation)

9.4.32. Sands and gravels are recorded in several boreholes within the Proposed Scheme 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.

9.4.33. 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.

9.4.34. 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.

Tills (Happisburgh Glacigenic Formation and Lowestoft Formation)

9.4.35. Tills are poorly sorted sediments deposited directly by ice sheets and are mapped extensively to the immediate south of the Proposed Scheme, 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.

9.4.36. Description of sediments in BGS boreholes from within the Proposed Scheme 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 Proposed Scheme boundary, but where present are of a low geoarchaeological potential.

VARIABLE MESSAGE SIGNS AND VESSEL WAITING FACILITIES

9.4.37. Six sites are proposed for the introduction of VMS and one for an vessel waiting facilities. They are discussed below by area and designated heritage assets are identified. Where data is available, non-designated heritage assets are also identified (Figure 9.3).

A47 South

9.4.38. No designated heritage assets lie within 250m of the proposed VMS on the A47 South.

9.4.39. One non-designated heritage asset lies within the proposed VMS location. This is a World War Two Light Anti-Aircraft Battery (HER 19084). Within a 250m buffer there are nine archaeological non-designated assets of World War Two date consisting of five air raid shelters (HER 43597, HER 43595, HER 43594, HER 43300 and HER 43618), an emergency water supply tank (HER 43312), pillboxes (HER 19949), road block (HER 27570) and a bomb crater (HER 27663).

Gapton Hall Road

9.4.40. No designated heritage assets are recorded within the location of the VMS n on Gapton Hall Road.

9.4.41. Within the 250m Study Area are nine non-designated heritage assets. They comprise of the site of 19th century drainage mill (HER 34996), probable post-medieval drains (HER 43474 and 43475), the route of the East Suffolk Railway (HER 13574) and Midland and Great Northern Joint Railway (HER 13581) and five World War Two sites (railway block (HER 42519), pill box (HER 32662) structure (HER 42531), and a bomb crater (HER 43470).

North Quay

9.4.42. The proposed VMS location is within the St Nicholas and Northgate Street Conservation Area. Immediately to the north of the proposed VMS location is the Scheduled Monument medieval Town Walls (NHLE 1003782). One Grade I, two Grade II* and 21 Grade II Listed Buildings lie within the 250m area around the proposed VMS location.

9.4.43. The non-designated heritage asset data was unavailable for this area at the time of the assessment.

Fuller Way

9.4.44. The proposed VMS location lies within the St Nicholas and Northgate Street Conservation Area. The Scheduled Monument medieval Town Walls (NHLE 1003782) are located approximately 150m from the proposed VMS location. Two Grade I, two Grade II* and 32 Grade II Listed Buildings lie within the 250m area around the proposed VMS location.

9.4.45. The non-designated heritage asset data was unavailable for this area at the time of the assessment.

Acle New Road

9.4.46. No designated heritage assets are located within the 250m study area. The non-designated heritage asset data was unavailable for this area at the time of the assessment.

Yarmouth Way

9.4.47. The proposed location lies between the King Street and the Hall Quay South Quay Conservation Areas. There are three Scheduled Monuments located in proximity: Medieval Town Walls (NHLE 1003782), Greyfriars Franciscan Friary (1017910) and Nos 6, 7 and 8 and Row 111, South Quay (NHLE 1003958)). Four Grade I, five Grade II* and 68 Grade II Listed buildings lie within the 250m area around the proposed VMS location.

9.4.48. There is partial data available for non-designated heritage assets and a total of 22 are recorded within proximity of the proposed VMS location and include the site of Great Yarmouth Castle (HER 13375). Most of the assets are of World War Two date.

Vessel Waiting Facilities

9.4.49. The proposed location lies adjacent to the boundary of the Gorleston Extension Conservation Area. Also within the 250m Study Area is the Cliff Hill Conservation Area. A total of seven Grade II Listed Buildings are located within the two Conservation Areas.

9.4.50. The non-designated heritage asset data was unavailable for this area at the time of the assessment.

VALUE OF RECEPTORS

9.4.51. All designated and non-designated heritage assets within the study area are listed in the gazetteer presented within Appendix 9A. The majority of the known archaeological remains found within the study area have been allocated a negligible to low value as they consist of World War 2 defensive sites which are no longer extant. Scheduled Monuments, Grade I and Grade II* Listed Buildings are high value, while Grade II Listed Buildings and Conservation Areas are medium value (see Table 9.1 - Factors for assessing the value of archaeological remains). The non-designated heritage assets are of low to medium value.

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

9.5 PREDICTED EFFECTS

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

- Permanent complete or partial loss of an archaeological feature or deposit as a result of ground excavation;
- Permanent or temporary loss of the physical and/or visual integrity of a feature, monument, building or group of buildings/monuments;
- Damage to the historic environment resources as a result of ground excavation;
- Damage to historic environment resources due to compaction, desiccation or waterlogging;
- Damage to historic environment resources as a result of ground vibration caused by construction; and
- Permanent or temporary impacts on the setting of heritage assets resulting from the construction works and during operation following the introduction of new infrastructure, and the resulting increase in noise from vehicles using the new crossing.

9.5.2. Overall impacts are considered to be adverse and all are considered to be permanent although mitigation is proposed as necessary to reduce the magnitude of the impact.

9.5.3. It should be emphasised that all impacts are based upon present understanding and knowledge and the overall impact and mitigation will be refined following further assessment and evaluation.

ARCHAEOLOGY

9.5.4. There are eight non-designated heritage assets which represent potential buried archaeological remains within the Proposed Scheme. Of these, two are sites of World War II bomb craters (HER 27700 and 43589) of negligible value and three are sites of World War II defences (HER 27967, 42355 and 42353) of low to negligible value. No physical remains associated with these assets are anticipated and therefore the impact is predicted to be **negligible** or **no change.**

9.5.5. There is a potential for a **major adverse** impact on buried deposits associated with the late 19th century icehouse and salt stores (HER 55685), the Route of Norfolk and Suffolk Joint Railway (HER 13575) and the Routes of Great Yarmouth urban railways (HER 13576). All these are assets are of low value.

9.5.6. There is a potential for a major adverse impact on currently unknown heritage assets in the form of a buried medieval shoreline and associated features or finds. The value of these assets is currently unknown but could potentially be **moderate adverse**.

Variable Message Signs and Vessel Waiting Facilities

9.5.7. The location of VMS on North Quay, Fuller Way and Yarmouth Way lie within the limits of the medieval settlement of Great Yarmouth and there is a potential for buried archaeological deposits within the footprint of these which could be disturbed during the works. Given the urban nature of these three locations, it is anticipated that the archaeological remains will either be heavily disturbed and/or deeply buried. The impacts are therefore judged to be **minor adverse** to **negligible**.

9.5.8. The proposed VMS location on the A47 South lies within the location of a World War Two Light Anti-Aircraft Battery (HER 19084). No below ground remains are anticipated to have survived and therefore the impacts are **negligible** to **no change**.

9.5.9. The potential impacts on buried remains for Acle New Road cannot be assessed at this time as no data was available.

9.5.10. The design of the proposed vessel waiting facilities is currently unknown and therefore the impact is also unknown.

BUILT HERITAGE

9.5.11. The Grade II listed Dolphin Public House (NHLE 1096829) is currently the only built heritage asset identified within the Proposed Scheme, although further assessment may identify additional currently non-designated built assets within the Proposed Scheme. The current designs include the retention of the Dolphin Public House, however there is a potential for **major adverse** impact on this asset through changes to its immediate setting from the Proposed Scheme during construction and operation. Further assessment is required to establish how far the setting of the Dolphin Public House contributes to its value and what the impact of the Proposed Scheme will have on its setting. Moreover, where a heritage asset is a listed building, its beneficial use is of considerable practical importance to its future conservation, and assessment of the Proposed Scheme in this regard will also be required.

9.5.12. The Grade II Listed Gas Holder (NHLE 1096789) lies approximately 100m from the Proposed Scheme. Due to Its proximity there is a potential for **major adverse** impacts during construction and operation due to a change in its setting. There is also a potential for **major adverse** impacts on the nearby Camperdown Conservation Area, The Gorleston Extension Conservation Area and the built heritage assets contained within them due to their proximity. The Grade I listed Nelson's Monument (NHLE 1246057) and the Grade II Scenic Railway Roller Coaster at Great Yarmouth (NHLE 1436976) have also been identified as potential sensitive receptors with a potentially **moderate adverse** impact.

9.5.13. Further assessment is required to establish if there will be any beneficial impacts on all of the Conservation Areas resulting in the change in traffic volumes resulting from the Proposed Scheme.

9.5.14. There is a potential for **major adverse** impacts on currently unconfirmed non-designated built heritage assets within the Proposed Scheme as a result of demolition. It is proposed that residential buildings along Queen Anne's Road and Southtown Road are removed to facilitate the Proposed Scheme, however a review of online historic maps suggests these are of late 19th century date. If confirmed to be of late 19th century date and if they are determined to have significance (historical, archaeological, architectural or artistic), they could be of low to moderate value.

Variable Message Signs and Vessel Waiting Facilities

9.5.15. The locations of VMS on North Quay and Fuller Way are located within the St Nicholas and Northgate Street Conservation Areas and in proximity of the Scheduled Monument of the Town Walls (NHLE 1003782). The VMS location on Yarmouth Way lies between the boundaries of the King Street and Hall Quay South Quay Conservation Areas and in proximity of three Scheduled Monuments. While there is already a high level of street furniture in these areas (e.g. existing road signs, lights, etc.) there is still a potential for an adverse impact on these assets with the addition of further signage. The magnitude of impact is currently unknown but has the potential to be **moderate** to **minor adverse**.

9.5.16. The design of the proposed vessel waiting facilities is currently unknown and therefore the impact is also unknown. Given that the facilities will lie adjacent to the boundary of the Gorleston Extension Conservation Area, there is a potential that features associated with the Conservation Area will be altered. This could either be beneficial or adverse, depending on the nature of the impact.

HISTORIC LANDSCAPES

9.5.17. The historic landscape is predominately a product of late 19th century to modern date activity and is of low value. The impact of the Proposed Scheme is currently unknown as it has not yet been assessed, however there is potential for a **moderate adverse** impact following the removal of buildings of potential late 19th century date and the introduction of new infrastructure.

PALAEOENVIRONMENTAL

9.5.18. 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. While the impacts will be confined to within the Proposed Scheme and the footprint of the piles, they are still judged to be **moderate adverse** at this stage until further assessment has been undertaken. The assessment will comprise initially of a desk-based archaeological review of the borehole, vibrocore and CPT logs generated by geotechnical contractor with the aim of establishing the likely presence of horizons of archaeological interest and broadly characterise them. Where necessary, archaeological recording of selected retained or new core samples will be undertaken.

9.5.19. 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[90] . Boreholes suggest deposits in this area are likely to be minerogenic alluvium, with possible subordinate layers of organic alluvium, overlying late Pleistocene sands and gravels. At this time the impacts are judged to be **moderate adverse**, however this could be subject to change following further assessment and evaluation.

9.5.20. 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

[90] Jordan et al 2016

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. Due to the expected ground disturbance expected within the footprints of the new transport links, the impacts at this stage are predicted to be **major adverse**.

9.6 PROPOSED MITIGATION

9.6.1. At this stage it is anticipated that impacts to the cultural heritage assets can be reduced via appropriate mitigation and will be further investigated during the EIA. A full assessment will be carried out, including a site visit to assess impacts, as well as opportunities for enhancement, in more detail.

Archaeology

9.6.2. DMRB Volume 10, Section 6, Part 1[91] states that 'The fundamental aim of archaeological mitigation is to avoid impacts on nationally important or highly significant remains. If this is not possible then such remains should be archaeologically recorded in order to 'preserve by record' the significant aspects of the site'. Preservation in situ of nationally important or highly significant remains which may be affected by the Proposed Scheme options is the preferred option, however, where this is not possible then alternative options will be investigated. Should no acceptable options be identified which would allow for the preservation of a site, detailed excavation (the scope of which will be agreed with the Norfolk Historic Environment Team) would be carried out in order to further understanding of the site affected.

9.6.3. Intrusive investigations in and around the River Yare have the potential to be challenging due to waterlogged conditions and depths of deposits and have the potential to adversely impact on the programme and costs for the Proposed Scheme. The area surrounding the river consists of an urban townscape with very little open ground that is not covered by active roads or buildings. This makes any non-intrusive archaeological investigation problematic as techniques available would be limited by the presence of hardstanding.

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

Built Heritage and Historic Landscape

9.6.5. The Proposed Scheme may result in an impact on the setting of at least one Grade II listed building and directly impact on properties of potential late 19th century date which will be demolished. Further research is required to establish the value of the non-designated built heritage resource within the Proposed Scheme. Consultation will be undertaken with Historic England and the Norfolk Historic Environment Team to discuss appropriate mitigation options to reduce these impacts. This could include a programme of historic building recording prior to demolition.

9.6.6. Where possible, in the first instance, impacts upon the setting of a heritage asset (including historic landscapes) would be mitigated through changes in design, in accordance with Historic England's guidelines[92]. Where design

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

[92] Historic England (2017) The Setting of Heritage Assets (2nd edition)

adjustments are not practicable, visual or acoustic screening (such as landscape planting or acoustic barriers) may be considered to reduce harm.

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

Palaeoenvironmental

9.6.8. A separate palaeoenvironmental desk-based assessment will be prepared in order to understand the potential and significance of the palaeoenvironmental resource. 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.

9.6.9. 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.

9.7 CONCLUSIONS AND EFFECTS

9.7.1. Limited assessment work has been undertaken to date based on the current scheme proposals and therefore the conclusions and effects drawn at this stage could be subject to change in the ES. There will be a potential to reduce or remove the effects through mitigation.

Archaeology

9.7.2. There is a potential for major adverse impacts on buried deposits associated with a late 19th century icehouse and salt stores (HER 55685), the Route of Norfolk and Suffolk Joint Railway (HER 13575) and the Routes of Great Yarmouth urban railways (HER 13576) which are all of low value. Where remains are present and subject to disturbance, the effects will be Slight.

9.7.3. Eight heritage assets of World War II date are recorded within the Proposed Scheme and one in the proposed location of the road traffic sign on the A47 South of low value. The anticipated impact on these is judged to be negligible to no change and therefore the effects will be Neutral.

9.7.4. There is a potential for a major adverse impact on currently unknown heritage assets in the form of a buried medieval shoreline and associated features or finds within the Proposed Scheme. The value of these assets is currently unknown but could potentially be medium and the effects Moderate/Large.

9.7.5. There is a potential for minor adverse to negligible impacts on buried remains of medium value within the location of the VMS on North Quay, Fuller Way and Yarmouth Way. Where remains are disturbed, the effects will be Slight/Neutral. The effect of the vessel waiting facilities is unknown.

Built Heritage

9.7.6. A major adverse impact is currently predicted on the Grade II Dolphin Public House (NHLE 1096829), which is located within the Proposed Scheme, and the Grade II Gas Holder (NHLE 1096789), the Camperdown and Gorleston Conservation Areas which lie in proximity due to changes in the setting during construction and operation. The assets are of medium value and therefore the effects are predicted to be Moderate/Large at this stage.

9.7.7. There is also a potential for a moderate adverse impact on the setting of the Grade I Listed Nelson's Monument (NHLE 1246057), which has a high value, and the Grade II Scenic Railway Roller Coaster (NHLE 1436976) which as a medium value. If confirmed through further assessment, the effects on these would be Moderate/Large and Moderate/Slight, respectively.

9.7.8. The demolition of buildings within the Proposed Scheme Site which fit the definition of non-designated heritage assets of low value will result in a major impact and the effects would be Slight.

9.7.9. The introduction of VMS on North Quay, Fuller Way and Yarmouth Way have the potential to result in a moderate to minor adverse impacts on the setting of conservation areas of medium value and Scheduled Monument of high value. The effects could be Moderate to Slight, depending on the value of assets impacted. The effects of the vessel waiting facilities are unknown.

Historic Landscapes

9.7.10. The historic landscape is predominately a product of late 19th century to modern date activity and is of low value and the impact is currently predicted to be moderate adverse with a **Slight** effect.

Palaeoenvironmental

9.7.11. The impacts on the palaeoenvironmental remains of within the River Yare on deposits of medium to high value are judged to be moderate adverse. The effects on these deposits is therefore expected to be Moderate/Large to Moderate/Slight at this stage of assessment.

9.7.12. A major adverse impact is predicted on high value deposits of the Breydon Formation which are thought to be located on west side of the River Yare and the effects will be Large/Very Large where the deposits are disturbed. A major adverse impact is also expected on deposits on the east side of the River Yare, although these are thought to be of low value and the effect Slight. Further assessment is required to ascertain whether these deposits are present in the Proposed Scheme and at what depth below the current ground level.

9.8 ASSESSMENTS STILL TO BE COMPLETED

9.8.1. An additional assessment is underway to assess the potential impacts of the Proposed Scheme on the archaeology, built heritage and historic landscape resource. This will include a walkover survey which will assess the potential visual impacts of the Proposed Scheme in the near vicinity of the Proposed Scheme, but also on the wider landscape. The visual impact assessment on cultural heritage assets and agreement on viewpoints is being progressed in consultation with the Townscape and Visual Impact assessment team. These will be determined in consultation with GYBC and NCC's Historic Environment Team.

9.8.2. The assessment will also assess the buildings within the Proposed Scheme which are to be demolished to establish their cultural heritage value in the first instance. Additional built heritage surveys maybe required to inform a programme of mitigation.

9.8.3. The assessment will include a detailed map regression exercise of the Proposed Scheme and its immediate environs using maps held at the Norfolk Record Office (Norwich). The aim of this will be to identify any further heritage assets within the Proposed Scheme which could be adversely impacted by the Proposed Scheme.

9.8.4. The limitations of undertaking intrusive evaluation investigations in the Proposed Scheme footprint have been outlined in the Scoping Report and are still judged to be accurate. In order to establish the potential impacts of

the Proposed Scheme on buried remains, a palaeoenvironmental assessment will also be undertaken in order to better understand the value geoarchaeological resource and the potential impacts on deposits. This will use data collected during Ground Investigation works undertaken within the Proposed Scheme, including from within the River Yare, and existing information, including that gathered for the Great Yarmouth Archaeological Map.

9.8.5. The assessment reports will be presented in full as technical appendices to the ES chapter.

9.8.6. As part of the assessment work, NCC's Historic Environment Team and Historic England will be consulted in order to discuss the potential impacts and identify where any effects can be reduced through appropriate mitigation.

10

TOWNSCAPE AND VISUAL IMPACTS

10 TOWNSCAPE AND VISUAL IMPACTS

10.1 INTRODUCTION

10.1.1. This chapter provides preliminary information with regard to Townscape and Visual Impacts as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. The term 'townscape' is used to mean a type of landscape where the built environment is dominant and includes the buildings, the relationships between them, the different types of urban open spaces including green spaces, and the relationship between buildings and open spaces. The assessment of this topic area considers potential impacts of the Proposed Scheme on:

- townscape character; and
- views experienced by visual receptors.

10.1.2. The assessment has incorporated the comments of the SoS in the Scoping Opinion[6]. This chapter should be read in conjunction with Chapter 9: Cultural Heritage.

STUDY AREA

10.1.3. The parameters for the proposed study area are outlined below. The proposed 3km study area has been agreed with the landscape officer at NCC who has been requested to act as consultee on behalf of GYBC.

10.1.4. In line with guidance provided in Guidelines for Landscape and Visual Impact Assessment 3rd Edition (2013) (GLVIA3)[93],the study area is defined as the area in which existing townscape character may change or be influenced, or views available to people and their visual amenity be modified as a direct result of construction and operation of the Proposed Scheme.

10.1.5. The proposed study area is 3 km radius from the centre of the Proposed Scheme based on the current design. However, it has been reduced in the east to follow the coast line. The study area is shown on Figure 10.3. This has been identified through a preliminary review of OS 25K mapping and aerial mapping to establish the likely extents that townscape and visual receptors will potentially be significantly affected by the Proposed Scheme.

10.1.6. The study area will be reviewed through the production of a Zone of Theoretical Visibility (ZTV) through digital modelling and confirmed by site work, with a view to reducing the extent of the study area.

10.1.7. It is anticipated that no significant effects will arise beyond 3km due to the context, scale and nature of the Proposed Scheme. If there is greater visibility than anticipated the study area will be adjusted to reflect this.

10.1.8. It is noted there are ancillary works associated with the main bridge crossing which are included in the study area, these will be reviewed once there is a greater clarity on the design, but it is anticipated to scope these out of the assessment.

LIMITATIONS

10.1.9. This chapter is based on preliminary information relating to the Proposed Scheme and data currently available and gathered at this point of the assessment process.

10.1.10. Currently there is no fixed design solution for the double leaf bascule bridge, the designs being explored are described in Chapter 2 and presented in Figures 2.5 and 2.6. For the assessment, a working envelope is being

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

used which covers the various design solutions, the key factor relevant to townscape and visual is the counterweights which will either be above deck level or in two bascule chambers to accommodate their movement. For the purposes of the PEIR the design with above counterweights is deemed to be the most visually intrusive, due to the structure being up to 44.5m (AOD) when open.

10.1.11. The information contained herein is intended to inform consultation responses at this stage. A detailed assessment of potentially significant impacts of the Proposed Scheme on identified sensitive receptors will be undertaken at subsequent stages to inform the ES.

10.1.12. Any gaps in information identified at this PEIR stage will be considered and addressed along with specific mitigation measures as part of the assessment.

10.2 RELEVANT POLICIES

10.2.1. This section provides an outline of policies considered relevant to the Proposed Scheme with respect to its impacts on the townscape character and visual amenity.

National Policy Statement for National Networks

10.2.2. NPS NN states that "*Where the development is subject to EIA the applicant should undertake an assessment of any likely significant landscape and visual impacts in the environmental impact assessment and describe these in the environmental assessment*".

National Policy Statement for Ports (NPSP) (January 2012)

10.2.3. Whilst the Proposed Scheme does not constitute Port development, the NPS for Ports does provide useful context for coastal projects in so far that in paragraph 5.11.1 it clarifies that references to landscape should be taken as "*covering seascape and townscape, where appropriate*."

10.2.4. It is considered at this stage that due to the Proposed Scheme being located within Great Yarmouth on the River Yare inland of the coastline that the resulting changes are unlikely to result in significant effects on views from and towards the coastline and the associated seascape and will be scoped out of the assessment.

National Planning Policy Framework 2018

10.2.5. Paragraph 124 of the NPPF states that: "*The creation of high quality buildings and places is fundamental to what the planning and development process should achieve. Good design is a key aspect of sustainable development, creates better places in which to live and work and helps make development acceptable to communities. Being clear about design expectations, and how these will be tested, is essential for achieving this. So too is effective engagement between applicants, communities, local planning authorities and other interests throughout the process'.*

10.2.6. Paragraph 127 of the NPPF specifies design objectives that development should achieve, and paragraph 170 states that the planning system *"should contribute to and enhance the natural and local environment*" including by protecting and enhancing valued landscapes.

10.2.7. These principles have been taken into account in the development of the Proposed Scheme.

East Inshore and East Offshore Marine Plans[94]

10.2.8. The plans provide for the application or clarification of national planning policy in relation to coastal areas.

10.2.9. Policy SOC3 sets out, in order of preference, how proposals that may affect terrestrial or marine character should avoid, reduce, mitigate or provide justification for potential impacts. This will be tested for its relevance to Great Yarmouth and the River Yare with a view to scoping it out of the assessment due to the context of the River Yare within the urban fabric of Great Yarmouth.

10.3 ASSESSMENT METHODOLOGY

10.3.1. The following methodology for assessment, outlined in sections 10.3 – 10.4 of this chapter has been agreed with the landscape officer at NCC, who has been requested to act as consultee on behalf of GYBC.

10.3.2. The Townscape and Visual Impact Assessment (TVIA) will be undertaken in accordance GLVIA3.

10.3.3. The assessment will also refer to the following guidelines applicable to the Proposed Scheme:

- Highways Agency Interim Advice Note 135/10[95]; and
- An Approach to Landscape Character Assessment (second version) (March 2018)[96].

STAGES IN THE ASSESSMENT PROCESS

10.3.4. There are four key stages in the assessment:

- Recording and analysis of the existing townscape and visual context of the receiving environment (the baseline environment);
- Identification of changes and associated impacts that will be associated with the Proposed Scheme including embedded mitigation and the significance of these impacts in the context of the baseline townscape and visual context of the study area;
- Identification of further mitigation where the assessment identifies potentially significant effects appropriate to the Proposed Scheme and the townscape character and visual context of the receiving local area; and
- Description of the residual effects and their significance associated with the Proposed Scheme following the application of additional mitigation.

[94] HM Government (2014) East Inshore and East Offshore Marine Plans (Online). (Accessed June 2018). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/312496/east-plan.pdf

[95] Highways England (2010) Interim Advice Note 135/10 Landscape and Visual Effects Assessment, former Highways Agency. (Online) (Accessed June 2018). Available at http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian135.pdf

[96] Natural England (2018) An Approach to Landscape Character Assessment. (second version) (online) (Accessed June 2018). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/691184/landscape-character-assessment.pdf (Accessed May2018)

SCOPE OF THE TVIA ASSESSMENT

10.3.5. The GLVIA3 requires that a clear distinction is drawn between townscape and visual effects:

- Townscape effects relate to the degree of change to characteristics or physical components of an urban area, which together form the character of that townscape, including the buildings, the relationships between them, the different types of open spaces, and the relationships between buildings and open spaces; whilst
- Visual effects relate to the degree of change to an individual receptor's or receptor group's view of that townscape, e.g. local residents, users of public footpaths or motorists passing through the area.

10.3.6. The TVIA will consider the potential effects of the Proposed Scheme during:

- The construction phase, which is assumed to be a defined period, during which time cranes and lifting equipment are anticipated to be present on the Application Site, and will include the presence of associated plant, construction compounds and local traffic management;
- During operation, at the opening of the Proposed Scheme, the assessment will assume that the visual context applicable would be experienced during winter months and with the bridge in the raised position, when the degree of visual exposure is potentially greatest and represents the worst-case scenario. However, the bridge will be predominantly in the lowered position and therefore commentary will be provided on this as appropriate.
- The assessment will also include potential night time effects of the associated (including additional highway) lighting where appropriate;
- During operation, at year 15 in the summer months and with the bridge in the lowered position. The analysis at 15 years into operation would demonstrate the effectiveness of any townscape and visual related mitigation proposals associated with the Proposed Scheme, allowing for maturation of any planting.

Scope covered with the PEIR

10.3.7. The PEIR has identified the published national and local landscape character assessments, which have been reviewed and identified the key characteristics of relevance to the study area.

10.3.8. An initial review of the design envelope has been undertaken and the likely visual envelope and visual receptors likely to be affected by the Proposed Scheme which are represented by the proposed viewpoints.

10.3.9. A high-level appraisal of predicted impacts on townscape and visual receptors based on the design envelope has been identified during construction and operation of the Proposed Scheme.

BASELINE ENVIRONMENT IDENTIFICATION

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

- Desk based analysis of OS mapping relating to landform, built form, vegetation, settlement patterns and the drainage regime in the wider area;
- Desk based analysis of aerial photography for the area;
- Review of the townscape units, types and relevant landscape or landscape related designations e.g. Conservation Areas, Registered Parks and Gardens;
- Review of any relevant published landscape character and townscape assessments;

- Site surveys and identification of townscape units/types. Site recording involving annotation of 1:1,250 and 1: 25,000 scale OS plans defining the units and the key elements determining character;
- Development and agreement of representative/key viewpoints to be assessed for potential effects on visual amenity;
- Site photography to illustrate character units, notable views / viewpoints and key townscape elements; and
- Drafting and describing local townscape character units within the context of the broader assessment and associated with the Proposed Scheme and wider setting including an evaluation of their quality, value and sensitivity to change in the context of the proposed form of the proposed Scheme.

ASSESSMENT OF EFFECTS ON TOWNSCAPE CHARACTER

10.3.11. As the Proposed Scheme would be located within an urban context it is considered that the appropriate aspect of landscape to be assessed is the townscape. In assessment terms townscape is a subset of landscape and refers to areas where the built environment dominates.

10.3.12. The Great Yarmouth Borough Council Landscape Character Assessment[97] identifies several landscape character areas that extend beyond the limits of the urban area Great Yarmouth and within the 3km radius study area. The above assessment identifies the built environment as 'urban', within which the TVIA will refine the urban area into appropriate local townscape character areas. In addition, the study area extends to cover the eastern fringes of The Broads Landscape Character Assessment[98].

10.3.13. The assessment of townscape effects will be structured around the identification of individual Townscape Character Areas (TCA's) within the study area. TCAs are areas of relatively homogenous townscape character. They are defined by the combination of elements that contribute to townscape context, character and value. Typical townscape elements include landform, street patterns and built development, vegetation and open space. More subjective criteria are also considered such as scale, unity and enclosure. These areas will be created from the baseline assessment within the study area for this assessment in the absence of detailed published townscape areas as set out above.

10.3.14. The sensitivity of the receiving townscape and the magnitude of impact will be assessed to determine a significance of effect rating that will result from the construction and operation of the Proposed Scheme and the effect that this will have on the perception of townscape character.

Townscape Value

10.3.15. High townscape value correlates to areas of scenic merit or those displaying important historic and cultural associations. Townscape value is frequently addressed by reference to international, national, regional and local designations. An absence of a formal designation does not, however, determine that a townscape is necessarily of low value; factors such as accessibility and local scarcity can render areas as an important resource at a local level. For example, an area of relatively insignificant townscape may have increased value associated with it due to its proximity to housing or as an informal recreational space.

[97] Great Yarmouth Borough Council (2008) Great Yarmouth Borough Council Landscape Character Assessment. (Online) (Accessed June 2018). Available at: https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1236&p=0

98 The Broads Authority (2016) The Broads Landscape Character Assessment. (Online) (Accessed June 2018). Available at: http://www.broads-authority.gov.uk/news-and-publications/publications-and-reports/planning-publications-and-reports/landscape-character-assessments

Townscape Susceptibility to change

10.3.16. Townscape susceptibility to change is the ability of the TCA to accommodate the Proposed Scheme without undue consequences for the maintenance of the baseline situation.

10.3.17. A high quality or high value townscape should not, by definition, infer that it has a high susceptibility to future change. Similarly, an area expressing low quality or value does not automatically have a lower susceptibility to change. Susceptibility has been defined in GLVIA3 as, "*The ability of the landscape receptor to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and / or the achievement of landscape policies and strategies'.* Susceptibility to change is therefore likely to reflect the type and nature of the proposed changes.

Townscape Sensitivity

10.3.18. The sensitivity of a TCA is an expression of its suitability to accommodate the Proposed Scheme. Sensitivity is judged based on a combination of its susceptibility to the type of change or development proposed and the value attached to the townscape, as set out in Table 10.1 – Townscape Criteria below.

Table 10.1 – Townscape Criteria

Townscape Sensitivity	Criteria
High	A townscape displaying particularly distinctive character, of good or greater quality which is highly valued and considered susceptible to relatively small changes. Townscape characteristics or features with little or no capacity to absorb the type of change proposed without fundamentally altering current character. Townscape designated for its international or national townscape value or with highly valued features. Outstanding example of well cared for townscape or set of features that combine to give a very strong sense of place.
Medium	A townscape of medium value and considered reasonably tolerant of change. Townscape characteristics or features with moderate capacity to absorb change without fundamentally altering their present character. Townscape designated for its local townscape value or a regional designated townscape where the characteristics and qualities that led to the designation of the area are less apparent or are partially eroded or an undesignated townscape which may be valued locally – for example an important open space. An example of a townscape or a set of features which is relatively coherent, with a good but not exceptional sense of place - occasional buildings and spaces may lack quality and cohesion.
Low	A townscape of relatively low value and considered tolerant of substantial levels of change. Townscape characteristics or features which are tolerant of change without determent to their present character. An area with a weak sense of place and/or poorly defined character /identity. No designation present or of low local value or in poor condition. An example of monotonous unattractive visually conflicting or degraded townscape or set of features.

Magnitude of Impact

10.3.19. The magnitude of impact will be based on the extent and manner in which the Proposed Scheme will form a new component in the townscape and alter the balance between existing components.

10.3.20. Magnitude of change is an expression of the size or scale of change in the townscape, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described below:

- The extent and proportion of existing townscape elements that will be lost and the contribution of those elements to the character of the immediate townscape and wider setting;
- The extent to which aesthetic or perceptual aspects of the townscape are altered either by the removal of existing townscape elements or by the addition of new ones;
- Whether the effect changes the key characteristics of the townscape, which are integral to its distinctive character;
- The geographic area over which the townscape effects will be felt (within the Application Site itself; the immediate setting of the Application Site; at the scale of the townscape type or character area; on a larger scale influencing several townscape types or character areas); and
- The duration of the effects (short term, medium term or long term) and whether it is permanent, temporary or reversible.

10.3.21. A three-point scale is shown in Table 10.2 that provides examples of the magnitude of impact that can be attached to the changes associated with each TCA.

Table 10.2 - Townscape Magnitude of impact criteria

Magnitude of Impact	Criteria
High	Where the development would appear as a significant new component in the townscape and result in the total loss of or major alteration to the existing balance of components in the baseline context.
Medium	Where the development would appear as a noticeable new component in the townscape and result in a partial loss of or alteration to the existing balance of components in the baseline context.
Low	Where the development would appear as a barely perceptible component in the townscape and result in a slight loss of or alteration to the existing balance of components in the baseline context.

Townscape Significance of Effect Assessment

10.3.22. The evaluation of effects for townscape character will involve consideration of the sensitivity to change, derived during the baseline assessment and the predicted magnitude of change that will occur because of the construction and subsequent operation of the Proposed Scheme. Effects are significant where they are identified as being moderate or greater.

10.3.23. The findings of the assessment will be represented using a descriptive, descending scale ranging from large - moderate – slight - beneficial through neutral to an ascending scale of slight - moderate – large – very large adverse. Explanation of the significance of effect ratings that are proposed is provided below in a descending scale of significance shown in Table 10.3 –Townscape character significance of effect criteria.

Table 10.3 –Townscape character significance of effect criteria

Degree of Significance	Townscape Significance of Effect Criteria
Large Beneficial Effect	The proposals: ▪ Constitute a major restructuring of a degraded townscape or form an essential part of a townscape strategy to redevelop a major area of dereliction, leading to establishment of a new, attractive environment.
Moderate Beneficial Effect	The proposals provide an opportunity to enhance the townscape because: ▪ They fit very well with the scale, built form and pattern of the townscape; ▪ There is potential, through mitigation, to enable the restoration of characteristic features, partially lost or diminished as the result of changes to the baseline context, e.g. from previous inappropriate development; ▪ They will enable a sense of place and scale to be restored through careful design and appropriate mitigation measures, that is, characteristic features are perhaps enhanced through the use of local materials and appropriate scale of the development that fits well into the surrounding townscape; ▪ They enable some sense of quality to be restored or enhanced through design features; and ▪ They further government objectives to regenerate degraded urban areas.
Slight Beneficial Effect	The proposals: ▪ Fit well with the scale, built form and pattern of the townscape; ▪ Incorporate measures for mitigation to ensure they will complement the surrounding townscape structure; ▪ Will enable some sense of place and scale to be restored through careful design and appropriate use of materials as mitigation measures; and ▪ Maintain or enhance existing townscape quality and character.
Neutral Effect	The proposals are well designed to: ▪ Complement the scale, built form and pattern of the townscape; ▪ Incorporate measures for mitigation to ensure that the Proposed Scheme will blend in well with surrounding features and elements; and ▪ Maintain existing townscape quality and character.
Slight Adverse Effect	The proposals: ▪ Do not quite fit the built form and scale of the townscape; ▪ Cannot be completely mitigated for because of the nature of the proposal itself or the character of the townscape in which the development would sit; and ▪ May affect an area of recognised townscape quality.
Moderate Adverse Effect	The proposals: ▪ Are out of scale with, or at odds with, the local townscape pattern and built form; ▪ Are not possible to fully mitigate for, that is, mitigation will not prevent the Proposed Scheme from scarring or detrimentally affecting the townscape in the longer term as some features of interest will be partly destroyed or their setting reduced or removed; and ▪ Will have an adverse effect on a townscape of recognised quality or on vulnerable and important characteristic features or elements.
Large Adverse Effect	The proposals are very damaging to the townscape in that they: ▪ Are at considerable variance with the built form, scale and pattern; ▪ Are likely to degrade, diminish or even destroy the integrity of a range of characteristic features and elements of their setting;

Degree of Significance	Townscape Significance of Effect Criteria
	▪ Will be substantially damaging to a high value or highly vulnerable townscape, resulting in fundamental change and be considerably diminished in quality; and ▪ Cannot be adequately mitigated for.
Very Large Adverse Effect	The proposals would result in exceptionally severe adverse effects on the townscape because they: ▪ Are at complete variance with the built form, scale and pattern; ▪ Would irrevocably damage or degrade, badly diminish or even destroy the integrity of characteristic features and elements and their setting; ▪ Would cause a very high quality or highly vulnerable townscape to be irrevocably changed and its quality very considerably diminished; and ▪ Cannot be mitigated for, that is, there are no measures that would protect or replace the loss of a nationally important townscape.

ASSESSMENT OF VISUAL EFFECTS

10.3.24. The assessment of visual effects will involve the adoption of the four stages of assessment described in Section 10.3.4.

10.3.25. Visual effects may result from the changes in the composition of views or overall visual amenity from the introduction of the Proposed Scheme. The degree to which people will be affected by changes depends on a range of factors, such as:

- The activity of the receptor, such as taking part in leisure, recreational and sporting activities, travelling through the area or working;
- The value of the viewing place or viewpoint, as reflected by designations, inclusion in guidebooks or the facilities provided for visitors, for example;
- Whether receptors are likely to be stationary or moving and how long they will be exposed to views of the Proposed Scheme;
- The extent of the route or area over which the changes would be visible;
- Whether receptors would be exposed to the change daily, frequently, occasionally or rarely; and
- Whether views are oblique or direct.

Zone of Theoretical Visibility (ZTV)

10.3.26. It is widely accepted that the magnitude of change in relation to views tends to decrease with distance. A desktop study together with a ZTV will determine the likely areas where there could be views of the Proposed Scheme. The ZTV will represent the extent of the area within the proposed 3 km study area as defined in Section 2 and within which there would be potential for views of the Proposed Scheme. The analysis will consider three scenarios separately:

- HGV Traffic (4.5m vehicle height) – 4 points at 25m intervals along the bridge deck;
- Bridge Lowered - 2 points to represent the high point of the bridge when lowered; and
- Bridge Raised - 2 points to represent the high point of the deck of the bridge when raised.

10.3.27. The visual analysis will be carried out using the viewshed analysis tool in ArcMap 10.5 and will be based on:

- 2018 OS Terrain 5m contour mapping;
- Lidar Information if available; and
- Observer points using XYZ co-ordinates to replicate the three scenarios.

10.3.28. The Digital Terrain Model (DTM) 5m contour mapping will be used to develop the ZTV. Whilst this is useful in developing the ZTV, it is not always reflected by what is visible on site. The mapping provided illustrates where there is the potential for the tallest aspect of the Proposed Scheme namely the proposed raised bridge structure to be visible, however this is only theoretical and includes all features with a degree of inter-visibility. The ZTV may therefore suggest that the structure would be visible over much broader extents than would be the reality.

10.3.29. If available, 2008-2009 LiDAR Digital Surface Modelling (DSM) at 1m resolution (which includes surface features such as buildings and vegetation) and is accurate to +/-10cm for XY and +/- 5cm for Z will be used to develop the ZTV, it includes all landform, vegetation and built form. It is noted that the ZTV, whilst useful does not always reflect what is visible on site. Whilst all features of the Proposed Scheme, including local road ties in will be assessed the mapping provided illustrates where there is potential for the tallest aspect of the Proposed Scheme to be visible, however this is only theoretical and includes all features with a degree of inter-visibility. The ZTV may therefore suggest that the Proposed Scheme would be visible over much broader extents than in reality.

10.3.30. The results of the analysis will be shown on a plan. Areas will be shaded to indicate locations that are predicted to have direct views of all or part of the bridge structure and represent the worst-case scenario. In areas where the shading is less dense and more sporadically distributed, this will indicate that these views may be highly constrained and/or comprise only the very highest sections of the bridge structure, which are likely to limit the degree to which a significant effect is anticipated to arise.

10.3.31. As a result, the top of the structure may not be visible from all locations suggested by the software or these locations may not be representative of views experienced by the public. The following reasons may include:

- It may be rooflines of buildings or the tops of trees that are registering as having a view (rather than the eye line of a person at that location);
- Intervening buildings and/or vegetation which were not recorded within the baseline data used (e.g. built form and vegetation is not recorded within the mapping data); or
- Upper floor windows from private dwellings or glimpses between buildings will be included which in reality may be heavily constrained or orientated away from the structure.

10.3.32. Therefore, some interpretation of the results is required. The primary objective will be to establish an area within which key receptors or viewpoints, whose views may be influenced by the Proposed Scheme, could be identified to inform the assessment.

10.3.33. Further field surveys will be undertaken to verify the actual extent of views and the likelihood that these will be subject to change. Therefore, inclusion of an area within the ZTV is not an indicator that all potential receptors within the defined area will experience views of the Proposed Scheme.

Representative Viewpoints

10.3.34. The assessment of visual effects is based on the identification of representative viewpoints, which represent a range of receptors within the study area that are likely to experience views of the Proposed Scheme. A total of 12 viewpoints (see Figures 10.1 and 10.2) have been agreed with the landscape officer at NCC, who has been requested to act as consultee on behalf of GYBC. Site surveys will be undertaken to establish the nature, exact location and actual availability of the anticipated view.

Identification of representative viewpoints

The 12 viewpoint locations will be recorded by reviewing the settlement pattern, land use, topography, vegetation, and access and transportation patterns contained within the boundaries of the ZTV. Viewpoints plotted via the desk based review and validated through site survey include the following:

- Residential clusters and individual properties;
- Heritage or cultural locations;
- Main and local roads; and
- Recreational and public access areas including footpaths, cycle routes and public

10.3.35. The viewpoint locations are presented in Figures 10.1 and 10.2.

Field Assessment of viewpoints

10.3.36. The 12 viewpoints will be visited and assessed. Factors considered during the visual assessment will include:

- Associated receptor types and numbers where appropriate (e.g. dwelling / footpath);
- Existing view;
- Distance of view;
- Percentage and elements of the Proposed Scheme likely to be visible;
- Viewpoint position (view up / view down / level view);
- Angle of view (acute / perpendicular / oblique);
- Type of view (foreground / middle ground / background) and position of the Proposed Scheme in the view;
- Analysis of potential impact.

Analysis of Visual Effects

10.3.37. Analysis of the likely visual impacts and evaluation of their associated effects involves consideration of the sensitivity to change and magnitude of impact based upon information gathered through site surveys and analysis of the aesthetics of the Proposed Scheme.

10.3.38. Evaluation of visual effects relates to the potential impacts during:

- The construction phase, which is assumed to be a defined period, during which time cranes and lifting equipment are anticipated to be present on site, and will include the presence of associated plant, construction compounds and local traffic management;
- During operation, at the opening of the Proposed Scheme, the analysis will assume that the visual context applicable would be experienced during winter months and with the bridge in the raised position, when the degree of visual exposure is potentially greatest and represents the worst-case scenario. The assessment also includes an assessment of the potential night time effects of the associated lighting, including additional highway lighting;
- During operation, at year 15 years in summer months and with the bridge in the raised position. The analysis at 15 years into operation demonstrates the effectiveness of any townscape mitigation proposals associated with the Proposed Scheme, allowing for its maturation; and
- Night time effects.

10.3.39. The analysis relates to each representative viewpoint and concludes with an evaluation of the predicted significance of effect.

Visual Sensitivity

10.3.40. Sensitivity to change will consider the nature, location and context of the receptor and is derived from the susceptibility to change of the receptor and the value of the view. Less sensitive receptors are considered, for example, to be people engaged in work whose primary focus would not necessarily be on the surrounding townscape views. Conversely, more emphasis is placed upon receptors whose change in view or visual amenity is either the prime focus, greater in scale, a valued view such as a lookout or potentially covers a wider area.

10.3.41. The degree and importance of the view gained from a receptor also contributes to an understanding of how sensitive a given receptor is towards change. Therefore, value of the view, scenic quality and visual expectations of the receptor are also considered. In this assessment, sensitivity to change is proposed to be ranked as described in Table 10.4 Sensitivity of viewpoints.

Table 10.4 Sensitivity of viewpoints

Sensitivity	Criteria
High	▪ Occupiers of residential properties ▪ Recreational users or tourists whose attention is focussed on the townscape, such as visitors of Registered Parks and Gardens, users of promoted routes/long distance paths/PRoW and canal or river networks ▪ Views that are of high value e.g. lookout points and promoted views.
Medium	▪ People walking or cycling through urban areas where their attention is likely to be focussed to a degree on their surroundings ▪ People staying in hotels, educational and healthcare institutions where the setting and surroundings make a contribution to their experience. ▪ People travelling by vehicle along scenic routes through the townscape where their attention is likely to be focussed to a degree on their surroundings.
Low	▪ People at work and in educational institutions where the setting and surroundings does not contribute to their experience. ▪ People engaged in formal sports activities. ▪ People walking or cycling through urban areas where they are more likely to be preoccupied with getting to their destination than enjoying views and scenery along their route. ▪ People travelling on high speed transport routes through the townscape.

Magnitude of Impact

10.3.42. The magnitude of visual impact resulting from the Proposed Scheme is based on the size or scale of change in the view, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described below:

- The scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the Proposed Scheme;
- The degree of contrast or integration of any new features or changes to the form, scale, mass, building line, height, sky-line, background, visual clues, focal points, colour and texture;
- The time over which the Proposed Scheme will be visible and whether views will be full, partial or glimpsed;
- The angle of view in relation to the main activity of the receptor, distance of the viewpoint from the Proposed Scheme and the extent of the area over which the changes would be visible; and
- The duration of the effects (short term, medium term or long term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

10.3.43. In this assessment, the magnitude of impact is assessed as high, medium or low considering the criteria set out in Table 10.5 Magnitude of visual impact criteria.

Table 10.5 Magnitude of visual impact criteria

Level of Impact	Magnitude of Impact Criteria
High	Where the Proposed Scheme would cause a substantial change to the existing view, and or become a dominant feature of focal point of the view.
Medium	Where the Proposed Scheme would cause a noticeable change to the existing view, and or which would be a prominent feature readily apparent to the receptor.
Low	Where the Proposed Scheme would cause a slight change to the existing view, and or would not alter the overall balance of feature and elements that comprise the existing view.

Degree of Significance of Visual Effect Criteria

10.3.44. The prime criteria used to evaluate visual effects will relate to the extent to which existing views associated with key viewpoints (such as residents, users of public facilities and visitors to open space and public areas), will change, taking account of embedded mitigation measures. Effects will be significant where they are identified as being moderate or greater.

10.3.45. Other criteria proposed to be used to ascertain visual effect include the size, elevation and proportion of the Proposed Scheme in respect of the receiving environment and the degree to which activity within the receiving environment would alter, both during and post construction, and be visible.

10.3.46. Effects can be detrimental where features or key characteristics such as established planting, old buildings or structures will have to be removed, directly affecting the view. Conversely, effects can prove beneficial where derelict buildings or poorly maintained townscape features are proposed to be restored, replaced or maintained, or where there is the introduction of new tree planting and a townscape structure where none currently exists, constituting an improvement in the current view.

10.3.47. The identification of the resulting effects will be established through an evaluation of the sensitivity of the baseline and the magnitude of the impact likely to occur because of the Proposed Scheme.

10.3.48. The findings are proposed to be represented using a descriptive scale ranging in a descending scale from large - moderate – slight - beneficial and through neutral to an ascending scale of slight - - moderate – large – very large adverse.

10.3.49. Whilst there is a large degree of professional judgement involved in determining the significance of townscape and visual effects, they can broadly be determined by the interaction of the sensitivity of the receptor and magnitude of change, which has been informed by pre-defined criteria as outlined in Table 10.6 – Visual Significance of effect criteria below.

Table 10.6 – Visual Significance of effect criteria

Degree of Significance	Description of visual effect
Large Beneficial Effect	Lead to the removal of a significant eyesore such as a derelict site or buildings and incorporates townscape measures which substantially remodel and enhance the outlook for many people, or where the proposal would cause a substantial improvement in the existing view.
Moderate Beneficial Effect	Visual intrusion associated with the existing view is noticeably relieved, or where the Proposed Scheme would result in a marked improvement. It would also apply where the Proposed Scheme includes provision for townscape proposals which would largely reduce the visual intrusion of the existing outlook.

Degree of Significance	Description of visual effect
Slight Beneficial Effect	Existing visual intrusion associated with the current outlook is slightly relieved, or where the Proposed Scheme would cause a barely perceptible improvement in existing receptor view.
Neutral Effect	Implementation of the Proposed Scheme not leading to a discernible improvement or deterioration in existing receptor view or outlook.
Slight Adverse Effect	The Proposed Scheme is at some distance from the viewpoint, or where the Proposed Scheme would not constitute a new point of principal focus. It would also occur where the Proposed Scheme is closely located to the viewpoint but is seen at an acute angle and at the extremity of the overall available view, or by less sensitive receptor types.
Moderate Adverse Effect	The Proposed Scheme resulting in a noticeable deterioration to the current outlook, involving removal of existing, visually screening elements in the view, exposing the Proposed Scheme. It would also occur where large new structures are introduced as part of the Proposed Scheme which may appear at distance but be positioned as a focal point the field of view, or where the Proposed Scheme can only be partially mitigated.
Large Adverse Effect	The Proposed Scheme would cause a marked deterioration in the current receptor view or outlook, be positioned prominently within an existing view of local interest in a valued townscape, or where only selected elements of the Proposed Scheme can be effectively mitigated.
Very Large Adverse Effect	The Proposed Scheme would cause a high level of deterioration to the current view, and/or be positioned prominently within an existing view of regional or national importance.

NIGHT TIME EFFECTS

10.3.50. Where relevant, night time effects will be considered as part of the assessment where the introduction of new light sources may affect the visual and townscape context. Where available, isolux contour plans will be used to inform this process.

10.3.51. Night time photography is not considered to be required for the Proposed Scheme due to the existing urban context including the port infrastructure and existing lighting along the River Yare.

10.4 BASELINE ENVIRONMENT

TOWNSCAPE

10.4.1. The following data sources have been consulted to inform the baseline data for this report:

- Great Yarmouth Local Plan - Core Strategy, 2015;[99]
- Broads Authority Local Development Framework - Core Strategy, 2007-2021[100];

[99] Great Yarmouth Borough Council (2015) Great Yarmouth Local Plan (Online). (Accessed June 2018). Available at: https://www.great-yarmouth.gov.uk/article/2489/Current-Local-Plan

[100] Broads Authority (2007) Local Development Framework – Core Strategy (Online). (Accessed June 2018). Available at: http://www.broads-authority.gov.uk/planning/planning-policies/development/current-documents/core-strategy-development-plan

- National Character Areas, Natural England;[101]
  - NCA79 – North East Norfolk and Flegg[102]
  - NCA80 – The Broads[103]
  - NCA82 – Suffolk Coast and Heaths[104]
- Broads AuthorityLandscape Character Assessment, 2013;[105]
- Great Yarmouth Borough Council Landscape Character Assessment, 2008;[106]
- MAGIC website[107];
- Google Earth[108]; and
- Bing Maps [109] Including Ordnance Survey mapping

Statutory Landscape Designations

10.4.2. The Broads National Park lies 1 km to the north-west.

Other Designations

10.4.3. The Venetian Waterways, grade II listed registered Park and Garden lies 2.5 km to the north of the Proposed Scheme. There are ten Conservation Areas within the study area, seven to the north and three to the south, however none are located within the Proposed Scheme extents.

TOWNSCAPE CONTEXT

10.4.4. Within the context of a flat terrain, the study area lies within the low-lying town of Great Yarmouth, and is bisected in a north-south orientation by the River Yare.

10.4.5. There are currently many empty properties within this part of the river corridor which give the area a degraded character. There are areas of hard standing on the banks of the river; on the western bank these are a public

[101] Natural England (2013) National Character Area Profiles. (Online). (Accessed June 2018). Available from: http://publications.naturalengland.org.uk/category/587130
[102] Natural England (2013) National Character Area Profile 79 – North East Norfolk and Flegg. (Online). (Accessed June 2018). Available from: http://publications.naturalengland.org.uk/publication/4543880858959872?category=587130
[103] Natural England (2013) National Character Area Profile 80 – The Broads. (Online). (Accessed June 2018). Available from: http://publications.naturalengland.org.uk/publication/11549064?category=587130
[104] Natural England (2013) National Character Area Profile 82 – Suffolk Coast and Heaths. (Online). (Accessed June 2018). Available from: http://publications.naturalengland.org.uk/publication/5626055104659456?category=587130
[105] Broads Authority (2013) The Broads Landscape Character Assessment (Online). (Accessed June 2018). Available at: http://www.broads-authority.gov.uk/news-and-publications/publications-and-reports/planning-publications-and-reports/landscape-character-assessments
[106] Great Yarmouth Borough Council (2008) Landscape Character Assessment (Online). (Accessed June 2018). Available at https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1236&p=0
[107] Department for Environmental and Rural Affairs, Natural England, Environmental Agency, Historic England, Forestry Commission and Marine Management Organisation (2018) – Magic (online). (Accessed: June 2018). Available at http://publications.naturalengland.org.uk/category/587130
[108] Google (2018) Google Earth Aerial Mapping (online). (Accessed June 2018). Available from Google Earth https://earth.google.com/web/
[109] Microsoft (2018) Bing Mapping (online). (Accessed June 2018). Available from https://www.bing.com/maps

space. Building heights are broadly similar throughout the area, typically of no more than three storeys and occasionally, punctuated by taller industrial towers or tanks.

10.4.6. The east bank of the river comprises a mixed pattern of buildings including different sized warehouses, depots and industrial units. Large scale industrial and maritime activities tend to occupy the eastern river bank. Facilities comprising large tanks, storage areas and associated warehouses and offices act to contain views in and out of the river corridor. Some of the older warehouses and buildings have historical and architectural merit but are interspersed by new development and industrial infrastructure of limited architectural value.

10.4.7. The properties overlooking the western bank of the river mainly comprise Victorian red brick terraces in small rows, interspersed with commercial premises, and disused plots of land. To the west of the river the study area consists of a mixed and fragmented urban fringe environment of limited distinctiveness. The residential properties most affected by the Proposed Scheme are situated along Cromwell Road, Queen Anne's Road and Southtown Road.

10.4.8. West of Southtown Road, away from the industrialised waterfront, and approaching the A47 more vegetation becomes apparent where it lines short sections of William Adams Way and Suffolk Road. In places rows of properties fronting the river give some distinctive townscape pattern but this declines beyond to a mix of land uses including scattered commercial buildings. A more distinctive residential pattern can be found to the south of William Adams Way. There is also a prominent belt of conifers to the rear of Queen Anne's Road. Small pockets of green space are interspersed amongst the industrial and domestic land uses either side of William Adams Way and provide a break from the surrounding primarily commercial townscape. A larger green space is Southtown Common Recreation Ground, to the south of William Adams Way and adjacent to the A47. This is bounded by mature deciduous vegetation on its north and east sides, screening it from adjoining busy roads.

10.4.9. There appears to be little pedestrian activity in the study area with some limited use of waterfront spaces, and most movement by motor vehicle.

PUBLISHED NATIONAL CHARACTER AREAS

10.4.10. The Proposed Scheme lies within NCA 79: North East Norfolk and Flegg and NCA 80: The Broads. Due to its proximity, 500m south-west of the Proposed Scheme, NCA 82: Suffolk Coast and Heaths, to the south west has also been included. It should be noted that the published descriptions of these character areas primarily relate to their rural characteristics, and not urban areas lying within or adjoining them. The characteristics of relevance to the study area are listed below.

10.4.11. The key characteristics of relevance NCA 79 are:

- Generally flat, low-lying landscape, compared to adjacent areas, which has limited topographic variation and slopes gently from west to east, becoming flatter as it merges with the Broads.
- Distinctive coastal sand dune system and deposits of marine shingle, with sections of sandy cliffs and long, wide, sandy beaches.
- The River Yare, which provides a distinctive riverine landscape and flows out through the tidal lake of Breydon Water to the North Sea.
- Strong vernacular style of domestic and agricultural buildings, reinforced by use of flint and red brick. Roofs are commonly Norfolk reed thatch or pantiles. Isolated flint churches – either round-towered Saxo-Norman churches or medieval wool churches – are prominent in the open landscape.
- Chalet parks and large caravan sites dominate the settlement structure along parts of the coast.

10.4.12. The key characteristics of NCA 80:

- The landscape is low-lying with some areas below sea level and has characteristic open, extensive views over slow meandering rivers, drained marshland and coastal plain in the lower valley flood plain. Views inland are framed by the tree-lined valley ridge lines.
- The middle, upper and narrow incised side valley tributaries are small scale, low and enclosed, often supporting woodland.
- Rivers dominate the landscape with the middle and Lower River reaches flowing between flood banks, above the level of the surrounding land which is drained by dykes, ditches and pumps.
- The Broads, which are former flooded peat workings, form naturally nutrient-rich shallow lakes of various sizes surrounded by fens, wet woodland and large expanses of reed bed, rich in biodiversity.
- Field patterns are principally defined by drainage over most of the Broads. Regular 18th- and 19th-century enclosure fields (generally marshland) are clearly defined by straight, reed-fringed drainage ditches that form a strongly geometric layout across the lower flood plain. Some earlier curvilinear enclosure of marshland also survives.
- Vertical features are very distinctive in this generally flat landscape and include some very fine medieval churches on the higher ground and several traditional drainage mills located on embankments flanking some of the drainage channels on the marshes and coastal plain.
- Small boatyards and marinas form part of the traditional riverside scenery although, increasingly, extensive modern boatyard/marina developments challenge the traditional character.

10.4.13. The key characteristics of NCA 82 are:

- A predominantly low-lying landscape with some areas along the coastal plain below or at sea level. Changes in relief are slight, but enough to distinguish the Sandlings, sandy rolling ‘upland’ between estuaries.
- A dynamic coast, shaped by long, sweeping bays, cut by the series of more sheltered estuaries. The shoreline is defined by shingle beaches and structures, sea defence features and in places low, soft crumbling cliffs.
- Rivers flow west-east forming intimate, twisting alluvial valleys. Estuaries support internationally important salt marshes and intertidal flats with large numbers of waders and wildfowl, while their open waters are busy with pleasure and commercial craft.
- Expansive coastal level grazing marshes divided by drainage dykes contain internationally important reed beds and fens. Many are managed as nature reserves owing to their rich biodiversity, which includes a nationally important concentration of breeding bittern.
- Large commercial ports (Harwich and Felixstowe), Sizewell nuclear power station, the Cobra Mist transmitting station and the Orwell Bridge all contribute landmark diversity. Major transport infrastructure includes the A14 and A12 and the main East Coast rail line.

Local Landscape Character Areas

10.4.14. Great Yarmouth Borough Landscape Character Assessment, 2008 classifies the area that the Proposed Scheme sits within as Urban. The following landscape character areas are within the study area:

- C1 – Yare Valley – Great Yarmouth Edge
- G4 – Hobland Settled Farmland

10.4.15. The Broads Authority Landscape Character Assessment Supplementary Planning Documents defines an area in the north-west of the study area as Area 20 Yare – Breydon Water; and Area 21 Yare – Burgh Castle Marshes.

TOWNSCAPE CHARACTER

10.4.16. Based on published character studies, mapping, desk studies and fieldwork, townscape character areas will be determined for the assessment within the Environmental Statement.

TOWNSCAPE SENSITIVITY

10.4.17. Sensitivity relates to how much the townscape is valued in combination with the extent to which it is susceptible to the change brought about by the Proposed Scheme. Three orders of sensitivity (high, medium and low) will be adopted and applied to each of the townscape character areas as defined in Section 10.3.

VISUAL AMENITY

10.4.18. Establishment of the visual baseline for the Proposed Scheme will involve the adoption of the four stages of assessment described in Section 10.3.

10.4.19. To establish the distribution and types of visual receptors the following will be undertaken:

- Review of OS 25k mapping, and other published material;
- Review of the ZTV;
- Discussion with the heritage team; and
- Consultation with the local planning authority

10.4.20. Visual receptors will include the following:

- Occupants of residential clusters and individual properties;
- Users on roads with views of the Proposed Scheme; and
- Recreational users of publicly accessible areas including Public Rights of Way, published walking or cycling routes such as national cycling routes and long-distance walking trails, lookout points, and areas of green space.

10.4.21. Until the production of the ZTV and detailed site work all the potential visual receptors cannot be identified, however a preliminary review of baseline information has identified the following receptors likely to experience views of the Proposed Scheme, and form the basis for the selection of 12 representative photographic viewpoints. The list of visual receptors may be adjusted in line with further information and findings as the ES progresses.

Public and cultural visual receptors

10.4.22. Public and cultural receptors include:

- National Cycle Route 517;
- Werrymans' Way;
- Angles Way Long Distance Path;
- England Coast Path;
- Look out point at Nelson Museum;
- Elizabeth House (National Trust);

- Hall Quay / South Quay Conservation Area;
- Public open space adjacent to Hall Quay and Haven Bridge;
- Southtown Common; and
- Footpaths and surrounding roads with potential visibility of the Proposed Scheme.

Residential visual receptors

10.4.23. Properties to the north-west of the Proposed Scheme include:

- Cromwell Road, one property will be demolished as part of the Proposed Scheme;
- Cromwell Court; and
- Southtown Road, nine properties will be demolished as part of the Proposed Scheme.

10.4.24. Properties to the south of the Proposed Scheme include:

- Queen Anne's Road, (ten properties will be demolished as part of the Proposed Scheme);
- Southtown Road (these may be demolished as part of the Proposed Scheme);
- Alpha Road; and
- Ferry Hill.

10.4.25. Properties to the north and east of the Proposed Scheme include:

- Admiralty Road;
- Barrack Road;
- The Steeps; and
- South Quay.

PRELIMINARY REPRESENTATIVE VIEWPOINTS

10.4.26. The following 12 preliminary photographic viewpoints presented in Table 10.7 below have been identified as shown on Figures 10.1 and 10.2; these have been agreed with the landscape officer at NCC who has been requested to act as consultee on behalf of GYBC. The location of the proposed viewpoints will be validated on site and may be relocated following the site visit as required. The locations have been selected to also cover potentially affected heritage locations.

Table 10.7 - Proposed representative viewpoints

Viewpoint Number	Viewpoint Name/Location	Receptors Represented
Viewpoint 1	Southtown Road	Recreational Users on NCN 571 Recreational Users on the East Coast Path Residential Receptors
Viewpoint 2	Queen Anne's Road	Recreational Users NCN 571 Recreational Users East Coast Path Residential Receptors (residential receptors may be demolished as part of the Proposed Scheme)
Viewpoint 3	Southtown Common Recreation Ground	Recreational Users
Viewpoint 4	William Adams Way	Road Receptors
Viewpoint 5	A47 Footbridge	Road Users Recreational Receptors
Viewpoint 6	Bollard Quay	Recreational Users on NCN 571 Recreational Users on the East Coast Path Residential Receptors
Viewpoint 7 (combined heritage viewpoint)	Dolphin Public House	Heritage Asset Recreational Users
Viewpoint 8 (combined heritage viewpoint)	Barrack Road	Heritage Asset Residential Receptors
Viewpoint 9	Admiralty Road	Residential Receptors
Viewpoint 10	Ferryside	Recreational Users on NCN 571 Recreational Users on the East Coast Path Residential Receptors
Viewpoint 11 (combined heritage viewpoint)	South Quay	Heritage Asset Recreational Users
Viewpoint 12	Hall Quay	Recreational Users

PROPOSED PHOTOMONTAGES

10.4.27. Photomontages can be used to demonstrate the appearance and visibility of the Proposed Scheme. Such visualisations will be produced in accordance with Advice Note 01/11110 and the draft LI Advice Note 2018111 published by the Landscape Institute. Where appropriate, mitigation planting can be illustrated at years 0 (completion) and year 15.

10.4.28. The following representative viewpoints are proposed for the creation of verifiable photomontages as they represent highly sensitive receptors who are likely to experience significant effects resulting from the Proposed Scheme.

- Viewpoint 1 – Recreational Users on National Cycle Route 571, East Coast Path and Residential Receptors; and
- Viewpoint 6 – Recreational Users on National Cycle Route 571, East Coast Path and Residential Receptors.

10.5 PREDICTED EFFECTS

CONSTRUCTION

10.5.1. The demolition of buildings will create new views within the townscape. Construction compounds, scaffolding, hoarding, cranes and plant, along with material stockpiles will introduce new prominent visual elements into existing views and alter the balance of townscape components and pattern.

OPERATION

10.5.2. The introduction of the Proposed Scheme will result in a new prominent visual feature of a noticeably different scale and form within the part of the urban fabric of Great Yarmouth. There will be a change to the pattern of townscape and new views resulting from the loss of buildings and introduction of a new public realm, control tower and ancillary highway elements. There will be a change in the setting of River Yare and views along the River Yare. The Proposed Scheme may provide benefits to townscape quality and quality of views.

10.6 PROPOSED MITIGATION

10.6.1. The proposed mitigation is likely to be embedded within the design of the Proposed Scheme, particularly in the bridge structure and placement of associated elements. Due to the scale of the bridge structure it is unlikely that planting will effectively reduce effects at Year 15, however there is scope to screen and filter views of specific receptors along with improving townscape quality through the design of the public open space and planting along the supporting roads and junctions. There is potential to include localised planting to improve specific visual receptors adjacent to the Proposed Scheme where Large Effects have been identified.

[110] Landscape Institute (2011) Advice on photography and photomontage (online) (Accessed June 2018). Available at https://www.landscapeinstitute.org/visualisation/photography-and-photomontage/?utm_source=dotmailer&utm_medium=email&utm_campaign=9545935_20180605%20-%20Photography%20photomontage%20guidance%20update&dm_i=6KZ,5OLOV,4YDDWR,M460P,1

[111] Landscape Institute (2018) Public Consultation Draft (online) (Accessed June 2018). Available at https://www.landscapeinstitute.org/visualisation/photography-and-photomontage/?utm_source=dotmailer&utm_medium=email&utm_campaign=9545935_20180605%20-%20Photography%20photomontage%20guidance%20update&dm_i=6KZ,5OLOV,4YDDWR,M460P,1

CONSTRUCTION

10.6.2. During construction the siting of compounds and boundary treatments such as hoarding of appropriate scale to hide construction activity and storage of materials, particularly around construction compounds will reduce effects on visual receptors.

OPERATION

10.6.3. At operation, mitigation is likely to be embedded within the Proposed Scheme design. Due to the nature and context of townscape, mitigation opportunities such as screening may not be possible or limited to specific receptors, dependant on the chosen final design.

10.7 CONCLUSIONS ON EFFECTS

10.7.1. The bridge structure will be a prominent new feature within the townscape and highly visible.

10.8 ASSESSMENT STILL TO BE UNDERTAKEN

10.8.1. The townscape and visual assessment will be undertaken during the ES in accordance with methodology set out in 1.3.

10.8.2. The following activities are to be undertaken:

- Confirm the design options for the bridge to be taken forward for assessment;
- Define townscape character areas through desk based study and site work within the study area;
- Undertake a ZTV to determine the visual envelope, which will be confirmed or amended through site visits to determine the study area and subsequent amendments if required;
- Undertake the assessment of townscape and visual effects in accordance with the methodology set out in section 1.3
- Prepare photomontages for selected viewpoint locations to be agreed with landscape officer at NCC who has been requested to act as consultee on behalf of GYBC;
- Prepare and agree appropriate mitigation measures, and or design modification where possible aimed at reducing or avoiding significant effects.

11

ROAD DRAINAGE AND THE WATER ENVIRONMENT

11 ROAD DRAINAGE AND THE WATER ENVIRONMENT

11.1 INTRODUCTION

11.1.1. This chapter describes the preliminary assessment of likely significant effects during construction and operation of the Proposed Scheme on the water environment (surface water and groundwater) The assessment is limited to the Proposed Scheme to date and data currently available at this point of the assessment process.

11.1.2. The potential impacts of the Proposed Scheme on other related aspects are addressed in other chapters as follows:

- Flood risk - Chapter 12;
- Nature conservation – Chapter 8; and
- Release of land based contaminants into surface or ground water bodies – Chapter 16

11.1.3. This chapter also addresses the requirements of the Water Framework Directive (WFD). The WFD compliance assessment will be incorporated into the ES for the Proposed Scheme. The WFD assessment will make reference to the findings of the ES in respect of aquatic ecology which will be included in the Nature Conservation Chapter.

11.1.4. The study area has been defined as the area within 1km of the Proposed Scheme Boundary for the assessment of impacts on surface water and 2km for the assessment of impacts on groundwater. Where there is direct hydraulic connectivity, potential impacts on surface water bodies which are outside the defined study area have been considered also. The study area is presented in Figure 11.1. The Proposed Scheme Boundary includes six proposed VMS locations and a large vessel waiting facility. The study area boundaries have been extended to cover these small areas, however at this stage these areas have not been assessed. The work in these areas is limited to erection of VMS or designated vessel waiting facility and therefore no significant effects are currently anticipated. This will be confirmed as part of the ES.

11.2 DIRECTIVES, STATUTES AND RELEVANT POLICES

11.2.1. A summary of the current legislation, policy and guidance documents relevant to the assessment of impacts of the Proposed Scheme on road drainage and the water environment is presented below.

THE WATER FRAMEWORK DIRECTIVE – DIRECTIVE 2000/60/EC

11.2.2. The Water Framework Directive (WFD) makes provision for the maintenance and improvement of the 'ecological and chemical status' of the water environment, which includes rivers, lakes, wetlands, groundwater, estuaries and coastal waters. Chemical status is determined from compliance with environmental standards for chemicals that are classed as 'priority hazardous substances' and 'priority substances'. The ecological status of a surface waterbody is measured through a range of biological quality elements, supported by measurements of physicochemistry, hydromorphology and compliance with environmental standards for chemicals that are classed as 'specific pollutants'. For groundwater the overall status has a quantitative and a chemical component.

11.2.3. The aim is for designated waterbodies to achieve 'good overall status' and prevent deterioration of status of surface waters and groundwater. Certain surface waterbodies may be designated as artificial/heavily modified and will have less stringent targets to meet, however these will still need to demonstrate 'good overall potential'.

11.2.4. Guidance published by the Environment Agency (EA) provides further information on assessing the risk of activities in relation to the River Basin Management Plan (RBMP) objectives.

GROUNDWATER DIRECTIVES

11.2.5. The WFD and the Groundwater Daughter Directive (GDD) (2006/118/EC), which were enacted in 2000 and 2006 respectively, replace the original Groundwater Directive (80/68/EEC) which was repealed in 2013. The GDD introduces procedures for assessing the 'Chemical Status' of groundwater as per the WFD, and protects groundwater by preventing direct discharge of 'hazardous pollutants' and limiting the direct discharge of non-hazardous pollutants.

NATIONAL LEGISLATION

11.2.6. The following legislation is relevant to the objectives of the Directives discussed above and generally to the subject matter of this part of the assessment:

- The Water Resources Act 1991;
- The Water Act 2003;
- The Flood and Water Management Act 2010;
- The Salmon and Freshwater Fisheries Act 1975;
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- The Environmental Permitting (England and Wales) Regulations 2016;
- The Control of Pollution (Oil Storage) (England) Regulations 2001; and
- The Environmental Damage (Prevention and Remediation) (England) Regulations 2015.

11.2.7. Consents will be required from the EA for temporary construction and permanent operational discharges as well as any temporary or permanent abstractions, impoundments and in-channel works. Under the Environmental Permitting Regulations, it is an offence to cause or knowingly permit a water discharge activity, including the discharge of polluting materials to freshwater, coastal waters, relevant territorial waters or groundwater, unless complying with an exemption or an environmental permit.

National Planning Policy Framework[56]

11.2.8. The revised National Planning Policy Framework (NPPF) for England was published in July 2018. In particular, Section 15 of the NPPF (Conserving and enhancing the natural environment) is relevant to the assessment of impacts on the water environment from the Proposed Scheme.

11.2.9. Paragraph 170 states that the planning system should contribute to and enhance the natural environment by "*preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability*".

National Policy Statement for National Networks[55]

11.2.10. Specific policies for NSIPs for which particular considerations apply are set out in national policy statements. The key document for the Proposed Schemet is the National Policy Statement for National Networks. It sets out detailed policy on environmental mitigations for development including pollution control, and assessment and management of water quality and resources.

11.3 ASSESSMENT METHODOLOGY

11.3.1. The road drainage and water environment assessment has and will continue to involve the following key tasks:

- Consultations with the relevant statutory and non-statutory bodies to establish the principal water environment issues to be assessed;
- Desk studies and field surveys to ascertain the current baseline conditions on site;
- Assessment of the potential impacts related to the construction and operation of the Proposed Scheme;
- Identification of measures to avoid, minimise or mitigate predicted impacts.

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

11.3.3. This assessment provides preliminary information as it relates to the Proposed Scheme to date and data currently available at this point of the assessment process. This preliminary assessment is a qualitative assessment, based largely on existing published datasets and information contained within reports from previous stages of the Proposed Scheme. An initial assessment of the potential impacts of the Proposed Scheme on the water environment has been completed using professional judgment to assess the likely magnitude of impacts where sufficient data is not yet available to quantify these impacts.

11.3.4. A more detailed assessment of potential impacts of the Proposed Scheme on identified receptors will be undertaken for the ES. Gaps in information identified at this PEIR stage will be considered and addressed along with confirmation of the Proposed Scheme design and specific mitigation measures.

SCOPED OUT IMPACTS

11.3.5. The specific characteristics of the Proposed Scheme enable particular impacts to be considered as highly unlikely to occur. Based on professional judgement and taking account of water environment characteristics, Proposed Scheme design and Scoping Opinion, the following items are not intended to be considered further:

- Loss of standing water - scoped out due to the scale of the Proposed Scheme, the urban setting of the study area and the lack of standing water bodies below or adjacent to the Proposed Scheme;
- Loss or change to Groundwater Dependent Terrestrial Ecosystems - scoped out due to the urban setting of the study area and the lack of such ecosystems below or adjacent to the options under development;
- Changes to groundwater level or flows due to cuttings and related dewatering - scoped out as no cuttings are anticipated for the Proposed Scheme.
- Groundwater impacts to Chalk Group aquifer and associated water users as the above lying London Clay Formation will provide a substantially thick low permeable layer to prevent scheme related construction activities impacting upon these receptors.

CONSTRUCTION POLLUTION

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

11.3.7. Mobilisation of potentially contaminated sediments during construction will also be considered in terms of local receptors with hydraulic connectivity to the Proposed Scheme. For the ES this will be informed by sediment

transport modelling that will be undertaken for the Proposed Scheme and sediment sampling to determine levels of contamination. A qualitative assessment has been completed for the PEIR.

POLLUTION FROM ROUTINE RUN-OFF

11.3.8. DMRB HD 45/09[112] specifies procedures for the assessment of pollution impacts from routine run-off on surface waters, known as 'Method A'.

11.3.9. The Method A assessment comprises two separate elements:

- HAWRAT Assessment: the Highways Agency Water Risk Assessment Tool (HAWRAT) is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road run-off. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment-bound pollutants, respectively; and

- EQS Assessment: EQS are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the WFD. The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.

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

11.3.11. However, Method A was developed for assessment of discharges into freshwater bodies rather than transitional water such as the River Yare, with such water bodies having different characteristics, receptors and baseline conditions due to tidal influence and dilution factors. Therefore, the appropriate method of assessment for routine run-off will be discussed and agreed with the EA. A qualitative assessment of potential impacts has been completed for the PEIR based on the preliminary drainage strategy for the Proposed Scheme, alongside the hydrological regime of the receiving watercourses.

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

POLLUTION FROM ACCIDENTAL SPILLAGE

11.3.13. The DMRB document HD 45/09[112] specifies procedures for the assessment of pollution impacts from accidental spillage, known as 'Method D'. A summary of the methodology is provided below, with full details provided in HD 45/09[112].

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

- The probability that an accident will occur, resulting in a serious spillage of a polluting substance on the carriageway; and

[112] Design Manual for Roads and Bridges Volume 11, Section 3, Part 10 (HD 45/09) Road Drainage and the Water Environment, former Highways Agency, November 2009

- The probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.

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

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

11.3.17. However, as for Method A, Method D was developed for assessment of discharges into freshwater bodies rather than the transitional water of the River Yare with associated tidal influence and dilution factors. Therefore, the appropriate method of assessment for accidental spillage will be discussed and agreed with the Environment Agency. A qualitative assessment of potential impacts has been completed for the PEIR based on the preliminary drainage strategy for the Proposed Scheme, alongside the hydrological regime of the receiving watercourses.

HYDROMORPHOLOGICAL CHANGES

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

11.3.19. A qualitative assessment of potential impacts has been completed for the PEIR, based on professional judgment as to the likely magnitude of potential impacts on the flow regime of the River Yare due to the proposed bridge structure, physical changes to other surface water bodies and potential changes to the current drainage regime.

GROUNDWATER POLLUTION THROUGH MIGRATION OF CONTAMINATED SEDIMENTS

11.3.20. An assessment of the potential impact of the Proposed Scheme on groundwater quality will be undertaken with respect to potential contamination through migration of contaminated sediments or land-based contaminants entering groundwater through piling or similar activities.

LOSS OR CHANGE TO AQUIFERS AND SUPPORTED WATER SUPPLIES

11.3.21. An assessment of the potential impacts of the Proposed Scheme on groundwater quality and quantity will be undertaken with respect to aquifers and groundwater abstractions within 2km of the Proposed Scheme Boundary. This will include assessment of licensed abstractions and unlicensed private water supplies.

INDIRECT LOSS OR CHANGE TO SURFACE WATER RECEPTORS

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

ATTENUATION POND AND STORM WATER STORAGE FEATURE IMPACT TO GROUNDWATER

11.3.23. The preliminary drainage strategy suggests that a storm water attenuation pond and storage feature will be required for the scheme to operate. An assessment of the potential impacts these will pose on the local aquifers and associated water users will be required.

IMPACT ASSESSMENT CRITERIA

11.3.24. The predicted significance of impacts on surface waters and groundwater will be based on the importance or sensitivity of the relevant waterbody and the magnitude of the impact from the Proposed Scheme, as recommended in DMRB document HD 45/09[112].

11.3.25. The importance or sensitivity of the waterbodies is evaluated taking into account their quality, rarity, scale and substitutability. The criteria used is based on the guidance and examples given in HD 45/09 (Table A4.3) and WebTAG guidance and is provided in Appendix 11A.

11.3.26. The magnitude of the various impacts is evaluated taking into account the extent of loss and effects on integrity of the relevant waterbody attributes. The criteria used is based on the guidance and examples given in HD 45/09 (Table A4.4) and WebTAG guidance and is provided in Appendix 11A.

11.3.27. The estimation of the impact significance is derived by combining the estimated importance of the affected waterbodies and the magnitude of the impacts, taking into account mitigation and the guidance provided in HD 45/09[112], Table A4.5. Details for the methodology and criteria are provided in Chapter 5: Assessment Approach and should be read in conjunction to this chapter.

11.3.28. Where there is more than one option for significance rating, professional judgement is used to determine the significance for the particular impact. Any residual effects assessed as Moderate, Large or Very Large are deemed to be significant.

WATER FRAMEWORK DIRECTIVE ASSESSMENT

11.3.29. A WFD Assessment will be undertaken to assess the Proposed Scheme against the key objectives of the WFD. The approach to the assessment is based on EA guidance available on Gov.UK and will consider the potential impacts of the Proposed Scheme against the quality elements of the WFD waterbodies to determine whether the Proposed Scheme will affect the waterbody status and / or achieving the objectives stated in the RBMP. A preliminary assessment, incorporated into this chapter, has been completed for the PEIR and will be consulted on with the EA.

SOURCES OF INFORMATION

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

- Great Yarmouth Third River Crossing, Stage 2 Environmental Impact Assessment Report 2009 (“the Stage 2 Report”);[113]
- Ordnance Survey Mapping and terrain data;

[113] Mott MacDonald (2009). Great Yarmouth Third River Crossing Simple Environmental Assessment

- Defra's online GIS portal MAGIC[107];
- 1:50,000 Geological map England and Wales Sheet 162, Great Yarmouth, British Geological Survey;
- 1:125,000 Hydrogeological Map of Northern East Anglia, Sheet 1 Regional Hydrological Characteristics and Explanatory Notes, British Geological Survey;
- Datasets available from data.gov.uk, including:
  - LIDAR terrain data;
  - Locations of designated sites;
  - EA Asset Information Management System (AIMS) data;
- FEH web service portal (river catchment boundaries);
- EA Catchment Data Explorer (WFD data)[114]; and
- Groundsure report (2017)[115].

11.4 BASELINE ENVIRONMENT

DESCRIPTION OF THE STUDY AREA

11.4.1. Figure 11.1 shows the study area and key features, which are subject to update when data is received from the EA and local authorities.

11.4.2. The Proposed Scheme is located at and adjacent to the River Yare in Great Yarmouth (NGR 6524 3059). The Proposed Scheme Boundary is approximately 2.5km upstream from the outlet to the North Sea at Gorleston-on Sea. The study area comprises land in the vicinity of the River Yare and is mostly contained within the urban area of Great Yarmouth, although it also encompasses agricultural land to the north and west of the town and the North Sea to the east.

11.4.3. The topography of the area is reasonably flat and low-lying. Land to the south west falls from an elevation of approximately 15 m above Ordnance Datum (AOD) towards the River Yare at Great Yarmouth whilst land to the north and west (near Breydon Water) lies below ordnance datum. The eastern half of Great Yarmouth (east of the River Yare) forms a spit of land with a maximum elevation of around 7 mAOD.

11.4.4. The current land use within the study area is varied. Within the Proposed Scheme Boundary, current uses largely comprise industrial and commercial properties and highway infrastructure. The wider study area includes mainly industrial and commercial properties alongside the River Yare, with infrastructure such as South Denes Power Station and Great Yarmouth Port. Areas of open space for recreation and similar uses are present west of the River Yare, within the urban area. North and west of the town the land use becomes mainly agricultural consisting of marshland surrounding Breydon Water, an area of intertidal mudflats through which the River Yare flows. In addition to the port and harbour, the eastern coastline of Great Yarmouth comprises beaches used for leisure and recreation.

[114] Environment Agency (2018) Catchment Data Explorer. [online] available at http://environment.data.gov.uk/catchment-planning/. Accessed June 2018.
[115] Groundsure Enviro Insight Report Ref: CMAPS-CM-636391-16287-030717EDR, Centre Maps Live, July 2017

SURFACE WATER FEATURES

River Yare

11.4.5. The main surface water feature in the study area is the River Yare which flows north to south through the Application Site and enters the sea through a gap in the spit of land at Gorleston on Sea. The River Yare is a tidal river, according to the Stage 2 report the tidal limit is approximately 15km upstream, with a spring tidal range of approximately 2.2 m. The River Yare is a Main River, under the jurisdiction of the EA.

11.4.6. A confluence between the River Bure (also Main River) and the River Yare is located 2.1 km upstream of the Application Site. The River Waveney also joins the River Yare approximately 8 km upstream. The distance to the River Waveney is considered sufficient such that no impact is likely to result from the Proposed Scheme.

11.4.7. Upstream of the Proposed Scheme Boundary the River Yare passes through Breydon Water, an area of intertidal mudflats with its downstream extent at Breydon Bridge, approximately 2.4km upstream of the Proposed Scheme. Breydon Water covers an area of around 500 ha and is an internationally important RSPB nature reserve, and designated as a Special Protection Area (SPA), Site of Special Scientific Interest (SSSI) and is on the List of Wetlands of International Importance (Ramsar Site).

11.4.8. The River Yare is included in the Outer Thames Estuary SPA which extends from Caister on Sea south to the Thames Estuary.

11.4.9. The River Yare has a large catchment, estimated at around 3,000 km^2. The catchment includes the main tributaries of the River Bure, River Wensum and River Waveney, rising inland, and a significant area of low lying land drained via a network of ditches and channels in the Norfolk Broads.

11.4.10. Through the study area the river is around 80m wide, with banks consisting of engineered quay walls. The EA Asset Information Management System (AIMS) database shows numerous outfalls to the River Yare along both banks as it passes through Great Yarmouth. Several control gates and penstocks are also present near the confluence with the River Bure. The Haven Bridge crosses the River Yare approximately 1500m upstream of the Proposed Scheme, with the Vauxhall Bride crossing a further 800m upstream. Both structures include piers in the channel and associated structures.

11.4.11. Under the WFD, the River Yare is part of the Bure & Waveney & Yare & Lothing waterbody. This is a heavily modified transitional waterbody and is linked with several protected sites. It has an overall status (2016) of Moderate, comprising an ecological status of Moderate and Chemical Status of Good. The objective for the waterbody is to achieve Moderate status by 2027. Details of specific measures to achieve this objective are not known at this stage.

11.4.12. According to the Stage 2 report the normal spring tide discharge is in the region of 400 m^3/s with velocities around 2 m/s. As part of the sediment modelling study in 2008 current velocities were obtained which varied between 0.25 and 2.0 m/s.

11.4.13. The Stage 2 report references water and sediment sampling that was completed in November and December 2007. The sampling locations and details of the methodology are unknown at this stage. The results showed that concentrations of Copper, Biochemical Oxygen demand (BOD) and Total Suspended Solids all exceed their respective quality standard. Sediment samples consisted almost entirely of inorganic material (99%). The results showed that samples exceed probable effect level (PEL) standards (used at the time) for dibenzo(a,h)anthracene and phenanthrene. Sediments exceeding PEL standards suggest that remobilisation of these sediments could cause frequent adverse biological effects. Threshold effect level (TEL) standards were exceeded for the majority of heavy metals and PAHs in the core and grab samples collected in the same area. Exceedance of TEL standards suggests that remobilisation could result in an occasional adverse biological effect. The particle size distribution was determined from sediment samples taken. The majority of sediment grab and core samples had particles with a mean diameter of <1000 µm (ranging from coarse sand to silt). The sediment samples were assessed as being generally poorly sorted. This suggests that sediment at these sites is subject to intermittent disturbances such as storm surges and tidal cycles, during which rapid resuspension and deposition occurs.

River Bure

11.4.14. The River Bure is a tributary of the River Yare with its confluence approximately 2.1 km upstream of the Proposed Scheme Boundary. The River Bure is also a tidal Main River at this location. The River Bure passes through a largely rural catchment, estimated at around 1,000 km^2, in its lower reaches comprising the low-lying land of the Norfolk Broads. The River Bure is also included in the Outer Thames Estuary SPA. The River Bure is part of the Bure & Waveney & Yare & Lothing waterbody.

North Sea

11.4.15. The River Yare discharges to the North Sea at Gorleston-on-Sea. Under the WFD, this is included in the Norfolk East waterbody. This is a heavily modified coastal waterbody and is linked with several protected sites. It has an overall status (2016) of Moderate, comprising an ecological status of Moderate and Chemical Status of Good. The objective for the waterbody is to achieve Moderate status by 2015. Details of specific measures to achieve this objective are not known at this stage.

Other surface water features

11.4.16. Upstream of Great Yarmouth land either side of the main rivers is mainly marshland, drained via a network of ditches and small watercourses. The land generally lies below ordnance datum and land north of Breydon Water is managed by the Broads Internal Drainage Board (IDB). The land to the south is managed by the Waveney, Lower Yare & Lothingland IDB. It is likely these areas ultimately drain to the Breydon water and then the River Yare. The majority of this marshland area lies outside the study area although a small part adjacent to Great Yarmouth is included in the 1km buffer zone for surface water features.

11.4.17. Within the 1km study area there are several small ditches / watercourses and a small pond shown on OS mapping. These are generally located in less densely developed areas, but still within the urban area of Great Yarmouth. These are likely to form part of the surface water drainage infrastructure for the area. Most of the open watercourses are located outside of the Proposed Scheme Boundary although a few are shown within the Proposed Scheme Boundary, around Southtown Common and the A47 roundabout.

11.4.18. These watercourses eventually drain to the marshland west of Great Yarmouth and to the River Yare at Breydon Water via a pumping station.

SURFACE WATER ABSTRACTIONS AND DISCHARGES

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

11.4.20. No active surface water abstraction licenses were identified in the study area.

GEOLOGY

11.4.21. A detailed description of the geology of the study area is available in Chapter 16: Geology and Soils. The associated geological map is presented within the Contaminated Land desk study in Appendix 16A. The main characteristics of the geology of the study area are:

- Blow sand along the shore;
- Quaternary sand and gravel deposits from the North Denes Formation at the East of the Proposed Scheme Boundary;
- Quaternary clay and silt deposits from the Breydon Formation at the West and North West of the Proposed Scheme Boundary;
- Peat, also from the Breydon Formation, at the West and South West of the Proposed Scheme Boundary;

- Quaternary sand and silt deposits from the Lowestoft Till Formation and Happisburgh Glacigenic Formation at the South of the Peat Deposit;
- Underneath the Quaternary deposits, the bedrock consists of sands, gravels, silts and clays from the Crag Group.

11.4.22. The London Clay Formation, Thanet Formation and the Chalk Group underlie the Crag Group. The geological units and their main characteristics in the study area are listed in Table 11.1.

HYDROGEOLOGY

11.4.23. The Hydrogeological Map of North East Anglia 1:125,000 (1976), available on the BGS website[116], gives information about the regional hydrogeological characteristics of the study area. The area consists of three main aquifers: a superficial aquifer in the recent sedimentary deposits and two deeper Principal aquifers.

11.4.24. Including the 2km radius around the Proposed Scheme Boundary, the superficial aquifers comprises of blown sand and shingle, North Denes Formation and Happisburgh Formation. These aquifers are classified by the EA as Secondary A Aquifers, capable of supporting water supplies and/or river base-flow, at a local rather than strategic scale. They directly underlie, or are at shallow depth within the study area and are vulnerable to contamination.

11.4.25. Blown sand and shingle deposits to the east of the Proposed Scheme Boundary where the thickness varies between 9m and 15m. Abstraction yields of up to 15l/s have been proven from these deposits and it should be noted that water in this area is saline.

11.4.26. The North Dene Formation has proven abstraction yields of approximately 25l/s from the gravels. However, this may vary locally.

11.4.27. The Happisburgh Glacigenic Formation has proven abstraction yields of up to approximately 5l/s from the glacial sand and gravels units.

11.4.28. The Crag Group and Chalk Group underlie the superficial deposits (Section 11.4.21 and Section 11.4.24) and are classified by the EA as Principal Aquifers. The EA define these aquifers as having high intergranular and/or fracture permeability and usually provide a high level of water storage, capable of supporting water supplies and/or river base-flow at a regional / strategic scale.

11.4.29. The Crag Group aquifer consists mainly of interbedded sands and gravels. The aquifer dips and thickens eastward and reaches about 60m thick on the east coast. Distinguishing the Crag Group from the overlying superficial aquifers can be difficult where they are in contact due to similarity in composition. The superficial aquifers and Crag Group aquifer are assumed to be hydraulically connected.

11.4.30. The Chalk Group is classified as a Principal Aquifer; with high intergranular and/or fracture permeability and usually providing a high level of water storage.

11.4.31. The hydrogeological map also provides a cross section (Section 1), which is located slightly to the north of the study area but is considered representative of the main hydrogeological characteristics of the area of interest. The cross section gives in depth information on the variation of the hydrogeological units and shows that the Crag Group aquifer and the Chalk Group aquifer are separated by the London Clay Formation, which is assumed to be around 95m thick.

11.4.32. Table 11.1 provides a summary of the hydrogeological units.

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

Table 11.1 – Main Geological and Hydrogeological units

Geological Time	Geological Formations and Description	Hydrogeological characteristics of the principal formations	Aquifer	EA Aquifer Classification
Quaternary - Holocene	Blown Sand	The blown sand, shingle and valley gravel unit is present locally along the coast. Its thickness varies between 9 and 15m at Great Yarmouth. Water supplies of up to 15l/s have been obtain at this same location, with water being mostly saline.	Superficial Aquifer	Secondary A Aquifer
	North Denes Formation: sand and gravel			
	Breydon Formation: mainly silt and clay	The thickness of this layer varies between 3.5m to 10m. This formation tends to be a low permeability unit.	Non- aquifer	Unproductive Strata
	Breydon Formation: Peat			
Quaternary - Pleistocene	Lowestoft Till Formation: mainly Chalky sandy clay	The chalky boulder clay unit is commonly 30 to 50m thick, where present. This formation limits the infiltration to the underlying aquifers (Crag Group and Chalk Group aquifers) and affects their chemical characteristics.	Non- aquifer	Unproductive Strata
	Happisburgh Glacigenic Formation: mainly sand; some sandy clay; gravel	This formation occurs in mass within and around the chalky boulder clay mentioned above. Water supply up to 5l/s has been obtain where this unit overlays the Crag Group	Superficial Aquifer	Secondary A Aquifer
Quaternary – Pleistocene, Pliocene	Crag Group: Sand, partly shelly, some silt clay	The Crag Group aquifer consists mainly of sand and gravel. The aquifer dips and thickens eastward.	Crag Group Aquifer	Principal Aquifer
Tertiary - Eocene	London Clay Formation: Walton Member: silty mudstone	The London Clay Formation mainly consists of impermeable clays. This layer dips and thickens eastward and has a maximum thickness of around 95m at Great Yarmouth. This unit limits the infiltration to the Chalk Group aquifer below.	Non- aquifer	Unproductive Strata
	London Clay Formation: Harwich Member: sandy siltstone with volcanic ash layers			
	London Clay Formation: Hales Clay: siltstone and mudstone, sand and ash layers			

Geological Time	Geological Formations and Description	Hydrogeological characteristics of the principal formations	Aquifer	EA Aquifer Classification
Tertiary - Palaeocene	Thanet Formation: Ormesby Clay: mudstone mainly some ash layers	The Ormesby Clay have a thickness of around 10m at Great Yarmouth and are mainly non-water bearing. This unit limits the infiltration to the underneath Chalk Group aquifer.	Non- aquifer	Unproductive Strata
Mesozoic - Cretaceous	Chalk Group: white micritic limestone with layers of flint nodule.	This unit represent the principal aquifer. The layer dips eastward and is about 150m deep around the study area. The groundwater flow occurs mainly along the fissure and bedding planes, which are generally more open in the first 30 to 60m of the formation. In the study area the Chalk Group aquifer is confined by the clay layers mentioned above.	Chalk Group Aquifer	Principal Aquifer

GROUNDWATER LEVELS

11.4.33. The Hydrogeological Map of North East Anglia, available on the BGS website, provides a regional piezometric map with 5m interval contours on the estimated minimum level of Crag water table. The water level around the study area is around 0mAOD.

11.4.34. According to the Stage 2 report, groundwater strikes were recorded during the ground investigation drilling works between August and September 2007. Groundwater levels ranged between 0.88 and -1.04 mAOD within shallow deposits of silts and sands (piezometers located between 3 and 5 m below ground level (BGL). Groundwater levels were subsequently monitored at these sites on five occasions by Norfolk Partnership Laboratory. Groundwater levels within the areas of proposed excavation ranged between 0.77 and 2.83 mBGL (between -0.13 and 1.32 mAOD) over the one-month monitoring period.

11.4.35. Table 11.2 below gives water level strikes available on the GeoIndex (Onshore) map of the BGS webpage[117] of boreholes located in the study area. The water depths presented in the table below are consistent with the depths measured during the monitoring campaign of 2008. There are very few boreholes that penetrate the Crag Group and the Chalk Group in the vicinity of the study area, at this stage reliance is placed on the hydrogeological map contours.

[117] http://mapapps2.bgs.ac.uk/geoindex/home.html

Table 11.2 - Groundwater Strikes (BGS GeoIndex)

Borehole name, Reference and position according to the River Yare	Easting	Northing	Length (m)	Groundwater depth (m)	Associated aquifer
ADMIRALTY ROAD GREAT YARMOUTH 210 Ref: TG50NW1057 Drilled in 2003, at the east of the River Yare, in the study area	652668	305865	8.0	1	Superficial Aquifer
BOLLARD QUAY 10 Ref: TG50NW587, Drilled in 1985 at the west of the River Yare, in the study area	652400	305940	11.5	3	Superficial Aquifer
A47 GORLESTON RELIEF ROAD Ref: TG50NW45 Drilled in 1985, further east to the River Yare, on the west boundary of the site boundary	652033	305818	5	1.6	Superficial Aquifer

GROUNDWATER FLOW

11.4.36. Locally groundwater flow direction in the superficial deposits, while generally towards the River Yare will be variable and influenced by local changes in topography as well as the aquifer geometry, e.g. presence of clay layers, tidal fluctuations and rainfall.

11.4.37. The Hydrogeological Map of North East Anglia 1:125,000 (1976), available on the BGS website[116], provides a regional piezometric map with contours showing the estimated minimum level of the Crag Group and Chalk Group water table. This indicates that the regional groundwater flow in both aquifers is generally eastward towards the sea.

11.4.38. The London Clay Formation provides a substantially thick layer of low permeable material between scheme related construction activities and the Chalk Group aquifer. The Chalk will therefore not be impacted upon and is scoped out of this assessment. Where scheme construction details are changed, future assessments may require reconsideration of the impacts to the Chalk Group aquifer.

GROUNDWATER ABSTRACTIONS

11.4.39. There are two groundwater abstractions within study area based on data received from Groundsure in July 2017. A list of licensed groundwater abstractions is provided in Table 11.3. The distance and direction of these abstraction points from the Proposed Scheme Boundary are also provided in Table 11.2 below. Figure 11.1 shows the location of the two abstraction boreholes.

Table 11.3 - Licensed groundwater abstractions within the study area

Licence No.	Name	Estimated distance from the Proposed Scheme Boundary (m)	Easting	Northing	Direct source	Max daily volume (m3)	Version start date
AN/034/0015/020	Camplings Limited	198	651820	306080	Ground Water Source of Supply	210	1/12/2016

Licence No.	Name	Estimated distance from the Proposed Scheme Boundary (m)	Easting	Northing	Direct source	Max daily volume (m3)	Version start date
7/34/15/*G/0220	B & M LEISURE	1200	653140	307460	Ground Water Source of Supply	ND	1/3/1997

11.4.40. Further data regarding abstraction boreholes in the 2-km study area is currently being requested.

GROUNDWATER QUALITY

11.4.41. Under the WFD, the EA has determined the study area lies within the 'Broadland Rivers Chalk & Crag' Groundwater Waterbody (GB40501G400300), classified as holding a 'Poor' status for both quantitative and chemical classifications based on the 2016 dataset. The main pressures are either from agricultural and rural land management or 'no sector responsible'. This waterbody is linked to protected areas under the Drinking Water Directive although the study area does not lie within a drinking water safeguard zone.

11.4.42. The Site Investigation Factual Report (NCC, October 2007) indicates that in 2007 there was groundwater contamination within the study area when compared to drinking water standards, notably arsenic, boron, nickel, selenium, nitrate, sulphate, cyanide and benzo(a)pyrene. Table 11.4 gives more detail about the groundwater quality across the study area. The results shown below are based on a groundwater quality monitoring campaign carried out in nine boreholes in 2007 and represent the latest data available.

Table 11.4 - Groundwater quality results (2007)

Parameter	Minimum	Maximum	Drinking Water Standards	Units
Arsenic Dissolved	2	35	10	µg/l
Barium Dissolved	10	430	-	µg/l
Boron Dissolved	74	3000	1000	µg/l
Cadmium Dissolved	<0.4	0.6	5	µg/l
Chromium Dissolved	3	16	50	µg/l
Copper Dissolved	<1	2	2000	µg/l
Lead Dissolved	<1	1	25	µg/l
Nickel Dissolved	2	47	20	µg/l
Selenium Dissolved	<1	130	10	µg/l
Vanadium Dissolved	<1	25	-	µg/l
Zinc Dissolved	<3	160	50000	µg/l
Mercury Dissolved	<0.05	0	1	µg/l
Nitrate as NO3	<0.3	56	50	mg/l
Sulphate (soluble)	8	1600	250	mg/l
Sulphide	<0.5	<0.5	-	mg/l
Total Cyanide	<0.05	3.5	0.05	mg/l
Free Cyanide	<0.05	0.94	-	mg/l

Parameter	Minimum	Maximum	Drinking Water Standards	Units
pH Value	7.64	8.16	6.5 - 9.5	pH units
EPH (DRO) (C10-C40) Aqueous	<10	4300	-	µg/l
Naphthalene Aqueous	<26	67000	-	ng/l
Phenanthrene Aqueous	<22	13000	-	ng/l
Benzo(a)pyrene Aqueous	<9	34	10	ng/l
PAH 16 Total Aqueous	<27	93000		ng/l
Total PAH*	N/A	63	100*	ng/l

GROUNDWATER VULNERABILITY

11.4.43. The entire study area is designated by the EA as Major Aquifer High. Major aquifers include the Crag Group and Chalk Group aquifers, which are highly permeable formations and able to easily transmit pollution to groundwater.

11.4.44. The soils across the site are classed as having a high leaching potential (U). Soils with a high leaching potential have little ability to attenuate diffuse source pollutants. Non-adsorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater. The 'U' classification indicates an urban setting. The soil information for urban areas is based on fewer observations than elsewhere. Therefore, a worst-case high vulnerability classification is assumed, until proven otherwise.

11.4.45. The Crag Group, comprising silty clayey fine to medium sands, is not as important a source of groundwater as the Chalk Group. The less permeable layers of clay and silt within the Crag Group result in a variability in aquifer properties. Perched groundwater is also present in some horizons. Groundwater from the Crag Group is typified by a high carbonate, chloride, iron and nitrate concentrations, and high salinity overall because of its proximity to the coast. The Happisburgh Glacigenic Formation, comprising glacial tills and sand units, is also highly permeable. However, groundwater is restricted to its sand-rich horizons which are under-bedded with less permeable clay and silt. There are no Source Protection Zones (SPZs) within the study area.

11.4.46. The Crag Group and superficial aquifers of the study area are part of a Groundwater Nitrate Vulnerable Zone.

GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTE)

11.4.47. Based on the GWDTE map of England, no GWDTE has been identified in the 2km study area. The closest GWDTE is located more than 4km up gradient from the western limit of the study boundary and is unlikely to be affected by the Proposed Scheme.

Connections between groundwater and surface water (rivers, drains)

11.4.48. Based on the geology within the Proposed Scheme Boundary and the shallow groundwater, it is likely that there is connectivity between the river level and the surrounding groundwater system.

11.4.49. The groundwater system in the study area is likely to be influenced by tides. High frequency, i.e. 1hr, monitoring of river and groundwater levels is recommended in support of the Environmental Statement.

Future baseline

11.4.50. For the future baseline, the WFD objectives are assumed to be met. The Crag Group aquifer, which is currently designated a 'Poor' WFD status will, therefore, be assessed according to a future 'Good' WFD status. The EA expect the waterbody to achieve 'Good' status of all assessment parameters by 2027. Any potential change in status would not affect the importance of the receptor, which will remain a regionally important aquifer irrespective of designation. Based on the current available information no other changes are expected in baseline conditions.

Sensitive receptors

11.4.51. Based on the review of baseline conditions and current understanding sensitive receptors to the Proposed Scheme have been identified and detailed in Table 11.5 and Table 11.6 below.

Table 11.5 - Sensitive surface water receptors

Receptor	Key features	Current importance / sensitivity Future importance / sensitivity
River Yare	Main River Large tidal watercourse, navigable WFD Moderate status (objective Moderate by 2027) Heavily modified, engineered channel Within Outer Thames SPA Hydraulically linked to Breydon Water (SSSI, Ramsar) Numerous existing discharges No abstractions WFD Waterbody supports aquatic ecology Some contamination but WFD quality status generally good / moderate	Very High (size, linked to international designations) Very High (no change)
River Bure	Main River Large tidal watercourse WFD Moderate status (objective Moderate by 2027) Within Outer Thames SPA Hydraulically linked to Breydon Water (SSSI, Ramsar) No abstractions WFD waterbody supports aquatic ecology Some contamination but WFD water quality generally good / moderate	Very High (size, linked to international designations) Very High (no change)
Breydon Water	SSSI, SPA, Ramsar Intertidal mud-flats, some saltmarsh	Very High (international designations) Very High (no change)
North Sea	Open sea Bathing water protected areas Wild birds and species protected areas WFD Moderate (physico-chemical) Chemical status generally good Within Outer Thames estuary SPA	Very High (international designations, bathing waters) Very High (no change)
Ditches and watercourses within 1km buffer (marshland	Small watercourses Managed watercourses - likely some pumping, sluice gates & modifications WFD Moderate (overall waterbody catchment)	Medium (size, link to international designated sites but not directly

Receptor	Key features	Current importance / sensitivity Future importance / sensitivity
upstream of Great Yarmouth)	Hydraulically linked to Breydon Water (SSSI, Ramsar) Likely some agricultural function	providing key features, WFD status) Medium (no change)
Ditches and watercourses within 1km buffer (within urban area of Great Yarmouth). No direct connectivity to Proposed Scheme	Small watercourses Urban drains Likely engineered watercourses WFD Moderate (overall waterbody catchment), but locations suggest watercourses will receive urban discharges Urban drainage Some local amenity value (parks etc.)	Low (size, potential contamination, likely modification) Low (no change)
Ditches and watercourses in close proximity to Proposed Scheme but not directly affected	Small watercourses Urban drains Likely engineered watercourses WFD Moderate (overall waterbody catchment), but locations suggest watercourses will receive urban discharges Urban drainage	Low (size, potential contamination, likely modification) Low (no change)
Ditches and watercourses at A47 roundabout directly affected by the Proposed Scheme	Small watercourses Urban drains Likely engineered watercourses WFD Moderate (overall waterbody catchment), but locations suggest watercourses will receive urban discharges Urban drainage	Low (size, potential contamination, likely modification) Low (no change)

Table 11.6 - Sensitive groundwater receptors

Receptor	Key Feature	Current importance / sensitivity Future importance / sensitivity
Crag Group Aquifer	Principal Aquifer Shallow groundwater level Hydraulic connectivity with the superficial aquifer Groundwater Vulnerability: Major High aquifer Nitrate Vulnerable Zone WFD Groundwater – Quantitative and Chemical status 'poor'	High (regional aquifer for potable supplies) High (no change)
Blown Sand, North Denes Formation, Happisburgh Glacigenic Formation	Secondary A Aquifers Shallow groundwater level Hydraulic connectivity with the River Yare Poor quality due to saline intrusion and contamination form surface.	Medium (local scale, medium quality) Medium (no change)
Industrial abstraction boreholes	Non-potable, industrial supplies	Medium (local scale, medium quality, industrial uses) Medium (no change)

11.5 PREDICTED EFFECTS

11.5.1. A full description of the Proposed Scheme is included in Chapter 2. With respect to the water environment, key features of the Proposed Scheme are as follows:

- Construction of a new double leaf bascule bridge over the River Yare which will involve the construction of new piers / abutments in the channel, new substructures to support the bridge and temporary or permanent "knuckle walls" or cofferdams in the channel to accommodate their construction. The pier foundations are expected to be piled. A minimum navigable width of 50m will be retained.
- Highway works adjacent to the channel, including a new bridge over Southdown Road, construction of road embankments and construction and reconfiguration of existing at-grade highways;
- Demolition of existing roads, buildings and potentially culverts;
- Realignment and potential culverting of watercourses in the vicinity of the current and new roundabout at Kings Williams Way;
- Changes in traffic flows;
- New highway drainage. The preliminary drainage strategy is described in Chapter 2 and indicates that runoff from the highway west of the crossing will be attenuated and discharged into the existing watercourses at Kings Williams Way. Runoff from the bridge structure and highway east of the river will be discharged into existing Anglian Water combined sewer. The key principles of the preliminary drainage strategy are stated as:
  - Runoff to be attenuated to as close as practical to greenfield rates for the 100-year event, including climate change, and not to exceed existing rates and volumes;
  - Runoff will be adequately treated before discharge; and
  - SuDS will be used where possible.

11.5.2. Details of construction activities and temporary works are not yet available, but it is expected this will involve some in-channel works for the River Yare. A Code of Construction Practice (CoCP) will be developed to mitigate potential impacts during construction.

EFFECTS ON SURFACE WATER RECEPTORS

11.5.3. This topic area covers the assessment of the following potential impacts of the Proposed Scheme on the surface water receptors:

<u>Construction effects</u>

- Pollution to surface water due to increased generation and release of sediments and suspended solids; or dust and debris associated with demolition works.
- Pollution to surface water due to mobilisation of contaminated sediments.
- Pollution to surface water due to increased risk of accidental spillage of pollutants such as oil, fuel and concrete.
- Temporary alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications, temporary in-channel structures and drainage outfalls.

- Temporary loss or change to surface water supplies due to degradation of water quality, changes in drainage patterns or disruptions to supply infrastructure.

Operation effects

- Pollution to surface water due to contaminants contained within routine road runoff;
- Pollution to surface water due to accidental spillages and subsequent discharges of contaminants through road drainage systems;
- Alterations to the hydromorphological regime, such as changes to erosion, deposition and channel migration processes associated with channel modifications, in-channel structures and drainage outfalls;
- Loss or change to surface water supplies due to degradation of water quality, changes in drainage patterns or disruptions to supply infrastructure.

11.5.4. Chapter 16: Geology and Soils should be referred to for the assessment of potential effects associated with contaminated land.

11.5.5. Chapter 8: Nature Conservation should be referred to for specific assessment of potential effects on designated sites, habitats and species.

EFFECTS ON GROUNDWATER RECEPTORS

11.5.6. This topic area covers the assessment of the following potential impacts of the Proposed Scheme on the ground water receptors:

Construction effects

- Pollution of superficial aquifers and contamination of groundwater supported supplies as a result of construction activities, such as piling creating preferential pathways for transmission of contaminants; and seepage of spillages;
- Potential for saltwater contamination of the superficial aquifers and groundwater supported supplies as a result of construction activities i.e. dewatering during construction may result in freshwater and saline waters to mix;
- Mobilisation of pre-existing contamination due to invasive works such as temporary excavations and piling;
- Temporary loss of water from storage and the reduction in water levels within superficial aquifers and at groundwater abstractions due groundwater control measures; and
- Temporary change to groundwater discharge pathways affecting surface water receptors as a result of groundwater control measures.

Operation effects

- Pollution of groundwater and aquifers due to contaminants contained within routine road runoff, where infiltration is proposed as part of the drainage strategy.
- Pollution of groundwater and aquifers due to accidental spillage, and subsequent release of contaminants to groundwater through infiltration.
- Changes to groundwater flow paths due deep foundations; and
- Change to groundwater discharge pathways affecting surface water receptors as a result of deep foundations.

11.5.7. Changes in groundwater level, flows and groundwater quality in the Chalk Group aquifer have not been assessed in detail at this stage as effects on this aquifer are unlikely due the vertical separation between the aquifer and the study area (the Chalk is at considerable depth, 150m below the land within the Proposed Scheme Boundary, and separated by the London Clay Formation (95m thick) and Thanet Formation, approximately 10m thick). This will be confirmed in the next stage.

11.6 PROPOSED MITIGATION

EMBEDDED MITIGATION

11.6.1. At this stage of the development of the Proposed Scheme some embedded mitigation is already available for assessment. This includes the principle of provision of appropriate treatment of runoff and SuDS to be incorporated into the highway drainage. These remove hydrocarbons, soluble metals, sediment and sediment bound pollutants from road drainage discharges, and other flow attenuation systems. Full details will be provided in the ES once the design has been progressed and assessment has been completed. Mitigation will be incorporated to reduce pollution from routine run-off to acceptable levels as defined within DMRB.

ADDITIONAL MITIGATION

11.6.2. Mitigation beyond the commitments described in the drainage strategy has still to be determined however it is expected that further mitigation as necessary will be incorporated into the design of the Proposed Scheme and that a Code of Construction Practice will be developed for the Proposed Scheme to mitigate risks associated with construction activities.

Construction Mitigation

11.6.3. More detail of proposed measures will be incorporated into the ES once these have been defined however examples of appropriate measures are as follows. These will be implemented through the Code of Construction Practice (CoCP) which it is expected will also include appropriate training and monitoring procedures:

- Oil absorbent booms will be installed, as appropriate, on the surface watercourses immediately downstream of the works area, and will be regularly inspected and maintained;
- Temporary cut-off drains will be used uphill and downhill of the working areas to prevent clean runoff entering and dirty water leaving the working area without appropriate treatment;
- Vegetated buffer strips will be maintained adjacent to all watercourses where possible;
- Sediment laden water generated on site will be appropriately treated before discharge. This may be through the use of silt fences, silt traps, filter bunds, settlement ponds and/or proprietary units such as a ‘siltbuster’;
- Potential future sampling & removal of contaminated sediment if deposited in a sensitive area;
- Control and treatment measures will be regularly inspected to ensure they are working effectively;
- Local weather forecasts will be monitored and works scheduled accordingly. In particular, earthworks and in-stream works will be stopped during storm events;
- Emergency response plans will be developed and spill kits made available on site;
- Stockpiling areas will be located at least 50m from sensitive watercourses;
- Fuels and potentially hazardous construction materials will be stored in bunds that have areas with external cut-off drainage; fuel will be stored in double skinned tanks with 110% capacity;

- Fuelling and lubrication of construction vehicles and plant will generally be on hardstandings, where reasonably practical, with appropriate cut-off drainage and located away from watercourses. In the event of plant breakdown drip trays will be used during any emergency maintenance and spill kits will be available on site;

- Construction plant will be checked regularly for oil and fuel leaks, particularly when construction works are undertaken in or near the existing site waterbodies;

- Waste fuels and other fluid contaminants will be collected in leak-proof containers prior to removal from construction site to an approved recycling processing facility;

- Sewage generated from site welfare facilities will be disposed of appropriately. This may be by discharge to the foul sewer or by collection in septic tank for disposal off site;

- Temporary arrangements for diversion, culverting or pumping of existing watercourses to be made prior to blocking watercourses;

- Specific mitigation associated with the works within the River Yare is anticipated as follows:

  - Use of coffer dams to exclude works areas from the main waterbody, thus reducing the risk of increased sediment loads or hazardous substances being directly released into the waterbody; and

  - Dredged material to be disposed of appropriately (e.g. to sea subject to appropriate licensing and contamination testing) or to a licensed facility where contamination threshold levels are exceeded.

11.6.4. In relation to potential effects from piling activities, ground investigation and a Piling Risk Assessment will be undertaken as detailed in Chapter 16: Geology, Soils and Contamination.

11.6.5. It is anticipated that a piling method which does not allow the “dragging down” of contaminants and does not create pathways from the near-surface soils to the aquifers shall be adopted where required depending on site conditions. The precise solution will be discussed in the ES once the piling risk assessment has been completed.

11.6.6. There is potential for the piling construction exercise to introduce saltwater to the upper freshwater aquifers i.e. the superficial aquifers and the Crag Group aquifer. To our knowledge there is no low permeable geological barrier between the two aquifer units and therefore these aquifers are considered within hydraulic connectivity with each other. The hydraulic connectivity of the two aquifers will need to be proven prior to construction to ensure no contamination of freshwater aquifers occurs during construction, as per the WFD (. To determine if these aquifers are mutually exclusive or hydraulically connected a site-specific ground investigation will be required whereby multiple observation wells will be installed in the superficial and Crag Group aquifers and subsequently monitored. Monitoring should include for both groundwater level and groundwater quality data. The results of the monitoring exercise will define the hydraulic relationship of the aquifer units.

11.6.7. If the aquifers are not in hydraulic connectivity then mitigations such as clean drilling techniques into the superficial and Crag Group aquifers will be required to avoid cross contamination and aquifer deterioration. Discussions with the EA and other relevant statutory bodies will be required if the aquifers are deemed to be hydraulically connected to ensure the Regulator is satisfied with the assessment and proposed construction methodology.

11.6.8. A programme of water quality monitoring on the relevant watercourses, upstream and downstream of the working corridor will be implemented throughout the construction phase period. The monitoring parameters and frequency will be agreed with the EA prior to construction works commencing.

Operational Mitigation

11.6.9. Further mitigation that will be considered for inclusion in the design and operation of the Proposed Scheme includes:

- Design of crossing piers (if required) to reduce localised turbulence and scour effects;
- Inclusion of appropriate measures for spillage containment within the road drainage;
- Design of culverts to reduce effects on channel morphology and aquatic ecology where deemed necessary; such as oversizing of culverts and provision of natural bed; and
- Lining of drainage features where there is an unacceptable risk of migration of contaminated runoff to underlying groundwater.

11.7 CONCLUSIONS AND EFFECTS

11.7.1. Tables 11.8 to 11.11 summarise the findings of the preliminary assessment of potential impacts and resulting significance of effects from the construction and operation of the Proposed Scheme on the identified surface water and groundwater receptors. The estimation of the impact significance has been derived by combining the estimated importance of the affected waterbodies and the magnitude of the impacts, taking into account mitigation in line with the guidance provided in HD 45/09 Table A4.5. The full assessment, including assessment of impacts prior to additional mitigation, is provided in Appendix 11B.

Table 11.8 - Summary of potential effects during construction to surface water bodies

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
River Yare (Very High)	Increased sediment loads	CoCP; coffer dams	Minor adverse (temporary)	Moderate adverse (temporary)
	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material	Minor adverse (temporary)	Moderate adverse (temporary)
	Dust and debris pollution	CoCP	Minor adverse (temporary)	Moderate adverse (temporary)
	Pollution due to spillage or hazardous substances	CoCP; coffer dams	Minor adverse (temporary)	Moderate adverse (temporary)
	Changes to hydromorphological regime	CoCP; design of coffer dams etc	Minor adverse (temporary)	Moderate adverse (temporary)
	Loss or change to surface water supplies due to degradation of water quality	CoCP; coffer dams; suitable disposal of dredged material	Negligible adverse (temporary)	Slight adverse (temporary)
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	None identified	No change	Neutral
River Bure (Very High)	Increased sediment loads	CoCP; coffer dams; silt barriers	Negligible adverse (temporary)	Slight adverse (temporary)
	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material; silt barriers	Negligible adverse (temporary)	Slight adverse (temporary)
	Dust and debris pollution	CoCP	Negligible adverse (temporary)	Slight adverse (temporary)
	Pollution due to spillage or hazardous substances	CoCP; coffer dams	Negligible adverse (temporary)	Slight adverse (temporary)
	Changes to hydromorphological regime	CoCP; design of coffer dams etc	No change	Neutral

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Loss or change to surface water supplies due to degradation of water quality	CoCP; coffer dams; suitable disposal of dredged material	No change	Neutral
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	None identified	No change	Neutral
Breydon Water (Very High)	Increased sediment loads & deposition	CoCP; coffer dams; silt barriers	Negligible adverse (temporary)	Slight adverse (temporary)
	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material; silt barriers	Negligible adverse (temporary)	Slight adverse (temporary)
	Dust and debris pollution	CoCP	Negligible adverse (temporary)	Slight adverse (temporary)
	Pollution due to spillage or hazardous substances	CoCP; coffer dams	Negligible adverse (temporary)	Slight adverse (temporary)
	Changes to hydromorphological regime	CoCP; design of coffer dams etc	No change	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 change in drainage patterns or infrastructure	N/A		
North Sea (Very High)	Increased sediment loads & deposition	CoCP; coffer dams; silt barriers	Negligible adverse (temporary)	Slight adverse (temporary)

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material; silt barriers	Minor adverse (temporary)	Moderate adverse (temporary)
	Dust and debris pollution	CoCP	No change	Neutral
	Pollution due to spillage or hazardous substances	CoCP; coffer dams	Minor adverse (temporary)	Moderate adverse (temporary)
	Changes to hydromorphological regime	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 change in drainage patterns or infrastructure	N/A		
Ditches and watercourses within 1km buffer (marshland upstream of Great Yarmouth) (Medium)	Increased sediment loads & deposition	CoCP; coffer dams; silt barriers	No change	Neutral
	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material; silt barriers	No change	Neutral
	Dust and debris pollution	CoCP	No change	Neutral
	Pollution due to spillage or hazardous substances	CoCP; coffer dams	No change	Neutral
	Changes to hydromorphological regime	CoCP; design of coffer dams etc	No change	Neutral

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Loss or change to surface water supplies due to degradation of water quality	CoCP; coffer dams; suitable disposal of dredged material	No change	Neutral
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	None identified	No change	Neutral
Ditches and watercourses within 1km buffer (within urban area of Great Yarmouth) (Low)	Increased sediment loads & deposition	CoCP; coffer dams; silt barriers	No change	Neutral
	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material; silt barriers	No change	Neutral
	Dust and debris pollution	CoCP	No change	Neutral
	Pollution due to spillage or hazardous substances	CoCP; coffer dams	No change	Neutral
	Changes to hydromorphological regime	CoCP; design of coffer dams etc	No change	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 change in drainage patterns or infrastructure	N/A		
Ditches and watercourses in	Increased sediment loads & deposition	CoCP; coffer dams; silt barriers	Negligible adverse (temporary)	Neutral

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
proximity of the Proposed Scheme - but not directly affected	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material; silt barriers	No change	Neutral
	Dust and debris pollution	CoCP	No change	Neutral
	Pollution due to spillage or hazardous substances	CoCP; coffer dams	Negligible adverse (temporary)	Neutral
	Changes to hydromorphological regime	CoCP; design of coffer dams etc	No change	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 change in drainage patterns or infrastructure	N/A		
Ditches and watercourses at A47 roundabout directly affected by the Proposed Scheme (Low)	Increased sediment loads & deposition	CoCP; silt barriers	Moderate adverse (temporary)	Slight adverse (temporary)
	Disturbance of contaminated sediments	CoCP; coffer dams; suitable disposal of dredged material; silt barriers	No change	Neutral
	Dust and debris pollution	CoCP	Moderate adverse (temporary)	Slight adverse (temporary)
	Pollution due to spillage or hazardous substances	CoCP;	Minor adverse (temporary)	Neutral
	Changes to hydromorphological regime	CoCP – maintain drainage routes	Moderate adverse (temporary)	Slight adverse (temporary)

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Loss or change to surface water supplies due to degradation of water quality	N/A		
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	N/A		

Table 11.9 - Summary of potential effects during operation to surface water bodies

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
River Yare (Very High)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	Negligible adverse	Slight adverse
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	Negligible adverse	Slight adverse
	Changes to hydromorphological regime	Bridge pier design to reduce turbulence	Minor adverse	Moderate adverse
	Loss or change to surface water supplies due to degradation of water quality	Runoff treatment in drainage spillage containment	Negligible adverse	Slight adverse
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	Drainage routes maintained	No change	Neutral
River Bure (Very High)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	No change	Neutral
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	Negligible adverse	Slight adverse

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Changes to hydromorphological regime	Bridge pier design to reduce turbulence	No change	Neutral
	Loss or change to surface water supplies due to degradation of water quality	Runoff treatment in drainage spillage containment	No change	Neutral
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	Drainage routes maintained	No change	Neutral
Breydon Water (Very High)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	No change	Neutral
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	Negligible adverse	Slight adverse
	Changes to hydromorphological regime	Bridge pier design to reduce turbulence	No change	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 change in drainage patterns or infrastructure	N/A		
North Sea (Very High)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	No change	Neutral
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	No change	Neutral
	Changes to hydromorphological regime	N/A		
	Loss or change to surface water supplies due to degradation of water quality	N/A		

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	N/A		
Ditches and watercourses within 1km buffer (marshland upstream of Great Yarmouth) (Medium)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	No change	Neutral
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	Negligible adverse	Neutral
	Changes to hydromorphological regime	Bridge pier design to reduce turbulence	No change	Neutral
	Loss or change to surface water supplies due to degradation of water quality	Runoff treatment in drainage spillage containment	No change	Neutral
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	Drainage routes maintained	No change	Neutral
Ditches and watercourses within 1km buffer (within urban area of Great Yarmouth) (Low)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	No change	Neutral
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	Negligible adverse	Neutral
	Changes to hydromorphological regime	Bridge pier design to reduce turbulence	No change	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 change in drainage patterns or infrastructure	N/A		

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
Ditches and watercourses in proximity of the proposed Scheme - but not directly affected (Low)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	No change	Neutral
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	Negligible adverse	Neutral
	Changes to hydromorphological regime	Bridge pier design to reduce turbulence	No change	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 change in drainage patterns or infrastructure	N/A		
Ditches and watercourses at A47 roundabout directly affected by the Scheme (Low)	Pollution to surface water due to contaminants contained in routine road runoff	Runoff treatment in drainage	Minor adverse	Neutral
	Pollution to surface water due to spillage	Runoff treatment in drainage; spillage containment	Minor adverse	Neutral
	Changes to hydromorphological regime	Design of channels and culverts to reduce impacts	Moderate adverse	Slight adverse
	Loss or change to surface water supplies due to degradation of water quality	N/A		
	Loss or change to surface water supplies due to change in drainage patterns or infrastructure	N/A		

Table 11.10 - Summary of potential effects during construction to groundwater bodies

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
Crag Group (High)	Decrease in groundwater level due to use of groundwater control measures	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible.	Negligible adverse (temporary)	Slight (temporary)
	Disruption of groundwater flow due to use of groundwater control measures or due to construction process	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible	Negligible adverse (temporary)	Slight (temporary)
	Degradation of groundwater quality due to spillage or hazardous substances	CoCP; coffer dams	Minor adverse	Slight
	Mobilisation and / or drawdown of pre-existing contamination	CoCP;	Minor adverse	Slight
Blown Sand, North Denes Formation, Happisburgh Glacigenic Formation (Medium)	Decrease in groundwater level due to use of groundwater control measures	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible.	Negligible adverse (temporary)	Neutral (temporary)
	Disruption of groundwater flow due to use of groundwater control measures or due to construction process	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible	Negligible adverse (temporary)	Neutral (temporary)
	Degradation of groundwater quality due to spillage or hazardous substances	CoCP; coffer dams	Minor adverse	Slight
	Mobilisation and / or drawdown of pre-existing contamination	CoCP;	Minor adverse	Slight
Industrial abstraction boreholes (Medium)	Decrease in groundwater level due to use of groundwater control measures	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible.	Negligible adverse (temporary)	Neutral (temporary)

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Disruption of groundwater flow due to use of groundwater control measures or due to construction process	CoCP; Exclude groundwater flow into excavations using sheet piling or similar techniques rather than dewatering wherever possible	Negligible adverse (temporary)	Neutral (temporary)
	Degradation of groundwater quality due to spillage or hazardous substances	CoCP; coffer dams	Minor adverse	Slight
	Mobilisation and / or drawdown of pre-existing contamination	CoCP;	Minor adverse	Slight

Table 11.11 - Summary of potential effects during operation to groundwater bodies

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
Crag Group (High)	Local decrease in groundwater level due to a decrease in recharge caused by the impermeable construction	-	Negligible adverse	Slight adverse
	Local disruption of groundwater flow due to a decrease in recharge caused by the impermeable construction	-	Negligible adverse	Slight adverse
	Local disruption of groundwater flow due to piles	-	Negligible adverse	Slight adverse
	Degradation of groundwater quality due to spillage or hazardous substances	Runoff treatment in drainage; spillage containment	Negligible adverse	Slight adverse
	Degradation of groundwater quality due to contaminants contained in routine road runoff that infiltrate to the aquifer	Runoff treatment in drainage	Negligible adverse	Slight adverse
Blown Sand, North Denes Formation, Happisburgh Glacigenic Formation (Medium)	Local decrease in groundwater level due to a decrease in recharge caused by the impermeable construction	-	Negligible adverse	Neutral
	Local disruption of groundwater flow due to a decrease in recharge caused by the impermeable construction	-	Negligible adverse	Neutral
	Local disruption of groundwater flow due to piles	-	Negligible adverse	Neutral

Receptor and importance	Impact	Assumed mitigation	Residual impact magnitude	Residual significance
	Degradation of groundwater quality due to spillage or hazardous substances	Runoff treatment in drainage; spillage containment	Negligible adverse	Neutral
	Degradation of groundwater quality due to contaminants contained in routine road runoff that infiltrate to the aquifer	Runoff treatment in drainage	Negligible adverse	Neutral
Industrial abstraction boreholes (Medium)	Degradation of groundwater quality due to spillage or hazardous substances	Runoff treatment in drainage; spillage containment	Negligible adverse	Neutral
	Degradation of groundwater quality due to contaminants contained in routine road runoff that infiltrate to the aquifer	Runoff treatment in drainage	Negligible adverse	Neutral

11.7.2. Where the preliminary assessment has derived a level of significance, the majority of the operational effects are not considered to be significant at this PEIR stage. The exception is potential localised changes to the hydromorphological regime at the new crossing of the River Yare (currently assessed as Moderate adverse), associated with disrupted flows. This will be further assessed through the sediment transport modelling. During construction, some effects are considered to be Moderate adverse, and therefore deemed significant, where works are taking place within watercourses. However, the effects will be temporary with improvement in conditions over time as pollutants are treated and dispersed and disturbed sediment and silt settles out of the water column.

11.7.3. A preliminary review of the potential effects of the Proposed Scheme against the objectives of the WFD has been completed, as summarised in Table 11.12. At this stage it is considered the Proposed Scheme will be compliant with the requirements of the WFD.

Table 11.12 - Preliminary WFD review

Waterbody & type	Current status	Current objective	Scheme element	Comment
Bure & Waveney & Yare & Lothing Transitional water	Moderate	Moderate by 2027	New crossing of River Yare	No change to status or objectives - some potential temporary effects due to mobilised contaminated sediments (chemical status) and longer-term effects on flow characteristics but localised. Not sufficient to change ecological status
			Runoff discharges	No change – runoff will be treated and is expected to meet HAWRAT & EQS
Norfolk East (coastal)	Moderate	Moderate by 2015	New crossing of River Yare	No change to status or objectives - some potential temporary effects due to mobilised contaminated sediments (chemical status) and longer-term effects on flow characteristics but localised. Not sufficient to change ecological status
			Runoff discharges	No change – runoff will be treated and is expected to meet HAWRAT & EQS
Broadland Rivers Chalk & Crag Groundwater Waterbody (GB40501G400300)	Poor	Good by 2027	Runoff discharges	No change – runoff will be treated and is expected to meet HAWRAT & EQS. Infiltration not proposed
			Piling / foundations	No change to status or objectives – some potential for contamination during construction but insufficient to change overall chemical status. No significant change expected to groundwater flow regime – controlled by natural conditions.

11.8 ASSESSMENTS STILL TO BE COMPLETED

11.8.1. The following will be undertaken and presented in the ES:

- Further consultation to identify local abstractions in the study area;
- Groundwater monitoring;
- A dewatering impact assessment, subject to confirmation that dewatering will potentially be required;
- Detailed assessment on the water environment once the design has been further progressed;
- Sediment transport modelling and assessment of impacts on hydromorphological and regime;
- Sediment sampling and identification of mitigation measures as necessary to manage potential mobilisation of contaminated sediments during construction;
- DMRB HAWRAT calculations for routine run-off pollution impacts to surface waters (Methods A and B) and accidental spillages (Method D)
- The preliminary drainage strategy suggests that a storm water attenuation pond and storage feature will be required for the scheme to operate. An assessment of the potential impacts these will pose on the local aquifers and associated water users will be required once the design has been further progressed;
- Detailed assessment of potential impacts on groundwater aquifers from piling operations and the presence of piles, once the design has been further progressed and the piling risk assessment has been completed; and
- Water Framework Directive Assessment against the Anglian River Basin Management Plan.

12

FLOOD RISK

12 FLOOD RISK

12.1 INTRODUCTION

12.1.1. This chapter provides preliminary information with regard to cultural heritage as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. This Chapter supported by a hydraulic assessment technical note (Appendix 12A) and Figure 12.1.

12.1.2. A full Flood Risk Assessment (FRA) will be carried out upon confirmation of the design of the Proposed Scheme that will be presented at the application for the DCO. The FRA will include an assessment of flood risk to the Proposed Scheme from all sources as well as an assessment of the impact of the Proposed Scheme on flood risk elsewhere for both the construction and post-construction phases.

12.1.3. A number of comments were made at scoping stage by NCC and the Environment Agency (EA), these are discussed in this chapter and will also inform the FRA and Environmental Statement that will support the DCO.

12.1.4. The design of the Proposed Scheme will need to take into account the fact that works are planned to upgrade the quay walls through Great Yarmouth in the future to improve the standard of flood protection afforded by these. In addition, if deemed necessary following risk assessment, provision of a large vessel waiting facility at a remote location south of the crossing (including any dredging, quay strengthening, fendering and mooring alterations) will be required. If this is deemed necessary, its impact on flood risk will be assessed within the FRA.

STUDY AREA

12.1.5. The study area for the proposed assessment encompasses a large part of Great Yarmouth and is centred on the River Yare (see Figure 12.1). The Norfolk Broads are at the western extent of the study area, the eastern extent is the North Sea immediately where the River Yare meets the sea at Gorleston-on-sea. The study area extends as far as Caister-on-Sea in the north and Gorleston-on-Sea in the south.

LIMITATIONS

12.1.6. This chapter of the PEIR provides preliminary information as it relates to the Proposed Scheme to date and to data currently available and gathered at this point of the assessment process.

12.1.7. To date, the impact of the Proposed Scheme on fluvial and tidal flood risk post-construction has not been considered. The risk of flooding to the Proposed Scheme from all sources has not yet been assessed and will be in the full FRA submitted with the DCO application and appended to the ES. Similarly, the impact of the Proposed Scheme on surface water runoff will be assessed as part of the full FRA. The FRA will also consider the risk of flooding to the Proposed Scheme and impacts on flooding elsewhere during the construction phase.

12.1.8. At this stage, the modelling is in the early stages where a single tidal event (2013) has been simulated to understand how well the model represents flooding in Great Yarmouth.

12.1.9. The information contained herein is intended to inform consultation responses at this stage. Any gaps in information identified at this PEIR stage will be considered and addressed along with specific mitigation measures as part of the assessment for the production of the ES.

12.2 DIRECTIVES, STATUTES AND RELEVANT POLICES

DIRECTIVES

12.2.1. The Floods Directive (2007/60/EC) makes provision for the assessment of flood risk, mapping its potential impact and planning measures to reduce potential and significant flood risk.

REGULATIONS

12.2.2. The objectives of the Floods Directive discussed above that are relevant to this assessment are met through the following UK legislation:

- Highways Act 1980;
- The Water Resources Act 1991;
- Land Drainage Act 1991;
- Environment Act 1995;
- The Water Act 2003;
- Flood Risk Regulations (2009); and
- The Flood and Water Management Act 2010.

12.2.3. Under the various acts and regulations listed above, consent will be required from the Environment Agency for temporary construction and permanent operational discharges as well as any temporary abstractions, impoundments and in-channel works related to construction activities.

NATIONAL POLICY

12.2.4. The Proposed Scheme has been determined by Direction of the SoS to be nationally significant and to be development requiring development consent under the Planning Act and it has been agreed with the EA that it is “safety critical infrastructure” for the purposes of paragraph 4.41 of the NPS NN.

12.2.5. The NPS recognises that as a result of climate change, the risk of flooding will increase within the lifetime of NSIPs. The NPS NN states that the FRA should be carried out with reference to the guidance from the NPPF and accompanying National Planning Practice Guidance (NPPG) document.

12.2.6. Paragraphs 155 to 165 of the NPPF outline national planning policy in terms of flood risk. Supporting guidance is provided by the Planning Practice Guidance. The section of the PPG dealing with Flood Risk and Coastal Change provides additional guidance in the implementation of the NPPF in relation to development and flood risk.

12.2.7. The NPPF requires developments to address flood risk, requiring the provision of Flood Risk Assessments and the application of the Sequential and Exception Tests where appropriate Priority is given to the use of Sustainable Drainage Systems (SuDS) within the NPPF. The FRA for the Proposed Scheme will address the second part of the Exception Test as set out in the NPSNN and NPPF (paragraph 157) as the Sequential Test and first part of the Exception Test have already been completed.

GUIDANCE

12.2.8. The following guidance documents have also been taken into account:

- Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 HD 45/09[112]; and

- CIRIA Report 753 SuDS Manual[118].

12.3 ASSESSMENT METHODOLOGY

12.3.1. Baseline data relating to flooding has involved collation of the following:

- Collation and analysis of available data on flood risk;
- OS Mastermap covering Great Yarmouth;
- Bathymetric survey of the River Yare through Great Yarmouth (collected August 2017);
- 0.5m resolution LiDAR flown in 2015;
- Environment Agency Extreme Sea Levels;
- Daily average water level data recorded at the Haven Bridge and Great Yarmouth gauges; and
- Environment Agency defence levels through Great Yarmouth.

12.3.2. The objectives of the FRA presented in the ES will be to:

- Assess the risk to the Proposed Scheme from all potential sources of flooding (both during construction and operation);
- Establish the existing and future flood risk to the Proposed Scheme.
- Assess the potential impacts of the Proposed Scheme on flood risk elsewhere (both during construction and operation);
- Determine appropriate mitigation measures to manage flooding issues during operation in a sustainable way; and
- Link to the drainage strategy for the Proposed Scheme that will address how any additional surface water runoff generated by the Proposed Scheme will be managed.

12.3.3. The main source of flooding to the Proposed Scheme is tidal. The Great Yarmouth Strategic Flood Risk Assessment (SFRA)[119] identified that 'tidal-locking' may occur further up the Yare catchment, increasing the flood risk over a broad area. An existing 1D-2D hydraulic model of the River Yare and the wider Broadlands river network was obtained for use in this assessment. The existing model was reviewed and it was deemed appropriate to develop a new 2D only model of the River Yare through Great Yarmouth for the purposes of the FRA.

12.3.4. The focus of this assessment is the local hydraulic effects of the Proposed Scheme, therefore there is a need to use the most recent and accurate data, particularly within the Proposed Scheme boundary. The existing model was developed for a different purpose and is still valid but it has been necessary to refine and incorporate more detail into the model to determine the impacts of the Proposed Scheme on the hydraulics within the River Yare.

12.3.5. Wave overtopping from the open coast has been considered but it was judged not to be critical in this assessment as the main flood risk to Great Yarmouth is tidal inundation. The Proposed Scheme is approximately 2.6km from the coastal boundary, therefore wave overtopping will not have an impact on the Proposed Scheme because at water levels below the coastal defences, the arrangement of various defences at the River Yare

[118] CIRIA (2015). 753 SUDs Manual. [online] Available at http://www.scotsnet.org.uk/documents/NRDG/CIRIA-report-C753-the-SuDS-manual-v6.pdf . Accessed June 2018
[119] JBA Consulting. (2017) Great Yarmouth Strategic Flood Risk Assessment Final Report

entrance prevents significant transmission of waves into Great Yarmouth. Should the defences be overtopped, wave action would have less of an impact and wave overtopping has been judged as a small residual uncertainty. Sensitivity testing of the tidal boundary has shown that the peak tidal level has the greatest impact on the maximum flood levels predicted for each return period event.

12.3.6. A suite of sensitivity tests will be undertaken to determine the impact of a variety of parameters on the model results, including the roughness values representing land use within the model, fluvial inflows and tidal levels.

12.3.7. The model will be used to investigate three scenarios:

- Baseline – to establish the existing flood risk to the existing area of the Proposed Scheme and Great Yarmouth as a whole;
- Construction phase – to establish the impact of temporary works within the river channel on flood risk; and
- Proposed Scheme – to establish the impact of the Proposed Scheme on flooding elsewhere.

12.3.8. Model development is ongoing at this stage and it may be that the baseline flood risk predicted by the model is refined going forward. Once the baseline model is finalised, the results of the construction and post-scheme runs will be compared to the baseline results to determine their impacts on flood risk within Great Yarmouth.

12.3.9. Three flood return periods will be investigated using the flood model developed for the Proposed Scheme; these are:

- the 5% Annual Exceedance Probability (AEP) event;
- the 0.5% AEP event (tidal Flood Zone 3); and
- the 0.1% AEP event (tidal Flood Zone 2).

12.3.10. Model runs are to be undertaken for each return period with and without climate change allowances applied to determine the present day (2018) flood risk in Great Yarmouth and predicted future flood risk. The impact of, and resilience to, future flooding will be considered and mitigation against future flood risk elsewhere will be recommended as necessary. Climate Change allowances will be applied based on the NPSNN. As the Proposed Scheme is safety-critical, the UK Climate Projections (UKCP09) high emissions scenario for the 2080s at the 50% probability level will be used to inform the design and mitigation of the Proposed Scheme as agreed with the EA.

12.3.11. The design will be assessed against the H++ estimates (high risk, low probability) for sea level rise to assess a credible maximum scenario. The EA have agreed that they do not expect the design or mitigation to be provided to this level but the Proposed Scheme should be assessed against this scenario to understand the full picture of risk.

12.3.12. The need for flood mitigation is dependent on the magnitude of impact and the vulnerability of the receptor(s) that are affected by any increase in flood depth. Table 12.1 shows how a given increase in flood depth from the baseline scenario to the Proposed Scheme scenario will be classified in terms of impact.

12.3.13. Table 12.2 compares the magnitude of impact with the flood risk vulnerability of receptors (taken from Table 2 within the PPG for flood risk and coastal change) to demonstrate when mitigation may be required. The tables are valid up to and including the 0.5% AEP plus climate change event as the Proposed Scheme has to be designed and mitigated up to this level in line with current guidance[120]. The 0.1% AEP event will be considered separately in this assessment to provide a picture of the range of flood risk to Great Yarmouth, with the Proposed Scheme in place. Although Table 12-2 is used as a guide to determine when mitigation is required; the need for

[120] Flood Risk Assessment: standing advice, https://www.gov.uk/guidance/flood-risk-assessment-standing-advice, 2017.

mitigation is also determined using professional judgement based on the practicalities of what can be provided and how much benefit this will provide alongside discussions with the EA.

Table 12.1– Classification of magnitude of Flooding Impact

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

Table 12.2 – Significance of flood impact

Magnitude of Impact	Receptor Sensitivity				
	Water Compatible	Less Vulnerable	More Vulnerable	Highly Vulnerable	Essential infrastructure
No change	No Mitigation required	No Mitigation required	No Mitigation required	No Mitigation required	No Mitigation required
Negligible	No Mitigation required	No Mitigation required	No Mitigation required	Mitigation	Mitigation
Moderate	No Mitigation required	Mitigation	Mitigation	Mitigation	Mitigation
Major	No Mitigation required	Mitigation	Mitigation	Mitigation	Mitigation

12.4 BASELINE ENVIRONMENT

12.4.1. The Proposed Scheme lies predominantly within floodplain cited as Flood Zone 3 (defined as land having a 1 in 100 or greater annual probability of river flooding (1%) or land having a 1 in 200 or greater annual probability of sea flooding (0.5%)), with this typically adjacent and relatively close to the banks of the River Yare and Norfolk Broads, plus where the tributary River Bure is situated. Flood Zone 3 is the highest risk zone defined by the EA.

12.4.2. Additional areas of land classified as being within Flood Zone 2 are also within the study area (defined as land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%) or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%)), primarily the east side of the Proposed Scheme at Middle Road West.

12.4.3. Figure 12.2 shows the areas of Flood Zone 3 and 2 relative to the Proposed Scheme location.

12.4.4. The EA Flood Map for planning[121] only shows minimal lengths of flood defences in Great Yarmouth, however the River Yare quay walls are classified as formal defences and are generally at the same level as the ground behind them. Information regarding the levels of the quay walls was obtained from the EA for use in this assessment. The Broadlands Rivers Catchment Flood Management Plan aims to reduce flood risk within Great Yarmouth by continuing with improvement works to the existing defences. It is understood that the existing defences are to be patched using innovative techniques to identify defects reinstating the tidal flood protection.

[121] http://apps.environment-agency.gov.uk/wiyby/37837.aspx

It may be that in future, the overall flood risk to Great Yarmouth is reduced based on the works undertaken as part of the Broadlands Rivers Catchment Flood Management Plan.

12.4.5. The Proposed Scheme is not at flood risk from artificial sources, as the Great Yarmouth Third River Crossing design is not located within the maximum extent area of any nearby reservoirs or canals. However, there is a sewage and surface water pumping station in Great Yarmouth referred to as North Quay pumping station (Grid Reference: TG 5223 0831). It is unknown whether this particular pumping station has an impact on the Proposed Scheme area. This will be assessed as part of the full FRA.

12.4.6. Groundwater flooding is prominent in Great Yarmouth. The NCC Preliminary Flood Risk Assessment Report identified that approximately 1,000 to 10,000 properties in Great Yarmouth are susceptible to groundwater flooding. The locations of the properties at risk are currently unknown. Therefore, the risk of groundwater flooding to the Proposed Scheme will be assessed fully in the FRA.

12.5 PREDICTED EFFECTS

12.5.1. At this stage, a full modelling assessment has not been undertaken. Modelling has been undertaken to determine the predicted flooding by the model during an historic flood event (see Appendix 12A for further information) during which water overtopped the River Yare causing flooding to parts of great Yarmouth. The tidal profile for the high tidal event of 2013 has been simulated by forcing water levels at the two gauge locations in the domain (Haven Bridge and Great Yarmouth) and allowing the model to predict the water level, velocities and flooding within Great Yarmouth.

12.5.2. It should be noted that further refinement of the baseline hydraulic model is likely as the assessment progresses and the EA are further consulted regarding the modelling. The EA will review the hydraulic model developed for this assessment. A full FRA and modelling report will be produced for the ES.

12.5.3. The preliminary model results show significant flooding to Great Yarmouth for the simulated 2013 event. This is due to the tidal peak exceeding the defences in the harbour. See Appendix 12A for more information.

12.5.4. The model will be refined and calibrated using event data. It will then be submitted to the EA as part of the FRA assessment. The model is not yet developed enough to undertake the full assessment required for the FRA.

12.6 MITIGATION

12.6.1. At this stage, a worst-case scenario being considered and there is likely to be an impact on water levels in the channel and flood depths on the floodplain. Given that flood risk in the area is tidal, it is likely that any increases in water levels will be relatively small. EIA is an iterative process and the ongoing assessment of flood risk will inform the design of the Proposed scheme to minimise the impact on flooding as much as possible. As flood risk to Great Yarmouth is tidal, compensatory storage will not work as flood mitigation. It is therefore envisaged that any small increases in water levels will have to be managed by ensuring that an emergency plan is in place for flooding in Great Yarmouth and identifying safe access and egress from the Proposed Scheme during a flood event if possible. The EA will continue to be consulted to ensure that appropriate management measures are in place for any increase in water levels as a result of the Proposed Scheme.

12.7 CONCLUSIONS AND EFFECTS

12.7.1. There is existing flood risk to Great Yarmouth and the Proposed Scheme site from the sea. Flood risk to the Proposed Scheme and its impact on flood risk elsewhere will be quantified using the hydraulic model developed.

12.7.2. The Proposed Scheme lies predominantly within floodplain cited as Flood Zone 3 (defined as land having a 1 in 100 or greater annual probability of river flooding (1%) or land having a 1 in 200 or greater annual probability of sea flooding (0.5%)), with this typically adjacent and relatively close to the banks of the River Yare and Norfolk Broads, plus where the tributary River Bure is situated.

12.7.3. The Proposed Scheme is not at flood risk from artificial sources, as the Great Yarmouth Third River Crossing design is not located within the maximum extent area of any nearby reservoirs or canals.

12.7.4. Groundwater flooding is prominent in Great Yarmouth. Therefore, the risk of groundwater flooding to the Proposed Scheme will be assessed fully in the FRA.

12.7.5. Given that main flood risk in the area is tidal, it is likely that any increases in water levels will be relatively small. The EIA is an iterative process and the ongoing assessment of flood risk will inform the design of the Proposed scheme to minimise the impact on flooding as much as possible. As flood risk to Great Yarmouth is tidal, compensatory storage will not work as flood mitigation. It is therefore envisaged that any small increases in water levels will have to be managed by ensuring that an emergency plan is in place for flooding in Great Yarmouth and identifying safe access and egress from the Proposed Scheme during a flood event if possible.

12.8 ASSESSMENTS STILL TO BE COMPLETED

12.8.1. Further work is required to develop the model to make it robust for use in the flooding assessment. This will include engagement with the EA to ensure the model is acceptable for use in the assessment.

12.8.2. Further discussions with EA will determine whether any increase in flood depth and extent is acceptable as part of the Proposed Scheme. The EA discussions will inform any design decisions to minimise the impact of the Proposed Scheme on flood risk within Great Yarmouth.

12.8.3. When the design of the Proposed Scheme has been finalised, a full FRA will be carried out with reference to the NPPF and PPG to not only assess the impact of the Proposed Scheme elsewhere but to assess flood risk to the Proposed Scheme itself. All sources of flooding will be considered as part of the FRA and the surface water drainage required on the site will be determined. The FRA will also include a specific receptor assessment and discussion to assess the impact of flooding on Great Yarmouth.

12.8.4. The findings of the FRA will be presented within a Chapter of the ES.

13

CLIMATE CHANGE

13 CLIMATE CHANGE

13.1 INTRODUCTION

13.1.1. This chapter provides preliminary information with regard to climate change as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. This chapter considers the effects of the Proposed Scheme in terms of:

- The contribution to climate change: the greenhouse gas (GHG) emissions assessment under Section 13.2; and
- The assessment of the vulnerability of the Proposed Scheme to climate change (climate change resilience and adaptation) under Section 13.3.

13.1.2. The two distinct parts of the climate assessment are presented together in this chapter however, the presentation may be different in the subsequent ES.

13.2 GREENHOUSE GASSES

STUDY AREA

13.2.1. The assessment of vulnerability of the Proposed Scheme to the impacts of climate change is informed by regional scale information on historic and projected change in climate variables. The UK Climate Projections 2009 (UKCP09)[122] provide data on projected change in climate variables for each of the administrative regions of the UK. The Proposed Scheme falls within the East of England region so this will form the study area for the vulnerability assessment.

LIMITATIONS

13.2.2. The PEIR has been completed based on the currently available information regarding the scale and nature of the Proposed Scheme. Data to fully consider construction emissions, embodied carbon and operational end user emissions is not currently at a sufficient level to allow the assessment to take place. Data to be assessed will include:

- The type and volume of materials required for the Proposed Scheme (to consider construction emissions);
- The quantities of materials in construction elements such as major structures (e.g. roundabouts and bridges) (to assess the embodied carbon associated with the Proposed Scheme); and
- Emissions from the construction process (e.g. from vehicles and construction plant).

13.2.3. No modelling of regional traffic emissions was available at the time of writing and therefore it is not possible to determine the scale of any potential increase or reduction.

[122] DEFRA (2009) Adapting to Climate Change, UK Climate Predictions. [online] Available at https://www.gov.uk/government/publications/adapting-to-climate-change-uk-climate-projections-2009 . Last accessed June 2018

United Nations Framework Convention on Climate Change

13.2.4. The UK is a member of the United Nations Framework Convention on Climate Change (UNFCCC) which drives international action on climate change. The UK has pledged to reduce emissions under the Paris Agreement, as a part of a joint pledge by members of the European Union (EU). This provides an overarching commitment by the UK.

UK Climate Change Act

13.2.5. The Climate Change Act (2008) established a legal requirement for an 80% reduction in the GHG emissions of the UK economy by 2050 in comparison to the 1990 baseline. The Climate Change Act also created the Committee on Climate Change, with responsibility for:

- Setting 5-year Carbon Budgets covering successive periods of emissions reduction to 2050;
- Advising and scrutinising the UK Government's associated climate change adaptation programmes; and
- Producing a National Adaptation Plan for the UK Government to implement.

13.2.6. In 2011, the Highways Agency was required to complete a climate change adaptation report and submit it to UK government to inform the National Adaptation Plan. In 2015, Highways England submitted a voluntary report on progress following the climate change adaptation report.

Infrastructure Carbon Review

13.2.7. In 2013, the UK government published the Infrastructure Carbon Review[123], aiming to "release the value of lower carbon solutions and to make carbon reduction part of the DNA of infrastructure in the UK". Major infrastructure owners, operators and developers were invited to endorse, become signatories and make commitments under the review. Highways England was one of these organisations.

13.2.8. The review provided increased emphasis on 'capital carbon' (GHG emissions associated with raw materials, activities and transport for construction, repairs, replacement, refurbishment and de-construction of infrastructure) while acknowledging that 'operational carbon' (associated with energy consumption for the operation and use of infrastructure) will continue to dominate overall emission to 2050 and beyond.

13.2.9. The Infrastructure Carbon Review highlighted the need to assess GHG emissions early in the lifecycle of an infrastructure project when there is the greatest carbon reduction potential. It also led to the publication of a Publicly Available Specification on infrastructure carbon management; PAS2080:2016.

National Planning Policy Framework

13.2.10. The revised NPPF (2018)[124] includes in the definition of the environmental objective '*mitigating and adapting to climate change, including moving to a low carbon economy*' (paragraph 8).

- Chapter 9: Promoting Sustainable Transport encourages the provision of a choice of genuine transportation modes, the use of single private vehicles, the latter being understood to contribute to a significant proportion

[123] HM Treasury (2013). Infrastructure Climate Review. [online] Available at https://www.gov.uk/government/publications/infrastructure-carbon-review. Last Accessed June 2018

[124] Ministry of Housing, Communities and Local Government (July 2018) National Planning Policy Framework. Available here:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf

of total UK carbon emissions. For example, between 1990 and 2007, domestic transport comprised 24% of total UK emissions; the largest share was from road passenger cars at 86%[125]. In 2013, domestic and international transport accounted for 26% of all UK greenhouse gas emissions[126]; and

- Chapter 14: Meeting the Challenge of Climate Change, Flooding and Coastal Change, establishes that Local Planning Authorities should "*should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure*".

National Policy Framework for National Networks

13.2.11. The NPS NN chapters relevant to climate change mitigation and adaptation for the Proposed Scheme are shown in Table 13.1 – National Policy Statement for National Networks (2015) below:

Table 13.1 – National Policy Statement for National Networks (2015)

Chapter 3: Wider Government policy on national networks	
Emissions	Identifies that the transport sector will play an important part in meeting the Government's carbon targets. It is acknowledged that technologies, fuels, and promoting lower carbon transport choices will make the biggest reductions and that (comparatively) the likely impact from road development is "very small".
Technology	Sets out how the use of innovative technologies has the potential to improve the way we travel while "reducing costs and environmental impacts".
Sustainable transport	Describes how carbon impacts can be reduced by promoting *"sustainable modes of transport and high-quality cycling and walking environments*" which are "essential to reducing carbon emissions from transport".
Chapter 4: Assessment principles	
Environment impact assessment	This section sets out the fact that all proposals are subject to the EIA Directive (2011/92/EU) which requires "*an environmental impact assessment to identify, describe and assess effects on…air, climate…and the interactions between them*".
Climate change adaptation	Sets out the how the NPS shall put policy into practice with regards to climate change mitigation and adaptation when developing and consenting infrastructure.
Chapter 5: Generic impacts	
Carbon emissions	Sets out Government policy on climate change and outlines the importance of reducing carbon emissions, stating that the Government has a legally binding commitment to reduce greenhouse gas emissions by "at least 80% by 2050" and to conform to carbon budgets outlined in the "Carbon Plan 2011". The policy states that *"Carbon impacts will be considered as part of the appraisal of scheme options (in the business case), prior to the submission of an application for DCO*"

[125] Joseph Rowntree Foundation, Distribution of Carbon Emissions in the UK: Implications for Domestic Energy Policy, page 20 https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/carbon-emissions-energy-policy-full.pdf
[126] Department for Transport, Cars and carbon dioxide: http://www.dft.gov.uk/vca/fcb/cars-and-carbon-dioxide.asp

	and that "*any Environmental Statement will need to describe an assessment of any likely significant climate factors in accordance with the requirements in the EIA Directive*". However, it goes on to say that "*It is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets. However, road projects applicants should provide evidence of the carbon impact of the project and an assessment against the Government's carbon budgets*". The policy also states that "*an increase in carbon emissions is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the proposed Project are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets*".
Biodiversity & Conservation	The Biodiversity 2020 Strategy's aims need to be "*viewed in the context of the challenge of climate change: failure to address this challenge will result in significant impacts on biodiversity*".
Coastal change	Sets out the key considerations for infrastructure projects that are proposed on or near the coast. Developments in these areas are required to "*undertake an assessment of the vulnerability of the proposed development to coastal change, taking account of climate change, during the project's operational life*". With regards to the decision-making process, the policy states that "*the applicant must demonstrate that a full account has been taken of the policy on assessment and mitigation…taking account of the potential effects of climate change on these risks*".
Flood risk	Acknowledges the fact that climate change will likely lead to an "*increased flood risk in areas susceptible to flooding, and to an increased risk of flooding in some areas which are not currently thought of as being at risk*". It also states that an applicant's assessment should "*identify and assess the risks of all forms of flooding to and from the Proposed Scheme and demonstrate how these flood risks will be managed, taking climate change into account*" by taking *"the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made*" when preparing the Flood Risk Assessment.

Regional Policy

Great Yarmouth Borough Council Local Plan: Core Strategy 2013-2030[127]

13.2.12. The Core Strategy[75] contains a number of core policies which make reference to climate change. Policy CS1: Focusing on a Sustainable Future recognises that climate change is one of the greatest future challenges, but planning can support the transition of a low carbon economy and provide resilience to climate change impacts. If also states that policies in the Core Strategy will focus on ways to minimise greenhouse gas emissions, the risk of flooding and encourage the use of renewable energy.

13.2.13. Policy CS12: Utilising Natural Resources identifies an aim, where feasible, to reduce carbon dioxide emissions (over the requirements set by Building Regulations) by 10% through enhanced energy efficiency measures or the installation of renewable or low carbon sources in all major development.

[127] Great Yarmouth Borough Council (2013), Local Plan: Core Strategy: https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1213&p=0

13.2.14. CS14: Securing essential new infrastructure makes reference to having positive impacts on climate changes as the effect of the policy is to reduce reliance upon car use and therefore GHG emissions, by creating improvements to public transport, highways, footpaths and cycleways. The policy does note that positive impacts are reliant upon individual travel choices which are difficult to change.

ASSESSMENT METHODOLOGY

13.2.15. The Greenhouse Gas (GHG) assessment will be based on the following guidance:

- IEMA's EIA guide to Assessing GHG emissions and evaluating their significance[128]
- TAG Unit A3 Environmental Impact Appraisal (DfT, 2015). Chapter 4 Greenhouse Gases[129]; and
- PAS 2080:2016 Carbon management in infrastructure[130].

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

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

13.2.17. There are no specific criteria for assessing the significance of GHG emissions of highways schemes. In line with the NPS NN, significance of GHG impacts is assessed by comparing estimated GHG emissions arising from the Proposed Scheme with the respective UK carbon budgets (see Table 13.2) which have been set by the UK government covering 2018 to 2032.

13.2.18. The NPS NN also sets out *that "it is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets."*

13.2.19. There are currently no agreed thresholds for what level of greenhouse gas emissions is considered significant in an EIA context. A judgement is however made regarding the likely magnitude of emissions and the need for further assessment.

Table 13.2 - National Carbon Budgets set by the Government

Carbon budget period	UK carbon budget
Third: 2018 - 2022	2,544 $MtCO_2e$
Fourth: 2023 - 2027	1,950 $MtCO_2e$
Fifth: 2028 - 2032	1,725 $MtCO_2e$

[128] IEMA (2017) *EIA guide to Assessing GHG emissions and evaluating their significance*: https://www.iaia.org/pdf/wab/EIA%20Guide_GHG%20Assessment%20and%20Significance_IEMA_16May17.pdf

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

[130] BSI (2016) *PAS 2080:2016 Carbon management in infrastructure:* https://shop.bsigroup.com/ProductDetail?pid=000000000030323493

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

13.2.21. Table 13.3, therefore, presents the key emissions sources associated with each lifecycle stage of the Proposed Scheme and the corresponding conclusion of the scoping assessment.

Table 13.3 - Lifecycle stages and key emissions sources

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

13.2.22. The end of life stage has been scoped out as the expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of emissions activity. This scoping decision was agreed by the Planning Inspectorate in their Scoping Opinion issues May 2018, Case Reference TR010043.

Emissions Calculation

13.2.23. Emissions calculations for the construction stage will be completed within an industry recognised carbon calculation tool which focuses on emissions throughout the project lifecycle. For this particular assessment, Highways England's carbon tool will be used which multiplies emissions activity (e.g. quantities of material consumed, transport distances, fuel, power) by the relevant emissions factors expressed in carbon dioxide equivalents. Values will be reported as tonnes of carbon dioxide equivalents (tCO_2e).

13.2.24. The total operational stage end-user greenhouse gas emissions from traffic, will be modelled in accordance with the Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 Air Quality; HA 207/07[131]. The modelling will include the total greenhouse gas emissions for all vehicles covered by the traffic model covering the strategic and local road network in the area of the Proposed Scheme and its surrounding region.

Significance of Effects

13.2.25. At this stage, there is not enough information available to determine the level of magnitude or significance of emissions of the Proposed Scheme and, therefore, an assessment will be presented in the Environmental Statement.

13.2.26. Significance will be determined using professional judgement in line with the criteria outlined in paragraphs 13.2.16 to 13.2.19.

BASELINE ENVIRONMENT

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

- Construction and decommissioning emissions in the area of the Proposed Scheme footprint but also related to the transport of materials to and from the construction site, their manufacturing and disposal (this may be far from the scheme location e.g. emissions for manufacture of concrete and steel); and

- Operational emissions resulting from the Proposed Scheme infrastructure but also emissions, or any reduction in emissions, which result from the end-use of the Proposed Scheme (vehicle movements) and any consequent shifts in transport modes/patterns which may occur. Such emissions include those for traffic using the Proposed Scheme as well as the surrounding regional road network. Electricity consumption (e.g. for lighting) will typically result in emissions at power generation stations throughout the national electricity grid.

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

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

PREDICTED EFFECTS

13.2.29. The impacts of GHGs relate to their contribution to global warming and climate change. These impacts are global and cumulative in nature, with every tonne of GHG contributing to climate change impacts upon natural and human systems. GHG emissions result in the same global effects wherever and whenever they occur and, therefore, the sensitivity of different human and natural receptors is not considered.

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

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

PROPOSED MITIGATION

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

- Design optimisation to reduce the requirement for construction materials, substitute construction elements for lower-carbon alternatives (e.g. changing the design and materials for a bridge) and reduce the requirement for earth movements to/from and within the construction site;
- Specification of materials and products with reduced embodied GHG emissions including through material substitution, recycled or secondary content and from renewable sources;
- Recovery and re-use / recycling of site arisings (ideally, on-site);
- Selection and engagement of materials suppliers and construction contractors taking into account their policies and commitments to reduction of GHG emissions, including embodied emission in materials; and
- Through design, providing the conditions for efficient low-carbon vehicles and driving practices, such as increasing capacity, which would potentially result in a reduction in emissions per vehicle where congestion is relieved;

CONCLUSIONS AND EFFECTS

13.2.33. At this stage, there is not enough information available to determine the level of magnitude or significance of emissions of the Proposed Scheme and, therefore an assessment will be presented in the Environmental Statement.

13.2.34. Given the design, mitigation and enhancement measures available, it is not expected that there will be significant residual effects in terms of GHG emissions. This assertion will be confirmed in the Environmental Statement. It should also be noted that the NPS NN also set out that "*it is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets.*"

ASSESSMENTS STILL TO BE COMPLETED

13.2.35. GHG sources associated with the construction phase of the Proposed Scheme using available quantitative data such as a bill of quantities.

13.2.36. GHG emissions (baseline and total end user) during operational phase using traffic flow modelled in accordance with the Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 Air Quality; HA 207/07[41].

13.2.37. Total estimated GHG emissions arising from the Proposed Scheme to assess the significance of the Proposed Scheme.

13.3 CLIMATE RESILIENCE

INTRODUCTION

13.3.1. To mainstream the consideration of climate risk and vulnerability, a proportionate assessment should be undertaken at an early stage of project development, including as part of the EIA process. This will ensure that projects achieve an appropriate level of resilience in a cost-effective manner.

13.3.2. This document presents an assessment of the vulnerability of the Proposed Scheme to the impacts of climate change. Details of the proposed scheme are presented in Chapter 2. It should be noted that the assessment here is limited to providing preliminary information as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process.

STUDY AREA

13.3.3. The assessment of vulnerability of the Proposed Scheme to the impacts of climate change will be informed by regional scale information on historic and projected change in climate variables. The UK Climate Projections 2009 (UKCP09) provide data on projected change in climate variables for each of the administrative regions of the UK. The Proposed Scheme falls within the East of England region so this will form the study area for the vulnerability assessment.

ASSESSMENT APPROACH

13.3.4. This section outlines the full approach to assessment of climate vulnerability and risk in the EIA process. This approach aligns with the following UK and international guidance:

- IEMA (2015) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation[132];
- European Commission (2013) Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment[133];
- European Commission (2016) Climate change and major projects[134]; and
- European Commission Non-Paper Guidelines for Project Managers: Making vulnerable investments climate resilient[135].

[132] IEMA (2015) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. Available at: https://www.iema.net/assets/templates/documents/iema_guidance_documents_eia_climate_change_resilience_and_adaptation%20(1).pdf.

[133] European Commission (2013) Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment. http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf

[134] European Commission (2016) Climate Change and Major Projects. : https://ec.europa.eu/clima/sites/clima/files/docs/major_projects_en.pdf

[135] European Commission (undated) Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient. Available at: http://climate-adapt.eea.europa.eu/metadata/guidances/non-paper-guidelines-for-project-managers-making-vulnerable-investments-climate-resilient/guidelines-for-project-managers.pdf

13.3.5. The full approach consists of 4 steps:

- Step 1: Identify receptors and analyse policy context;
- Step 2: Climate vulnerability assessment;
- Step 3: Risk assessment; and
- Step 4: Adaptation measures.

13.3.6. In this PEIR, the results of Steps 1 and 2 will be presented in order to describe the level of vulnerability of the Proposed Scheme to the impacts of climate change and determine which vulnerabilities should be assessed further (following Steps 3 and 4) at the next stage of the EIA process.

Step 1: Identify receptors and analyse policy context

13.3.7. During this stage, relevant receptors which may be affected by climate change are identified with consideration given to the impact of extreme weather and changes in climate on the Proposed Scheme over its lifetime. These receptors may comprise both known (i.e. receptors affected by historic weather events) and unknown (new) receptors. This stage includes a definition of the policy context.

Step 2: Climate vulnerability assessment

13.3.8. This stage comprises an assessment of the vulnerability of the receptors identified in step 1 to projected climate change and extreme weather variables. The vulnerability of a receptor to extreme weather and climate change is a function of:

- The typical sensitivity of the receptor to climate variables – based on literature review and expert judgement.
- The exposure of the receptor to projected change in climate variables – based on information on observed climate and projected climate (from UKCP09).

13.3.9. For each element of the vulnerability assessment (i.e. sensitivity and exposure), a vulnerability categorisation is assigned to each climate variable in relation to each receptor based on the following scale:

- High: High climate sensitivity or exposure.
- Moderate: Moderate climate sensitivity or exposure.
- Low: No significant climate sensitivity or exposure.

13.3.10. This is a qualitative assessment informed by expert opinion and supporting literature.

13.3.11. The vulnerability of receptors to climate variables is determined from the combination of the sensitivity and exposure categorisation, using the matrix shown in Table 13.4. At this point ‘Low’ vulnerabilities are not taken forward for further assessment, whilst ‘High’ and selected ‘Moderate’ vulnerabilities are assessed further, following Steps 3 and 4.

Table 13.4 - Vulnerability rating matrix

Sensitivity	Exposure		
	Low	**Medium**	**High**
Low	Low vulnerability	Low vulnerability	Low vulnerability
Moderate	Low vulnerability	Medium vulnerability	Medium vulnerability
High	Low vulnerability	Medium vulnerability	High vulnerability

Step 3: Risk assessment

13.3.12. Firstly, hazards related to the 'Medium' and 'High' vulnerabilities are identified. Typical hazards are shown in Table 13.5.

Table 13.5 - Typical hazards associated with climate variables

Climate variable	Associated hazards
Average air temperature change (annual, seasonal, monthly)	High temperatures, longer growing season
Extreme air temperature (frequency and magnitude)	Heatwaves
Average precipitation (annual, seasonal, monthly)	Flooding (fluvial, pluvial), ground stability, soil moisture deficit, snow, ice and hail
Extreme rainfall (frequency and magnitude)	Flooding, ground stability
Average wind speed change (annual, seasonal, monthly)	Wind loading
Gales and extreme winds (frequency and magnitude)	Storms (tracks and intensity), including storm surge
Humidity	Fog
Solar radiation	High temperatures, storms and lightning
Sea level	Coastal flooding

13.3.13. The risk assessment is undertaken by considering the consequence and the likelihood of climate hazards to the Proposed Scheme elements. These determinants are then combined to develop a climate risk rating for each element of the Proposed Scheme in respect to specific climate hazards. The risk assessment is a qualitative assessment based on expert judgment, engagement with the project team and a review of relevant literature. This process is supplemented with quantitative data and information where available.

Table 13.6 - Risk rating matrix

Likelihood of hazard occurring	Consequence of hazard occurring				
	Negligible	Minor adverse	Moderate adverse	Large adverse	Very large adverse
Very high	Low	Medium	High	Extreme	Extreme
High	Low	Medium	Medium	High	Extreme
Medium	Low	Low	Medium	High	Extreme
Low	Low	Low	Medium	Medium	High
Very low	Low	Low	Low	Medium	Medium

Step 4: Adaptation measures

13.3.14. In the final step, adaptation measures for the Extreme, High and Medium risks are identified through consultation with the project team and expert opinion. Taking account of the contribution of incorporated adaptation measures, a summary of the level of climate resilience of the Proposed Scheme elements to climate change is applied:

- High - a strong degree of climate resilience, remedial action or adaptation may be required but is not a priority.
- Moderate - a moderate degree of climate resilience, remedial action or adaptation is suggested.
- Low – a low level of climate resilience, remedial action or adaptation is required as a priority.

13.3.15. Recommendations for supplementary climate change adaptation measures are then identified where necessary.

VULNERABILITY ASSESSMENT

13.3.16. This section presents the findings of the assessment of steps 1 and 2 in order to determine if there are significant vulnerabilities to climate change which need to be further assessed (through steps 3 and 4) in the next stage of the EIA process.

STEP 1: IDENTIFY RECEPTORS AND POLICY CONTEXT

13.3.17. Receptors associated with the Proposed Scheme are as follows:

- Dual carriageway road
- Double lead bascule bridge and supporting structures (design life 120 years)
- Roundabout
- Single span bridge
- Embankments and earth walls

- ‘Knuckle’ walls in the waterway
- New junction
- Cycle and pedestrian provision
- Parking
- Signage

13.3.18. The policy context for this assessment is set out in Table13.7.

Table 13.7 - Policy context

Document	Summary
National Planning Policy Framework (NPPF)	The revised National Planning Policy Framework (NPPF) was published on 24 July 2018. The Climate Change Act (2008) strengthened the institutional framework in respect of planning policy and managing the impact of climate change. In line with the objectives and provisions of the Climate Change Act (2008), the NPPF states that local authorities should adopt proactive strategies to mitigate and adapt to climate change (paragraph 149)
UK Climate Change Act (2008)	The Climate Change Act (2008) created a new approach to managing and responding to climate change in the UK, by: • Setting ambitious, legally binding reduction targets. • Taking powers to help meet those targets. • Strengthening the institutional framework. • Enhancing the UK’s ability to adapt to the impacts of climate change. • Establishing clear and regular accountability to the UK Parliament and to the developed legislatures. Key provisions of the Act in respect of climate change adaptation includes a requirement for Government to report, at least every five years, on the risks to the UK of climate change, and to publish a programme setting out how these will be addressed. The Act also introduced powers for Government to require public bodies and statutory undertakers to carry out their own risk assessment and make plans to address those risks.
Amendment to the EIA Directive (2014/52)	The requirement to consider a project’s (or Proposed Scheme’s) vulnerability to climate change results from the 2014 amendment to the EIA Directive (2014/52). The Directive requires: “A description of the likely significant effects of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.”
Tomorrow’s Norfolk, Today’s Challenge – Summary of the County Climate Change Strategy	‘Tomorrow’s Norfolk, Today’s Challenge’ is the climate change strategy for Norfolk, produced and endorsed by the county’s eight local authorities. It is a key element of Norfolk’s Sustainable Communities Strategy. It recognises the need for climate change adaptation and states that an adaptation plan will be developed following a comprehensive risk assessment.

STEP 2: CLIMATE VULNERABILITY ASSESSMENT

Sensitivity

13.3.19. Based on relevant guidance[136], the climate variables which the Proposed Scheme elements are typically vulnerable to are shown in Table 13.8. Cells in white in the table indicate where the climate variable or climate-related hazard is not relevant to the Proposed Scheme elements; these climate variables and climate-related hazards have then been omitted from the forthcoming analyses.

[136] Standards Australia (2013) Climate Change Adaptation for settlements and infrastructure – a risk based approach. SAI Global Limited

Table 13.8 - Climate variables and climate related hazards: Transport

Proposed Scheme element	Variable																	
	Sea				Precipitation			Temperature			Wind		Relative humidity		Soils			
	Sea level rise	Storm surge and storm tide	Surface temperature	Currents and waves	Change in annual average	Drought	Extreme precipitation events (flooding)	Changes in annual average	Extreme temperature events	Solar radiation	Gales and extreme wind events	Storms (snow, lightning, hail)	Changes in annual average	Evaporation	Soil moisture	Salinity/pH	Runoff	Soil stability
Roads	■	■			■	■	■		■	■	■	■			■	■		■
Bridges	■	■				■			■	■	■	■						■
Pedestrian and cycle	■	■			■	■	■		■	■	■	■			■	■		■

13.3.20. **Sea** – transport infrastructure located near the coast or in estuarine locations is sensitive to changes in sea level and storm surges. An increase in sea level or increased storm surges could lead to coastal flooding which could cause damage to roads, bridges and associated structures (e.g. earthworks, control buildings and equipment). Coastal flooding could lead to temporary closure of roads and bridges as well as deterioration of materials.

13.3.21. **Precipitation** – roads and bridges are sensitive to high rainfall. An average increase in winter rainfall may cause roads and footways to become flooded due to flooding of local watercourses (fluvial flooding) or surface water flooding (pluvial flooding). Flooding may mean that roads and footways are impassable and cause loss of amenity. Flooding may also cause damage to paved surfaces (leading to increased maintenance requirements). Roads, bridges and footways are also sensitive to extreme rainfall events which, in addition to flooding, may also lead to destabilisation of soils and earthworks, potentially leading to temporary or permanent loss of amenity. Any electronic control equipment associated with the bridge will also be sensitive to flooding.

13.3.22. Roads and footways are also sensitive to low rainfall or drought. Prolonged dry periods may lead to drying out and cracking of earthworks and soils.

13.3.23. **Temperature** – roads, bridges and footways are sensitive to extreme temperatures. High temperatures may cause damage to paved surfaces, including potential melting and deformation. An increase in solar radiation can also cause more rapid deterioration of materials and associated infrastructure such as signage. Bridges are sensitive to high temperatures which affect thermal expansion joints and increase earth pressures.

13.3.24. **Wind** – bridges are sensitive to high winds which increase wind loading on the structure. High winds and storms can affect the stability of above-ground infrastructure and hasten material degradation. High winds can also cause wind-driven rain infiltration into building materials and surfaces which can increase maintenance costs and operational disruption. High winds also increase risk to bridge users (particularly high sided vehicles) and may lead to temporary closure. Road and footway users may also be sensitive to high winds. Associated infrastructure such as signage or signals could also be damaged by high winds.

13.3.25. Bridges are also sensitive to storms, particularly the risk of lightning strike. Electronic control equipment associated with bridges is likely to be highly sensitive to lightning strike.

13.3.26. **Soils** – roads, bridges and footways are all sensitive to soil stability. Soil stability can be reduced as a result of extreme rainfall or prolonged periods of rainfall which can lead to waterlogging, as well as extreme temperatures and drought which can causes soils to dry out and crack. Earthworks and embankments associated with roads, bridges and footways are particularly sensitive to changes in soil stability.

13.3.27. Water availability can cause a number of impacts to water quality and soils. For example, greater water volumes can increase the mobilisation of pollutants in soils whilst water scarcity can increase the accumulation of chemicals and pollutants which may cause increased salinity and acidification. Sea level rise could also lead to increasing soil salinity. More acidic soils and/or water will increase the deterioration of building materials.

13.3.28. Based on the information described above, literature review and expert opinion, Table 13.9 outlines the climate sensitivity of the Proposed Scheme.

Table 13.9 - Sensitivity rating

Climate variable		Scheme element		
		Road	Bridge	Cycle and footway
Sea	Sea level rise	Medium	Medium	Medium
	Storm surge and storm tide	High	High	Medium
Precipitation	Changes in annual average	Medium		Low
	Drought	Medium		Medium
	Extreme precipitation events	High	High	Medium

Climate variable		Scheme element		
		Road	Bridge	Cycle and footway
Temperature	Extreme temperature events	High	High	Medium
	Solar radiation	Medium	Low	Low
Wind	Gales and high winds	Medium	High	Low
	Storms	Low	High	Low
Soils	Soil moisture	Medium		Medium
	Soil salinity	Low		Low
	Soil stability	Medium	High	Medium

EXPOSURE

13.3.29. This section considers the exposure of the Proposed Scheme to current climate and climate change/changes in extreme weather.

Current climate

13.3.30. The Proposed Scheme is located in the East of England which has a warm, dry climate, compared to UK average. Information long term average observed climate variables over the period 1980 – 2010 is presented below. This information is taken from the UKCP09 report, The Climate of the United Kingdom and Observed Trends[137] and Met Office regional climate profile for Eastern England[138].

Temperature

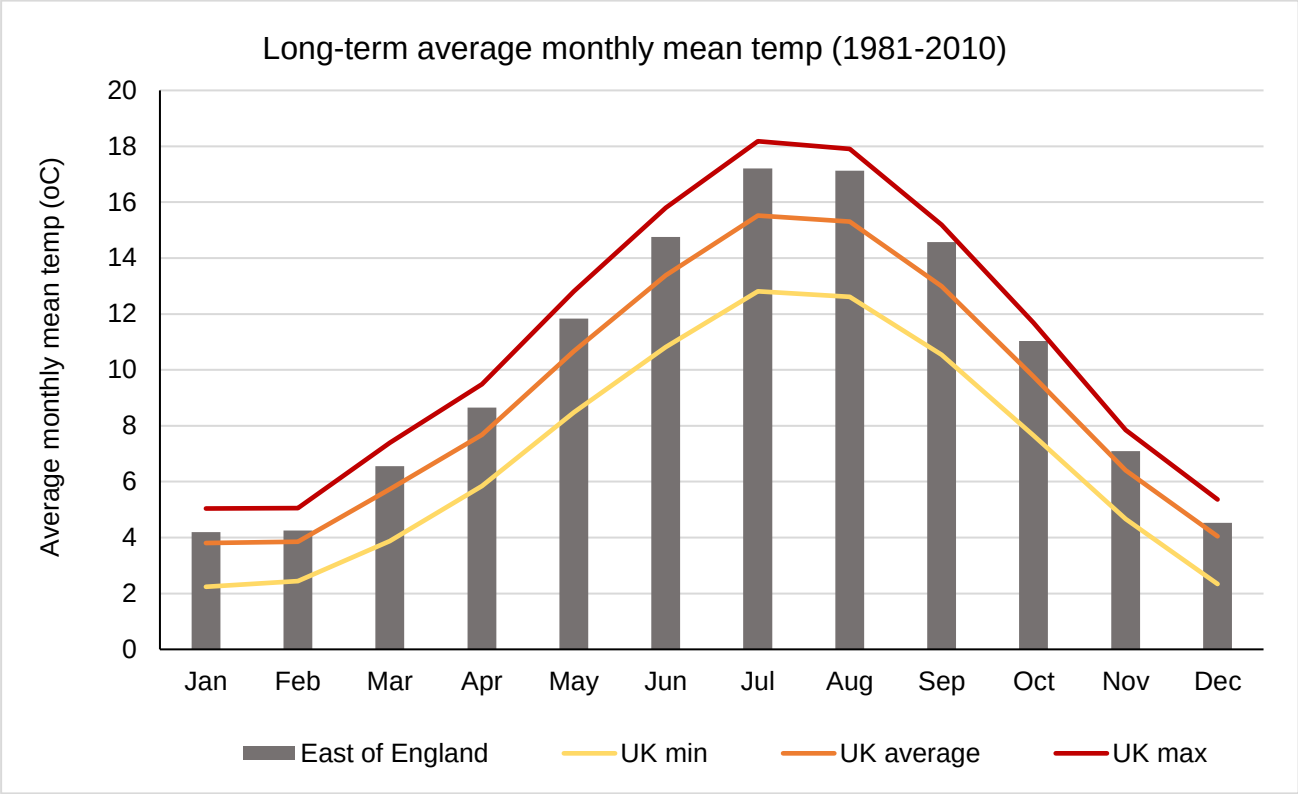
13.3.31. Figure 13.1 shows the long-term average mean monthly temperature for the East of England region between 1980 and 2010. The mean annual temperature over the region varies from around 9.5 °C to just over 10.5 °C[138].

13.3.32. Many of the UK maximum temperature records are held by stations in Eastern England. The highest known temperature recorded in the region was 37.3 °C at Cavendish on 10 August 2003[138].

13.3.33. Sea temperatures off the coast of eastern England vary from 5-6 °C in February and early March to 15-16 °C in August[139]. The temperature is governed by the influx of warm water associated with the Gulf Stream.

[137] Jenkins, G.J., Perry, M.C., and Prior, M.J. (2008). The climate of the United Kingdom and recent trends. Met Office Hadley Centre, Exeter, UK.
[138] Eastern England Climate, Met Office. https://www.metoffice.gov.uk/climate/uk/regional-climates/ee
[139] Eastern England Climate, Met Office. https://www.metoffice.gov.uk/climate/uk/regional-climates/ee

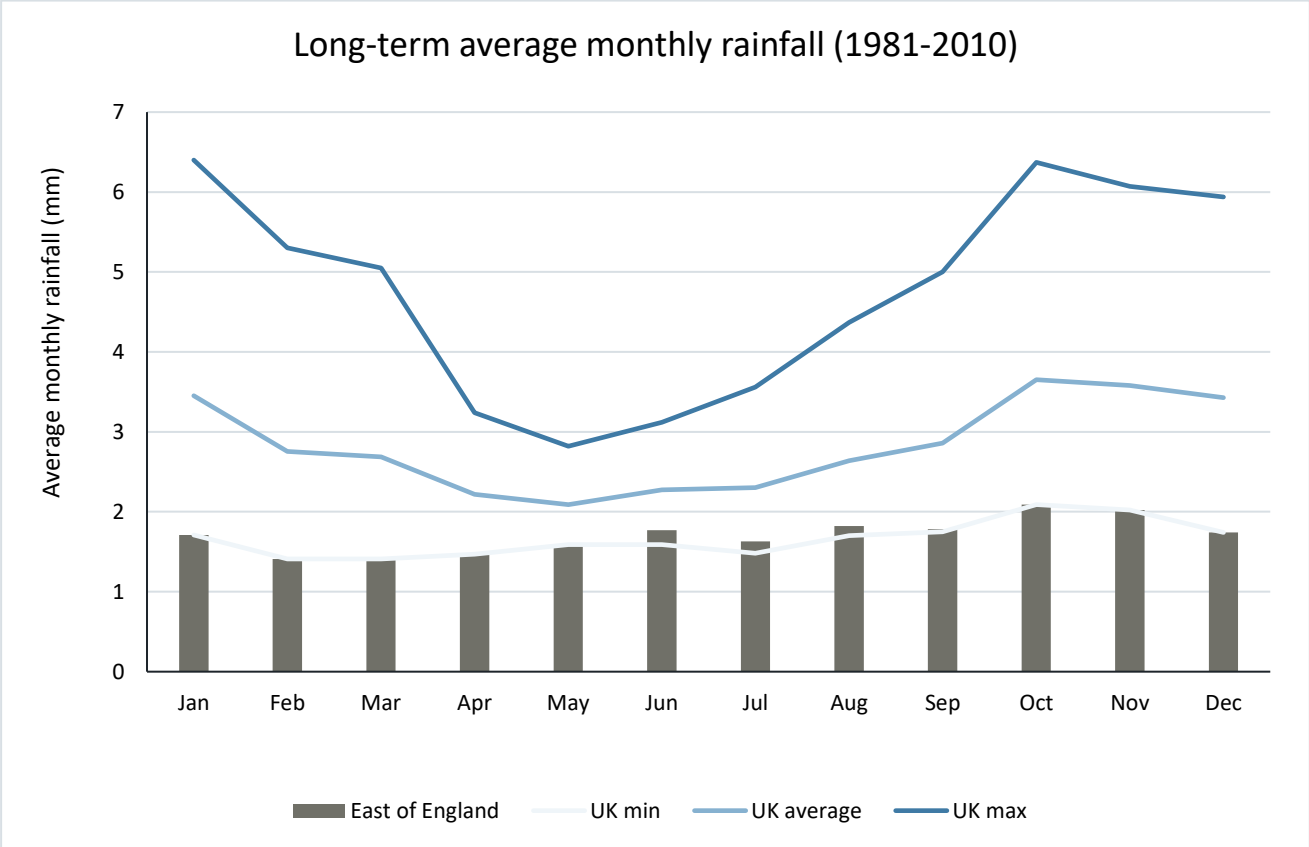
Figure 13.1 – Long term average mean monthly temperature



Precipitation

13.3.34. Figure 13.2 shows the long-term average monthly rainfall for the East of England region between 1981 and 2010. Across most of the region there are, on average, about 30 rain days (rainfall greater than 1 mm) in winter (December to February) and less than 25 days in summer (June to August) with the highest averages being at the higher altitude of the Lincolnshire Wolds.[139]

Figure 13.2 – Long term average mean monthly rainfall



13.3.35. Although rainfall is generally low in the East of England, there have been some noteworthy severe storms. These include[140]:

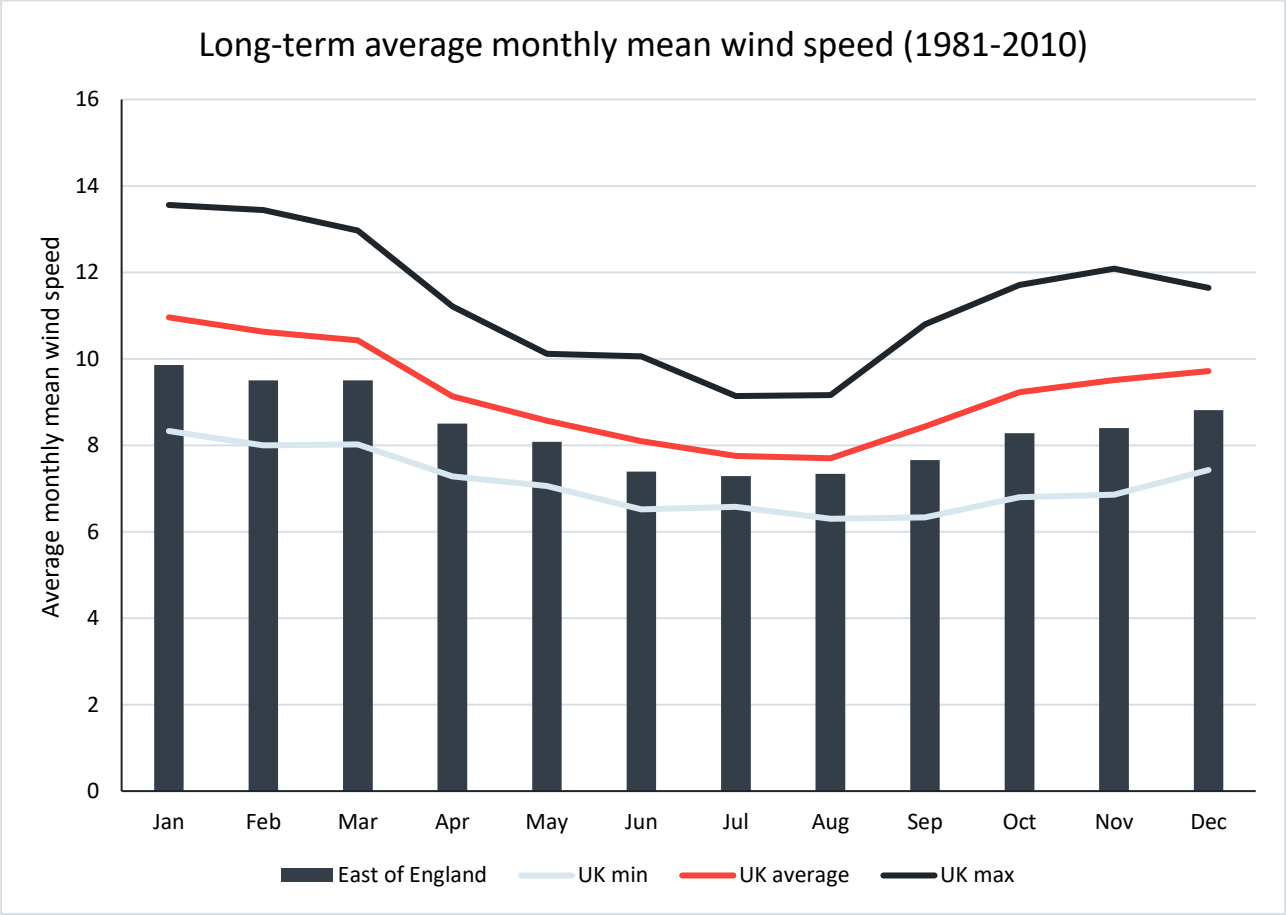
- 25 to 26 August 1912 - over 100 mm was recorded in Norfolk causing damage to roads and bridges
- 1 September 1994 - 147 mm was recorded in only a few hours at Ditchingham near Bungay in Suffolk, causing transport disruption and significant flooding

Wind

13.3.36. Figure 13.3 shows the long-term average monthly mean wind speed in the East of England region between 1981 and 2010. Eastern England is one of the more sheltered parts of the UK and the strongest winds are associated with the passage of deep depressions across or close to the UK[140].In coastal areas sea breezes are an important feature of the weather in late spring and summer when the land is warming up and the sea still relatively cool.[140]

[140] Eastern England Climate, Met Office. https://www.metoffice.gov.uk/climate/uk/regional-climates/ee

Figure 13.3 – Long term average monthly mean wind speed



13.3.37. A day of gale is defined as a day on which the wind speed attains a mean value of 34 knots or more over any period of 10 minutes.[140] Much of East Anglia and Lincolnshire has no more than 2 days of gale each year, but exposed coasts average about 5 gales each year. Two particularly noteworthy gale events have occurred in the region:[140]

- 2 January 1976 - a depression moved across Scotland to the North Sea causing storm force winds that particularly affected the north, east and Midland areas of England. Gusts exceeding 90 knots were reported in East Anglia and sea walls were breached at Walcott in Norfolk and Cleethorpes on Humberside causing extensive damage.

- The 'Great Storm' of 15-16 October 1987 caused widespread damage across south-east England. The strongest gust recorded in Eastern England was 87 knots at Shoeburyness (Landwick) in Essex.

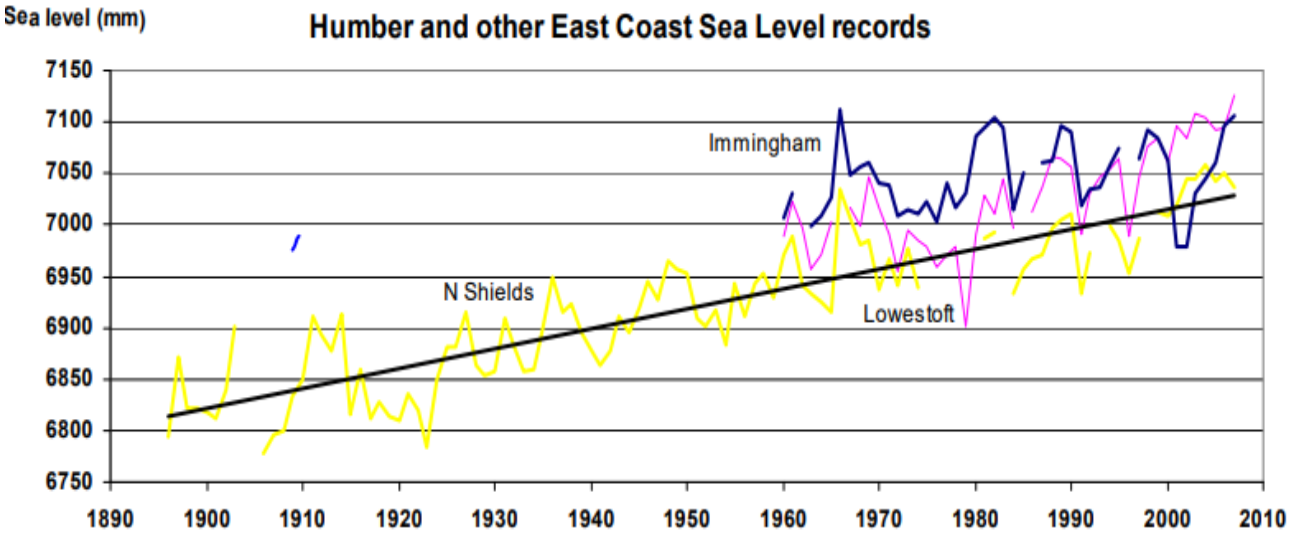
Sea level

13.3.38. Sea level change is controlled by two main factors: eustatic (changes related to the expansion and contraction of sea water plus changes in the volume of water stored on land as ice sheets/glaciers) and isostatic (changes related to movement of the land in responses to the effect of glaciers on the Earth's crust). Recent and future sea level change in the region is dominated by the eustatic component resulting from global warming. Local changes (i.e. in geomorphology), modify these broader changes and can have a significant effect on the actual sea level rise experienced along the region's coastline.

13.3.39. Sea level around the UK rose by about 1mm/yr in the 20th century, corrected for land movement[141]. At Lowestoft (the nearest tide gauge site to the Proposed Scheme), mean sea level increased by 2.01 (+/- 0.42) mm per year over the period 1960-1996[142].

13.3.40. Figure 13.4 shows sea level records on the east coast. Lowestoft is the nearest recording station to the Proposed Scheme.

Figure 13.4 – East coast sea level records



Projected climate

13.3.41. Information on projected climate is taken from the UK Climate Projections 2009. The UK Climate Projections 2009 (UKCP09) are the most up-to-date projections of climate change for the UK. Probabilistic projections of a range of climate variables are presented for different emissions scenarios[143] and for a range of timeslices[144] to the end of the 21st Century. The projections are provided at a resolution of 25 km over land, and as averages for administrative and river basin regions.

Precipitation

13.3.42. Climate change is projected to lead to wetter winters and drier summers, with more extreme rainfall events. UKCP09 suggests that by the 2050s in the East of England region, mean winter precipitation is expected to increase by 16% (50th percentile) and by the 2080s, increase by 26% (50th percentile) under the High emissions scenario. For the summer, by the 2050s, mean summer precipitation is expected to decrease by 18% (50th percentile) and by the 2080s, decrease by 27% (50th percentile), under the High emissions scenario. Table 13.10 summarises changes in mean winter and summer precipitation in the East of England region for the 2050s and 2080s under the Low, Medium and High emissions scenarios.

[141] Jenkins, G.J., Perry, M.C., and Prior, M.J. (2008). The climate of the United Kingdom and recent trends. Met Office Hadley Centre, Exeter, UK.
[142] Review of UK climate indicators, Defra. http://www.ecn.ac.uk/iccuk/indicators/9.htm
[143] UKCP09 shows data for 3 possible emissions scenarios: low, medium and high. These are the Intergovernmental Panel on Climate Change (IPCC) scenarios B1, A1B and A1FI respectively. More information on the nature of these emissions scenarios can be found in the IPCC's SRES report.
[144] UKCP09 projections are given for seven overlapping 30-year time periods. Each period steps forward by a decade, with the first time period being 2010-2039. For simplicity, these time periods are referred to by the middle decade, starting with the 2020s (2010-2039) and ending with the 2080s (2070-2099).

Table 13.10 - Projected change in mean summer and winter precipitation (mm) for the 2050s and 2080s under Low, Medium and High emissions scenario

Period		Emissions scenario								
		Low			Medium			High		
		10th	50th	90th	10th	50th	90th	10th	50th	90th
Summer	2050s	-34	-13	+14	-38	-17	+6	-40	-18	+8
	2080s	-36	-14	+11	-45	-21	+6	-53	-27	+4
Winter	2050s	+1	+12	+26	+3	+14	+31	+3	+16	+35
	2080s	+4	+16	+34	+4	+20	+44	+7	+26	+57

13.3.43. In addition to changes in seasonal average precipitation, it is likely that there will be more extreme rainfall events. By the 2050s, projections for the wettest day in summer for the East of England region suggest a decrease of up to 10% under both the low and high emissions scenario (central estimate). By the 2080s, projections for the wettest day in summer suggest decrease of between 10 and 20%, depending on emissions scenario (central estimate).

13.3.44. Snowfall is closely linked with temperature, with falls rarely occurring if the temperature is higher than 4 °C. For snow to lie for any length of time, the temperature normally has to be lower than this. With regards to future changes, rising winter temperatures are likely to reduce the amount of precipitation that falls as snow in winter. UKCP09 projects a reduction of mean snowfall, the number of days when snow falls and heavy snow events by the end of the 21st century. UKCP09 does not provide projections for the nearer-term for snow.

Temperature

13.3.45. Climate change is projected to lead to hotter summers and warmer winters. UKCP09 suggests that by the 2050s, mean winter temperature in the East of England region is expected to increase by 2.5ºC (50th percentile) and by the 2080s, increase by 3.7 ºC (50th percentile), under the High emissions scenario. For the summer, by the 2050s, mean summer temperature is expected to increase by 2.9 ºC (50th percentile) and by the 2080s, increase by 4.5 ºC (50th percentile), under the High emissions scenario. Table 13.11 summarises changes in mean winter and summer precipitation for the 2020s, 2050s and 2080s under the Low, Medium and High emission scenarios.

Table 13.11 - Projected change in mean summer and winter temperature (°C) for the 2050s and 2080s under Low, Medium and High emissions scenario

Period		Emissions scenario								
		Low			Medium			High		
		10th	50th	90th	10th	50th	90th	10th	50th	90th
Summer	2050s	1.0	2.4	4.0	1.2	2.5	4.3	1.3	2.9	4.8
	2080s	1.3	2.7	4.7	1.9	3.6	5.9	2.4	4.5	7.5
Winter	2050s	0.9	2.0	3.1	1.1	2.2	3.4	1.4	2.5	3.8
	2080s	1.4	2.6	4.0	1.6	3.0	4.7	2.0	3.7	5.7

13.3.46. In addition to changes in seasonal average temperatures, it is likely that there will be more extreme temperature events. By the 2050s, projections for daily maximum summer temperature for the East of England region suggest increases of between 2 and 4ºC, depending on emissions scenario (central estimate). By the 2080s, projections for daily maximum summer temperature suggest increases of between 3 and 6ºC, depending on emissions scenario (central estimate).

13.3.47. With regard to heat waves, research published by the Met Office Hadley Centre suggests the European summer heat wave in 2003 could become a normal event by the 2040s. By the 2060s, such a summer would be considered cool according to some climate models (Ref. 1.20). It is very likely (confidence level >90%) that human influence has at least doubled the risk of a heatwave exceeding mean summer temperatures experienced in 2003.[145]

Solar radiation

13.3.48. A recent (regional) study suggests that the England South region (including the UKCP09 East of England administrative region), is likely to see an increase in annual solar radiation by the 2050s of 5.6Wm-2 (Low), 5.3Wm-2 (Medium) or 6.2Wm-2 (High) under the central (50th percentile) estimate. By the 2080s, increases of 6.2 Wm-2 (Low), 6.8 Wm-2 (Medium) or 8.0 Wm-2 (High) under the central (50th percentile) estimate are projected[145]. All regions of the UK are likely to have increased cloud cover (although there is large uncertainty around future projections of cloud cover) and therefore slightly less solar radiation during the winter.

Wind

13.3.49. The UKCP09 projections depict a wide spread of future changes in mean surface wind speed, however, there is large uncertainty in projected changes in circulation over the UK and natural climate variability contributes much of this uncertainty[146]. It is therefore difficult to represent regional wind extreme winds and gusts within regional climate models[147].

13.3.50. Central estimates of change in mean wind speed for the 2050s are small in all ensemble runs (<0.2ms-1). A wind speed of 0.2 ms−1 (~0.4 knots) is small compared with the typical magnitude of summer mean wind speed of about 3.6–5.1 ms-1 (7–10 knots) over much of England[148]. Seasonal changes at individual locations across the UK lie within the range of –15% to +10%. Results suggest that there could be a future reduction in the summer westerly wind flows over the southern half of the UK. There may be an increase in westerly flows in the north during summer and also an increase in southerly flows over the UK in winter.

Relative humidity

13.3.51. Relative Humidity is the most common measure of humidity. It measures how close the air is to being saturated. By the 2050s, projections for winter mean relative humidity in the East of England region suggest a decrease of up to 5% under the high emissions scenario (central estimate). By the 2080s, winter mean relative humidity could increase by up to 5% (high emissions scenario, central estimate. The projection for summer mean humidity in the 2050s under the high emissions scenario is a decrease of up to 5% (central estimate). By the 2080s the decrease could be as much as 10% (high emissions scenario, central estimate).

Extreme climate change scenarios

13.3.52. A range of 'extreme' climate change scenarios (produced by Wade et al., 2015 have also been reviewed. Wade et al., (2015) considered a range of climate variables including heatwaves, cold snaps, low and high rainfall, droughts, floods and windstorms. The H++ scenarios represent the margins or beyond the 10th to 90th percentile

[145] Burnett, D., Barbour, E. and Harrison, G.P. (2014) The UK solar energy resource and the impact of climate change. Renewable Energy, 71, 333-343.

[146] Brown, S., Boorman, P., McDonald, R., and Murphy. J. (2012) Interpretation for use of surface wind speed projections from the 11-member Met Office Regional Climate Model ensemble. Post-launch technical documentation for UKCP09. Met Office Hadley Centre, Exeter, UK. Crown copyright.

[147] Brown, S., Boorman, P., Buonomo, E., Burke, E., Caesar, J., Clark, R., McDonald, R. and Perry, M. (2008) A climatology of extremes for the UK: A baseline for UKCP09. Met Office Hadley Centre, Exeter

[148] Jenkins, G. J., Perry, M. C. and Prior, M. J. (2008) The Climate of the United Kingdom and Recent Trends, Met Office Hadley Centre, Exeter, UK. Crown copyright.

range of the 2080s UKCP09 High emissions scenario as presented in the UKCP09 projections and reported here. These scenarios provide a high-impact, low-likelihood event to compare against more likely outcomes.

13.3.53. The H++ scenarios suggest that average summer maximum temperatures will exceed 30°C across most of the UK, with temperatures of the hottest days are also likely to exceed 40°C[149]. The H++ scenarios for heavy daily and sub-daily rainfall suggest that, for the same period, there is a 60% to 80% increase in rainfall for summer or winter events based on a consideration of new high-resolution modelling and physical processes. This is within the UKCP09 distribution range for the 2080s High emissions "wettest day of the winter" variable but higher than uplifts previously considered for summer.

Sea level

13.3.54. With regard to future changes in sea level, the UKCP09 projections provide predictions for four cities across the UK of which London is the most applicable here. Table 13.12 presents future projections of sea level (with respect to 1990 levels) to the end of the century.

Table 13.12 - Sea level rise projections (in cm) for London (relative to 1990 levels)

Year	Scenario		
	Low	Medium	High
2050	25.8	21.8	18.4
2060	31.4	26.3	22.2
2070	37.2	31.2	26.3
2080	43.3	36.3	30.5
2090	49.7	41.6	35
2095	53.1	44.4	37.3
2050	25.8	21.8	18.4
2060	31.4	26.3	22.2
2070	37.2	31.2	26.3

EXPOSURE RATING

13.3.55. Based on the climate change projections for the East of England region, Table 13.13 indicates the level of exposure of the Proposed Scheme to changes in climate variables.

[149] Wade, S., Sanderson, M., Golding, N., Lowe, J., Betts, R., Reynard, N., Kay, A., Stewart, L., Prudhomme, C., Shaffrey, L., Lloyd-Hughes, B., Harvey, B. (2015). Developing H++ climate change scenarios for heat waves, droughts, floods, windstorms and cold snaps. Met Office Hadley Centre, Exeter, UK. Crown copyright

Table 13.13 – Exposure assessment

Climate variable		Scheme element		
		Road	Bridge	Cycle and footway
Sea	Sea level rise	High		
	Storm surge and storm tide	High		
Precipitation	Changes in annual average	Medium		
	Drought	High		
	Extreme precipitation events	High		
Temperature	Extreme temperature events	High		
	Solar radiation	Medium		
Wind	Gales and high winds	Medium		
	Storms	Medium		
Soils	Soil moisture	High		
	Soil salinity	High		
	Soil stability	High		

VULNERABILITY RATING

13.3.56. The sensitivity and exposure analyses are combined to provide an overall assessment of vulnerability of the Proposed Scheme. Table 13.14, Table 13.15 and Table 13.16 present the overall assessment of vulnerability for the road, bridge and cycle and footway elements of the Proposed Scheme respectively.

Table 13.14 – Vulnerability rating assessment for road elements of the Proposed Scheme

Climate variable		Sensitivity	Exposure	Vulnerability
Sea	Sea level rise	Medium	High	**Medium**
	Storm surge	High	High	**High**
Precipitation	Changes in annual average	Medium	Medium	**Medium**
	Drought	Medium	High	**Medium**
	Extreme events	High	High	**High**
Temperature	Extreme temperature events	High	High	**High**
	Solar radiation	Medium	Medium	**Medium**
Wind	Gales and high winds	Medium	Medium	**Medium**
	Storms	Low	Medium	**Low**
Soils	Soil moisture	Medium	High	**Medium**
	Soil salinity	Low	High	**Low**
	Soil stability	Medium	High	**Medium**

Table 13.15 - Vulnerability rating assessment for bridge elements of the Proposed Scheme

Climate variable		Sensitivity	Exposure	Vulnerability
Sea	Sea level rise	Medium	High	**Medium**
	Storm surge	High	High	**High**
Precipitation	Extreme events	High	High	**High**
Temperature	Extreme temperature events	High	High	**High**
	Solar radiation	Low	Medium	**Low**
Wind	Gales and high winds	High	Medium	**Medium**
	Storms	High	Medium	**Medium**
Soils	Soil stability	High	High	**High**

Table 13.16 - Vulnerability rating assessment for cycle and footway elements of the Proposed Scheme

Climate variable		Sensitivity	Exposure	Vulnerability
Sea	Sea level rise	Medium	High	**Medium**
	Storm surge	Medium	High	**Medium**
Precipitation	Changes in annual average	Low	Medium	**Low**
	Drought	Medium	High	**Medium**
	Extreme events	Medium	High	**Medium**
Temperature	Extreme temperature events	Medium	High	**Medium**
	Solar radiation	Low	Medium	**Low**
Wind	Gales and high winds	Low	Medium	**Low**
	Storms	Low	Medium	**Low**
Soils	Soil moisture	Medium	High	**Medium**
	Soil salinity	Low	High	**Low**
	Soil stability	Medium	High	**Medium**

CONCLUSION

13.3.57. Based on the assessment provided above, the following variables with High and Medium Vulnerability ratings have been identified. Note, those with an asterisk indicate vulnerabilities common across all Proposed Scheme elements.

Table 13.17: High and Medium Climate Vulnerability ratings identified

Roads	
Sea	Sea level rise* Storm surge and storm tide*
Precipitation	Changes in annual average precipitation Drought Extreme precipitation events (including flooding)*
Temperature	Extreme temperature events* Solar radiation
Wind	Gales and high wind
Soils	Soil moisture Soil stability*
Bridges	
Sea	Sea level rise* Storm surge and storm tide*
Precipitation	Extreme precipitation events (including flooding)*
Temperature	Extreme temperature events*
Wind	Gales and extreme wind events Storms (lightning, hail)
Soils	Soil moisture Soil stability*
Cycle and footways	
Sea	Sea level rise* Storm surge and storm tide*
Precipitation	Drought Extreme precipitation events (including flooding)*
Temperature	Extreme temperature events*
Soils	Soil moisture Soil stability*

ASSESSMENTS STILL TO BE COMPLETED

13.3.58. The risks associated with the High and Medium vulnerabilities identified and required adaptation measures will be further assessed in the ES, following the methodology set out in paragraphs 13.3.12 to 13.3.15.

14

PEOPLE AND COMMUNITIES

14 PEOPLE AND COMMUNITIES

14.1 INTRODUCTION

14.1.1. This chapter provides preliminary information with regard to People and Communities as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. In particular, it considers the generation of direct, indirect and induced employment opportunities and increases in economic activity, increase in demand for accommodation, local services (including education and healthcare) and recreational / open space due to an influx of construction workers, land-take, severance and disruption to terrestrial and marine businesses and associated activities, change to access and amenity value of public routes and resources both on-site and off-site, land-take from public land and private holdings as well as change in driver stress and delay.

14.1.2. The Chapter also identifies, where appropriate, proposed mitigation measures to prevent, minimise or control likely adverse effects arising from the Proposed Scheme and the subsequent anticipated residual effects.

STUDY AREA

Generation of direct, indirect and induced employment opportunities

14.1.3. As the Proposed Scheme is located within Great Yarmouth, the 'local level' comprises Great Yarmouth Borough as noted in the EIA Scoping Report[5].

14.1.4. Given the scale of the Proposed Scheme, strong transport connections, economic linkages and travel to work patterns, the employment effects of the Proposed Scheme are considered to extend beyond Great Yarmouth. Based on the travel to work information identified in the Census 2011, a larger number of workers travel throughout Norfolk. As such, the 'regional level' has been set as Norfolk as a whole.

14.1.5. Statistics for East of England region / England / Great Britain / UK have been provided within the baseline for context, but are not utilised within the Chapter.

Increase in demand for accommodation, local services (including education and healthcare) and recreational / open space due to an influx of construction workers

14.1.6. The construction contracts for the Proposed Scheme have not been confirmed, meaning a proportion of the construction workers could be from beyond the local (Great Yarmouth Borough) and regional (East of England) areas and need to relocate to an area local to the Proposed Scheme for the duration of the construction phase. At this stage, it is not known where the construction workers moving to the area will be living; however, for the purposes of the assessment, it is assumed that they will be based within Great Yarmouth Borough. Therefore, the study area is the administrative area within Great Yarmouth Borough Council.

Land-take, severance and disruption to terrestrial and marine businesses and associated activities

14.1.7. The study area used for effects in relation to terrestrial and marine businesses will focus on the River Yare and Great Yarmouth port; the extent of the study area will be confirmed following discussions with relevant stakeholders and completion of the traffic modelling.

Change to access and amenity value of public routes and recreational resources both on-site and off-site

14.1.8. The study area that will be used for the assessment will include all public routes that are potentially affected by the Proposed Scheme. An initial study area of 2km around the Application Site has been used to identify key community receptors and the routes between them / residential areas; however, the focus is likely to be on those within 500m of the Application Site (given the potential for these to be significantly affected). The study area for the recreational resources will be confirmed following the completion of the traffic modelling and the hydromorphological analysis.

Land-take from public and private land holdings

14.1.9. The study area that will be used for the assessment includes the land within and immediately adjacent to the Application Site; however, consideration is given to the wider housing market and existing demand across the Great Yarmouth Borough.

Change in Driver Stress and Delay

14.1.10. The study area that will be used for the assessment will include all roads where a significant change in traffic is anticipated (e.g. greater than 10%) change. As such, the study area will include all the links in the SATURN traffic modelling (see Figure 17.1).

LIMITATIONS

14.1.11. The assessment reported within this Chapter is based on the information available at the time of writing. Therefore, the assessment has not taken consideration of:

- Construction information including construction contracts and Traffic Management systems;
- Vessel simulation model;
- Navigational Risk Assessment;
- Transport model and hydromorphological assessment;
- Traffic data;
- Economic Impact Assessment;
- Pedestrian and cyclist survey count data; and
- Walkers, Cyclists Horse-riding Assessment Report.

14.1.12. Where information is not available, the assessment has identified whether the Proposed Scheme is likely to have an ‘adverse’ or ‘beneficial’ effect. However, these should be treated as preliminary results as a more detailed assessment will be undertaken as part of the Environmental Impact Assessment.

14.1.13. The assessment is based on the use of secondary data that is publicly available. As such, there are limitations associated with the secondary data applied in each case.

14.2 DIRECTIVES, STATUTES AND RELEVANT POLICES

LEGISLATION

The Countryside and Rights of Way Act 2000

14.2.1. The Countryside and Rights of Way Act 2000[150] regulates Public Rights of Way and access to them. It requires local highway authorities to publish a 'rights of way improvement plan', which should be reviewed every 10 years. The Act also obliges the highway authority to recognise the needs of the mobility impaired when undertaking improvements.

[150] Countryside and Rights of Way Act 2000

Highways Act 1980

14.2.2. Footpaths, footways, bridleways and carriageways are all 'highways' and thus regulated under the Highways Act. The Act covers the following of relevance to people and communities:

- The creation of highways.
- Maintenance of publicly maintainable highways and maintenance of privately maintainable footpaths and bridleways.
- Stopping up and diversion of footpaths and bridleways.
- Protection of public rights and damage, obstruction to highways. For example, maintenance and erection of stiles and cutting or felling of foliage overhanging footpaths / bridleways.

Road Traffic Regulation Act 1984

14.2.3. Confers broad powers on Traffic Authorities to prohibit or restrict traffic (including pedestrians) on highways and other roads to which the public has access.

PLANNING POLICY

National Networks National Policy Statement

14.2.4. The Government's vision and strategic objectives for national networks includes '*supporting a prosperous and competitive economy and improving overall quality of life'* and specifically:

- Networks with the capacity and connectivity to support national, regional and local economic activity and facilitate growth whilst creating jobs; and
- Networks which sustain cohesion and decreases severance of communities and effectively providing linkages to each other.

14.2.5. Paragraph 2.27 of the NPS NN states that "*in some cases….it will not be sufficient to simply expand capacity on the existing network. In those circumstances new road alignments and corresponding links, including alignments which cross a river or estuary, may be needed to support increased capacity and connectivity*."

14.2.6. Paragraph 3.3 requires that in delivering new schemes, "*reasonable opportunities to deliver environmental and social benefits as part of the schemes*" should be considered and that environmental and social impacts should be mitigated in line with the principles set out in the National Planning Policy Framework (NPPF) and the Government's planning guidance.

14.2.7. It also states that "*Applicants should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the Application Site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan*".

National Policy Statement for Ports

14.2.8. The NPS for Ports provides a framework for decisions on proposals for new port development to provide port capacity, as well as associated road and rail links for which consent is sought alongside the principal development.

14.2.9. Paragraph 3.3.5 of the NPS for Ports states that the Government sees port development as an engine for economic growth that supports sustainable transport and supports sustainable development.

National Planning Policy Framework[56]

14.2.10. Within the revised NPPF, there is an overarching presumption in favour of sustainable development, so that "*sustainable development is pursued in a positive way*".. The NPPF notes in paragraph 8 that there are three dimensions to sustainable development; economic, social and environmental. Planning's role is to contribute to building a strong, responsive and competitive economy and by identifying and coordinating development requirements, including the provision of infrastructure.

14.2.11. Section 9 of the NPPF sets out how transport should be considered within the context of planning decisions and sustainable development..

14.2.12. The NPPF also encourages development that exploits opportunities for sustainable transport. Particularly by giving priority "*first to pedestrian and cycle movements, both within the scheme and with neighbouring areas; and second – so far as possible – to facilitating access to high quality public transport, with layouts that maximise the catchment area for bus or other public transport services, and appropriate facilities that encourage public transport use*" (paragraph 110).

14.2.13. Paragraph 80 states "*Significant weight should be placed on the need to support economic growth and productivity, taking into account both local business needs and wider opportunities for development".*

14.2.14. Paragraph 81 states that planning policies should *"set out a clear economic vision and strategy which positively and proactively encourages sustainable economic growth, having regard to Local Industrial Strategies and other local policies for economic development and regeneration".*

14.2.15. Paragraph 102 states that transport issues should be considered from the earliest stages of development proposals, so that (amongst other things) '*the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains*;

Great Yarmouth Local Plan: Core Strategy (2013-2030)

14.2.16. The following policies within the Great Yarmouth Local Plan: Core Strategy[75] are of relevance to people and communities:

- Policy CS3 Addressing the Borough's Housing Need: To ensure that new residential development in the borough meets the housing needs of local people, the Council and its partners will seek to make provision for at least 7,140 new homes over the plan period (2013-2030). The Council also encourages the effective use of the existing housing stock.

- Policy CS4 Delivering Affordable Housing: To ensure that an appropriate amount and mix of affordable housing is delivered throughout the borough, the Council and its partners will seek to maximise the provision of additional affordable housing within the overall provision of new residential developments. The Council will also ensure that affordable housing is provided either 'on-site' or via an 'off-site' financial contribution, in exceptional circumstances.

- Policy CS6 Supporting the Local Economy: To ensure that the conditions are right for new and existing businesses to thrive and grow, there is a need to continue to strengthen the local economy and make it less seasonally dependent.

- Policy CS15 Providing and Protecting Community Assets and Green Infrastructure: The Council will resist the loss of important community facilities and/or green assets unless appropriate alternative provision of equivalent or better-quality facilities is made in a location accessible to current and potential users or a detailed assessment clearly demonstrates there is no longer a need for the provision of the facility in the area. Ensure that all new developments contribute to the provision of recreational green space and incorporate improvements to the quality of, and access to, existing green infrastructure in accordance with local circumstances. The Council will also safeguard the natural beauty, openness and recreational value of the borough's beaches and coastal hinterland.

- Policy CS16 Improving Accessibility and Transport: The Council and its partners will work together to make the best use of, and improve, existing transport infrastructure within and connecting to the Borough.

GUIDANCE

14.2.17. In August 2012, Highways England produced the 'People and Communities Clarification Note'[151], which recommends combining the Interim Advice Note (IAN) assessments of 'Community and Private Assets' and 'Effects on all Travellers' into a single topic entitled 'People and Communities'. This Clarification Note will be adhered to within this assessment, and has therefore been considered within this Chapter of the PEIR.

14.2.18. The scope adopted for this assessment is also based on relevant parts of existing DMRB guidance (Volume 11, Section 3):

- Part 6: Land Use[152];
- Part 8: Pedestrians, Equestrians, Cyclists and Community Effects[153]; and
- Part 9: Vehicle Travellers[154].

14.2.19. In addition, guidance document IAN 195/16 'Cycle Traffic and the Strategic Road Network'[155]. has been used to inform this assessment

14.3 ASSESSMENT METHODOLOGY

OVERVIEW

14.3.1. The assessment methodology adopted is based on the principles set out in within DMRB guidance:

- Volume 11, Section 3, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects[153];
- Volume 11, Section 3, Part 6 Land Use[152];
- Volume 11, Section 3, Part 9 Vehicle Travellers[154]; and
- Interim Advice Note 125/09 Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment[156].'

COLLECTION OF BASELINE DATA

14.3.2. A desktop study has been undertaken to gather all the relevant information. The following data sources have been consulted to inform the baseline conditions reported within this Chapter:

- MAGIC Interactive Map[107];
- Office of National Statistics (ONS) Census 2011[157];

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[151] Interim Advice Note 125/15 Supplementary guidance for users of Design Manual for Roads and Bridges Volume 11 'Environmental Assessment', Highways England, October 2015
[152] Design Manual for Roads and Bridges Volume 11, Section 3, Part 6 (Land Use), former Highways Agency, August 2001
[153] Design Manual for Roads and Bridges Volume 11, Section 3, Part 8 (Pedestrians, Cyclists, Equestrians and Community Effects), former Highways Agency, June 1993.
[154] Design Manual for Roads and Bridges Volume 11, Section 3, Part 9 (Vehicle Travellers), former Highways Agency, June 1993.
[155] Highways England (2016) Interim Advice Note 195/16: 'Cycle Traffic and the Strategic Road Network'
[156] Highways England (2009) Interim Advice Note 125 /09: Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment'
[157] https://www.ons.gov.uk/

- ONS Labour Market Statistics Report (NOMIS)[158];
- Office of National Statistics English Indices of Multiple Deprivation (2015)[159];
- Great Yarmouth Borough Council Local Plan: Core Strategy (2013-2030)[75];
- Great Yarmouth Borough Council Local Plan Policies Map (2015)[160];
- Great Yarmouth Open Space Study (2013)[161]; and
- Webtris (Highways England's online traffic database)[162].

14.3.3. No site visits have been undertaken at this stage; however, a site visit will be undertaken to inform the Environmental Statement (ES).

ASSESSMENT METHODOLOGY

Generation of direct, indirect and induced employment opportunities

14.3.4. The key assumptions used during the assessment of effects related to employment are as follows:

- For the purposes of this assessment, it is assumed that there is no employment on-site at present;
- For the purposes of this assessment, it is assumed that one job is equal to one Full-Time Equivalent (FTE); and
- For the purposes of the assessment, the evaluation for the local and regional levels is not mutually exclusive i.e. the number of FTE / jobs is considered in relation to the total employees at both the local and regional levels.

Construction Phase

14.3.5. Generation of direct, indirect, and induced employment opportunities during construction of the Proposed Scheme will be assessed, including consideration of existing on-site employment displacement.

14.3.6. Calculations relating to employment generation will be undertaken using Excel-based analysis. All the modelling data sources used will be publicly available. Employment generation during the construction phase will be based on the construction duration and cost as shown in Table 14.1. The number of Full Time Equivalents (FTE) / jobs will be estimated by applying an average gross output per construction industry employee to the estimated total construction cost to determine gross and net construction employment generation per annum.

Table 14.1: Direct FTE / job calculation factors during the construction stage

Factor	Description
Anticipated total construction cost	£60,000,000
Construction period	2 years and 4 months

[158] Office of National Statistics. Available at https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/previousReleases
[159] https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015
[160] Great Yarmouth Borough Council 2015. Local Plan Policies Map. Available at https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1583&p=0 . Last accessed June 2018
[161] Great Yarmouth Borough Council 2013. Open Space Study.
[162] http://webtris.highwaysengland.co.uk/

14.3.7. Leakage rates will be applied to the construction employment calculations. Leakage effects are the benefits to those outside the effect area.

14.3.8. A multiplier will be applied in relation to the generation of indirect and induced employment opportunities. Multiplier effects describe the economic activity (jobs, expenditure or income) associated with additional local income and local supplier purchases. A multiplier of 1.5 will be applied on the basis that there are supply linkages associated with the Proposed Scheme, based on its location within Great Yarmouth.

Operational Phase

14.3.9. Once operational, the Proposed Scheme is anticipated to lead to an increase in economic activity due to greater connectivity afforded by the Proposed Scheme. The assessment will consider the potential effects on enhanced access for local businesses and industrial estates (e.g. Harfrey's Industrial Estate) and reduction in journey times / delay.

14.3.10. An economic appraisal was undertaken for the Proposed Scheme at Outline Business Case. The economic appraisal estimates that the Proposed Scheme would save £122,632 for business users and providers (£23,762 for business car journeys and £98,870 for freight journeys). The cost savings will be due to improved journey times and the associated cost of operating business vehicles. This information will be further refined and developed through the Economic Impact Report, which will be used to inform the assessment within the ES but is not available at the time of writing.

<u>Increase in demand for accommodation, local services (education and healthcare) and recreational / open space due to an influx of construction workers</u>

14.3.11. The construction contracts for the Proposed Scheme have not been confirmed, meaning a proportion of the construction workers could be from beyond Great Yarmouth and relocate to an area local to the Proposed Scheme for the duration of the construction phase. This could increase demand on accommodation, local services (e.g. education and healthcare facilities) and recreational / open space.

14.3.12. A qualitative assessment of effects relating to increase in accommodation, local services and recreational / open space induced by the newly created jobs will be undertaken by evaluating the likely number of additional individuals coming to live in the study area. It is anticipated that the Proposed Scheme would generate 18 gross direct jobs outside of Great Yarmouth (see Table 14.14). The influx of these construction workers will be used to estimate the magnitude of change on accommodation, local services and recreational / open space in context of existing demand within Great Yarmouth.

<u>Land-take, severance and disruption to terrestrial and marine businesses and associated activities</u>

14.3.13. During the construction of the Proposed Scheme, there is anticipated to be land-take from existing business premises. In addition, it is anticipated that during the construction phase, the roads within and in the vicinity of the Proposed Scheme Boundary will be subject to temporary closure and / or diversion to facilitate the Proposed Scheme. This may cause severance and / or disruption of accesses to these businesses. However, the Traffic Management systems that will be implemented during the construction phase are unknown at this stage of the Proposed Scheme. Once complete (i.e. during operation), the Proposed Scheme may enhance access for businesses and / or cause disruption to marine commercial activities.

14.3.14. A qualitative assessment will be undertaken to determine the land-take of private land, considering the importance of the land (i.e. whether it is imperative to a business operation), the availability of alternative land within the vicinity and proportion of the land-take as an overall of each land holding. The impact of land take is assessed during the construction phase as this is when the land will be taken and is the point of impact. The assessment will however consider whether the land take is permanent or temporary in nature.

14.3.15. The level of severance and disruption will also be considered qualitatively in terms of a reduction in footfall for businesses, for example off Queen Anne's Road and including increases in journey length for non-motorised and motorised users to reach the businesses. In accordance with DMRB, the average journey speeds for users will be assumed to be 5km/hr for non-vulnerable pedestrians (i.e. able-bodied adults), 3km/hr for vulnerable

pedestrians (i.e. elderly, disabled persons and children), 20km/hr for cyclists (assuming these are non-vulnerable) and 50km/hr for vehicle travellers. These speeds will be considered within the context of the length of the journey in terms of an increase / decrease to determine whether there is a significant change.

14.3.16. The assessment of effects on marine commercial businesses and activities will focus on land-take, severance and disruption to operations within the River Yare and Port operations. Vessel Simulation Modelling that allows a virtual navigation of a vessel through the River Yare to test how the Proposed Scheme interacts with Port operations is being ongoing, although it is not available at the time of writing. In addition, a Navigational Risk Assessment will also be prepared and used to inform the ES; however, this document was not available at the time of writing.

14.3.17. For the purposes of the assessment, land-take, severance and disruption will be considered as a single effect on the sensitive receptors identified.

Changes to access and amenity value of public routes and recreational resources both on-site and off-site

14.3.18. During construction, the Proposed Scheme will require changes to access and amenity value of public routes (including Public Rights of Way and non-designated public routes) and recreational resources[163] both on-site (i.e. within the Application Site and immediately vicinity) and off-site (i.e. within the wider area and along the Norfolk coast).

14.3.19. A qualitative assessment of changes to accessibility will consider disruption to routes due to construction activities / vehicles and increases in journey length / decrease of the route /recreational resource (e.g. recreational grounds).

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

14.3.21. The qualitative assessment of amenity value focuses on changes to fear / safety associated within the below:

- The current condition of the route / recreational resource (e.g. width of route etc.);
- Distance of the route / recreational resource from the works / the Proposed Scheme; and
- The presence of any barriers between the users of the route / recreational resource and associated plant / traffic.

14.3.22. During the operational phase, the assessment will consider the changes to the availability of routes and access to the recreational resource within the immediate area of the Application Site. For the wider resources which may be affected, the outputs of the hydromorphological analysis will be used to qualitatively determine what the change / impact may be at the off-site recreational resources (e.g. reduction in sand deposition at beaches and associated loss of recreational resources).

Land-take from public land

14.3.23. The assessment of loss of public land will consider the importance of the land (i.e. whether it is imperative to a community and residential receptor or business operation), the availability of alternative land / facilities within the vicinity and proportion of the land-take as an overall of each land holding.

[163] Open space, sport and recreational facilities

Change in driver delay and stress

14.3.24. The changes in driver delay and stress will be considered for both the construction and operational phases of the Proposed Scheme. The quantitative assessment will be based on the traffic and road conditions likely to be encountered and will consider the average hourly peak flow per lane, average journey speed, the location of the road (e.g. urban or rural) and the road of road (e.g. motorway, dual carriageway or single carriageway). The assessment will consider both the anticipated delay (in terms of time) for vehicle receptors to travel and driver stress, which is defined as the adverse mental and physiological effects experienced by a vehicle traveller traversing a road network.

ASSESSMENT CRITERIA

14.3.25. The assessment of potential effects as a result of the Proposed Scheme has taken into account both the construction and operation phase. Where possible, a significance level has been attributed to an effect based on the impact magnitude due to the Proposed Scheme and the sensitivity of the affected receptor/receiving environment due to change, as well as a number of other factors outlined in more detail in Chapter 5 Assessment Approach. Impact magnitude and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium low and negligible (as shown in Chapter 5 Assessment Approach).

14.3.26. Determining the sensitivity of receptor is based upon the baseline conditions. The criteria for sensitivity of community receptors are outlined in Table 14.2 - Criteria for Sensitivity.

Table 14.2 - Criteria for Sensitivity

Sensitivity	Criteria
High	A vulnerable receptor with little capacity to absorb change, such as: ▪ Areas with levels of considerable unemployment well in excess of the national / regional averages and level of relative deprivation (top 10%). ▪ Community facilities that are used by a very high number of individuals / limited in number within the area. ▪ Limited local services and recreational / open space available / that have the capability to cope with a limited increased demand. ▪ Businesses that depend on a high level of footfall. ▪ Residential properties / private land / access needed for ongoing business operations. ▪ PRoW frequently used by non-motorised users (NMU) (including pedestrians and cyclists) for commuting, recreational and leisure purposes (e.g. National Trails). Also for use by vulnerable travellers (e.g. elderly, school children and people with disabilities). Frequently used recreational areas. ▪ Routes of high driver stress (defined as a route with 1600+ average peak hourly flow per lane in flow units / 1 hour at any speed).
Medium	A non-vulnerable receptor with limited capacity to absorb change, such as: ▪ Areas with levels of unemployment above the national / regional averages and level of relative deprivation (top 50%). ▪ Community facilities that are used by a moderate number of individuals / several present within the area. ▪ Several local services and recreational / open space available / that have the capability to cope with some increased demand. ▪ Businesses that depend on a medium level of footfall. ▪ Private land / access that is not crucial for ongoing business operations.

Sensitivity	Criteria
	▪ PRoW moderately used by NMU for commuting, recreational and leisure purposes (e.g. regional trails). Moderately used recreational areas. ▪ Routes of medium driver stress (defined as a route with under 1,200 average peak hourly flow per lane in flow unit / 1 hour with average speed of 60-80 or 1200 - 1600 average peak hourly flow per lane in flow units / 1 hour with average journey speed of 60+km/hr).
Low	A non-vulnerable receptor with capacity to absorb change, such as: ▪ Areas with levels of unemployment in line with national / regional averages and level of relative deprivation (bottom 50%). ▪ Community facilities that are used by a limited number of individuals / a number are present within the area. ▪ A number of local services and recreational / open space available / that have the capability to cope with increased demand. ▪ Businesses that depend on a low level of footfall. ▪ Private land / access that is only required occasionally for ongoing business operations or where an alternative access is available. ▪ PRoW sometimes used by NMU for recreational / leisure purposes (e.g. local routes). Recreational areas with limited use by the general public. ▪ Routes of low driver stress (defined as a route with under 1,200 average peak hourly flow per lane in flow units / 1 hour with average journey speed of 80+km/hr).
Negligible	A non-vulnerable receptor with ability to absorb changes, such as: ▪ Areas of very limited unemployment (well below the national / regional averages) and level of relative deprivation (bottom 50%). ▪ Community facilities that are used by infrequently by individuals / a large number are present within the area. ▪ Large number of local services and recreational / open space available / that have the capability to cope with increased demand. ▪ Businesses that do not depend on a footfall / where customers are prepared to travel to the business operations. ▪ Private land / access that is not required for ongoing business operations ▪ PRoW not / infrequently used by NMU for recreational purposes. Recreational areas not / minimally used by the general public. ▪ Routes with very limited driver stress due to infrequent use.

14.3.27. Determining the impact magnitude relates to whether the Proposed Scheme will result in changes to the receptor and the scale of these effects. The criteria for impact magnitude are outlined in Table 14.3 - Criteria for Impact Magnitude.

Table 14.3 - Criteria for Impact Magnitude

Impact magnitude	Criteria
High	▪ Greater than 5% increase / decrease on existing baseline levels of employment. ▪ Where there will be a major impact on an asset used by the community due to disturbance (e.g. the asset could no longer fulfil its function). ▪ Where there will be a major impact on land holdings / access to landholdings (e.g. permanent loss of land / access to landholdings with no alternative access available). ▪ Permanent loss / severance of an existing recreational route / resource used by NMU / considerable change in amenity value. ▪ Where there will be a major increase / reduction in in driver stress resulting from the Proposed Scheme compared to the do minimum.
Medium	▪ 1% - 5% increase / decrease on baseline levels of employment. ▪ Where there will be a medium change on an asset used by the community due to disturbance (e.g. temporary impact on the ability to asset to fulfil its function). ▪ Where there will temporary land take / reduction in accessibility of private land ▪ Disruption of a recreational route / resource used by NMU with significant increase / decrease in journey length / time / or moderate change in amenity value. ▪ Where there will be a moderate increase / reduction in in driver stress resulting from the Proposed Scheme compared to the do minimum.
Low	▪ 0.01 – 0.9 % increase / decrease on existing baseline levels of employment. ▪ Where there will be a small change on an asset used by the community due to disturbance (e.g. limited impact on the ability to asset to fulfil its function). ▪ Where there will limited land take / reduction in accessibility of private land. ▪ Alteration of a recreational route / resource used by NMU but with no significant increase in journey or minor change in amenity value. ▪ Limited increase in driver stress above baseline levels.
Negligible	▪ Less than 0.01% increase / decrease on existing baseline levels of employment. ▪ Limited disturbance to assets used by community receptors. ▪ No change to recreational route / resource used by NMU or change in amenity value. ▪ No change to levels of driver stress above baseline levels.

EFFECT SIGNIFICANCE

14.3.28. The following terms have been used to define the significance of the effects identified; however, it is not prescriptive and professional judgement has been applied where appropriate:

- Large effect: where the Proposed Scheme could be expected to have a considerable effect (either beneficial or adverse) on people and communities receptors;
- Moderate effect: where the Proposed Scheme could be expected to have a noticeable effect (either beneficial or adverse) on people and communities receptors;
- Minor effect: where the Proposed Scheme could be expected to result in a small, barely noticeable effect (either beneficial or adverse) on peoples and communities receptors; and
- Neutral: where no discernible effect is expected as a result of the Proposed Scheme on people and community receptors.

14.3.29. Where the magnitude of change has not been assessed due to a lack of information at this stage of the Proposed Scheme the potential effect has been assigned an 'adverse' or 'beneficial' level of significance.

14.4 BASELINE ENVIRONMENT

POPULATION

14.4.1. The Proposed Scheme is located within Great Yarmouth, within Norfolk. The resident population in Great Yarmouth was estimated to be 99,200 (totalling 49,000 males and 50,200 females) in 2016 based on the Office of National Statistics (ONS) NOMIS report[158]. There are a lower proportion of individuals aged 16-64 in Great Yarmouth (58.7%), compared with the averages across the East of England region (61.5%) and Great Britain (63.1%).

DEPRIVATION

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

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

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

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

14.4.5. There are a number of local businesses located within the Application Site and surrounding area. Local businesses, including Kings Centre and Simpsons New and Used Motorhomes, are located off Queen Anne's Road and Suffolk Road. Businesses are also located off Suffolk Road, including, but not limited to, Space 4 U Storage Ltd and Great Yarmouth Day Services. Harfrey's Industrial Estate is situated immediately west of the A47 / Williams Adam Way roundabout. To the east of the River Yare, an industrial area including UKPN, Asco, Perenco is located adjacent to the river. A summary of the land holdings within the vicinity of the Scheme is provided in Table 14.5.

14.4.6. In Great Yarmouth, the proportion of individuals aged 16-64 who were estimated to be economically active in 2016 was 77.9% (47,300 people), compared with an average of 79.1% (437, 600 people) in Norfolk, 80.2% in the East of England and 78% across Great Britain. In 2015, there was an estimated 38,000 jobs in Great Yarmouth, with 60.5% full time and 42.1% part time.

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

14.4.8. The Borough of Great Yarmouth has a diverse local economy. According to the Great Yarmouth Local Plan, it is the main service base in England for the offshore energy industry and has a thriving seasonal visitor economy[164].

14.4.9. Table 14.4 details the estimated employee jobs by industry sector in 2016. In Great Yarmouth, the highest proportion of employee jobs were in the Human Health and Social Work Activities (Sector Q) at 21.1%. This is a greater proportion than the average across Norfolk (15%), the East of England region (11.8%) and Great Britain (13.3%). The construction industry (Sector F) constituted 3.9% of the workforce (approximately 1,500 jobs) in Great Yarmouth, which is slightly lower than the regional average (5.3%) and national average (4.6%).

Table 14.4 - Overview of estimated employee by jobs by industry sector (2016)

Industry sector	Great Yarmouth	Norfolk	East of England	Great Britain
B: Mining and quarrying	0.9	0.2	0.1	0.2
C: Manufacturing	7.9	9.5	8.0	8.1
D: Electricity, gas, steam and air conditioning supply	0.2	0.1	0.2	0.4
E: Water supply; sewerage, waste management and remediation activities	1.2	0.8	0.7	0.7
F: Construction	3.9	5.3	5.5	4.6
G: Wholesale and retail trade; repair of motor vehicles and motorcycles	15.8	17.3	16.8	15.3
H: Transportation and storage	3.9	3.9	5.1	4.9
I: Accommodation and food service activities	15.8	8.1	6.6	7.5
J: Information and communication	0.8	1.9	3.9	4.2
K: Financial and insurance activities	0.7	3.6	2.4	3.6
L: Real estate activities	0.5	1.3	1.4	1.6

[164] Great Yarmouth Borough Council (2015) Great Yarmouth Local Plan: Core Strategy 2013 - 2030

M: Professional, scientific and technical activities	7.9	5.6	8.7	8.6
N: Administrative and support service activities	5.3	8.6	11.3	9.0
O: Public administration and defence; compulsory social security	2.4	4.5	3.5	4.3
P: Education	7.9	8.9	9.1	8.9
Q: Human health and social work activities	21.1	15.0	11.8	13.3
R: Arts, entertainment and recreation	4.6	3.1	2.7	2.5
S: Other service activities	1.3	1.9	2.0	2.1

Source: NOMIS, ONS

LAND USES

14.4.10. Land within the Proposed Scheme Boundary and surrounding areas is in a mixture of private and public ownership. Private landholdings are owned by a mixture of companies as outlined in Table 14.5. The public-sector land holdings, including residential properties, are owned by Highways England, NCC and Great Yarmouth Borough Council.

14.4.11. The Proposed Scheme Boundary also includes a section of the River Yare used for berthing and as a navigation channel for commercial and for leisure vessels. The channel is maintained by the port operator Peel Ports and includes a large vessel waiting facility.

14.4.12. Table 14.5 provides a summary of the land holdings in the vicinity of the Proposed Scheme.

Table 14.5 – Land holdings within the vicinity of the Proposed Scheme

Landowner	Lessees or reputed lessees / Occupiers	Description
Highways England	N/A	Various
Transmit Containers Limited	N/A	Units 1A and 1B Boundary Road, Harfrey's Industrial Estate
SLA Property Company Limited	East Coast Waste Limited	Land lying to the east of Harfrey's Road, Great Yarmouth
Hope (Borough of Great Yarmouth)	Renfree Energy Limited	Land on the south west side of Queen Anne's Road, Great Yarmouth
Simpsons Garage (Great Yarmouth) Limited	N/A	Land on the west side of Suffolk Road, Gorleston, Great Yarmouth Land on the north-east side of Queen Anne's Road, Great Yarmouth and Land on the west side of Suffolk Road, Great Yarmouth
Great Yarmouth Borough Council	Asco UK Limited	Land at Queen Anne's Road, Great Yarmouth
Regaland Limited	N/A	Various
The Great Yarmouth and Gorleston Allotment Association Limited	N/A	Allotment Sites at Great Yarmouth, Gorleston and Bradwell

Landowner	Lessees or reputed lessees / Occupiers	Description
The Norfolk County Council	Saffron Housing Trust Limited / Eastern Power Networks Plc	Various
Private Residential Properties	N/A	Various
National Grid Property Holdings Limited	Great Yarmouth Port Company Ltd / Asco UK Limited	Various
Swift Taxis and Private Hire Ltd	N/A	173 Southtown Road, Great Yarmouth (NR31 0LA)
Fitzmaurice Holdings Limited	Stapleton's (Tyre Services) Limited	Land adjoining Units 1 and 2 Southtown Road, Great Yarmouth Units 1 and 2 Southtown Road, Great Yarmouth
Norwich Diocesan Board of Finance Limited	Private	Various
Great Yarmouth Port Authority / National Grid Property Holdings Limited / Private	Great Yarmouth Port Company Ltd	Various
Great Yarmouth Borough Council / National Grid Property Holdings Limited / Great Yarmouth Port Authority	Asco UK Limited	Various
Great Yarmouth Port Authority	Various (Perenco UK Limited, Asco UK Limited, Great Yarmouth Port Company Ltd, E.On Climate & Renewables UK Offshore Wind Ltd, Great Yarmouth Port Authority)	Land at Atlas Terminal, Southgates Road, Great Yarmouth
Yarmouth Stores Limited	Score (Europe) Limited	Various
Steel Services Holding Company Limited	N/A	Various
H S Fishing 2000 Limited	N/A	Various
Abbey Waste Control Limited	N/A	Land and buildings on the east side of South Denes Road, Great Yarmouth
Simpsons Garage (Great Yarmouth) Limited	N/A	land on the north side of Queen Anne's Road, Great Yarmouth
N/A	R & S Impex Ltd	The Dolphin Public House, Fish Wharf, Great Yarmouth, NR30 3LP
Quay Developers Ltd	N/A	land on the east side of Southgates Road, Great Yarmouth
A Fordable Car Sales Ltd	Private	Various
Unknown	Internet Workwear Ltd	Land and property to east of South Denes Road
Unknown	Yare Accountancy Services	37 Southgates Road

Landowner	Lessees or reputed lessees / Occupiers	Description
Unknown	221 (Great Yarmouth) Squadron Air Training	Land to the south of William Adams Way

14.4.13. Located to the west of the Proposed Scheme (west of Great Yarmouth) is Grade 3 agricultural land and further north there is Grade 4 agricultural land. Local businesses and community facilities are also situated within the Proposed Scheme Boundary and surrounding area (see below sections for further detail).

14.4.14. The area between William Adams Way and Queen Anne's Road is allocated as an Open Amenity Space (Saved Policy REC11) in the Great Yarmouth Core Strategy Proposals Map. The Proposed Scheme also includes a part of a Safeguarded Employment Area (CS6) to the north of Queen's Anne Road and a Safeguarded Employment Area (CS6) to the east of River Yare. A further Safeguarded Employment Area (CS6) is located to the south of Southtown Road, albeit this falls outside of the Application Site[160].

COMMUNITY FACILITIES

14.4.15. The only community receptors located within the Application Site itself are two allotment gardens, situated immediately north-east of the Queen's Anne Road and Suffolk Road junction, and Community Roots Mind Allotments. Community receptors located outside the Application Site include Southtown Common Recreation Ground, which is a key community receptor; it is located to the south of William Adams Way. Allotment gardens are located to the south-west of this recreation ground. Kingsgate Community Church is situated approximately 30m north of William Adams Way at its closest point. Harfrey's Industrial Estate is located directly west of the A47 / Williams Adam Way roundabout, offering a range of shops and also a gym.

14.4.16. As shown in Table 14.6 there are a number of other community facilities within 500m of the Application Site. Appendix 14A details all the currently identified community facilities within 2km of the Application Site.

14.4.17. **Table 14.6 – Community facilities within 500m 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

RECREATIONAL RESOURCES

14.4.18. The only recreational resources located within the Application Site itself are two allotment gardens, situated immediately north-east of the Queen's Anne Road and Suffolk Road junction, and Community Roots Mind Allotments. The recreational resources located outside of the Application Site include Southdown Common Recreation Ground and the allotment gardens to the south-west of the recreation ground. There are no water activity centres within the immediate vicinity of the Proposed Scheme; however, the potential for water sports (including canoeing, rowing and kayaking) along the River Yare will be identified through consultation with local groups and regional bodies such as the Great Yarmouth and Gorleston Sailing Club, Royal Yachting Association and The Broads Authority.

14.4.19. The Great Yarmouth sea front is located approximately 510m to the east of the Proposed Scheme Boundary at its closest point. There are numerous recreational attractions along the beach, including Pleasure Beach, a

scenic railway and Pleasure Beach Gardens. Pleasure Beach offers family rides and attractions and is located approximately 460m east of the most eastern extent of the Proposed Scheme Boundary.

14.4.20. The area to the east of Southtown Road, and east of the River Yare, is within the England Coast Path Coastal Margin and therefore has the potential to be open space**.**

14.4.21. There are also a number of additional open / recreation spaces within 500m of the Application Site, as outlined in Table 14.7 – Recreational facilities within 500m of the Application Site. The currently identified open / recreational spaces within 2km of the Application Site are shown in Appendix 14B.

Table 14.7 – Recreational facilities within 500m 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

14.4.22. The Great Yarmouth Open Space Study (Open Space Audits and Local Standards)[161] identified that there is 5.63ha of open space per 1,000 people in the Southtown and Cobholm ward and 4.38ha per 1,000 people in the Nelson ward. Across all wards, the total area of open space per ward ranges from 2.77ha to 77.93ha.

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

PUBLIC RIGHTS OF WAY AND NON-DESIGNATED PUBLIC ROUTES

14.4.24. Sustrans Cycle Route 517 is located within the Proposed Scheme and runs along Southtown Road and Malthouse Lane, which both join with William Adams Way. Hopton-on-Sea to Sea Palling is also a national trail with the trail forming part of the England Coast Path. It is located within the Proposed Scheme and also runs along Southtown Road and Malthouse Lane. It should be noted that NCC are currently in the process of progressing a separate scheme to improve cycle facilities along Southtown Road. This scheme includes widening the footway into the carriageway to provide a shared use facility for pedestrians and cyclists, between Queen Anne's Road and to the north of Waveney Road. Construction of this scheme has commenced with completion programmed in early August.

14.4.25. On a local level, a pedestrian footbridge is currently located along William Adams Way and a footbridge over this road providing access to Southtown Common Recreation Ground, although this will be demolished as

described Section 2.4 NMU Crossings. There are also a number of Public Rights of Way (PRoW) located within 2km of the Application Site, mainly located to the west of the Proposed Scheme Boundary, around Harfrey's Industrial Estate

14.4.26. A pedestrian and cyclist survey was undertaken for the existing Haven Bridge in June 2016[165]. The survey counted the number of pedestrians and / or cyclists observed crossing at this location during a 12-hour (7am – 7pm) period. Surveys taken at the A47 Breydon Bridge were not assessed due to the nature of the road (50mph) with no facilities for walking or cycling. Table 14.8 provides an overview of the survey count data for June 2016.

Table 14.8 – Summary of pedestrian and cyclist survey count (June 2016)

Date	Location	Pedestrian Count	Cyclist Count
30/06/2016	Haven Bridge	5,453	1,214

14.4.27. Additional surveys were undertaken in February 2017 at four locations, listed in Table 14.9 - Summary of pedestrian and cyclist survey count (February 2017). This survey data was used to supplement the June 2016 count data, mainly for assessing the impact of replacing the footbridge on William Adams Way with a toucan crossing.

Table 14.9 - Summary of pedestrian and cyclist survey count (February 2017)

Date	Location	Pedestrian Count	Cyclist Count
21/02/2017	Suffolk Road / Queen Anne's Road / William Adams Way	466	159
21/02/2017	William Adams Way Footbridge	386	79
21/02/2017	South Denes Road	45	59
21/02/2017	William Adams Way / Beccles	527	258

HIGHWAY NETWORK

14.4.28. The main roads in the vicinity of the Application Site include the A47 which is located immediately west of the Proposed Scheme. The A47 is a key road in Great Yarmouth and connects the area to Norwich, links south to Lowestoft and other areas to the west. To the south, the A12 provides links to Ipswich, while the A143 links Great Yarmouth with areas in the south-west such as Bury St Edmunds.

14.4.29. Table 14.10 – Average Annual Daily Traffic between 01/01/2017 and 01/01/2018 outlines the average volume of traffic (measured in Annual Average Daily Traffic) for the A47 northbound and southbound carriageways[166].

Table 14.10 – Average Annual Daily Traffic between 01/01/2017 and 01/01/2018

		Average Annual Daily Traffic			
Site Ref.	Direction	24hr	18hr	16hr	12hr
30360732	A47 northbound between A143 and A1243	16,894	16,324	15,934	13,812
6337/2	A47 southbound between A149 and A1243	17,634	17,182	16,623	14,439

Source: Webtris

[165] Mouchel (2017) Great Yarmouth Third River Crossing: Outline Business Case
[166] Highways England (2018) Webtris [online] Available at: http://webtris.highwaysengland.co.uk/ (Accessed May 2018)

14.4.30. A review of Collison Map167 (based on Government data) indicates that a number of slight accidents and one serious accident have recently occurred along the A47 / Williams Adam Way roundabout and approaches to the roundabouts (see Table 14.11 – Accidents within the vicinity of the Proposed Scheme between 31/12/13 and 31/12/16).

Table 14.11 – Accidents within the vicinity of the Proposed Scheme between 31/12/13 and 31/12/16

Location	Date	Severity	No casualties
A47 / Williams Adam Way roundabout	February 2015	Slight	4
A47 / Williams Adam Way roundabout	August 2016	Slight	2
A47 / Williams Adam Way roundabout	November 2015	Slight	1
A47 / Williams Adam Way roundabout	November 2014	Slight	1
Approx. 70m north of roundabout	November 2016	Serious	3
Approx. 140m north of roundabout	August 2014	Slight	1
Approx. 170m north of roundabout	April 2015	Slight	3
Approx. 210m north of roundabout	November 2014	Slight	1
Approx. 200m south of roundabout	October 2015	Slight	1

Source: Collison Map

Sensitive Receptors

14.4.31. The following sensitive receptors could be affected by the Proposed Scheme:

- Economic receptors, e.g. individuals of working age and businesses, terrestrial and marine commercial businesses;
- Community receptors e.g.. Kingsgate Community Church;
- Recreational receptors, including terrestrial (e.g. users / visitors to the Southtown Common Recreational Ground) and marine activities (e.g. users of the River Yare);
- Public landholdings;
- Non-motorised user receptors, including pedestrian and cyclist users of the local PRoW and non-designated public routes; and
- Vehicle user receptors, including drivers along the highway network.

[167] Buchanan Computing (2017) Collison Map [online] Available at: http://www.collisionmap.uk/ (Accessed May 2018)

14.5 PREDICTED EFFECTS

INSIGNIFICANT EFFECTS

14.5.1. It is considered that site security arrangements for the Proposed Scheme will be in line with the requirements set out within the Construction (Design and Management) Regulations 2015, and appropriate security (CCTV / security personnel including existing port security) will be provided on-site. Therefore, in accordance with the Scoping Opinion effects in relation to crime and perception of crime will not be considered further within this PEIR and the ES.

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

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

14.5.4. It is anticipated that the Proposed Scheme would generate 18 gross direct jobs outside of Great Yarmouth (see Table 14.14). It is anticipated that the effect of the influx of construction workers on the capacity of local services (e.g. education, healthcare or community facilities) and recreational / open space would be negligible and of neutral significance.

POTENTIAL EFFECTS

14.5.5. The Proposed Scheme could have the following potential effects on people and communities:

Construction Phase

- Generation of direct, indirect and induced employment opportunities;
- Land-take, severance and disruption to terrestrial and marine businesses and associated activities;
- Change to access and amenity value of public routes and resources both on-site and off-site;
- Land-take from public and private land holdings; and
- Changes in driver stress and delay.

Operational Effects

- Increase in economic activity due to improved connectivity;
- Severance and disruption to terrestrial and marine businesses and associated activities;
- Change to access and amenity value of public routes and resources both on-site and off-site; and
- Change in driver stress and delay.

14.5.6. Table 14.12 details the effects covered elsewhere within this PEIR. Table 14.15 at the end of the chapter provides an overview of the assessments that were able to be undertaken at this stage of the Proposed Scheme.

Table 14.12 – Summary of topics covered within this PEIR

Topic	Chapters
Effects in relation to quality of surroundings and sense of place	Cultural Heritage Chapter and Landscape and Visual Chapter
Effects in relation to health	Acoustics, Air Quality, Water Environment and Geology and Soils

Potential for disturbance, disruption and reduction in amenity of residents	Acoustics, Air Quality and Landscape and Visual Amenity

CONSTRUCTION PHASE

Generation of direct, indirect and induced employment opportunities

14.5.7. Construction employment represents a positive economic effect that can be estimated as a function of the scale and type of construction (e.g. infrastructure). The following sections estimate gross employment arising from the Proposed Scheme during the construction phase and then take into account leakage, displacement and multiplier effects in order to assess the net effects on local and regional economies.

Gross Direct Construction Employment

14.5.8. The estimated construction period is approximately two years and four months. The construction work is not permanent and therefore the effect will be temporary in nature. The capital and revenue expenditure involved in the construction period will lead to increased output in Great Yarmouth and the wider regional economy.

14.5.9. The employment resulting from the temporary construction phase can be estimated by applying an average gross output per construction industry employee to the estimated total construction cost. It is therefore estimated that there are likely to be 176 FTE construction workers per annum on the Site during the construction phase.

Leakage

14.5.10. Leakage effects are the benefits to those outside the effect area. Analysis carried out on Census 2011 data indicates that approximately 9,274 people working in Great Yarmouth live outside the area[168]. This corresponds to a low leakage rate as set out by HCA Additionality Guidance[169] and implies that the majority of employment opportunities will go to people living within the effect area. An adjustment of 10% has been applied to the estimated 176 gross construction jobs. It is therefore estimated that 158 employees from within Great Yarmouth and 18 employees from outside of Great Yarmouth will be working per annum at the Proposed Scheme during the construction period.

Displacement

14.5.11. Displacement measures the extent to which the benefits of a project are offset by reduction of output or employment elsewhere. An additional demand for labour cannot simply be treated as a net benefit – it has the potential to remove workers from other positions and the net benefit is reduced by the extent that this occurs.

14.5.12. Construction workers typically move between construction projects when delays occur or to help the workforce meet particular construction deadlines. Overall it is assumed that, due to the flexibility of the labour market and the fact that construction workers at the Proposed Scheme represent such a small proportion of the Great Yarmouth construction labour force, displacement of the direct construction employment will be low.

14.5.13. The HCA Additionality Guidance[169]**Error! Bookmark not defined.** provides 'ready reckoners' for displacement. Within the c ontext of Great Yarmouth, a low displacement of 25% is considered appropriate. This is considered to be a best practice approach in the absence of specific local information that might provide a defensible justification for another level of displacement being used, either above or below 25%. Applying this level of displacement to the

[168] Office for National Statistics (2018) Location of usual residence and place of work by method of travel to work [online]. Available at: https://www.nomisweb.co.uk/census/2011/WU03UK/chart/1132462257

[169] Homes & Communities Agency (2014) Additionally Guide: Fourth Edition

total gross direct employment figure results in a net direct employment figure of 132 jobs per annum during the construction period.

Multiplier Effect

14.5.14. In addition to the direct employment generated by the Proposed Scheme itself, there will be an increase in local employment arising from indirect and induced effects of the construction activity. Employment growth will arise locally through manufacturing services and suppliers to the construction process (indirect or supply linkage multipliers). Additionally, part of the income of the construction workers and suppliers will be spent in Great Yarmouth, generating further employment (in terms of induced or income multipliers).

14.5.15. The effects of the multiplier depend on the size of the geographical area that is being considered, the local supply linkages and income leakage from the area. The HCA Additionality Guidance[169]**Error! Bookmark not defined.** p rovides a 'ready reckoner' of composite multipliers – the combined effect of indirect and induced multiplier effects. This is considered to be a best practice approach in the absence of specific information that might provide a defensible justification for another multiplier effect level being used, appropriate to the sectors concerned. Applying the 1.5 multiplier to the figure for total net direct employment of 132 results in a net indirect employment of 66 during the construction period.

Net Additional Construction Employment

14.5.16. Table 14.13 presents the temporary employment generated by the Proposed Scheme taking leakage, displacement and multiplier effects into account. For the Proposed Scheme, the total net additional employment created within Great Yarmouth is estimated to be 178 whilst 20 jobs will be created outside of Great Yarmouth, supporting a total of 198 net jobs on average per year during the construction period.

Table 14.13 – Net Additional Construction Employment Per Year

FTE Employment	Total Great Yarmouth	Outside Great Yarmouth	Total
Gross direct employment	158	18	176
Displacement	-39	-4	-44
Net direct employment	118	13	132
Indirect & induced employment	59	7	66
Total net employment	**178**	**20**	**198**

14.5.17. In the context of the labour pool of construction workers in Great Yarmouth, the direct, indirect and induced employment, expenditure and upskilling created by the construction phase of the Proposed Scheme is likely to have a direct moderate beneficial, temporary effect on the Great Yarmouth economy (local study area) and minor beneficial effects on Norfolk's economy (regional study area).

Land-take, severance and disruption to terrestrial and marine businesses and associated activities

14.5.18. It is anticipated that there will be temporary and / or partial closures of the roads surrounding the Proposed Scheme during the construction phase. These temporary / partial closures could have **adverse** effects on the local businesses surrounding the Proposed Scheme. The Traffic Management systems that will be implemented during the construction phase are unknown at this stage of the Proposed Scheme meaning a full assessment cannot be undertaken. In addition, further detail on the types of businesses and footfall required by these businesses (e.g. specialised businesses will require less footfall as customers are prepared to travel for these services) will be sought to inform the ES.

14.5.19. In addition, construction activities within the River Yare, associated with piers (if required) and the placement of the bridge, have the potential to affect vessel transport and Port operations. Construction of the new crossing

will introduce a new structure within the River Yare which will reduce the width of the existing navigation channel. The Proposed Scheme will also result in the loss of quay spaces. The Proposed Scheme is likely to result in additional delays to recreational vessels wishing to navigate the River Yare.

14.5.20. It is therefore anticipated that the Proposed Scheme will have an adverse effect on commercial marine activities during construction. However, at the time of writing detailed information on the construction programme and activities was not available and therefore a full assessment could not be undertaken

Changes to access and amenity value of public routes and recreational resources both on-site and off-site

14.5.21. It is anticipated that the Proposed Scheme will cause temporary disruption and change in accessibility for public routes and recreational resources (both terrestrial and marine). The Proposed Scheme is also likely to result in additional delays to recreational vessels that want to navigate the River Yare.

14.5.22. At the time of writing, information on the construction diversion routes and recreational resources was not available and therefore a full assessment could not be undertaken. However, it is anticipated that there will be an **adverse** effect on accessibility for public routes and recreational resources during construction.

Land-take from public and private land holdings

14.5.23. Land-take from a number of public landholdings will be required to deliver the Proposed Scheme. The areas of land-take that will be required to deliver the Proposed Scheme, including NCC owned residential properties, warehouses and allotment land to the west of the River Yare. To the east of River Yare, the Proposed Scheme will require South Denes Car centre to be demolished as well as an industrial storage area.

14.5.24. Table 14.14 provides more detail on the residential, commercial and industrial properties that will be demolished to accommodate the Proposed Scheme.

Table 14.14 – Residential, commercial and industrial properties for demolition

Location	Description
Queen Anne's Road	Block of ten terraced properties (13 to 22 Queen Anne's Road)
South of Cromwell Road	Warehouses (including MMC Performance Ltd)
Cromwell Road	Residential property (11 Cromwell Road)
Southtown Road	Block of nine terraced houses (148 to 156 Southtown Road)
South Denes Road	Warehouse (including South Deans Car Centre

14.5.25. It is anticipated that the loss of the residential properties, warehouse and commercial spaces will have an adverse effect on the local community and businesses. However, a new allotment location, north of Queen Anne's Road, has been identified.

Changes in driver stress and delay

14.5.26. It is anticipated that temporary road blockades / partial closures and diversions will be required during the construction of the Proposed Scheme. It is anticipated that these diversions could, temporarily, increase driver stress delay and stress for vehicle receptors. At the time of writing, information on the construction diversion routes was not available and therefore a full assessment could not be undertaken at this stage of the Proposed Scheme. However, it is anticipated that there will be an **adverse** effect on driver stress during construction

OPERATIONAL PHASE

Increase in economic activity due to improved connectivity

14.5.27. During operation, the Proposed Scheme will provide a vehicular link across the River Yare, with the current crossing located approximately 1.5 km north of the Proposed Scheme Boundary. Therefore, the Proposed Scheme will link the communities to the west and east of River Yare, which could increase footfall for businesses and generate **beneficial** effects on local businesses and the economy. The Economic Impact Report was not available at the time of writing meaning a detailed assessment could not be undertaken at this stage of the Proposed Scheme.

Severance and disruption to terrestrial and marine businesses and associated activities

14.5.28. Once complete, the piers and the placement of the bridge have the potential to affect vessel transport and port operations. It is anticipated that the Proposed Scheme will have an **adverse** effect on accessibility for commercial marine activities. However, at the time of writing information the vessel simulation model and Navigational Risk Assessment was not available and therefore a full assessment could not be undertaken

Changes to access and amenity value of public routes and recreational resources both on-site and off-site

14.5.29. The Proposed Scheme will enhance connectivity for public routes and recreational resources as it will provide a link across the River Yare. The Proposed Scheme also includes non-motorised users' facilities across the River Yare (see Chapter 3 for more detail), resulting in a beneficial effect. However, as part of the Proposed Scheme the footbridge will be lost and replaced by controlled toucan crossings across Adam William's Way southeast and the bridge approaches to the western roundabout. Both will be signalised and staggered with a waiting area in the central reservation. The Proposed Scheme includes an uncontrolled crossing at Southtown Road and a new signalised crossing at Suffolk Road. Further non-motorised facilities would be provided at the eastern junction as described in Chapter 3. A more detailed assessment of the effects of the Proposed Scheme on NMU facilities will be undertaken as part of the Environmental Impact Assessment when the NMU survey count data and the NMU Context Report will be available.

14.5.30. In addition, it is anticipated that changes in traffic and the introduction of infrastructure associated with the Proposed Scheme could reduce amenity of both terrestrial and marine recreational resources (e.g. Southdown Common Recreation Ground, two replacement allotment gardens and River Yare), including the allotment gardens, resulting in an adverse effect.

14.5.31. During operation, the Proposed Scheme could cause sediment and hydromorphological changes to the River Yare and the wider Norfolk coast, which could have an **adverse** effect off-site recreational resources (e.g. beaches). Further details are presented within Chapter 11, which relates to Road Drainage and the Water environment. Sediment transport and hydromorphological assessments will be progressed as part of the Environmental Impact Assessment.

Changes in driver stress and delay

14.5.32. During the operational phase, the vehicle travellers are anticipated to experience a **beneficial** effect on driver delay as the Proposed Scheme will improve connectivity across the River Yare, and take traffic off local roads that currently allow access across the River Yare**.**

14.5.33. It is anticipated that vehicle travellers using the Proposed Scheme will also experience a reduction in driver stress as the Proposed Scheme will improve connectivity, journey times and reliability. However, as the traffic data is not available at the time of writing a detailed driver stress and delay assessment could not be undertaken at this stage

14.6 PROPOSED MITIGATION

14.6.1. At this stage, the following mitigation is considered relevant. However, further work in preparing the ES may determine that further mitigation will be required.

CONSTRUCTION

- The Applicant will work proactively with contractors and suppliers to provide employment opportunities and to enable access to training. The processes used to recruit and manage employees working to build the Proposed Scheme will be demonstrably fair and offer equal opportunities to all. There will also be one-to-many briefing for the local Jobcentre Plus and other local training providers.
- There may be scope for additional measures to optimise the spending by contractors in the local economy during the construction phase by voluntary measures to place contracts with local firms and purchase from local suppliers.
- The public will be informed of the nature, timing and duration of particular construction activities and the duration of the construction works by newsletters and liaison with the Applicant.
- Adherence to measures set out in the Construction Environmental Management Plan to reduce noise, air quality and lighting impacts, where practicable.
- Management / layout of construction compounds to reduce impacts on access to / from private landholdings.
- Construction plant that is not in use will be separated from public access points. Where practicable, NMU movements will be separated from construction activity and vehicle/machinery movements.
- The provision of appropriate and quality diversions which are established prior to construction and clear directions for any alternative routes and appropriate alternative diversions will be clearly publicised to maintain public access.

OPERATION

- Provision of off-site housing or financial contributions to mitigate the loss of private residential properties.
- Proposed road layout, road markings and traffic signs are clear and transparent to avoid confusion by all road users, including cyclists.

14.7 CONCLUSIONS AND EFFECTS

14.7.1. Interim conclusions drawn from the preliminary assessments carried out to date are that:

- The construction of the Proposed Scheme will have beneficial effects associated with the generation of direct, indirect and induced employment opportunities.
- During the construction phase, the Proposed Scheme could have adverse effects due to land-take, severance and disruption to terrestrial and marine businesses and associated activities, changes to access and amenity value of public routes and recreational resources both on-site and off-site, land-take from public and private land holdings as well as changes in driver stress and delay.
- The operation of the Proposed Scheme will have beneficial effects on economic activity due to improved connectivity, driver stress and delay as well as NMU connectivity across the River Yare.
- It is anticipated that the Proposed Scheme will have an adverse effect due to severance and disruption to terrestrial and marine businesses and associated activities as well as changes to access and amenity value of public routes and recreational resources both on-site and off-site.

Table 14.15 - Assessment of Effects

Environmental aspect	Sensitivity	Type of impact	Nature of impact	Magnitude of impact (Adverse and Beneficial)	Significance of effect
Generation of direct, indirect and induced employment opportunities	Local study area (Great Yarmouth): High	Construction	The construction of the Proposed Scheme is likely to generate direct, indirect and induced employment opportunities.	Moderate	Beneficial
	Regional study area (Norfolk): Medium			Minor	Beneficial
Increased demand for local services and recreational / open space	Local services and recreational / open space: Medium	Construction	An influx of construction workers could increase demand on local services (e.g. education, healthcare or community facilities) and recreational / open space.	Negligible	Neutral

14.8 ASSESSMENTS STILL TO BE COMPLETED

14.8.1. The following assessment will be included as part of the ES:

- A revised quantitative assessment of the direct on-site and indirect and induced employment opportunities that will be generated as a result of the Proposed Scheme will be undertaken based on more detailed information.
- A detailed assessment of:
  - Changes to access and amenity value of public routes and recreational resources both on-site and off-site;
  - Land-take from public and private land holdings;
  - Changes in driver stress and delay;
  - Increase in economic activity due to improved connectivity; and
  - Severance and disruption to terrestrial and marine businesses and associated activities.

15

MATERIALS

15 MATERIALS

15.1 INTRODUCTION

15.1.1. This chapter provides preliminary information with regard to materials as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. This section considers the implications of the Proposed Scheme on the consumption of material resources (which includes recovered site arisings), and the generation and disposal of waste. It sets out the proposed methodology and identifies those impacts that can be scoped out of the EIA.

15.1.2. The assessment methodology proposed in this assessment is based on guidance set out in IAN 153/11 (Highways Agency, 2011) Environmental Assessment of Material Resources[170]. IAN153/11[171] sets out the process and information required for the assessment of significant effects from material resources and waste.

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

15.1.4. IAN 153/11 does not include a definition of waste, however the EU Waste Framework Directive[172] defines it as "*any substance or object that the holder discards or intends or is required to discard*".

STUDY AREA

15.1.5. The primary study area comprises the Proposed Scheme Boundary presented in Figure 2.3

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

15.2 DIRECTIVES, STATUTES AND RELEVANT POLICES

LEGISLATIVE FRAMEWORK

15.2.1. The legislative framework applicable to Material Resources is summarised as follows:

Waste Framework Directive (2008/98/EC)[173].

15.2.2. The Directive provides a comprehensive foundation for the management of waste across the European Community and provides a common definition of waste. A definition of waste is provided in Article 3 of the Directive which defines waste as:

- *"any substance or object that the holder discards or intends or is required to discard".*

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

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

172 The EU Waste Framework Directive, European Directive 2006/12/EC, as amended by Directive 2008/98/EC.

173 European Commission (2014)The Environmental Impact Assessment Directive (2014/52/EU)

15.2.3. It is important to note that the definition of 'discard' set out in the Waste Framework Directive is different to its dictionary definition: the Directive definition includes any substance or object that is discarded for disposal or that has not been subject to acceptable recovery (including recycling).

15.2.4. In accordance with the Waste Framework Directive, Member States are obligated to give due consideration to waste prevention mechanisms and where possible recover, reuse or recycle waste. Specifically, explicit targets are laid out for construction, demolition and excavation wastes: 70% of non-hazardous construction and demolition waste must be recovered, reused or recycled by 2020.

15.2.5. The Waste Framework Directive sets out the Waste Hierarchy (Figure 15.1) against which action to reduce the production and disposal of waste shall be taken.

Figure 15.1 – Waste Hierarchy

15.2.6. The main principles of the Waste Hierarchy[174] are:

- Prevention - using less material in design and manufacture; keeping products for longer; re use; using less hazardous materials;
- Preparing for reuse - checking, cleaning, repairing, refurbishing, whole items or spare parts;
- Recycling - turning waste into a new substance or product; includes composting if it meets quality protocols;
- (other types of) Recovery - anaerobic digestion; incineration with energy recovery; gasification and pyrolysis which produce energy (fuels, heat and power); recovering materials from waste; some backfilling; and
- Disposal - landfill and incineration without energy recovery.

[174] Defra (2011) Guidance on the Waste Hierarchy

UK Legislation

15.2.7. The following legislations set out the principal requirements relevant to the control of the storage, collection, treatment and disposal of waste in England:

The Controlled Waste (England and Wales) Regulations 2012[175]*.*

15.2.8. The Regulations provide a definition of controlled waste and classifies waste as household, industrial or commercial waste. It allows Local Authorities to implement charges for the collection of waste from non-domestic properties.

The Waste (England and Wales) Regulations 2011[176]*.*

15.2.9. The legislative requirements of the EU Directive are transposed into UK law via these regulations. They stipulate the requirement for industry and businesses to implement the Waste Hierarchy.

Clean Neighbourhoods and Environment Act 2005[177]*.*

15.2.10. States that it is the responsibility of construction workers on site to guarantee that waste is disposed in the appropriate manner. In accordance with this, employees must undertake waste disposal activities as outlined in national law.

Hazardous Waste (England and Wales) Regulation's 2005[178]*.*

15.2.11. Introduce measures to control the storage, transport and disposal of hazardous waste. It provides a means to ensure that hazardous waste and any associated risks are appropriately managed.

Waste Minimisation Act 1998[179]*.*

15.2.12. Enables Local Authorities to take the appropriate steps to reduce and minimise the generation of household, commercial or industrial waste within their area.

Environmental Protection Act 1990[180]*.*

15.2.13. Outlines the requirement of the manager of a development to ensure that any excess materials or waste as a result of construction activities are recovered or disposed of without any subsequent adverse effects upon the surrounding environment.

The Control of Pollution Act 1974[181]*.*

15.2.14. Makes provisions with respect to the generation and revision of 'waste disposal plans' and prohibits the unlicensed disposal of waste.

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[175] HM Government (2012) The Controlled Waste (England and Wales) Regulations 2012
[176] HM Government (2011) The Waste (England and Wales) Regulations 2011
[177] HM Government (2005) The Clean Neighbourhoods and Environment Act 2005
[178] HM Government (2005) Hazardous Waste (England and Wales) Regulations 2005
[179] HM Government (1998) Waste Minimisation Act 1998

[180] HM Government (1990) The Environmental Protection Act 1990
[181] HM Government (1974) The Control of Pollution Act 1974

NATIONAL POLICY

15.2.15. The following policy documents set out the vision, goals and ambitions for waste in England.

The NPS for National Networks (NPS NN)

15.2.16. NPS NN re-iterates the waste hierarchy as a method of achieving sustainable waste management. It also states that an applicant should provide "*Evidence of appropriate mitigation measures (incorporating …. use of materials) in both design and construction….*"

National Policy Statement for Ports (NPSP)

15.2.17. NPSP also mentions the use of the waste hierarchy in order to attain sustainable waste management as well as providing information on dredging and disposal of waste at sea.

Waste Management Plan for England, 2013[182].

15.2.18. The Waste Management Plan for England provides a detailed analysis of the present state of waste management at a national level, and assesses how the objectives of the Waste Framework Directive will be effectively supported. It states that excavation, construction and demolition waste is the largest contributor to total waste generation in the UK (Waste Management Plan for England, 2013).

15.2.19. The Waste Management Plan for England also outlines the waste hierarchy, which gives top priority to waste prevention, followed by preparing for reuse, the recycling, other types of recovery and finally disposal (e.g. landfill).

National Planning Policy for Waste, 2014[183].

15.2.20. The National Planning Policy for Waste outlines the ambition to promote a sustainable approach to resource use and management. It sets out waste planning policies, and should be read alongside: the recently revised National Planning Policy Framework; the National Waste Management Plan for England and any relevant successor policies, guidance or documents. Policies include:

- Delivery of sustainable development and resource efficiency, including provision of modern infrastructure, local employment opportunities and wider climate change benefits, by driving waste management up the waste hierarchy;
- Ensuring that waste management is considered alongside other spatial planning concerns, such as housing and transport, recognising the positive contribution that waste management can make to the development of sustainable communities;
- Helping to secure the reuse, recovery or disposal of waste without endangering human health and without harming the environment; and
- Ensuring the design and layout of new residential and commercial development and other infrastructure (such as safe and reliable transport links) complements sustainable waste management, including the provision of appropriate storage and segregation facilities to facilitate high quality collections of waste.

15.2.21. The National Planning Policy for Waste also states that when determining planning applications for non-waste development, local planning authorities should, to the extent appropriate to their responsibilities, ensure that:

[182] Defra (2013) Waste Management Plan for England
[183] DCLG (2014) National Planning Policy for Waste

- The likely impact of proposed, non-waste related development on existing waste management facilities is acceptable and does not prejudice the implementation of the waste hierarchy and/or the efficient operation of such facilities;

- New, non-waste development makes sufficient provision for waste management and promotes good design to secure the integration of waste management facilities with the rest of the development and, in less developed areas, with the local landscape; and

- The handling of waste arising from the construction and operation of development maximises reuse/recovery opportunities, and minimises off-site disposal.

National Policy Statement for Hazardous Waste 2013[184].

15.2.22. This policy statement outlines the main objectives on Government Policy for hazardous waste, including:

- To protect human health and the environment: there are stringent legislative controls in place to control the management of waste with hazardous properties;

- Implementation of the waste hierarchy: This aids the production of less hazardous waste, promoting its reuse as a resource (where possible). Disposal of the waste is noted as a last resort;

- Self-sufficiency and proximity: This ensures that sufficient disposal facilities are provided across country to match expected arisings of all hazardous wastes, except those produced in very small quantities, and to enable hazardous waste to be disposed of in one of the nearest appropriate installations; and

- Climate change: To minimise greenhouse gas emissions and maximise opportunities for climate change adaptation and resilience.

15.2.23. The policy additionally outlines the key principles for the management of hazardous waste, as follows:

- Principle 1: Hazardous waste should be managed as to provide the best possible environmental outcome. This is expected to be in line with the waste hierarchy, with the exception of when life cycle analysis suggests that the best overall environmental option would require a departure from that hierarchy.

- Principle 2: Requires a reduction in reliance upon landfill, with landfill only being used where there is no alternative recovery or disposal option available.

- Principle 3: This principle requires that hazardous waste is not mixed with different categories of hazardous waste or with other waste substances or materials (although co-disposal of some wastes in landfill is allowed).

- Principle 4: Stipulates that organic hazardous wastes that cannot be reused, recycled or recovered should be subject to destruction using best available techniques, with energy recovery for all appropriate treatments. No hazardous organic waste should be landfilled unless the requirements of the Landfill Directive are met.

- Principle 5: The practice of relying on higher Landfill Directive waste acceptance criteria to enable some hazardous waste to continue to be landfilled must end.

[184] Defra (2013) National Policy Statement for Hazardous Waste

LOCAL POLICY

15.2.24. The Norfolk Mineral and Waste Local Development Framework[185] is published by NCC within the Core Strategy and Waste Management Policies Development Plan Document (DPD) 2010-2026 and adopted in September 2011. The strategy document is central to NCCl's Development Plan and contains the Minerals and Waste Policies. The purpose of the Minerals and Waste Development Framework is to plan for mineral extraction and associated development and waste management facilities in the most sustainable way that minimises adverse impacts on amenity and the environment. The principal aims of the Minerals Policy (CS1 & CS2) are to:

- Manage and safeguard mineral resources to meet current and future needs through the development of Mineral Safeguarding Areas. This includes protecting minerals of economic importance from unnecessary sterilisation by non-mineral development, and considering the feasibility of mineral extraction proper to non-mineral development (subject to certain assessment criteria).
- Assess proposals for non-energy mineral extraction both individually and cumulatively in terms of their contribution to national and regional guidelines and social, environmental and economic impacts.
- Impose high standards of restoration and aftercare to worked land to ensure it is returned to the most appropriate and beneficial use.

15.2.25. The principal aims of the Waste Policy (CS3 – CS16) are to encourage action in the highest tiers of the Waste Hierarchy. This will be achieved through:

- Assessing proposals for waste management facilities in regard to location criteria, such as achieving on-site waste management, expansion of existing facilities, co-location of waste facilities, situated within employment areas and using previously developed land.
- Ensuring the development would not have an adverse impact on the environment and human health.
- Only permitting development that would result in the loss of a waste management facility where it can be demonstrated that there is no longer a need for that facility, or the capacity can be met elsewhere.

GUIDANCE

15.2.26. IAN 153/11 Guidance on the Environmental Assessment of Material Resources[186] provides guidance for the assessment of the impacts and effects associated with the use of materials in new construction, improvement and maintenance projects. The document outlines the consideration of material resource use and waste as part of an EIA process. The document provides a definition of materials resources:

15.2.27. *"The materials and construction products required for the construction, improvement and maintenance of the road network. Materials resources include primary raw materials such as aggregates and minerals, and manufactured construction products. Many material resources will originate off site, purchased as construction products, and some will arise on site such as excavated soils or recycled road planings".*

[185] Core Strategy and Minerals and Waste Development Management Policies Development Plan Document 2010-2026 (adopted September 2011)
[186] Highways England (2011) IAN 153/11 Environmental Assessment of Materials & Resources

15.3 ASSESSMENT METHODOLOGY

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

15.3.2. As the proposed works comprise demolition works, highway alterations and the generation of a new river crossing with associated infrastructure, the Proposed Scheme is classed as a ‘large local major scheme’; this aligns with the IAN153/11 guidance definition of 'complex improvement and large new construction works'. In accordance with the requirements for complex works set out in the guidance, a detailed assessment of material resources shall be undertaken.

15.3.3. The consumption of material resources and production / disposal of waste beyond the first year of Proposed Scheme operation has been scoped out, because forecasts anticipate negligible impacts and effects. This scoping method has been agreed by the Planning Inspectorate in their Scoping Opinion dated May 2018, Case Reference TR010043.

15.3.4. As part of the EIA, the following tasks will be carried out:

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

15.3.5. The ES will take into account the nature of impacts (adverse/beneficial, permanent/temporary, direct/indirect) from material resources and waste. Significance of effects will be determined using Table 2.4 in DMRB Volume 11 Section 2 Part 5 HA 205/08[187], whilst also taking into account the requirements of the national and local policy documents.

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

- Resources (including site arisings) and waste; and
- The measures which will be implemented to eliminate or mitigate impacts, and to fulfil resource efficiency and circular economy opportunities.

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

15.4 BASELINE ENVIRONMENT

15.4.1. The following sections describe baseline material consumption and waste disposal for these current assets, and provide a regional / national information and data in the context of which subsequent environmental impact assessment will be undertaken.

MATERIAL RESOURCES

Materials Currently Required:

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

15.4.3. The current consumption of construction and other material resources within the Proposed Scheme boundary is, however, deemed negligible.

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

UK and regional perspective: availability of construction materials

15.4.5. Table 15.1 provides a summary of the availability of the main construction materials in the East of England and the UK, as required to deliver typical highways and bridge schemes. The overview provides a context in which the assessment of impacts and significant effects from material consumption on the Proposed Scheme can be undertaken.

Table 15.1: Construction materials available in the East of England and the UK

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

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

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

SITE ARISINGS

Site Arisings Currently Generated

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

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

National and Regional Perspective: Transfer, Recovery and Recycling

15.4.10. Defra data (Table 15.2) shows that within England, the recovery rate for non-hazardous construction and demolition arisings has remained above 90% since 2010. This exceeds the EU target of 70%, which the UK must meet by 2020.

15.4.11. Defra confirmed that it does not publish construction, demolition and excavation figures at a regional level, and only national (England) data are accessible through the publicly available Waste Data Interrogator Database; the database is held and operated by the Environment Agency. It was quoted that:

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

15.4.13. Until such a time that construction, demolition and excavation generation and recovery rates by region are made available by Defra, transfer (non-civic), recovery and metal recycling data (available through the Waste Data Interrogator Database) will be used as the closest possible proxy.

Table 15.2: Non-hazardous construction and demolition arisings and recovery in England

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

15.4.14. Figure 15.2 shows that rates of material transfer (non-civic), recovery and metal recycling within the East of England continue to rise steadily. Since 2011, rates for material recovery have increased notably. Data provided include all waste types in the region and hence will include, but are not specific to, construction, demolition and excavation arisings.

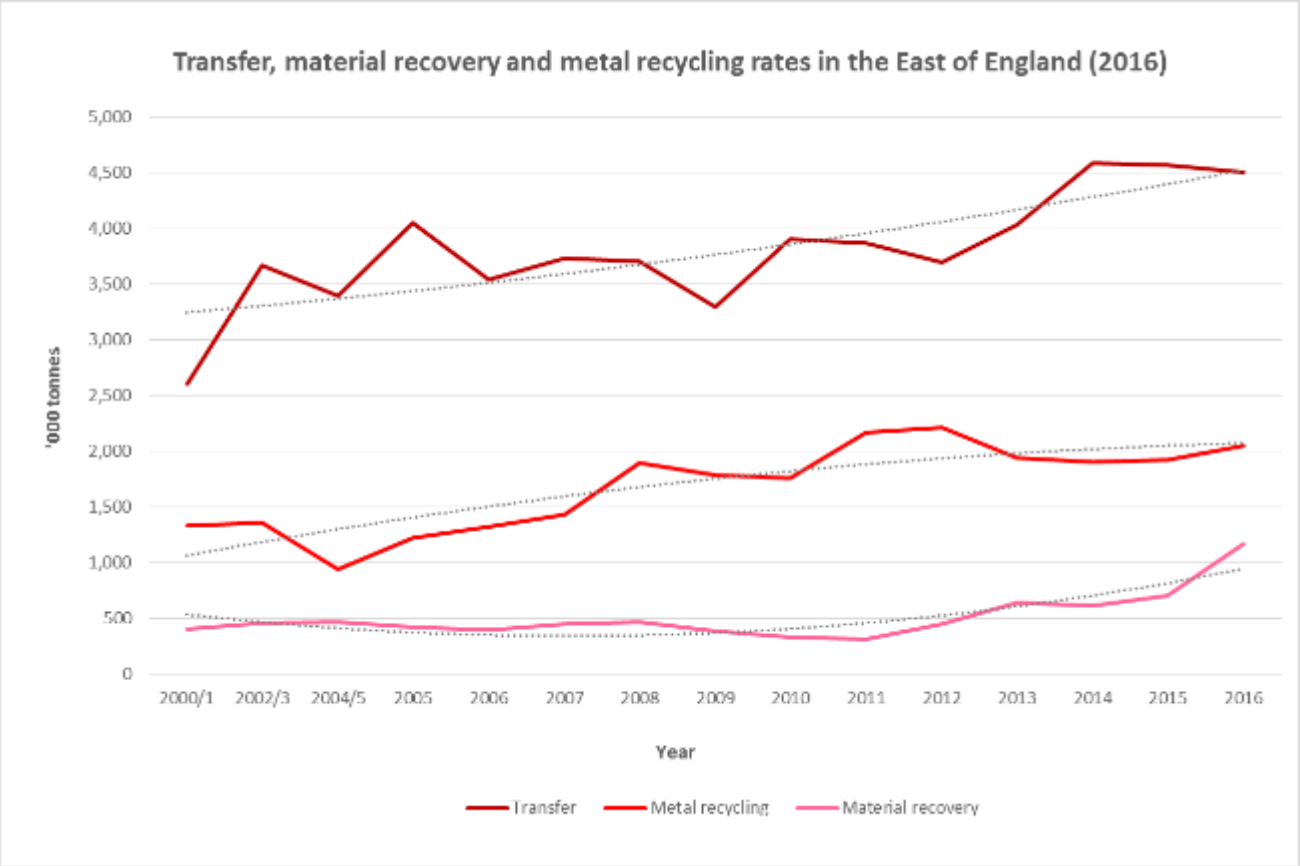


Figure 15.2 – Transfer, material recovery and metal recycling in the East of England

15.4.15. Available data demonstrate that the upward trends for transfer, recovery and metal recycling within the East of England remain consistent. Data indicate that there is likely to be regional infrastructure and capacity for the transfer and recovery for construction, demolition and excavation arisings from the Proposed Scheme. Construction and demolition recovery trends across England (Table 15.3) demonstrate further capacity in this context.

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

WASTE GENERATION AND DISPOSAL

Waste currently generated and disposed of

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

Regional perspective: remaining landfill capacity

15.4.18. At the end of 2016, the East of England had 45 active landfill sites with 58.2Mm^3 of remaining capacity. Table 15.3 summarises the Environment Agency data relating to these landfill types.

Table 15.3 - Landfill capacity in the East of England (2016)

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

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

15.4.20. Using the most up to date information available, trends for baseline regional landfill capacity are detailed in Figure 15.3 overleaf.

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

15.4.22. Simple forecasting calculations (using the MS Excel forecast function) shows that non-hazardous landfill capacity may (in the absence of future provision) decrease as much as 49% by 2023 (the first year of scheme operation). Forecasting for inert and total landfill capacity trends has not been undertaken due to the recent increase in landfill capacity.

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

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

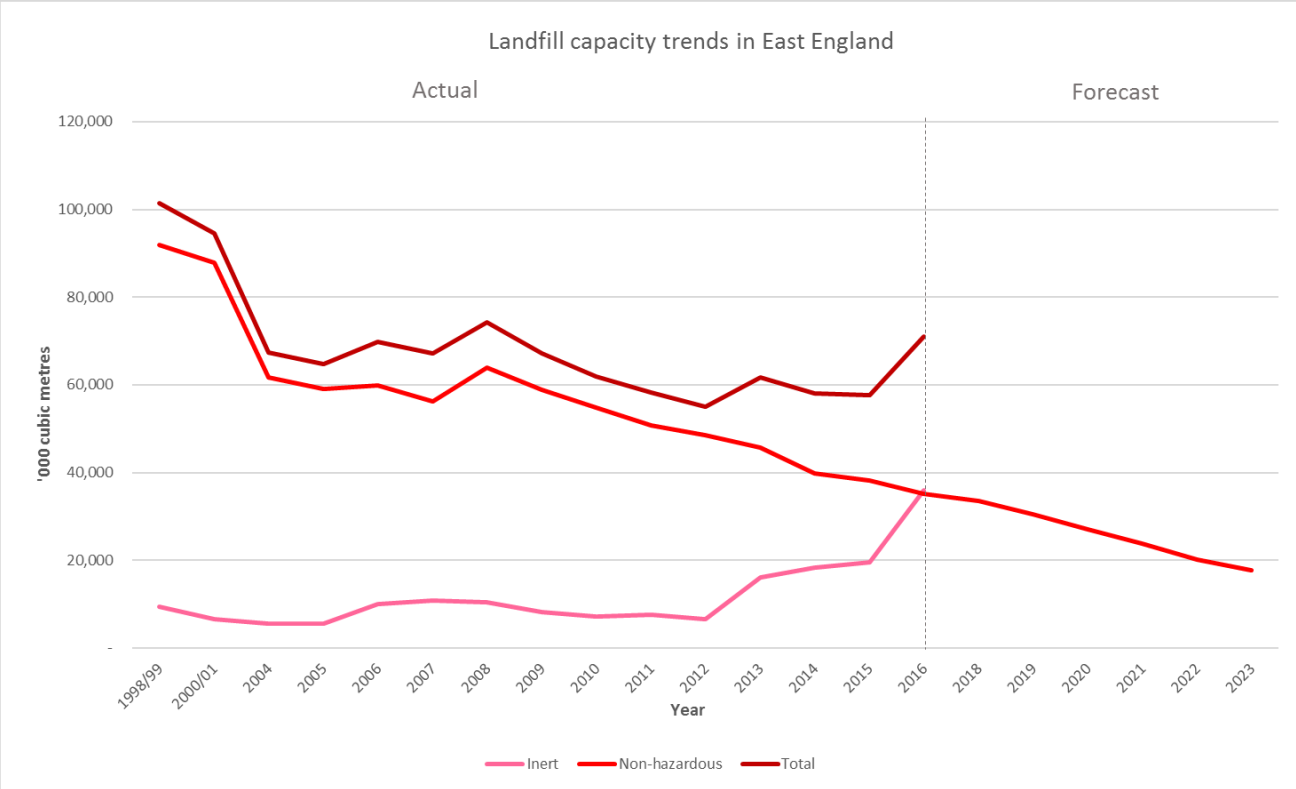


Figure 15.3 - East of England Remaining Landfill Capacity (2000/1-2016) and Non-hazardous Landfill Capacity Forecast (2023)

15.5 PREDICTED EFFECTS

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

15.5.2. The associated potential environmental impacts (both direct and indirect) will occur during these lifecycle phases. Impacts arising further into the operational lifecycle are expected to be negligible, and hence (as described in Table 15.4) have been scoped out of this assessment.

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

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

15.5.5. In response to the requirements set out in IAN 153/11 (paragraph 3.2.1 of the guidance), a summary of the potential for material resource consumption and waste generation and disposal to generate significant environmental effects, is provided in Table 15.4. Where appropriate, the potential influence of recovering and reusing/recycling site arisings is also included within Table 15.4 - Potential impacts and significant effects of consuming material resources and disposing of waste.

Table 15.4 - Potential impacts and significant effects of consuming material resources and disposing of waste

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

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

Element	Use of materials resources	Production and disposal of waste
	▪ Bulk materials for earthworks and landscaping (volumes will be dependent on the cut and fill balance); ▪ Road and pedestrian paving and kerbing materials, including sub-base and bituminous materials; ▪ Steel for bridge structures and sheet piling; ▪ Concrete including for pre-cast and prefabricated elements, especially for the new embankments, retaining walls, bridge structure and drainage arrangements; ▪ Bricks, sand and aggregate; ▪ Timber and steel for fencing and formwork; ▪ New street furniture, signage and lighting; ▪ Cabling; ▪ Specialist mechanical and engineering (M&E) components / technologies; and ▪ Other general construction materials. ▪ The volumes of material resources required for the Proposed Scheme will be ascertained during environmental impact assessment. Volumes of bulk earthworks, road paving, steel, concrete and aggregate are expected to be significant. The main impacts as a result of the use of materials are the consumption of natural resources. Impacts would be considered adverse, direct and permanent, and would result in the following effects: ▪ depletion of natural resources and local / regional stocks; and ▪ degradation of the natural environment. ▪ Based on the scale and nature of the works it is anticipated that the consumption of material resources has the potential to have significant adverse effects.	▪ Concrete, bricks, aggregate and steel waste; ▪ Road paving materials including sub-base and bituminous materials; ▪ Hazardous or contaminated material found or generated on site; ▪ Surplus cabling; ▪ Redundant street furniture, signage and lighting; ▪ General construction waste e.g. packaging, ducting, damaged goods. ▪ The volumes of waste likely to be generated and disposed of as result of the Proposed Scheme will be identified and assessed during environmental impact assessment. ▪ Impacts as a result of waste generation would be adverse and direct, and are generally accepted to be permanent in nature. The resultant adverse effects would be a reduction in landfill void capacity, and any indirect effects that result (greenhouse gas emissions, water consumption, water pollution – among others). ▪ It is expected that a programme commitment to reuse or recycle site arisings will be established – making use of these resources either within, or outside, the Proposed Scheme boundary. Where this is not possible, disposal is likely to be required. ▪ Based on the scale and nature of the works, it is anticipated that there is potential for significance adverse effects from the generation and disposal of waste.

Element	Use of materials resources	Production and disposal of waste
Operation and maintenance of asset	In the first year of operation, minor amendments and changes to the Proposed Scheme assets may be required. Depending on the extent of these changes, the potential to consume material resources (including recovered site arisings), and produce and dispose of waste may be required. The extent of changes within the first year of operation are unlikely to have significant effects. Similarly, and beyond the first year of operation, it is predicted that there will no significant effects. These elements have therefore been scoped out of the assessment, as agreed in the Planning Inspectorate Scoping Opinion dated May 2018, Case Reference TR010043.	

15.6 PROPOSED MITIGATION

15.6.1. Specific design, mitigation and enhancement measures to avoid and mitigate adverse impacts from materials consumption and the generation and disposal of waste, and to encourage beneficial outcomes from the recovery and reuse of site arisings, may include those set out in Table 15.5 - Potential design, mitigation and enhancement measures

Table 15.5 - Potential design, mitigation and enhancement measures

Element	Enhancement and mitigation measures	Application lifecycle stage	Monitoring
Material resources	Identification and specification of materials that can be acquired responsibly, in accordance with BES 6001 Responsible Sourcing of Construction Products.[188]	Design, construction	Incorporate on engineering plans configurations and layouts that show how the most effective use of materials can be achieved. Maintain records of materials that were acquired in accordance with BES 6001 Responsible Sourcing of Construction Products.
	Design for resource optimisation: simplifying layout and form, using standard sizes, balancing cut and fill, maximising the use of renewable materials, and materials with recycled or secondary content, and setting net importation as a Proposed Scheme goal.	Design	
	Design for off-site construction: maximising the use of pre-fabricated structures and components, encouraging a process of assembly rather than construction	Design	
	Design for the future: considering how materials can be designed to be more easily adapted over an asset lifetime, and how deconstructability and demountability of elements can be maximised decommissioning/ at end-of-first-life.	Design	
Site arisings	Design for recovery and reuse: identifying, securing and using materials at their highest value, whether they already exist on site, or are sourced from other schemes.	Design	Incorporate on engineering plans configurations and layouts that show how the

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

Element	Enhancement and mitigation measures	Application lifecycle stage	Monitoring
	Identify opportunities to minimise the export and import of materials.	Design, construction	most effective use of site arisings can be achieved. Implement a regime of comparing and contrasting data on site arisings in a Design Site Waste Management Plan (forecast), with construction data (actuals)
	Working to a proximity principle, ensuring arisings generated are handled, stored, managed and re-used or recycled as close as possible to the point of origin.	Design, construction	
	Identify areas for stockpiling and storing arisings that will minimise quality degradation and leachate, and will minimise damage and loss.	Design, construction	
	Ensure potential arisings and waste are properly characterised before or during design, to maximise the potential for highest value reuse.	Design	
	Capture information and data on site arisings recovered and diverted from landfill, by developing a Design Site Waste Management Plan once a preferred option has been selected.	Design	
	Implement a Materials Management Plan in accordance with the CL:AIRE 189 Definition of Waste: Code of Practice.	Construction	
Waste to landfill	Engage early with contractors to identify possible enhancement and mitigation measures, and to identify opportunities to reduce waste through collaboration and regional synergies.	Design, Procurement	Implement a regime of comparing and contrasting data on waste in a Design Site Waste Management Plan (forecast), with construction data (actuals) Ensure all legal documentation (waste carrier registration, landfill licence, waste transfer documentation) associated with the management of construction and operational materials, site arisings and waste is recorded and retained.
	Capture information and data on waste sent to landfill, by developing a Design Site Waste Management Plan once a preferred option has been selected.	Design	

[189] CL:AIRE is the acronym for 'Contaminated Land: Applications in Real Environments'

15.7 CONCLUSIONS AND EFFECTS

15.7.1. It is anticipated that, with the implementation of effective mitigation measures, including designing out waste, and implementing a Construction Environmental Management Plan (CEMP) including a Site Waste Management Plan (SWMP) and Materials Management Plan (MMP) on site, that there would be no significant residual effects associated with material resources. This assertion will be tested fully as part of the Proposed Scheme environmental impact assessment.

15.7.2. The consumption of construction materials is likely to have an adverse impact on the regional and national market resources. Primary materials required for the Proposed Scheme are a finite resource and whilst they are generally available through local and regional supply, some national or wider sourcing may be required.

15.7.3. It has not been possible to quantify the amount of materials needed for the Proposed Scheme as the design is not yet been finalised.

15.7.4. During demolition, site remediation and preparation, and construction, it is expected that a proportion of the waste generated will be suitable for recovery (processing / reuse / recycling) at an off-site facility, in line with Norfolk Waste Strategies. Excavated and other materials that comply with an appropriate waste exemption, or reuse criteria set out in the CL:AIRE Definition of Waste Code of Practice[190] are expected to be reused on the scheme.

15.7.5. Any waste which cannot be diverted from landfill is likely to have an adverse impact on (the reducing) landfill capacity in the region.

15.7.6. During the first year of operation and beyond, minor amendments, changes and maintenance of the Proposed Scheme assets may be required.

15.8 ASSESSMENTS STILL TO BE COMPLETED

15.8.1. Due to the absence of robust material resource information at this stage of the design, a detailed assessment of material resources will be undertaken and reported in the ES.

[190] CL:AIRE Definition of Waste - Development Industry Code of Practice [link]

16

GEOLOGY AND SOILS

16 GEOLOGY AND SOILS

16.1 INTRODUCTION

16.1.1. This chapter describes the preliminary assessment of the likely significant effects of the Proposed Scheme on geology, soils and contamination during the construction and operational phases of the Proposed Scheme. It is supported by a Contaminated Land Desk Study, which is presented in Appendix 16A.

16.1.2. The assessment of this topic area considers potential impacts relating to the following aspects:

- The potential for disturbance of existing contaminated land (including river sediments);
- The potential that construction could establish pathways between pollutants and receptors;
- Effects on users/adjacent users of the Proposed Scheme;
- Effects on buried infrastructure (including buried services and foundations);
- Effects on controlled waters (from the mobilisation of contaminants). The water environment is specifically dealt with in Chapter 11 Road Drainage and the Water Environment.

16.1.3. The impact on ecological receptors are assessed in Chapter 8: Nature Conservation and sediment modelling is addressed in Chapter 12: Flood Risk. The comments received through the Scoping Opinion have been addressed in this chapter.

STUDY AREA

16.1.4. The study area for this PEIR is the Proposed Scheme Boundary presented in Figure 2.3. It is anticipated that any impacts to geology and soils are not likely to extend beyond this boundary.

16.1.5. The study area covers an area of approximately 43ha, centred at National Grid Reference 652320, 306005.

LIMITATIONS

16.1.6. This chapter of the PEIR provides preliminary information as it relates to the Proposed Scheme to date and to data currently available and gathered at this point of the assessment processes.

16.1.7. The information contained herein is intended to inform consultation responses at this stage. A more detailed assessment of potential impacts as a result of the Proposed Scheme on individual sensitive receptors will be undertaken at subsequent stages to inform the ES.

16.1.8. Any gaps in information identified at this PEIR stage will be considered and addressed along with specific mitigation measures as part of the assessments for the production of the ES.

16.2 DIRECTIVES, STATUTES AND RELEVANT POLICES

16.2.1. The assessment has been undertaken in accordance with and in reference to legislation specific to geology, hydrogeology and human health as follows:

NATIONAL LEGISLATION

- The Environmental Protection Act 1990;
- Water Resources Act 2003; and
- Water Act 2003.

NATIONAL POLICY

- National Planning Policy Framework 2018[56]; and
- National Policy Statement for National Networks 2015.
- National Policy Statement for Ports 2012

16.2.2. Further information on these is provided in Table 16.1 - Relevant Legislation to the Assessment of Geology and Soils:

Table 16.1 - Relevant Legislation to the Assessment of Geology and Soils

Legislation	Summary
The Environmental Protection Act 1990	The Environmental Protection Act 1990 defines, within England, Wales and Scotland, the fundamental structure and authority for waste management and control of emissions into the environment. The Act was intended to strengthen pollution controls and support enforcement with heavier penalties. Part 2A of the Environmental Protection Act 1990 was inserted into that Act by section 57 of the Environment Act 1995 and contains a regulatory regime for the identification and remediation of contaminated land. In addition to the requirements contained in the primary legislation, operation of the regime is subject to regulations and statutory guidance. The main objective underlying the introduction of the Part 2A contaminated land regime was to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment, assessed in the context of the current use and circumstances of the land. It provides a means of identifying and remediating land that poses a significant risk to health or environment, where there is no alternative solution. It also works alongside planning rules to help ensure that this land is made suitable for use following development. Development of land will have to take into account Part 2A because a change in the use of the land may bring the development inside the statutory definition of contaminated land by creating a pollutant linkage.
Water Resources Act 2003	The Water Resources Act 1991 replaced the corresponding sections of the Water Act 1989. The Act sets out the responsibilities of the Environment Agency in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The Act regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwaters. To prevent pollution of controlled waters, planning policies and decisions should ensure that new development is appropriate for its location. The risks at site need to be adequately characterised. The Water Resources Act 2003 amends the Water Resources Act 1991 to improve long-term water resource management by: ■ creating two new forms of abstraction licence – the transfer licence and the temporary licence; ■ widening the control over impoundments so that licences are required for the whole duration of impoundment works; ■ replacing licensing exemptions based on water use with a new exemption threshold of less than 20 cubic metres of water per day; ■ ending the current exemption for irrigation (other than spray irrigation) and dewatering from the abstraction licensing regime; ■ requiring all new abstraction licences to be time-limited;

Legislation	Summary
	▪ empowering the Environment Agency to revoke or vary an abstraction licence without compensation if it has not been used for four years; and ▪ removing the entitlement to compensation if the SoS (or the Assembly) directs that a licence without a time limit should be curtailed, on or after 15 July 2012, on the grounds of serious environmental damage.
Water Act 2003	Under the Water Act it is an offence to cause or knowingly permit a discharge of poisonous, noxious or polluting matter into any Controlled Waters without the proper authority.
National Planning Policy Framework 2018	NPPF (paragraphs 178--183) provides guidance on land contamination issues. These include local policies and decisions that ensure development sites are suitable for use, taking account of ground conditions and pollution arising from previous uses, as well as any proposals for land remediation. Paragraph 180 of the NPPF states that: *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".*
National Policy Statement for National Networks 2015	NPS NN provides some guidance on assessing geology, soils and contamination in relation to biodiversity and ecological conservation, coastal change, noise and vibration, water quality and resources, land use and sets out how the impacts should be considered.
National Policy Statement for Ports (2012)	PNPS, in Paragraph 5.13.8, likewise advises that developments on "*previously developed land……should ensure that they have considered the risk posed by land contamination*".

16.3 ASSESSMENT METHODOLOGY

16.3.1. An Environmental Desk Based Study (Appendix 16A) has been prepared, using information from historical Ordnance Survey maps, environmental data reports, together with published and internet based information sources.

16.3.2. An understanding of the likely existing environmental setting in terms of geology, soils and contamination has been established with reference to the following sources of information:

- British Geological Survey[191];
- Environment Agency[192]; and
- Historical Ordnance Survey maps and environmental data reports obtained from GroundSure.

[191] www.bgs.ac.uk
[192] https://www.gov.uk/government/organisations/environment-agency

16.3.3. The assessment will be based upon the guidance presented in DMRB Volume 11 Section 3 Part 11 Geology and Soils[193] and be supplemented by the assessment procedures contained within BS10175:2011[194] and CLR11[195]. The assessment of significance will take into account the procedures contained within BS10175 and CLR11 as well as professional judgement.

GROUND INVESTIGATION

16.3.4. A land based ground investigation was completed in March 2018 and comprised:

- 25 onshore cable percussion boreholes;
- 9 window samples;
- 1 machine excavated trial pit;
- Soil sampling and associated chemical testing;
- Gas and groundwater monitoring wells constructed in selected boreholes; and
- Gas and groundwater monitoring.

16.3.5. A marine ground investigation is being undertaken and comprises;

- 10 marine cable percussion boreholes;
- Soil sampling and associated chemical testing;

16.3.6. An Interpretative Environmental Ground Investigation Report will be prepared and included with the ES. This will include a risk assessment of human health and controlled waters undertaken in accordance with:-

- CLR and SR (SC050021 series) (DEFRA) guidance as well as CL:AIRE guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008[196]; and
- Environment Agency Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination, 2006[197].

16.3.7. These two risk assessments will assess the potential contaminant linkages identified in the Contaminated Land Desk Study Report (presented in Appendix 16A) and will allow the development of an updated site conceptual model to clarify potential source-pathway-receptor linkages, and assist with the assessment of potential impacts on human health and controlled waters.

16.3.8. The Interpretative Environmental Ground Investigation Report will also include a waste assessment and material re-use assessment to determine likely waste disposal routes for excavated soils and to determine if excavated

[193] The Highways Agency et al, (1993), Design Manual for Roads and Bridges, Volume 11, Section 3, Part 11, Geology and Soils.
[194] British Standards Institution (2011). BS 10175:2011 Code of Practice for the Investigation of Contaminated Land.
[195] The Environment Agency (2004). Model Procedures for the Management of Land Contamination. Contaminated Land Report.
[196] The Chartered Institute of Environmental Health (2008). Guidance on Comparing Soil Contamination Data with Critical Concentration
[197] Environment Agency 2006. Remedial Targets methodology, Hydrogeological Risk Assessment for Land Contamination. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/314317/geho0706bleq-e-e.pdf

soils are suitable for re-use within the Proposed Scheme. Chapter 15: Materials provides further detail on the materials aspect of the Proposed Scheme.

16.3.9. Outline remedial measures will be reported if remediation is considered necessary and these measures will inform the mitigation assessment with the Environmental Statement.

SIGNIFICANCE CRITERIA

16.3.10. In terms of geological and geomorphological resources as well as contaminated land, DMRB does not provide any specific methods of assessment or scales of measurement for either the value / sensitivity of the receptor or the magnitude of the impact. Assessment will therefore be based on professional judgement, using a phased approach, taking into account the assessment procedures detailed in CLR11 to inform a quantitative risk assessment using the source-pathway-receptor protocol. Determination of significance will be carried out using the principals detailed in CIRIA C552[198] and professional judgement.

16.4 BASELINE ENVIRONMENT

Designated Sites

16.4.1. No geologically designated sites exist within 500m of the Proposed Scheme.

Bedrock Geology

16.4.2. As indicated on the British Geological Survey (BGS) website[199] the bedrock geology across the study area comprises sand and gravel of the Crag Group.

Superficial Geology

16.4.3. The BGS website indicates that the Application Site is underlain by the following 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; and
- Within the River Yare - Clay and silt tidal river or creek deposits.

Soils and Sediment

16.4.4. The Soilscapes website[200] indicates the soils at the Application Site comprise loamy and clayey soils of coastal flats with naturally high groundwater, freely draining slightly acid sandy soils and sand dune soils.

16.4.5. However, due to previous development across the Application Site, it is unlikely that significant amounts of naturally occurring soils are present and made ground is more likely to be prevalent in most areas.

16.4.6. The nature of onsite soils and sediments determined during the ground investigation is discussed in the Ground Investigation Information sub-section below.

[198] CIRIA (2001). Contaminated Land Risk Assessment. A Guide to Good Practice.
[199] www.bgs.ac.uk/geologyofbritain /home.html
[200] http://landis.org.uk

Potentially Contaminated Sites

16.4.7. The Interpretive Environmental Desk Study Report presented in Appendix 16A includes a review of information from a GroundSure report (reference CMAPS-CM-636391-16287-030717). This records that no locations within the study area are determined as contaminated land under Part 2A legislation, but does record a number of historical ground workings, as well as industrial uses; all of which may have introduced contaminated material onto the study area. On the eastern side of the study area, these included a gasworks, boat building yard, an icehouse, fish canning, oilskin production, chemical factory and unspecified depots, factories and warehouses. On the western side of the study area, historical industrial uses include an iron works, rope walk, gas works, malthouses, a railway, shoe factory and a printing works. A quayside / dock area was present on both sides of the river.

16.4.8. There are records relating to an historic Environment Agency landfill 450m to the west, an Environment Agency licensed waste site located onsite and eight records within 250m of the study area although both have multiple entries in the GroundSure report (see Appendix 16A).

Existing Ground Investigation / Remediation Information

16.4.9. Other than the ground investigations carried out by NCC and detailed below, no other ground investigation or remediation information has been provided to WSP for review.

Ground Investigation Information

16.4.10. A land based ground investigation was undertaken between September 2017 and March 2018 by Ground Technology Services for NCCl. A copy of the Interpretative Environmental Ground Investigation report will be provided as an Appendix to the Environmental Statement once the report has been completed.

16.4.11. Superficial and bedrock geology ground conditions encountered during the ground investigation were generally sand or sand and gravel with some clay, silt and peat layers – North Denes Formation overlying the Crag Formation. These strata were generally overlain by made ground of varying thickness although at a few locations at the western end of the study area, made ground was absent and thin topsoil was present overlying the superficial deposits.

16.4.12. Made ground was recorded at most locations and varied in thickness up to 11.6m (BH12B located on the east side of the River Yare, close to the quayside. Made ground was generally thickest close to the quayside and thinnest at the western and eastern ends of the study area. Made ground was absent from some of the window sample locations in the west of the Application Site where drilling occurred through landscaped areas.

16.4.13. From the Engineers logs provided by the Ground Investigation Contractor, the made ground appeared to be reworked natural soils with brick or concrete content. Other detritus including metal, glass, wood, slate, cloth, slag, ash and plastic was also recorded.

16.4.14. Olfactory evidence of contamination described as diesel fuel odour was recorded at 2.6 and 7.6m depth in BH14 located on the eastern side of the River Yare, close to the edge of the quayside. No other visual or olfactory evidence of contamination was recorded.

16.4.15. A marine ground investigation is currently being undertaken and the findings will also inform the Environmental Statement.

16.5 PREDICTED EFFECTS

16.5.1. At this stage, until the interpretation of the ground investigation chemical test data is complete it is not possible to assess the likely significance of the predicted effects.

Construction Impacts

16.5.2. This section assesses the potential effects, using the information that is available at the PEIR stage, of the construction phase on the receptors identified in the Environmental Desk Study (Appendix 16A) and on the underlying and surrounding geology and soils. Construction work is likely to cause adverse disturbance to the geology and soils and this includes potentially contaminated ground which could then impact upon identified receptors.

Geology and Soils

16.5.3. Contamination is anticipated to be site wide associated with the differing historic site uses and may be present either within natural soils or made ground. During construction, contaminants could be mobilised resulting in an adverse effect of cross contamination of uncontaminated ground or controlled waters. Controlled waters are discussed in Chapter 11: Road Drainage and the Water Environment.

Water Environment

16.5.4. Impacts to the water environment are discussed in detail in Chapter 11: Road Drainage and the Water Environment. The ground investigation reporting will include an assessment of the potential risks to the water environment from soil and water based contaminants.

Site Users and Adjacent Site Users including Construction Workers

16.5.5. Site users, adjacent site users and construction workers could be adversely impacted during construction through direct contact, ingestion and inhalation of contaminated soils and possibly also contaminated ground water.

On-Site Infrastructure

16.5.6. The works will include the construction of below ground structures that will interact with the geology and soils and potentially contaminated ground which has the potential to adversely impact the integrity of buried structures.

Operational Impacts

Geology and Soils

16.5.7. All necessary remediation will be undertaken during the construction phase. It is therefore considered that operation of the Proposed Scheme within the existing urban environment will not impact Geology and Soils or adversely affect the baseline environment.

Water Environment

16.5.8. Impacts to the water environment are discussed in detail in Chapter 11: Road Drainage and the Water Environment.

16.5.9. Remedial mitigation measures will have been completed during the construction phase. Therefore no additional soil or geology mitigation measures will be required as part of the operational phase of the Proposed Scheme.

Site Users and Adjacent Site Users including Construction Workers

16.5.10. In areas such as landscaping where humans could interact with the geology and soils, adverse operational impacts could arise through direct contact, ingestion or inhalation of contaminated soils.

On-Site Infrastructure

16.5.11. Onsite infrastructure could be adversely impacted through direct contact with geology, soils and contamination and onsite infrastructure could also impact geology and soils through the creation of new pathways for migration of contamination.

16.6 PROPOSED MITIGATION

Construction Impact Mitigation

16.6.1. This section summarises the proposed mitigation for the above predicted impacts, using the information that is available at the PEIR stage.

16.6.2. The Proposed Scheme will adhere to pollution prevention guidance and best practice during the construction works which will be incorporated into and managed via the full CEMP. A CoCP will be prepared for submission with the ES and subsequently a full CEMP will be prepared by the Contractor.

Geology and Soils

16.6.3. Good working practices and housekeeping during construction such as sealing or covering stockpiles of contaminated soils and treating water removed from excavations prior to discharge are considered likely to reduce the risks.

16.6.4. A piling risk assessment will be prepared once the findings of the ground investigation are known and will assess the potential risks to the Study Area and surrounding geology and soils from piling activities during construction.

Water Environment

16.6.5. Controlled waters are further discussed in Chapter 11: Road Drainage and the Water Environment.

16.6.6. Where contaminated soils / waters are identified as posing unacceptable risks to controlled waters, consideration will be given to remediation in those areas to minimise the risks.

16.6.7. As indicated in 16.6.2 above, the Proposed Scheme will adhere to pollution prevention guidance and best practice during the construction works which will be incorporated into and managed via the full CEMP.

16.6.8. Silt pollution caused by working within the River Yare will be minimised by keeping water out of the works area using appropriate isolation techniques, such as coffer dams, pile jackets, by-pass channels, silt curtains or the use of special excavation plant.

16.6.9. Water removed from any excavations will be disposed of in accordance with Environment Agency requirements.

16.6.10. During construction, any soil stockpiles will be located away from the quayside and River Yare and will be sealed and if necessary covered to minimise runoff during heavy rainfall.

16.6.11. A piling risk assessment will be prepared once the findings of the ground investigation are known and will assess the potential risks to the water environment from piling activities during construction.

Site Users and Adjacent Site Users including Construction Workers

16.6.12. Potential risks to construction workers during the construction phase will be managed through the CDM Regulations by the Contractor using developed Method Statements, Risk Assessments and the use of good construction practices. These practices will be included within the interim CEMP and will include:-

- Use of appropriate PPE for construction workers;
- Good hygiene practice including wearing gloves and washing hands before eating, drinking or smoking when working with potentially contaminated soils or water; and
- Damping down during periods of dry weather to reduce dust generation.

On Site Infrastructure

16.6.13. Assessment of the ground conditions during the ground investigation and at detailed design stage together with the implementation of appropriate remediation measures and design specifications such as clean inert trench fill and sulphate resistant concrete are likely to minimise the risk to onsite infrastructure.

Operational Impact Mitigation

Water Environment

16.6.14. Mitigation for the water environment is discussed in detail in Chapter 11: Road Drainage and the Water Environment.

16.6.15. A suitable drainage system will be incorporated into the Proposed Scheme to mitigate to acceptable levels the risk of contamination that could arise from traffic emissions entering the water environment.

Site Users and Adjacent Site Users including Construction Workers

16.6.16. Appropriate remedial measures, informed from the results of the ground investigation, will be undertaken where required in areas such as landscaping where humans could interact with the geology and soils. The remedial measures will be designed to break the contaminant linkage by treating or removing the contamination source or pathway thereby reducing the potential risks to receptors to appropriate levels.

On Site Infrastructure

16.6.17. The findings of the ground investigation will inform detailed structural bridge design and structures such as concrete foundations will be designed accordingly so that onsite infrastructure will not be impacted by the geology and soils during the operational phase. The findings of the ground investigation will also inform the detailed design of structures to ensure they do not impact geology and soils such as introducing new contamination pathways through piled foundations.

16.7 CONCLUSIONS AND EFFECTS

16.7.1. A preliminary assessment has been undertaken of the predicted impacts of the Proposed Scheme on the geology and soils, including potentially contaminated soils and the subsequent impacts on human health, controlled waters and the environment.

16.7.2. At the submission of this PEIR, only desk based assessments have been undertaken which have identified the potential for contamination to be present across the Application Site. If present, this contamination could be mobilised during and after construction, leading to potentially unacceptable impacts on geology and soils, controlled waters, human health and the environment.

16.7.3. Intrusive ground investigation undertaken between September 2017 and March 2018 and the marine ground investigation being undertaken have gathered information on the ground conditions and will allow a quantitative

assessment of the potential contamination risks to be undertaken and to identify likely remedial measures to be required.

16.7.4. Impacts upon human receptors are considered likely during the construction phase without appropriate mitigation and management of potential risks through the Construction (Design and Management) Regulations 2015, the development of Method Statements and Risk Assessments and the use of good construction practices.

16.7.5. On completion of the contamination risk assessments, the potential construction and operational impacts will be further assessed and appropriate mitigation developed to minimise the potential impacts. It is not considered at this time that residual significant effects upon geology, soils and contamination will occur.

16.8 ASSESSMENTS STILL TO BE COMPLETED

16.8.1. Following the completion of the land and marine based ground investigation works, an Interpretative Environmental Ground Investigation Report will be prepared and will include human health and controlled waters risk assessments. This will culminate in a revision of the preliminary conceptual site model presented in the Environmental Desk Study report (Appendix 16A). An assessment of the potential contaminant linkages that can be discounted and those that are considered to pose an unacceptable risk will be included.

16.8.2. Outline remedial measures for mitigation of any identified contamination risks will be included within the Interpretative Environmental Ground Investigation Report.

17

TRAFFIC AND TRANSPORT

17 TRAFFIC AND TRANSPORT

17.1 INTRODUCTION

17.1.1. This chapter of the PEIR describes the preliminary assessment of the likely significant effects of the Proposed Scheme with respect to traffic and transport. This includes a consideration of the effects of the re-distributed traffic associated with the Proposed Scheme, identifying areas where there are expected changes in traffic on the existing highway network during the weekday AM and PM peak hours.

17.1.2. This chapter also describes the methods used to assess the effects and the baseline conditions currently existing in the study area. It also identifies the studies and assessments that are yet to be undertaken which will be presented in the ES. This chapter is supported by figures 17.1 and 17.2 and the Preliminary Transport Assessment which is included in Appendix 17A.

17.1.3. This chapter incorporates an assessment of the Effects on All Travellers, as set out in Chapter 11 of DMRB and considers the impacts of the Proposed Scheme against the following criteria, in accordance with IEMA and DMRB Guidelines:

- Effects on Public Transport Users;
- Driver delay;
- Pedestrian and cyclist amenity, journey times and delay;
- Collisions and safety;
- Fear and intimidation; and
- Hazardous Loads.

STUDY AREA

17.1.4. The study area has been informed by those junctions where traffic is expected to change significantly. This could be by way of an increase in traffic flow, decrease in traffic flow, or changes to the direction of flow of traffic. The study area is shown on Figure 17.1.

LIMITATIONS

17.1.5. This chapter of the PEIR provides preliminary information as it relates to the Proposed Scheme and data currently available and collated at this point of the assessment process. The information contained herein is intended to inform consultation responses at this stage. A more detailed assessment of potential impacts as a result of the Proposed Scheme on identified sensitive receptors will be undertaken at subsequent stages to inform the ES.

17.1.6. Any gaps in information identified at this PEIR stage will be considered and addressed along with specific mitigation measures as part of the assessments for the production of the ES.

17.2 DIRECTIVES, STATUTES AND RELEVANT POLICES

17.2.1. The following legislation and planning policy will inform the ES.

LEGISLATION

Countryside and Rights of Way Act (2000)

17.2.2. The CRoW Act (2000) amongst other ecological matters provides for public access on foot to certain types of land and amends the law relating to public rights of way (PRoW).

The Wildlife and Countryside Act (1980)

17.2.3. Part III of the Wildlife and Countryside Act 1980 requires Local Authorities to produce a Definitive Map showing all PRoW within their jurisdiction. The map has been used to identify PRoW within the study area to be considered within the assessment.

The Highways Act (1980)

17.2.4. The Highways Act 1980 gives Highway Authorities powers (subject to exceptions and controls) to divert or stop up public footpaths or bridleways.

The Road Traffic Regulation Act (1984)

17.2.5. Confers broad powers on Traffic Authorities to prohibit or restrict traffic (including pedestrians) on highways and other roads to which the public has access.

PLANNING POLICY

National Planning Policy Framework (July 2018)[56]

17.2.6. The revised NPPF states that the planning system should help to shape places in ways that contribute to radical reductions in greenhouse gas emissions (paragraph 148). The Proposed Scheme has a primary aim of reducing congestion, and will thereby support reduced greenhouse gases and pollutants.

17.2.7. With particular reference to transport, paragraph 111 of the NPPF states that:

"All developments that will generate significant amounts of movement should be required to provide a travel plan, and the application should be supported by a transport statement or transport assessment so that the likely impacts of the proposal can be assessed".

17.2.8. Whilst the Proposed Scheme is not 'development' which itself generates trips, it will cause traffic reassignment around the town which requires assessment.

National Policy Statement for National Networks

17.2.9. The NPS NN, January 2015, sets out the need for the development of NSIPs on the national road networks in England and the Government's policies to deliver these. The NPS works to complement the overall strategic aims of the NPPF.

17.2.10. The Government, therefore, sets out its vision and strategic objectives for the national road network in the NPS, which are as follows:

"The Government will deliver national networks that meet the country's long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:

- *Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs;*
- *Networks which support and improve journey quality, reliability and safety;*
- *Networks which support the delivery of environmental goals and the move to a low carbon economy; and*
- *Networks which join up our communities and link effectively to each other*".

17.2.11. The NPS highlights the need for development of the national road network and delivers the above aims in the context of Government policy for economic performance, environment, safety, technology, sustainable transport,

accessibility and journey reliability. The national road network connects towns, cities and regions and there is a critical need to address congestion issues to provide safe and resilient networks. The pressure on this network is predicted to increase as the long-term drivers for demand to travel, GDP and population, are also forecast to increase.

The National Infrastructure Plan[201]

17.2.12. The National Infrastructure Plan (NIP) was published in 2014 and is based on the principle that high quality infrastructure boosts productivity and competitiveness, allowing businesses to grow and enabling them to reach suppliers, deepen labour and product markets, collaborate and innovate, and attract inward investment.

17.2.13. Hence, the NIP recognises the role of Government in funding improvements to the Strategic Road Network (SRN) and aims to transform the nation's road network over the next 25 years. Furthermore, local roads which are not a component of the SRN, are also crucial to the successful operation of the transport system. Local authorities are responsible for managing, maintaining and improving the overall local road network. The Government provides financial support for road maintenance and renewal schemes, and supports investment in new local transport schemes through Growth Deals, allocating Local Growth Fund through Local Enterprise Partnerships.

17.2.14. This support was fulfilled in Autumn 2017, when the Chancellor, pledged £98m of funding towards the construction of the Proposed Scheme

17.3 ASSESSMENT METHODOLOGY

17.3.1. A Transport Assessment (TA) will be prepared to assess the impact of the Proposed Scheme on the capacity of highway infrastructure. This will be scoped with NCC (as Highway Authority) and key stakeholders, and submitted in support of the DCO. The ES will summarise the findings of the TA and will focus on likely significant environmental effects upon the local community during construction and operation of the Proposed Scheme, such as severance, driver delay or an increased collision rate. The ES will:

- Address changes to local traffic flows during the construction phase and once the Proposed Scheme is completed and operational;
- Address potential disruption to local pedestrians, cyclists and road vehicle users during the construction phase; and
- Provide information on transport conditions both before and after the Proposed Scheme is built, including changes in relative accessibility of the local area by foot, bicycle, and public transport.

17.3.2. DMRB Volume 11 Section 3 Part 8[153] provides additional guidelines for the assessment of effects on pedestrians, cyclists, equestrians and community. It suggests where relevant, it should include the key facilities and their catchment area. DMRB guidelines also states that in addition to the above, other factors such as level of use, use by vulnerable users and availability of alternative facilities should be taken into account.

17.3.3. The ES will take account of paragraphs 108 to 111 of the updated NPPF and also consider the IEMA Guidelines for the Environmental Assessment of Road Traffic (1993)[202], which whilst no longer in publication contains additional relevant detail. Close consultation will be undertaken with key stakeholders, including Highways England, NCC and GYBC.

[201] Infrastructure and Projects Authority 2013. National Infrastructure Delivery Plan 2016-2021.
[202] Institute of Management and Environmental Assessment (1993) Guidelines for the environmental assessment of road traffic.

17.3.4. Further desk studies and site visits will be undertaken to identify key features of the existing road and pedestrian/cycle networks in the vicinity of the Proposed Scheme and to obtain data on existing collision rates and identify existing public transport services.

17.3.5. The proposed methodology to assess the significance of transport effects of the Proposed Scheme during construction and operation on receptors is detailed below. This sets out the criteria for identifying links that require assessment as a part of the ES, the sensitivity of different receptors to environmental change, the methodology for determining the magnitude of a transport impact and sets out a matrix for determining the significance of an environmental effect.

ASSESSMENT CRITERIA

17.3.6. The Institute of Environmental Management and Assessment (IEMA) 'Guidelines for the Environmental Assessment of Road Traffic[202]' and Design Manual for Roads and Bridges (DMRB) Volume 11 have been used to ensure that the environmental effects arising due to predicted changes in traffic levels are properly and comprehensively addressed.

17.3.7. The following types of effects will be considered as a part of the ES.

- Effects on Public Transport Users;
- Driver delay;
- Pedestrian and cyclist amenity and delay;
- Collisions and safety;
- Fear and intimidation; and
- Hazardous Loads.

17.3.8. The following impacts will inform this assessment; however, they are not assessed directly as a part of this chapter:

- Severance (including new pedestrian severance from community facilities and relief from severance for pedestrians);
- Driver Stress;
- Noise;
- Vibration; and
- Population and Human Health.

17.3.9. The IEMA Guidelines[202] provide two 'rules of thumb' as a screening process to delimit the scale and extent of the assessment of traffic impacts and the determination of which traffic links require assessment. The rules are as follows:

- Rule 1: Include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30%); and
- Rule 2: Include any other specifically sensitive areas where traffic flows have increased by 10% or more.

17.3.10. DMRB Volume 11 Section 3 Part 8[153] provides additional guidelines for the assessment of effects on pedestrians, cyclists, equestrians and community. It suggests where relevant, it should include the key facilities and their catchment area. DMRB guidelines also states that in addition to the above, other factors such as level of use, use by vulnerable users and availability of alternative facilities should be taken into account.

SENSITIVITY OF RECEPTORS

17.3.11. The sensitivity of a receptor to environmental change varies depending upon a combination of its value and susceptibility. The sensitivity of different receptors is outlined in Table 5.1.

MAGNITUDE OF PREDICTED CHANGE

17.3.12. To assist with identifying the magnitude of predicted change, the IEMA Guidelines sets out considerations, and in some cases thresholds, in respect to changes in the volume and composition of traffic to facilitate judgement on the significance of traffic impacts. Where no guidelines are available, commonly agreed thresholds for judging the significance of an impact on sensitive receptors and professional judgement have been applied. Dependent on whether magnitude of impact is positive or negative, the impact on receptors can be adverse or beneficial.

Public Transport Network

17.3.13. There is no formal or published guidelines for the assessment of impacts on the public transport network. Accordingly, professional judgement has been applied to determine the magnitude of impact of on the public transport network. For this purpose of this assessment, the following factors have been taken into consideration:

- Changes in bus and rail capacity;
- Enhancements to existing routes / services;
- New routes / services; and
- Changes to the connectivity / waiting facilities of public transport interchanges (e.g. bus stops).

Pedestrian and Cyclist Delay

17.3.14. There are no formal or published guidelines for the assessment of pedestrian or cyclist delay. However, the IEMA Guidelines recommend assessors use their professional judgement to determine the significance of impacts. For the purpose of this assessment changes in traffic flows of 30%, 60% and 90% are considered to represent a low, medium and high magnitude impact on pedestrian delay.

Pedestrian and Cyclist Amenity

17.3.15. The IEMA Guidelines suggest a screening threshold for judging the significance of changes in pedestrian amenity would be where the traffic flow is halved or doubled. In the absence of other criteria, this threshold has been used in this assessment for assessing pedestrian and cyclist amenity.

Fear and Cyclist Intimidation

17.3.16. In the absence of commonly agreed thresholds for judging the significance of likely fear and intimidation impacts, IEMA Guidelines suggest the thresholds outlined in Table 17.2 are used as an option to assess the magnitude of impact on fear and intimidation.

Table 17.2- Example of Fear and Intimidation. Source: IEMA 'Guidelines for the Environmental Assessment of Road Traffic' (1993)[202]

Degree of hazard	Average traffic flow over 18 hr day (veh/hr)	Total 18 hr HGV vehicle flow	Average speed over 18 hr day (mph)
Extreme	1,800 +	3,000 +	20 +
Great	1,200 – 1,800	2,000 – 3,000	15 – 20
Moderate	600 – 1,200	1,000 – 2,000	10 - 15

17.3.17. Considerations key to assessing the impact on fear and intimation include: volume of traffic, percentage of HGVs and the proximity of pedestrians to traffic. In addition, the speed of traffic, the number of turning movements, the proximity of schools and the level of vulnerable groups should be considered.

Driver Delay

17.3.18. A Paramics Discovery model will be used to quantify the operational impact of the Proposed Scheme on junctions and links within the Study Area. The Paramics Discovery model previously submitted in support of the OBC will be updated in line with the SATURN model.

17.3.19. Traffic surveys have recently been undertaken at key junctions and links surrounding the Proposed Scheme, and the SATURN model previously submitted in support of the OBC is currently being updated to produce a 2018 base year, taking account of this data and recently completed local infrastructure schemes.

17.3.20. The 2023 and 2038 forecast year models will also be updated to reflect the latest design of the Proposed Scheme and will include future schemes on the A47 SRN and the local network. Forecast traffic flows from the updated SATURN model will be used in the quantified assessments of air quality and noise in the ES and to generate an updated BCR for the Proposed Scheme.

17.3.21. The magnitude of impact on driver delay will be quantified based on the absolute and percentage change in driver delay at key junctions and links surrounding the Proposed Scheme. The threshold for defining the magnitude of impact will be based on professional judgement.

Accidents and Safety

17.3.22. An estimate can be made of potential changes to global accident statistics relative to change in traffic flows, using COBALT software. However, in the case of change to the character of traffic or the road and transport network professional judgement will be used to assess the implications.

Hazardous Loads

17.3.23. If the number of hazardous load movements is expected to be significant, a risk or catastrophe analysis will be required to illustrate the potential for an accident to happen and the likely impact of such an accident.

SIGNIFICANCE OF EFFECT

17.3.24. As set out in Regulation 14(2) of the EIA Regulations, it is the effects, not the impacts, of a development which are to be reported in its environmental statement.

17.3.25. The significance of the traffic and transport effect is a product of the receptors sensitivity and magnitude of impact. A matrix for determining the significance of effects is provided in Table 5.3.

17.3.26. The potential effects will be considered to determine the level of significance, either: major, moderate, minor or of negligible significance. Effects of major and moderate significance are considered to be significant in EIA terms.

17.3.27. The following terms have been used to define the significance of the effects identified:

- Major effect: where the Proposed Scheme could be expected to have a very significant effect (either positive or negative) on users of the local transport network;
- Moderate effect: where the Proposed Scheme could be expected to have a noticeable effect (either positive or negative) on users of the local transport network;
- Minor effect: where the Proposed Scheme could be expected to result in a small, barely noticeable effect (either positive or negative) on users of the local transport network; and

- Negligible: where no discernible effect is expected as a result of the Proposed Scheme on users of the local transport network.

17.3.28. Following the classification of an effect as detailed in Table 5.3, a clear statement will be made as to whether the effect is 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate.

17.4 BASELINE CONDITIONS

17.4.1. This section examines the existing transport conditions within the vicinity of the Proposed Scheme. The study area is shown in Figure 17.1.

17.4.2. STRATEGIC ROAD NETWORK

17.4.3. The SRN in England is managed by Highways England and within the study area includes the A47. Key junctions and infrastructure on this route in the study area include:

- Vauxhall Roundabout;
- Breydon Bridge (Bascule Bridge);
- Gapton Hall Roundabout; and
- Harfrey's Roundabout.

17.4.4. The closest access to the SRN from the Proposed Scheme is via the A47 Harfrey's roundabout, which lies at the western end of the red line boundary approximately 0.4km west of the river.

Local Highway Network

17.4.5. On the western side of the river, a new five-arm roundabout will connect the new crossing with Suffolk Road, William Adams Way and the western end of Queen Anne's Road; A single span bridge over Southtown Road, will join the bridge to the new roundabout at William Adams Way;

17.4.6. The Queen Anne's Road junction with Suffolk Road will be closed, and a new priority junction onto Southtown Road created, providing access to the Queen Anne's Road residential area;

17.4.7. The scheme will incorporate revised access arrangements for existing businesses onto the local highway network including, potentially, a new structure to allow vehicular access under the proposed crossing on the eastern bank subject to agreement with affected businesses and landowner;

17.4.8. It includes dedicated provision for cyclists and pedestrians which tie into existing networks and the demolition of an existing pedestrian bridge on William Adams Way;

17.4.9. A control tower structure will be located adjacent to the crossing on the western side of the river. The control tower will facilitate the 24/7 operation of the opening span of the new double leaf bascule bridge;

17.4.10. The scheme incorporates additional signage to assist the movement of traffic in response to network conditions and the openings / closings of the double leaf bascule bridge;

17.4.11. The scheme may also include associated changes, modifications and/or improvements to the existing local highway network as informed by traffic modelling. This could include improvements within the existing highway boundary to some existing junctions within the red line boundary, in addition to amended parking arrangements.

17.4.12. On the eastern section of the road crossing, the proposed link over the River Yare links into a new signalised junction with South Denes Road. The direction of operation of Sutton Road and Swanston's Road will be

reversed to ensure efficient operation. Controlled crossing facilities will be incorporated to assist the movement of pedestrians and cyclists.

Baseline Traffic Data

17.4.13. A summary of the existing, and historic, two-way traffic flows from DfT data sources in the study area is shown in the table below:

Table 17.3 -Summary of traffic flow data

Source	Type Count	Date	Number Sites
TRADS	ATC	Permanent	4
DfT	ATC	Permanent	6
NCC	MCC	October 2015	9
AECOM	MCC	June 2015	8
	ATC	April 2016	38
	MCC		8
	ANPR		36
WSP (Mouchel)	RSIs	November 2016	9
	MCC		41
	ATC		3
WSP	MCC	March 2018	15
	ATC		20

Public Transport Network

17.4.14. Bus services cover the main corridors through the town, with all routes from outlying areas serving the town centre and Market Gates bus station. The majority of bus services in Great Yarmouth are operated by First in Norfolk and Suffolk, with a small number operated by other local bus operators.

17.4.15. The majority of bus services in the town run in north / south direction connecting Great Yarmouth with the Caister-on-Sea to the north and / or Gorleston-on-Sea to the south. Notable exceptions to this this are bus service 2, a circular route serving the town centre and Denes Peninsula only, and bus service 74 between Great Yarmouth Town Centre and Little Plumstead to the west.

17.4.16. Great Yarmouth Market Gates bus station is located in the town centre, 2 km north of the scheme, and is approximately 550m from the sea front, or a 5- to 7=minute walk. Public realm improvements are currently being undertaken at Market Hill Bus Station, this includes new Real Time Passenger Information (RTPI) displays along, new lighting and new railings.

17.4.17. The nearest bus stop to the Proposed Scheme is located on Southtown Road on the western bank of the River Yare. The majority of bus services in stop at bus stops along this road as it connects with Bridge Road and Haven Bridge. The most central bus stop to the location of the Proposed Scheme is Waveney Road bus stop. This is comprised of a flag and pole only; no other waiting facilities or passenger information is provided.

17.4.18. The highest frequency service operating along Southtown Road is bus route 8 operated by First in Norfolk and Suffolk. This operates between James Paget Hospital in Gorleston and Caister-on-Sea on a 15-minute frequency Monday to Saturday, reducing to a 30-minute frequency on Sundays. In addition to this service, eleven other bus services operate along Southtown Road, the majority of these operate on a half hourly or hourly frequency.

17.4.19. To the east of the River Yare there are no bus stops within the immediate vicinity of the Proposed Scheme. The closest bus stop on the east side of the River Yare is Battery Road bus stop on Admiralty Road. This is the southernmost bus stop on the peninsula and is severed by service 2 only. This is a circular route that connects the peninsula with Great Yarmouth town Centre. There are no bus stops along the A1243 South Denes Road.

17.4.20. Great Yarmouth Station is one of two stations on the Wherry Line railway from Norwich. The station is located approximately 1.5 miles, or a 30-minute walk, from the Proposed Scheme. No bus services currently serve Great Yarmouth station forecourt bus stop. However, it is approximately 1km from the town centre, or a 10-to-15-minute walk via Vauxhall Bridge where a number of bus services can be accessed.

17.4.21. All train services from Great Yarmouth Station are operated by Abellio Greater Anglia. According to the Office of Rail Regulation usage figures for 2016-2017, Great Yarmouth was the fifth-busiest railway station in Norfolk, after Norwich, King's Lynn, Diss and Downham Market.

17.4.22. The majority of services from Great Yarmouth run direct to Norwich via Acle, however two trains per day run direct to Norwich via Berney Arms. On both routes, the majority of services call at all stations. The approximate journey time between Great Yarmouth and Norwich is 35 minutes.

17.4.23. During the AM peak period (07:00-10:00), four services depart from Great Yarmouth to Norwich. In the PM peak period (16:00-19:00), there are five services to Norwich. Off-peak there is typically 1 departure per hour to Norwich, however between 20 May and 9 September four additional direct non-stopping services operate between Great Yarmouth and Norwich. At weekends, the Saturday timetables to Norwich operate similarly to weekdays. However, there are a reduced number of Sunday services, whereby services operate only every other hour to Norwich.

Pedestrian Network

17.4.24. The River Yare divides the western side of Great Yarmouth from the town centre, sea front, harbour and other destinations on the South Denes peninsula. To access these facilities, all pedestrian and cycle journeys between east and west have to cross the existing bridges. For pedestrians this means using Haven Bridge, as the Breydon Bridge has no footways. As a result of this, the time and distance involved for many trips is significant when compared with the equivalent "crow fly" distance.

17.4.25. The pedestrian network along the eastern bank of the River Yare is adequate, with footways generally provided on both sides of the A1243. Along South Quays Road the footways are generally between 1.5m and 2.0m in width, however as you travel further south these become very narrow, with footways of between 1.0 and 1.5m in width on both sides of Southgates Road and South Denes Road. South of Hartman Road there is also large stretches South Denes with no footway provision.

17.4.26. On the western side of the river, the pedestrian network is less comprehensive with no public realm space or footway directly alongside the river due to the existing industrial units that occupy this space.

17.4.27. On Southtown Road, which runs parallel to the River Yare, there are footways of between 1.2 to 1.5m on both sides the carriageway and at the signalised junction of William Adams Way / Beccles Road / Southtown Road there are pedestrian crossing facilities. To the south of Southtown Road there is limited footway provision along Malthouse Lane and Riverside Road.

17.4.28. Footways of about 2m in width are provided along the south side of William Adams Way, however at the A47 / William Adams Way roundabout, only informal pedestrian crossing facilities are provided. There is a ramped pedestrian and cycle bridge on William Adams Way which provides access to Suffolk Road and Queen Anne's Road.

17.4.29. Haven Bridge is the main crossing for pedestrians travelling between Gorleston and Great Yarmouth. Footways of approximately 2m in width are provided on Bridge Road on approach and across the River Yare on both sides of the carriageway. Breydon Bridge to the north has no footways and is not considered suitable for use by non-motorised users due to the 50mph speed limit.

Cycle Network

17.4.30. Great Yarmouth's cycle network, comprises sections of National Cycle Network (Routes 30 and 517) and the Regional Cycle Network, as well as other signposted on-road cycle routes (referred to as pedalways), advisory cycling routes and some traffic free cycle routes.

17.4.31. Existing opportunities for cyclists to cross the River Yare are limited. The Breydon Bridge has designated cycle lanes on either side of the carriageway, however, these are unsegregated and pose a risk to cycle users due to the nature of the road (50mph speed limit). The Haven Bridge has a shared use path leading up to it on either side of the river as part of the National Cycle Network Route 517, however, there is no provision on the crossing itself and cycle users have to dismount.

17.4.32. Along the east bank of the River Yare, there is a wide segregated footway/cycleway along the western side of A13243 South Quay between Haven Bridge and Nottingham Way. South of Nottingham Way and towards the location of the Proposed Scheme there is no designed cycle route or infrastructure along the A1243. Pedalway Route 1 runs parallel to the A1243 along Blackfriars Road, Camden Road and Admiralty Road and connects with Pedalway Route 2 which runs along the beach front. This route is principally on-street along quieter residential with limited provision for cyclists.

17.4.33. Opposite the Haven Bridge, there is a dedicated cycle lane on Regent Street (Pedalway Route 7) which provides cycle access to the town centre. To the north of Haven Bridge, an on-road cycle route starts at Stonecutters Way and runs through to George Street, and The Conge, before linking in with National Cycle Route 30 at the North Quay junction.

17.4.34. On the western side of the River Yare, Southtown Road is designated as National Cycle Network Route 517, it is non-segregated apart from a section close to the Pasteur Road junction. The route continues on to Malthouse Lane and Riverside Road before reaching Gorleston. Pedalway Routes 5 and 6 follow the same route before turning on to Ferry Hill at the Riverside Road junction towards Bradwell and Gorleston respectively. Pedalways Routes 3 and 4 follow Pasteur Road on an off-carriageway footway/cycleway from Haven Bridge before continuing on to Gapton Hall Road towards Burgh Castle and Belton.

Community facilities

17.4.35. The movement of vehicles and NMUs to community facilities is presently severed by the River Yare, particularly in relation to destinations on the peninsula. Volume II shows community facilities in the area, which include religious buildings, medical and educational facilities.

Personal Injury Collisions

17.4.36. For the OBC submission, personal injury collisions (PIC) data for the Great Yarmouth area was obtained from STATS19 Road Safety Data from the five year period between 2012 and 2016. In total, there were 115 injury collisions across the junctions assessed within the Preliminary Transport Assessment in Appendix 17A. There were no fatal collisions, 20 severe PICs and 95 slight PICs during the five year period. More detailed accident analysis can be found within the Preliminary Transport Assessment. This analysis will be updated using newer data as part of the final Transport Assessment.

17.5 POTENTIAL SIGNIFICANT EFFECTS

17.5.1. The introduction of the Proposed Scheme will not in itself generate any additional traffic although providing the bridge as an alternative route to the current crossing options, will result in a reassignment of traffic and these impacts will be assessed in the Transport Assessment.

17.5.2. The potential impacts of the Proposed Scheme with regards to traffic are likely to be predominantly positive, with journey time savings, vehicle operating cost savings, reduced congestion, enhanced journey time reliability, collision and casualty savings, and an increase in the use of more active modes of travel.

17.5.3. As noted in the limitations statement above (paragraphs 17.1.5 and 17.1.6, the Preliminary Transport Assessment has been based on information available at the time of writing, and thus relies upon the work undertaken at OBC stage. Further assessment will be carried out in order to produce the final Transport Assessment and ES. The following paragraphs summarise the aspects which will be considered.

CONSTRUCTION PHASE

Pedestrian and cyclist amenity and delay

17.5.4. The construction phase of the Proposed Scheme will lead to an increase in traffic flows on local roads in the immediate vicinity. This will include a temporary increase in HGV movements. Prior to mitigation this is likely to result in a worsening of amenity for pedestrians and cyclists travelling along effected links.

Collisions and safety

17.5.5. The construction phase of the Proposed Scheme will increase traffic flows on the local and strategic road network, including a temporary increase in the number of HGVs. Detailed consideration will be given to impacts during construction and how these can be mitigated in the CoCP.

Fear and intimidation

17.5.6. The construction phase of the Proposed Scheme will lead to an increase in traffic flows on local road. This will include a temporary increase in HGV movements. Prior to mitigation this is likely to result in a worsening of fear and intimidation of pedestrians and cyclists along affected links. Detailed consideration will be given to impacts during construction and how these can be mitigated in the CoCP.

OPERATION PHASE

Effects on Public Transport Users

17.5.7. The operation of the Proposed Scheme will enable existing bus services to be rerouted across the Third River Crossing. This is likely to result in improved public transport accessibility for people living and working on the South Denes Peninsula. This is also likely to result in wider public transport journey time improvements across Great Yarmouth as a result of a reduction in traffic congestion at and around Haven Bridge.

Pedestrian and cyclist amenity and delay

17.5.8. Operation of the Proposed Scheme will lead to a reassignment of traffic on the local and strategic road network. Prior to mitigation, on links where there is an increase in traffic flows there is likely to be a deterioration in the amenity for pedestrian and cyclists. On links where there will be a reduction in traffic flows there is likely to be an improvement in the amenity for pedestrians and cyclists.

Collisions and safety

17.5.9. Once the Proposed Scheme is operational, the forecast changes in traffic assignment across the network will lead to a change in likely accident rates and locations. This will be quantified using COBALT software, which

based on the evidence from the OBC, is anticipated to show an overall reduction in the costs of accidents across the study area.

Fear and intimidation

17.5.10. Operation of the Proposed Scheme will lead to a reassignment of traffic on the local and strategic road network. Prior to mitigation, on links where there is an increase in traffic flows there is likely to an increase in fear and intimidation for pedestrian and cyclists. On links where there will be a reduction in traffic flows there is likely to be a reduction in fear and intimidation for pedestrians and cyclists.

Hazardous Loads

17.5.11. The construction phase of the Proposed Scheme is likely to involve the transportation of hazardous (oversize loads). Prior to mitigation this is likely to result in disruption to users and present increased risk to users of the local and strategic road network.

17.6 MITIGATION

17.6.1. As described previously in Chapter 3 and section 17.4, the Proposed Scheme includes new highway infrastructure on either side of the crossing to enable its efficient operation. This will be supplemented with advance variable message signage (VMS) to enable drivers to divert if required when the Proposed Scheme is closed to road traffic. It is anticipated that local signage will also be required within the red line boundary to direct drivers and non-motorised users to the most appropriate routes depending on their destination.

17.6.2. Proposed mitigation works will be detailed in the final Transport Assessment and summarised in the ES once all modelling work has been completed.

17.7 CONCLUSIONS AND EFFECTS

17.7.1. It is likely that the Proposed Scheme will result in adverse effects during the construction phases of the Proposed Scheme. These are expected to be temporary in nature, being restricted to the construction phase only.

17.7.2. Findings from the Preliminary Transport Assessment indicate the Proposed Scheme is expected to make a positive contribution to the delivery of the scheme objectives, in some cases with very large positive effects. This is expected to result in long tern beneficial effects during the operation phase of the Proposed Scheme, particularly in relation to access and connectivity for all modes, increased resilience of local road network, reduced congestion and improved journey time reliability.

17.7.3. The significance of such effects has yet to be fully determined, and will be assessed once transport modelling data is available. This be presented within the Environmental Statement.

17.8 ASSESSMENTS STILL TO BE COMPLETED

17.8.1. The Preliminary Transport Assessment in Appendix 17A details the assessments which will be completed for inclusion in the final Transport Assessment.

18

CUMULATIVE EFFECTS

18 CUMULATIVE EFFECTS

18.1 INTRODUCTION

18.1.1. This chapter presents the preliminary assessment of Cumulative Effects (CEA) as it relates to (i) the Proposed Scheme to date; and (ii) data currently available and gathered at this point of the assessment process. The focus of a CEA is to assess the potential cumulative effects of the Proposed Scheme interacting with other developments as a result of multiple actions on receptors and resources over time which are generally additive or interactive.

18.1.2. This assessment is emerging and will be based upon Advice Note 17: Cumulative Effects Assessment203. Cumulative effects These generally fall into three categories:

- Cumulative effects arising from the combination of the different environmental topics as outlined in the PEIR;
- Cumulative effects arising from a range of developments (projects), occurring at different locations or over a period of time. Separately, such individual projects may not create an unacceptable degree of adverse impact but collectively the results may be potentially significant; and
- Cumulative effects caused by the project in conjunction with other developments that occurred in the past, present or are likely to occur in the foreseeable future.

18.1.3. As identified in the second point above, cumulative or combined effects are those that are likely to arise when the Proposed Scheme is considered in relation to other foreseeable developments (projects) either located in the immediate vicinity or that have a relationship with similar environmental resources. Individually, the impact of the Proposed Development may be of minor magnitude but when combined with the impact from other projects could increase the overall significance of an effect on an individual resource. The results of this process enable the determining authority to ensure that this and any future developments are mutually compatible and remain within the environmental capacity of the area considered.

STUDY AREA

18.1.4. The study area for the assessment has been determined following consideration of the likely significant effects that could reasonably arise from the projects that have been considered alongside the Proposed Scheme. At present this is still being developed in line with (i) advice provided by the Planning Inspectorate within the Scoping Opinion and (ii) the scoping response received from GYBC[6] on the 8th June 2018.

LIMITATIONS

18.1.5. This chapter of the PEIR provides preliminary information as it relates to the Proposed Scheme to date and to data currently available and gathered at this point of the assessment process.

[203] The Planning Inspectorate. Advice Note 17: Cumulative effects assessment relevant to nationally significant infrastructure projects. Available here. Last accessed May 2018

18.2 DIRECTIVES, REGULATIONS AND RELEVANT POLICIES

EIA Regulations

18.2.1. Schedule 4 of the EIA Regulations state that a description of likely significant effects on the environment resulting from the following is required:

"the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;"

National Policy Statement for National Networks

18.2.2. The NPS NN states that the SoS should take into account "*potential adverse impacts, including any longer term and cumulative adverse impacts, as well as any measures to avoid, reduce of compensate for any adverse impacts*". The Examining Authority should consider how significant cumulative effects and the interrelationships between effects might as a whole affect the environment, even though they may be considered on an individual basis with mitigation measures in place.

National Policy Statement for Ports

18.2.3. The NPSP provides a framework for the decisions on proposals for new port development. It applies, wherever relevant, to associated development, such as road and rail links, for which consent is sought alongside that for the principal development.

18.2.4. The NPSP specifically identifies adverse cumulative impacts upon health as a topic for consideration with an ES, as well as the cumulative effects from flooding and the potential shortage of construction workers.

Planning Inspectorate Advice Note 17

18.2.5. This Advice Note identifies the nature of projects (referred to as 'other developments' in the Advice Note) that should be within a CEA.

18.3 ASSESSMENT METHODOLOGY

18.3.1. The Assessment will be undertaken in accordance with the advice presented in Advice Note 17[203]. Guidance within Advice Note 17 identifies a four-stage process to the CEA process and the ES will include a CEA that follows the same approach. Table 18.1 - CEA Main Stages and Activities outlines this process.

18.3.2. Rejected planning applications that are not subject to appeal will not be considered as their implementation is not considered to be reasonably foreseeable.

18.3.3. The assessment will consider the capacity of environmental resource and receptors to accommodate changes that are likely to occur. This includes the duration, extent, type (additive or synergistic), frequency, value and resilience of the receptor and likely mitigation.

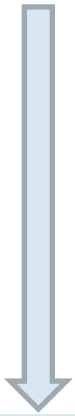
18.3.4. When considered in isolation environmental effects of a single resource or receptor may not be significant. However, when individual effects are considered in combination the resulting cumulative effect may be significant.

Table 18.1 - CEA Main Stages and Activities

CEA Stage	Main Activities
Stage 1 Establishing a zone of influence for the Proposed Scheme and identifying a long list of 'other developments'	Identifying a long list of 'other development' that is proposed in the vicinity of the Proposed Scheme. The applicant undertakes a desk study of planning documents, development plan documents, and relevant development frameworks within the Zone of Influence. The applicant will consult with the relevant planning authority and statutory consultees regarding the list
Stage 2 Identify a shortlist of 'other developments'	Identifying the nature of the 'other development; and assessing whether there is the potential for significant cumulative effects The applicant will consult with the relevant planning authority and statutory consultees regarding the list Documented information can be high level, identifying the key issues to be taken forward to stage 2 and 3
Stage 3 Information gathering	Collation of information on the 'other development identified at Stage 2
Stage 4 Assessment	Assessing Applicant reviews each of the 'other development' in turn to assess weather cumulative effects may arise and documents this Mitigation measures should be identified in relation to adverse cumulative effects The applicant may wish to consult with applicants/developers of 'other development' to identify means to jointly address the mitigation of significant adverse cumulative effect and the means to ensure delivery.

18.3.5. A list of 'other developments' for inclusion with the CEA is to be determined using the tiered selection projects, an approach that is published within Advice Note 17[203] and reproduced in Table 18.2 – 'Other Development' for Inclusion in CEA below.

Table 18.2 – 'Other Development' for Inclusion in CEA

Tier 1	Under construction	Decreasing level of detail likely to be available 
	permitted application(s), whether under the PA2008 or other regimes, but not yet implemented;	
	submitted application(s) whether under the PA2008 or other regimes but not yet determined;	
Tier 2	projects on the Planning Inspectorate's Programme of Projects where a scoping report has been submitted.	
Tier 3	projects on the Planning Inspectorate's Programme of Projects where a scoping report has not been submitted.	
	identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited;	
	identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.	

DETERMINING STUDY AREA

18.3.6. Advice Note 17[203] states that the *'scale and nature of NSIPs will typically dictate a broad and temporal zone of influence (ZOI) for an NSIP'*. For individual environmental topics, the ZOI is defined by the relevant institutional guidelines which are discussed within each respective chapter. However, in determining a ZOI for 'other developments' that could give rise to cumulative effects when interacting with the Proposed Scheme it will be necessary to consider each development on a case by case basis. A desk study was completed to examine and record permitted developments that, as a result of scope and nature or temporal scope, may cause a cumulative effect.

18.3.7. The scale and nature of developments identified within the ZOI is included if it is considered that interactions between developments and the Proposed Scheme could result in cumulative effect.

SIGNIFICANCE OF EFFECTS

18.3.8. The significance of the effect is formulated as a function of the receptors or a resources' environmental value (or sensitivity) and the magnitude of the project impact. Advice Note 17[203] states "*The significance criteria used to assess likely cumulative effects should consider the capacity of environmental resources and receptors to accommodate changes that are likely to occur. The terminology used to determine significance should be explicit and ensure a clear understanding of the outcome of the CEA*."

18.3.9. The significance of effect will be determined using the significance criteria for cumulative effects, published within Volume 11, Section 2, Part 5 of the DMRB (HA 205/08)[31] This has been reproduced in Table 18.3 – Determining Significance of Cumulative Effects below.

Table 18.3 – Determining Significance of Cumulative Effects

Significance	Definition Effect
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issue.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

18.3.10. In line with the DMRB, the following have been considered in determining the significance of cumulative effects;

- Which receptors/resources are affected;
- How will the activity or activities affect the condition of the receptor/resource;
- What are the probabilities of such effects occurring; and
- What ability does the receptor/resource have to absorb further effects before change becomes irreversible?

18.4 BASELINE ENVIRONMENT

18.4.1. At this stage of the Proposed Scheme the CEA is at Stage 1, wherein the zone of influence for the Proposed Scheme is being established.

18.4.2. The EIA Scoping Report[5], presented the following developments as having the potential to result in a cumulative impact in combination with the Proposed Scheme:

- Great Yarmouth and Lowestoft Enterprise Zone;
- Lake Lothing Third River Crossing;
- Great Yarmouth Tidal Barrier;
- East Anglia Array Windfarm;
- Beacon Park Enterprise Zone;
- Great Yarmouth Waterfront Area;
- South Denes Enterprise Zone and Energy Park; and
- A27 Great Yarmouth Vauxhall, Harfrey's and Gapton Junctions.

18.4.3. In response to this list of projects, the Panning Inspectorate, within the Scoping Opinion[6], noted that the inclusion of the East Anglia Array Windfarm, and requested that the ES clearly define which NSIP(s) this relates to, as several windfarms have been proposed or consented.

18.4.4. The East Anglia Array is a wind farm development that consists of four phases, although it is noteworthy that two of these phases are proposed to be combined into a single DCO submission.

18.4.5. East Anglia ONE received development consent in August 2017. It is understood that construction of the onshore elements commenced in May 2017, the offshore works are due to commence in August 2018, first power achieved in 2019 and full operation during 2020. This the construction phased of this development is unlikely to significantly overlap with that of the Proposed Scheme.

18.4.6. East Anglia THREE received development consent in August 2017. The Environmental Statement[204] submitted with the application states that "*Construction of the proposed East Anglia THREE project…would commence between 2020 and 2025*. This will overlap with the construction phase of the Proposed Scheme.

18.4.7. A scoping opinion for East Anglia TWO[205] and East Anglia ONE NORTH[206] was issued by the SoS in December 2017. The scoping opinion for both projects notes that "*Onshore construction works are anticipated to take approximately 18 to 24 months*". However, no details on the dates of the construction programme for either project are yet available although a combined PEIR for both East Anglia TWO and East Anglia ONE North is proposed for late 2018 with submission of the East Anglia TWO DCO in 2019 and East Anglia ONE NORTH DCO in 2020. It is possible likely that these developments will overlap with the construction phase of the Proposed Scheme.

18.4.8. On this basis it is likely that East Anglia ONE will be excluded from the assessment. East Anglia ONE NORTH, East Anglia TWO and East Anglia TWO are likely to be included, subject to further assessment.

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[204] Royal Haskoning 2015. East Anglia Three Environmental Statements. [online] .Available here. Last accessed June 2018

[205] The Planning Inspectorate 2017. Scoping Opinion: Proposed East Anglia Two Offshore Windfarm. [online] Available here. Lat Accessed June 2018

[206] The Planning Inspectorate 2017. Scoping Opinion: Proposed East Anglia One North Offshore Windfarm. [online] Available here. Last Accessed June 2018

18.4.9. In the Scoping Opinion[6], the Planning Inspectorate stated that cumulative effects assessment should clearly state the other developments that have been included within the traffic data, and provide appropriate cross-reference to other aspect chapters, as applicable. As stated in chapter 17, whilst the additional trips from new developments are not directly related to the Proposed Scheme, they are a consequence of the new crossing therefore the anticipated impact should be assessed within the ES. It is anticipated that the Proposed Development and associated infrastructure improvements will meet the demand for the additional trips by all modes without putting additional pressure on the existing transport networks. Although it is not covered within this PEIR, the ES will consider the cumulative effects that may arise from the Proposed Scheme in conjunction with other existing and / or approved projects. Details of committed schemes which have been included in the SATURN modelling work are contained in the preliminary Transport Assessment, presented in Appendix 17A.

18.4.10. Early consultation with the Environment Agency identified the potential for a Tidal Barrier scheme for Great Yarmouth. It is understood that this project is at the early concept stage and the funding has not yet been applied for. Information relating to this project is expected to be limited and it is anticipated that it will form a Teir 3 development in accordance with the advice given in Advice Note 17.

18.4.11. The GYBC scoping response also provides additional advice on other schemes for inclusion within the assessment of cumulative effects. Including the following:

- "*Great Yarmouth Local Development Orders Great Yarmouth currently Local Development Orders (LDO) in place, which relate to (i) the South Denes LDO; and (ii) the Beacon Park LDO. The GYBC scoping response identifies that these LDOs broadly cover the same areas as the two Enterprise Zones and notes that the LDOs can allow some potentially significant developments to take place without express planning permission needing to be granted;*

- *Epoch 2 of the Great Yarmouth Flood Defence Improvements, which is being led by the Environment Agency;*

- *Various proposed junction improvements to the A47 being progressed by Highways England – Gapton Hall, Harfrey's and Vauxhall (all in Yarmouth), with other A47 improvements further west (Burlingham-Blofield dualling, Thickthorn junction improvements and Easton-North Tuddenham dualling). These developments are being considered within the transport modelling assessment;*

- *Consent for roughly 1,000 residential dwellings at Beacon Park, which are under construction;*

- *The proposed North Lowestoft Garden Village (Draft Allocation in the Waveney Local Plan, c. 1,300 dwellings, 8ha employment land, anticipated delivery 2026-2044); and*

- *Proposed leisure developments south of Pleasure Beach, Great Yarmouth, which include a new hotel, restaurant and car parking (under construction), and an outline permission for a proposed casino plus cinema, bars & restaurants etc*".

18.4.12. The next step of the assessment, to be presented within the ES, will be to identify a shortlist of developments and obtain information about those developments, in accordance with CEA Stage 2. This will be presented within Matrix 1, published in Appendix 1 for Advice Note 17.

18.5 POTENTIAL SIGNIFICANT EFFECTS

18.5.1. An assessment of the potential significant cumulative effects has yet to be undertaken. This forms CEA stages 3 and 4 as defined in Advice Note 17. The findings of the impact assessment will be presented in an assessment Matrix consistent with Appendix 2 of Advice Note 17.

18.6 MITIGATION

18.6.1. The mitigation requirements for the Proposed Scheme cannot currently be determined. This will be provided within the ES as part of the Stage 4 assessment.

18.7 CONCLUSIONS AND EFFECTS

18.7.1. At this stage of the assessment a number of projects have been identified within the vicinity of the Proposed Scheme, which could result in cumulative effects in combination with the Proposed Scheme.

18.7.2. It has been determined that a number of nearby NSIPs have construction phases that overlap with that of the Proposed Scheme. The significance of these cumulative effects will be assessed as the potential effects of the Proposed Scheme emerge.

18.7.3. As this stage of the Proposed Scheme it is not possible to reach a conclusion about the combined effects arising from environmental topics as assessments are in at the preliminary stages.

18.8 ASSESSMENTS STILL TO BE COMPLETED

18.8.1. At this stage of the Proposed Scheme, the CEA is at Stage 1, wherein the zone of influence for the Proposed Scheme is being established. Stages 3 – 4 of the assessment are to be progressed based upon the combined feedback presented within the Scoping Opinion[6] and the Scoping response from GYBC.

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Appendix G-4 Part 2 – Consultation Materials: Preliminary Environmental Information Report

Norfolk County Council

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Environmental Information Report
Volume II: Figures

GYTRC-WSP-EGN-XX-RP-EN-0002
AUGUST 2018

PUBLIC

Norfolk County **Council**

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Environmental Information Report Volume II: Figures

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70046035
OUR REF. NO. GYTRC-WSP-EGN-XX-RP-EN-0002

DATE: AUGUST 2018

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft for client review	Revision A for Issue		
Date	June 2018	02 August 2018		
Prepared by	J. Davey	J. Davey		
Signature				
Checked by	M. Whalley	M. Wood		
Signature				
Authorised by	M. Whalley	M. Wood		
Signature				
Project number	70046035	70046035		
Report number	GYTRC-WSP-EGN-XX-RP-EN-0002/P01	GYTRC-WSP-EGN-XX-RP-EN-0002/A		
File reference	\\uk.wspgroup.com\central data\Projects\62240xxx\62240375 - GYTRC\02 WIP\EI EIA and flood risk\03 Document\00 PEIR\00 PEIR Vol II - Figures			

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FIGURE 8.6: STATUTORY DESIGNATED SITES

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LAND USE ARRANGEMENT KEY

1. DRAINAGE DITCH AND NATIVE PLANTING
2. SOUTHTOWN COMMON RECREATION GROUND
3. ROUNDABOUT PLANTING WITH FEATURE TREES AND MAINTENANCE PARKING BAY
4. PROPOSED RAMP AND STEP ACCESS FROM WILLIAM ADAM'S WAY TO QUEEN ANNE'S ROAD
5. NATIVE BIO-DIVERSE PLANTING
6. PROPOSED LEISURE CRAFT PONTOONS OR FENDERED BERTH (50m LONG)
7. NEW LOCATION FOR ALLOTMENTS
8. NEWLY FORMED TURNING HEAD FOR QUEEN ANNE'S ROAD
9. PROPOSED ZEBRA CROSSING
10. CYCLE FACILITY OFF CARRIAGEWAY
11. NEW LOCATION FOR BUS STOP AND INTEGRATED CYCLEWAY
12. SHARED USE FACILITY OFF CARRIAGEWAY
13. CYCLE ROUTE ON CARRIAGEWAY
14. LOW LEVEL SHRUB PLANTING
15. PROPOSED CAR PARKING
16. CYCLE FACILITY ON CARRIAGEWAY
17. MAINTENANCE ACCESS
18. PERENCO SITE
19. FORMER DOLPHIN PUB
20. QUAY WALL DEFENSE
21. WATERFRONT SEATING
22. TERRACED STEPS AND MOVEABLE SEATING AREA
23a. CONTROL TOWER OPTION A WITH PEDESTRIAN STAIRS AND LIFT FROM SOUTHTOWN ROAD TO BRIDGE DECK
23b. CONTROL TOWER OPTION B
23c. CONTROL TOWER OPTION C
24. MIND COMMUNITY SITE RETAINED
25. PROPOSED FOOTWAY

0 10 20 50

N

LANDSCAPE AND URBAN DESIGN KEY

- RED LINE BOUNDARY
- CYCLE WAY
- SHARED FOOT/CYCLE WAY
- PAVING TYPE 1
- PAVING TYPE 2
- PAVING TYPE 3
- BENCH SEAT
- TREE GRILLE
- RAILINGS
- LIGHT COLUMN
- BOLLARD LIGHT

SOFT LANDSCAPE KEY

- EXISTING TREES
- PROPOSED TREE
- HEDGE
- SHRUB PLANTING
- SPECIES RICH GRASSLAND
- GRASS

Notes:

- This figure shows one of a number of double bascule bridge designs currently being considered, however the final opening mechanism design is not likely to materially impact on the proposed land use arrangement presented here
- This figure shows three location options for the control tower. The exact location and size to be confirmed.

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DRAWING TITLE

GREAT YARMOUTH
THIRD RIVER CROSSING
PROPOSED LAND USE ARRANGEMENT

REV.	DESCRIPTION	CHECKED	DATE
P01	FOR PEIR	MJ	08.06.18
P02	FOR PEIR	MJ	14.06.18
P03	FOR PEIR	MJ	29.06.18
P04	UPDATED CONTROL TOWER LOCATIONS	CN	16.07.18

	INITIALS	DATE
DESIGNED BY	CN	04.06.18
DRAWN BY	CT	28.06.18
CHECKED BY	CN	28.06.18
APPROVED BY	MJ	28.06.18

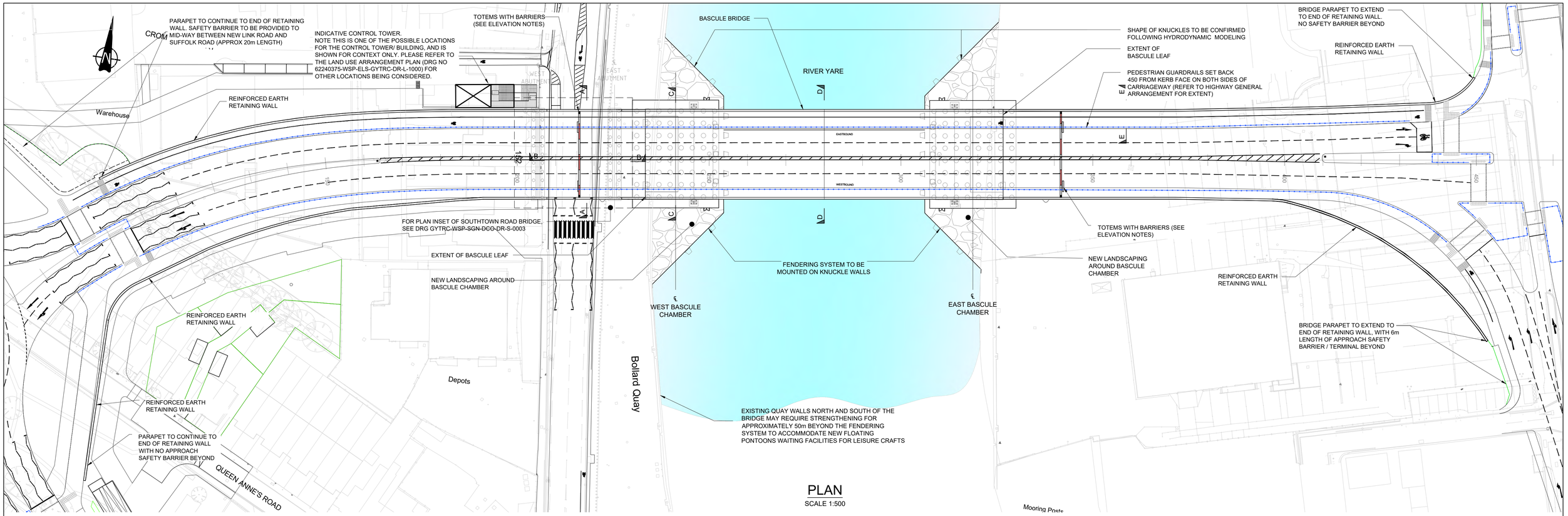
DRAWING No. GYTRC-WSP-ELS-GYTRC-DR-L-1000

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

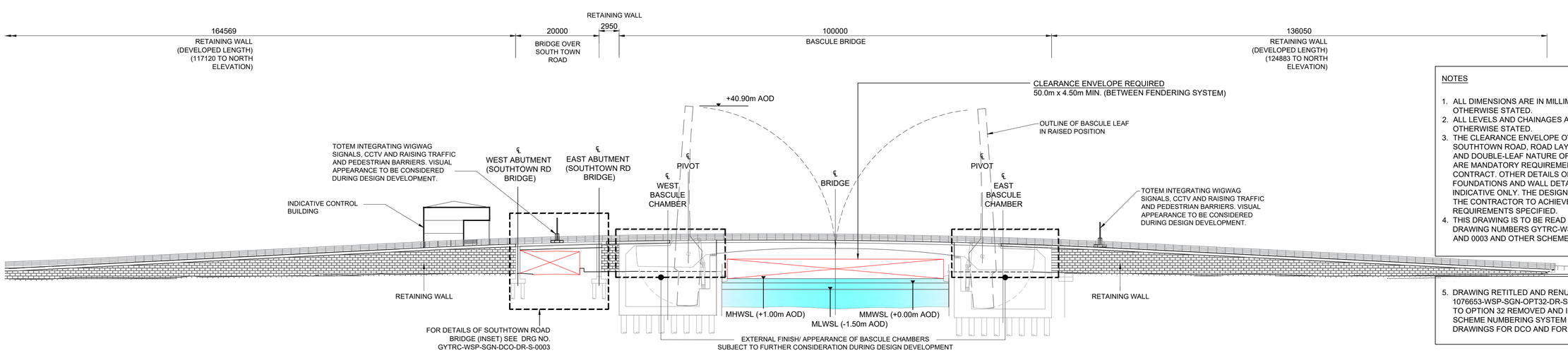
SCALE 1:1500 @ A1

FILE No. 1000

BIL 1965115



PLAN
SCALE 1:500



CHAINAGE	00.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	420.000	430.000	440.000	450.000	460.000	470.000
PROPOSED LEVELS	1.922	3.262	3.647	4.109	4.609	5.109	5.609	6.109	6.609	7.109	7.609	8.073	8.478	8.824	9.112	9.340	9.510	9.621	9.673	9.666	9.601	9.477	9.293	9.051	8.751	8.391	7.973	7.496	6.996	6.496	5.996	5.496	4.996	4.496	3.996	3.501	3.048	2.645	2.269	1.987
EXISTING LEVELS	1.705	0.680	0.818	1.044	0.966	1.299	1.268	1.397	1.565	1.694	1.768	1.930	1.938	1.677	1.658	2.421	-0.287	-0.304	-0.339	-0.316	-0.334	-0.308	-0.317	-0.302	-0.285	2.227	2.064	1.925	1.779	1.732	1.742	1.471	1.486	1.447	1.584	1.685	1.742	1.815	1.602	1.896
LEVEL DIFFERENCE	0.217	2.582	2.829	3.065	3.643	3.810	4.341	4.712	5.045	5.415	5.841	6.143	6.540	7.147	7.453	6.919	9.797	9.925	10.012	9.983	9.934	9.784	9.610	9.353	9.036	6.164	5.908	5.570	5.216	4.764	4.253	4.024	3.510	3.049	2.412	1.816	1.306	0.830	0.667	0.091

VERTICAL ALIGNMENT:
REFER TO HIGHWAYS DRAWINGS FOR LATEST.

SOUTH ELEVATION
SCALE 1:500

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS AND CHAINAGES ARE IN METRES UNLESS OTHERWISE STATED.
3. THE CLEARANCE ENVELOPE OVER THE RIVER AND OVER SOUTHTOWN ROAD, ROAD LAYOUT OVER THE CROSSING AND DOUBLE-LEAF NATURE OF THE BASCULE BRIDGE ARE MANDATORY REQUIREMENTS OF THE SCOPE OF THE CONTRACT. OTHER DETAILS OF THE BRIDGE, FOUNDATIONS AND WALL DETAILS SHOWN ARE INDICATIVE ONLY. THE DESIGN IS TO BE DEVELOPED BY THE CONTRACTOR TO ACHIEVE THE PERFORMANCE REQUIREMENTS SPECIFIED.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NUMBERS GYTRC-WSP-SGN-DCO-DR-S-0002 AND 0003 AND OTHER SCHEME DRAWINGS.
5. DRAWING RETITLED AND RENUMBERED AT P06 FROM 1076653-WSP-SGN-OPT32-DR-S-0001 WITH REFERENCE TO OPTION 32 REMOVED AND IN LINE WITH UPDATED SCHEME NUMBERING SYSTEM WITH SEPARATE DRAWINGS FOR DCO AND FOR PROCUREMENT.

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DRAWING TITLE

FIGURE 2.6a - GREAT YARMOUTH THIRD RIVER CROSSING
BASCULE BRIDGE OPTION 1 - SIMPLE TRUNNION
CONCEPTUAL GENERAL ARRANGEMENT - SHEET 1 OF 2

REV.	DESCRIPTION	CHECKED	DATE
P05	BASCULE KENTLEDGE & MINOR AMENDMENTS	JLG	16-04-18
P06	RETITLED, RENUMBERED AND MINOR CHANGES	JLG	08-06-18
P07	MINOR AMENDMENTS + PARAPET NOTES ADDED	JLG	14-06-18
P08	CONTROL TOWER & QUAY STRENGTENING NOTES	JLG	29-06-18

	INITIALS	DATE
DESIGNED BY	AH	15.03.17
DRAWN BY	OW	15.03.17
CHECKED BY	SA	15.03.17
APPROVED BY	GS	15.03.17

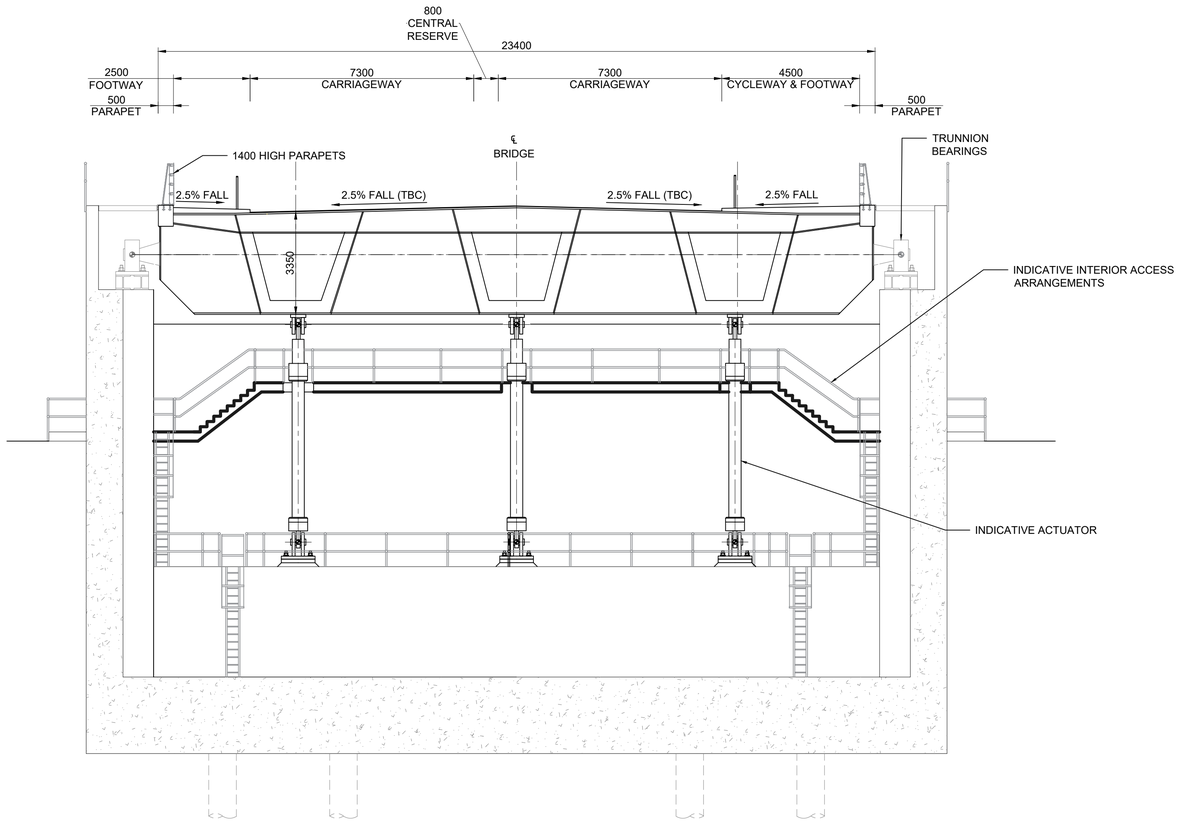
DRAWING No. GYTRC-WSP-SGN-DCO-DR-S-0001

PROJECT TITLE: GREAT YARMOUTH THIRD RIVER CROSSING

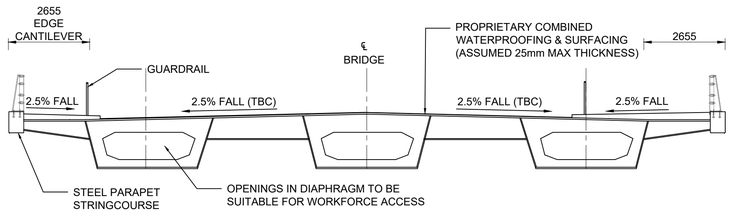
SCALE: 1:500 @ A1

FILE No.

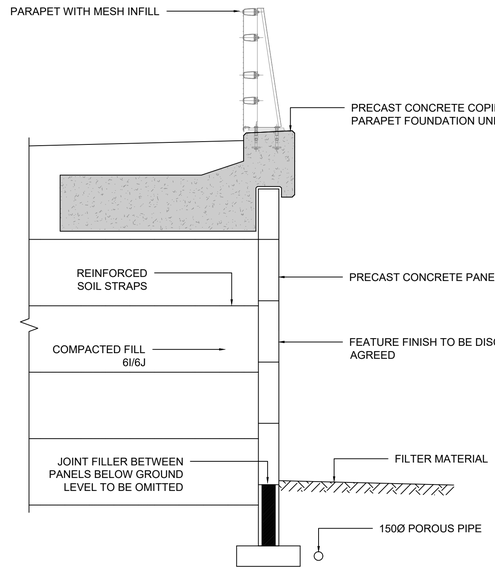
BIL 19/01/15



SECTION C-C
(AT SUPPORT)
SCALE 1:100



SECTION D-D
(MID-SPAN)
SCALE 1:100



SECTION E-E
SCALE 1:30

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES UNLESS OTHERWISE STATED.
3. ALL CHAINAGES ARE IN METRES UNLESS OTHERWISE STATED
4. BRIDGE, FOUNDATION AND WALL DETAILS SHOWN ARE INDICATIVE ONLY. TO BE CONFIRMED AND DEVELOPED BY THE CONTRACTOR.
5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NUMBERS: GYTRC-WSP-SGN-DCO-DR-S-0001, 0003 AND OTHER SCHEME DRAWINGS
6. DRAWING RETITLED AND RENUMBERED AT P03 REMOVING REFERENCE TO OPT32 AND ADOPTING NEW SCHEME NAMING REFERENCE WITH SEPARATE DRAWINGS FOR DCO AND FOR PROCUREMENT.

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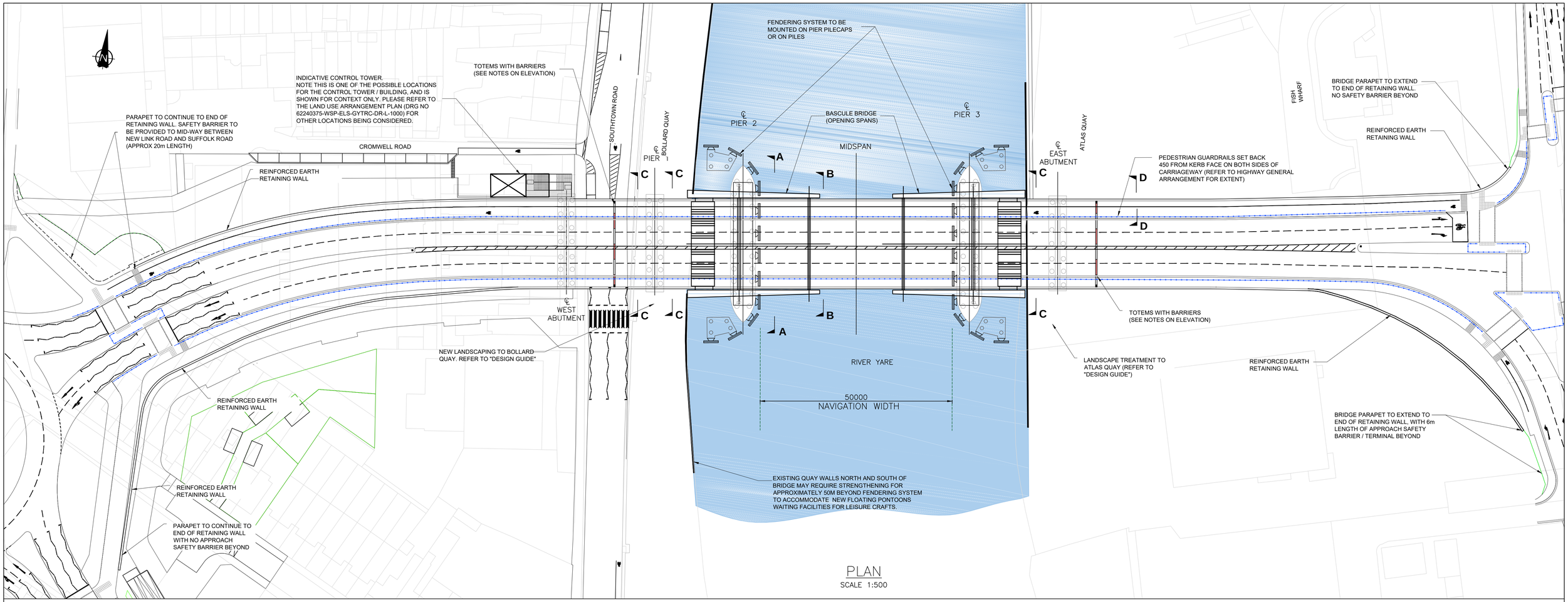
DRAWING TITLE

FIGURE 2.6b - GREAT YARMOUTH THIRD RIVER CROSSING
BASCULE BRIDGE OPTION 1 - SIMPLE TRUNNION
CONCEPTUAL GENERAL ARRANGEMENT - SHEET 2 OF 2

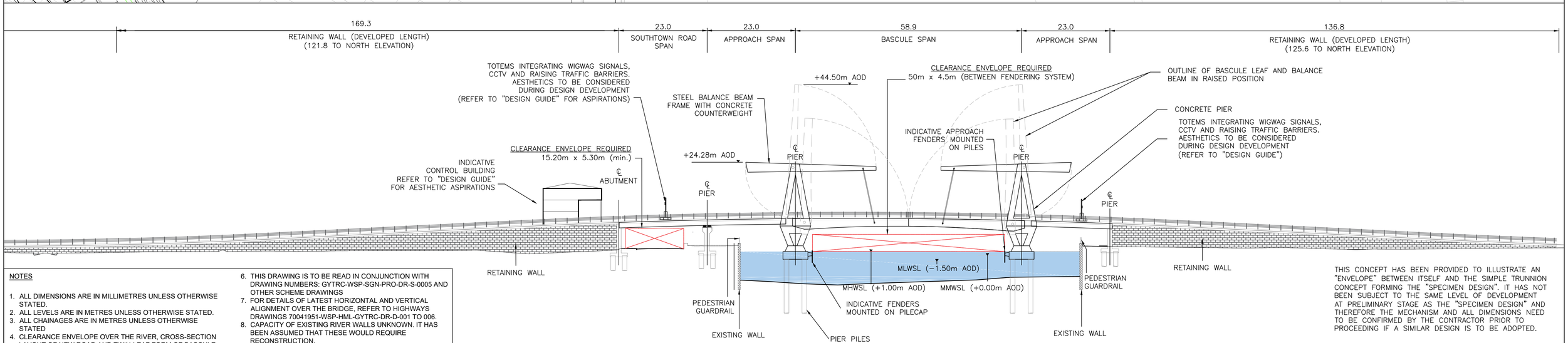
REV.	DESCRIPTION	CHECKED	DATE
P01	RETAINING WALL PATTERN AND LENGTH AMENDED	GS	16-02-18
P02	MINOR AMENDMENTS	JLG	16-04-18
P03	SOUTHTOWN RD BRIDGE ON SEPARATE DRAWING	JLG	07-06-18
	RETITLED AND RENUMBERED FROM 1076653-WSP-SGN-OPT32-DR-S-0002		
P04	MINOR AMENDMENTS + "DCO" CODE ADDED TO REF	JLG	15-06-18

	INITIALS	DATE	
DESIGNED BY	AH	15-11-16	DRAWING No. GYTRC-WSP-SGN-DCO-DR-0002
DRAWN BY	OW	27-04-17	PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING
CHECKED BY	SA	27-04-17	SCALE 1:500 @ A1 / FILE No.
APPROVED BY	GS	27-04-17	

BIL 1995/15



PLAN
SCALE 1:500



SOUTH ELEVATION
SCALE 1:500

THIS CONCEPT HAS BEEN PROVIDED TO ILLUSTRATE AN "ENVELOPE" BETWEEN ITSELF AND THE SIMPLE TRUNNION CONCEPT FORMING THE "SPECIMEN DESIGN". IT HAS NOT BEEN SUBJECT TO THE SAME LEVEL OF DEVELOPMENT AT PRELIMINARY STAGE AS THE "SPECIMEN DESIGN" AND THEREFORE THE MECHANISM AND ALL DIMENSIONS NEED TO BE CONFIRMED BY THE CONTRACTOR PRIOR TO PROCEEDING IF A SIMILAR DESIGN IS TO BE ADOPTED.

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES UNLESS OTHERWISE STATED.
3. ALL CHAINAGES ARE IN METRES UNLESS OTHERWISE STATED
4. CLEARANCE ENVELOPE OVER THE RIVER, CROSS-SECTION LAYOUT OF NEW ROAD AND TWIN-LEAF FORM OF BASCULE BRIDGE ARE MANDATORY REQUIREMENTS OF THE SCOPE OF THE WORKS. OTHER DETAILS OF THE FORM OF BRIDGE, FOUNDATIONS AND WALLS SHOWN ARE CONCEPTUAL AND INDICATIVE ONLY. DESIGN TO BE DEVELOPED BY THE CONTRACTOR TO ACHIEVE THE SPECIFIED PERFORMANCE REQUIREMENTS.
5. BRIDGE DRAINAGE NOT SHOWN. TO BE DEVELOPED BY CONTRACTOR.
6. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NUMBERS: GYTRC-WSP-SGN-PRO-DR-S-0005 AND OTHER SCHEME DRAWINGS
7. FOR DETAILS OF LATEST HORIZONTAL AND VERTICAL ALIGNMENT OVER THE BRIDGE, REFER TO HIGHWAYS DRAWINGS 70041951-WSP-HML-GYTRC-DR-D-001 TO 006.
8. CAPACITY OF EXISTING RIVER WALLS UNKNOWN. IT HAS BEEN ASSUMED THAT THESE WOULD REQUIRE RECONSTRUCTION.
9. TIE-BARS EXTEND IN THE GROUND BEHIND THE EXISTING RIVER WALLS. DIFFERENT SPAN LENGTHS AND PIER POSITIONS TO AVOID AFFECTING TIE-BARS AND MINIMISE WALL RECONSTRUCTION SHALL BE INVESTIGATED BY THE CONTRACTOR DURING DEVELOPMENT OF THE DESIGN.
10. "DESIGN GUIDE" DENOTES "GREAT YARMOUTH THIRD RIVER CROSSING - DESIGN GUIDANCE" (DOC REF: 62240375-WSP-ELS-GYTRC-RP-L-8001).

Contract Drawing Number
NCCT41361-03-C-18-08

APPROVED FOR ISSUE WITH INVITATION TO PARTICIPATE IN DIALOGUE

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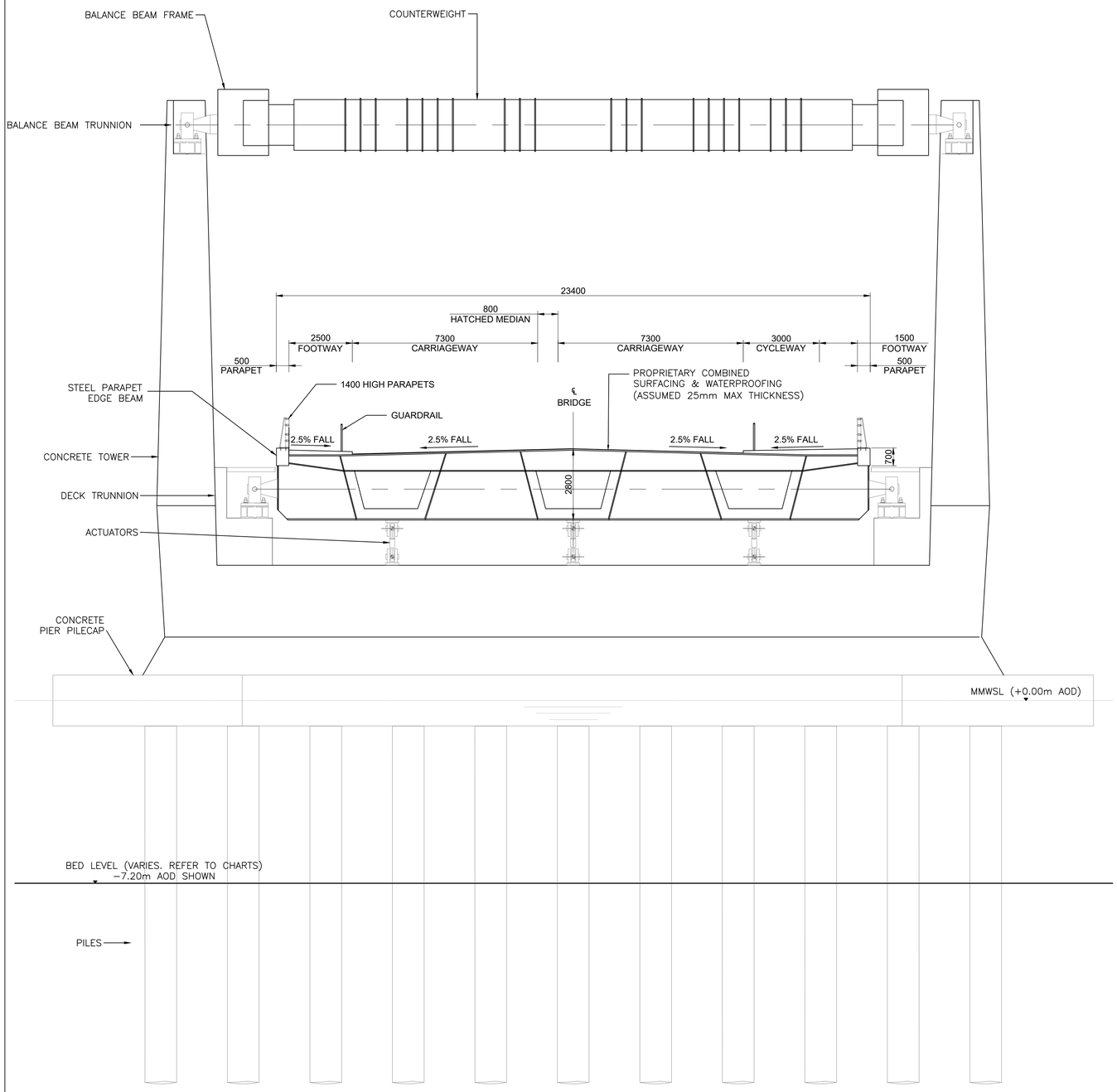
DRAWING TITLE
FIGURE 2.7a - GREAT YARMOUTH THIRD RIVER CROSSING
BASCULE BRIDGE OPTION 2 - BALANCE BEAM TRUNNION
CONCEPTUAL GENERAL ARRANGEMENT - SHEET 1 OF 2

REV.	DESCRIPTION	CHECKED	DATE
P01	INITIAL ISSUE	JLG	07-06-18
P02	MINOR AMENDMENTS + PARAPET NOTES ADDED	JLG	15-06-18
P03	FENDERS AMENDED + REVISIONS TO NOTES	JLG	13-07-18

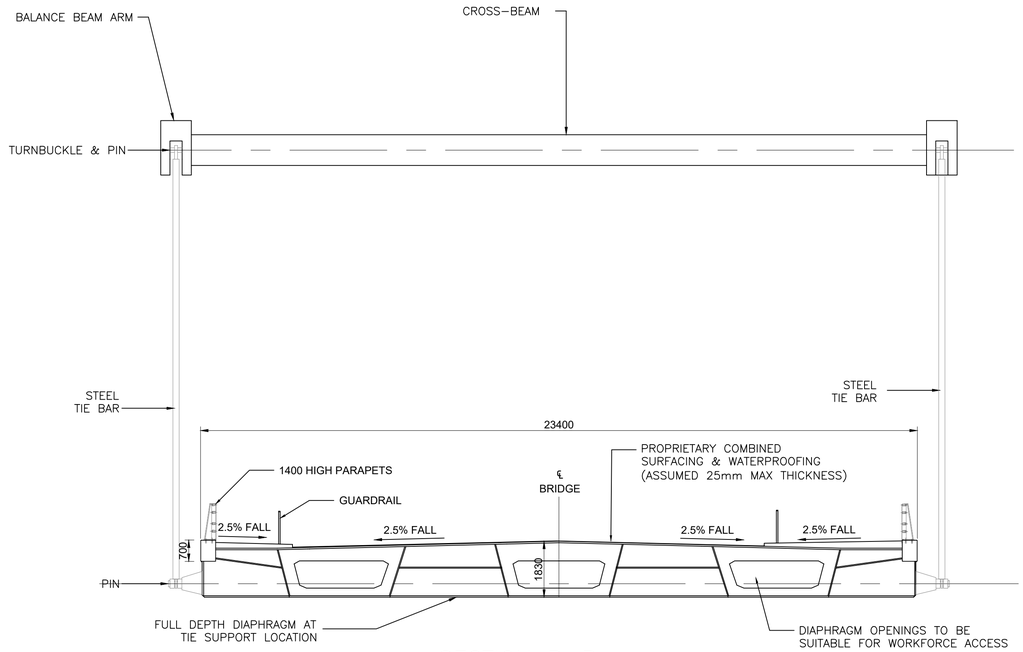
	INITIALS	DATE
DESIGNED BY	JLG	05.06.18
DRAWN BY	CE	05.06.18
CHECKED BY	JLG	07.06.18
APPROVED BY	BD	07.06.18

DRAWING No. GYTRC-WSP-SGN-PRO-DR-S-0004
PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING
SCALE 1:500 @ A1
FILE No.

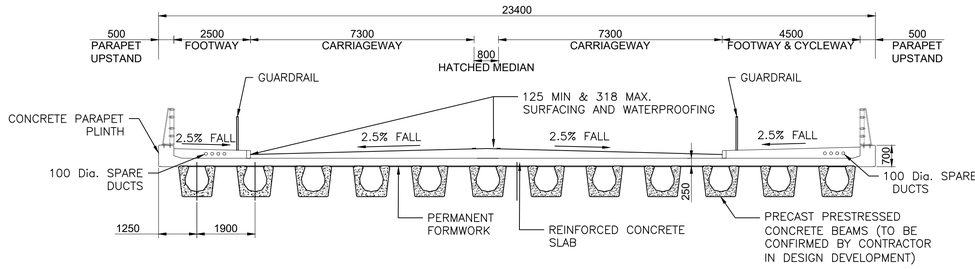
BIL 19/07/18



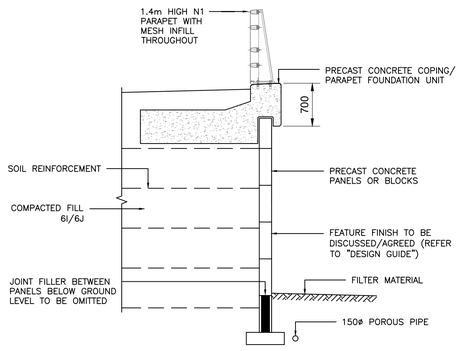
SECTION A–A
(BASCULE BRIDGE AT MAIN PIER)
SCALE 1:100



SECTION B–B
(BASCULE BRIDGE AT TIE SUPPORT)
SCALE 1:100



SECTION C–C
(APPROACH & SOUTHTOWN ROAD SPANS)
SCALE 1:100



SECTION D–D
(TYPICAL SECTION THROUGH REINFORCED EARTH WALLS)
SCALE 1:50

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES UNLESS OTHERWISE STATED.
3. ALL CHAINAGES ARE IN METRES UNLESS OTHERWISE STATED
4. CLEARANCE ENVELOPE OVER THE RIVER, CROSS-SECTION LAYOUT OF NEW ROAD AND TWIN-LEAF FORM OF BASCULE BRIDGE ARE MANDATORY REQUIREMENTS OF THE SCOPE OF THE WORKS. OTHER DETAILS OF THE FORM OF BRIDGE, FOUNDATIONS AND WALLS SHOWN ARE CONCEPTUAL AND INDICATIVE ONLY. DESIGN TO BE DEVELOPED BY THE CONTRACTOR TO ACHIEVE THE SPECIFIED PERFORMANCE REQUIREMENTS.
5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NUMBERS: GYTRC-WSP-SGN-PRO-DR-S-0004 AND OTHER SCHEME DRAWINGS. IN PARTICULAR, NOTE THE COMMENT ON DRAWING DR-S-0004 ON THE ILLUSTRATIVE NATURE OF THIS CONCEPT IN COMPARISON TO THE "SPECIMEN DESIGN".
6. "DESIGN GUIDE" DENOTES "GREAT YARMOUTH THIRD RIVER CROSSING - DESIGN GUIDANCE" DOC REF 62240375-WSP-ELS-GYTRC-RP-L-8001
7. SEPARATE DRAWINGS NOW PRODUCED FOR DCO AND FOR PROCUREMENT, DENOTED BY "PRO" OR "DCO" IN DRAWING NO.
8. BRIDGE DRAINAGE NOT SHOWN. TO BE DEVELOPED BY CONTRACTOR.

Contract Drawing Number
NCCT41361-03-C-18-09

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DRAWING TITLE
FIGURE 2.7b - GREAT YARMOUTH THIRD RIVER CROSSING
BASCULE BRIDGE OPTION 2 - BALANCE BEAM TRUNNION
CONCEPTUAL GENERAL ARRANGEMENT - SHEET 2 OF 2

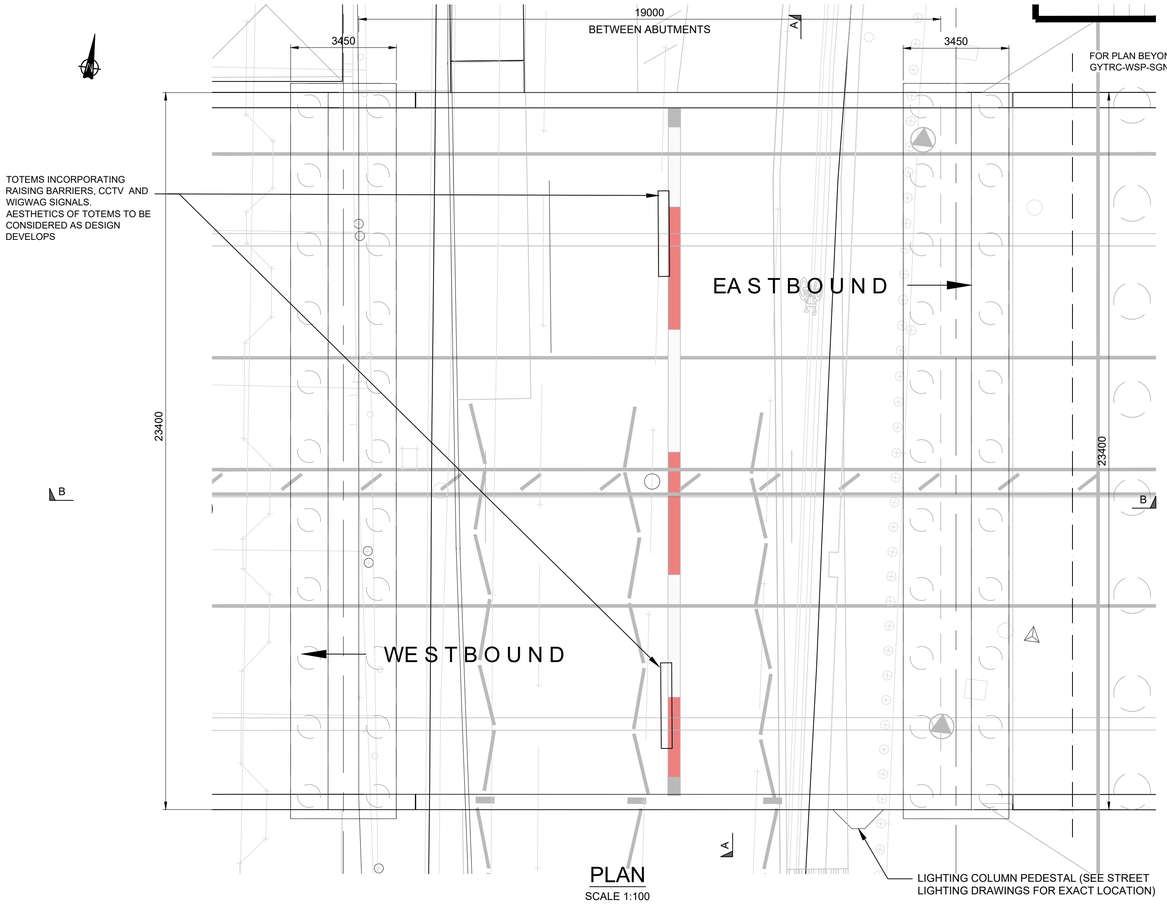
REV.	DESCRIPTION	CHECKED	DATE
P01	INITIAL ISSUE	JLG	07-06-18
P02	NOTES AMENDED + "PRO" ADDED TO DRG NO	JLG	13-07-18

APPROVED FOR ISSUE WITH INVITATION TO PARTICIPATE IN DIALOGUE

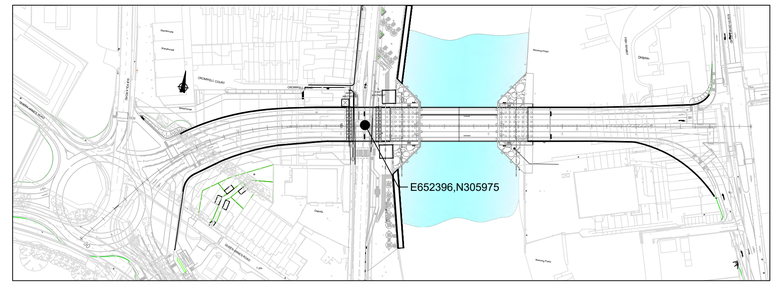
	INITIALS	DATE
DESIGNED BY	JLG	05.06.18
DRAWN BY	CE	05.06.18
CHECKED BY	JLG	07.06.18
APPROVED BY	BD	07.06.18

DRAWING No. GYTRC-WSP-SGN-PRO-DR-S-0005
PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING
SCALE 1:500 @ A1
FILE No.

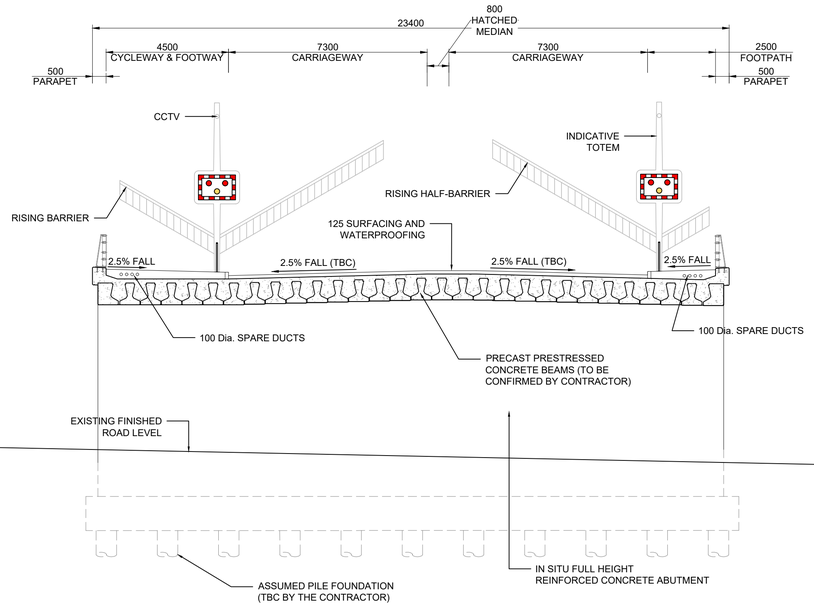
BIL 19/01/15



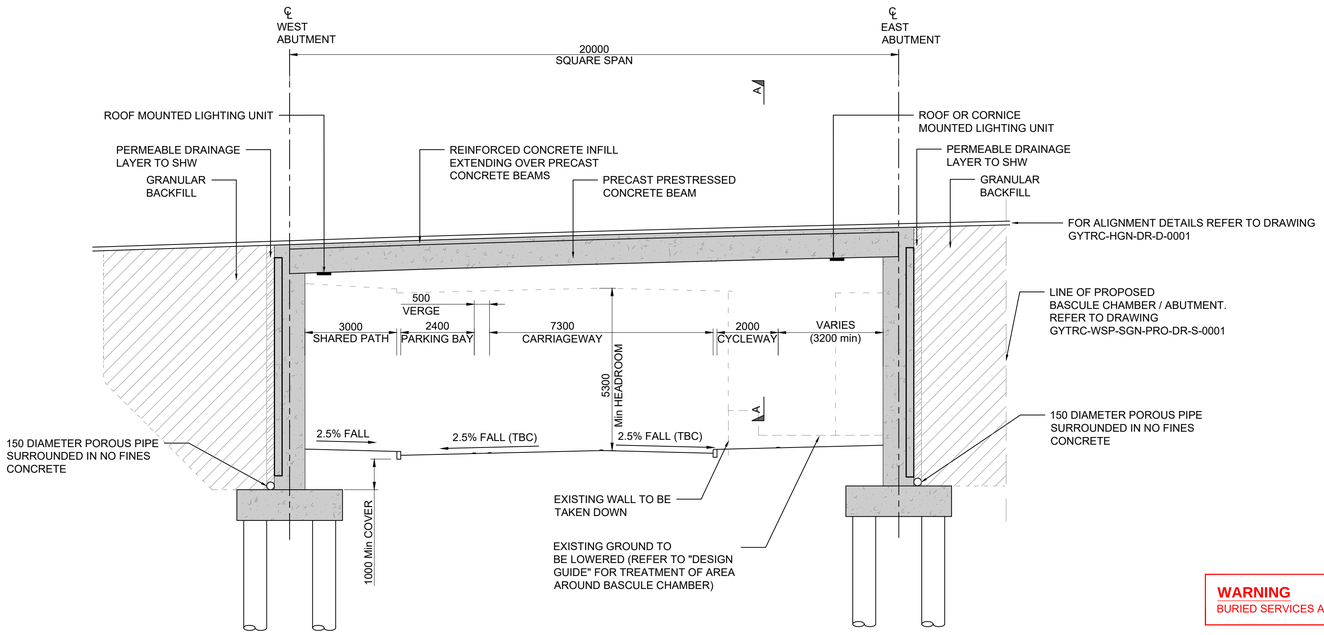
PLAN
SCALE 1:100



KEY PLAN
SCALE: NTS



SECTION A-A
SCALE 1:100



SECTION B-B
SCALE 1:100

WARNING
BURIED SERVICES ARE PRESENT BUT NOT SHOWN.

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES UNLESS OTHERWISE STATED.
3. ALL CHAINAGES ARE IN METRES UNLESS OTHERWISE STATED
4. WITH EXCEPTION OF CLEARANCE ENVELOPE AND LAYOUT OF NEW LINK ROAD ABOVE THE CROSSING, WHICH ARE REQUIREMENTS OF THE SCOPE OF THE CONTRACT, DETAILS SHOWN INCLUDING BRIDGE, FOUNDATIONS AND WALL DETAILS ARE CONCEPTUAL ONLY. DESIGN TO BE DEVELOPED BY THE CONTRACTOR TO ACHIEVE THE SPECIFIED PERFORMANCE SPECIFICATION.
5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NUMBERS: GYTRC-WSP-SGN-DCO-DR-S-0001, 0002 AND OTHER SCHEME DRAWINGS
6. DRAWING RENUMBERED AT P02 FROM 1076653-WSP-SGN-OPT32-DR-S-0003 TO SUIT UPDATED SCHEME DRAWING NUMBERING WITH SEPARATE DRAWINGS FOR DCO AND FOR PROCUREMENT

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DRAWING TITLE
FIGURE 2.8 - GREAT YARMOUTH THIRD RIVER CROSSING
SOUTHTOWN ROAD BRIDGE
CONCEPTUAL GENERAL ARRANGEMENT

REV.	DESCRIPTION	CHECKED	DATE
P01	FIRST ISSUE	JLG	30-04-18
P02	SOUTHTOWN RD AMENDED; DRG RENUMBERED	JLG	08-06-18
P03	MINOR AMENDMENTS TO ACCOMPANY PEIR ISSUE	JLG	15-06-18

	INITIALS	DATE
DESIGNED BY	AH	30-04-18
DRAWN BY	ON	30-04-18
CHECKED BY	JLG	30-04-18
APPROVED BY	BD	30-04-18

DRAWING No.
GYTRC-WSP-SGN-DCO-DR-S-0003
PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING
SCALE
1:500 @ A1
FILE No.

BIL 190515

Notes:

1. The plan is in its first draft and is to be shared with relevant Risk Management Authorities to provide comment. A preliminary drainage design is currently being progressed and what has been included within this plan may change due the scheme progression.
2. For the western side of the River Yare the proposal is to discharge into the ordinary watercourses. For the eastern side the proposal is to discharge into the existing AW combined sewer on South Denes Road restricted at an existing rate or a rate specified by AW.
3. A CCTV survey will be required to confirm the existing drainage assets within the area of the scheme.
4. The existing watercourses within the area will require de-silting and re-surveying to confirm the levels for the proposed system to discharge to.
5. Alternative discharge strategies for the western side of the proposed scheme are also being explored; these include full discharge into the River Yare main river and a split discharge to the main river and ordinary watercourses. These other potential options are being discussed with the relevant authorities.

Area 1 to discharge into proposed Pond 1

New pond to discharge into realigned watercourse at a controlled rate

Existing watercourse to be realigned within Kings Centre property boundary

Kings Centre

Pond 1

Storage 2

Area 2 to discharge into proposed Storage 2 (underground). Size, type and location of Storage 2 to be confirmed.

Proposed storage to discharge into culverted watercourse at a controlled rate

River Yare

Area 3 to discharge into AW combined network at a controlled rate defined by AW

South Denes Road

KEY

- AW Combined Sewer
- EXISTING WATERCOURSE TO REMAIN
- EXISTING CULVERT TO REMAIN
- NEW CULVERTED WATERCOURSE
- NEW REALIGNED WATERCOURSE
- NEW POND
- DRAINED AREA 1
- DRAINED AREA 2
- DRAINED AREA 3
- NEW STORAGE FEATURE

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DRAWING TITLE

FIGURE 2.9
GREAT YARMOUTH THIRD RIVER CROSSING
PROPOSED HIGH LEVEL DRAINAGE STRATEGY PLAN

REV.	DESCRIPTION	CHECKED	DATE
A	Title amended	RJW	06/18
B	RLB added	RJW	06/18
C	Border amended	RJW	06/18
D	Figure number added	RJW	08/18

	INITIALS	DATE
DESIGNED BY	RJW	03.18
DRAWN BY	RJW	03.18
CHECKED BY	RFS	03.18
APPROVED BY	SG	03.18

DRAWING No. GYTRC-WSP-HDG-XX-DR-D-0007

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

SCALE 1:1000 @ A1

FILE No. 0007

BL 19/07/18

N

0 55 110 220 330 440 Meters

1:4,000

Key

- PEIR Red Line Boundary

Distance from Redline Boundary

- 20m from Redline Boundary
- 50m from Redline Boundary
- 100m from Redline Boundary
- 200m from Redline Boundary
- 350m from Redline Boundary

Sensitive Receptors

- Residential Receptors
- Educational Receptors
- Health Receptors

Ecological Receptors

- Outer Thames Estuary Special Protection Area

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Figure 6.1a

Air Quality Construction Phase
Assessment Study Area

REV.	DESCRIPTION	CHECKED	DATE
A	INITIAL ISSUE	JD	19/07/18

	INITIALS	DATE
DESIGNED BY	CL	19/07/2018
DRAWN BY	CL	19/07/2018
CHECKED BY	JD	19/07/2018
APPROVED BY	JD	19/07/2018

DRAWING No. GYTRC-WSP-EAU-XX-DR-EN-0001

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:4,000@ A1

FILE No.

N

0 65 130 260 390 520 Meters

1:5,000

Key

- PEIR Red Line Boundary

Distance from Redline Boundary

- 20m from Redline Boundary
- 50m from Redline Boundary
- 100m from Redline Boundary
- 200m from Redline Boundary
- 350m from Redline Boundary

Sensitive Receptors

- Residential Receptors
- Educational Receptors
- Health Receptors

Ecological Receptors

- Outer Thames Estuary Special Protection Area

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DRAWING TITLE

Figure 6.1b

Air Quality Construction Phase
Assessment Study Area

REV.	DESCRIPTION	CHECKED	DATE
A	INITIAL ISSUE	JD	19/07/18

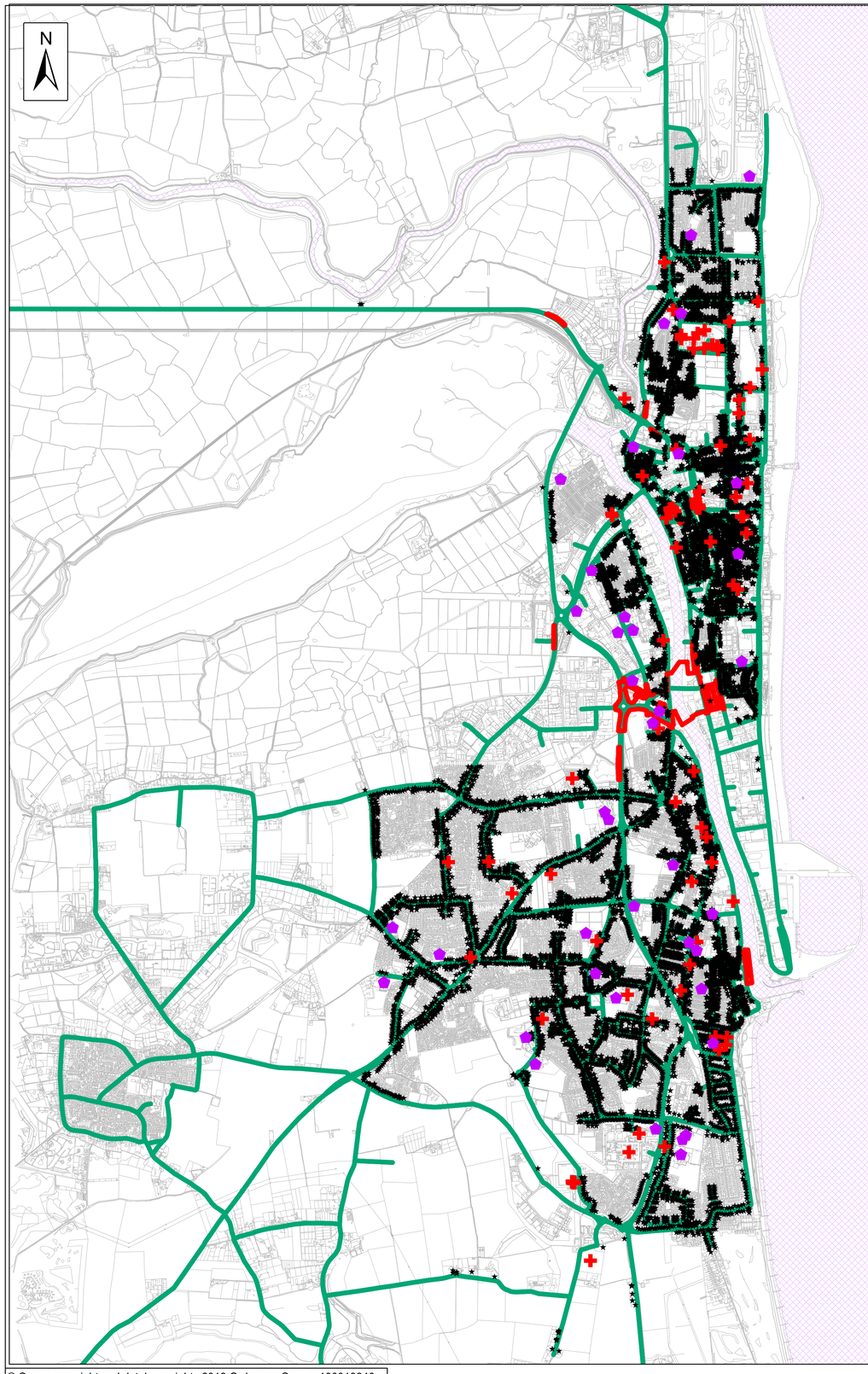
	INITIALS	DATE
DESIGNED BY	CL	19/07/2018
DRAWN BY	CL	19/07/2018
CHECKED BY	JD	19/07/2018
APPROVED BY	JD	19/07/2018

DRAWING No. GYTRC-WSP-EAU-XX-DR-EN-0004

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:5,000 @ A1

FILE No.



0 275 550 1,100 1,650 2,200 Meters

1:20,000

Key

Preliminary Traffic Network

Sensitive Receptors

Residential Receptors within 50m of the preliminary traffic network, from which a selction of representative properties will be modelled

Educational Receptors

Health Receptors

PEIR Red Line Boundary

Ecological Receptors

Outer Thames Estuary Special Protection Area, study area to consist of a transect starting at the closest relevent point to the scheme as advised by ecology specialists

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Figure 6.2
Air Quality Operational
Assessment Study Area

REV.	DESCRIPTION	CHECKED	DATE
	INITIAL ISSUE	JD	14/06/2018

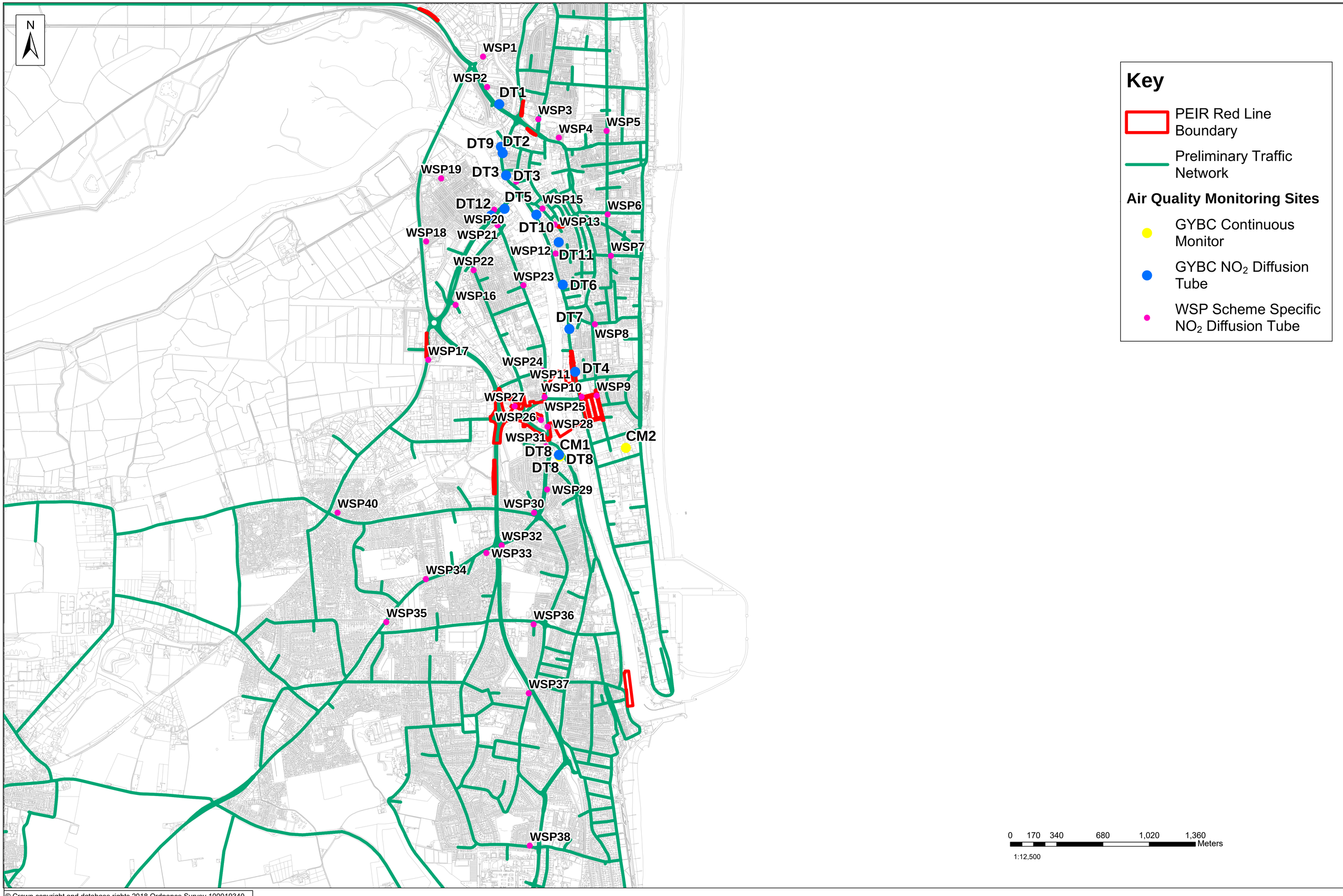
	INITIALS	DATE
DESIGNED BY	CL	18/07/2018
DRAWN BY	CL	18/07/2018
CHECKED BY	JD	18/07/2018
APPROVED BY	JD	18/07/2018

DRAWING No. GYTRC-WSP-EAU-XX-DR-EN-0002

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:20,000@A1

FILE No.



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DRAWING TITLE

Figure 6.3
Air Quality Monitoring

REV.	DESCRIPTION	CHECKED	DATE
	INITIAL ISSUE	JD	14/06/2018

	INITIALS	DATE
DESIGNED BY	CL	18/07/2018
DRAWN BY	CL	18/07/2018
CHECKED BY	JD	18/07/2018
APPROVED BY	JD	18/07/2018

DRAWING No. GYTRC-WSP-EAU-XX-DR-EN-0003

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:12,500@A1

FILE No.

Appendix G-4 Part 3 – Consultation Materials: Preliminary Environmental Information Report

N

Legend

- Proposed Scheme Boundary
- Provisional Operational Noise Study Area (1.6km buffer around Proposed Scheme and bypassed routes)

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FIGURE 7.1
PROVISIONAL OPERATIONAL NOISE STUDY AREA

REV.	DESCRIPTION	CHECKED	DATE
A	INITIAL ISSUE	JD	13/07/18

	INITIALS	DATE
DESIGNED BY	RB	18/07/2018
DRAWN BY	RB	18/07/2018
CHECKED BY	JD	18/07/2018
APPROVED BY	JD	18/07/2018

DRAWING No. GYTRC-WSP-ENV-XX-DR-EN-0001

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:11,000 @ A1

FILE No.

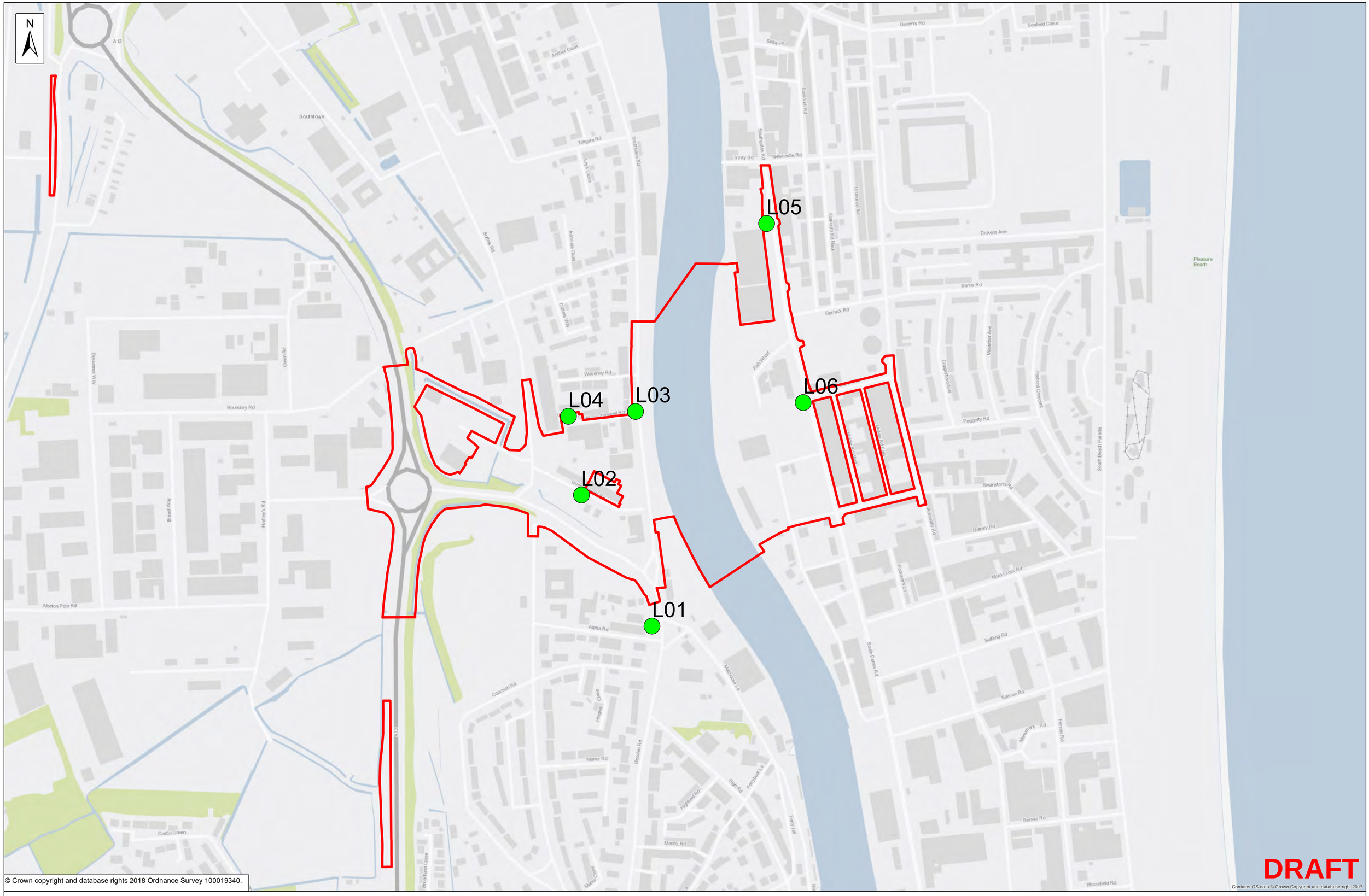

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FIGURE 7.2
BASELINE NOISE SURVEY MONITORING LOCATIONS

REV.	DESCRIPTION	CHECKED	DATE
A	INITIAL ISSUE	JD	13/07/18

	INITIALS	DATE
DESIGNED BY	RB	13/07/2018
DRAWN BY	RB	13/07/2018
CHECKED BY	JD	13/07/2018
APPROVED BY	JD	13/07/2018

DRAWING No. GYTRC-WSP-ENV-XX-DR-EN-0002

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:2,500 @ A1

FILE No.

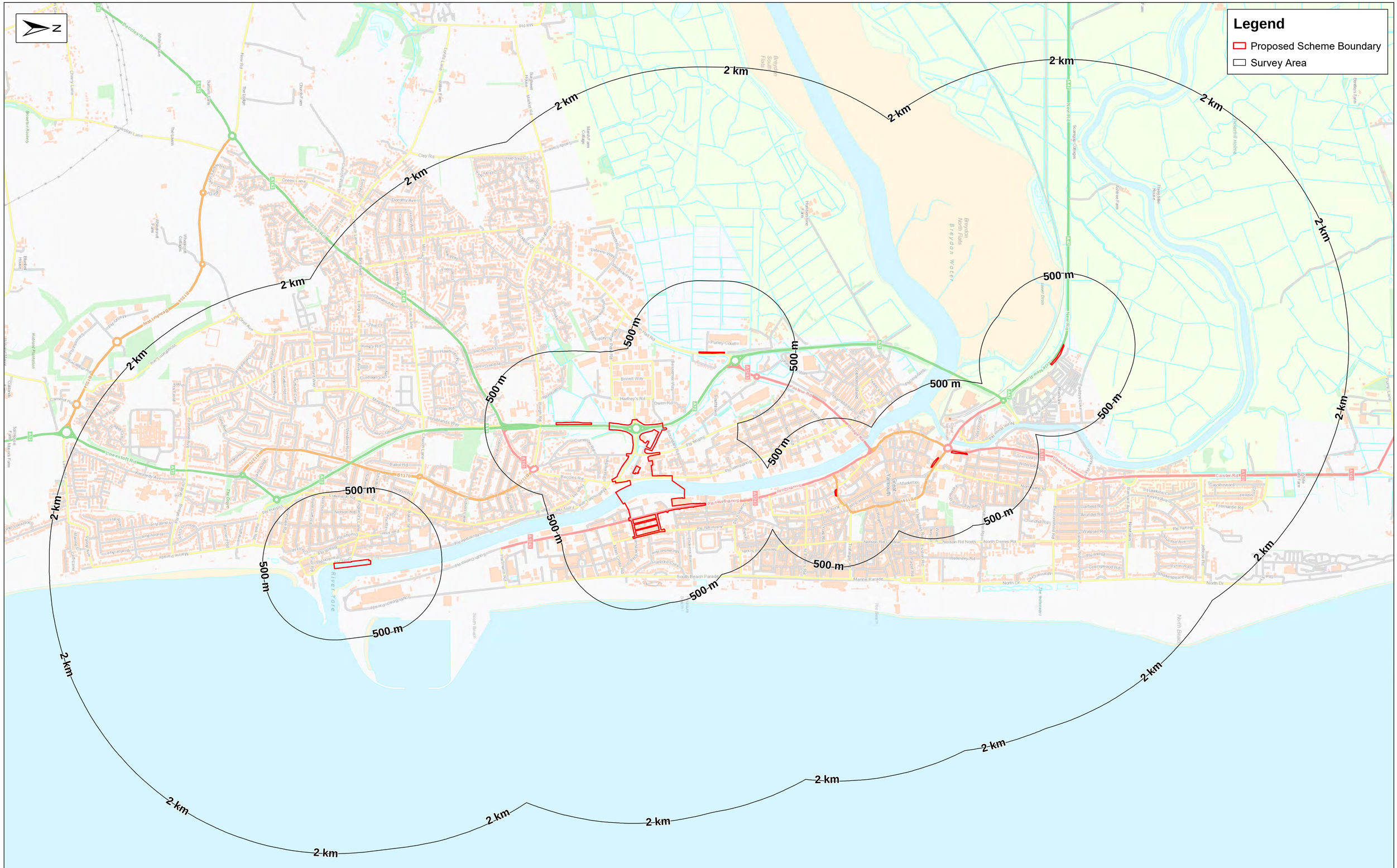

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Figure 8.1 Main and Broad Study Areas

REV.	DESCRIPTION	CHECKED	DATE
A	INITIAL ISSUE	JD	13/07/18

	INITIALS	DATE
DESIGNED BY	-	-
DRAWN BY	BS	17/07/2018
CHECKED BY	DE	17/07/2018
APPROVED BY	JD	17/07/2018

DRAWING No. GYTRC-WSP-EBD-XX-DR-EC-0001

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

SCALE 1:12,000@ A1

FILE No.

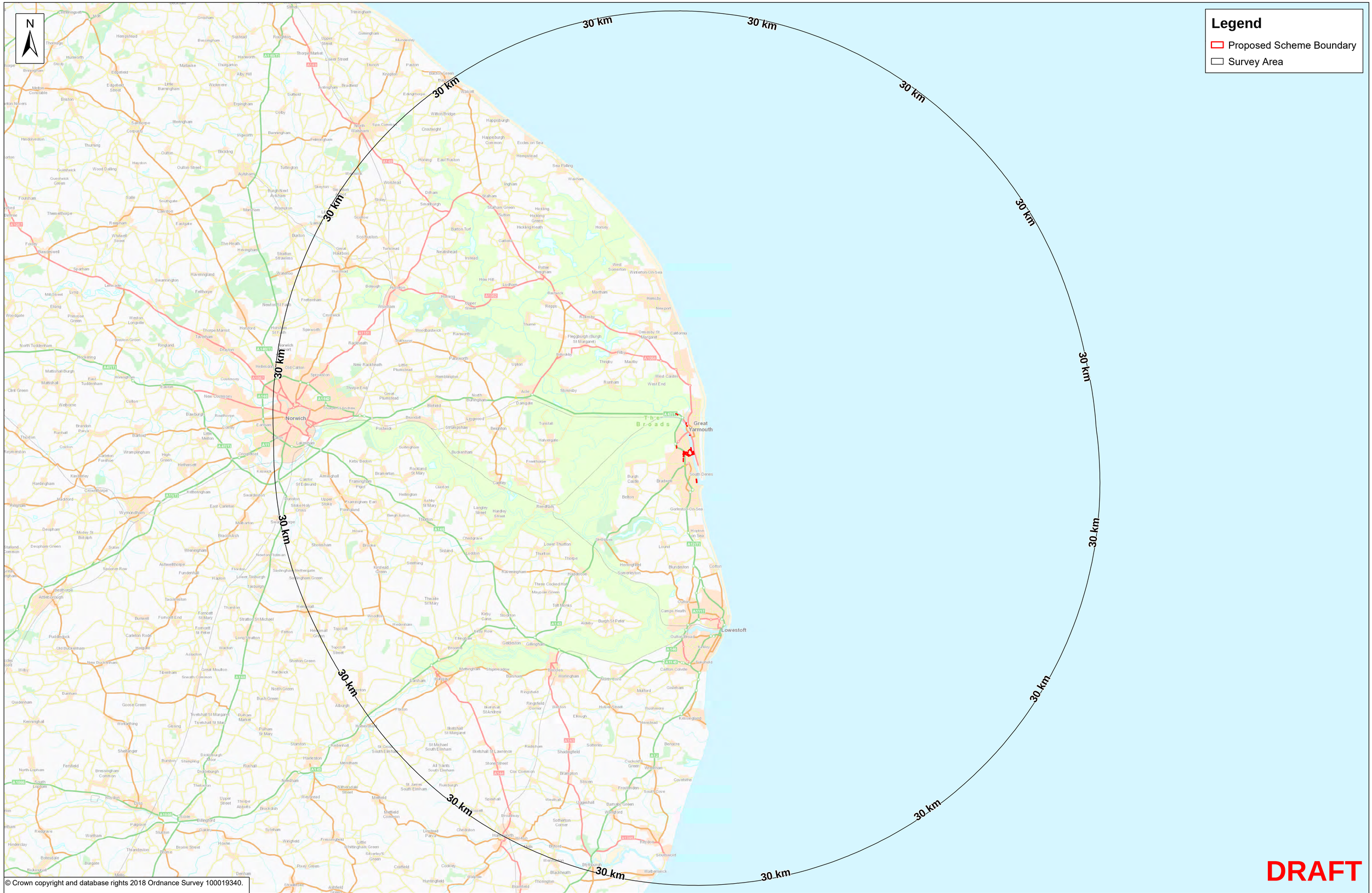

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Figure 8.2 Extended Study Area

REV.	DESCRIPTION	CHECKED	DATE
A	INITIAL ISSUE	JD	13/07/18

	INITIALS	DATE
DESIGNED BY	-	-
DRAWN BY	BS	17/07/2018
CHECKED BY	DE	17/07/2018
APPROVED BY	JD	17/07/2018

DRAWING No. GYTRC-WSP-EBD-XX-DR-EC-0002

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

SCALE 1:125,000@ A1

FILE No.

To Beacon Industrial Park
Gapton Hall Industrial Estate
Yarmouth Business Park
Harfrey's Industrial Estate
Southtown Port Area
Breydon Water
Breydon Bridge
Haven Bridge
River Yare
Riverside Road Industrial Estate Area
Long's Industrial Estate
Gorlestone On-Sea
Time and Tide Museum
Great Yarmouth Minster
South Denes
South Denes Industrial Area
Outer Harbour

0 10 20 50

N

KEY

Town Centre
Proposed Bridge
Train Station
Bus Station
Hospital
School
Yacht Station
Attractions
Pier
Cycle Shop

Cycle Routes
Route 1 (Caister-South Denes)
Route 2 (North Denes-South Denes)
Route 3 (Town Centre-Burgh Castle)
Route 4 (Town Centre-Belton)
Route 5 (Town Centre-Bradwell)
Route 6 (Town Centre-Gorleston)
Route 7 (Town Centre Orbital)
Sustrans (Routes 30 & 517)
Neighbourhood Routes
Traffic Free Path

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DRAWING TITLE
FIGURE 17.2
GREAT YARMOUTH
THIRD RIVER CROSSING
WIDER NMU CONTEXT

REV.	DESCRIPTION	CHECKED	DATE
P01	FOR INFORMATION	CN	29.05.18

	INITIALS	DATE
DESIGNED BY	CN	31.05.18
DRAWN BY	CT	31.05.18
CHECKED BY	JD	31.05.18
APPROVED BY	JD	31.05.18

DRAWING No. 70041951-WSP-ELS-GYTRC-SK-L-9001
PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING
SCALE 1:10,000 @ A1
FILE No. 9001

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Figure 2.1 – Proposed Scheme Locations

REV.	DESCRIPTION	CHECKED	DATE
01	INITIAL ISSUE	JD	13/07/2018

	INITIALS	DATE
DESIGNED BY	KH	26/07/2018
DRAWN BY	BS	26/07/2018
CHECKED BY	JD	26/07/2018
APPROVED BY	JD	26/07/2018

DRAWING No. GYTRC-WSP-EGN-XX-DR-EN-0001

PROJECT TITLE: GREAT YARMOUTH THIRD RIVER CROSSING

SCALE: 1:11,000 @ A1

FILE No.

KEY

EXTENT OF WORKS BOUNDARY (PEIR)

PROPOSED LAND FOR ACQUISITION

0 50 100 150 200 m

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GREAT YARMOUTH -THIRD RIVER CROSSING
FIGURE 2.3 - PEIR RED LINE BOUNDARY
SHEET 1 OF 7

REV.	DESCRIPTION	CHECKED	DATE
P01	DRAFT ISSUE	MO	May 18
P02	FIRST ISSUE	MO	May 18
P03	AMENDMENT TO REDLINE BOUNDARY	MO	Jun 18

	INITIALS	DATE
DESIGNED BY	DE	May 18
DRAWN BY	EL	May 18
CHECKED BY	YS	May 18
APPROVED BY	MD	May 18

DRAWING No. GYTRC-WSP-RLB-XX-DR-D-0001

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE NTS

FILE No. 0001

BIL 190515

KEY

EXTENT OF WORKS BOUNDARY (PEIR)

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GREAT YARMOUTH -THIRD RIVER CROSSING
FIGURE 2.3 - PEIR RED LINE BOUNDARY
SHEET 2 OF 7

REV.	DESCRIPTION	CHECKED	DATE
P01	DRAFT ISSUE	MO	May 18
P02	FIRST ISSUE	MO	May 18
P03	AMENDMENTS TO REDLINE BOUNDARY	MO	Jun 18

	INITIALS	DATE
DESIGNED BY	DE	May 18
DRAWN BY	EL	May 18
CHECKED BY	YS	May 18
APPROVED BY	MD	May 18

DRAWING No. GYTRC-WSP-RLB-XX-DR-D-0002

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:2000 @ A1

FILE No. 0001

BIL 190515

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GREAT YARMOUTH -THIRD RIVER CROSSING
FIGURE 2.3 - PEIR RED LINE BOUNDARY
SHEET 3 OF 7

REV.	DESCRIPTION	CHECKED	DATE
P01	DRAFT ISSUE	MO	May 18
P02	FIRST ISSUE	MO	May 18
P03	AMENDMENT TO REDLINE BOUNDARY	MO	Jun 18

	INITIALS	DATE
DESIGNED BY	DE	May 18
DRAWN BY	EL	May 18
CHECKED BY	YS	May 18
APPROVED BY	MD	May 18

DRAWING No. GYTRC-WSP-RLB-XX-DR-D-0003

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

SCALE 1:2000 @ A1

FILE No. 0001

BIL 19/01/15

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GREAT YARMOUTH -THIRD RIVER CROSSING
FIGURE 2.3 - PEIR RED LINE BOUNDARY
SHEET 4 OF 7

REV.	DESCRIPTION	CHECKED	DATE
P01	DRAFT ISSUE	MO	May 18
P02	FIRST ISSUE	MO	May 18
P03	AMENDMENT TO REDLINE BOUNDARY	MO	Jun 18

	INITIALS	DATE
DESIGNED BY	DE	May 18
DRAWN BY	EL	May 18
CHECKED BY	YS	May 18
APPROVED BY	MD	May 18

DRAWING No. GYTRC-WSP-RLB-XX-DR-D-0004

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:2000 @ A1

FILE No. 0001

BIL 19/01/15

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DRAWING TITLE

GREAT YARMOUTH -THIRD RIVER CROSSING
FIGURE 2.3 - PEIR RED LINE BOUNDARY
SHEET 5 OF 7

REV.	DESCRIPTION	CHECKED	DATE
P01	DRAFT ISSUE	MO	May 18
P02	FIRST ISSUE	MO	May 18
P03	AMENDMENT TO REDLINE BOUNDARY	MO	Jun 18

	INITIALS	DATE
DESIGNED BY	DE	May 18
DRAWN BY	EL	May 18
CHECKED BY	YS	May 18
APPROVED BY	MD	May 18

DRAWING No. GYTRC-WSP-RLB-XX-DR-D-0005

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

SCALE 1:2000 @ A1

FILE No. 0001

BIL 19/01/15

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GREAT YARMOUTH -THIRD RIVER CROSSING
FIGURE 2.3 - PEIR RED LINE BOUNDARY
SHEET 6 OF 7

REV.	DESCRIPTION	CHECKED	DATE
P01	DRAFT ISSUE	MO	May 18
P02	FIRST ISSUE	MO	May 18
P03	AMENDMENT TO REDLINE BOUNDARY	MO	Jun 18

	INITIALS	DATE
DESIGNED BY	DE	May 18
DRAWN BY	EL	May 18
CHECKED BY	YS	May 18
APPROVED BY	MD	May 18

DRAWING No. GYTRC-WSP-RLB-XX-DR-D-0006

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

SCALE 1:2000 @ A1

FILE No. 0001

BIL 19/01/15

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GREAT YARMOUTH -THIRD RIVER CROSSING
FIGURE 2.3 - PEIR RED LINE BOUNDARY
SHEET 7 OF 7

REV.	DESCRIPTION	CHECKED	DATE
P01	DRAFT ISSUE	MO	May 18
P02	FIRST ISSUE	MO	May 18
P03	AMENDMENT TO REDLINE BOUNDARY	MO	Jun 18

	INITIALS	DATE
DESIGNED BY	DE	May 18
DRAWN BY	EL	May 18
CHECKED BY	YS	May 18
APPROVED BY	MD	May 18

DRAWING No. GYTRC-WSP-RLB-XX-DR-D-0007

PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING

SCALE 1:2000 @ A1

FILE No. 0001

BIL 19/01/15

INSET A

NEW BRIDGE APPROACH TO PASS OVER EXISTING SOUTHTOWN ROAD WHICH WILL REMAIN OPEN

EXISTING ACCESS TO THE BUSINESS UNIT TO BE RETAINED

NEW SIGNALISED CROSSING

NEW SIGNALISED CROSSING

EXISTING HARFREYS ROUNDABOUT

1.8m WIDE CENTRAL RESERVATION

2 x 3.65m LANES

NEW ROUNDABOUT

EXISTING FOOTBRIDGE

NEW SIGNALISED CROSSING

3m WIDE CENTRAL RESERVATION

2 x 3.65m LANES

RETAINING WALL

PROPOSED TURNING HEAD

NEW ACCESS - QUEEN ANNES ROAD JUNCTION WITH SOUTHTOWN ROAD

4 x 3.65m LANES

0.8m MINIMUM WIDTH HATCHED MARKINGS

4.5m FOOTWAY/ CYCLEWAY

NEW FOOTWAY/CYCLEWAY

Navigable channel = 50m minimum

2.5m WIDE FOOTWAY

EXISTING ACCESS TO BE MODIFIED TO A LEFT OUT ONLY EXIT ACCESS

DIRECTION OF ONE-WAY SYSTEM ON SUTTON ROAD AND SWANSTONS ROAD TO BE REVERSED

NEW SIGNAL CONTROLLED JUNCTION

DIRECTION OF ONE-WAY SYSTEM ON SUTTON ROAD AND SWANSTONS ROAD TO BE REVERSED

EXISTING ACCESS RADII TO BE WIDENED TO ACCOMMODATE VEHICLES ACCESSING PERENCO AND ASCO SITE

NOTE: THIS FIGURE SHOWS ONE OF A NUMBER OF DOUBLE LEAF BASCULE BRIDGE DESIGNS CURRENTLY BEING CONSIDERED, HOWEVER THE FINAL OPENING MECHANISM DESIGN IS NOT LIKELY TO MATERIALLY IMPACT ON THE PROPOSED HIGHWAYS ARRANGEMENT PRESENTED HERE.

KEY

- PROPOSED GRASS VERGE/LOW VEGETATION
- PROPOSED EARTHWORKS
- GRASSCRETE MAINTENANCE HARDSTANDING
- PROPOSED CROSSING POINT
- PROPOSED FOOTWAY/CYCLEWAY
- PROPOSED CARRIAGEWAY
- PROPOSED DITCHES
- PROPOSED TACTILE PAVING
- EXTENT OF WORKS BOUNDARY
- PROPOSED ROAD MARKINGS
- PROPOSED PEDESTRIAN GUARD RAIL
- PROPOSED DOUBLE YELLOW LINE

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FIGURE 2.4 – GENERAL ARRANGEMENT PLAN
REGULATION 5(2)(o)
SHEET 1 OF 1

REV.	DESCRIPTION	CHECKED	DATE
P01	First Issue	MO	05.18
P02	Second Issue	MO	06.18
P03	Third Issue	MO	06.18
P04	Road Model Amended	MO	07.18

	INITIALS	DATE
DESIGNED BY	DPP	05.18
DRAWN BY	EL	05.18
CHECKED BY	MO	05.18
APPROVED BY	YS	05.18

DRAWING No. GYTRC-WSP-HGN-XX-DR-D-0001

PROJECT TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING

SCALE 1:1250 @ A1

FILE No. XXXXX

BIL 19/01/15

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

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70046035
OUR REF. NO. GYTRC-WSP-EGN-XX-RP-EN-0003

DATE: AUGUST 2018

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft for client review	Revision A for Issue	Revision A.1 updated issue	
Date	28 June 2018	02 August 2018	13 August 2018	
Prepared by	Jonathan Davey	Jonathan Davey	Jonathan Davey	
Signature				
Checked by	Matt Whalley	Marcus Wood	Marcus Wood	
Signature				
Authorised by	Matt Whalley	Marcus Wood	Marcus Wood	
Signature				
Project number	70046035	70046035	70046035	
Report number	GYTRC-WSP-EGN-XX-RP-EN-0003/P01	GYTRC-WSP-EGN-XX-RP-EN-0003/A	GYTRC-WSP-EGN-XX-RP-EN-0003/A.1	
File reference	\\uk.wspgroup.com\central data\Projects\62240xxx\62240375 - GYTRC\02 WIP\EI EIA and flood risk\03 Document\00 PEIR			

CONTENTS

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]

Broads Authority, Yare House, 62-64 Thorpe Road. Norwich NR1 1RY
[redacted]
www.broads-authority.gov.uk

[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]
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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

Customer Services
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T 0300 060 3900

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:

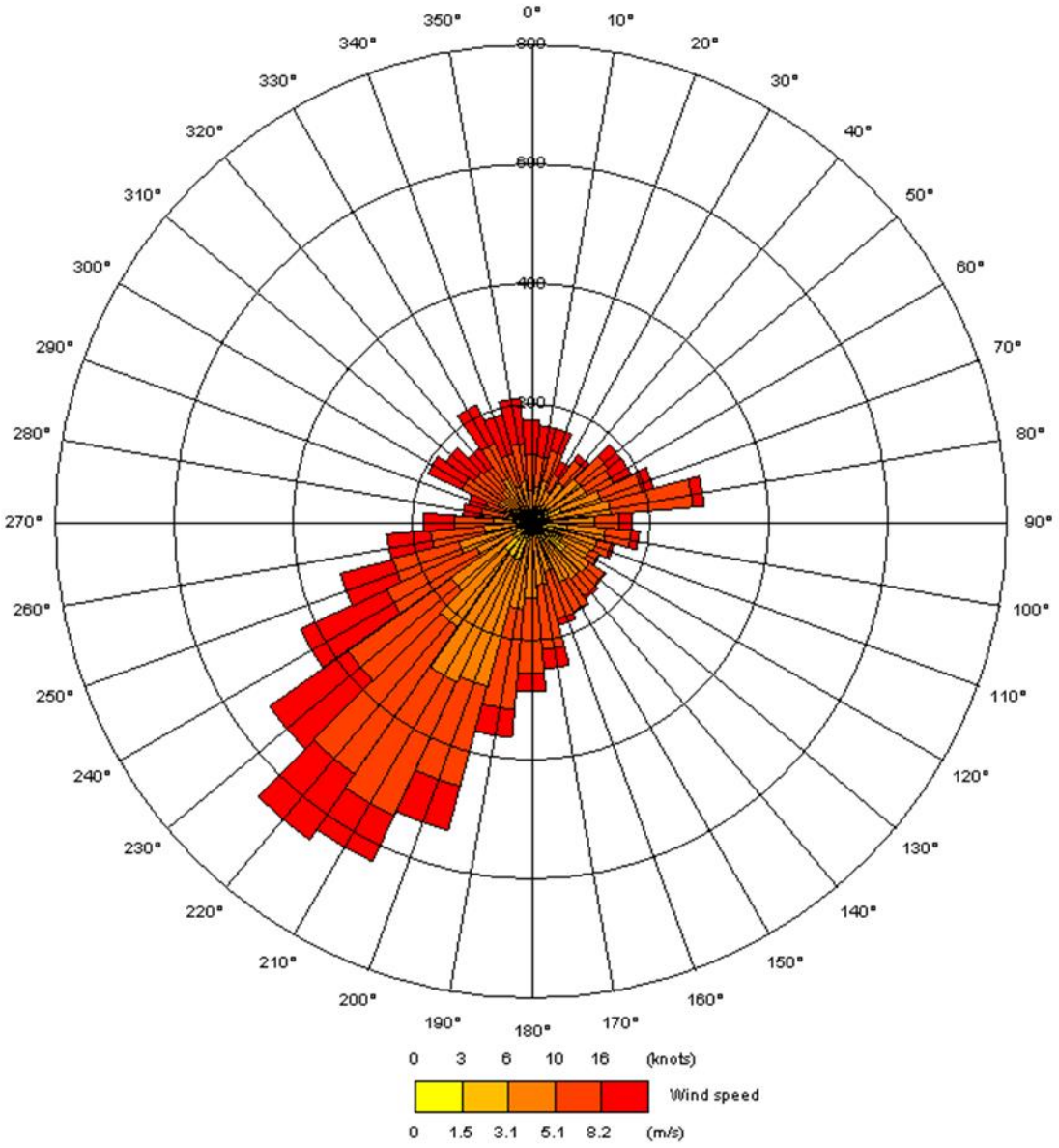
- A summary of dust emission magnitude and sensitivity of the study area;
- The potential risk of impacts associated with the construction phase, without mitigation; and
- Details of appropriate mitigation measures commensurate to the scale and nature of construction activities and locations; this will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

Norfolk County Council

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Document Control Sheet

Project Title	Great Yarmouth Third River Crossing
Report Title	Preliminary Ecological Appraisal
Report ref no.	
Revision	1
Status	Final
Control Date	October 2016

Record of Issue

Issue	Status	Author	Date	Check	Date	Authorised	Date
1	Final	D. Lovett	20/10/16	R. Bailey	21/10/16	A. Bascombe	24/10/16

Distribution

Date	Organisation	Contact	Format	Copies

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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*

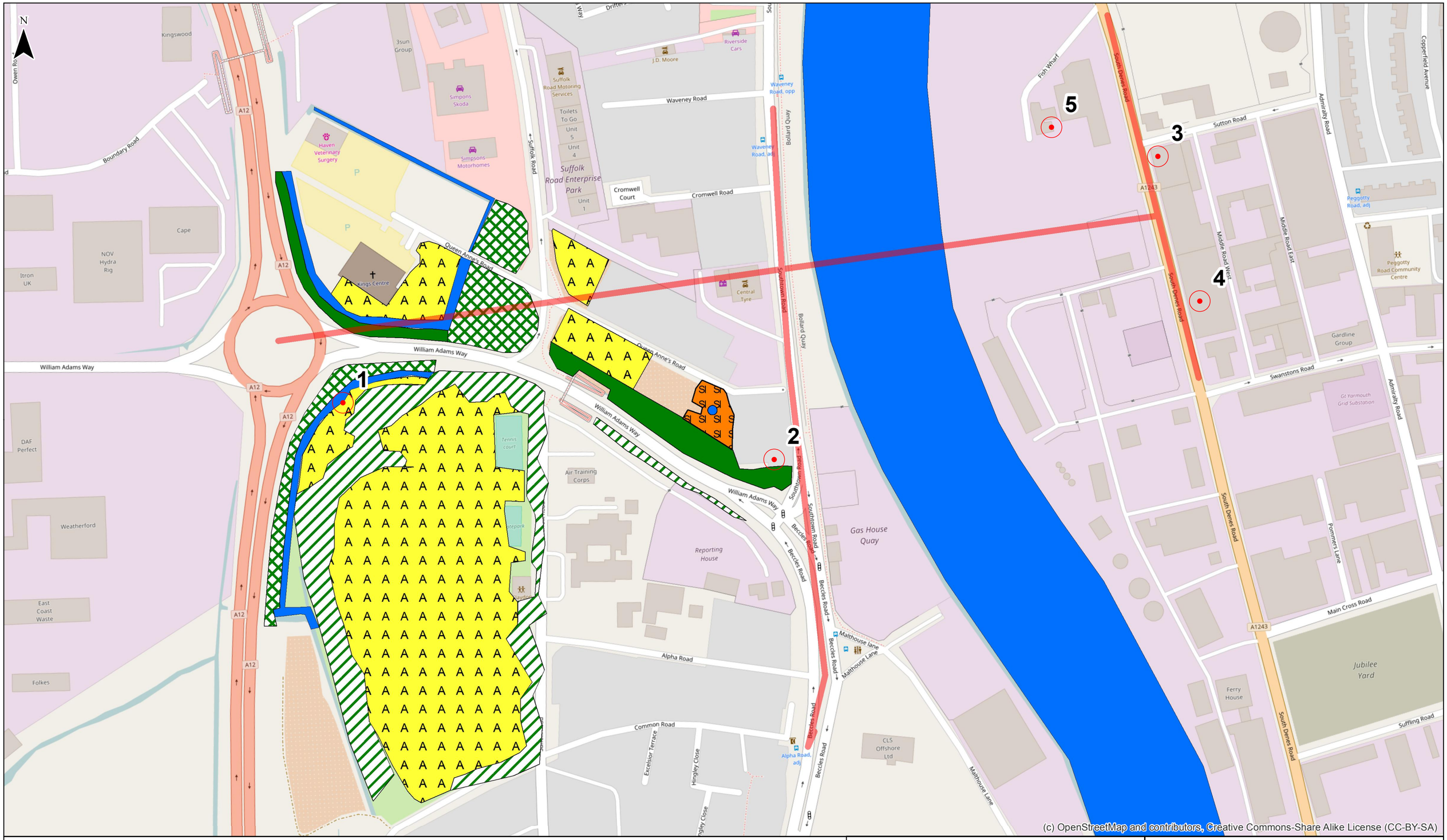
The buildings within the site are either to be purchased for demolition or will be subject to disturbance during the construction of the proposed scheme. It is recommended that further surveys are undertaken to confirm the presence or absence of bats within these buildings.

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.

BIBLIOGRAPHY

- 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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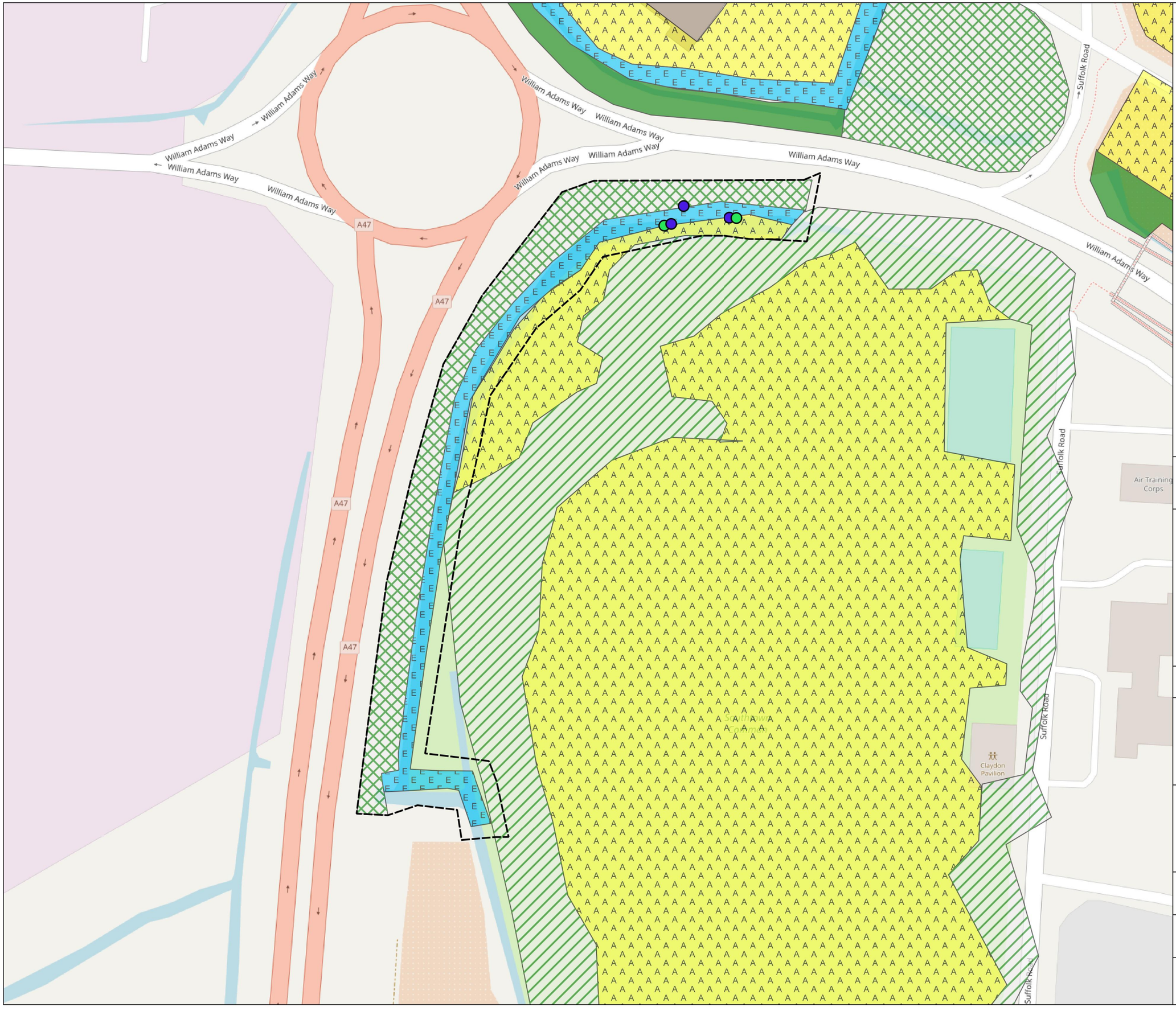
Three White Rose Office Park
Millshaw Park Lane
Leeds
LS11 0DL

wsp.com



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

WSP, 6 Devonshire Square
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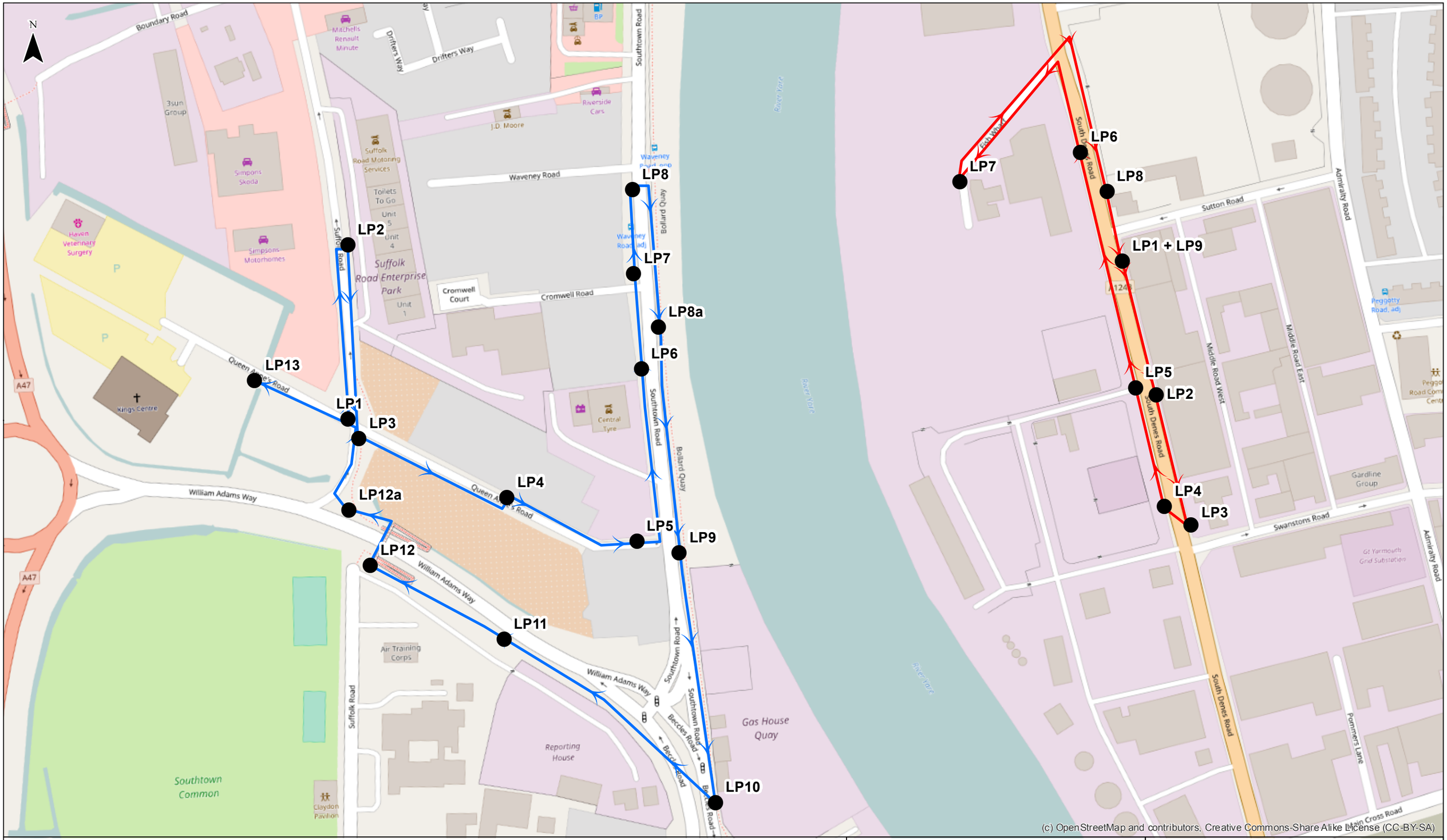
www.wsp.com

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

Draft (V0.1)
Public

Project no: 62240375-017
Date: July 2017

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QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks				
Date	18/07/2017			
Prepared by	K Brown			
Signature				
Checked by	V Anderton-Johnson			
Signature				
Authorised by	S Hales			
Signature				
Project number	62240375-017			
Report number	62240375-017-DBA			
File reference				

PRODUCTION TEAM

CLIENT

Function	Name
Function	Name
Function	Name

WSP

Function	Name
Function	Name
Function	Name

SUBCONSULTANTS

Function	Name
Function	Name
Function	Name

LIMITATIONS

This report is presented to Norfolk County Council in respect of the “Great Yarmouth Third River Crossing” proposed development and may not be used or relied on by any other person. It may not be used by Norfolk County Council in relation to any other matters not covered specifically by the agreed scope of this Report.

Notwithstanding anything to the contrary contained in the report, WSP is obliged to exercise reasonable skill, care and diligence in the performance of the services required by Norfolk Country Council and WSP shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

This report has been prepared by WSP. No individual is personally liable in connection with the preparation of this report. By receiving this report and acting on it, the client or any other person accepts that no individual is personally liable whether in contract, tort, for breach of statutory duty or otherwise.

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

WSP have been commissioned by Norfolk County Council to undertake a cultural heritage Desk Based Assessment (DBA) to assess the heritage impact of the proposed works as part the of Great Yarmouth Third River Crossing.

This document will identify the known heritage resources and likely types of archaeological remains which may be encountered and the predicted impacts of the development upon them.

1.2 SITE DESCRIPTION

The proposed scheme is located approximately 800m to the south of the town centre of Great Yarmouth and sits at approximately 1.2m AOD. It consists of a new bridge that will be constructed between the A12 and South Denes Road, crossing the River Yare and improvements to the existing roads in this area. The roads are surrounded by industrial land, interspersed with smaller areas of residential and recreational land to the east and west of the river.

The site is centred at TG 52469 05894.

1.3 PLANNING BACKGROUND

This assessment has been carried out to support an Outline Business Case (OBC) for the construction of the Great Yarmouth Third River Crossing.

The requirement for a heritage statement is outlined in Policy 128 of the National Planning Policy Framework (NPPF) which outlines the need to identify and assess all heritage assets, their significance and the impact the proposals may have upon them (where possible). The assessment has been undertaken in accordance with the Chartered Institute for Archaeologists' Standards and Guidance for Historic Environment Desk-Based Assessments (CIfA 2014).

2 AIMS AND OBJECTIVES

The objectives of this desk-based assessment are to:

- à provide an assessment of appropriate records, cartographic and written sources in order to identify known heritage assets and where possible, quantify, the size, complexity and potential of any below ground archaeology issues;
- à provide a preliminary assessment of the potential impact of the proposed works to both known and unknown archaeological assets,
- à provide a preliminary assessment of the potential impact of the proposed works to built heritage within the study area,
- à advise on the requirement for, and scope of, any further work likely to be required to support any future planning applications; and
- à to inform future budgets and programmes.

The desk based assessment forms the first stage of an iterative process of a cultural heritage assessment which will be considered alongside wider scheme issues during development of the scheme design. As part of any future detailed design process, further archaeological investigations may be required to assess the extent, character and significance of buried remains.

It is necessary to assess the significance of any such archaeological interest and the likely impact of any proposed re-development upon the significance of any heritage assets, where possible, in accordance with Policy 128 of the National Planning Policy Framework.

3 LEGISLATIVE CONTEXT

3.1 NATIONAL, REGIONAL AND LOCAL POLICY

PLANNING (LISTED BUILDINGS AND CONSERVATION AREAS (P(LBCA)) ACT 1990

3.1.1 Section 1 of the P(LBCA) Act defines a listed building as a 'building which is for the time being included in a list compiled or approved by the Secretary of State under that section. For the purpose of the Act any object or structure fixed to the building, which, since on or before 1 July 1948, has formed part of the land and is comprised within the curtilage of the building is treated as part of the building. 'Building' is defined as including any structure or erection and any part of a building'. The key elements of this Act relevant to this assessment are outlined below:

- Section 66 places a responsibility upon the decision-maker in determining applications for planning permission for a Scheme that affects a listed building or its setting to have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses; and
- Section 72 of the Act places a duty upon the decision maker in determining applications for planning permission within conservation areas to pay special attention to the desirability of preserving or enhancing the character or appearance of that area.

HEDGEROWS REGULATIONS 1997

3.1.2 The Hedgerow Regulations Act presents the following criteria for determining important hedgerows (archaeology and history):

- The hedgerow marks the boundary, or part of the boundary, of at least one historic parish or township and for this purpose "historic" means existing before 1850;
- The hedgerow incorporates an archaeological feature which is: (a) included in the schedule of monuments compiled by the Secretary of State under section 1 (schedule of monuments) of the Ancient Monuments and Archaeological Areas Act 1979(7); or (b) recorded at the relevant date in a Sites and Monuments Record (Now Historic Environment Record);
- The hedgerow is: (a) is situated wholly or partly within an archaeological site included or recorded as mentioned in paragraph 2 or on land adjacent to and associated with such a site; and (b) is associated with any monument or feature on that site;
- The hedgerow: (a) marks the boundary of a pre-1600 AD estate or manor recorded at the relevant date in a Sites and Monuments Record or in a document held at that date at a Record Office; or (b) is visibly related to any building or other feature of such an estate or manor;
- The hedgerow is: (a) recorded in a document held at the relevant date at a Record Office as an integral part of a field system pre-dating the Inclosure Acts(8); or (b) is part of, or visibly related to, any building or other feature associated with such a system, and that system is (i) substantially complete; or (ii) is of a pattern which is recorded in a document prepared before the relevant date by a local planning authority, within the meaning of the 1990 Act(9), for the purposes of development control within the authority's area, as a key landscape characteristic.

NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

3.1.3 National planning policies on the conservation of the historic environment are set out in the NPPF (DCLG, March 2012). Sites of archaeological or cultural heritage significance that are valued components of the historic environment and merit consideration in planning decisions are grouped as 'heritage assets'. The NPPF states that "heritage assets are an irreplaceable resource" the conservation of which can bring "wider social, cultural, economic and environmental benefits."[1] . It also states that the "significance of any heritage assets affected including any contribution made by their setting... should be understood in order to assess the potential impact[2]. In addition to standing remains, heritage assets of archaeological interest can comprise sub-surface remains and, therefore, assessments should be undertaken for a site with potential below-ground archaeological deposits.

3.1.4 NPPF draws a distinction between designated heritage assets and other remains considered to be of lesser significance; "great weight should be given to the asset's conservation. Substantial harm to or loss of a Grade II listed building, park or garden should be exceptional. Substantial harm to or loss of designated heritage assets of the highest significance, including scheduled monuments, protected wreck sites, battlefields, Grade I and II* listed buildings and Grade I and II* registered parks and gardens and World Heritage Sites, should be wholly exceptional." [3]. Therefore, preservation in situ is the preferred course in relation to such sites unless exceptional circumstances exist.

3.1.5 It is normally accepted that non-designated heritage assets will be preserved by record, in accordance with their significance and the magnitude of the harm to or loss of the asset as a result of the proposals to "avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposals."[4]. Non-designated heritage assets of archaeological interest will also be subject to the policies reserved for designated heritage assets if they are of equivalent significance to Scheduled Monuments[5].

GREAT YARMOUTH LOCAL PLAN (ADOPTED 2015)

The policies in the Local Plan relates to the protection and enhancement of the historic environment and is relevant for the proposed development. Policy CS10: Safeguarding local heritage assets deals with development affecting Scheduled Monuments, Listed Buildings, Parks and gardens and Conservation Areas, and their settings, as well as regionally and locally important archaeological sites.

3.2 STANDARDS AND GUIDANCE

The archaeological assessment has been undertaken using guidance from with Volume 11, section 3, part 2 of the Design Manual for Roads and Bridges (DMRB HA 208/07), and the standards and guidance for desk based assessments set by the Chartered Institute for Archaeologists (CIfA 2014) which sets out supplementary policies and guidance on heritage.

The assessment has been undertaken using appropriate methods and practices which satisfy the stated aims of the project, which comply with the Code of Conduct and other relevant by-laws of the CIfA.

[1] NPPF Section 12, paragraph 126
[2] op cit, 128.
[3] op cit, 132
[4] op cit, 129
[5] op cit, 132

4 METHODOLOGY

This desk study has been undertaken to investigate, as far as is reasonable and practical, the character and extent of any known or potential heritage assets within a study area. The study area for designated assets is within 1km of the scheme, for non-designated assets are within a study area of 500m.

The assessment has been informed by a review of all available archaeological records; historical documentary evidence; cartographic evidence and photographic material. This has involved a consultation of the following sources:

- à Historic England - for all records relating to known designated heritage assets.
- à Norfolk Historic Environment Record (HER) - for all records relating to known heritage assets and secondary source material including archaeological investigation reports and aerial photographs;
- à Norfolk Archives - for historic documentary evidence relating to the site, including both primary and secondary sources;
- à National, regional and local planning policy;
- à Other readily available online sources such as Google Earth.

The solid and drift geology for the site has been identified based on that recorded by the British Geological Survey.

A site visit of the proposed scheme was conducted, where access and safety allowed, to allow for a consideration of the study area, the possible identification of landscape and archaeological features and factors that may have had an impact on buried remains (i.e. drains, services etc). The site walkover was undertaken on the 14th July 2017. Photographs were taken using a digital camera. Access was limited to public rights of way.

The assessment of the value of cultural heritage assets which make up the baseline environment has involved reference to the guidance provided in Annexes 5, 6 and 7 of the DMRB HA208/07. The annexes identify factors which it is appropriate to consider during the evaluation of cultural heritage assets. The guidance recommends the adoption of six ratings for value in relation to archaeology and built heritage: very high, high, medium, low, negligible and unknown. See tables 1 and 2 below.

Table 4-1: Criteria for Assessing the Value of Archaeological Assets

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

Table 4-2: Criteria for Establishing the Value of Built Heritage Assets

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

The assessment of the magnitude of the impact has involved the reference to the guidance provided in Annexes 5, 6 and 7 of the DMRB HA208/07. See table 3 below which is an amalgamation of the tree tables which are found in the above annexes.

Table 4-3: Assessing the magnitude of impacts

FACTORS IN THE ASSESSMENT OF MAGNITUDE OF IMPACTS	
Major	Changes to most or all key archaeological materials or key historic building elements such that the resource is totally altered. Change to most or all key historic landscape elements, parcels or components: extreme visual effects: gross change of noise or change to sound quality: fundamental changes to use or access: resulting in total change to historic landscape character unit. Comprehensive changes to setting.
Moderate	Changes to many key archaeological materials or key historic building elements, such that the resource is clearly modified. Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access: resulting in moderate changes to historic landscape character. Considerable changes to setting that affect the character of the asset.
Minor	Changes to key archaeological materials or key historic building elements, such that the asset is slightly altered. Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access: resulting in limited changes to historical landscape character. Slight changes to setting.
Negligible	Very minor changes to archaeological materials, historic buildings elements, or setting. Very minor changes to key historic landscape elements, parcels or compounds, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in very small change to historic landscape character.

FACTORS IN THE ASSESSMENT OF MAGNITUDE OF IMPACTS	
No Change	No change to fabric or setting. No change to elements, parcels or components; no visual or audible changes; no changes arising from in amenity or community factors.

The overall significance of impact has involved the use of the matrices provided in Annexes 5, 6 and 7 of the DMRB HA208/07 to establish an overall rating for each asset. This is subject to adjustment using professional judgement. Please see the matrix below.

Table 4-4: Significance of Impact

	NO CHANGE	NEGLIGIBLE	MINOR	MODERATE	MAJOR
Very high	neutral	Slight	moderate or large	large or very large	very large
High	neutral	Slight	moderate or slight	moderate or large	large or very large
Medium	neutral	neutral or slight	slight	moderate	moderate or large
Low	neutral	neutral or slight	neutral or slight	slight	slight or moderate
Negligible	neutral	Neutral	neutral or slight	neutral or slight	slight

All features identified through the research have been plotted on a site plan (Appendix B) in GIS and the site numbers correspond with the reference numbers in the gazetteer (Appendix A).

A PDF copy of the approved final report will also be deposited with the Norfolk Historic Environment Record.

5 SITE DESCRIPTION

5.1 PROPOSED SCHEME DESCRIPTION

The addition of a new bridge and road alterations are proposed for the site crossing the River Yare, running from the extant A12 and South Deres Road. The scheme aims to provide a much needed additional link across the River Yare, connecting the strategic road network and wider urban area to the southern part of Great Yarmouth, which is a key economic growth hub and Enterprise Zone. The land surrounding the scheme is primarily industrial, with some small areas of residential throughout the study area, towards Southtown to the west and the pleasure beach to the east.

5.2 SITE VISIT

A site visit was conducted on 14.07.17. Weather conditions were bright with cloud cover and some rain. Visibility was generally good, although some views were blocked by buildings and vegetation. Access was restricted to public rights of way. This did not affect the confidence of the assessment.

The purpose of the site visit was to assess the visual impact of the development on the heritage assets within the study area with particular regard to the designated assets in areas close to the proposed development, and also to identify any potential previously unknown heritage assets.

The study area consists of the proposed consists of the proposed bridge over the River Yare and associated road improvements in the surrounding area.

No previously unknown sites were identified during the walkover survey. Existing development may have affected the survival of any below ground remains, although there may be archaeology present at deeper levels.

5.3 GEOLOGY

The scheme is situated on bedrock geology of Crag Group - Sand and Gravel. This is sedimentary bedrock that formed approximately 0 to 5 million years ago in the Quaternary and Neogene periods. The local environment was previously dominated by shallow seas. These rocks were formed in shallow seas with mainly siliciclastic sediments (comprising of fragments or clasts of silicate minerals) deposited as mud, silt, sand and gravel.

The site has multiple superficial geological deposits. The River Yare has overlying superficial deposits of Tidal River or Creek Deposits - Clay and Silt. These are superficial deposits formed up to 2 million years ago in the Quaternary Period. These rocks were formed in shoreline environments with sediments deposited in beaches and barrier islands.

The western banks of the River Yare has superficial deposits of Happisburgh Glacigenic Formation - Sand. These are superficial deposits that were formed up to 3 million years ago in the Quaternary Period. The local environment was previously dominated by ice age conditions. These rocks were formed in shoreline environments with sediments deposited in beaches and barrier islands.

The eastern banks of the river comprise of superficial deposits of North Denes Formation - Sand and Gravel. These are superficial deposits formed up to 2 million years ago in the Quaternary Period. These rocks were formed in shoreline environments with sediments deposited in beaches and barrier islands.

6 HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

6.1 INTRODUCTION

The location of the designated heritage assets from the National Heritage List for England (NHLE) which lie within the site and within a 1km radius from the boundary and un-designated heritage assets taken from the Norfolk Historic Environment Record (HER) which lie within the site and within a 500m radius from the boundary are tabled in the Gazetteer and indicated in Figure 1 in the appendices of this report. A total of 136 assets have been identified. These are listed individually in the Gazetteer (Appendix A).

6.2 HISTORICAL AND ARCHAEOLOGICAL OVERVIEW

DESIGNATED ASSETS

There are no World Heritage Sites, Registered Parks and Gardens, Registered Battlefields or Protected Wreck sites within 1km of the proposed scheme options. There are 45 Listed Buildings and one Scheduled Monument within 1km. The Listed Buildings consist of 1 Grade I, 4 Grade II* and 40 Grade II. The majority of the Listed Buildings and the Scheduled Monument will be screened from the proposed development by topography, vegetation and existing structures. The Scheduled Monument is the medieval defensive town walls. The Listed Buildings represent a mixture of domestic, religious, industrial and leisure uses and mainly date to the late post-medieval period. The study area overlaps four Conservation Areas, listed below:

- Camperdown
- Gorleston Conservation Area Extensions
- King Street
- Seafront

KNOWN HERITAGE ASSETS

The assets within the study area are described in the context of a timeline of archaeological periods from prehistoric through to modern. The location of the recorded sites and features can be cross referenced with Figure 1 (Appendix B) and the Gazetteer (Appendix A). For reference, all assets are listed in Table 4 with an assessment of their value.

The time periods discussed can be broadly divided as follows:

- Prehistoric:
  - Palaeolithic 250,000 – 10,000 BC
  - Mesolithic 10,000 – 4,000 BC
  - Neolithic 4,000 – 2,500 BC
  - Bronze Age 2,500 – 700 BC
  - Iron Age 800 BC – AD 43
- Roman AD 43 – 410
- Early Medieval AD 410 - 1066
- Medieval AD 1066 – 1540
- Post-Medieval AD 1540 – 1900
- Modern AD 1900 to 2050

PREHISTORIC

The landscape surrounding the site has consisted primarily of shorelines up to the medieval period, and as such there has been little evidence of any prehistoric activity identified within the study area. A single Neolithic scraper (Asset Number 42) has been recovered at the junction of Boundary Road and Suffolk Road during construction works for a petrol tank. Further evidence of prehistoric activity in the study area may be buried beneath later shoreline deposits.

ROMAN AND EARLY MEDIEVAL

As with evidence of prehistoric activity, the landscape surrounding the site has consisted of primarily shorelines up to the medieval period. Therefore, for the same reason, there has been no evidence of any Roman or early medieval activity identified within the study area.

MEDIEVAL

The boundary of the medieval walled town lies to the north of the Proposed Scheme options, approximately 600m north of the proposed scheme. The extent of the medieval town is represented by the well preserved remains of the defence walls (Asset Number 136) which is designated as a Scheduled Monument. Construction of the walls began in the late 13th century, although they have been subjected to periodic remodelling, including during the refortification of the town in the 17th century during the Civil War.

Just outside the 500m study area for undesignated sites, within the medieval walled town area, the remains of boats have been found on a buried shoreline at around 3m below the current ground level. An old landing place was also recorded below the Town Hall site in 1887. This suggests that buried medieval deposits may survive deep below the current ground level on either side of the River Yare within the study area.

There are two further medieval assets within the study area:

The remains of the house of the Austin Friars comprising a church, priory and leper hospital are located on Burnt Lane (Asset Number 121). This friary was founded in the 13th century, although the earliest known buildings date to the 15th century. Much of the priory has now been destroyed, although the west gate is recorded to have still been standing up to the beginning of the last century. Remains from the structures have been recovered from the surrounding area, and some of the building materials have been re-used. The area has now been redeveloped as housing.

In 2013, a watching brief revealed beam slots and post holes associated with a late medieval timber-framed building located on Burnt Lane (Asset Number 123). Finds recovered from these features included late medieval brick, roof tile and wall plaster that could be high status. The beam slots and post holes described the south western corner of a medieval timber structure. The area has now been redeveloped as housing.

POST-MEDIEVAL

There are 51 post-medieval assets within the study area, principally 19th century houses and also including villas and a lodge, both mileposts and boundary posts and two churches. There are also industrial areas with railways, a coal power station, gas works, potteries, fish curing works, workshop ranges, utility blocks and a rope walk.

There is one Grade I Listed Building within the study area. Nelsons Monument (Asset Number 132), also known as the Norfolk Pillar, was the first of the Nelson columns, being erected in 1817, and comprises a figure of Britannia standing on top of a Doric column which faces towards Nelson's birthplace. The monument has recently been restored, and located within an industrial area. This asset may be inter-visible with the scheme.

There are 4 Grade II* Listed buildings of post medieval date. These consist of Great Yarmouth Potteries (Asset Number 23), formerly listed as Trinity Place fish curing house, which was built in the 19th century against the town walls. This asset may be inter-visible with the scheme.

The Winter gardens (Asset Number 36) are located on South Beach Parade, and were originally designed and constructed in Torquay in the late 1800s before being relocated to Great Yarmouth in 1904. The building comprises a single storey structure of cast iron framing and glass.

St Nicholas Hospital Main Entrance Range (Asset Number 51) Main Block (Asset Number 52), walls and railings (Asset Number 53) and South Block (Asset Number 54) form a naval hospital built for casualties from the North Sea squadron in the Napoleonic War, with the entrance range comprising guard rooms, an archway and service rooms. The main block became a naval barracks in 1818 and subsequently a general hospital. This asset may be inter-visible with the scheme.

A Grade II Listed Gasworks (Asset Number 70) lies to the north east of the scheme. The gasometer was originally built at another site, but collapsed and was rebuilt here in 1885. An old map shows this was the site of a steam engine before the gasometer was built. This asset may be inter-visible with the scheme.

Grade II Listed Buildings Providence Villa (Asset Number 112), 96 and 95 High Road (Asset Numbers 113 and 114) and Ahoy and Manby House (Asset Number 115) sit to the south of the scheme. These assets may be inter-visible with the scheme.

There are 7 undesignated assets which date to the post medieval period consisting of industrial assets such as railways (Asset Numbers 88 and 95) and a rope walk (Asset Number 10), as well as a maltings which was later used as a prison (Asset Number 110), a boundary post (Asset Number 125) and a ditch (Asset Number 2).

MODERN

There are 79 modern assets located within the study area. One of these is Grade II Listed. The Dolphin Public House (Asset Number 89), formerly known as Fish Wharf Refreshment Room, is a public house built in 1900. This asset is within the sightline of the proposed development.

The town was first bombed during World War I in 1915 and this event represents the first aerial bombardment in the UK, however the majority of wartime features date to World War II. During this time the town suffered extensive bombing by the Luftwaffe as it was the last significant place the German bombers could drop bombs before returning home. However, despite this, two-thirds of the medieval town wall survived.

Other modern assets in the study area date to the Second World War, and consist of primarily military structures and associated assets. There are 12 bomb craters and one bomb site within the study area, which may indicate the possibility of further, potentially unexploded, ordinance. There are also 43 air raid shelters, anti-tank defences, three pillboxes, eight road blocks, two military buildings and multiple other assets including spigot mortar engagements, a barracks (Asset Number 13), barbed wire obstructions, weapons pits, a blast wall (Asset Number 103), a fire station (Asset Number 111) and an ambulance station (Asset Number 131).

Most of these features recorded on the NHER have since been demolished, with modern development having removed all trace.

HISTORIC LANDSCAPE

There are no designated landscapes within the study area.

Historic Landscape Characterisation (HLC) has been completed for the surrounding area, however this study specifically excluded an analysis of the areas within the town and village

development limits. Therefore, although the smaller villages were considered as a part of a wider landscape context and character, no specific townscape or urban character assessments were undertaken.

Some areas have had Historic Landscape Character completed as part of the Norfolk County Council HER Character Area Report. The study area falls across two different character types, with a linear strip of Coastal - Managed Wetland to the east of the study area. This land was previously Unimproved Intertidal land. There are also small blocks of Coastal - Drained Enclosure to the west, which were previously Coastal - Managed Wetland, Unimproved Marine Marsh or Brackish Fen.

6.3 ARCHAEOLOGICAL POTENTIAL

The study area has undergone extensive development as it forms part of the urban centre of Great Yarmouth. This development is likely to have disturbed any potential archaeological remains to the level of modern building foundations. The river itself has seen various alterations and may have been dredged, which would affect what could be uncovered during the course of any works.

Due to the presence of several WWII defensive structures within close vicinity to the site, there is the potential to uncover any underground remains or previously unknown WWII sites during the course of works. There are also numerous recorded bomb craters located close to the proposed site, the possibility of unknown unexploded ordinances should be considered. There is also a 19th century railway located to the east end of the proposed works, which may be uncovered.

There is generally a moderate potential for previously undiscovered remains of up to high value to be uncovered during the proposed works.

7 STATEMENT OF IMPACT

ARCHAEOLOGY AND HISTORIC LANDSCAPE

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

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

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

There could be minor changes to the historic landscape setting but these would be negligible in magnitude.

POTENTIAL SOURCES OF IMPACT

The assessment to date suggests the presence of currently unknown heritage assets in the form of a buried medieval shoreline. The proposed works have the potential to impact upon these remains, if present, due to the engineering solutions required for the bridge supports and the potential requirement for excavation works associated with existing infrastructure.

Not enough is known about buried remains in the scheme area, further work is required to quantify potential impacts.

HISTORIC BUILDINGS

There could be a visual impact from the new bridge to the immediate setting of at least twelve Listed Buildings:

- A Gas Works (Asset Number 70) of medium value may suffer a minor impact as it could be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.
- The Dolphin Public House (Asset Number 89) of medium value may suffer a minor impact as it is within the sight line of the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.
- St Nicholas Hospital (Asset Numbers 51, 52, 53, 54 and 55) of medium to high value may suffer a minor impact as it would be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.

- The Great Yarmouth Potteries (Asset Number 23) of high value may suffer a minor impact as it would be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.
- Medium value assets Providence Villa (Asset Number 112), 96 and 95 High Road (Asset Numbers 113 and 114) and Ahoy and Manby House (Asset Number 115) may all suffer a minor impact as it would be inter-visible with the scheme, resulting in minor significance. The magnitude of this impact is dependent on the design of the bridge; at present there is a minor impact but depending on proposed bridge elements further impacts may occur and should be reassessed.

Parts of the study area overlap four Conservation Areas; Camperdown, Gorleston Conservation Area Extensions, King Street and Seafront. The magnitude of this impact is dependent on the design of the bridge; at present there is a no impact but depending on proposed bridge elements further impacts may occur and these should likewise be reassessed.

8 RECOMMENDATIONS

Impacts to the cultural heritage assets can be minimised or eliminated via appropriate mitigation.

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

As there is the potential for previously unknown archaeological remains, in the form of a buried former medieval shoreline, it would be necessary to carry out archaeological investigations in order to establish the presence or absence and character of any features within the proposed footprint of the chosen option. The appropriate technique, scope and scale for investigation should be agreed with the Norfolk Historic Environment Team, but may include archaeological trial trenching, specialist dredging, auguring or dive surveys.

There is also potential for visual impacts on 12 Listed Buildings, it is recommended that these impacts are considered in the design process. This may involve consultation with Historic England, Conservation Officers and the Norfolk Historic Environment Team to discuss appropriate mitigation options which would reduce the visual impact on affected buildings. Once the design has been finalised, impacts should be reassessed.

No recorded historic landscapes will be impacted upon by the proposed options, although there are a number of Conservation Areas within the wider study area. Appropriate mitigation would include design of lighting, surfacing and screening in line with those utilised within the Conservation Areas.

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Appendix A

GAZETTEER

Appendix A - Gazetteer

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
1	MNF49675 (NHER)	TG 5170 0621	Bomb Crater	A line of ten WWII bomb craters visible as earthworks on 1940s aerial photographs. Recent aerial photographs and OS mapping suggest the sites is now partially under Harfreys Industrial Estate and waste ground, and the craters have presumably been levelled.	HER	Modern (WWII)	Low
2	MNF49172 (NHER)	TG 5164 0606	Ditch, Bank	A disused drain which probably dates to the post medieval period visible on 1940s aerial photographs. It was probably associated with the drainage of Southtown marches in the post medieval period, but has now been built over.	HER	Post medieval	Low
3	MNF49672 (NHER)	TG 5175 0607	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
4	MNF49610 (NHER)	TG 5174 0589	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
5	MNF49606 (NHER)	TG 5190 0593	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
6	MNF49603 (NHER)	TG 5199 0587	Bomb Crater	A WWII bomb crater visible as an earthwork on 1940s aerial photographs. The site has now been built over.	HER	Modern (WWII)	Low
7	MNF48761 (NHER)	TG 5200 0600	Pillbox	A possible WWII pillbox is visible as an extant structure on 1940s aerial photographs. It if was a pillbox, it would have formed part of a chain of anti-invasion defences sites along the landward side of Great Yarmouth to protect the town and transport links. The structure was removed in 1945. An industrial park now occupies the site.	HER	Modern (WWII)	Low
8	MNF49697 (NHER)	TG 5209 0601	Air Raid Shelter	Three WWII air raid shelters visible on 1940s aerial photographs. They appear to have been within some sort of industrial site and are likely to have	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				been industrial shelters for the site workers. The shelters have since been levelled and built over.			
9	MNF49681 (NHER)	TG 5212 0645	Bomb Crater, Spigot Mortar Emplacement	A pit dating to WWII which is possibly a bomb crater or a spigot mortar emplacement is visible as an earthwork on 1940s aerial photographs. If it was a mortar emplacement it may have been associated with the possible military training area 40m to the SE. The site has been levelled and built over.	HER	Modern (WWII)	Low
10	MNF49738 (NHER)	TG 5216 0644	Ropery, Ropewalk	A ropewalk is marked at this location on the OS 1st edition map. It is one of several which once existed at Great Yarmouth. The site has since been levelled and mostly built over.	HER	Post medieval	Low
11	MNF32661 (NHER)	TG 5206 0632	Pillbox	A WWII type 24 pillbox survives on land at which is now Yarmouth Business Park in Southtown. It was visited on the ground in 1995. It was part of a line of anti-invasion defences cited to protect the landward side of Great Yarmouth.	HER	Modern (WWII)	Low
12	NHLE ref 1245813	TG 52303 06872	Building	Workshop range north of Number 244A. Range of outbuildings constructed for Admiralty barrack use in 1855. It was in commercial use from 1891 and converted to light engineering works in 1971. Built of red brick under Welsh slate roofs.	Listed (Grade II)	Post medieval	Medium
13	NHLE ref 1245811	TG 52303 06872	Barracks	Militia Barracks, built in 1853-5. Converted to light engineering works in 1971.	Listed (Grade II)	Post medieval	Medium
14	NHLE ref 1393268	TG 52313 06850	Offices	Utility block immediately east of No 244A Southtown Road. Smithy and Carpenters shop dating to 1806-1810 to designs of James Wyatt for the Ordnance Board. Converted to light engineering works in 1971.	Listed (Grade II)	Post medieval	Medium
15	NHLE ref 1245812	TG 52313 06850	Offices	Utility block immediately east of No 244A Southtown Road. Ancillary building to the naval arsenal by James Wyatt in 1806. Now light engineering works.	Listed (Grade II)	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
16	NHLE ref 1245814	TG 52314 06828	Arsenal	244B Southtown Road. Naval arsenal, built 1806 by James Wyatt. Now used as light engineering works. This building was the actual armoury and had until 1829 a fireproof stone roof.	Listed (Grade II)	Post medieval	Medium
17	NHLE ref 1245815	TG 52280 06827	Lodge	245 Southtown Road was the North Lodge to the former naval arsenal, shown as 'Clerk of the Cheques' House' in 1810. Built of 1806-10 by James Wyatt for the Ordnance Board. Altered probably in 1891 when the site was relinquished by the Admiralty for commercial use.	Listed (Grade II)	Post medieval	Medium
18	NHLE ref 1245810	TG 52281 06806	House	244 Southtown Road was a storekeepers house to the naval arsenal. It was built in 1806 by James Wyatt and formed the south lodge to the complex. It is now commercial offices.	Listed (Grade II)	Post medieval	Medium
19	NHLE ref 1245807	TG 52201 06797	Wall	Boundary wall to south of number 66, built early 19th century of tarred red brick	Listed (Grade II)	Post medieval	Medium
20	NHLE ref 1245808	TG 52201 06794	Wall	Boundary wall to south of number 67, built early 19th century of brick.	Listed (Grade II)	Post medieval	Medium
21	NHLE ref 1245809 MNF48074 (NHER)	TG 52328 06490	House	83 & 84 Southtown Road. A pair of late 18th century houses with 19th century alterations. The houses are separated by an arched passageway with cast iron gates.	Listed (Grade II) & HER	Post medieval	Medium
22	NHLE ref 1096791	TG 52766 06976	Fish curing works	Tower fish curing works, built in 1880 in red brick with some stone to the south and east ranges. It is a triangular site with 3 ranges of buildings around a yard. The managers house and office occupies the west end of the north range. Inside the complex, the brine tanks are still intact.	Listed (Grade II)	Post medieval	Medium
23	NHLE ref 1245561	TG 52727 06909	Fish curing works, pottery production site.	Fish Curing works, then converted to the Great Yarmouth potteries. Built early 19th century against the town walls of 1285-95 to the east. Built of brick and flint with timber interior partitioning.	Listed (Grade II*)	Post medieval	High
24	NHLE ref 1246059	TG 52885 06854	Terrace	41-46 Nelson Road South. Terrace of 6 houses built in the mid-19th century, all were converted into a hotels in the 20th century. Built of gault brick with	Listed (Grade II)	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				stuccoed and rusticated ground floors with slate and concrete tile roofs.			
25	NHLE ref 1246584	TG 53034 06937	Hotel	The Royal Hotel opened in 1840. The façade and large rear extensions were added in 1877 by JB Pearce. It is of stuccoed red brick with a slate roof. Charles Dickens apparently stayed here in 1848-9 while writing David Copperfield.	Listed (Grade II)	Post medieval	Medium
26	NHLE ref 1096805	TG 53004 06878	Terrace, Hotel	Donna Doone Hotel (Nos 1, 1A & 2), Neptune Hotel (Nos 9-11) and Sienna Lodge Hotel (Nos 17-18). Terrace of houses, now including 3 hotels, which were built in 1844-47 of gault brick and partly stuccoed and colourwashed.	Listed (Grade II)	Post medieval	Medium
27	NHLE ref 1245564	TG 53002 06910	Terrace	11-16 Wellington Road. Terrace of houses built in the early 1840s of gault brick.	Listed (Grade II)	Post medieval	Medium
28	NHLE ref 1245566	TG 53020 06885	Arch	Wellington Arch is an archway forming the north entrance to the Victoria estate and was built in 1846 by John Brown. It was restored in 1980. It is built of gault brick with rendered details.	Listed (Grade II)	Post medieval	Medium
29	NHLE ref 1245563	TG 53041 06894	Terrace	3, 4 and 5 Waterloo Road. Terrace of 3 houses built in the mid-19th century of gault brick.	Listed (Grade II)	Post medieval	Medium
30	NHLE ref 1246583	TG 53051 06878	Hotel	Cavendish Hotel, formerly known as Brandon Mansions Hotel. Originated as a terrace of houses built in 1844 by Farrants & Turrel. Built of stuccoed brick with slate and concrete tile roof.	Listed (Grade II)	Post medieval	Medium
31	NHLE ref 1096806	TG 52991 06832	Terrace	The Embassy Hotel (Nos 38-41). Terrace of houses, part now a hotel, built in 1844-7 of gault brick.	Listed (Grade II)	Post medieval	Medium
32	NHLE ref 1271805	TG 53016 06832	Arch	Wellington Mews Arch is a monumental arch forming the entrance to the mews behind Kimberley Terrace. It was built in 1847 of gault brick.	Listed (Grade II)	Post medieval	Medium

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
33	NHLE ref 1271269	TG 53022 06805	Terrace	Carlton Hotel (Nos 1-5). Terrace of houses, part now a hotel. It was laid out from 1841 as the first part of the Victoria Building Company's estate under the overall direction of Thomas Marsh Nelson. Built of stuccoed brick with slate roofs.	Listed (Grade II)	Post medieval	Medium
34	NHLE ref 1096787	TG 52980 06784	Terrace	Mayflower Hotel (No 5), St Georges Hotel (Nos 7-8). Terrace of 8 houses, now 2 hotels. Built in 1844 of stuccoed brick with concrete and tile roofs.	Listed (Grade II)	Post medieval	Medium
35	NHLE ref 1271606	TG 53006 06732	Assembly Rooms	Masonic Royal Assembly Rooms built 1863 by HH Collins. It partly burnt out in 1870 and became the masonic lodge under patronage of HRH Prince of Wales. It is built of gault brick with slate roofs.	Listed (Grade II)	Post medieval	Medium
36	NHLE ref 1271608	TG 53148 06762	Winter Gardens	The Winter Gardens were designed and constructed in Torquay by John Watson and William Harvey between 1878 and 1881 at a cost of £12783. It was relocated to Great Yarmouth in 1904.	Listed (Grade II*)	Post medieval	High
37	NHLE ref 1271607	TG 53034 06684	House	Shadingfield Lodge, formerly a house, now a hotel. Built 1862-5 by AW Morant and altered internally in 1953 by AW Ecclestone. Built of gault brick under slate roofs.	Listed (Grade II)	Post medieval	Medium
38	MNF48764 (NHER)	TG 5223 0633	Air Raid Shelter, Bomb Crate, Defence work, gun emplacement, military training site, practice trench.	A WWII military site, comprising various features and defences including air raid shelters, slit trenches, bomb craters and possibly a searchlight emplacement. The precise function of the site is unclear, although the variety of installations and the disorganised layout would suggest a military training site. Much of the site has been built over and no features are no longer visible on the ground or on modern aerial photographs.	HER	Modern (WWII)	Low
39	MNF49703 (NHER)	TG 5228 0636	Air Raid Shelter	A possible air raid shelter dating to WWII visible as an earthwork mound (presumably covering a structure) on 1940s aerial photographs. Its size and shape suggest a private shelter, possibly an Anderson shelter. No trace of the structure survives above ground today.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
40	MNF49678 (NHER)	TG 5214 0617	Bomb Crater	Two WWII bomb craters are visible as earthworks on 1940s aerial photographs. The site has now been levelled and built over.	HER	Modern (WWII)	Low
41	MNF48763 (NHER)	TG 5219 0615	Roadblock, anti-tank block	A group of WWI anti invasion defences, comprising two road blocks and a possible pillbox, are visible on aerial photographs taken in 1944. They were situated on the western edge of the inhabited part of Southtown. They were removed in 1945 and no trace of them exists today.	HER	Modern (WWII)	Low
42	MNF12936 (NHER)	TG 5222 0617	Findspot	In 1977 a Neolithic scraper was found during building work. It was found at a depth of 4.2m.	HER	Modern (WWII)	Low
43	MNF49679 (NHER)	TG 5231 0616	Bomb Crater	A probable WWII bomb crater visible on 1940s aerial photographs. The site has since been levelled and built over.	HER	Modern (WWII)	Low
44	MNF48762 (NHER)	TG 5231 0610	Spigot Mortar Emplacement	A WWII spigot mortar emplacement is visible as an extant structure and earthwork on 1940s aerial photographs. It appears to have been associated with two roadblocks and other defences. It appears that site has been levelled.	HER	Modern (WWII)	Low
45	MNF48800 (NHER)	TG 5259 0655	Hut, Civil Defence Building	A hut or temporary building, probably related to civil defence or shelter during WWII was visible as an extant structure on 1940s aerial photographs. It was removed soon after the end of the war.	HER	Modern (WWII)	Low
46	MNF49709 (NHER)	TG 5262 0642	Air Raid Shelter	Six probable air raid shelters dating to WWII visible as structures and earthworks on 1940s aerial photographs. These were most likely private shelters and may have been Anderson shelters. There is no evidence of these structures above ground today.	HER	Modern (WWII)	Low
47	MNF46372 (NHER)	TG 5267 0646	Air Raid Shelter	A WWII air raid shelter is visible as an extant earth covered structure on 1940s aerial photographs. It size and location within a light industrial yard would suggest it was placed to protect the local workforce. The site has been levelled and built over.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
48	NHLE ref 1245981	TG 52716 06548	Church	Parish church of St James. The nave and chancel date to 1870-78 by JP Seddon. The aisles date to 1902-8 by Bottle & Olley. Built of cut and knapped flint with red brick dressings.	Listed (Grade II)	Post medieval	Medium
49	MNF4340 (NHER)	TG 5283 0642	Barracks, Hospital, Royal Naval Hospital	St Nicholas's Hotel, also known as the Royal Naval Hospital, was built between 1809 to 1811. It was used as a military barracks between 1818 to 1854, but subsequently reverted to its original use as a Naval hospital. The buildings were surround a courtyard in which a greenhouse built around 1890, used to stand. In 1815 seven sailors and seventeen Waterloo soldiers were apparently buried in the courtyard. The burials were reported to have been excavated in 1979. During WWII the hospital was used as a Naval information centre and administrative quarters, named HMS Watchful. The surviving hospital buildings have been restored and converted into flats and houses.	HER	Modern (WWII)	Low
50	MNF46399 (NHER)	TG 5278 0651	Air Raid Shelter	A large WWII air raid shelter is visible as an extant earth covered structure on 1940s aerial photographs. It lay within the grounds of the former St James School, directly adjacent to the main school building as was presumably intended for use by the pupils and teachers of the school.	HER	Modern (WWII)	Low
51	NHLE ref 1245984	TG 52840 06464	Hospital	St Nicholas Hospital Main Entrance Range. These buildings consisted of guard rooms, archway and service rooms to the naval hospital, now general storage and kitchens to St Nicholas' Hospital. Of yellow stock brick with Portland stone dressings and slate roof.	Listed (Grade II*)	Post medieval	High
52	NHLE ref 1245983	TG 52890 06400	Naval hospital	St Nicholas Hospital, formerly Naval Hospital. Built in 1809-11 by William Pilkington under supervision of Edward Holl, Architect to the Navy Board. It became naval barracks in 1818 and subsequently a general hospital. It is of yellow brick laid in Flemish bond with dressings of Portland stone. It is on a quadrangle plan with single depth wards, with a west chapel. Each of the four wings is linked by a single storey quadrant passageway.	Listed (Grade II*)	Post medieval	High

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
53	NHLE ref 1245986	TG 52926 06371	Wall, Railings	St Nicholas Hospital Walls and Railings dating to 1811 with mid-20th century insertions and repairs. By Edward Holl and William Pilkington, architects at the Navy Board. They are of brick and cast-iron. The walls run around the west, south and east sides of the site.	Listed (Grade II)	Post medieval	Medium
54	NHLE ref 1245985	TG 52845 06289	Hospital	St Nicholas Hospital South Block. This was an Isolation wing to the Naval Hospital, now St Nicolas' Hospital. It was built c.1809-11 by William Pilkington, supervised by Edward Holl, Architect to the Navy Board. It is of yellow stock brick under slate roofs. It is of one storey.	Listed (Grade II)	Post medieval	Medium
55	NHLE ref 1245982	TG 52778 06286	Mortuary, Chapel	St Nicholas Hospital CSSD store. Formerly a mortuary and chapel dating to c.1810, now dis-used. It is of various shades of red brick with a hipped slate roof. It is rectangular and single depth in plan.	Listed (Grade II)	Post medieval	Medium
56	MNF57307 (NHER)	TG 52550 06356	Naval storehouse	The surviving section of a sail loft and storehouse which was constructed in 1798 for the Royal Navy.	HER	Modern (WWII)	Low
57	MNF49707 (NHER)	TG 5269 0636	Air Raid Shelter	Three probable air raid shelters dating to WWII are visible as earthworks with structural elements on 1940s aerial photographs. These were probably private shelters. The site has since been redeveloped as housing and shelters have presumably been levelled.	HER	Modern (WWII)	Low
58	MNF48794 (NHER)	TG 5299 0641	Air Raid Shelter, Barrage Balloon Site, Hut	WWII military activity and installations are visible as extant buildings, structures and earthworks on aerial photographs from the 1940s. They were located immediately east of the Royal Naval Hospital and may also have been under Naval control during the war. There is no evidence on the ground that these features still exist.	HER	Modern (WWII)	Low
59	MNF46973 (NHER)	TG 5316 0636	Barbed Wire Obstruction, Trench, Pillbox	A group of WWII anti invasion defences is visible as extant structures, buildings and earthworks on 1940s aerial photographs. The defences, which are visible on Great Yarmouth seafront stretching from Wellington Pier to the Pleasure Beach, formed part	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				of a longer line of defences which extended all the way along the seafront. There is no evidence that any trace of the defences survives today.			
60	MNF46981 (NHER)	TG 5306 0627	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. It appears to have been removed some time before the end of the war.	HER	Modern (WWII)	Low
61	MNF46982 (NHER)	TG 5306 0622	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. A small structure to its west, which appears to be surrounded by a blast wall, may have been an associated defensive building. The road block seems to have been removed some time before the end of the war.	HER	Modern (WWII)	Low
62	MNF47003 (NHER)	TG 5304 0616	Air Raid Shelter	Nine small WWII air raid shelters, at least some of which were probably Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that any remains survive above ground.	HER	Modern (WWII)	Low
63	MNF46989 (NHER)	TG 5306 0611	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. As with other examples, they appear to have been removed before the end of the year.	HER	Modern (WWII)	Low
64	MNF47007 (NHER)	TG 5306 0606	Air Raid Shelter	A large WWII air raid shelter is visible as an arrangement of structures and earthworks on 1940s aerial photographs. It was levelled after the end of the war.	HER	Modern (WWII)	Low
65	MNF41610 (NHER)	TG 53137 06006	Fairground Ride	The 'scenic railway' was built in 1932, and is one of only a few examples in the world of an early wooden roller coaster, and may be the oldest outside of the USA.	HER	Modern	Low
66	MNF47061 (NHER)	TG 5278 0620	Air Raid Shelter	Two small WWII air raid shelters which could have been Anderson shelters or a similar design, are visible on 1940s aerial photographs. There is no evidence that any remains of the shelters survive above ground.	HER	Modern (WWII)	Low
67	MNF47065 (NHER)	TG 5279 0625	Air Raid Shelter	A group of earthwork mounds with structural elements, probably WWII air raid shelters, visible on 1940s aerial photographs. There is no evidence	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				that any remains of these survive above ground today.			
68	MNF47063 (NHER)	TG 5285 0625	Air Raid Shelter	A group of earthwork mounds with structural elements, probably WWII air raid shelters, visible on 1940s aerial photographs. There is no evidence that any remains of these survive above ground today.	HER	Modern (WWII)	Low
69	MNF47000 (NHER)	TG 5295 0623	Air Raid Shelter	Four WWII air raid shelters visible as earth covered structures on 1940s aerial photographs. They all lay within the grounds of what is now Greenacre First and Middle Schools and were probably constructed for the use of its staff and pupils. These were levelled since the end of the war.	HER	Modern (WWII)	Low
70	NHLE ref 1096789 MNF32731 (NHER)	TG 52739 06149	Gas Works	Excellent example of a gasometer with ornate finials to the uprights of the frame which is braced with a lattice pattern. The gasometer was built at another site, but collapsed and was rebuilt here in 1885. An old map shows this was the site of a steam engine before the gasometer was built.	Listed (Grade II) & HER	Post medieval	Medium
71	MNF47033 (NHER)	TG 5281 0611	Air Raid Shelter	Five small WWII air raid shelters, at least some of which were Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest any remains survive above ground today.	HER	Modern (WWII)	Low
72	MNF47029 (NHER)	TG 5287 0609	Air Raid Shelter	Eleven small WWII air raid shelters, at least some of which were probably Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence that any remains survive above ground today.	HER	Modern (WWII)	Low
73	MNF47024 (NHER)	TG 5295 0609	Air Raid Shelter	Fifteen small WWII air raid shelters, at least some of which were probably Anderson shelters, visible as earthworks and structures on 1940s aerial photographs. There is no evidence that any remains survive above ground today.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
74	MNF47008 (NHER)	TG 5301 0602	Air Raid Shelter	Two small WWII air raid shelters, at least one of which was probably an Anderson shelter, visible as earthworks and structures on 1940s aerial photographs. There is no evidence that any remains survive above ground today.	HER	Modern (WWII)	Low
75	MNF46991 (NHER)	TG 5306 0600	Roadblock	WWII road block visible as a structure on 1940s aerial photographs. As with other examples, this one appears to have been removed some time before the end of the war.	HER	Modern (WWII)	Low
76	MNF46960 (NHER)	TG 5316 0564	Weapons Pit, Gun Emplacement	A group of WWII anti invasion defences is visible as extant structures, buildings and earthworks on 1940s aerial photographs. These defences were visible on Great Yarmouth seafront stretching from the Pleasure Beach to the open ground now used as a caravan park and were part of a longer line of defences which extended all the way along the seafront. There is no evidence that any trace of the defences survive as upstanding features.	HER	Modern (WWII)	Low
77	MNF4328 (NHER)	TG 530 059	Battery	The South Star Battery was built in 1782. A magazine for storing gunpowder was added in 1793. The battery was restored and reconstructed several times and was still in use in 1914 when it was being used as a barracks. The site is now under Harbord Crescent east of battery road.	HER	Modern (WWII)	Low
78	MNF47009 (NHER)	TG 5305 0594	Air Raid Shelter	Five small WWII air raid shelters, at least some of which were probably Anderson shelters, are visible as earthworks and structures on 1940s aerial photographs. There is no evidence that anything of these remains above ground today.	HER	Modern (WWII)	Low
79	MNF47048 (NHER)	TG 5297 0595	Air Raid Shelter	Five small WWII air raid shelters, at least some of which were Anderson shelters are visible as earthworks on 1940s aerial photographs. There is no evidence that anything of these remains above ground today.	HER	Modern (WWII)	Low
80	MNF46992 (NHER)	TG 5305 0589	Roadblock	A WWII road block is visible as a structure on 1940s aerial photographs. This was removed some time before the end of the war.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
81	MNF47012 (NHER)	TG 5303 0586	Air Raid Shelter	A small WWII air shelter, possibly an Anderson shelter, is visible as an earthwork on aerial photographs taken in 1945. There is no evidence that any remains of these survive above ground today.	HER	Modern (WWII)	Low
82	MNF46932 (NHER)	TG 5302 0584	Air Raid Shelter	Three WWII air raid shelters visible as earthworks and structures on 1940s aerial photographs. The site has been built over and the shelters probably levelled.	HER	Modern (WWII)	Low
83	MNF47081 (NHER)	TG 5254 0619	Military building	A group of probable WWII buildings visible as extant structures on wartime aerial photographs. All or some of the buildings might be military in origin and relate to the defence of Great Yarmouth or the naval base that was established at the town. Alternatively, they might relate to industrial activity at the quayside during the war years. The buildings have been since levelled and redeveloped in the post war period.	HER	Modern (WWII)	Low
84	MNF47068 (NHER)	TG 5259 0618	Bomb Crater	Two WWII bomb craters are visible as earthworks on 1940s aerial photographs. The intended target was probably the gas works 50m to the southeast. The site has since been levelled since the end of the war.	HER	Modern (WWII)	Low
85	MNF47071 (NHER)	TG 5263 0617	Gas Holder	A WWII air raid shelter and a former gas holder, the latter possibly used as an emergency water supply tank, and visible as extant earthworks and structures on 1940s aerial photographs. The site has since been levelled.	HER	Modern (WWII)	Low
86	MNF62069 (NHER)	TG 5253 0609	Salt Store, Ice House	Icehouse and salt stores visible on the 1st edition ordnance survey map. The buildings have all since been demolished.	HER	Post medieval	Low
87	MNF47036 (NHER)	TG 5257 0582	Barbed wire obstruction, Military building	WWI defences, comprising a circuit of fencing and barbed wire as well as several small buildings, visible on 1940s aerial photographs. These were laid out along the quayside and around the former fish wharf buildings. They were removed after the end of the war.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
88	MNF13576 (NHER)	TG 52364 07247	Railway	During the mid and late 19th century a series of railway lines were constructed within Great Yarmouth town. One section linked Vauxhall station to Beach Station, North Quay and the fishmarket, whilst the second linked Ballast Quay and North Pier. At first the trains were horse drawn, but after 1883 engines were used. The railways were closed at various times from 1927 onwards and many of the routes are now covered by modern development, although some features do survive in places.	HER	Post medieval	Low
89	NHLE ref 1096829 MNF38779 (NHER)	TG 52587 06039	Public House	The Dolphin Public House was built between 1900 and 1904. It was designed by J.W. Cockrill and features his distinctive use of red brick over concrete and decorative tiles. The decorative tiles feature marine subjects.	Listed (Grade II), & HER	Modern	Medium
90	MNF48439 (NHER)	TG 5229 0597	Roadblock	A group of WWII anti invasion defences comprising anti-tank blocks, a type 24 pillbox and a spigot mortar emplacement, are visible as extant buildings, structures and earthworks on 1940s aerial photographs. In the post war period the site was levelled and built over, and there is no evidence that any part of the defences still survives.	HER	Modern (WWII)	Low
91	MNF48445 (NHER)	TG 5239 0588	Roadblock	A group of WWII anti invasion defences, comprising a substantial road block and tank trap protected by two or three pillboxes are visible on 1940s aerial photographs. The defences were removed before August 1945.	HER	Modern (WWII)	Low
92	MNF47054 (NHER)	TG 5287 0594	Air Raid Shelter	A small WWII air raid shelter, possibly an Anderson shelter, visible as an earthwork on 1940s aerial photographs. It lay in the back garden of a house and was probably a private shelter. There is no evidence to suggest that any remains above ground today.	HER	Modern (WWII)	Low
93	MNF61853 (NHER)	TG 5275 0584	Coal Fired Power Station	Great Yarmouth Electricity Works was Great Yarmouth's first power station using steam engines and steam turbines to provide power to industry, transport, public lighting and domestic use. It was	HER	Post medieval	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				decommissioned in 1958 and part of the building (although not original parts) still remain.			
94	MNF47044 (NHER)	TG 5280 0585	Military Building	A WWII structure, possibly a military building such as a guardhouse or sentry box, visible as an extant building on 1940s aerial photographs. It was demolished by 1951.	HER	Modern (WWII)	Low
95	MNF13576 (NHER)	TG 52364 07247	Railway	Railway lines constructed in the mid to late 19th century, no longer extant.	HER	Post medieval	Low
96	MNF49602 (NHER)	TG 5234 0576	Bomb Crater	A probable WWI bomb crater visible as a partially backfilled earthwork on 1940s aerial photographs. The site has since been levelled and resurfaced.	HER	Modern (WWII)	Low
97	MNF49685 (NHER)	TG 5237 0573)	Air Raid Shelter	A WWII air raid shelter visible as an earthwork and structure on 1940s aerial photographs. Its small size and location within a garden suggest that it was a private shelter. The site has since been built over and the shelter probably levelled.	HER	Modern (WWII)	Low
98	MNF49691 (NHER)	TG 5232 0570	Air Raid Shelter	A WWI air raid shelter is visible as an earthwork on 1940s aerial photographs, It lay within what appears to have been an industrial site and its size suggests that it was an industrial shelter. The site has since been levelled and built over.	HER	Modern (WWII)	Low
99	MNF49598 (NHER)	TG 5196 0561	Bomb Crater	A probable WWII bomb crater is visible on an earthwork and disturbed ground on 1940s aerial photographs. Recent aerial photographs show that the site may still survive as a slight earthwork.	HER	Modern (WWII)	Low
100	MNF19084 & MNF19949 (NHER)	TG 5207 0537	Pillbox, Anti Aircraft Battery	A WWII Light Anti Aircraft Battery is visible as a group of earthworks, structures ad buildings on aerial photographs and has also been partially recorded on the ground, It comprised a Bofors gun emplacement, a Type 22 pillbox, a possible earthwork gun emplacement and a variety of ancillary structures and huts. Many of the structures were removed at the end of the war, the pillbox was demolished in 1991 during the	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				construction of the A12(T) on top of the former railway embankment.			
101	MNF49686 (NHER)	TG 5234 0564	Air Raid Shelter	A probable WWII air raid shelter visible as an earthwork on 1940s aerial photographs. There is no evidence to suggest that anything survives above ground today.	HER	Modern (WWII)	Low
102	MNF49688 (NHER)	TG 5239 0564	Air Raid Shelter	A probable WWII air raid shelter visible as an earthwork on 1940s aerial photographs. There is no evidence to suggest that anything survives above ground today.	HER	Modern (WWII)	Low
103	MNF49687 (NHER)	TG 5241 0561	Blast Wall, Air Raid Shelter	A probable surface level air raid shelter is visible as an extant building on 1940s aerial photographs. It has since been levelled and built over.	HER	Modern (WWII)	Low
104	MNF49578 (NHER)	TG 5227 0558	Air Raid Shelter	Two possible WWI air raid shelters visible as earthworks on 1940s aerial photographs. The area has since been levelled.	HER	Modern (WWII)	Low
105	MNF49689 (NHER)	TG 5218 0548	Air Raid Shelter	A large WWI air raid shelter is visible as an earthwork and associated structures on 1940s aerial photographs. This was probably a public shelter. The site has since been levelled and built over.	HER	Modern (WWII)	Low
106	MNF49561 (NHER)	TG 5219 0543	Air Raid Shelter	Twelve probably WWII air raid shelters visible as earthworks and structures. The site has since been levelled.	HER	Modern (WWII)	Low
107	MNF48435 (NHER)	TG 5223 0544	Bomb Site, Water Tank	A static emergency water supply tank, dating to WWII, is visible as an extant structure on 1940s aerial photographs taken in 1944. It is one of several such tanks positioned around Great Yarmouth for use by fire fighters after bombing raids. It was located on what was probably a bomb site but had been removed by 1945.	HER	Modern (WWII)	Low
108	MNF49514 (NHER)	TG 5228 0545	Air Raid Shelter	A probable WWII air raid shelter visible as an earthwork on 1940s aerial photographs. There is no evidence that anything remains above ground today.	HER	Modern (WWII)	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
109	MNF49567 (NHER)	TG 5233 0550	Air Raid Shelter	Two probable WWII air photographs visible on aerial photographs. The site has since been levelled.	HER	Modern (WWII)	Low
110	MNF15149 (NHER)	TG 525 055	Prison, Maltings	A post medieval maltings, dating from the early 19th century. The maltings were said to have been used as a prison during the Napoleonic War. The buildings were demolished in the 1980s after being damaged by fire.	HER	Post medieval	Low
111	MNF48433 (NHER)	TG 5252 0550	Fire Station, Air Raid Shelter, Broadcasting Transmitter	Structures and buildings visible on 1940s aerial photographs. These may have represented WWII civil defence buildings. No traces of these structures are visible today.	HER	Modern (WWII)	Low
112	NHLE ref 1246973 MNF47922 (NHER)	TG 52570 05433	House	Providence Villa, built in 1843. It is built of red brick with a gault brick façade. There is a date plaque on the house which reads *Providence Villa I & S L, 1843*.	Listed (Grade II), & HER	Post medieval	Medium
113	NHLE ref 1246972 MNF47923 (NHER)	TG 52575 05424	House	96 High Road was built around 1830s. It is mainly constructed of red brick but has a gault brick façade.	Listed (Grade II), & HER	Post medieval	Medium
114	NHLE ref 1246971 MNF48137 (NHER)	TG 52579 05414	Terraced House	95 High Road was once two early 19th century terraced houses, but is now one house. It is constructed of gault brick and is of two storeys with a black glazed pantile roof.	Listed (Grade II), & HER	Post medieval	Medium
115	NHLE ref 1246970 MNF48136 (NHER)	TG 52610 05354	House	Ahoy and Manby House (86 and 87 High Road) are a pair of red brick houses built in the 1840s. Most of the structures are colourwashed. On no 86 there is an inscriptions stating that Captain G W Manby F.R.S, the inventor of life saving apparatus) lived in the house and dies there is 1854.	Listed (Grade II), & HER	Post medieval	Medium
116	MNF66695, MNF10562 (NHER)	TG 5250 0530	Church, Priory, Leper Hospital	This is the site of a large Augustinian Friary and church. The friary was founded in the 13th century and was dissolved in 1538. Human skeletons have been found here since the 18th century and excavations have revealed the presence of structures on the site. Remains of the friary buildings have also been incorporated into buildings to the north and south of Burnt Lane.	HER	Medieval	Medium

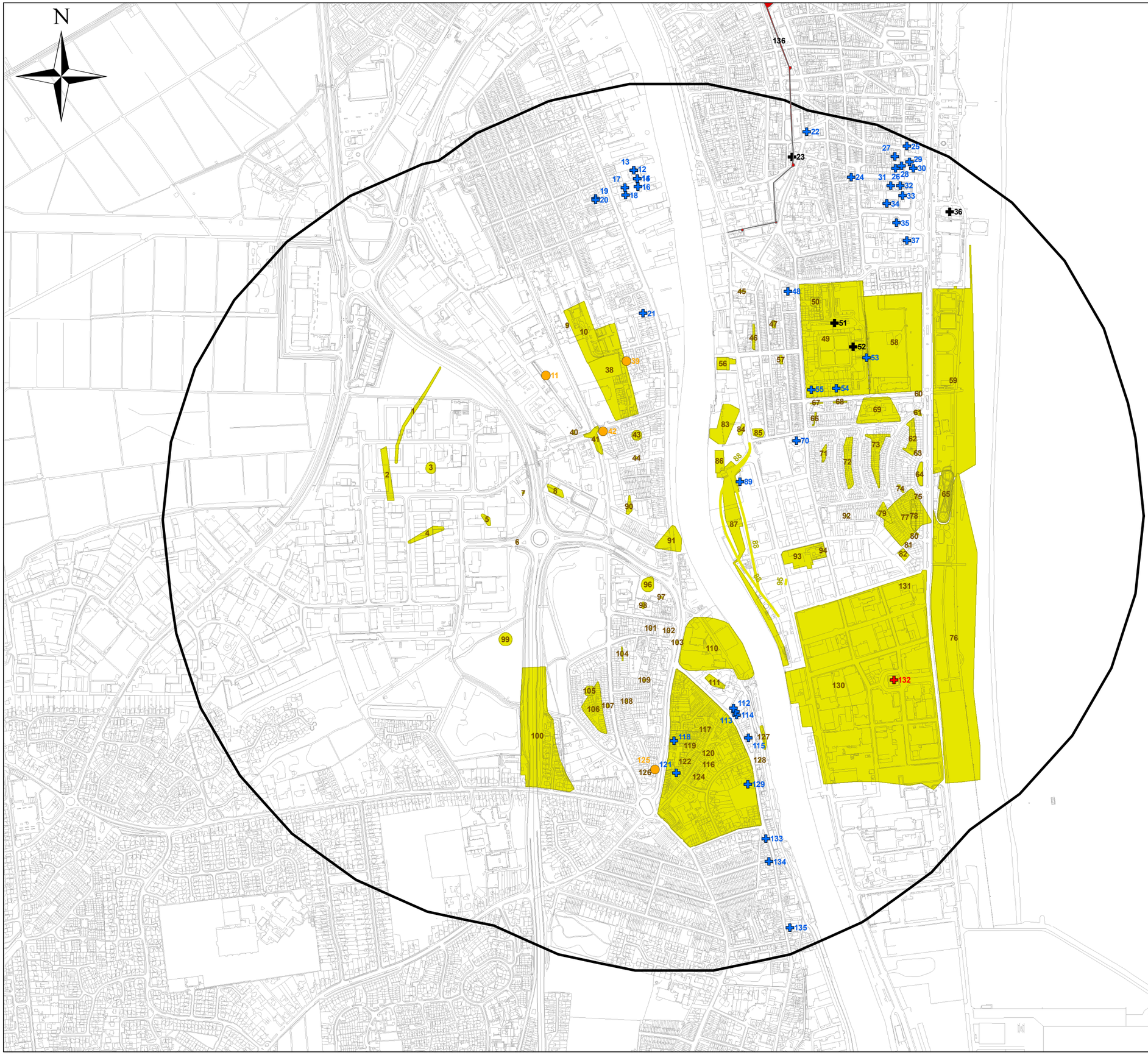
Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
117	MNF49505 (NHER)	TG 5249 0537	Air Raid Shelter	Two probable WWII air raid shelters are visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that any part of the shelters now survives above ground.	HER	Modern (WWII)	Low
118	NHLE ref 1096790 MNF47939 (NHER)	TG 52411 05346	Methodist Chapel	Southtown and Gorleston Methodist Church is a late 19th century red brick Methodist church which was extended in 1901. It has a gault brick façade under a slate roof and is of a single storey.	Listed (Grade II), & HER	Post medieval	Medium
119	MNF49503 (NHER)	TG 5245 0533	Air Raid Shelter	Two probable WWII air raid shelters visible as earthworks on 1940s aerial photographs. There is no evidence to suggest anything survives above ground today.	HER	Modern (WWII)	Low
120	MNF49506 (NHER)	TG 5250 0531	Air Raid Shelter	Possible WWII air raid shelter visible as an earthwork on 1940s aerial photographs. The site has since been built over.	HER	Modern (WWII)	Low
121	NHLE ref 1096804	TG 52417 05260	Friary	Remains of the house of the Austin Friary. This building dates to the 15th century, but the Friary was founded in 1311. It is of flint and brick. The surviving remains consist of a short stretch of wall with part of a 15th century chafered 4 centred brick arch.	Listed (Grade II)	Medieval	Medium
122	MNF49502 (NHER)	TG 5244 0528	Air Raid Shelter	Five probable WWII air raid shelters visible as earthworks and structures on 1940s aerial photographs. There is no evidence to suggest that anything survives above ground today.	HER	Modern (WWII)	Low
123	MNF66634 (NHER)	TG 5244 0527	Beam Slot, Timber Framed Building	A watching brief in 2013 revealed beam slots and post holes associated with a late medieval timber-framed building. Finds recovered from these features included late medieval brick, roof tile and wall plaster.	HER	Uncertain	Low
124	MNF49500 (NHER)	TG 5247 0525	Air Raid Shelter	Five probable WWII air raid shelters visible as earthworks and structures on 1940s aerial photographs. There is nothing to suggest that anything remains above ground today.	HER	Modern (WWII)	Low
125	MNF39960 (NHER)	TG 5236 0527	Boundary Post	A cast iron boundary post which is probably dated to 1819. It is inscribed '*The Bounds of Gorleston and Southtown*'.	HER	Post medieval	Low

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
126	MNF49513 (NHER)	TG 5233 0526	Air Raid Shelter	A probable air raid shelter dating to WWII is visible as a structure on 1940s aerial photographs. The site has since been levelled.	HER	Modern (WWII)	Low
127	NMF32655 (NHER)	TG 5264 0535	Gun emplacement	A group of WWII defences, comprising a tower for a light anti-aircraft gun, a spigot mortar emplacement and a possible air raid shelter, are visible as extant structures and earthworks on aerial photographs. The tower was demolished in the post war period and there is no evidence that any trace of the defences now survives at the site.	HER	Modern (WWII)	Low
128	MNF61540 (NHER)	TG 5264 0529	Findspot	An archaeological evaluation in August 2010 revealed an alluvial deposit and a residual sherd of late 18th to late 19th century pottery.	HER	Modern (WWII)	Low
129	NHLE ref 1246974	TG 52608 05230	House	Koolunga House, formerly known as Wishbone. The house has now been split into flats. It is dated 1826 and built of gault brick with slate roof.	Listed (Grade II)	Post medieval	Medium
130	MNF46945, MNF46934 (NHER)	TG 5291 0550	Military training site, weapons pit, pillbox	Evidence of WWII military activity, including anti invasion defences, is visible on 1940s aerial photographs as groups of earthworks, buildings and structures. These extended across a large area of South Denes, from Main Cross Road in the north to an area of open ground (now a caravan park) to the south. They included areas of pit digging, weapons pits, possible pillboxes, a possible air raid shelter, spigot mortar emplacements, barbed wire and anti-tank scaffolding. The majority of these features were removed by 1945.	HER	Modern (WWII)	Low
131	MNF46925 (NHER)	TG 5302 0576	Ambulance station	Two buildings are visible on 1940s aerial photographs. The precise function of the buildings is not clear, but they could have been a WWII ambulance station. One of these buildings may still survive as a garage building.	HER	Modern (WWII)	Low
132	NHLE ref 1246057	TG 52999 05508	Monument	Nelsons Monument, also known as Norfolk Pillar. Constructed in 1817-19 by William Wilkins. It was the first monument in England to Admiral Lord Nelson (Nelson's Column in London was 1840s,	Listed (Grade I)	Post medieval	High

Site no.	HER/NHLE Ref	Grid ref	Site type	Description	Designation	Period	Value
				but the column in Dublin was of 1808). The monument consists of fluted Greek Doric column on a square pedestal standing on a raised plinth.			
133	NHLE ref 1246978	TG 52657 05084	Milepost	Milepost in front of No 245 High Street. It is made of cast iron and dated 1828. It is triangular casting with a broach into a flat top.	Listed (Grade II)	Post medieval	Low
134	NHLE ref 1246977	TG 52665 05022	House	235 High Street is an early 19th century house of rendered and colourwashed brick. It has a slate roof and is of 2 storeys with a dormer attic.	Listed (Grade II)	Post medieval	Medium
135	NHLE ref 1246975	TG 52721 04845	Public House	The Short Blue Public House was built in the early 18th century and altered in the 20th century. It is built of stuccoed brick and colourwashed. It has a pantile roof which is black glazed to the front.	Listed (Grade II)	Post medieval	Medium
136	NHLE ref 1003782	TG 52560 06702 to TG 51779 08524	Town Walls	The Medieval Town Wall of Great Yarmouth runs from the river Bure to the banks of the River Yare and is about 23 feet (7m) high and 2238 (680m) long. It is constructed from knapped flint on a flagstone base, cut into a moat. Building started in 1284 and was completed in the late 14th century.	Scheduled Monument	Medieval	High

Appendix B

HERITAGE ASSET PLAN



KEY

- Undesignated Site Location
- Undesignated Site (Line)
- Undesignated Site (Region)
- 1KM Designated Boundary

Great Yarmouth Listed Building Grade

- I
- II
- II*

- Scheduled Monument (Town Walls)

Ver	Amendments	Originated by and date	Checked by and date	Approved by and date
A		IW 24/07/2017	KB 25/07/2017	RA 25/07/2017

Client

Project

Great Yarmouth Thrid River Corssing

Drawing Title

Heritage Assets Plan

Drawing No.

Appendix B

Scale @ A3 : 1:10,000

Purpose : Information

Path: \\cormsfsbsg01\shared\jobs\ENVADMIN\Hydradmin\GIS_Projects_External\GreatYarmouth_3rdRiverCrossing\MXD_GIS\Appendix B Heritage Assets Plan.mxd

Appendix 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.

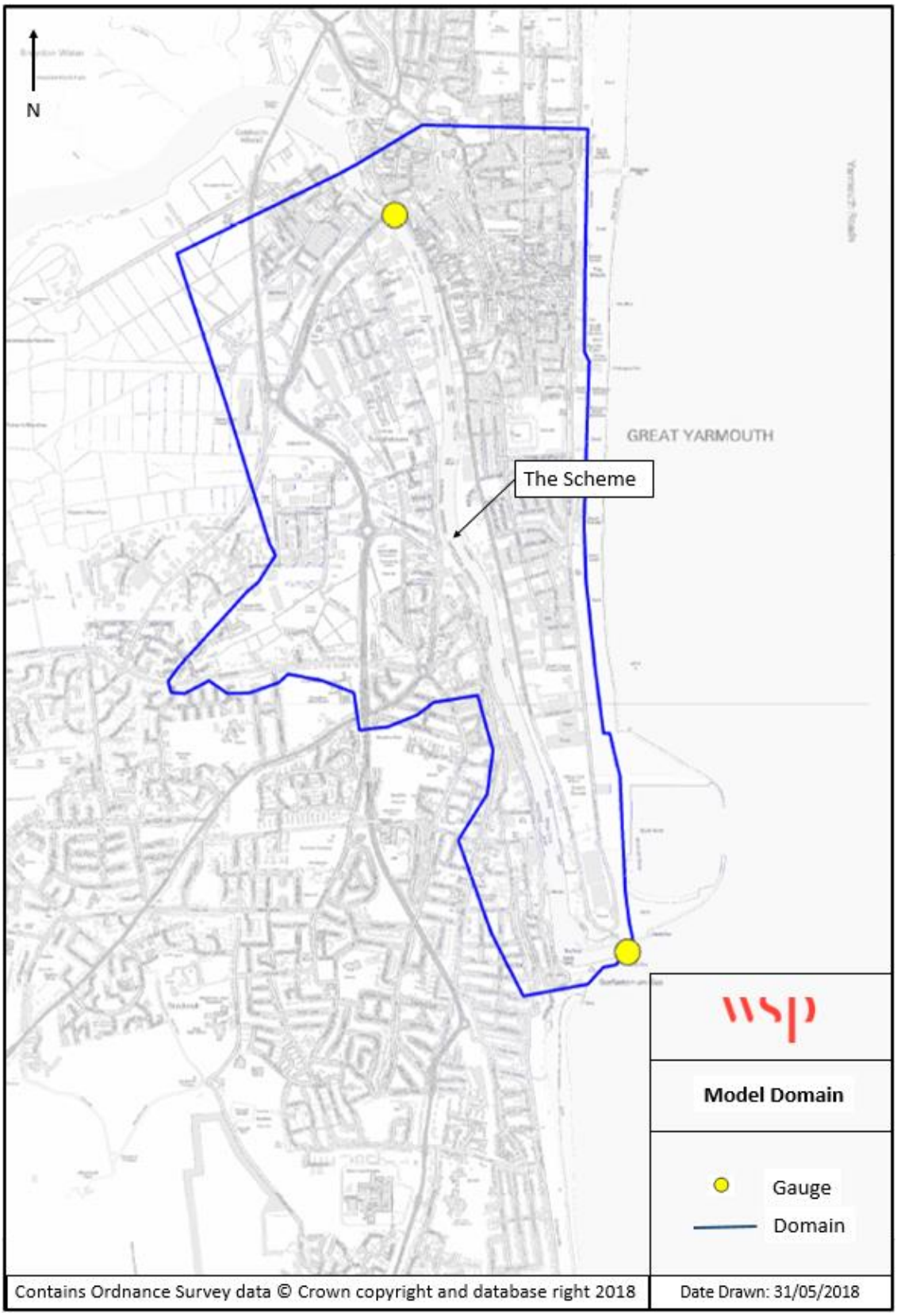

Figure 12A.1 - Model Domain

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.

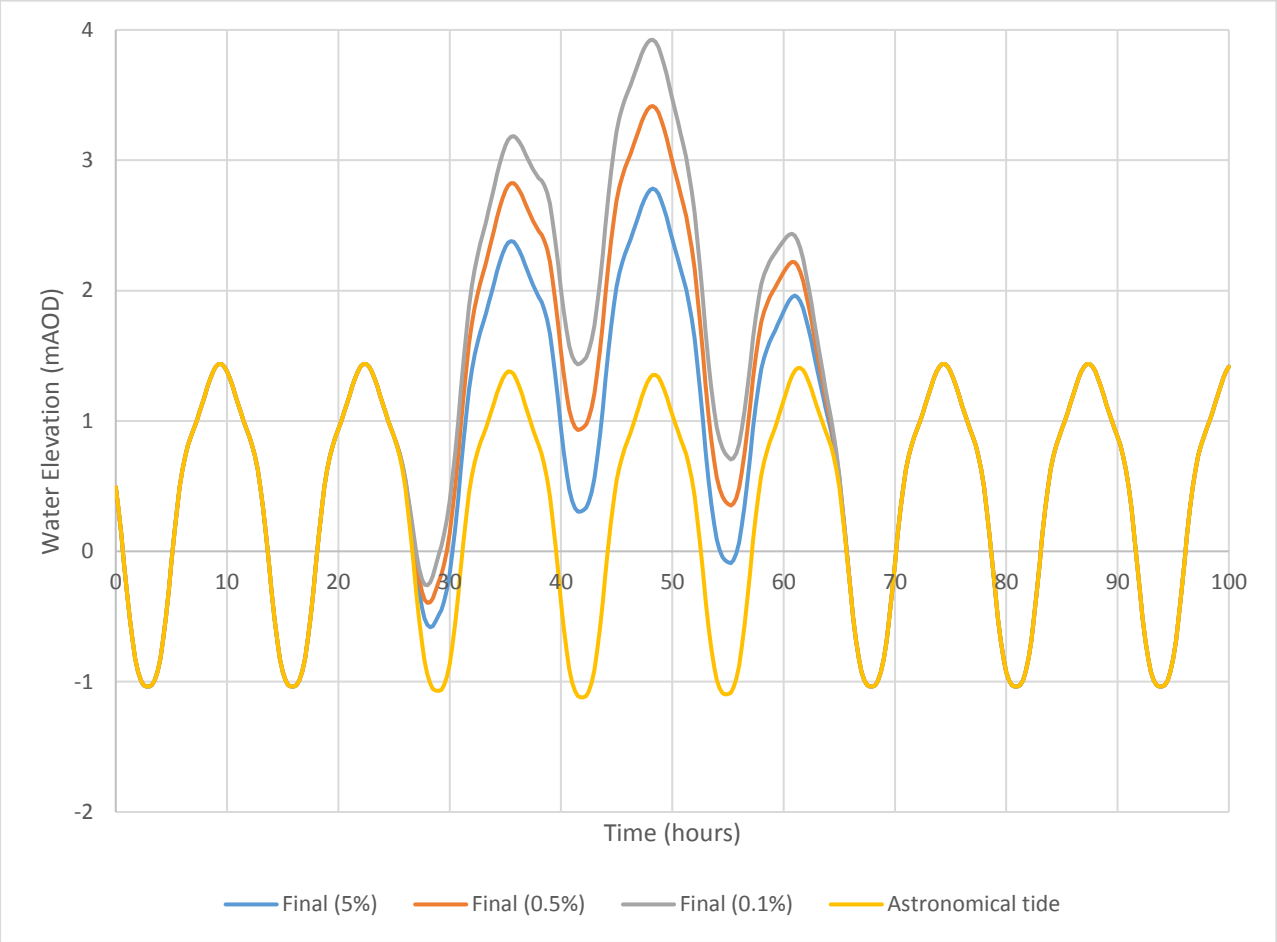

Figure 12A.2 - Extreme Sea Level Curves

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.

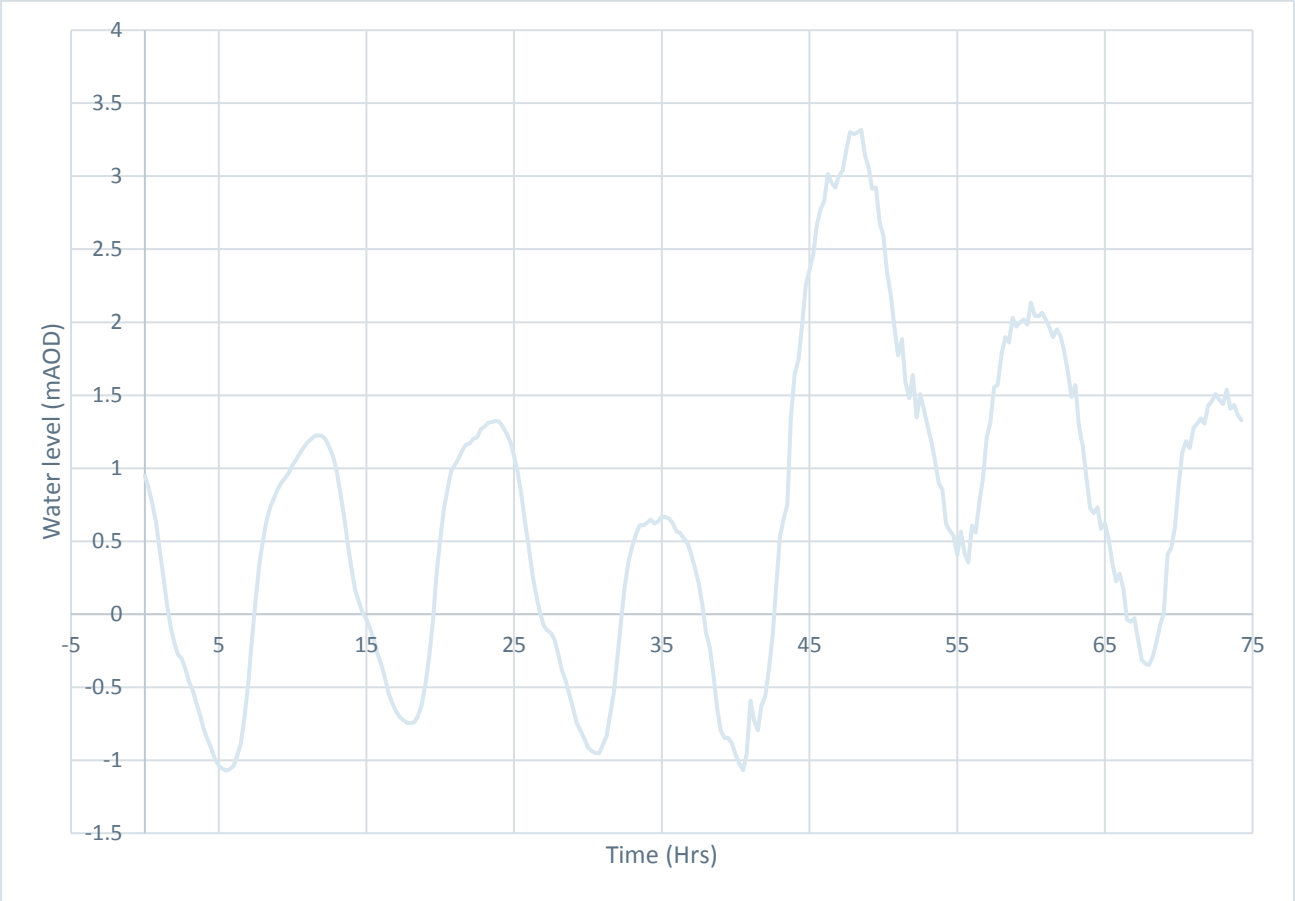

Figure 12A.3 - 2013 Event Tidal Curve

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.

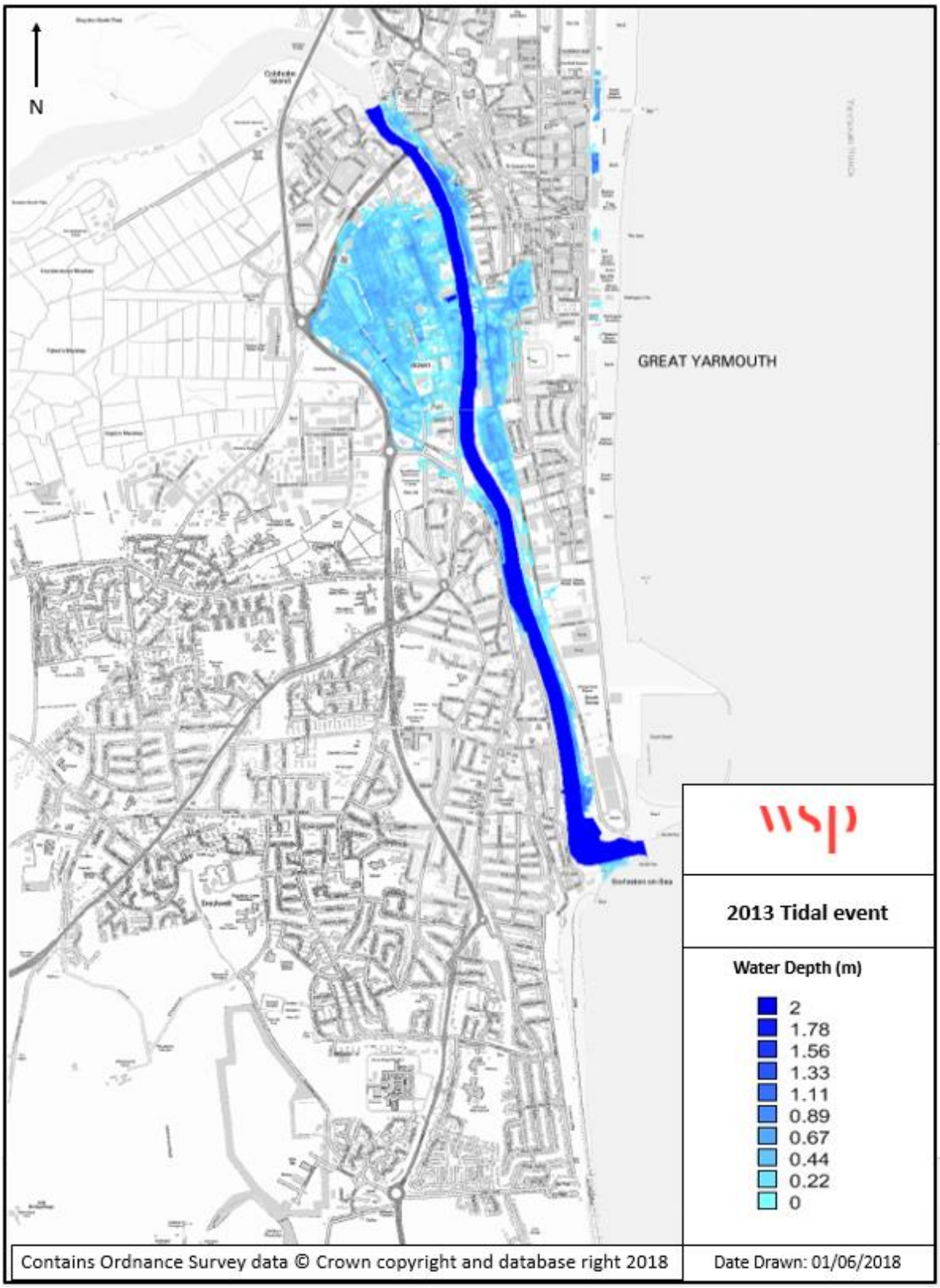

Figure 12A.4 - Baseline Flood Map for the 2013 Event

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

Project Title	Great Yarmouth Third Crossing
Report Title	Environment Agency (EA) model review.
Revision	1
Status	Draft

Record of Issue

Issue	Status	Author	Date	Check	Date	Authorised	Date
1	Draft	D Eddon	August 17	J Hunt	August 17	J Hunt	August 17

Distribution

Organisation	Contact	Copies
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

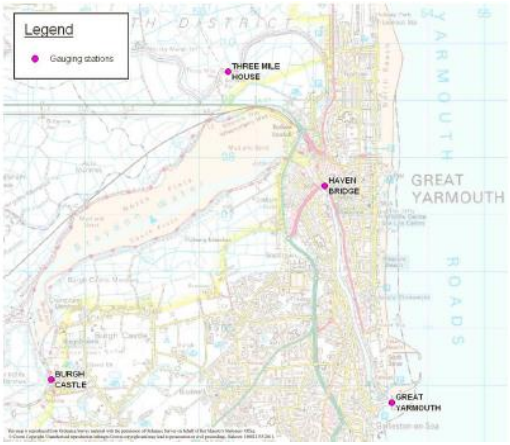
Subject document / file		Description	Version/Date	Filename	Reviewer's comments
2.1	Hydraulic model Guide	Modelling report provided with the model.	Final report issued in April 2011	GreatYarmouth_Report_2011-04-18_GM.doc	Note provides sufficient detail on the Great Yarmouth model development.
2.2	Flood 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**

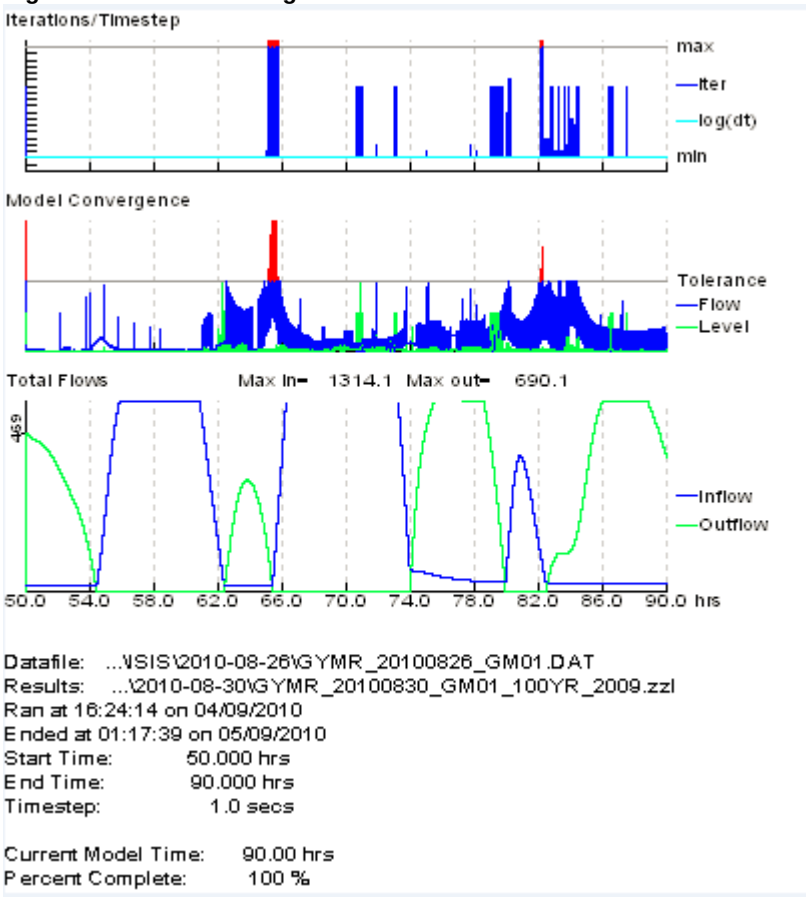
7 2D Domain - General

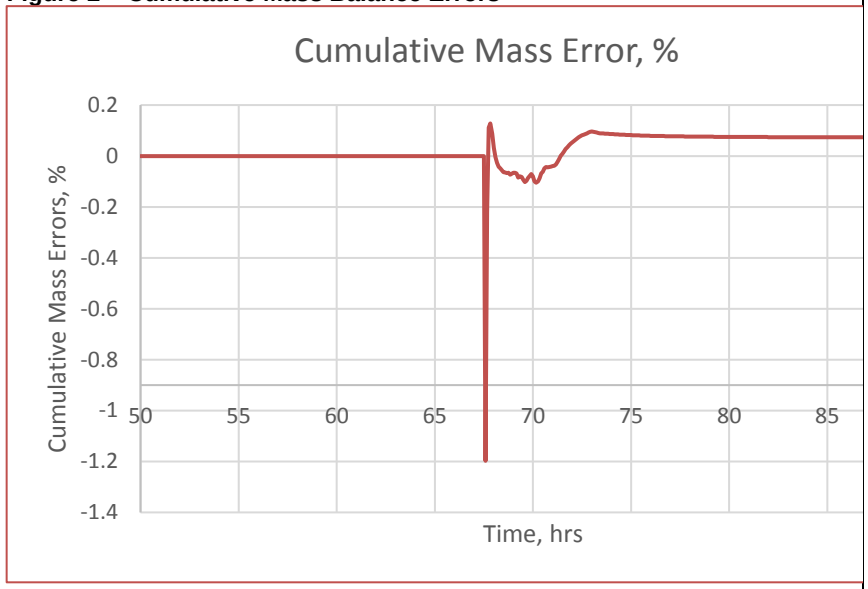
Issue	Summary	Reviewer comments	Action
7.1 General, Cell size(s), Suitable for study objectives?	10m grid size. The 2D grid simulates all Great Yarmouth, the River Yare and the land mass between the River Yare and the River Bure.	Cell size should be reduced if possible.	**Useful**
7.2 Base topography	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

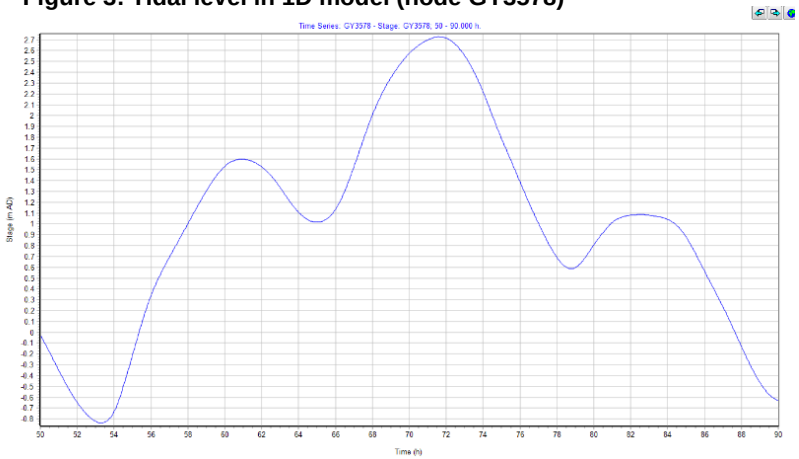
Issue		Summary	Reviewer comments	Action
8.1	Computational Time-step and run time	1s in 1D and 2s in 2D. (runtime 8:53:24)	This is considered suitable for model configuration. This can be decreased if the large events cause stability issues. Reducing the runtime would be preferable if possible.	**Good 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**

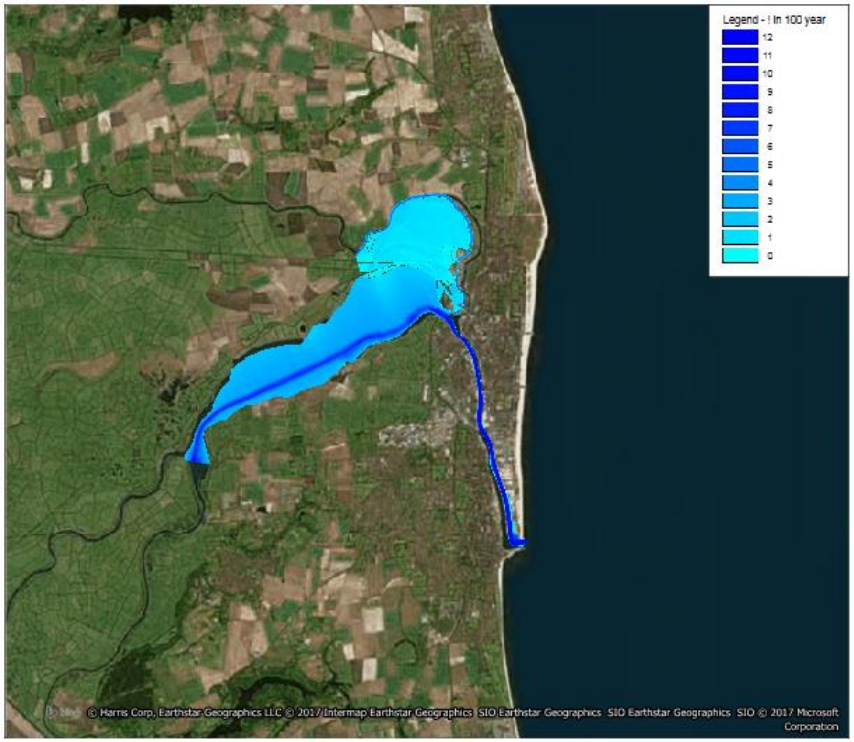
8.3	Convergence	ISIS model runs show that there are some instances of poor model convergence (figure 1). **Figure 1 – Model Convergence**  	The poor convergence is at the high water point. In a tidal model of this size, this is acceptable however it should be reduced if possible.	**Useful**

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.

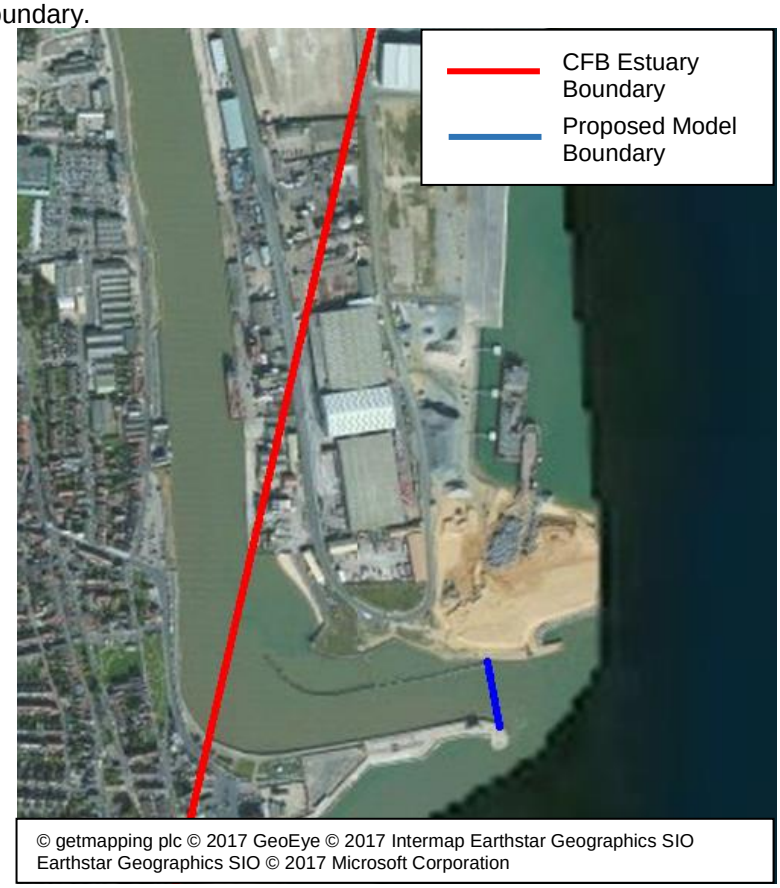


Figure 1: Estuary Boundary Check,

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.

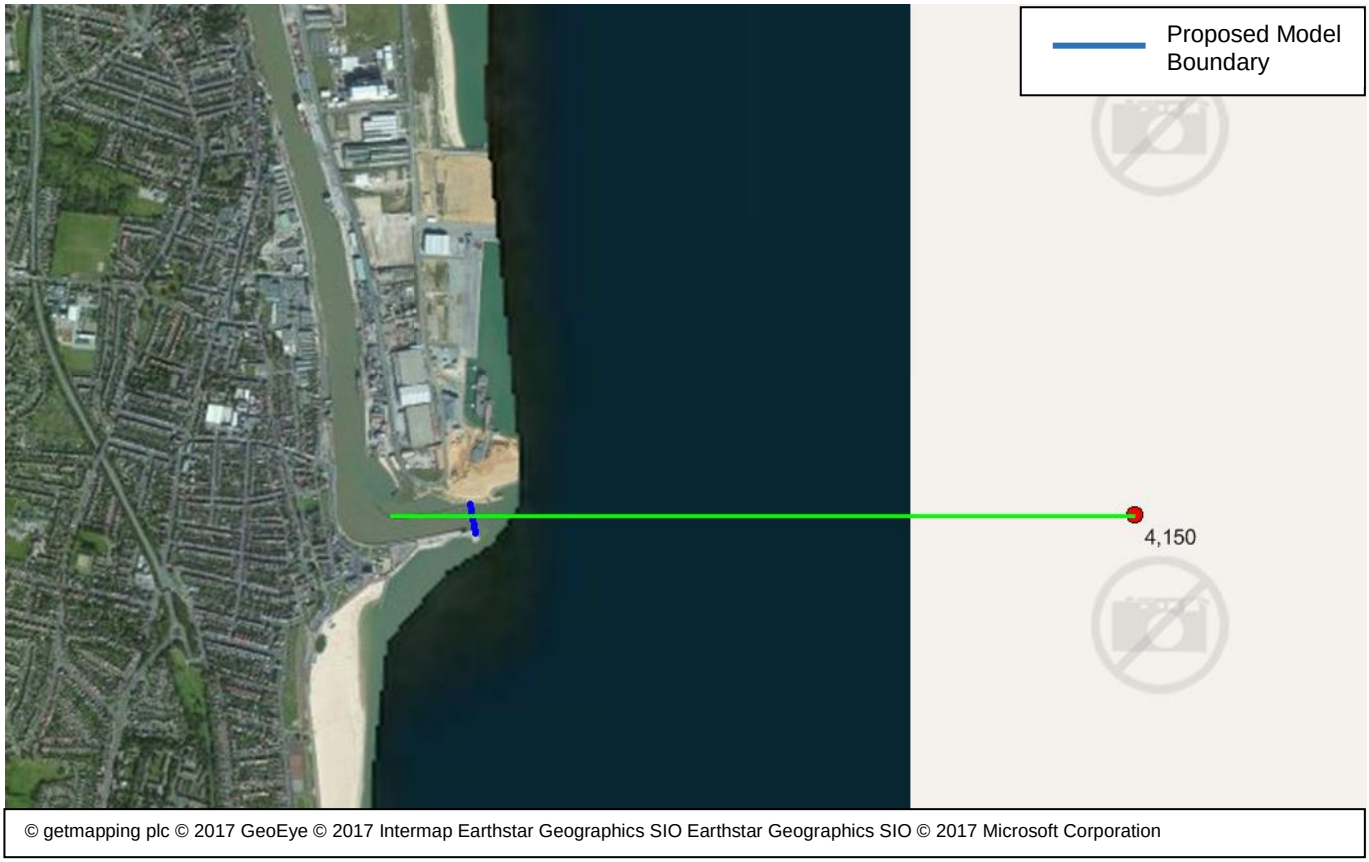


Figure 2: Chainage

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.

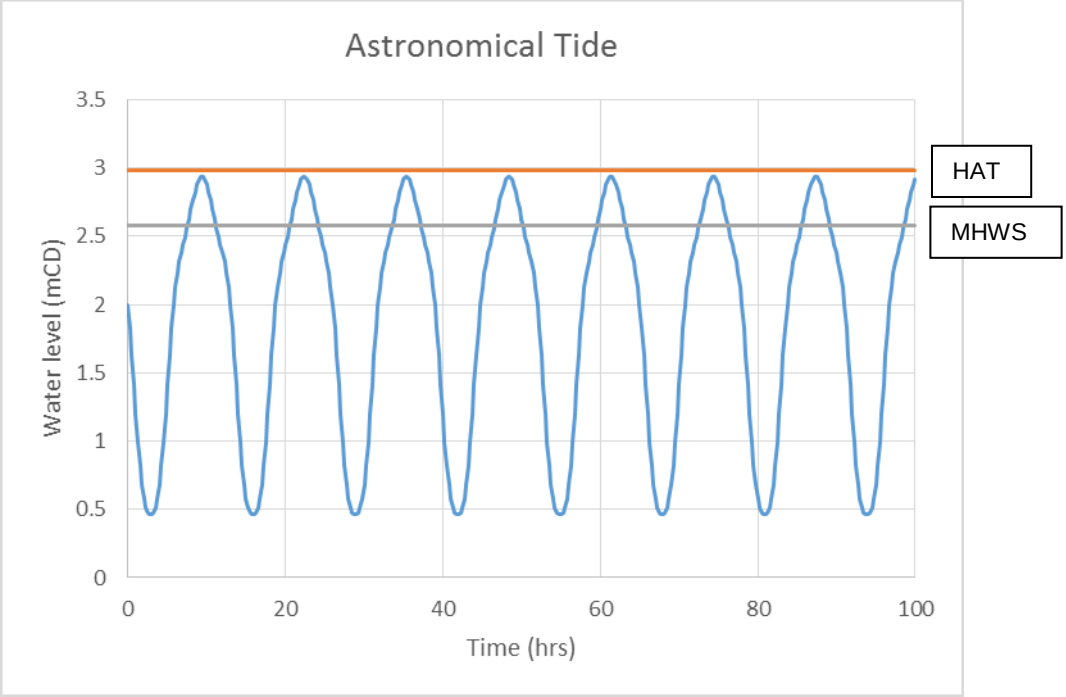


Figure 3: Astronomical tidal profile comparison

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

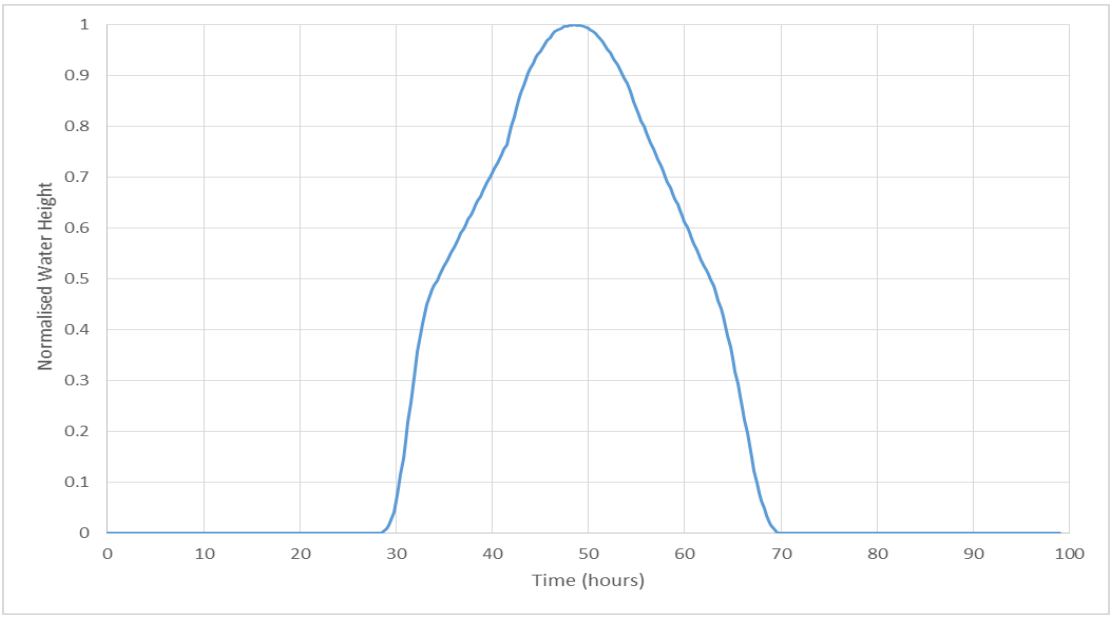


Figure 4: Shape 9 – Lowestoft Surge

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)

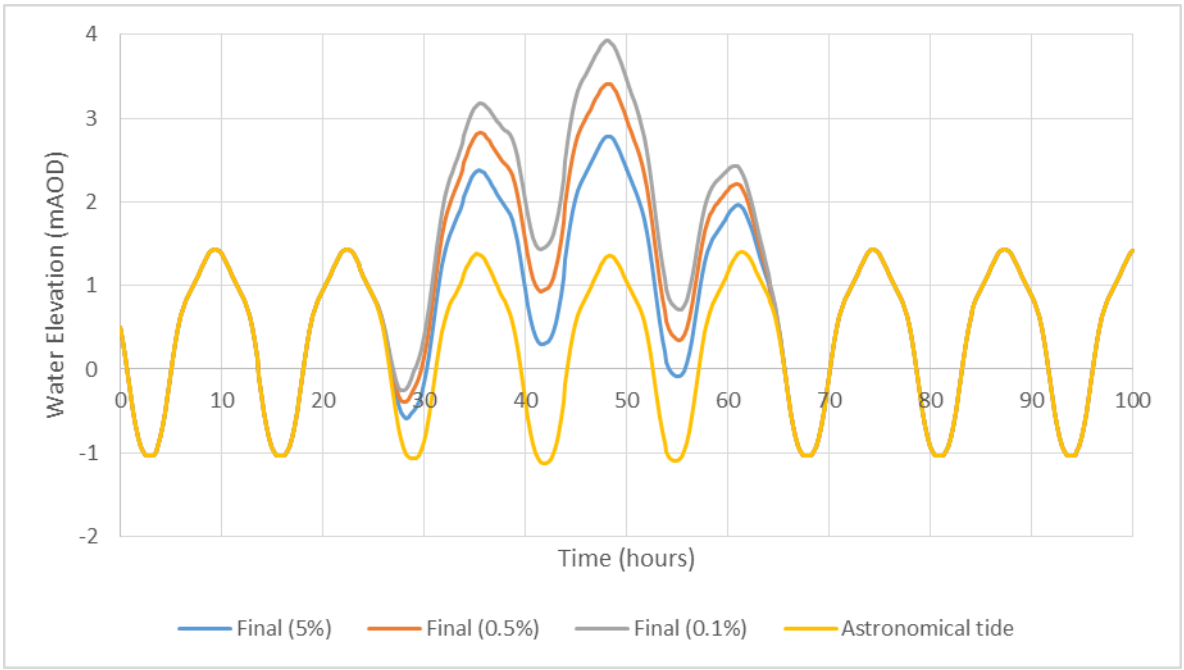


Figure 5: Final design event tidal curves

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

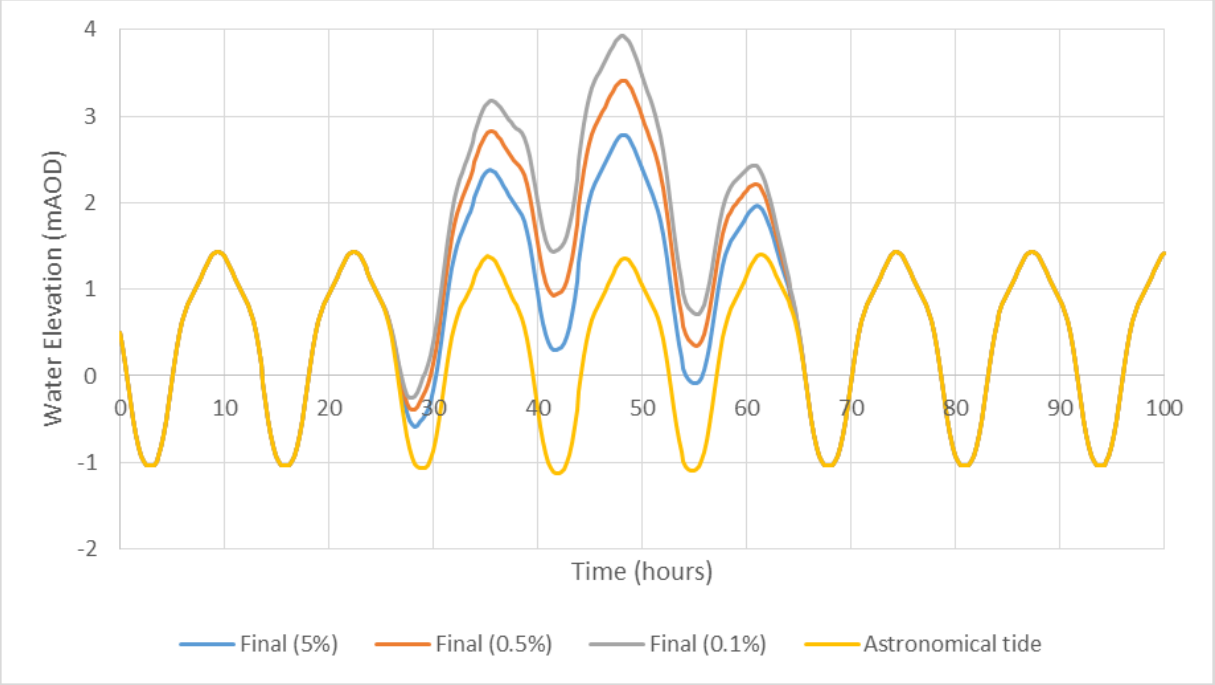


Figure A1: Final design event tidal curves

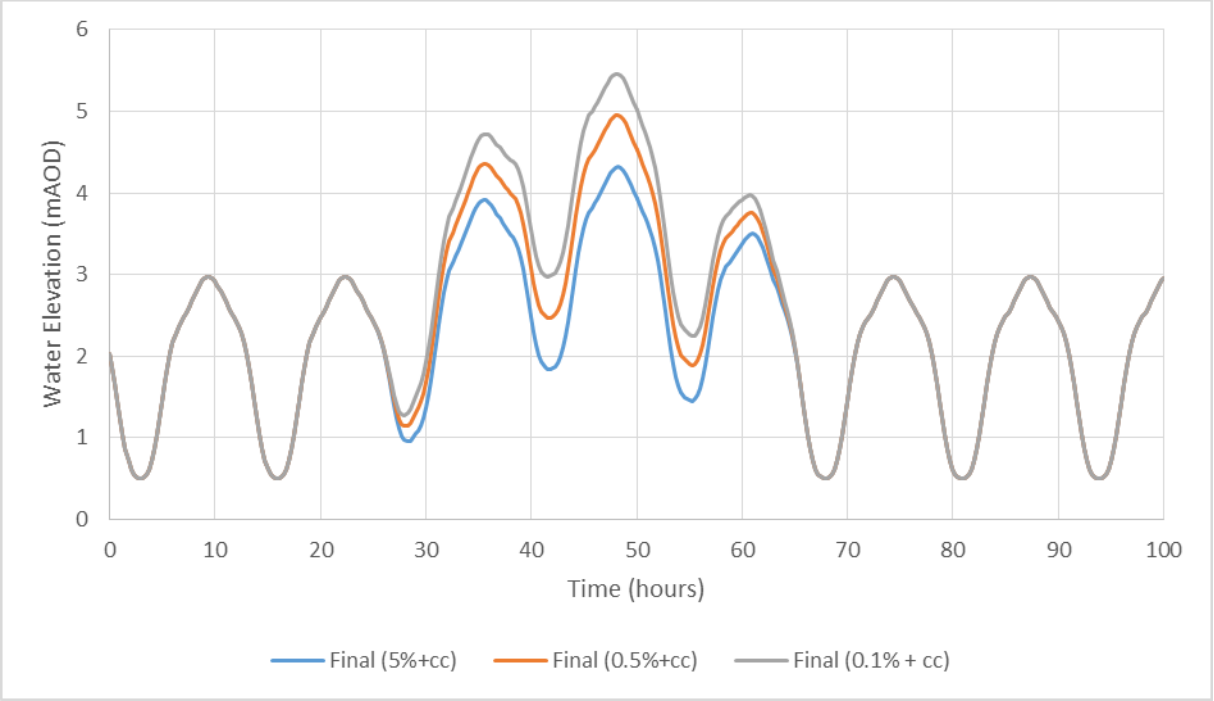


Figure A2: Final present day climate change scenario tidal curves (based on NPPF – table 3 sea level increase scenario)

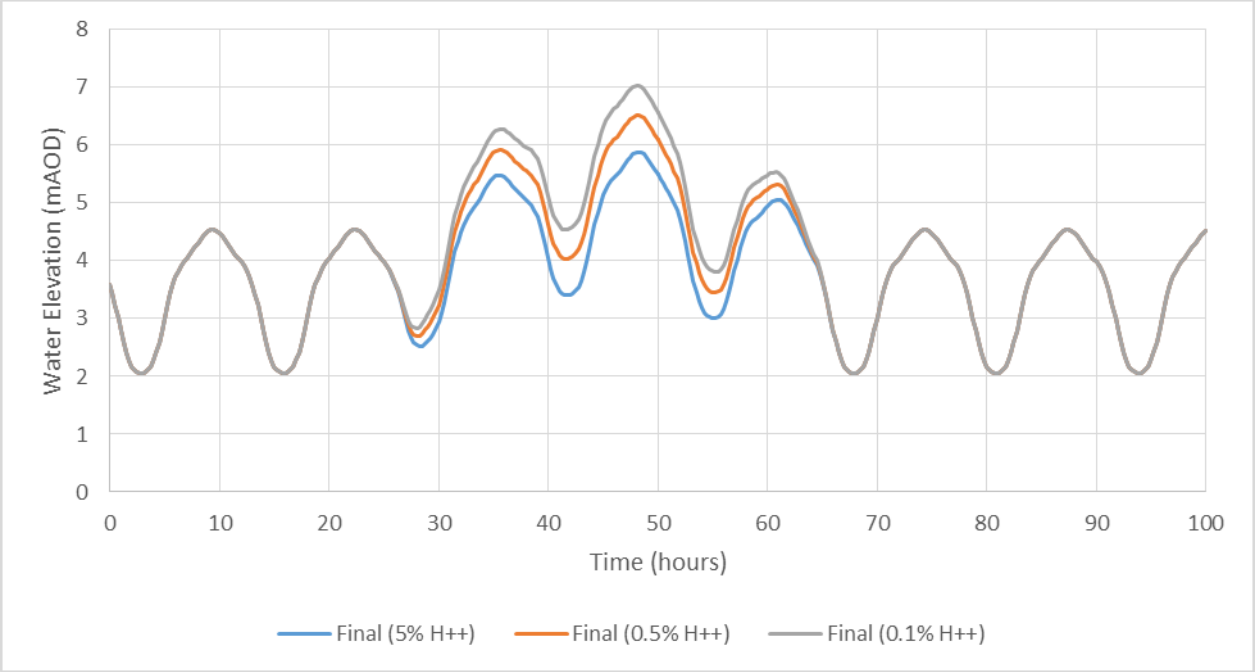


Figure A3: Final H++ scenario tidal curves

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

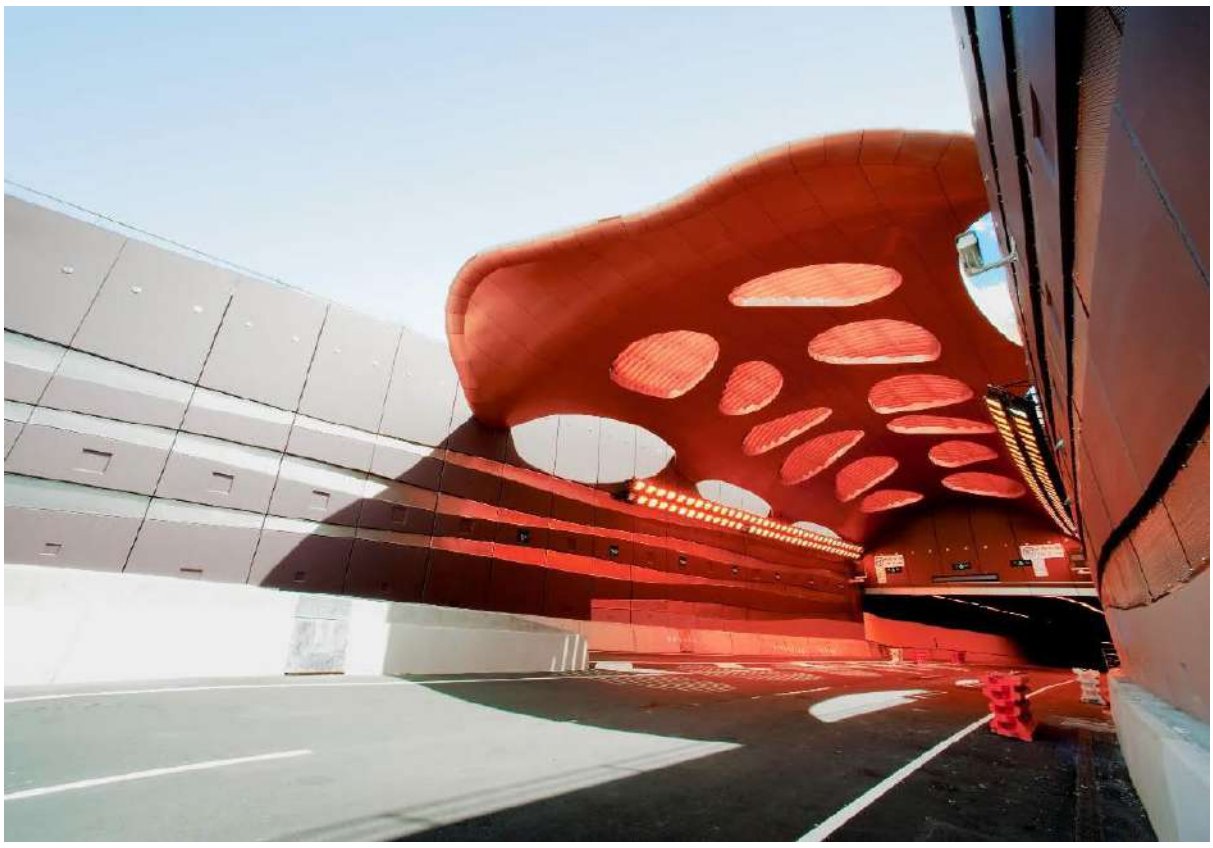
Name	Description	Direction from the Proposed Scheme	Distance from the Proposed Scheme
Hawthorn Road	Play Area	1.31 km	SW
Phoenix Pool & Gym	Sport centres	1.33 km	SW
Hunter Drive	Play Area	1.37 km	SW
Elder Green	Play Area	1.43 km	SW
Crittens Road	Play Area	1.48 km	NW
Pine Green	Play Area	1.50 km	SW
El 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

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks				
Date	July 2017			
Prepared by	Neil Balderstone			
Signature	[redacted]			
Checked by	Dave Watts			
Signature	[redacted]			
Authorised by	Dave Watts			
Signature	[redacted]			
Project number	62240375			
Report number	62240375-016-R01			
File reference				

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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.
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- 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
A -	DR -	L -	016/01

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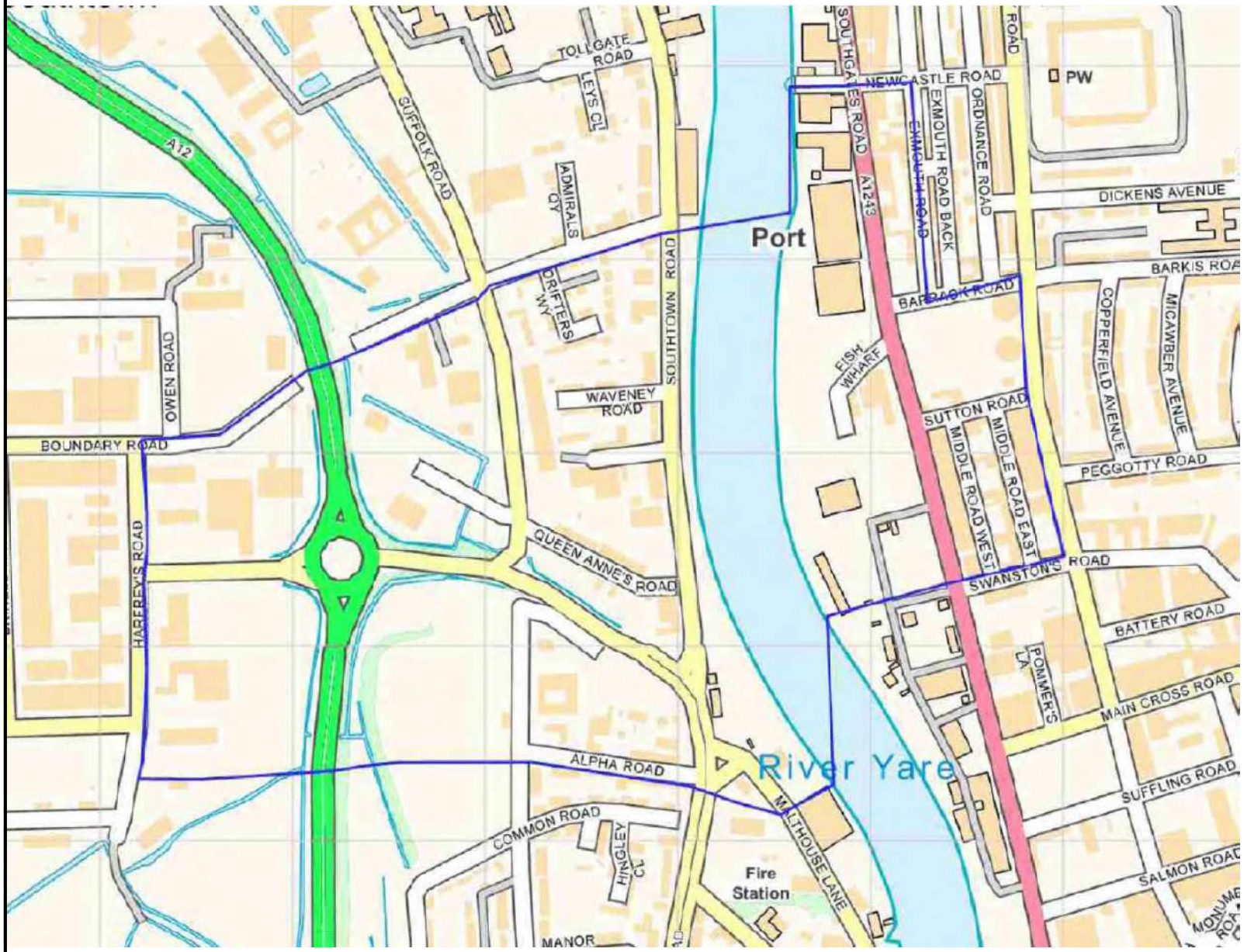

STUDY AREA BOUNDARY

REV	DETAILS	CHKD	APPD	DATE

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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

Study Area Boundary

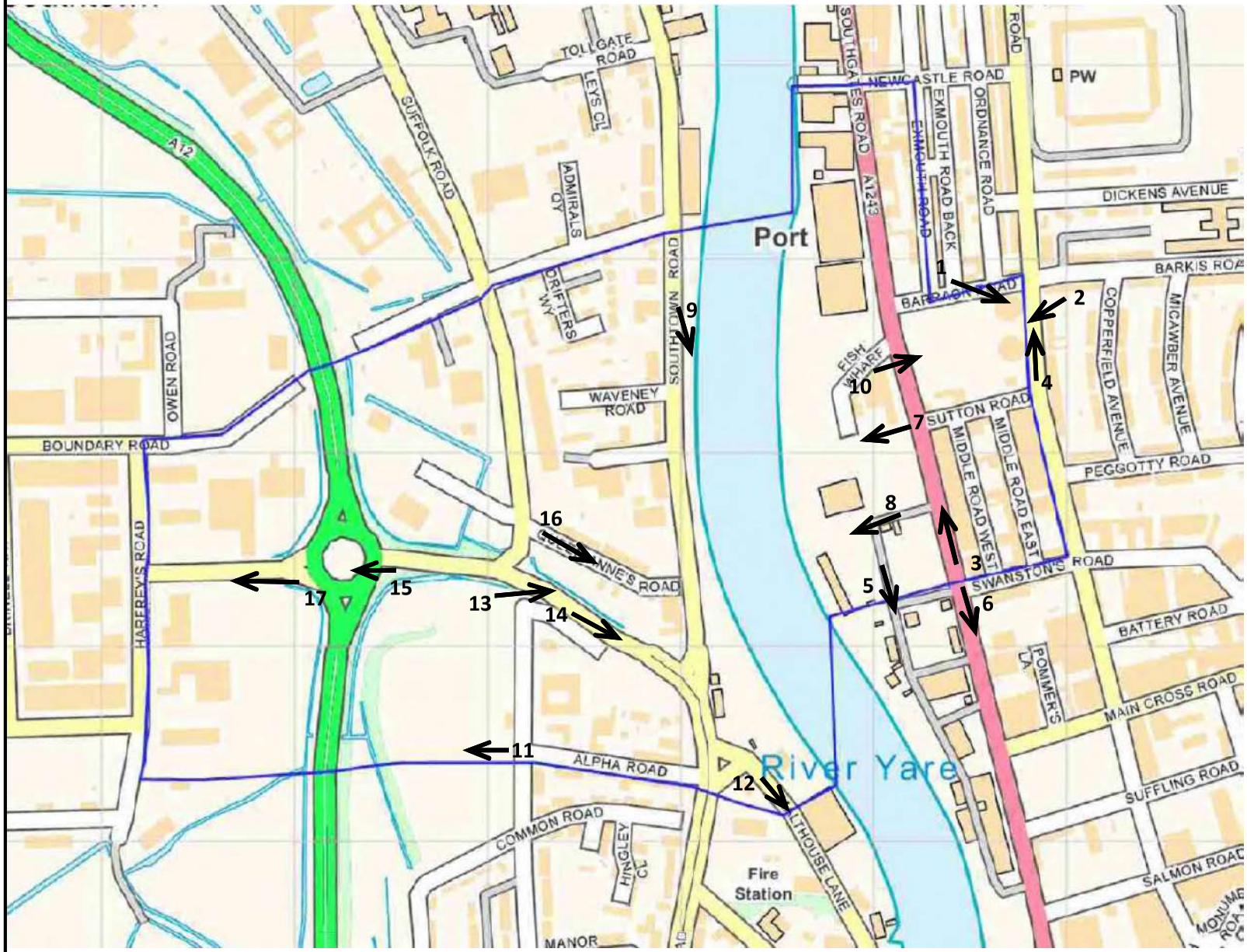
ORIG DRAWING SIZE: A3	DIMENSIONS: m
COPYRIGHT ©	SCALE: N/A
SCHEME REF No.	REVISION A

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.

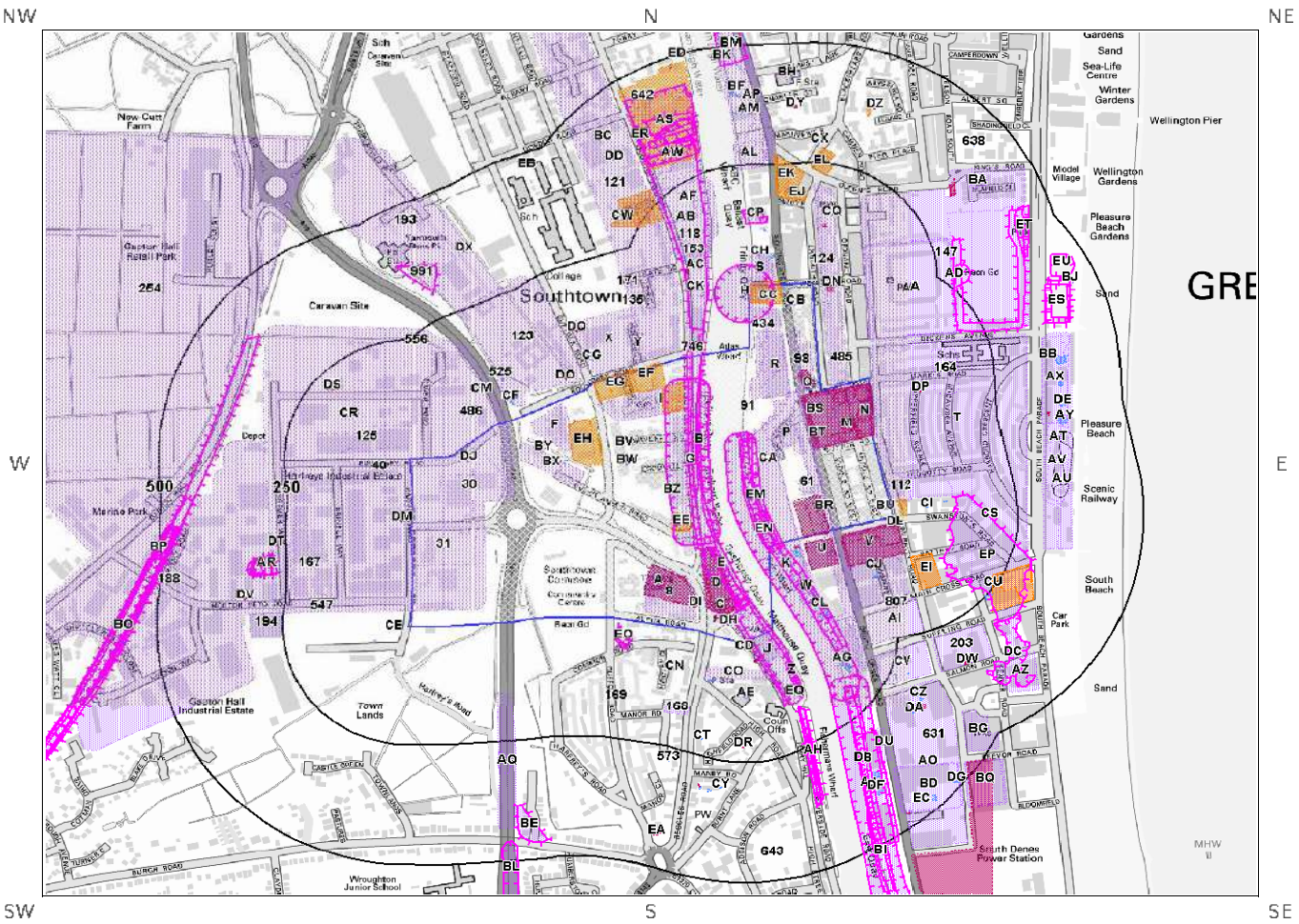
Note: Maps

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

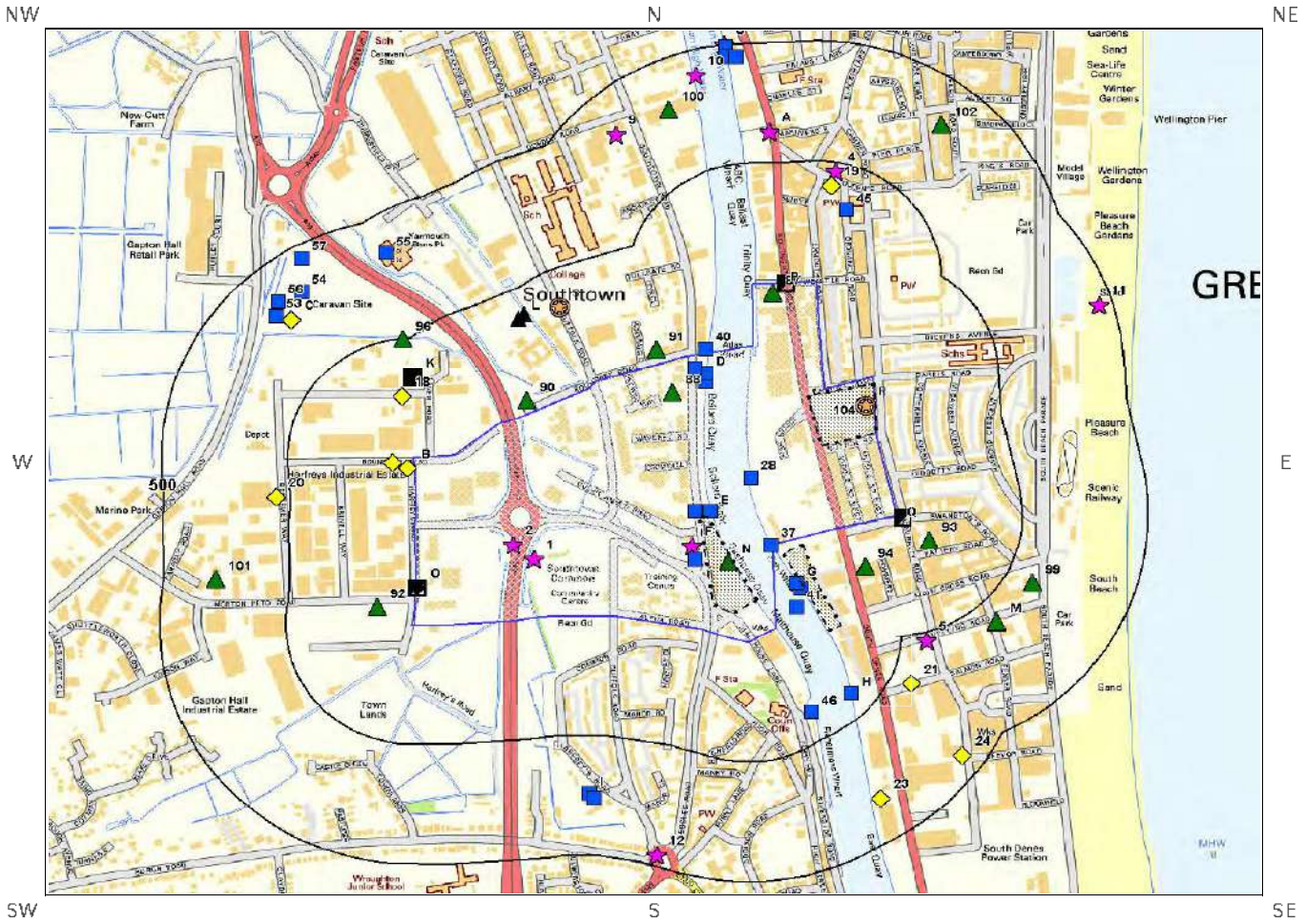
Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 81

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

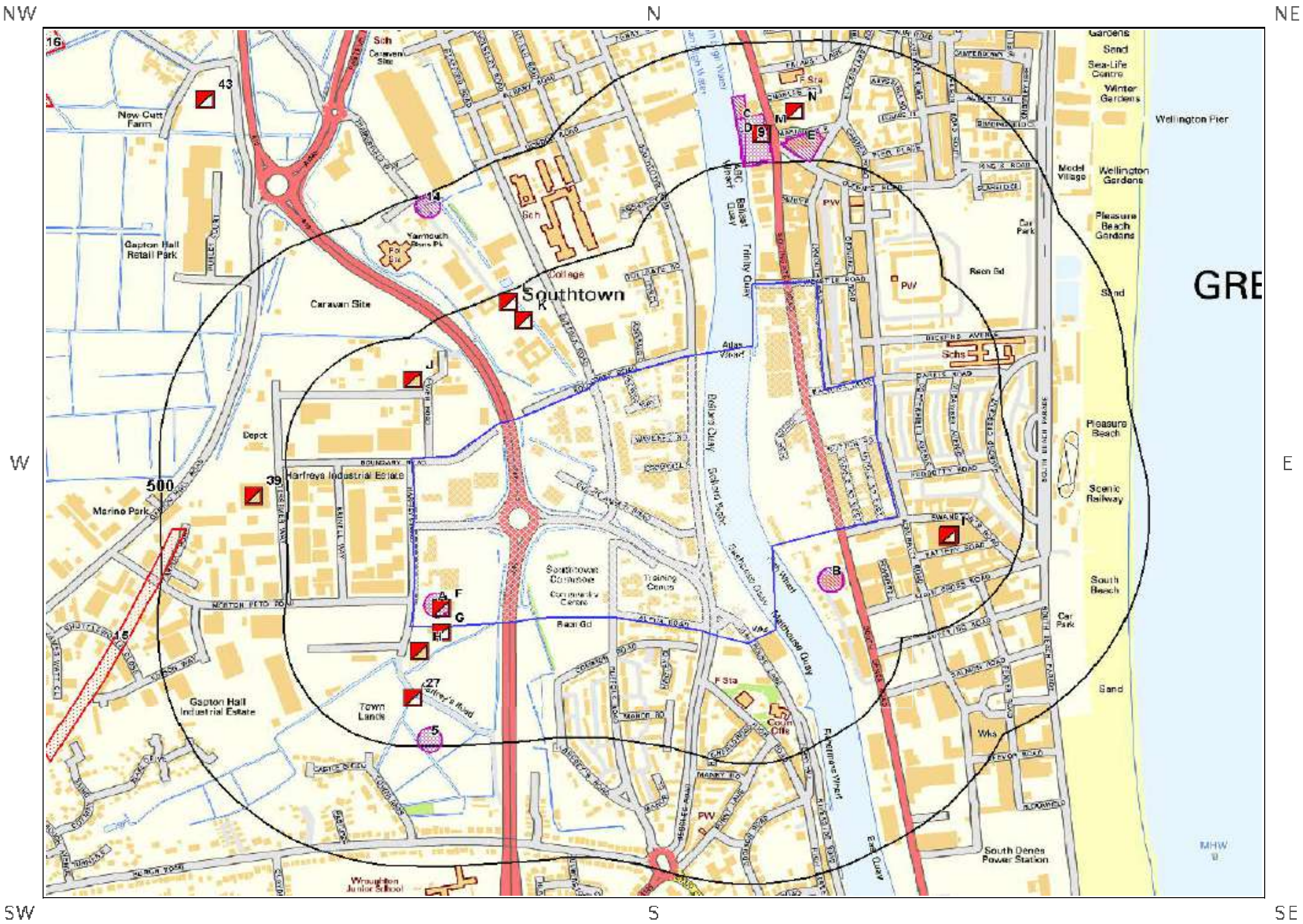
How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? 0

Database searched and no data found.

Groundsure LOCATION INTELLIGENCE

CENTRE MAPS LIVE.

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

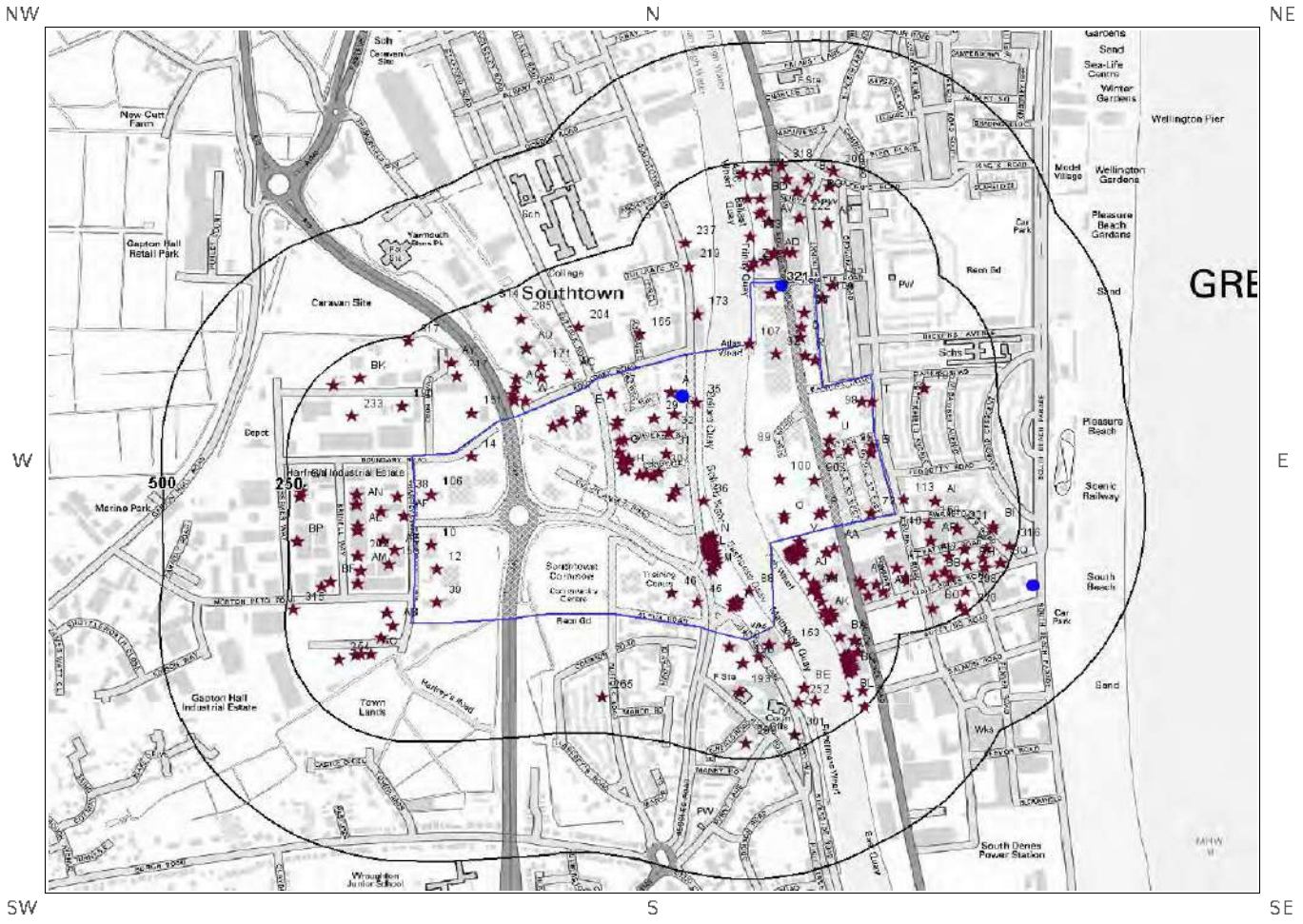
ID	Distance (m)	Direction	NGR	Details	
35L	229	NW	652033 306339	Site Address: Yarmouth Business Park, Suffolk Road, Great Yarmouth, Norfolk, NR31 0ER Type: Special Waste Transfer Station Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: MAL001 EPR reference: EA/EPR/YP3199NQ/S004 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

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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

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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

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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

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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

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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

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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

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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.

Appendix G-4 Part 5 – Consultation Materials: Preliminary Environmental Information Report

5. Geology

5.1 Artificial Ground and Made Ground

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

5.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
NRD-XSV	NORTH DENES FORMATION	SAND AND GRAVEL
BRYD-P	BREYDON FORMATION	PEAT
BRYD-XCZ	BREYDON FORMATION	CLAY AND SILT
BRYD-XCZ	BREYDON FORMATION	CLAY AND SILT
TRD-XCZ	TIDAL RIVER OR CREEK DEPOSITS	CLAY AND SILT
HPGL-S	HAPPISBURGH GLACIGENIC FORMATION	SAND
BSA-S	BLOWN SAND	SAND

5.3 Bedrock and Solid Geology

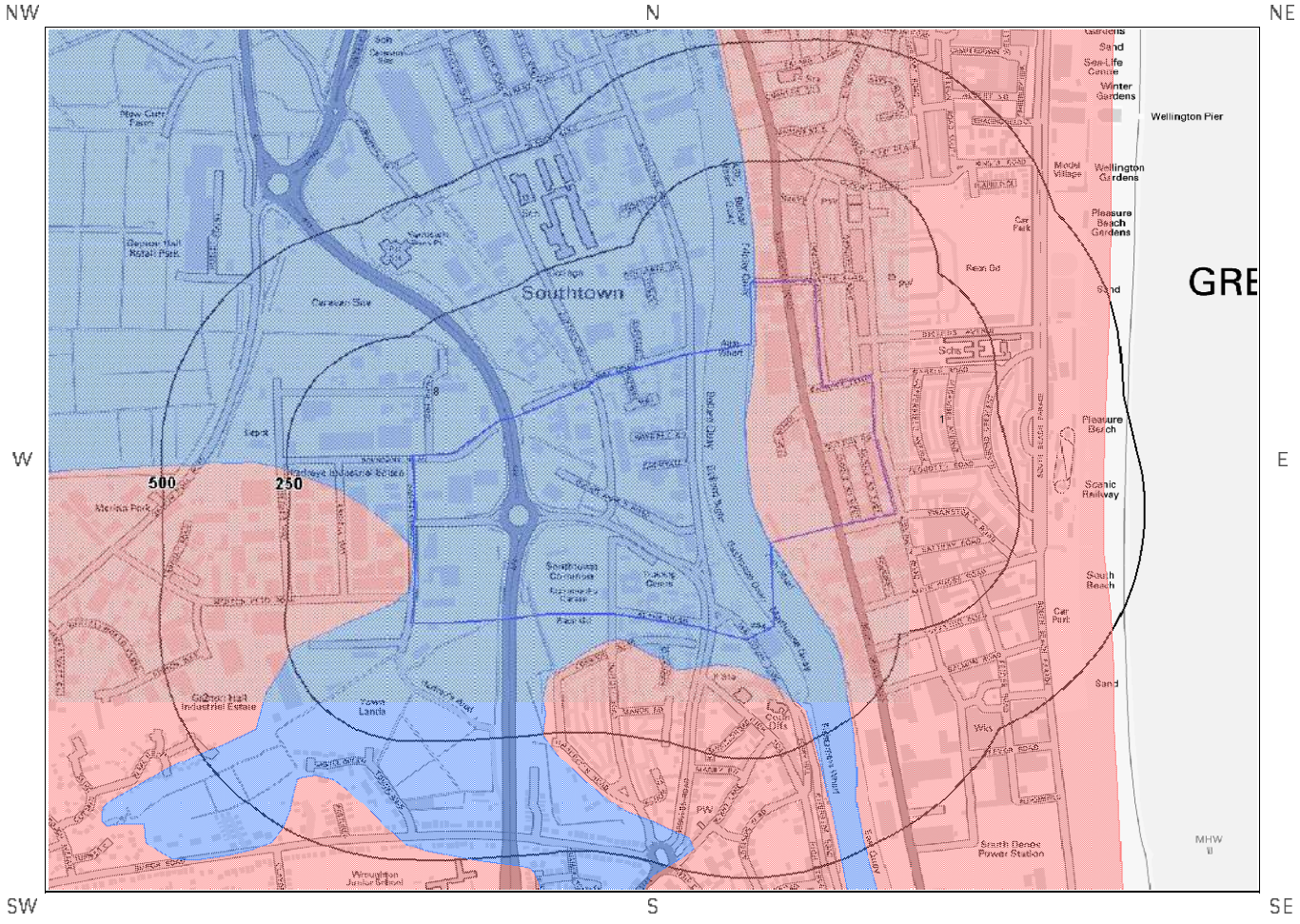
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
CRAG-XSV	CRAG GROUP	SAND AND GRAVEL

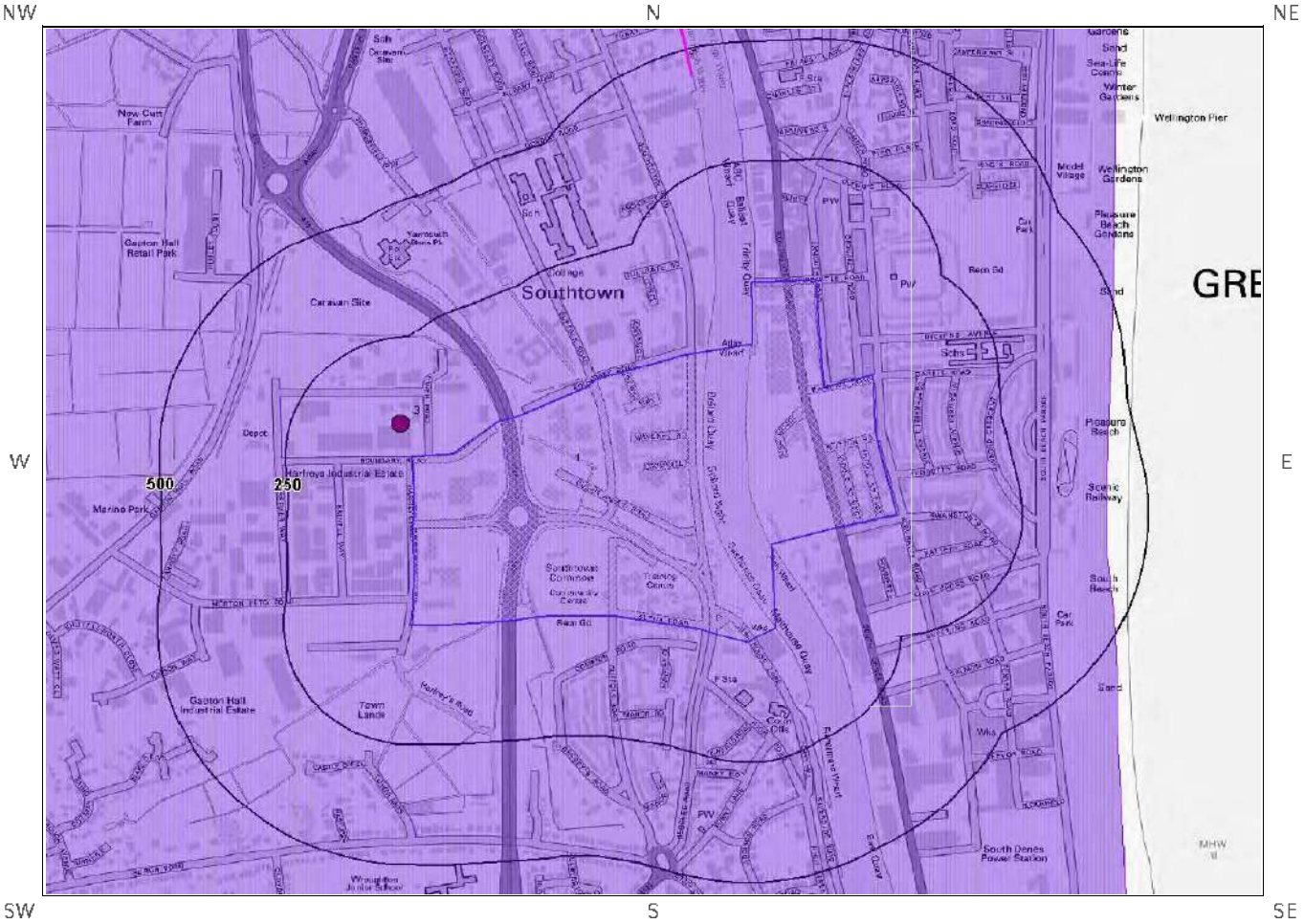
(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

6a. Aquifer Within Superficial Geology



6b. Aquifer Within Bedrock Geology and Abstraction Licenses



Site Outline

250 / 500 Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

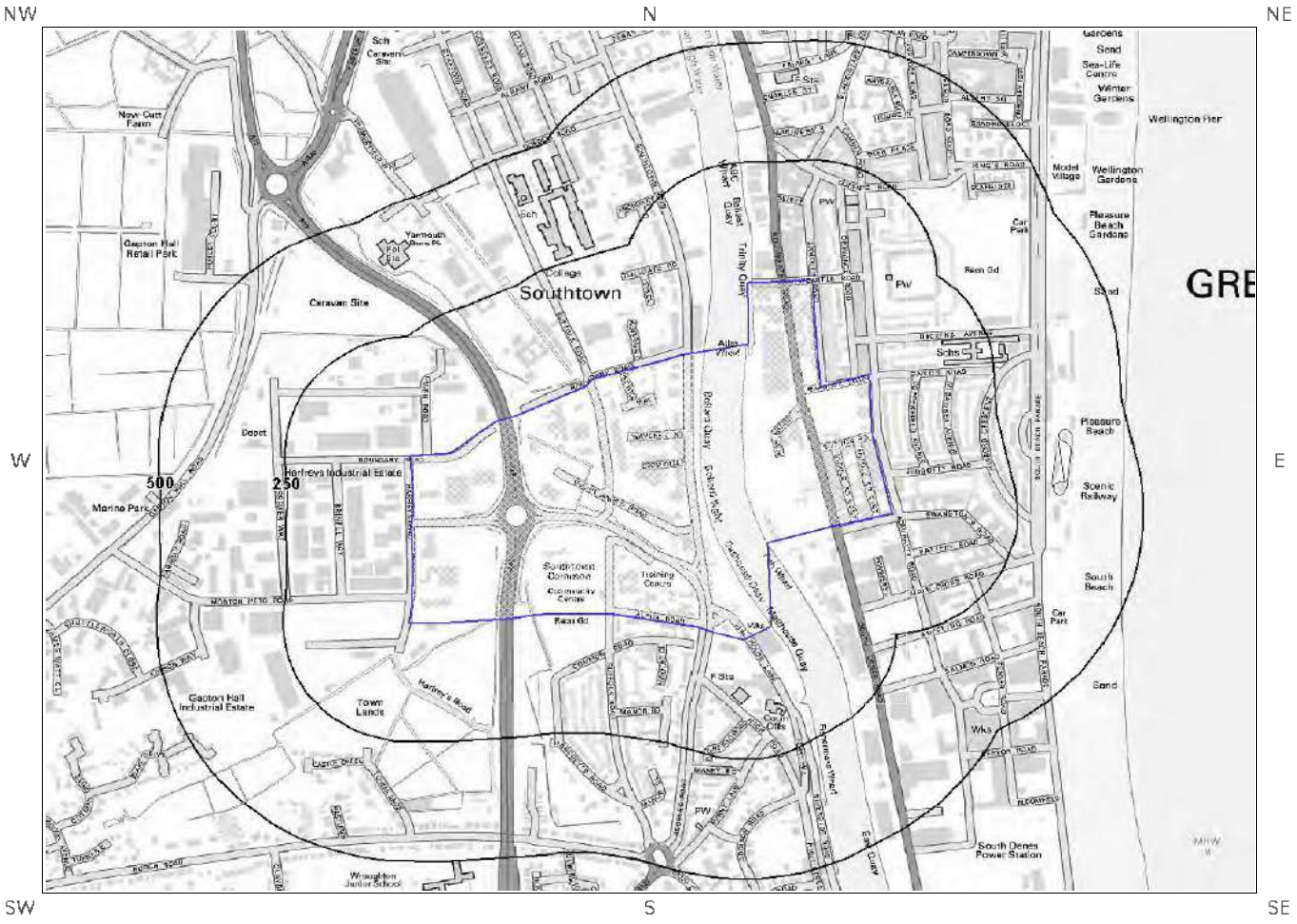
Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



Site Outline

250 — 500 — Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

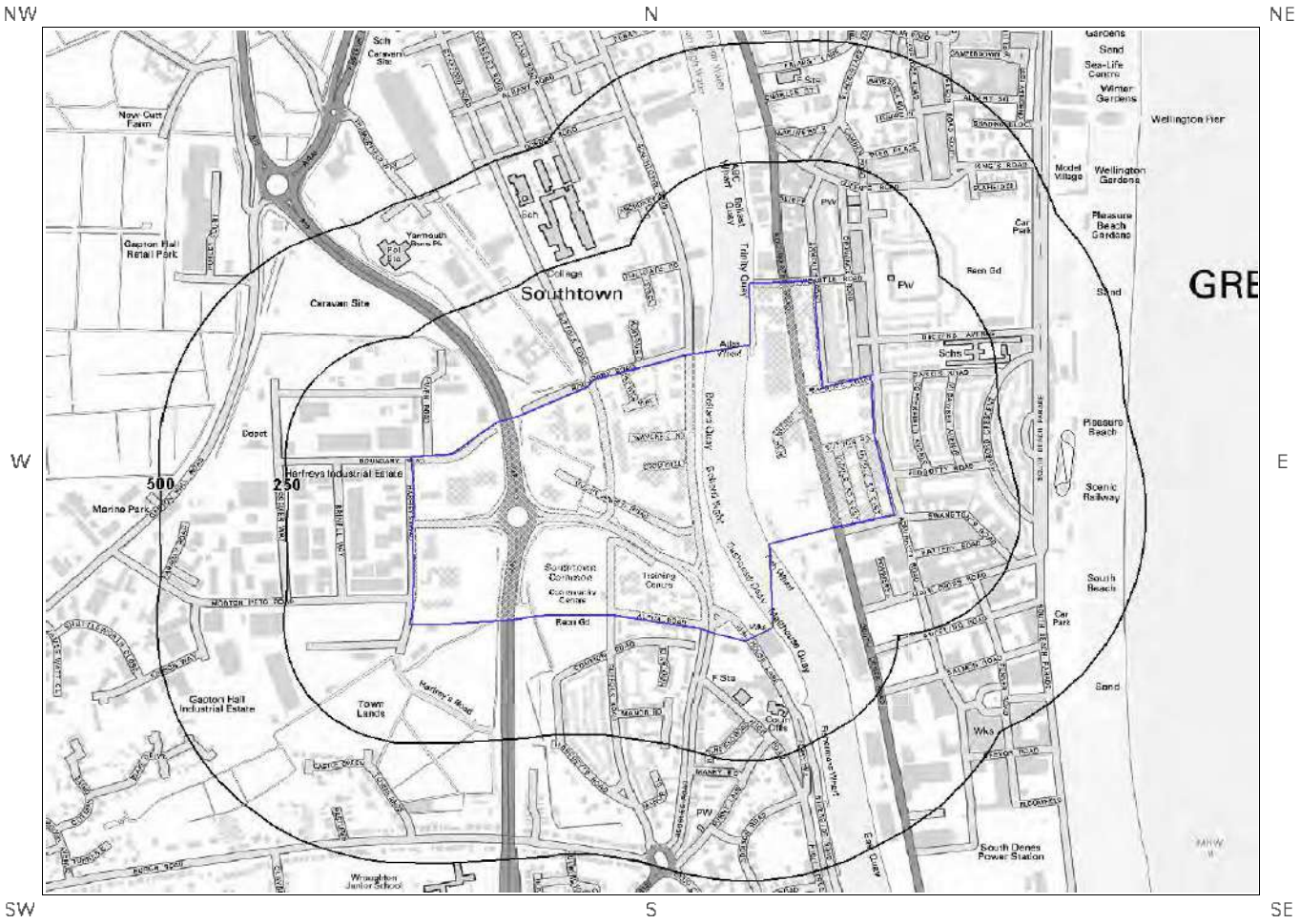
Source Protection Zone 2 - Outer Catchment

Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

6d. Hydrogeology – Source Protection Zones within confined aquifer



Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2C - Outer Catchment within Confined Aquifer

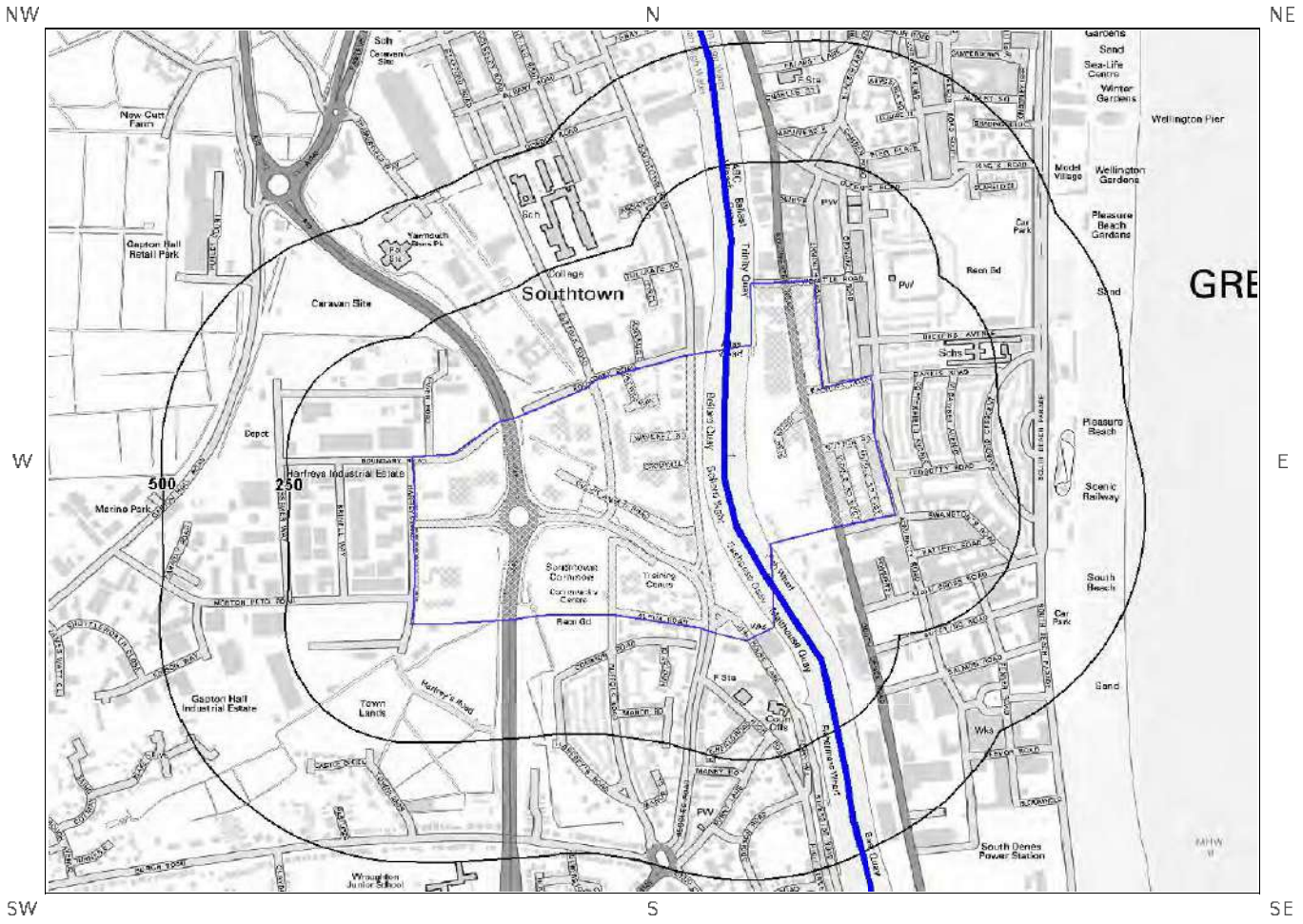
Source Protection Zone 3C - Total Catchment within Confined Aquifer

Site Outline

Potable Water Abstraction Licence

250 — 500 — Search Buffers (m)

6e. Hydrology – Detailed River Network and River Quality



6.Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	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. These are generally aquifers formerly classified as minor aquifers
8	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
2	3	W	Secondary A	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. These are generally aquifers formerly classified as minor aquifers

6.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property?Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details	
3	71	N	651820 306080	Status: Active Licence No: AN/034/0015/020 Details: Laundry Use Direct Source: Ground Water Source Of Supply Point: Wellpoints At The Laundry, Portland Lane, Great Yarmouth Data Type: Point Name: Camplings Limited	Annual Volume (m^3): 60000 Max Daily Volume (m^3): 210 Original Application No: NPS/WR/024446 Original Start Date: 1/12/2016 Expiry Date: 31/3/2030 Issue No: 1 Version Start Date: 1/12/2016 Version End Date:
Not shown	1187	NE	653140 307460	Status: Historical Licence No: 7/34/15/*G/0220 Details: Make-Up or Top Up Water Direct Source: Ground Water Source Of Supply Point: Wellpoint At Gt Yarmouth Data Type: Point Name: B & M LEISURE	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 1/3/1997 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1997 Version End Date:

6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? Yes

The following Surface Water Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details	
5	443	N	652372 306914	Status: Historical Licence No: AN/034/0015/013 Details: Hydraulic Testing Direct Source: Surface Water Source Of Supply Point: River Yare At Berth 28, Great Yarmouth Data Type: Line Name: INTERSERVE CONSTRUCTION LIMITED	Annual Volume (m^3): 4000 Max Daily Volume (m^3): 100 Application No: NPS/WR/014706 Original Start Date: 16/12/2013 Expiry Date: 31/3/2015 Issue No: 1 Version Start Date: 16/12/2013 Version End Date:

6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? No

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Major Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
0	On Site	Major Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
487	W	Major Aquifer/High Leaching Potential	H1	Soils which readily transmit liquid discharges because they are shallow or susceptible to rapid flow directly to rock, gravel or groundwater.

6.9 River Quality

Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? No

6.9.1 Biological Quality:

Database searched and no data found.

6.9.2 Chemical Quality:

Database searched and no data found.

6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distance (m)	Direction	Details	
1	0	On Site	River Name: River Yare Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined

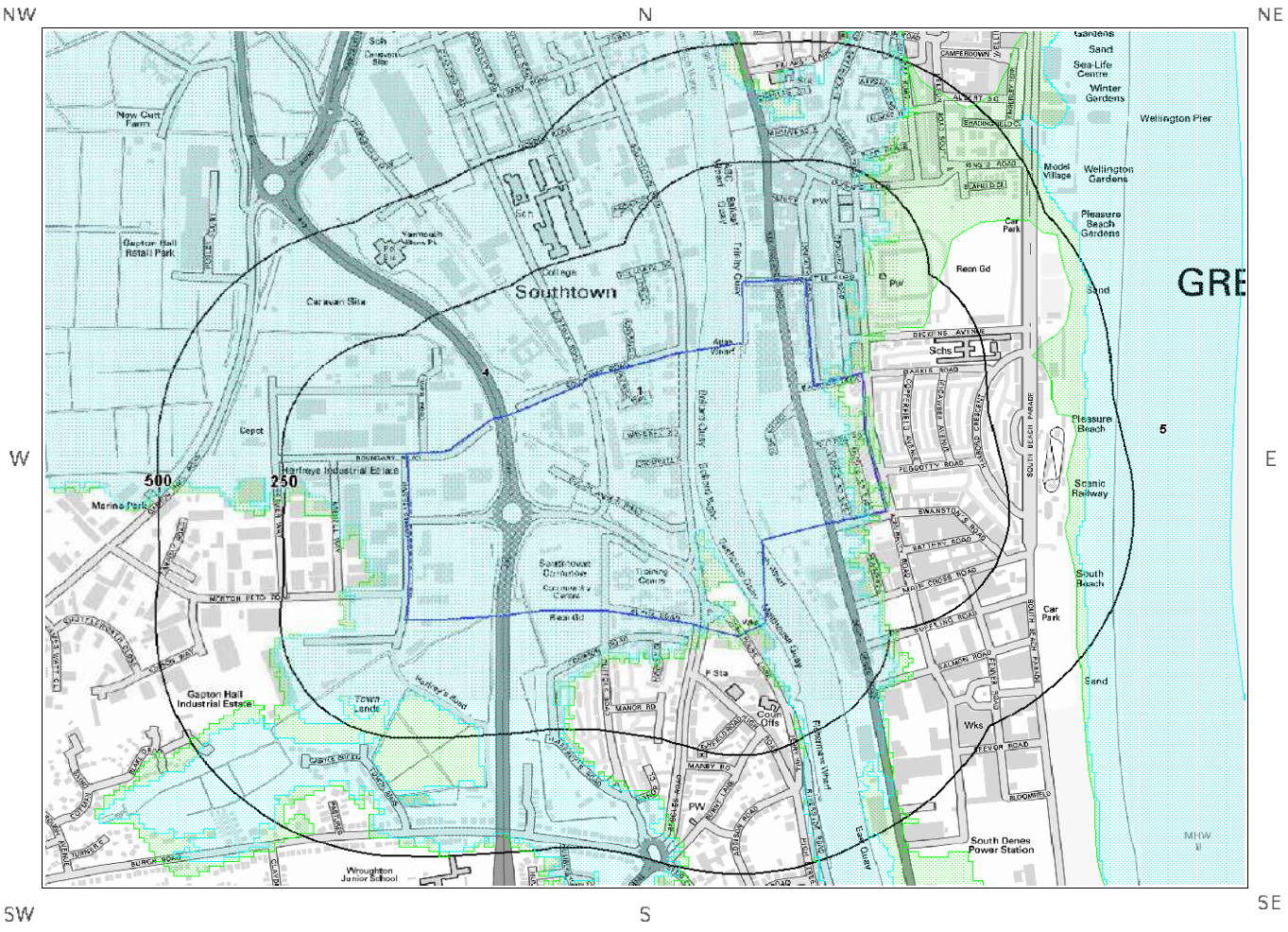
6.11 Surface Water Features

Are there any surface water features within 250m of the study site? Yes

The following surface water records are not represented on mapping:

Distance (m)	Direction
0	On Site
0	On Site
0	On Site
0	On Site
0	On Site
0	On Site
0	On Site
0	On Site
17	NW
25	NW
29	N
37	NW
52	NW
74	SW
105	NW
118	S
143	S
158	NW
176	S

7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



Site Outline

100
250
Search Buffers (m)

Zone 2 Floodplain

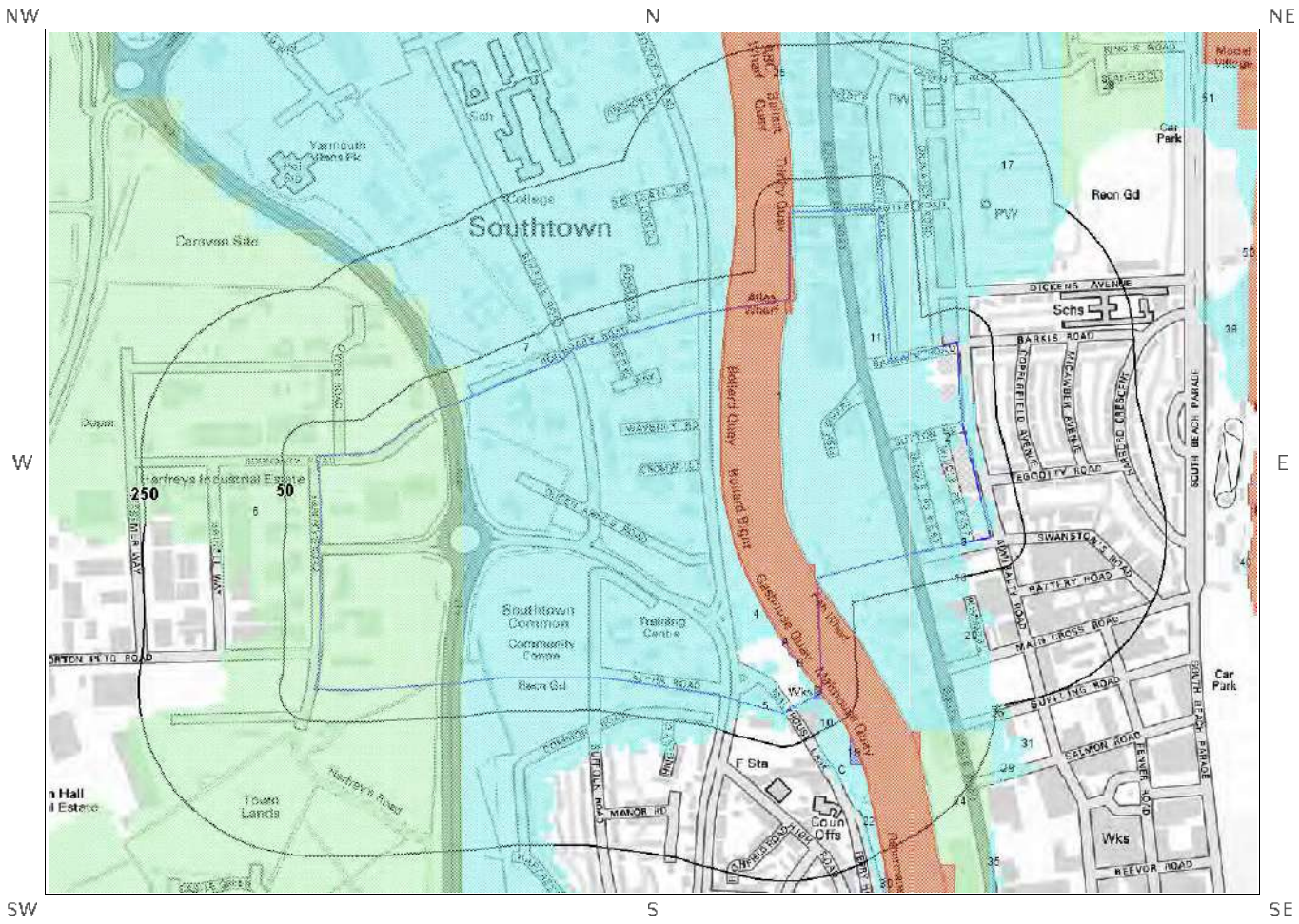
Zone 3 Floodplain

Flood Defences

Area used for Flood Storage

Area Benefiting from Flood Defences

7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



7 Flooding

7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? Yes

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

ID	Distance (m)	Direction	Update	Type
1	0	On Site	19-Jun-2017	Zone 2 - (Fluvial /Tidal Models)

7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? Yes

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

ID	Distance (m)	Direction	Update	Type
1	0	On Site	19-Jun-2017	Zone 3 - (Fluvial Models)

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? High

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a High (1 in 30 or greater) chance of flooding in any given year.

Any relevant data within 250m is represented on the RoFRaS Flood map. Data to 50m is reported in the table below.

ID	Distance (m)	Direction	RoFRas flood RIsk
1	0.0	On Site	Low
2	0.0	On Site	Low

3	0.0	On Site	Low
4	0.0	On Site	Low
5	0.0	On Site	Low
6	0.0	On Site	Very Low
7	0.0	On Site	Low
8B	0.0	On Site	Low
9	0.0	On Site	Medium
10	0.0	On Site	Low
11	0.0	On Site	Low
12A	0.0	On Site	Medium
13A	0.0	On Site	Medium
14B	0.0	On Site	Medium
15B	0.0	On Site	Medium
16	0.0	On Site	High
17	5.0	E	Low
18	30.0	S	Low

7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No

Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

7.6 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? No

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Clearwater Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Limited potential

Where limited potential for groundwater flooding to occur is indicated, this means that although given the geological conditions there may be a groundwater flooding hazard, unless other relevant information, e.g. records of previous flooding, suggests groundwater flooding has occurred before in this area, you need take no further action in relation to groundwater flooding hazard.

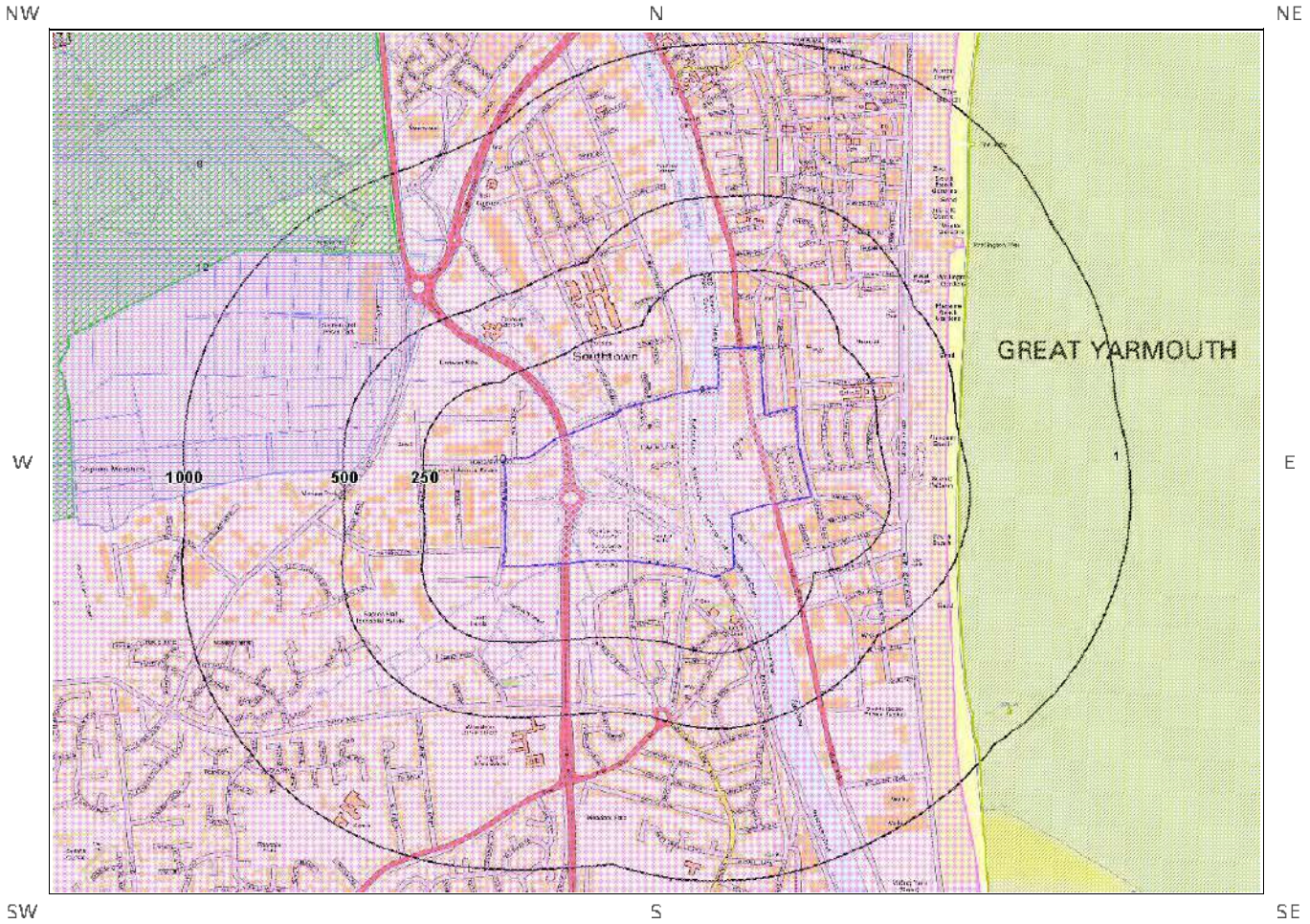
7.8 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? Low

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

8. Designated Environmentally Sensitive Sites Map



Site Outline

100
250
Search Buffers (m)

AONB
National Park
SSSI
Special Protection Areas
Nitrate Vulnerable Zones

Green Belt
Environmentally Sensitive Areas
Special Areas of Conservation
World Heritage Sites
Nitrate Sensitive Areas

Ancient Woodland
National Nature Reserve
Local Nature Reserves
Ramsar Sites

8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site? Yes

8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

3

The following Site of Special Scientific Interest (SSSI) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SSSI Name	Data Source
Not shown	1794	NW	Breydon Water	Natural England
4	1848	NW	Breydon Water	Natural England
Not shown	1949	NW	Breydon Water	Natural England

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

2

The following Special Protection Area (SPA) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SPA Name	Data Source
1	465	E	Outer Thames Estuary	Natural England

ID	Distance (m)	Direction	SPA Name	Data Source
2A	1794	NW	Breydon Water	Natural England

8.5 Records of Ramsar sites within 2000m of the study site:

1

The following Ramsar records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	Ramsar Site Name	Ramsar Site Status	Data Source
6A	1794	NW	Breydon Water	Listed	Natural England

8.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

1

The following Local Nature Reserve (LNR) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	LNR Name	Data Source
7	1797	NW	Breydon Water	Natural England

8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

2

The following Environmentally Sensitive Area records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	ESA Name	Data Source
12	392	W	Broads	Natural England
Not shown	1839	W	Broads	Natural England

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

8.11 Records of National Parks (NP) within 2000m of the study site:

2

The following National Park records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NP Name	Data Source
8	754	NW	The Broads	Natural England
Not shown	1839	W	The Broads	Natural England

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

2

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NVZ Name	Data Source
10	0	On Site	Existing	DEFRA
Not shown	1839	W	Existing	DEFRA

8.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a **Groundsure Geo Insight**, available from **our website**. The following information has been found:

9.1.1 Shrink Swell

What is the maximum Shrink-Swell* hazard rating identified on the study site? Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

9.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property no significant increase in insurance risk due to natural slope instability problems.

9.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? High

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Very significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Construction may not be possible at economic cost. For existing property probable increase in insurance risk from compressibility especially if water conditions or loading of the ground change significantly.

9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

9.1.6 Running Sand

What is the maximum Running Sand** hazard rating identified on the study site? Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Significant potential for running sand problems with relatively small changes in ground conditions. Avoid large amounts of water entering the ground (for example through pipe leakage or soak-aways). Do not dig (deep) holes into saturated ground near the property without technical advice. For new build consider the consequences of soil and groundwater conditions during and after construction. For existing property possible increase in insurance risk from running sand, for example, due to water leakage, high rainfall events or flooding.

9.2 Radon

9.2.1 Radon Affected Areas

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.

* This indicates an automatically generated 50m buffer and site.

9.2.2 Radon Protection

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.

10. Mining

10.1 Coal Mining

Are there any coal mining areas within 75m of the study site?	No

Database searched and no data found.

10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary?	No

Database searched and no data found.

10.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? Guidance: No Guidance Required.	No

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.

Contact Details

CENTREMAPS
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Groundsure@centremaps.co.uk
Open Space, Upper Interfields, Malvern, Worcester, WR14 1UT

British Geological Survey Enquiries
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Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries:
enquiries@bgs.ac.uk

Environment Agency
National Customer Contact Centre, PO Box 544
Rotherham, S60 1BY
Tel: 03708 506 506
Web: **www.environment-agency.gov.uk**
Email: enquiries@environment-agency.gov.uk

Public Health England
Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe
Email:**enquiries@phe.gov.uk**
Main switchboard: **020 7654 8000**

The Coal Authority
200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey
Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority
Authority: Great Yarmouth Borough Council
Phone: 01493 856 100
Web: http://www.great-yarmouth.gov.uk
Address: Town Hall, Hall Plain, Great Yarmouth, Norfolk, NR30 2QF

Getmapping PLC
Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
https://www.groundsure.com/terms-and-conditions-sept-2016

CENTREMAPS

Open Space, Upper Interfields,
Worcester, WR14 1UT

Report Reference: CMAPS-CM-636391-16287-030717GEO

Your Reference: 16287

Report Date 3 Jul 2017

Report Delivery Method: Email - pdf

Geo Insight

Address: ,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo 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 Geo Insight

Groundsure
LOCATION INTELLIGENCE

Geo Insight

Address:	,
Date:	3 Jul 2017
Reference:	CMAPS-CM-636391-16287-030717GEO
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

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.

Contents Page

Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the 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: Geology 1:10,000 Scale

1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	Yes
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	No
	1.2.2 Are there any records of landslip within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	No

Section 2: Geology 1:50,000 Scale

2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	Yes
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	Yes
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes
	2.2.3 Are there any records of landslip within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geology 1:50,000 Scale

2.3 Bedrock, Solid Geology and Faults	2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary?	Yes
	2.3.3 Are there any records of faults within 500m of the study site boundary?	No

Section 3: Radon

3. Radon	3.1Is 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.
	3.2Radon Protection	No radon protective measures are necessary.

Section 4: Ground Workings	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	11	1	12	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	0	0	0
4.3 Current Ground Workings	1	2	0	1	4

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	0	0	0
5.2 Coal Mining	0	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
5.4 Non-Coal Mining*	0	0	0	0	0
5.5 Non-Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0

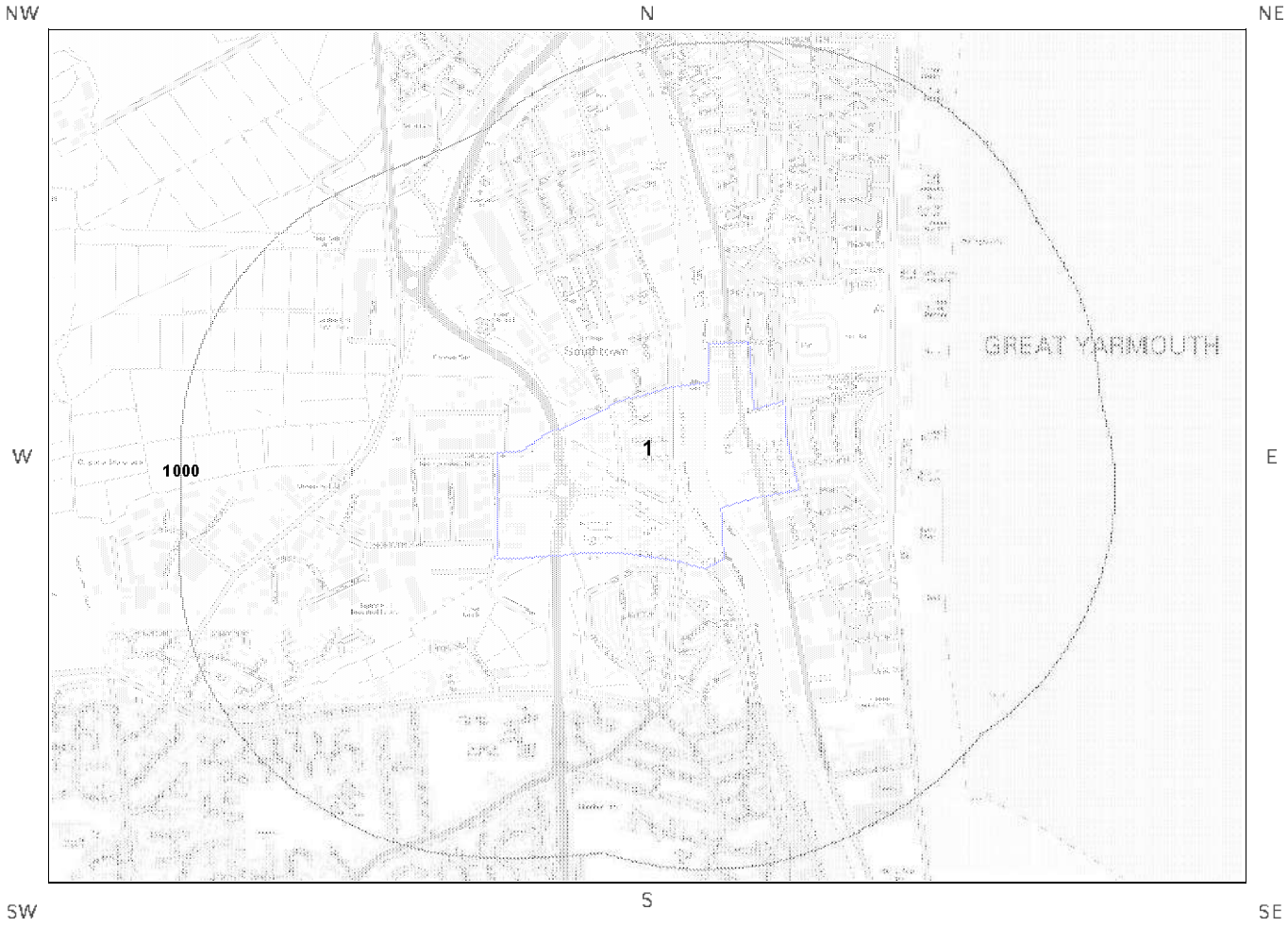
Section 6: Natural Ground Subsidence	On-site
6.1 Shrink-Swell Clay	Low
6.2 Landslides	Low
6.3 Ground Dissolution of Soluble Rocks	Negligible
6.4 Compressible Deposits	High
6.5 Collapsible Deposits	Very Low
6.5 Running Sand	Moderate

Section 7: Borehole Records	On-site	0-50m	51-250
7 BGS Recorded Boreholes	107	33	77

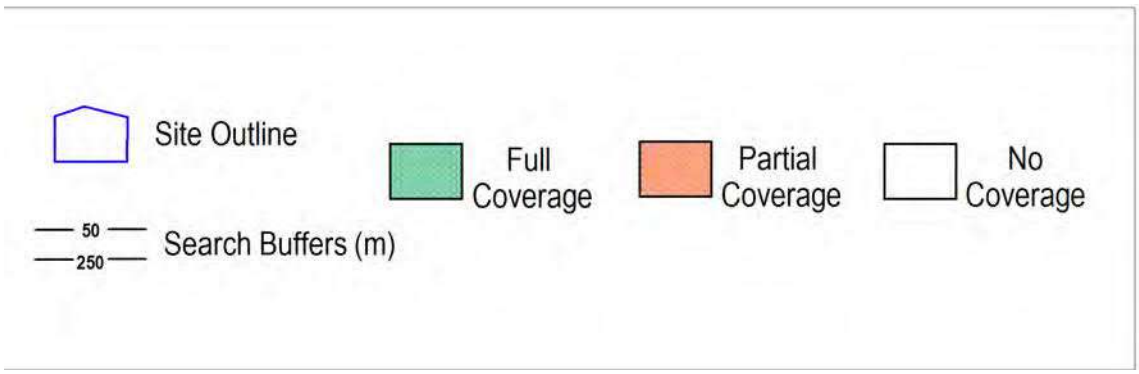
Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250
8 Records of Background Soil Chemistry	16	3	0

Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500
9.1 Tunnels	0	0	0	Not Searched
9.2 Historical Railway and Tunnel Features	31	6	21	Not Searched
9.3 Historical Railways	3	0	0	Not Searched
9.4 Active Railways	0	0	0	Not Searched
9.5 Railway Projects	0	0	0	0

1:10,000 Scale Availability



1_10,000 Availability Legend



Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	No deposits are mapped	No coverage	No coverage	No coverage

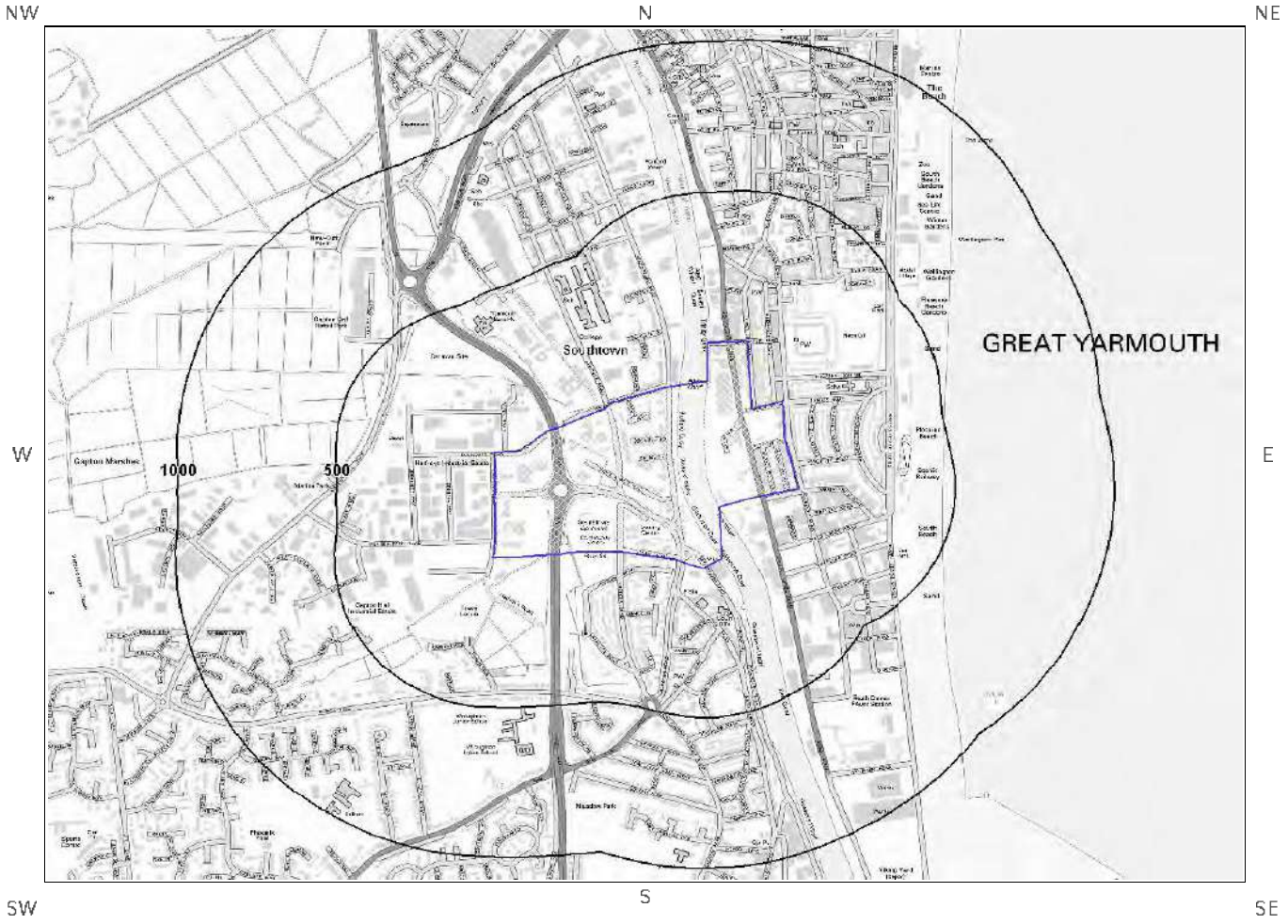
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

1 Geology (1:10,000 scale).

1.1 Artificial Ground Map (1:10,000 scale)



Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Worked Ground (undivided)

Infilled Ground

Disturbed Ground (undivided)

Landscaped Ground (undivided)

Reclaimed Ground

1. Geology 1:10,000 scale

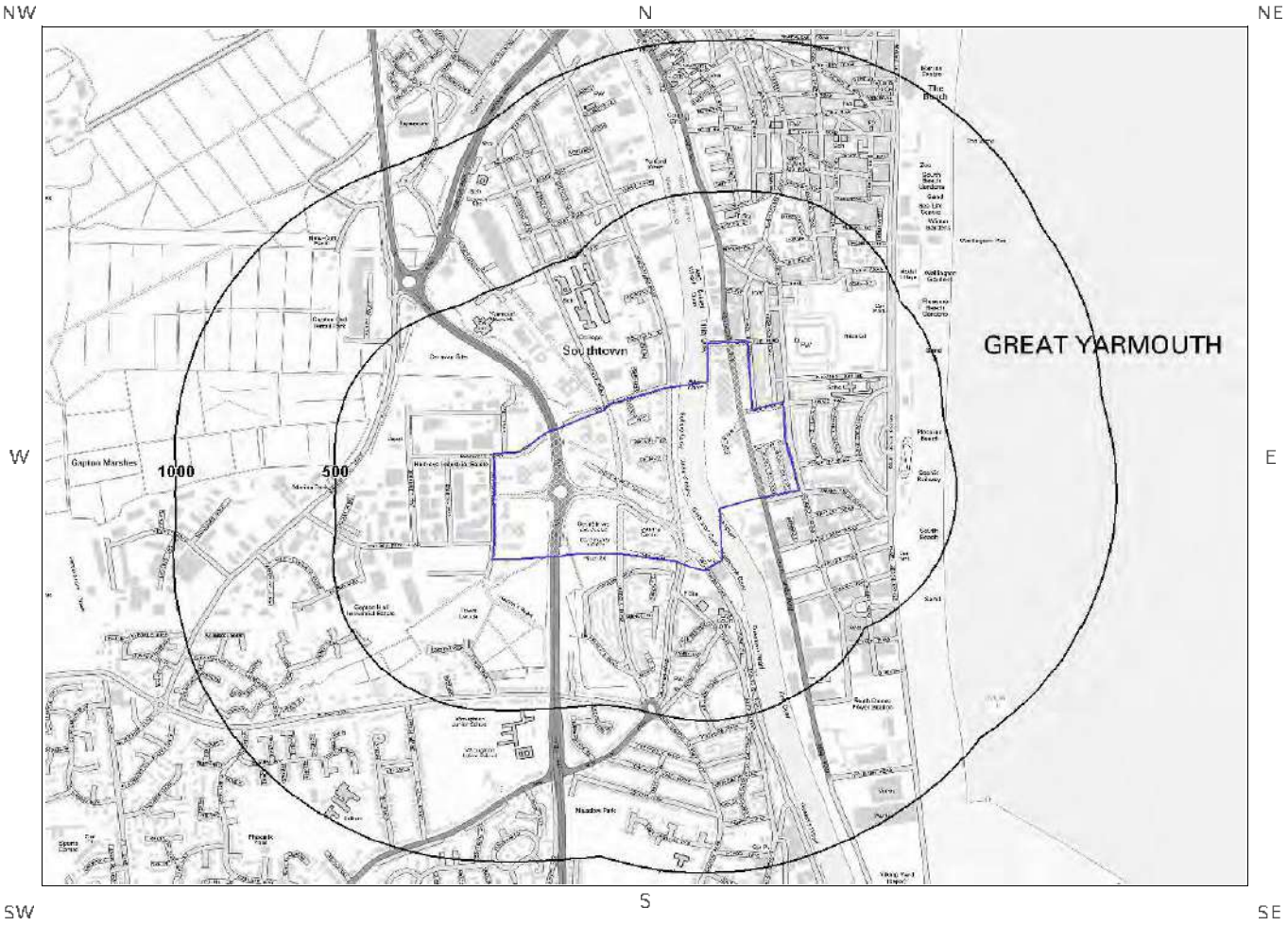
1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

1.2 Superficial Deposits and Landslips Map (1:10,000 scale)



Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

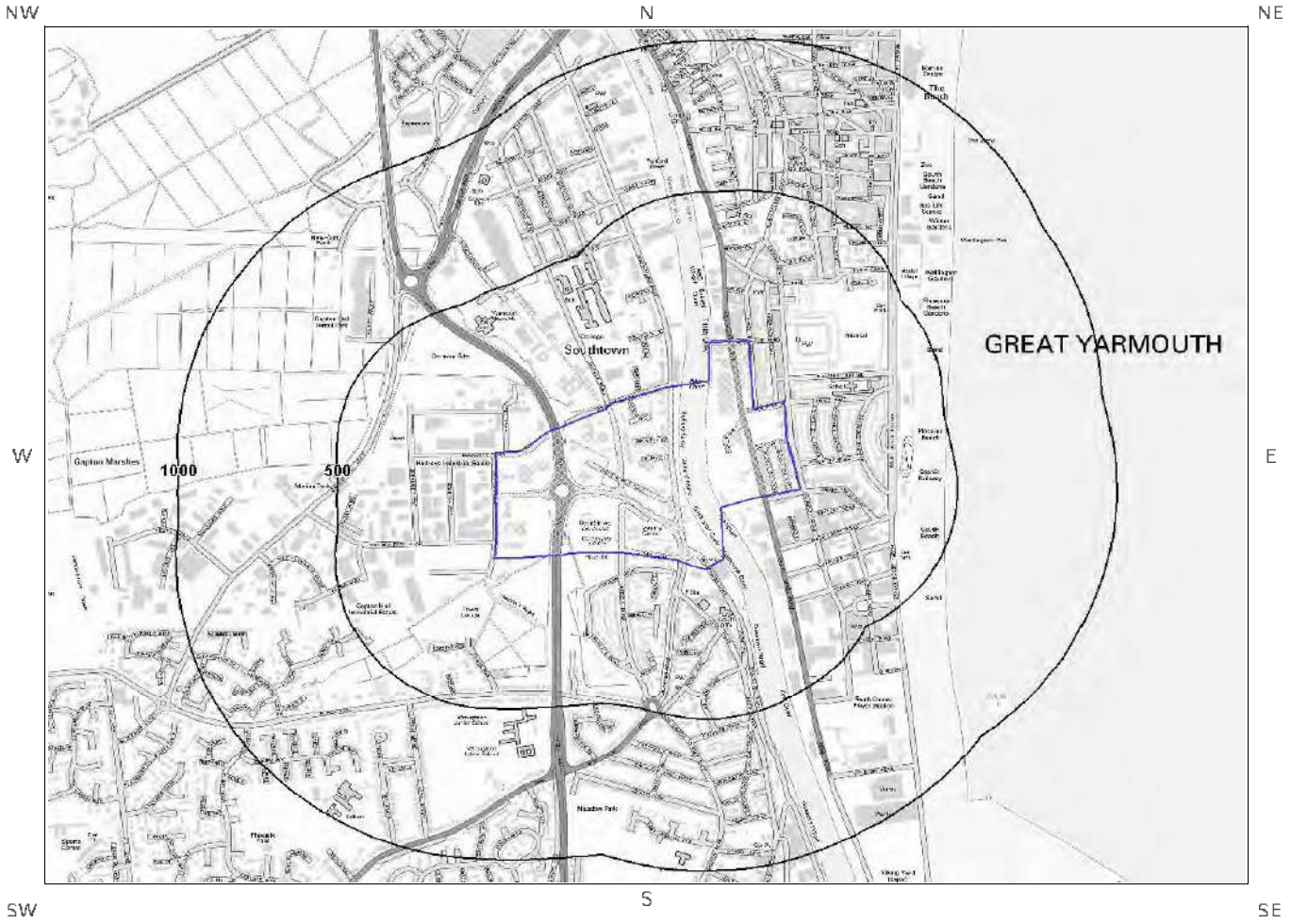
No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3 Bedrock and Faults Map (1:10,000 scale)



Bedrock and Faults Legend

Site Outline

500
1000
Search Buffers (m)

1.3 Bedrock and Faults

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

Database searched and no data found at this scale.

1.3.2 Faults

Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found at this scale.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

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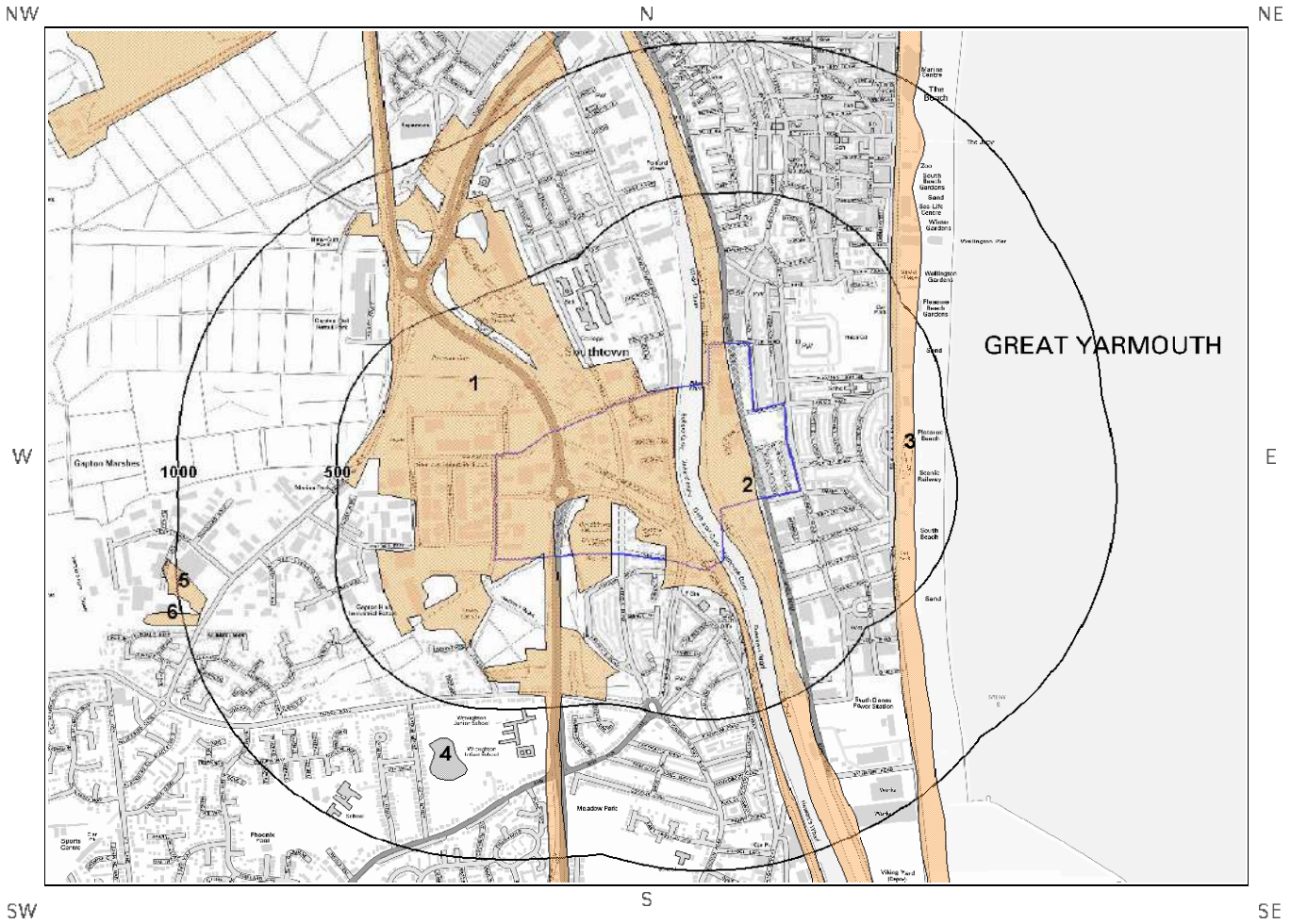
2 Geology 1:50,000 Scale

2.1 Artificial Ground Map



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Worked Ground (undivided)

Infilled Ground

Disturbed Ground (undivided)

Landscaped Ground (undivided)

Reclaimed Ground

2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 162

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? Yes

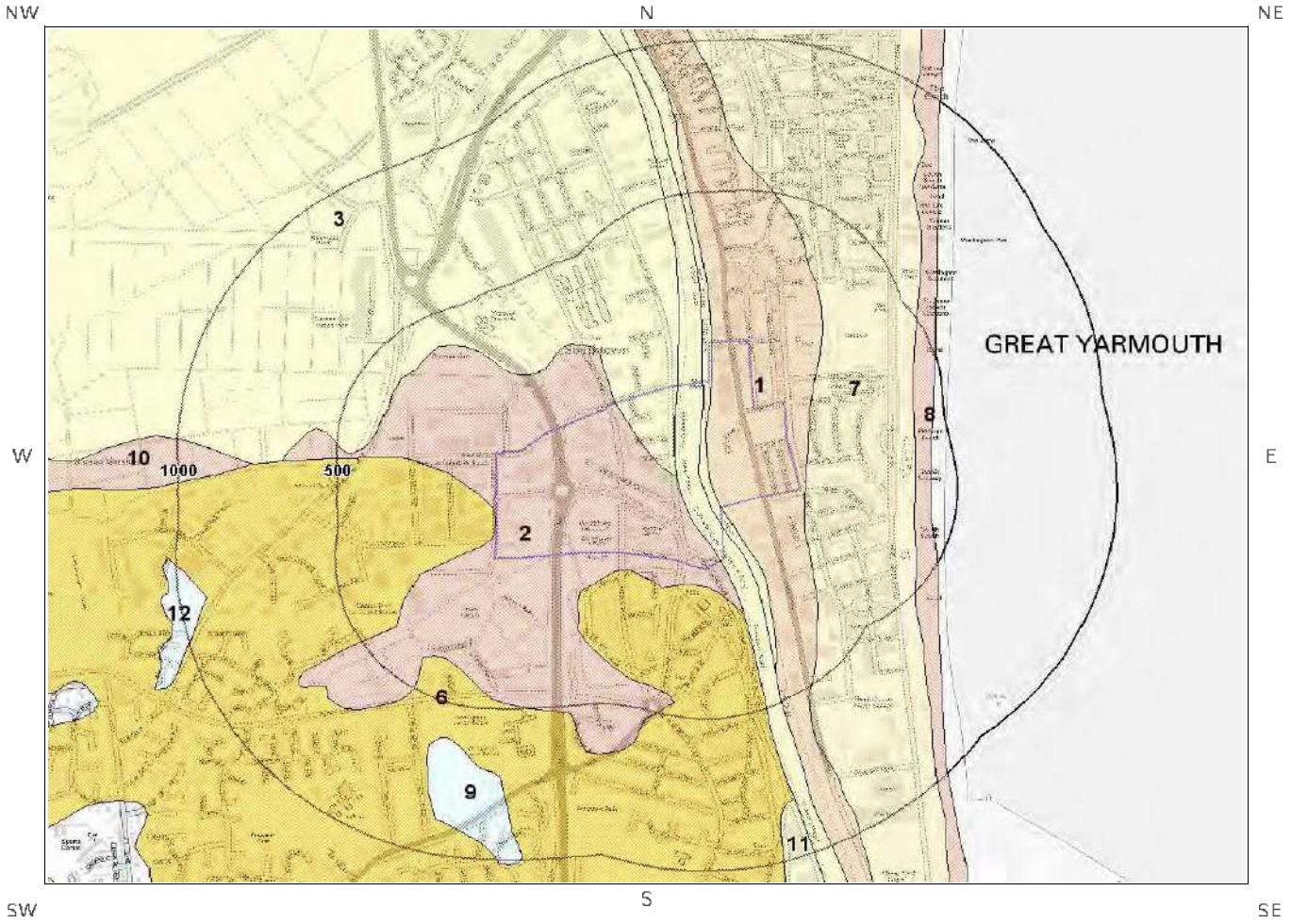
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
2	0.0	On Site	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
3	300.0	E	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Very High	Low
0.0	On Site	Mixed	Very High	Low

2.2 Superficial Deposits and Landslips Map (1:50,000 scale)



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	NRD-XSV	NORTH DENES FORMATION	SAND AND GRAVEL
2	0.0	On Site	BRYD-P	BREYDON FORMATION	PEAT
3	0.0	On Site	BRYD-XCZ	BREYDON FORMATION	CLAY AND SILT
4	0.0	On Site	BRYD-XCZ	BREYDON FORMATION	CLAY AND SILT
5	0.0	On Site	TRD-XCZ	TIDAL RIVER OR CREEK DEPOSITS	CLAY AND SILT
6	3.0	W	HPGL-S	HAPPISBURGH GLACIGENIC FORMATION	SAND
7	16.0	E	BSA-S	BLOWN SAND	SAND
8	366.0	E	MBD-XSV	MARINE BEACH DEPOSITS	SAND AND GRAVEL

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Low	Very Low
0.0	On Site	Intergranular	Low	Very Low
0.0	On Site	Mixed	Low	Very Low
0.0	On Site	Mixed	Low	Very Low
0.0	On Site	Intergranular	Very High	High
3.0	W	Intergranular	High	High
16.0	E	Intergranular	High	High

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

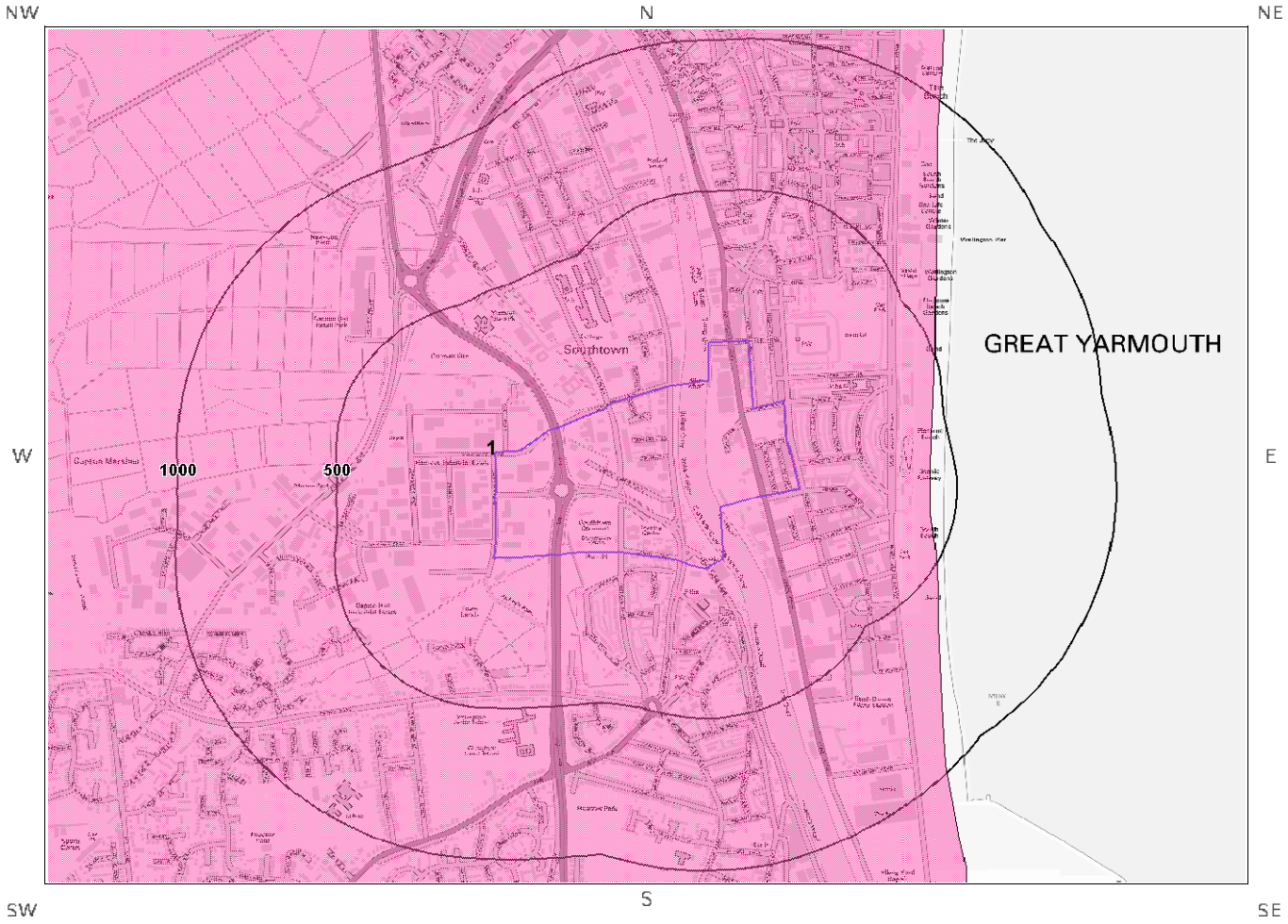
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

Database searched and no data found.

2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 162

2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	CRAG-XSV	CRAG GROUP - SAND AND GRAVEL	-

2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distance	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Intergranular	Very High	High

2.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.

3 Radon Data

3.1 Radon Affected Areas

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.

3.2 Radon Protection

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.

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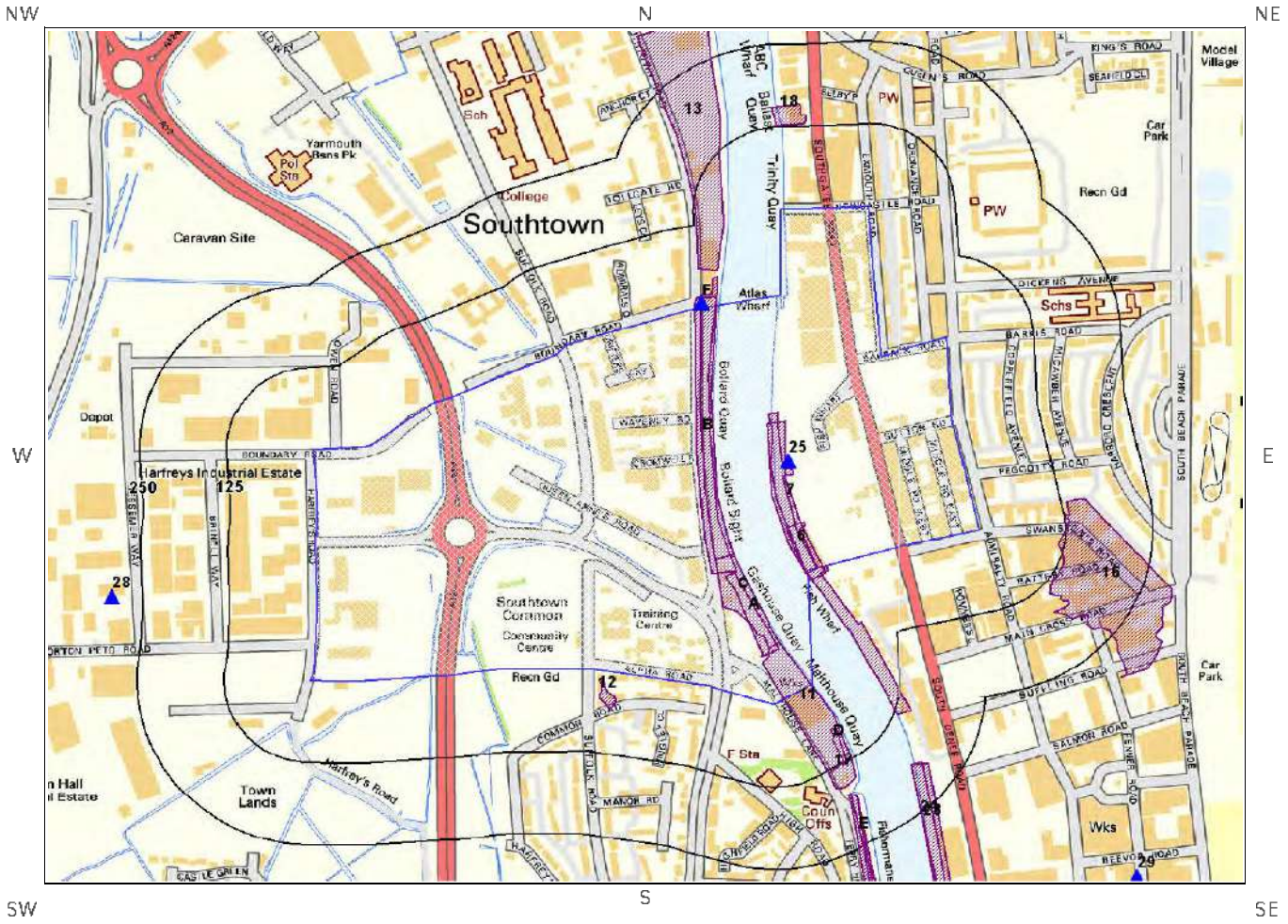
4 Ground Workings Map



Ground Workings Legend

Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

Historic Underground Workings

Current Ground Workings

4 Ground Workings

4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Use	Date
1B	0.0	On Site	652403 306035	Quay	1952
2A	0.0	On Site	652474 305764	Quay	1904
3A	0.0	On Site	652474 305764	Quay	1946
4B	0.0	On Site	652408 306062	Quay	1988
5B	0.0	On Site	652408 306062	Quay	1978
6	0.0	On Site	652545 305863	Unspecified Wharf	1988
7	0.0	On Site	652518 305936	Unspecified Wharf	1884
8C	0.0	On Site	652466 305783	Quay	1988
9C	0.0	On Site	652466 305783	Quay	1978
10	0.0	On Site	652556 305840	Unspecified Wharf	1978
11	0.0	On Site	652552 305622	Quay	1978
12	15.0	S	652266 305643	Pond	1884
13	52.0	N	652371 306479	Dock	1946
14D	73.0	SE	652596 305561	Quay	1946
15D	73.0	SE	652596 305561	Quay	1904
16	117.0	E	652990 305803	Sand Pit	1884
17	124.0	SE	652602 305523	Quay	1988
18	127.0	N	652526 306521	Dry Docks	1904
19E	169.0	SE	652639 305395	Quay	1978
20E	169.0	SE	652639 305395	Quay	1988
21E	172.0	SE	652636 305385	Quay	1904

ID	Distance (m)	Direction	NGR	Use	Date
22E	172.0	SE	652636 305385	Quay	1946
23	188.0	SE	652776 305268	Quay	1952
24	188.0	SE	652742 305367	Quay	1978

4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

4.3 Current Ground Workings

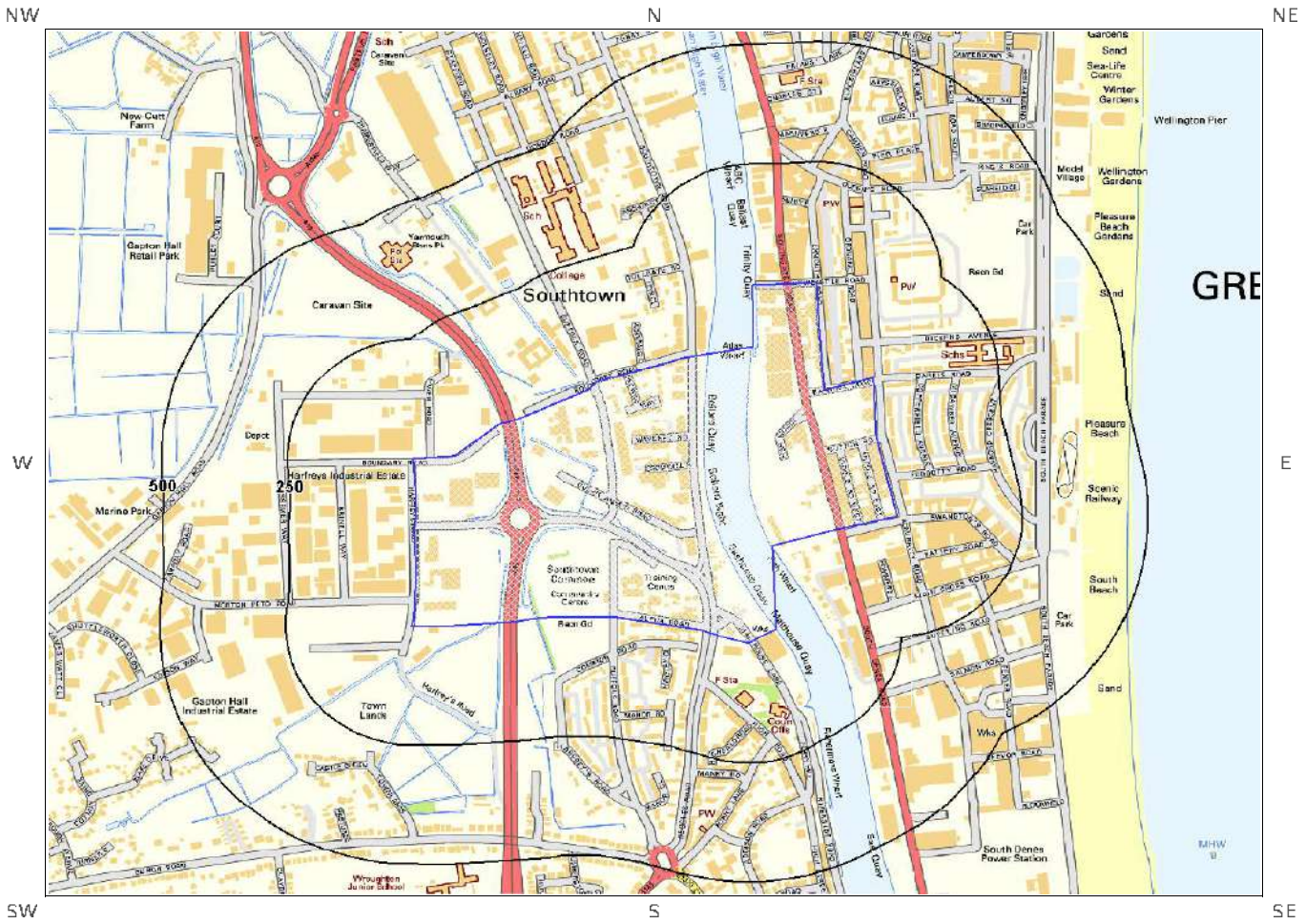
This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Survey:

ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
25	0.0	On Site	652525 305995	Crushed Rock	Berth 4 Great Yarmouth Docks	Sea, river or canal wharf where mineral commodities are unloaded and stored	Active
26F	6.0	N	652400 306235	Crushed Rock	Great Yarmouth Wharf	Sea, river or canal wharf where mineral commodities are unloaded and stored	Inactive
27F	6.0	N	652400 306235	Secondary	Great Yarmouth Wharf	Sea, river or canal wharf where mineral commodities are unloaded and stored	Inactive
28	294.0	W	651553 305790	Sand & Gravel	Harfrey's Farm Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
29	549.0	SE	653026 305365	Sand	Nelson Sand Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	686.0	S	651666 304999	Clay & Shale	Lilypit Cottage Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	766.0	S	651860 304897	Clay & Shale	Lily Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	911.0	N	652250 307250	Secondary	Yeoman Wharf	Sea, river or canal wharf where mineral commodities are unloaded and stored	Active

5 Mining, Extraction & Natural Cavities Map



Mining, Extraction and Natural Cavities Legend

Site Outline

250
500
Search Buffers (m)

Historical Mining

Non-Coal Mining Cavities

Natural Cavities

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

5 Mining, Extraction & Natural Cavities

5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? No

The following information provided by JPB is not represented on mapping: Database searched and no data found.

5.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

Are there any Tin Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.10 Clay Mining

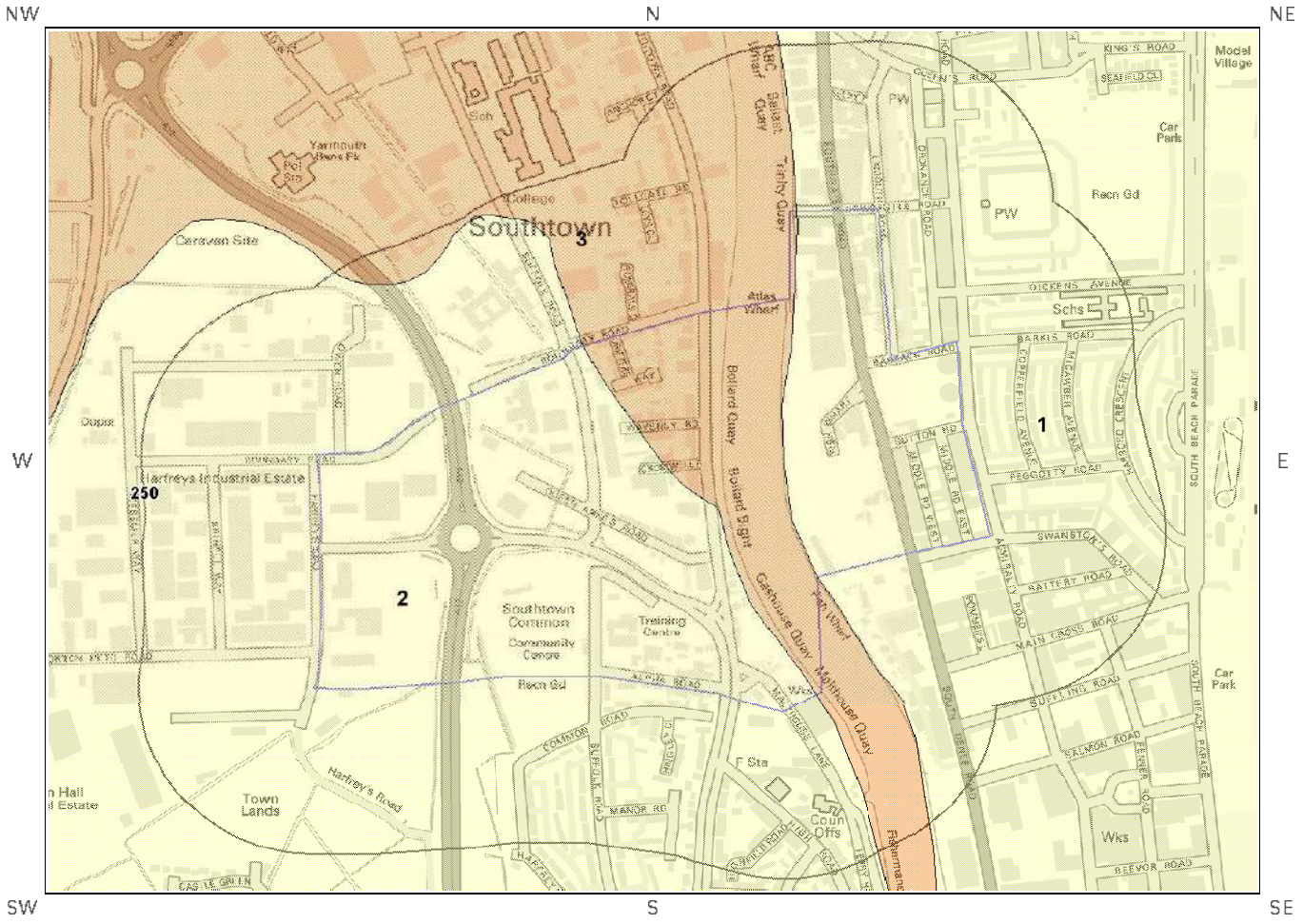
This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

Are there any Clay Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

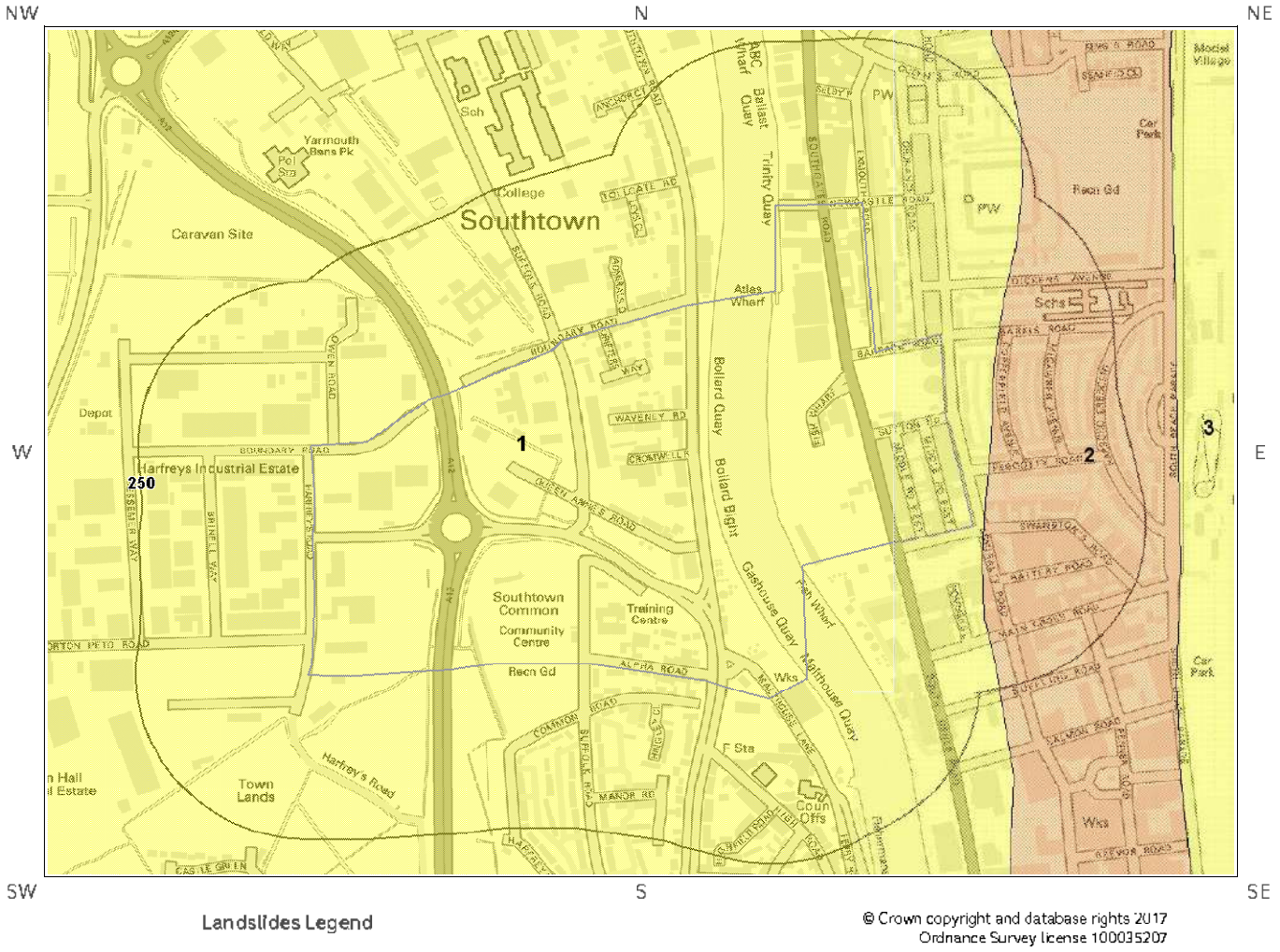
6 Natural Ground Subsidence

6.1 Shrink-Swell Clay Map



Shrink Swell Clay Legend

6.2 Landslides Map



Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

High

6.3 Ground Dissolution of Soluble Rocks Map

Ground Dissolution
Soluble Rocks Legend

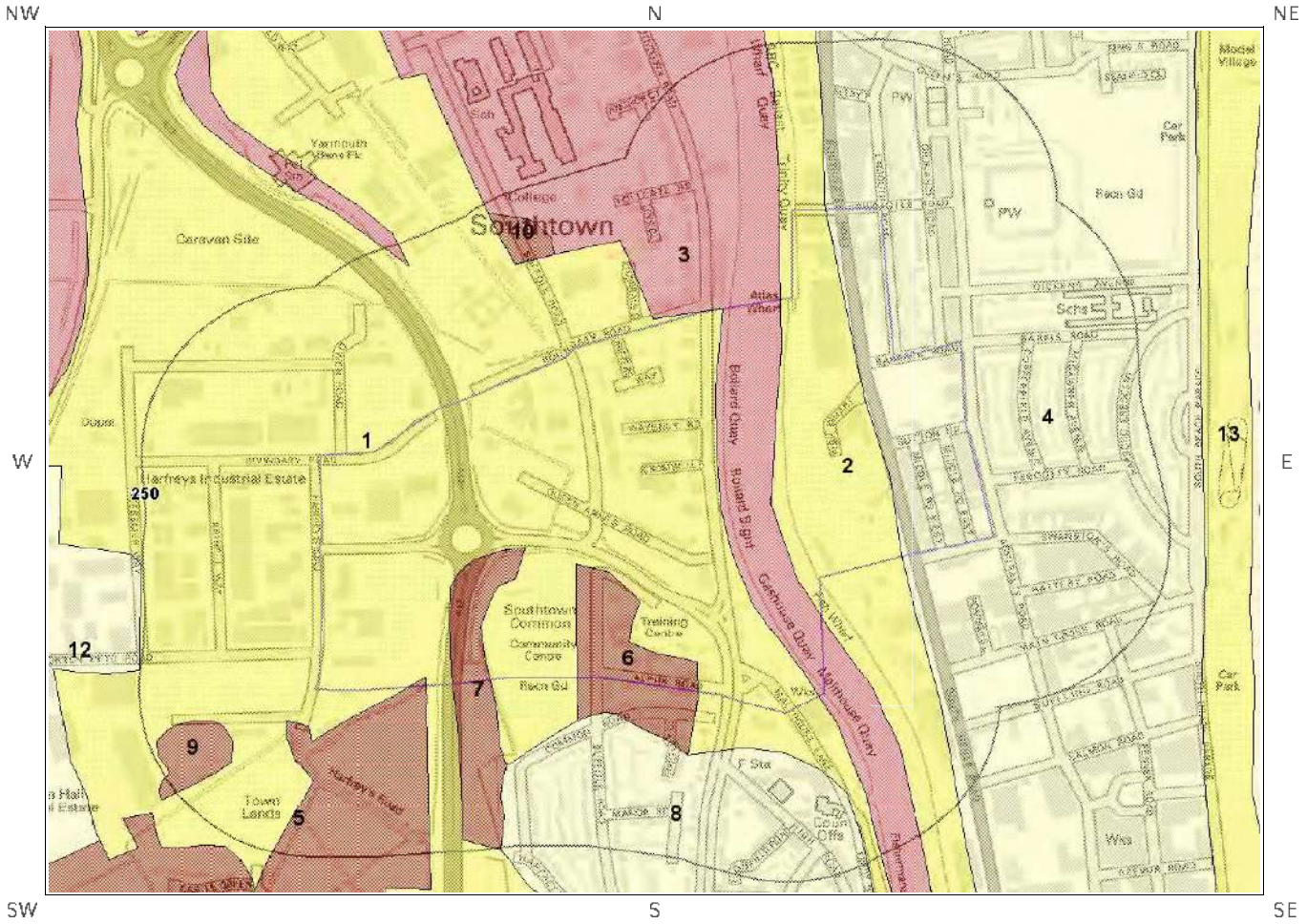
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.4 Compressible Deposits Map



Compressible Deposits Legend

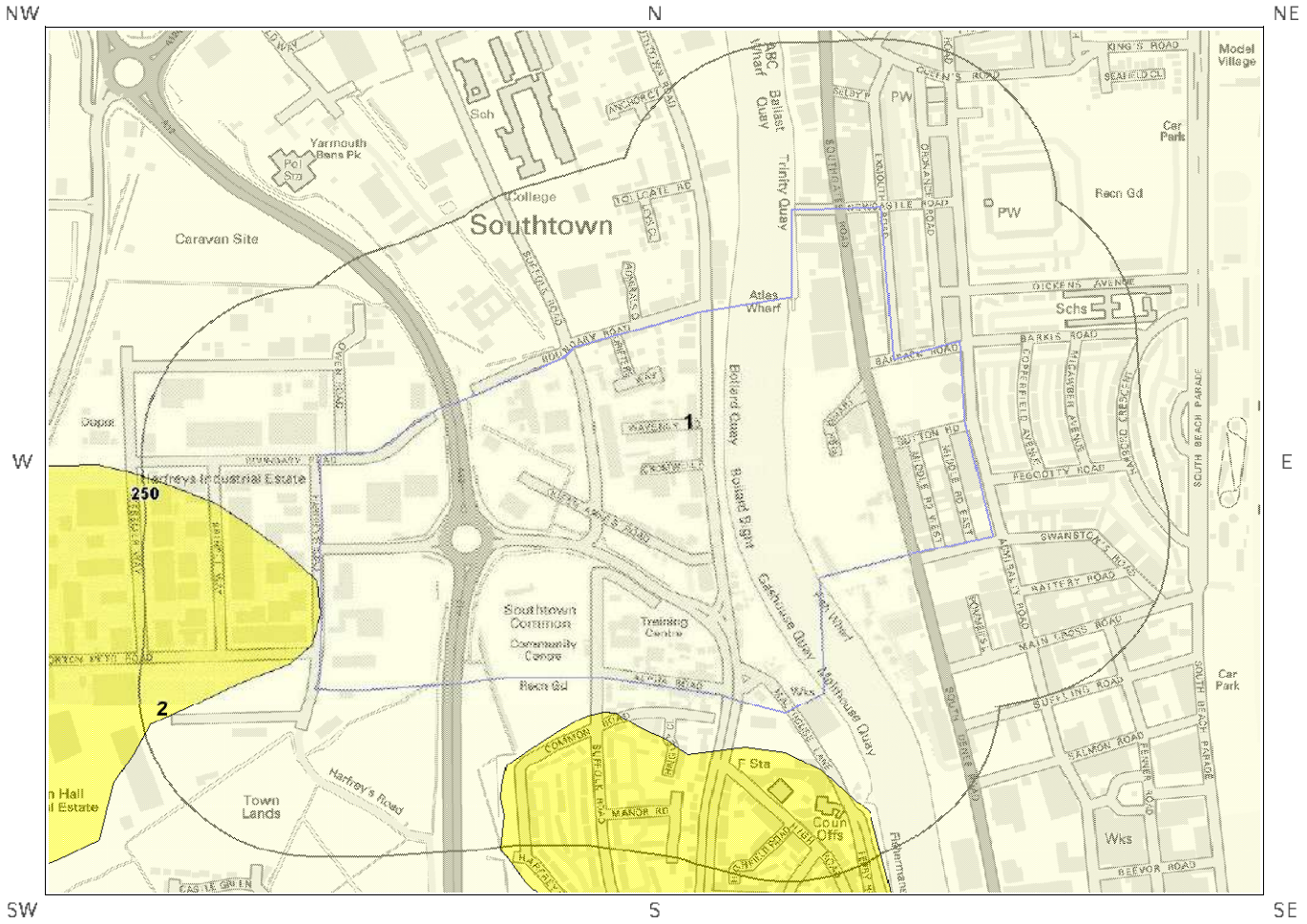
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.5 Collapsible Deposits Map



Collapsible Deposits Legend

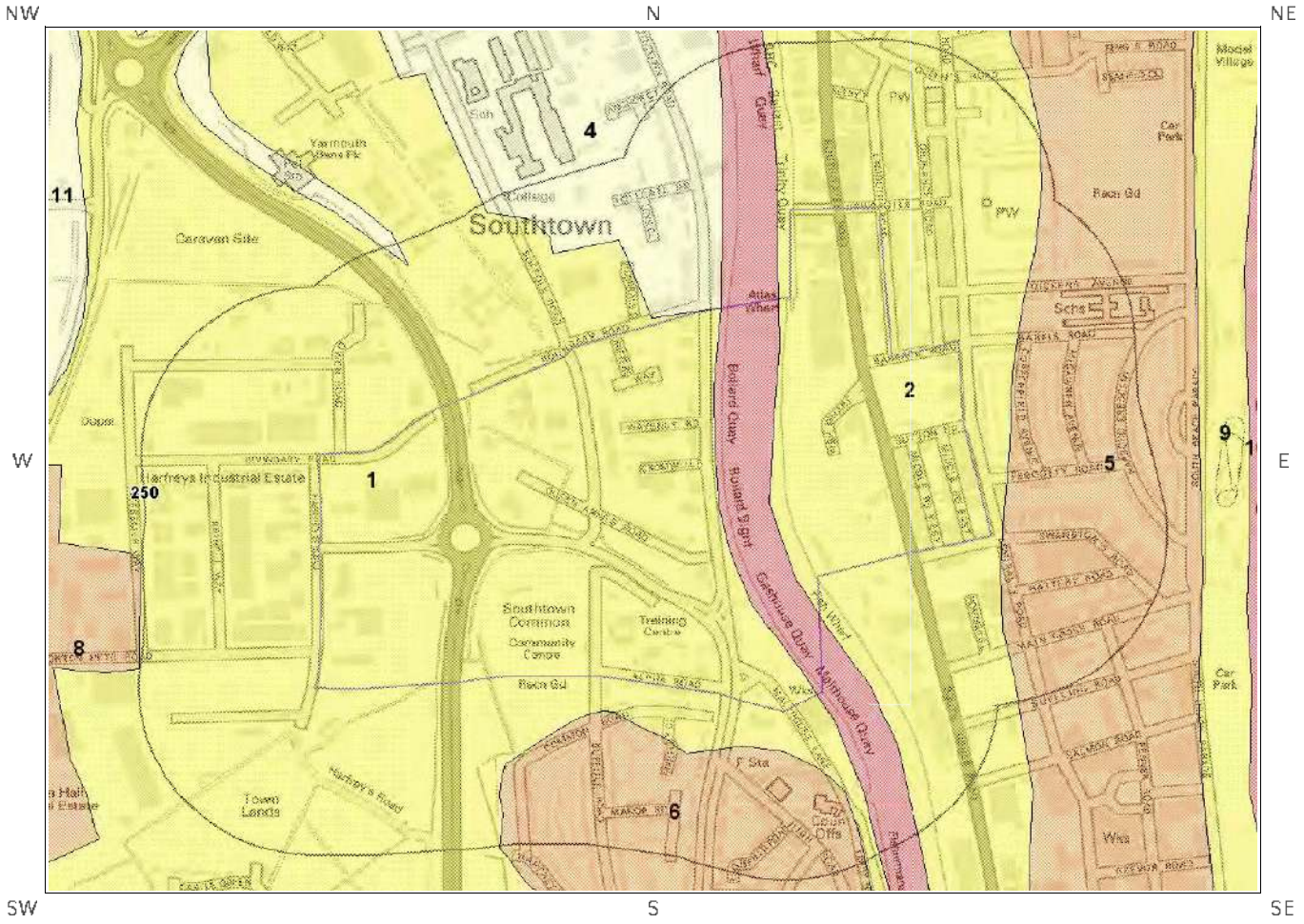
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.6 Running Sand Map



Running Sand Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site* boundary? High

6.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
2	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
3	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

* This includes an automatically generated 50m buffer zone around the site

6.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.
2	16.0	E	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.

6.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Very low potential for compressible deposits to be present. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
2	0.0	On Site	Very Low	Very low potential for compressible deposits to be present. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
3	0.0	On Site	Moderate	Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property - possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

ID	Distance (m)	Direction	Hazard Rating	Details
4	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
5	0.0	On Site	High	Very significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Construction may not be possible at economic cost. For existing property - probable increase in insurance risk from compressibility especially if water conditions or loading of the ground change significantly.
6	0.0	On Site	High	Very significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Construction may not be possible at economic cost. For existing property - probable increase in insurance risk from compressibility especially if water conditions or loading of the ground change significantly.
7	0.0	On Site	High	Very significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Construction may not be possible at economic cost. For existing property - probable increase in insurance risk from compressibility especially if water conditions or loading of the ground change significantly.
8	50.0	S	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
2	3.0	W	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

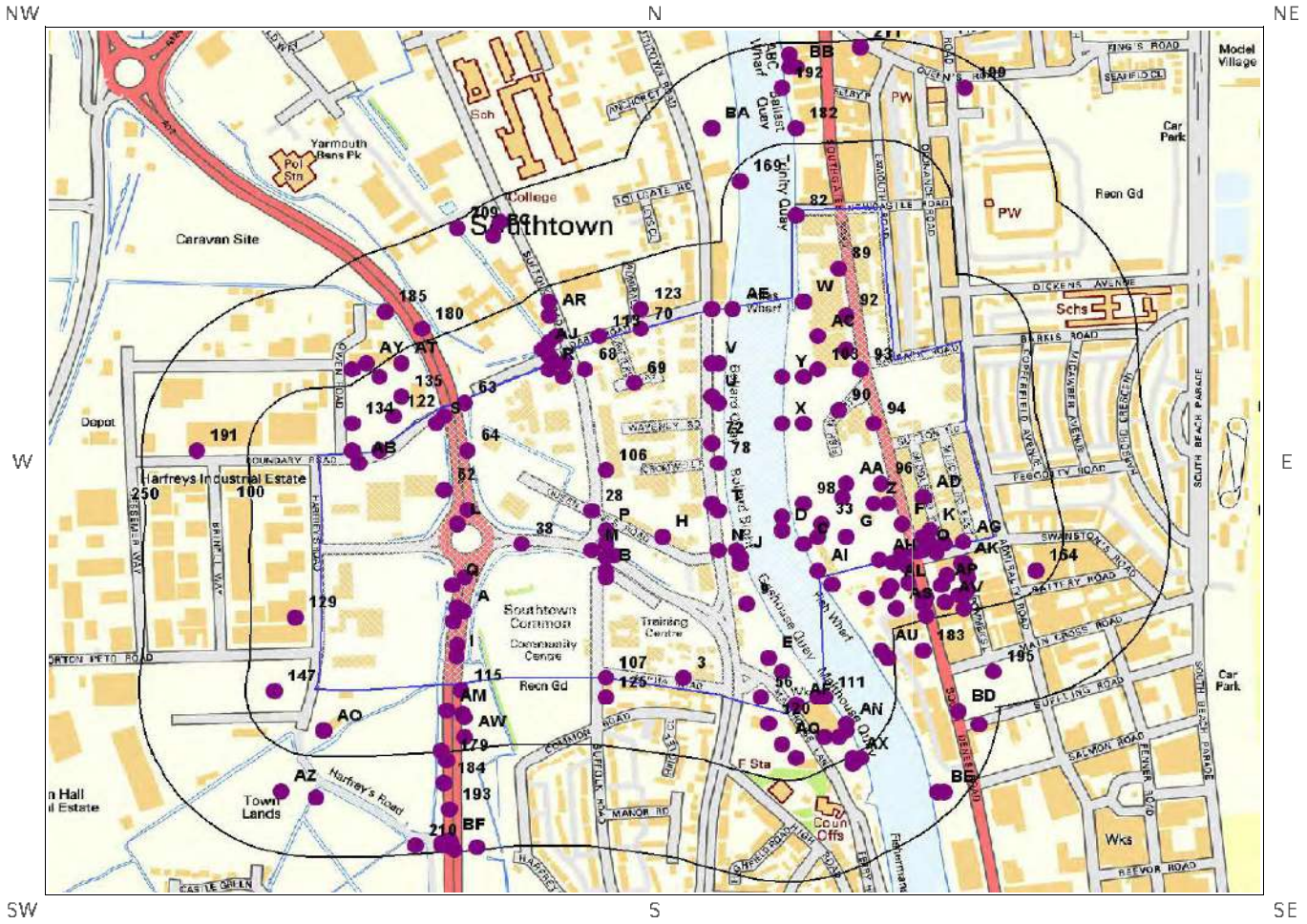
6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

ID	Distance (m)	Direction	Hazard Rating	Details
2	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
3	0.0	On Site	Moderate	Significant potential for running sand problems with relatively small changes in ground conditions. Avoid large amounts of water entering the ground (for example through pipe leakage or soak-aways). Do not dig (deep) holes into saturated ground near the property without technical advice. For new build - consider the consequences of soil and groundwater conditions during and after construction. For existing property - possible increase in insurance risk from running sand, for example, due to water leakage, high rainfall events or flooding.
4	1.0	N	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
5	16.0	E	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
6	50.0	S	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.

7 Borehole Records Map



Borehole Records Legend

Site Outline

Borehole Locations

125
250
Search Buffers (m)

7 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary: 217

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1Q	0.0	On Site	652033 305818	TG50NW45	5.0	A47 GORLESTON RELIEF ROAD
2A	0.0	On Site	652049 305780	TG50NW43	6.2	A47 GORLESTON RELIEF ROAD
3	0.0	On Site	652360 305680	TG50NW332	7.62	GT YAR BOR CNCL ALPHA ROAD 27
4AI	0.0	On Site	652550 305840	TG50NW590	15.0	FISHWHARF ZAPATA QUAY 2
5B	0.0	On Site	652250 305840	TG50NW164	24.38	GT YAR BOROUGH COUNCIL YARE TUNNEL 7
6J	0.0	On Site	652440 305860	TG50NW583	15.5	BOLLARD QUAY 6
7M	0.0	On Site	652230 305870	TG50NW185	6.71	GT YAR BOROUGH COUNCIL DRAINAGE SCHEME 3
8C	0.0	On Site	652530 305880	TG50NW591	15.0	FISHWHARF ZAPATA QUAY 3
9	0.0	On Site	652450 305790	TG50NW840	10.0	GAS QUAY GT YARMOUTH 1
10A	0.0	On Site	652038 305785	TG50NW374	2.3	A12 GORLESTON RELIEF RD GT YAR S BY PASS
11B	0.0	On Site	652250 305830	TG50NW27	12.0	A47 GT YARMOUTH WESTERN BY PASS 237
12C	0.0	On Site	652550 305890	TG50NW592	15.5	FISHWHARF ZAPATA QUAY 4
13H	0.0	On Site	652330 305890	TG50NW1008	18.28	CENTRAL ELECTRICITY BOARD GORLESTON
14D	0.0	On Site	652500 305900	TG50NW892	20.0	SOUTHGATES RD GT YARMOUTH 3
15D	0.0	On Site	652500 305900	TG50NW891	20.0	SOUTHGATES RD GT YARMOUTH 2
16D	0.0	On Site	652500 305900	TG50NW893	20.0	SOUTHGATES RD GT YARMOUTH 4
17A	0.0	On Site	652034 305764	TG50NW32	7.05	A47/A12 GORLESTON RELIEF ROAD
18L	0.0	On Site	652040 305910	TG50NW13	20.12	GORING CEB GREAT YARMOUTH
19I	0.0	On Site	652038 305712	TG50NW386	14.3	A12/A47 GORLESTON RELIEF RD REPORT
20E	0.0	On Site	652480 305710	TG50NW942	8.0	GAS HOUSE QUAY GT YARMOUTH 3
21F	0.0	On Site	652670 305910	TG50NW570	-1.0	FISH QUAY TRIAL PIT PS22

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
22E	0.0	On Site	652500 305690	TG50NW792	10.0	MALTHOUSE QUAY GT YARMOUTH 7
23D	0.0	On Site	652500 305920	TG50NW571	-1.0	FISH QUAY TRIAL PIT PS23
24G	0.0	On Site	652590 305890	TG50NW17/C	17.37	HIPPERSON & SON ELECTRICITY POWER STN
25F	0.0	On Site	652700 305890	TG50NW109	-1.0	CEGB 132 KV TRANSFORMER SITE GT YAR DKM 3
26G	0.0	On Site	652590 305890	TG50NW998	17.1	ELECTRICAL POWER STATION GREAT YARMOUTH NO 1
27H	0.0	On Site	652330 305890	TG50NW995	13.71	CENTRAL ELECTRICITY BOARD GORLESTON
28	0.0	On Site	652230 305930	TG50NW184	7.01	GT YAR BOROUGH COUNCIL DRAINAGE SCHEME 2
29T	0.0	On Site	652410 305930	TG50NW582	15.5	BOLLARD QUAY 5
30K	0.0	On Site	652710 305900	TG50NW108	-1.0	CEGB 132 KV TRANSFORMER SITE GT YAR DKM 2
31I	0.0	On Site	652040 305728	TG50NW44	6.2	A47 GORLESTON RELIEF ROAD
32D	0.0	On Site	652500 305900	TG50NW890	20.0	SOUTHGATES RD GT YARMOUTH 1
33	0.0	On Site	652555 305910	TG50NW162	36.58	GT YAR BOROUGH COUNCIL YARE TUNNEL 5
34O	0.0	On Site	652700 305870	TG50NW110	-1.0	CEGB 132 KV TRANSFORMER SITE GT YAR DKM 4
35N	0.0	On Site	652410 305870	TG50NW588	20.0	BOLLARD QUAY 11
36J	0.0	On Site	652435 305870	TG50NW163	36.58	GT YAR BOROUGH COUNCIL YARE TUNNEL 6
37K	0.0	On Site	652710 305880	TG50NW107	-1.0	CEGB 132 KV TRANSFORMER SITE GT YAR DKM 1
38	0.0	On Site	652130 305880	TG50NW472	15.0	A12 GT YARMOUTH WESTERN BY-PASS 318
39G	0.0	On Site	652590 305890	TG50NW17/B	14.02	HIPPERSON & SON ELECTRICITY POWER STN
40P	0.0	On Site	652250 305900	TG50NW29	10.0	A47 GT YARMOUTH WESTERN BY PASS 239
41L	0.0	On Site	652040 305910	TG50NW1026	17.67	CENTRAL ELECTRICITY BOARD GREAT YARMOUTH
42L	0.0	On Site	652040 305910	TG50NW1005	20.11	CENTRAL ELECTRICITY BOARD GREAT YARMOUTH
43M	0.0	On Site	652250 305860	TG50NW26	11.0	A47 GT YARMOUTH WESTERN BY PASS 236
44N	0.0	On Site	652440 305850	TG50NW180	9.15	GT YAR BOROUGH COUNCIL SEWERAGE WORKS 14
45O	0.0	On Site	652668 305865	TG50NW1057	8.0	ADMIRALTY ROAD GREAT YARMOUTH 210

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
46B	0.0	On Site	652262 305862	TG50NW429	7.6	A12 GT YAR W BY PASS DOT REPORT
47P	0.0	On Site	652250 305880	TG50NW28	11.5	A47 GT YARMOUTH WESTERN BY PASS 238
48Q	0.0	On Site	652050 305830	TG50NW46	4.5	A47 GORLESTON RELIEF ROAD
49L	0.0	On Site	652054 305931	TG50NW428	17.0	A12 GT YAR W BY PASS DOT REPORT
50H	0.0	On Site	652330 305890	TG50NW1009	24.38	CENTRAL ELECTRICITY BOARD GORLESTON
51AH	0.0	On Site	652638 305856	TG50NW1050	17.0	ADMIRALTY ROAD GREAT YARMOUTH 202
52L	0.0	On Site	652040 305910	TG50NW1006	16.76	CENTRAL ELECTRICITY BOARD GREAT YARMOUTH
53G	0.0	On Site	652590 305890	TG50NW17/A	17.07	HIPPERSON & SON ELECTRICITY POWER STN
54H	0.0	On Site	652330 305890	TG50NW12	18.29	GORING CEG GREAT YARMOUTH
55AF	0.0	On Site	652520 305640	TG50NW793	19.0	MALTHOUSE QUAY GT YARMOUTH 8
56	0.0	On Site	652470 305650	TG50NW795	10.5	MALTHOUSE QUAY GT YARMOUTH 10
57K	0.0	On Site	652730 305880	TG50NW1063	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 106
58O	0.0	On Site	652691 305868	TG50NW1053	8.5	ADMIRALTY ROAD GREAT YARMOUTH 205
59AG	0.0	On Site	652757 305882	TG50NW1065	5.0	ADMIRALTY ROAD GREAT YARMOUTH WS 108
60AB	0.0	On Site	651900 306000	TG50NW687	0.9	BGS AUGR HL 162 GAPTON MARSHES
61S	0.0	On Site	652010 306060	TG50NW467	2.5	A12 GT YARMOUTH WESTERN BY-PASS 235
62	0.0	On Site	652020 305960	TG50NW226	11.8	GT YAR BOR CNCL A12 WESTERN BY PASS
63	0.0	On Site	652050 306090	TG50NW466	24.3	A12 GT YARMOUTH WESTERN BY-PASS 234
64	0.0	On Site	652054 306020	TG50NW430	11.3	A12 GT YAR W BY PASS DOT REPORT
65R	0.0	On Site	652170 306140	TG50NW308	-1.0	GT YAR BOR CNCL HIGH MILL RD CPT 11
66R	0.0	On Site	652190 306150	TG50NW181	14.8	GT YAR BOROUGH COUNCIL SEWERAGE WORKS 25
67R	0.0	On Site	652190 306130	TG50NW306	-1.0	GT YAR BOR CNCL HIGH MILL RD CPT 9
68	0.0	On Site	652220 306140	TG50NW183	7.01	GT YAR BOROUGH COUNCIL DRAINAGE SCHEME 1
69	0.0	On Site	652290 306120	TG50NW307	-1.0	GT YAR BOR CNCL HIGH MILL RD CPT 10
70	0.0	On Site	652300 306200	TG50NW310	-1.0	GT YAR BOR CNCL HIGH MILL RD CPT 13
71S	0.0	On Site	652020 306070	TG50NW468	25.0	A12 GT YARMOUTH WESTERN BY-PASS 235A
72	0.0	On Site	652400 306030	TG50NW586	20.0	BOLLARD QUAY 9
73U	0.0	On Site	652400 306100	TG50NW908	25.0	SOUTHTOWN RD GT YARMOUTH 1

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
74V	0.0	On Site	652400 306150	TG50NW585	15.5	BOLLARD QUAY 8
75T	0.0	On Site	652400 305940	TG50NW587	11.5	BOLLARD QUAY 10
76U	0.0	On Site	652410 306090	TG50NW580	15.5	BOLLARD QUAY 3
77V	0.0	On Site	652410 306150	TG50NW579	15.0	BOLLARD QUAY 2
78	0.0	On Site	652410 306000	TG50NW581	15.0	BOLLARD QUAY 4
79AE	0.0	On Site	652430 306230	TG50NW578	15.5	BOLLARD QUAY 1
80Y	0.0	On Site	652500 306130	TG50NW341	20.5	GREAT YARMOUTH FLOOD DEFENCES 1
81X	0.0	On Site	652500 306060	TG50NW342	22.1	GREAT YARMOUTH FLOOD DEFENCES 2
82	0.0	On Site	652520 306370	TG50NW928	26.0	TRINTY QUAY GT YARMOUTH 2
83W	0.0	On Site	652530 306240	TG50NW934	20.0	SOUTHGATES RD GT YARMOUTH 12
84W	0.0	On Site	652530 306240	TG50NW935	20.0	SOUTHGATES RD GT YARMOUTH 13
85W	0.0	On Site	652530 306240	TG50NW933	20.0	SOUTHGATES RD GT YARMOUTH 11
86X	0.0	On Site	652530 306060	TG50NW344	25.0	GREAT YARMOUTH FLOOD DEFENCES 4
87Y	0.0	On Site	652530 306130	TG50NW343	25.0	GREAT YARMOUTH FLOOD DEFENCES 3
88R	0.0	On Site	652170 306140	TG50NW210	18.5	GT YAR COUNCIL STH TOWN PUMPING STN 2A
89	0.0	On Site	652580 306290	TG50NW276	-1.0	GT YAR BOR CNCL SOUTHGATE ROAD 2047A
90	0.0	On Site	652580 306080	TG50NW573	-1.0	FISH QUAY TRIAL PIT PS25
91AA	0.0	On Site	652590 305970	TG50NW577	-1.0	FISH QUAY TRIAL PIT PP4
92	0.0	On Site	652590 306220	TG50NW279	-1.0	GT YAR BOR CNCL SOUTHGATE ROAD 2047D
93	0.0	On Site	652610 306140	TG50NW277	-1.0	GT YAR BOR CNCL SOUTHGATE ROAD 2047B
94	0.0	On Site	652630 306060	TG50NW572	-1.0	FISH QUAY TRIAL PIT PS24
95Z	0.0	On Site	652630 305940	TG50NW576	-1.0	FISH QUAY TRIAL PIT PP3
96	0.0	On Site	652640 305970	TG50NW574	-1.0	FISH QUAY TRIAL PIT PP1
97Z	0.0	On Site	652650 305940	TG50NW575	-1.0	FISH QUAY TRIAL PIT PP2
98	0.0	On Site	652530 305940	TG50NW368	3.0	GREAT YARMOUTH FLOOD DEFENCES TP 12
99AA	0.0	On Site	652585 305950	TG50NW161	24.38	GT YAR BOROUGH COUNCIL YARE TUNNEL 4
100AD	0.0	On Site	652700 305950	TG50NW996	9.4	SUTTON ROAD GREAT YARMOUTH

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
101AB	0.0	On Site	651930 306020	TG50NW1081	5.0	TRAVIS PERKINS GREAT YARMOUTH WS102
102AC	0.0	On Site	652550 306190	TG50NW1046	30.34	GREAT YARMOUTH (FISHWHARF OFF SOUTH DENES ROAD) 3
103	0.0	On Site	652550 306140	TG50NW1045	30.32	GREAT YARMOUTH (FISHWHARF OFF SOUTH DENES ROAD) 2
104AC	0.0	On Site	652590 306170	TG50NW1044	30.45	GREAT YARMOUTH (FISHWHARF OFF SOUTH DENES ROAD) 1A
105AD	0.0	On Site	652700 305950	TG50NW23	9.45	SUTTON RD GT YARMOUTH
106	0.0	On Site	652250 305990	TG50NW4	7.01	GREAT YARMOUTH NO 4
107	0.0	S	652250 305680	TG50NW331	7.62	SUFFOLK ROAD 26
108AE	1.0	N	652400 306230	TG50NW584	20.0	BOLLUAY QUAY 7
109AF	1.0	SE	652550 305650	TG50NW353	25.0	GREAT YARMOUTH FLOOD DEFENCES 13
110AB	4.0	N	651890 306020	TG50NW1076	20.2	TRAVIS PERKINS GREAT YARMOUTH 101
111	6.0	SE	652560 305650	TG50NW350	20.0	GREAT YARMOUTH FLOOD DEFENCES 10
112AG	6.0	S	652719 305867	TG50NW1048	8.2	ADMIRALTY ROAD GREAT YARMOUTH 102
113	7.0	N	652240 306190	TG50NW309	-1.0	GT YAR BOR CNCL HIGH MILL RD CPT 12
114AH	7.0	S	652658 305852	TG50NW1070	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 201
115	10.0	S	652045 305662	TG50NW41	7.8	A47 GORLESTON RELIEF ROAD
116R	11.0	NW	652170 306160	TG50NW209	15.25	GT YAR COUNCIL STH TOWN PUMPING STN 1A
117R	11.0	NW	652170 306160	TG50NW182	15.25	GT YAR BOROUGH COUNCIL SEWERAGE WORKS 26
118AI	14.0	S	652570 305820	TG50NW281	-1.0	GT YAR BOR CNCL FISH WHARF B12
119O	15.0	S	652676 305848	TG50NW1051	14.4	ADMIRALTY ROAD GREAT YARMOUTH 203
120	23.0	S	652480 305610	TG50NW796	10.0	MALTHOUSE QUAY GT YARMOUTH 11
121AJ	24.0	NW	652160 306170	TG50NW179	18.3	GT YAR BOROUGH COUNCIL SEWERAGE WORKS 11
122	26.0	NW	651950 306070	TG50NW1079	18.5	TRAVIS PERKINS GREAT YARMOUTH 104
123	28.0	N	652300 306230	TG50NW3	10.67	GREAT YARMOUTH NO 3
124AJ	29.0	NW	652170 306180	TG50NW212	15.0	GT YAR COUNCIL SUFFOLK RD SEWERAGE 5
125	30.0	S	652250 305650	TG50NW5	7.62	GREAT YARMOUTH NO 5
126AJ	30.0	NW	652180 306190	TG50NW178	18.3	GT YAR BOROUGH COUNCIL SEWERAGE WORKS 10

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
127AK	31.0	S	652754 305850	TG50NW1067	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 110
128AK	31.0	S	652760 305851	TG50NW1068	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 111
129	38.0	W	651810 305770	TG50NW958	-1.0	HARFREYS ROAD GRT YARMOUTH 1
130AL	39.0	S	652653 305817	TG50NW1054	9.0	ADMIRALTY ROAD GREAT YARMOUTH 207
131AM	40.0	S	652025 305630	TG50NW31	9.5	A47/A12 GORLESTON RELIEF ROAD
132AL	41.0	S	652679 305822	TG50NW1052	13.1	ADMIRALTY ROAD GREAT YARMOUTH 204
133AK	43.0	S	652734 305833	TG50NW1066	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 109
134	44.0	N	651890 306060	TG50NW1080	6.0	TRAVIS PERKINS GREAT YARMOUTH WS101
135	45.0	NW	651960 306100	TG50NW1084	5.0	TRAVIS PERKINS GREAT YARMOUTH WS105
136AL	46.0	S	652649 305809	TG50NW1071	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 202
137AK	46.0	S	652762 305836	TG50NW1069	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 112
138AL	47.0	S	652620 305800	TG50NW287	-1.0	GT YAR BOR CNCL FISH WHARF B22
139AQ	47.0	S	652500 305580	TG50NW797	15.5	MALTHOUSE QUAY GT YARMOUTH 12A
140AM	47.0	S	652048 305625	TG50NW42	8.0	A47 GORLESTON RELIEF ROAD
141AM	52.0	S	652050 305620	TG50NW385	12.0	A12 GORLESTON RELIEF RD GT YAR S BY PASS
142AK	53.0	S	652763 305829	TG50NW1064	1.0	ADMIRALTY ROAD GREAT YARMOUTH WS 107
143AP	56.0	S	652726 305818	TG50NW1047	8.0	ADMIRALTY ROAD GREAT YARMOUTH 101
144AN	56.0	SE	652590 305610	TG50NW349	20.0	GREAT YARMOUTH FLOOD DEFENCES 9
145AN	59.0	SE	652560 305590	TG50NW794	19.0	MALTHOUSE QUAY GT YARMOUTH 9A
146AR	59.0	NW	652170 306220	TG50NW211	27.0	GT YAR COUNCIL SUFFOLK RD SEWERAGE 4
147	59.0	W	651780 305660	TG50NW225	10.7	GT YAR BOR CNCL A12 WESTERN BY PASS
148AO	63.0	S	651850 305600	TG50NW923	20.0	HARFREYS RD GT YARMOUTH 1
149AO	63.0	S	651850 305600	TG50NW924	20.0	HARFREYS RD GT YARMOUTH 2
150AO	63.0	S	651850 305600	TG50NW925	20.0	HARFREYS RD GT YARMOUTH 3
151AO	63.0	S	651850 305600	TG50NW926	20.0	HARFREYS RD GT YARMOUTH 4
152AN	64.0	SE	652590 305600	TG50NW75	1.2	GT YARMOUTH FLOOD DEFENCES POSFORD PAVRY C15
153AP	68.0	S	652700 305800	TG50NW946	20.0	SOUTH DENES ROAD 1
154AP	68.0	S	652700 305800	TG50NW947	15.5	SOUTH DENES ROAD 2

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
155AQ	68.0	S	652520 305560	TG50NW798	10.0	MALTHOUSE QUAY GT YARMOUTH 13
156AN	68.0	SE	652580 305590	TG50NW352	25.0	GREAT YARMOUTH FLOOD DEFENCES 12
157AP	70.0	S	652705 305799	TG50NW1055	8.0	ADMIRALTY ROAD GREAT YARMOUTH 208
158AP	70.0	S	652764 305812	TG50NW1062	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 105
159AS	74.0	S	652662 305783	TG50NW1049	15.35	ADMIRALTY ROAD GREAT YARMOUTH 201
160AP	75.0	S	652750 305804	TG50NW1060	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 103
161AR	76.0	NW	652170 306240	TG50NW177	9.15	GT YAR BOROUGH COUNCIL SEWERAGE WORKS 9
162AP	76.0	S	652758 305804	TG50NW1061	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 104
163AS	77.0	S	652700 305790	TG50NW569	-1.0	FISH QUAY TRIAL PIT PS21
164	79.0	SE	652860 305840	TG50NW589	15.0	FISHWHARF ZAPATA QUAY 1
165AV	81.0	S	652731 305793	TG50NW1059	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 102
166AU	82.0	E	652640 305720	TG50NW871	10.0	FISH WHARF GT YARMOUTH 1
167AW	82.0	S	652050 305590	TG50NW39	5.0	A47/A12 GORLESTON RELIEF ROAD
168AT	85.0	NW	651960 306150	TG50NW1078	16.2	TRAVIS PERKINS GREAT YARMOUTH 103
169	86.0	NW	652440 306420	TG50NW927	22.0	TRINTY QUAY GT YARMOUTH 1
170AT	87.0	NW	651930 306130	TG50NW1082	5.0	TRAVIS PERKINS GREAT YARMOUTH WS103
171AU	91.0	E	652650 305710	TG50NW872	10.0	FISH WHARF GT YARMOUTH 2
172AS	95.0	S	652704 305773	TG50NW1056	8.0	ADMIRALTY ROAD GREAT YARMOUTH 209
173AV	96.0	S	652758 305784	TG50NW1058	4.0	ADMIRALTY ROAD GREAT YARMOUTH WS 101
174AW	100.0	S	652016 305570	TG50NW40	6.1	A47 GORLESTON RELIEF ROAD
175AX	104.0	SE	652600 305560	TG50NW76	2.4	GT YARMOUTH FLOOD DEFENCES POSFORD PAVRY C16
176AX	109.0	SE	652610 305560	TG50NW348	20.0	GREAT YARMOUTH FLOOD DEFENCES 8
177AX	113.0	SE	652600 305550	TG50NW351	25.5	GREAT YARMOUTH FLOOD DEFENCES 11
178AY	114.0	NW	651910 306150	TG50NW1083	5.0	TRAVIS PERKINS GREAT YARMOUTH WS104
179	115.0	S	652025 305555	TG50NW384	14.7	A12 GORLESTON RELIEF RD GT YAR S BY PASS
180	118.0	N	651990 306200	TG50NW227	11.5	GT YAR BOR CNCL A12 WESTERN BY PASS
181AY	118.0	NW	651890 306140	TG50NW1077	23.0	TRAVIS PERKINS GREAT YARMOUTH 102
182	122.0	N	652520 306500	TG50NW786	20.0	SOUTHGATES RD GT YARMOUTH 3

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
183	142.0	E	652700 305720	TG50NW568	-1.0	FISH QUAY TRIAL PIT PS20
184	148.0	S	652020 305522	TG50NW30	6.2	A47/A12 GORLESTON RELIEF ROAD
185	161.0	NW	651938 306226	TG50NW431	13.0	A12 GT YAR W BY PASS DOT REPORT
186AZ	161.0	S	651790 305510	TG50NW971	7.7	HARFREYS FARM GT YARMOUTH 13
187AZ	163.0	S	651840 305500	TG50NW959	9.0	HARFREYS FARM GT YARMOUTH 1
188BA	167.0	NW	652400 306500	TG50NW895	2.0	INSPECTORATE QUAY GT YAR' 2
189BA	167.0	NW	652400 306500	TG50NW896	25.0	INSPECTORATE QUAY GT YAR' 2A
190BA	167.0	NW	652400 306500	TG50NW894	25.0	INSPECTORATE QUAY GT YAR' 1
191	173.0	W	651670 306020	TG50NW686	1.2	BGS AUGR HL 161 GAPTON MARSHES
192	183.0	N	652500 306560	TG50NW789	25.7	SOUTHGATES RD GT YARMOUTH 1
193	187.0	S	652028 305483	TG50NW383	12.3	A12 GORLESTON RELIEF RD GT YAR S BY PASS CPT 129
194BD	191.0	E	652750 305630	TG50NW567	-1.0	EAST QUAY TRIAL PIT PS19
195	197.0	S	652800 305690	TG50NW283	-1.0	GT YAR BOR CNCL FISH WHARF B14
196BC	203.0	NW	652090 306340	TG50NW176	9.15	GT YAR BOROUGH COUNCIL SEWERAGE WORKS 8
197BB	212.0	N	652520 306590	TG50NW785	17.3	SOUTHGATES RD GT YARMOUTH 2
198BB	212.0	N	652510 306590	TG50NW784	20.0	SOUTHGATES RD GT YARMOUTH 1
199	214.0	NE	652760 306560	TG50NW196	6.1	GT YAR BOR CNCL MAVERS RD PUMPING STN 23
200BC	215.0	NW	652100 306360	TG50NW213	15.4	GT YAR COUNCIL SUFFOLK RD SEWERAGE 6
201BE	217.0	SE	652720 305510	TG50NW991	25.0	GREAT YARMOUTH SALMON ROAD 4
202BD	224.0	E	652780 305610	TG50NW993	10.5	GREAT YARMOUTH SALMON ROAD 5
203BE	224.0	SE	652730 305510	TG50NW992	25.25	GREAT YARMOUTH SALMON ROAD 4A
204BF	232.0	S	652028 305438	TG50NW388	1.5	A12/A47 GORLESTON RELIEF RD REPORT
205BB	232.0	N	652510 306610	TG50NW790	3.0	SOUTHGATES RD GT YARMOUTH 2
206BB	232.0	N	652510 306610	TG50NW791	26.0	SOUTHGATES RD GT YARMOUTH 2A
207BF	236.0	S	652018 305434	TG50NW37	0.6	A47/A12 GORLESTON RELIEF ROAD
208BF	236.0	S	652030 305434	TG50NW373	0.8	A12 GORLESTON RELIEF RD GT YAR S BY PASS
209	237.0	NW	652040 306350	TG50NW214	15.4	GT YAR COUNCIL SUFFOLK RD SEWERAGE 7

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
210	237.0	S	651980 305430	TG50NW961	8.0	HARFREYS FARM GT YARMOUTH 3
211	239.0	N	652610 306620	TG50NW274	-1.0	GT YAR BOR CNCL QUEENS RD B18
212BF	239.0	S	652032 305431	TG50NW387	1.8	A12/A47 GORLESTON RELIEF RD REPORT
213BF	240.0	S	652020 305430	TG50NW224	6.4	GT YAR BOR CNCL A12 WESTERN BY PASS DKM2
214BF	240.0	S	652018 305429	TG50NW38	10.0	A47/A12 GORLESTON RELIEF ROAD
215BF	241.0	S	652030 305429	TG50NW401	1.8	A12/A47 GORLESTON RELIEF RD REPORT
216BF	246.0	S	652068 305427	TG50NW389	8.05	A12/A47 GORLESTON RELIEF RD REPORT
217BF	249.0	S	652035 305422	TG50NW372	4.3	A12 GORLESTON RELIEF RD GT YAR S BY PASS

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#1Q: scans.bgs.ac.uk/sobi_scans/boreholes/519577
#2A: scans.bgs.ac.uk/sobi_scans/boreholes/519575
#3: scans.bgs.ac.uk/sobi_scans/boreholes/519864
#4AI: scans.bgs.ac.uk/sobi_scans/boreholes/520122
#5B: scans.bgs.ac.uk/sobi_scans/boreholes/519696
#6J: scans.bgs.ac.uk/sobi_scans/boreholes/520115
#7M: scans.bgs.ac.uk/sobi_scans/boreholes/519717
#8C: scans.bgs.ac.uk/sobi_scans/boreholes/520123
#9: scans.bgs.ac.uk/sobi_scans/boreholes/520372
#10A: scans.bgs.ac.uk/sobi_scans/boreholes/519906
#11B: scans.bgs.ac.uk/sobi_scans/boreholes/519559
#12C: scans.bgs.ac.uk/sobi_scans/boreholes/520124
#13H: scans.bgs.ac.uk/sobi_scans/boreholes/520540
#14D: scans.bgs.ac.uk/sobi_scans/boreholes/520424
#15D: scans.bgs.ac.uk/sobi_scans/boreholes/520423
#16D: scans.bgs.ac.uk/sobi_scans/boreholes/520425
#17A: scans.bgs.ac.uk/sobi_scans/boreholes/519564
#18L: scans.bgs.ac.uk/sobi_scans/boreholes/519543
#19I: scans.bgs.ac.uk/sobi_scans/boreholes/519918
#20E: scans.bgs.ac.uk/sobi_scans/boreholes/520474
#22E: scans.bgs.ac.uk/sobi_scans/boreholes/520324
#24G: scans.bgs.ac.uk/sobi_scans/boreholes/519549
#26G: scans.bgs.ac.uk/sobi_scans/boreholes/520530
#27H: scans.bgs.ac.uk/sobi_scans/boreholes/520527
#28: scans.bgs.ac.uk/sobi_scans/boreholes/519716
#29T: scans.bgs.ac.uk/sobi_scans/boreholes/520114
#31I: scans.bgs.ac.uk/sobi_scans/boreholes/519576
#32D: scans.bgs.ac.uk/sobi_scans/boreholes/520422
#33: scans.bgs.ac.uk/sobi_scans/boreholes/519694
#35N: scans.bgs.ac.uk/sobi_scans/boreholes/520120
#36J: scans.bgs.ac.uk/sobi_scans/boreholes/519695
#38: scans.bgs.ac.uk/sobi_scans/boreholes/520004
#39G: scans.bgs.ac.uk/sobi_scans/boreholes/519548
#40P: scans.bgs.ac.uk/sobi_scans/boreholes/519561
#41L: scans.bgs.ac.uk/sobi_scans/boreholes/520558
#42L: scans.bgs.ac.uk/sobi_scans/boreholes/520537
#43M: scans.bgs.ac.uk/sobi_scans/boreholes/519558
#44N: scans.bgs.ac.uk/sobi_scans/boreholes/519712
#45O: scans.bgs.ac.uk/sobi_scans/boreholes/18092227
#46B: scans.bgs.ac.uk/sobi_scans/boreholes/519961
#47P: scans.bgs.ac.uk/sobi_scans/boreholes/519560
#48Q: scans.bgs.ac.uk/sobi_scans/boreholes/519578
#49L: scans.bgs.ac.uk/sobi_scans/boreholes/519960
#50H: scans.bgs.ac.uk/sobi_scans/boreholes/520541
#51AH: scans.bgs.ac.uk/sobi_scans/boreholes/18092181
#52L: scans.bgs.ac.uk/sobi_scans/boreholes/520538
#53G: scans.bgs.ac.uk/sobi_scans/boreholes/519547
#54H: scans.bgs.ac.uk/sobi_scans/boreholes/519542
#55AF: scans.bgs.ac.uk/sobi_scans/boreholes/520325
#56: scans.bgs.ac.uk/sobi_scans/boreholes/520327
#57K: scans.bgs.ac.uk/sobi_scans/boreholes/18092804
#58O: scans.bgs.ac.uk/sobi_scans/boreholes/18092213
#59AG: scans.bgs.ac.uk/sobi_scans/boreholes/18092809
#60AB: scans.bgs.ac.uk/sobi_scans/boreholes/520219
#61S: scans.bgs.ac.uk/sobi_scans/boreholes/519999
#62: scans.bgs.ac.uk/sobi_scans/boreholes/519758

#63: scans.bgs.ac.uk/sobi_scans/boreholes/519998
#64: scans.bgs.ac.uk/sobi_scans/boreholes/519962
#66R: scans.bgs.ac.uk/sobi_scans/boreholes/519713
#68: scans.bgs.ac.uk/sobi_scans/boreholes/519715
#71S: scans.bgs.ac.uk/sobi_scans/boreholes/520000
#72: scans.bgs.ac.uk/sobi_scans/boreholes/520118
#73U: scans.bgs.ac.uk/sobi_scans/boreholes/520440
#74V: scans.bgs.ac.uk/sobi_scans/boreholes/520117
#75T: scans.bgs.ac.uk/sobi_scans/boreholes/520119
#76U: scans.bgs.ac.uk/sobi_scans/boreholes/520112
#77V: scans.bgs.ac.uk/sobi_scans/boreholes/520111
#78: scans.bgs.ac.uk/sobi_scans/boreholes/520113
#79AE: scans.bgs.ac.uk/sobi_scans/boreholes/520110
#80Y: scans.bgs.ac.uk/sobi_scans/boreholes/519873
#81X: scans.bgs.ac.uk/sobi_scans/boreholes/519874
#82: scans.bgs.ac.uk/sobi_scans/boreholes/520460
#83W: scans.bgs.ac.uk/sobi_scans/boreholes/520466
#84W: scans.bgs.ac.uk/sobi_scans/boreholes/520467
#85W: scans.bgs.ac.uk/sobi_scans/boreholes/520465
#86X: scans.bgs.ac.uk/sobi_scans/boreholes/519876
#87Y: scans.bgs.ac.uk/sobi_scans/boreholes/519875
#88R: scans.bgs.ac.uk/sobi_scans/boreholes/519742
#98: scans.bgs.ac.uk/sobi_scans/boreholes/519900
#99AA: scans.bgs.ac.uk/sobi_scans/boreholes/519693
#100AD: scans.bgs.ac.uk/sobi_scans/boreholes/520528
#101AB: scans.bgs.ac.uk/sobi_scans/boreholes/18403322
#102AC: scans.bgs.ac.uk/sobi_scans/boreholes/18062800
#103: scans.bgs.ac.uk/sobi_scans/boreholes/18062798
#104AC: scans.bgs.ac.uk/sobi_scans/boreholes/18062797
#105AD: scans.bgs.ac.uk/sobi_scans/boreholes/519555
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#108AE: scans.bgs.ac.uk/sobi_scans/boreholes/520116
#109AF: scans.bgs.ac.uk/sobi_scans/boreholes/519885
#110AB: scans.bgs.ac.uk/sobi_scans/boreholes/18403317
#111: scans.bgs.ac.uk/sobi_scans/boreholes/519882
#112AG: scans.bgs.ac.uk/sobi_scans/boreholes/18092135
#114AH: scans.bgs.ac.uk/sobi_scans/boreholes/18092823
#115: scans.bgs.ac.uk/sobi_scans/boreholes/519573
#116R: scans.bgs.ac.uk/sobi_scans/boreholes/519741
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#120: scans.bgs.ac.uk/sobi_scans/boreholes/520328
#121AJ: scans.bgs.ac.uk/sobi_scans/boreholes/519711
#122: scans.bgs.ac.uk/sobi_scans/boreholes/18403320
#123: scans.bgs.ac.uk/sobi_scans/boreholes/519512
#124AJ: scans.bgs.ac.uk/sobi_scans/boreholes/519744
#125: scans.bgs.ac.uk/sobi_scans/boreholes/519514
#126AJ: scans.bgs.ac.uk/sobi_scans/boreholes/519710
#127AK: scans.bgs.ac.uk/sobi_scans/boreholes/18092813
#128AK: scans.bgs.ac.uk/sobi_scans/boreholes/18092816
#130AL: scans.bgs.ac.uk/sobi_scans/boreholes/18092219
#131AM: scans.bgs.ac.uk/sobi_scans/boreholes/519563
#132AL: scans.bgs.ac.uk/sobi_scans/boreholes/18092184
#133AK: scans.bgs.ac.uk/sobi_scans/boreholes/18092811
#134: scans.bgs.ac.uk/sobi_scans/boreholes/18403321

#135: scans.bgs.ac.uk/sobi_scans/boreholes/18403325
#136AL: scans.bgs.ac.uk/sobi_scans/boreholes/18092826
#137AK: scans.bgs.ac.uk/sobi_scans/boreholes/18092818
#139AQ: scans.bgs.ac.uk/sobi_scans/boreholes/520329
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#141AM: scans.bgs.ac.uk/sobi_scans/boreholes/519917
#142AK: scans.bgs.ac.uk/sobi_scans/boreholes/18092806
#143AP: scans.bgs.ac.uk/sobi_scans/boreholes/18092089
#144AN: scans.bgs.ac.uk/sobi_scans/boreholes/519881
#145AN: scans.bgs.ac.uk/sobi_scans/boreholes/520326
#146AR: scans.bgs.ac.uk/sobi_scans/boreholes/519743
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#150AO: scans.bgs.ac.uk/sobi_scans/boreholes/520457
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#190BA: scans.bgs.ac.uk/sobi_scans/boreholes/520426
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#215BF: scans.bgs.ac.uk/sobi_scans/boreholes/519933
#216BF: scans.bgs.ac.uk/sobi_scans/boreholes/519921
#217BF: scans.bgs.ac.uk/sobi_scans/boreholes/519904

8 Estimated Background Soil Chemistry

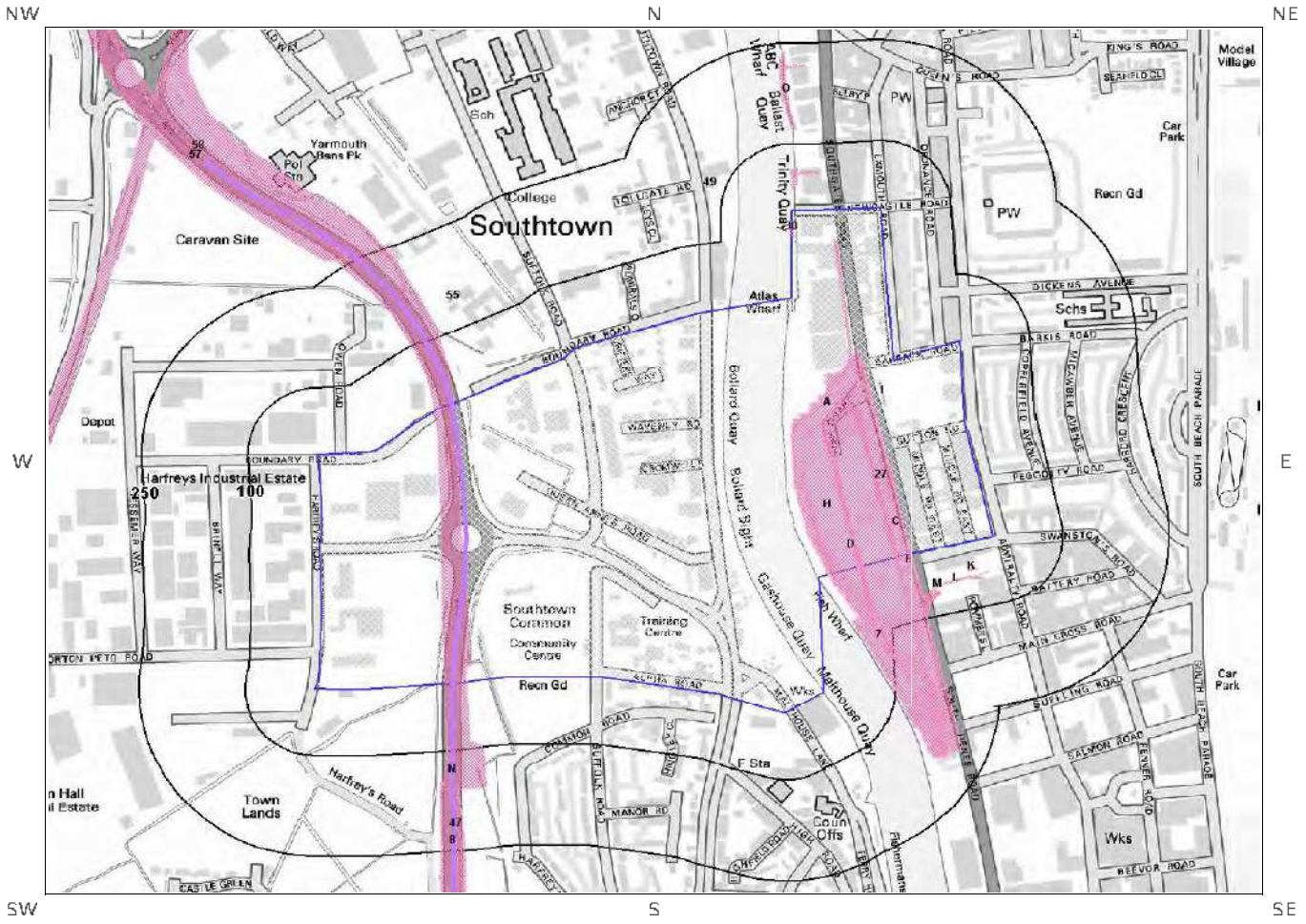
Records of background estimated soil chemistry within 250m of the study site boundary: 19

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<100 mg/kg
3.0	W	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
16.0	E	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
48.0	E	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

9 Railways and Tunnels Map



Railways and Tunnels Legend

- Site Outline
- Search Buffers (m): 250, 500
- Underground or Partially Underground Railway / Subway System
- Railway Tunnel (OS Mapping)
- Abandoned or Dismantled Railway (OpenStreetMap)
- Railway Track (OS Mapping)
- Railway Track (OpenStreetMap)
- High Speed 2
- High Speed 2 Revised Proposed Route
- Crossrail 1
- Railway and/or Tunnel Feature from Historical Mapping

9 Railways and Tunnels

9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? Yes

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Details	Date
1D	0	On Site	652582 305858	Railway Sidings	1946
2B	0	On Site	652582 305860	Railway Sidings	1904
3A	0	On Site	652564 306095	Railway Sidings	1978
4C	0	On Site	652661 305900	Railway Sidings	1946
5A	0	On Site	652564 306095	Railway Sidings	1952
6	0	On Site	652583 305858	Railway Sidings	1938

ID	Distance (m)	Direction	NGR	Details	Date
9E	0	On Site	652580 305840	Railway Sidings	1958
10F	0	On Site	652683 305838	Railway Sidings	1958
11B	0	On Site	652626 305950	Railway Sidings	1927
12C	0	On Site	652662 305924	Railway Sidings	1981
13D	0	On Site	652558 305882	Railway Sidings	1981
14H	0	On Site	652540 306032	Railway Sidings	1887
15G	0	On Site	652567 306085	Railway Sidings	1966
16E	0	On Site	652580 305840	Railway Sidings	1949
17E	0	On Site	652580 305840	Railway Sidings	1968
18E	0	On Site	652580 305839	Railway Sidings	1957
19E	0	On Site	652580 305839	Railway Sidings	1949
20E	0	On Site	652580 305839	Railway Sidings	1968
21F	0	On Site	652683 305838	Railway Sidings	1968
22F	0	On Site	652683 305837	Railway Sidings	1968
23F	0	On Site	652683 305837	Railway Sidings	1957
24F	0	On Site	652683 305838	Railway Sidings	1949
25F	0	On Site	652683 305837	Railway Sidings	1949
26G	0	On Site	652567 306085	Railway Sidings	1949
27	0	On Site	652641 305980	Railway Sidings	1905
28I	0	On Site	652643 306106	Railway Sidings	1949
29H	0	On Site	652585 305922	Railway Sidings	1883
30	0	On Site	652515 306351	Railway Sidings	1905
31	0	On Site	n/a	Railway	1946
32I	0	On Site	652643 306106	Railway Sidings	1963
33I	0	On Site	652643 306106	Railway Sidings	1949
34J	33	N	652516 306425	Railway Sidings	1928
35J	37	N	652521 306429	Railway Sidings	1949
36K	40	S	652771 305842	Railway Sidings	1958
37K	40	S	652771 305842	Railway Sidings	1949

ID	Distance (m)	Direction	NGR	Details	Date
38K	42	S	652772 305841	Railway Sidings	1949
39K	42	S	652772 305841	Railway Sidings	1957
40L	51	S	652777 305830	Railway Sidings	1958
41L	51	S	652777 305830	Tramway Sidings	1949
42K	52	S	652777 305829	Railway Sidings	1957
43K	52	S	652777 305829	Railway Sidings	1949
44M	54	S	652722 305817	Tramway Sidings	1949
45M	54	S	652718 305816	Railway Sidings	1957
7	67	E	652638 305740	Railway Sidings	1884
46N	97	S	652033 305537	Railway Sidings	1958
47	111	S	652044 305396	Railway Sidings	1927
48N	112	S	652033 305529	Railway Sidings	1905
49	117	W	652398 306417	Railway Sidings	1928
50	117	E	652706 305621	Railway Sidings	1905
51O	122	N	652505 306558	Railway Sidings	1966
52O	122	N	652505 306558	Railway Sidings	1975
53O	122	N	652505 306558	Railway Sidings	1954
54O	127	N	652505 306558	Railway Sidings	1949
55	141	NW	652035 306248	Railway Sidings	1968
8	146	S	652035 305381	Railway Sidings	1938
56	163	N	652500 306574	Railway Sidings	1928
57	235	N	n/a	Railway	1906
58	243	N	n/a	Railway	1906

Any records that have been identified are represented on the Railways and Tunnels Map.

9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? Yes

Have any historical railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Status
0	On Site	Abandoned
0	On Site	Abandoned
0	On Site	Dismantled

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail 1 rail project? No

Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.

The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

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Fax: 0115 936 3276.
Email:**enquiries@bgs.ac.uk**
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries

British Gypsum

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LE12 6HX

The Coal Authority

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Mansfield
Notts NG18 4RG
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DX 716176 Mansfield 5
www.coal.gov.uk

Public Health England

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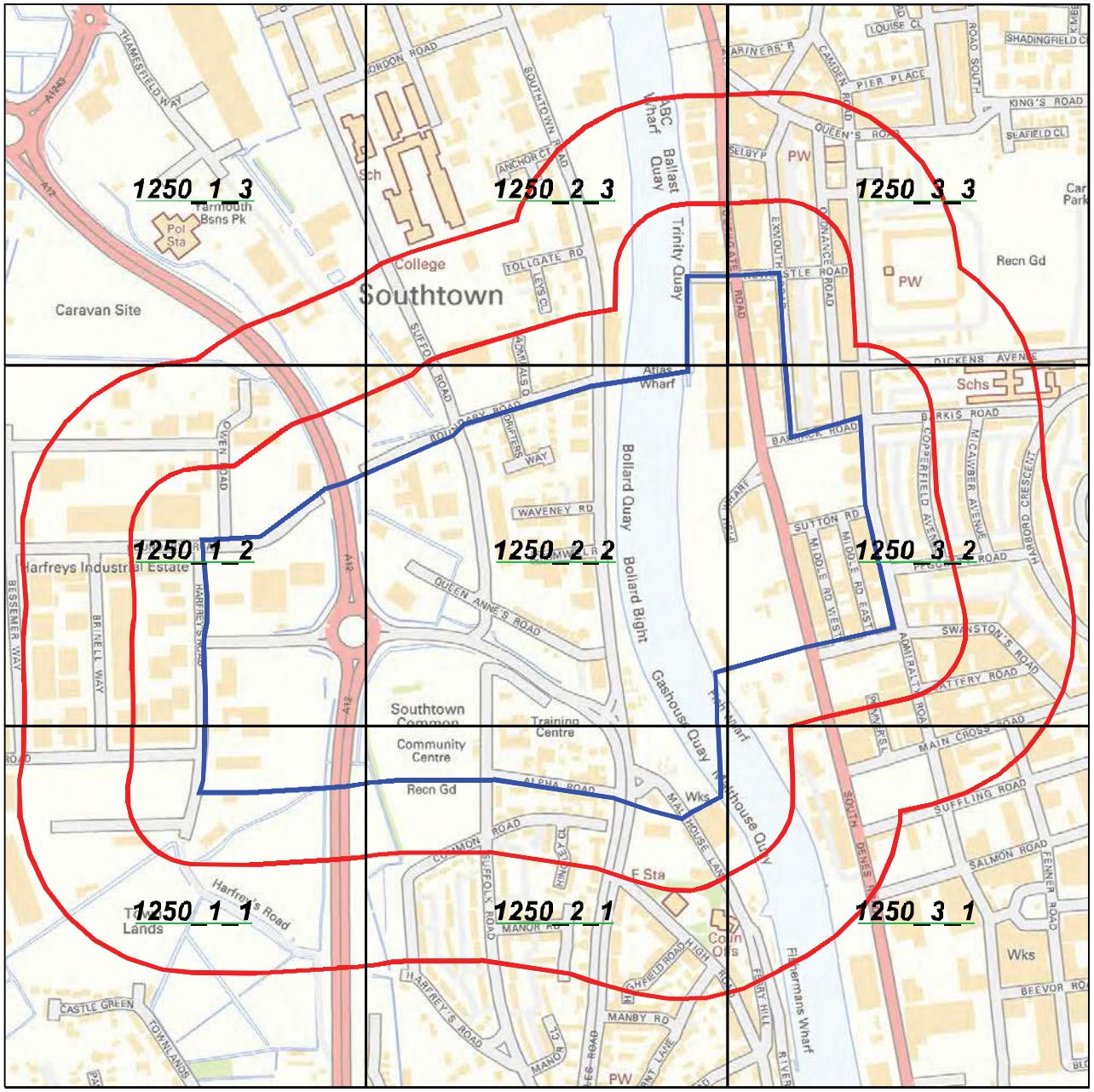

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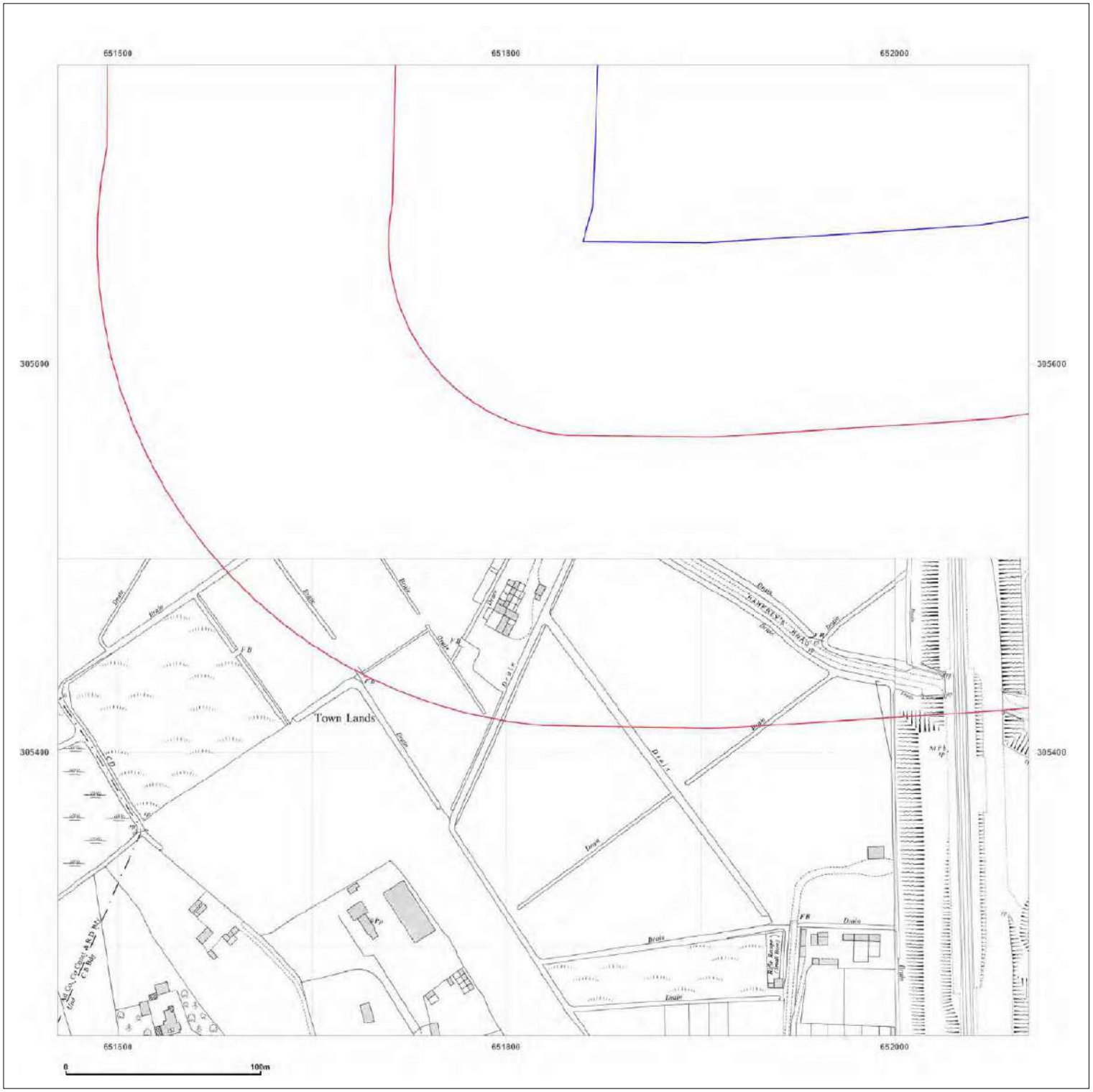
1:1250 Scale Grid Index



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Grid Ref: 651819, 305504

Map Name: National Grid
Map date: 1953-1955
Scale: 1:1,250
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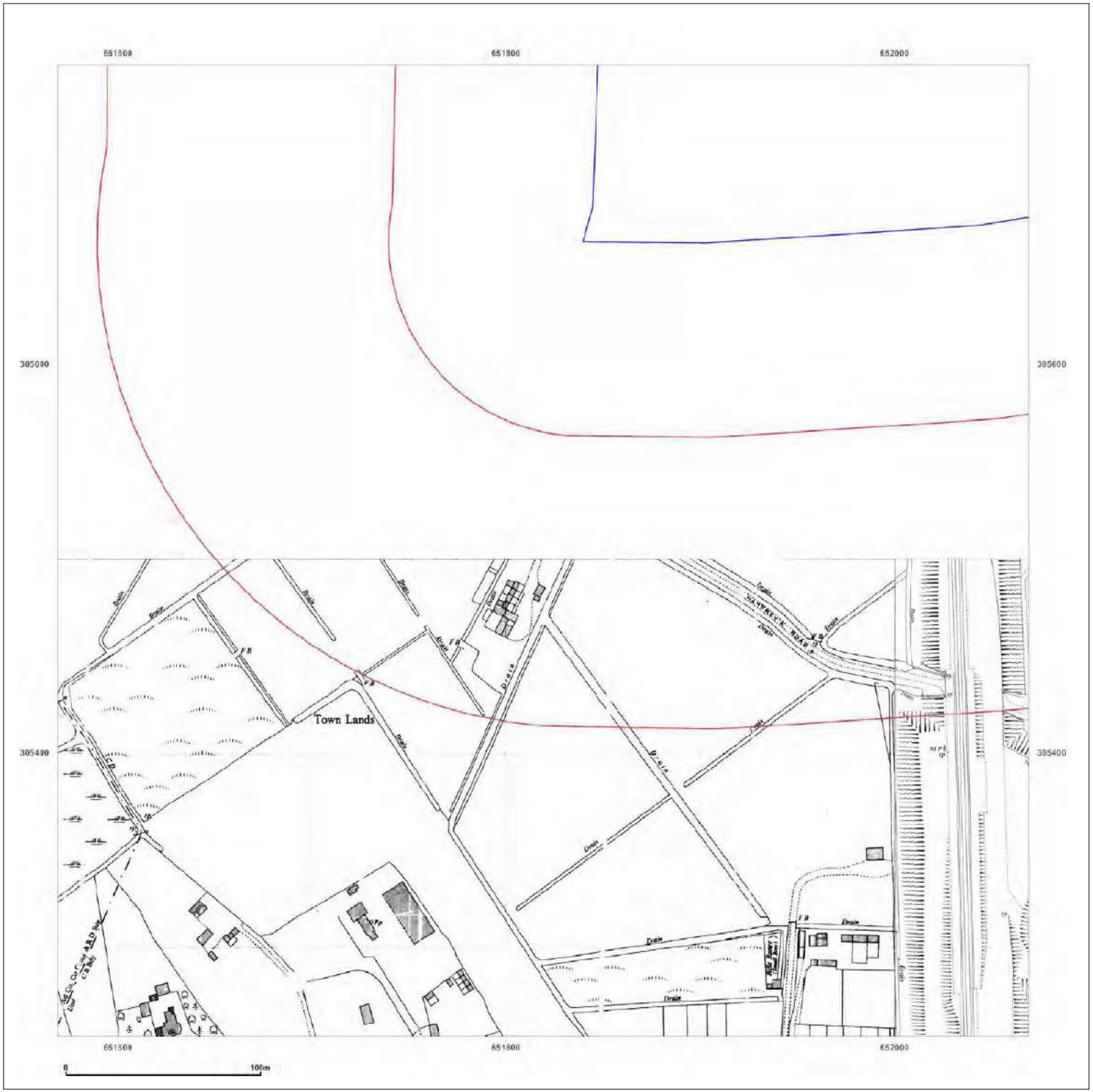

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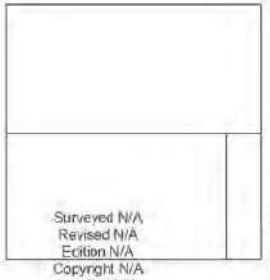

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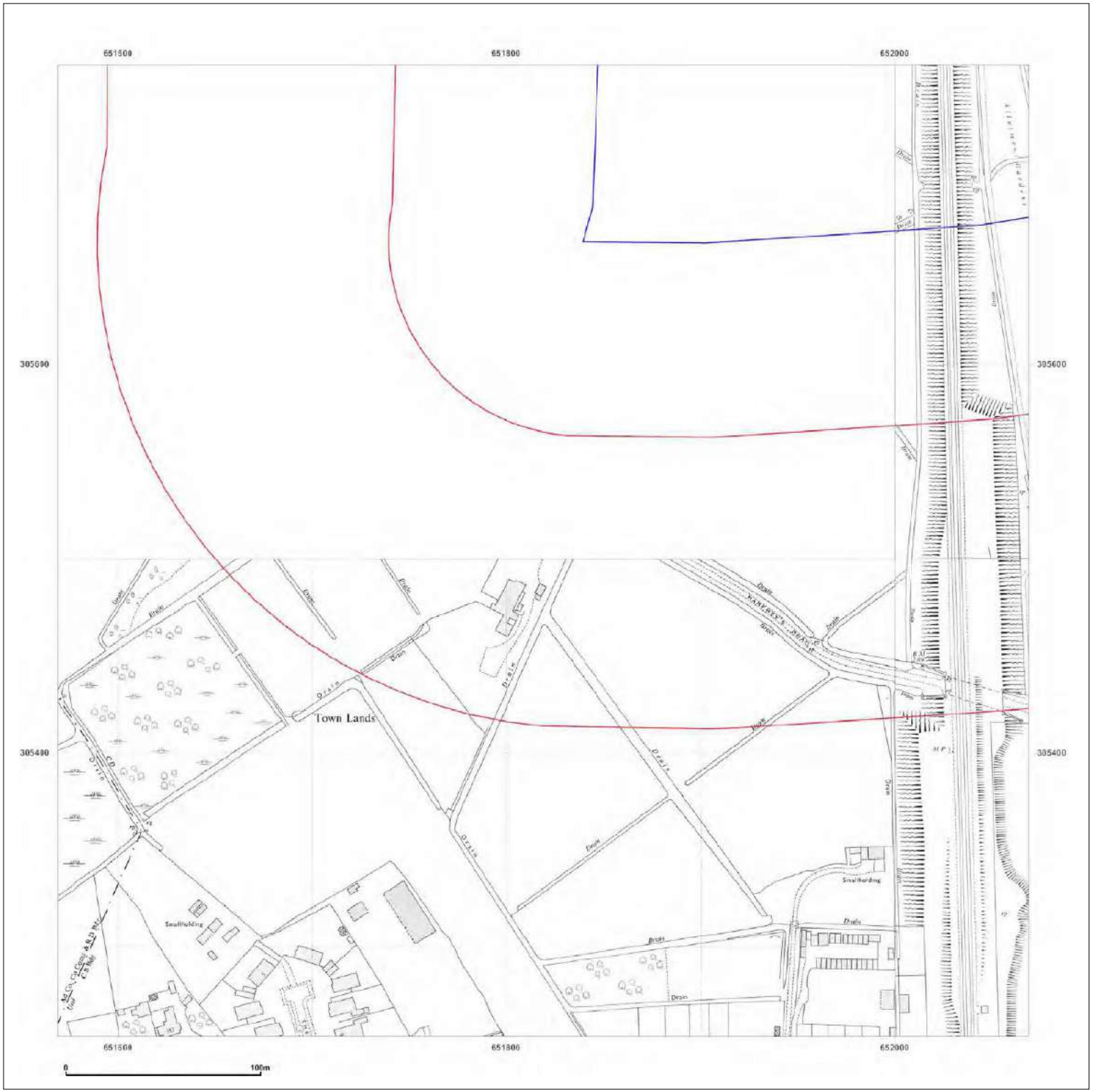

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Grid Ref: 651819, 305504

Map Name: National Grid
Map date: 1967-1970
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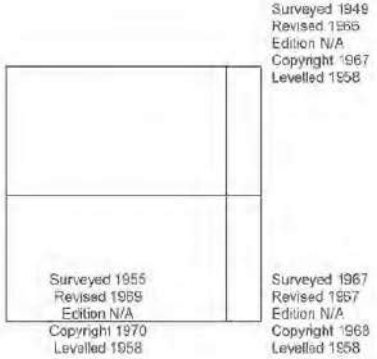

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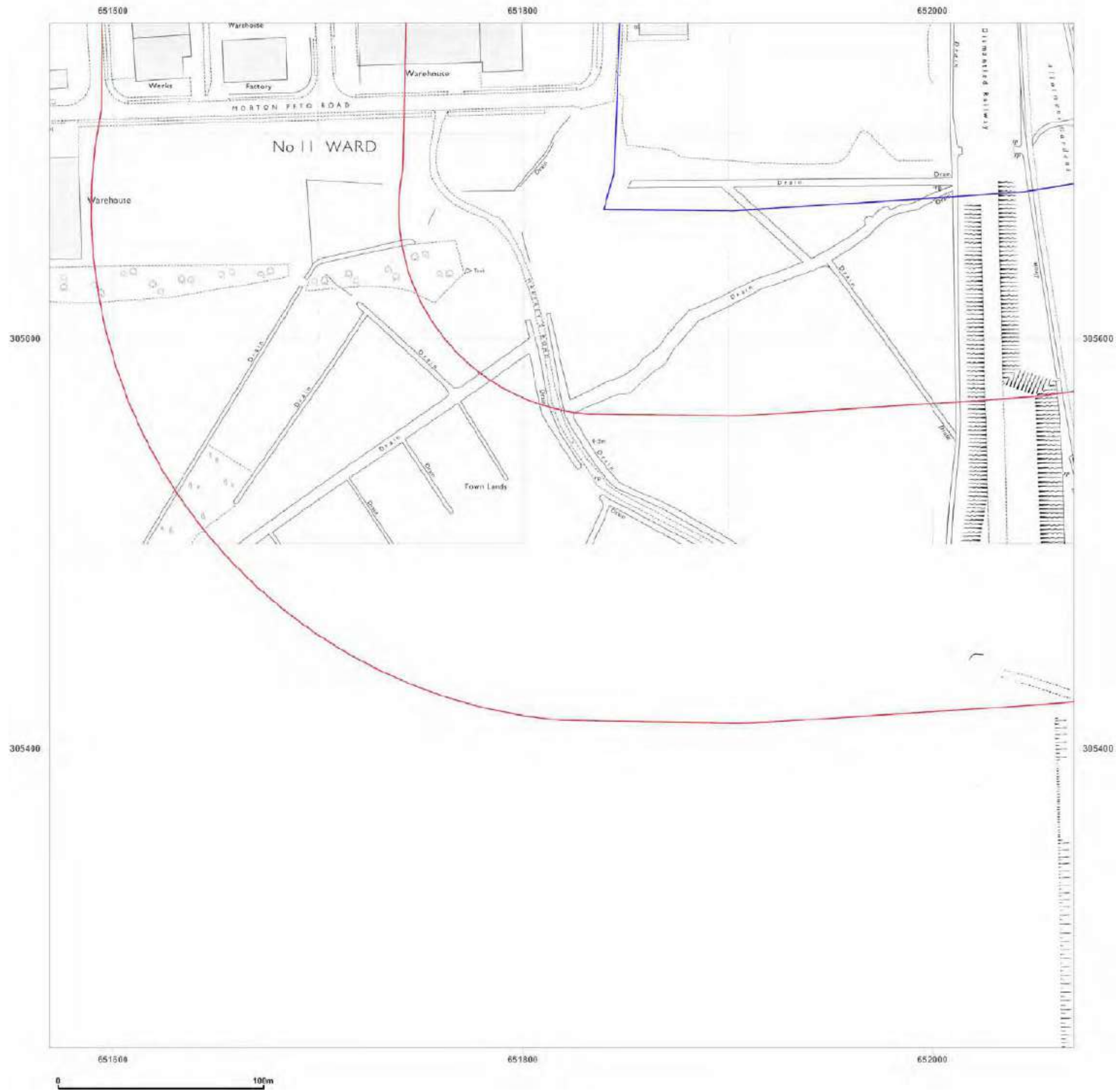

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Grid Ref: 651819, 305504

Map Name: National Grid

Map date: 1976-1978

Scale: 1:1,250

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Map Name: National Grid
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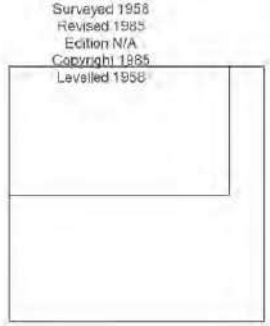

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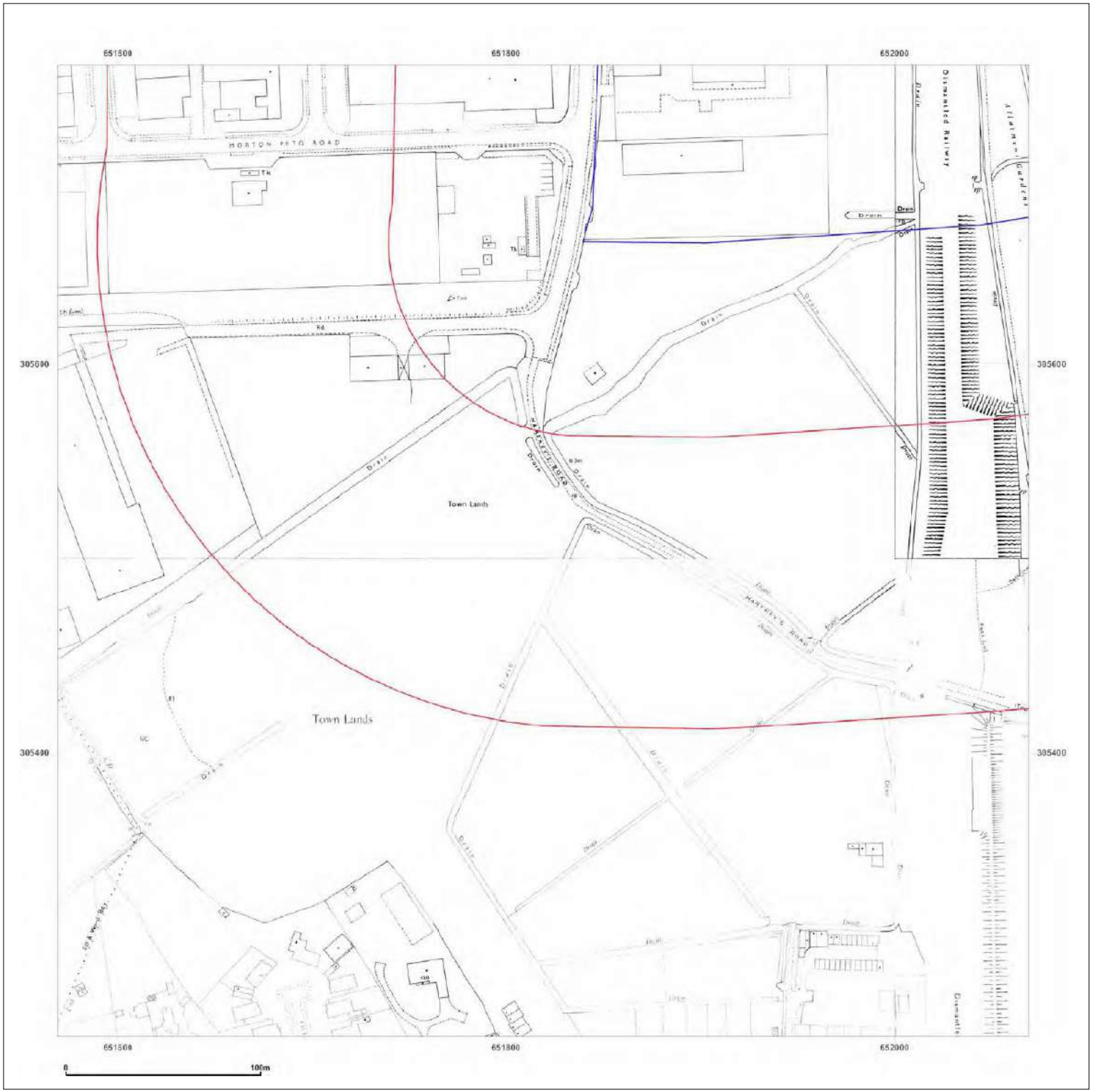

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Map Name: National Grid
Map date: 1986-1990
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Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 305504

Map Name: National Grid
Map date: 1990-1994
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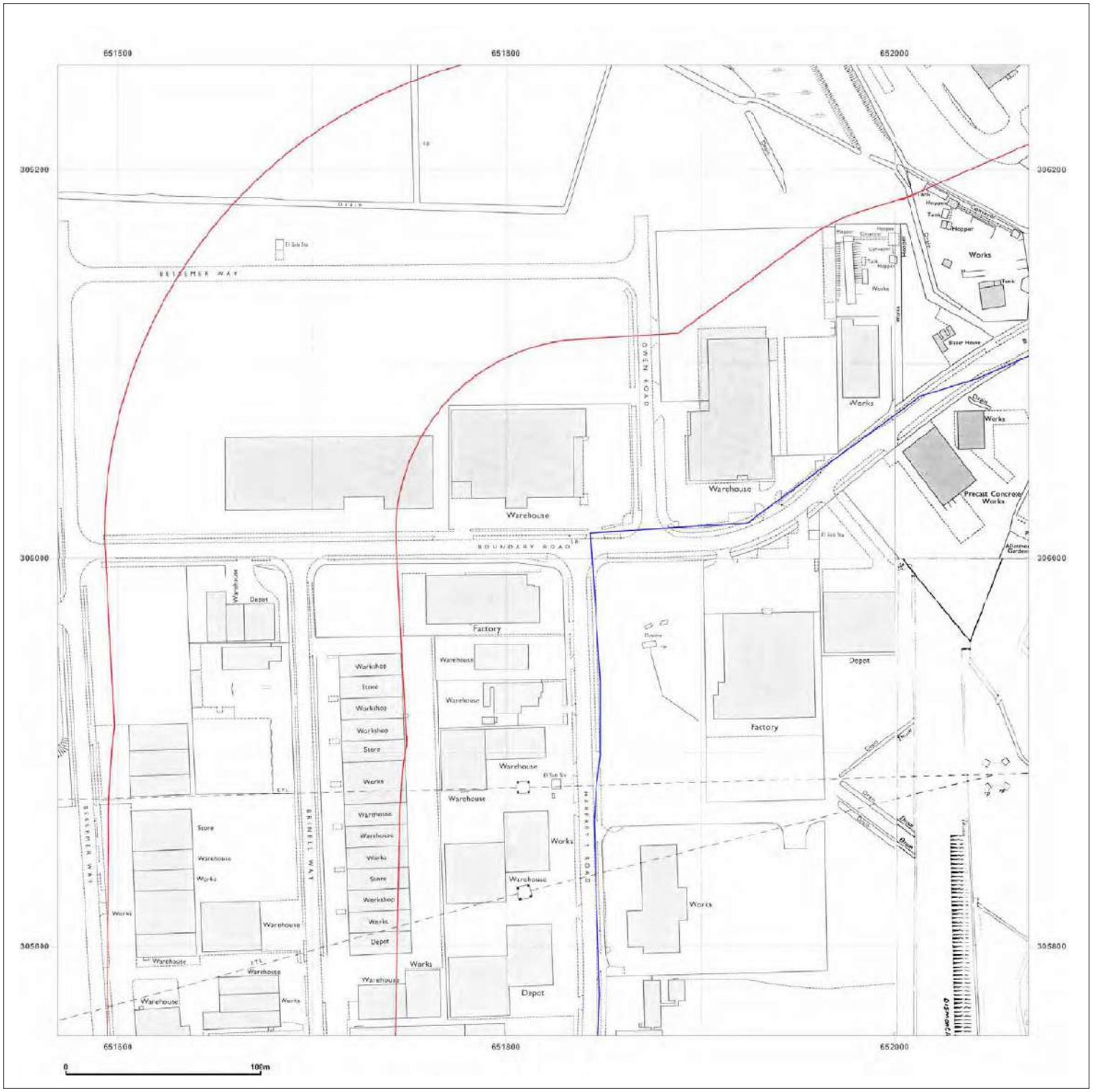

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Grid Ref: 651819, 306004

Map Name: National Grid
Map date: 1975-1978
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Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306004

Map Name: National Grid
Map date: 1976-1980
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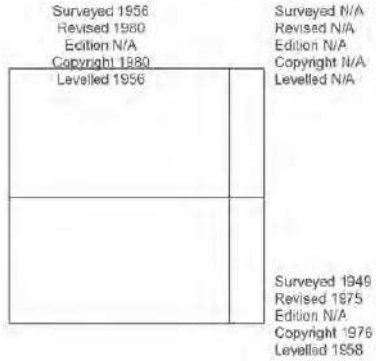

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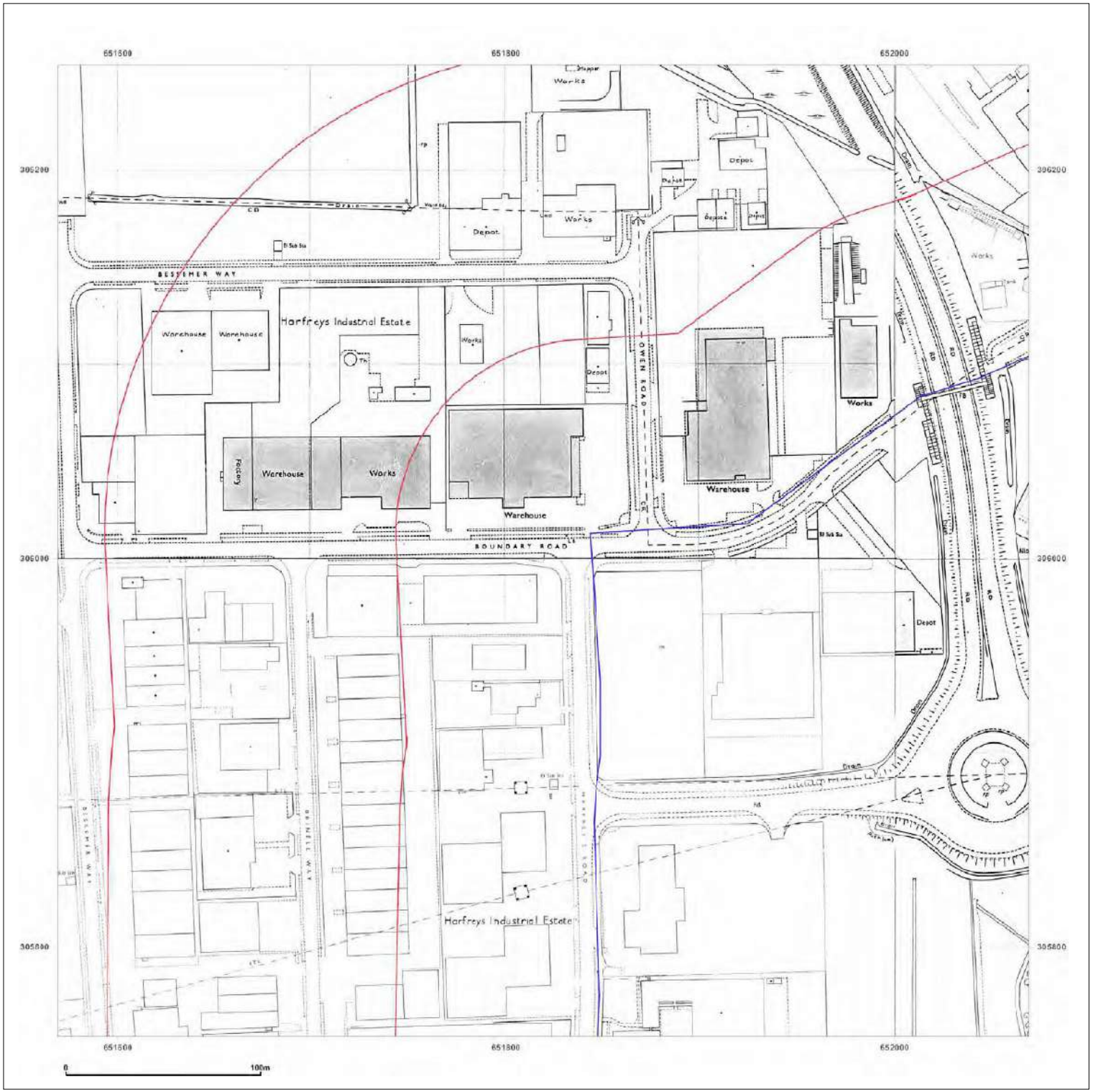

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Grid Ref: 651819, 306004

Map Name: National Grid
Map date: 1985-1990
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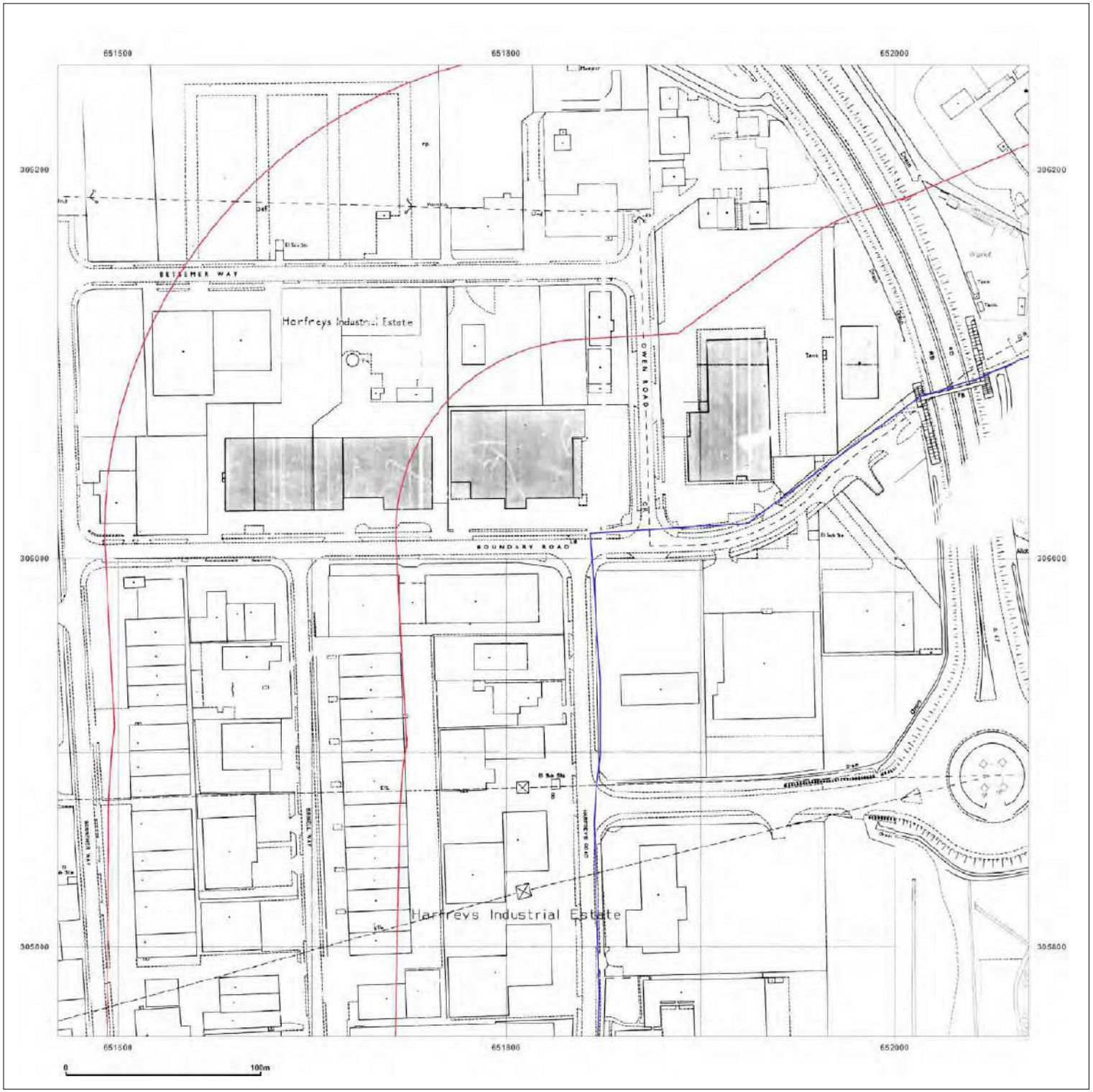

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Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306004

Map Name: National Grid
Map date: 1985-1994
Scale: 1:1,250
Printed at: 1:2,000

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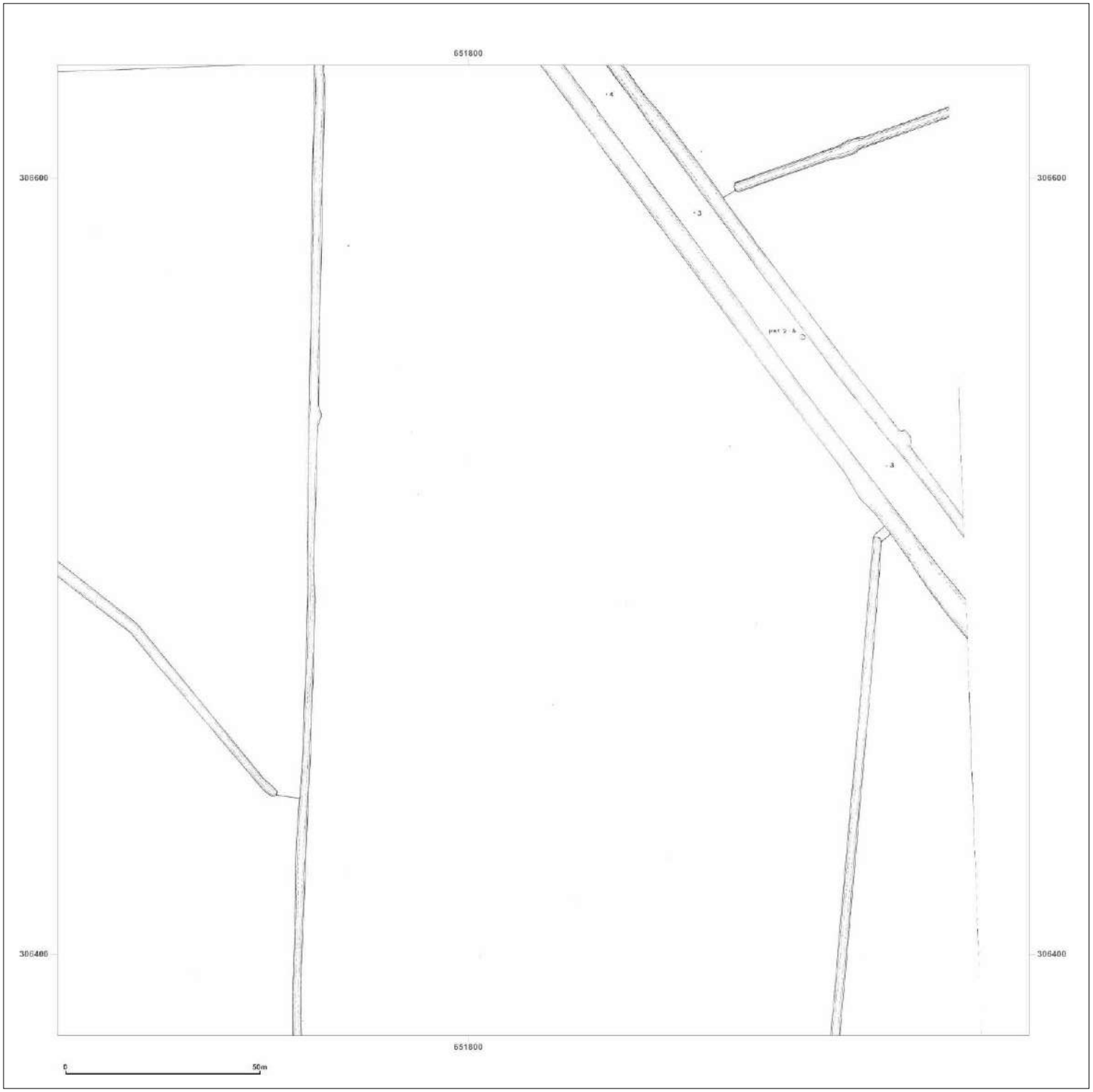

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

Map Name: County Series Town Plan
Map date: 1884-1885
Scale: 1:500
Printed at: 1:1,000

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Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1864
Revised N/A
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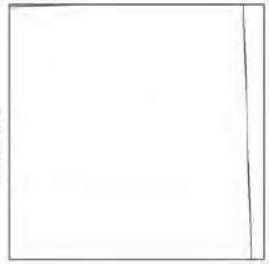

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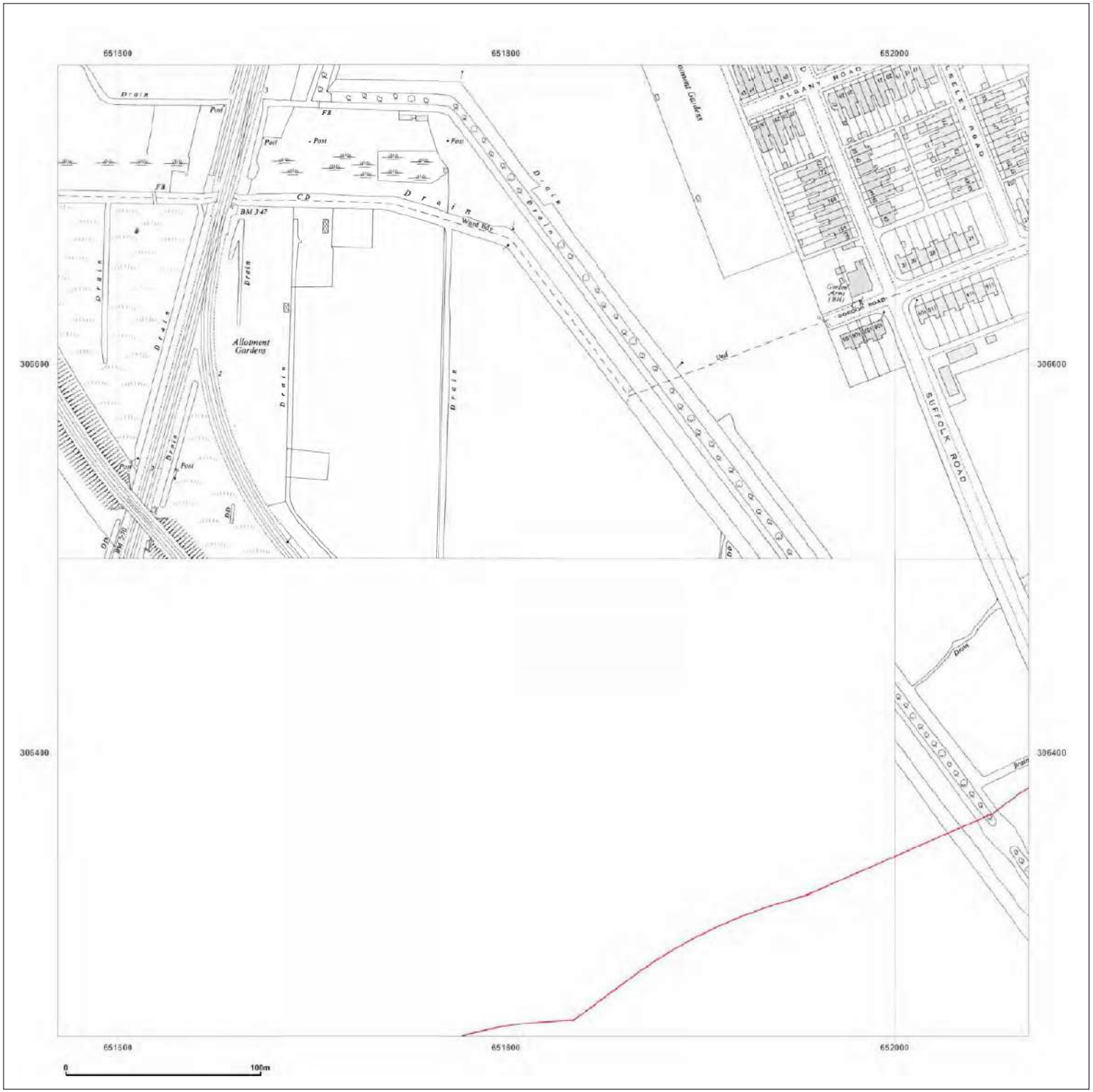

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Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1949
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
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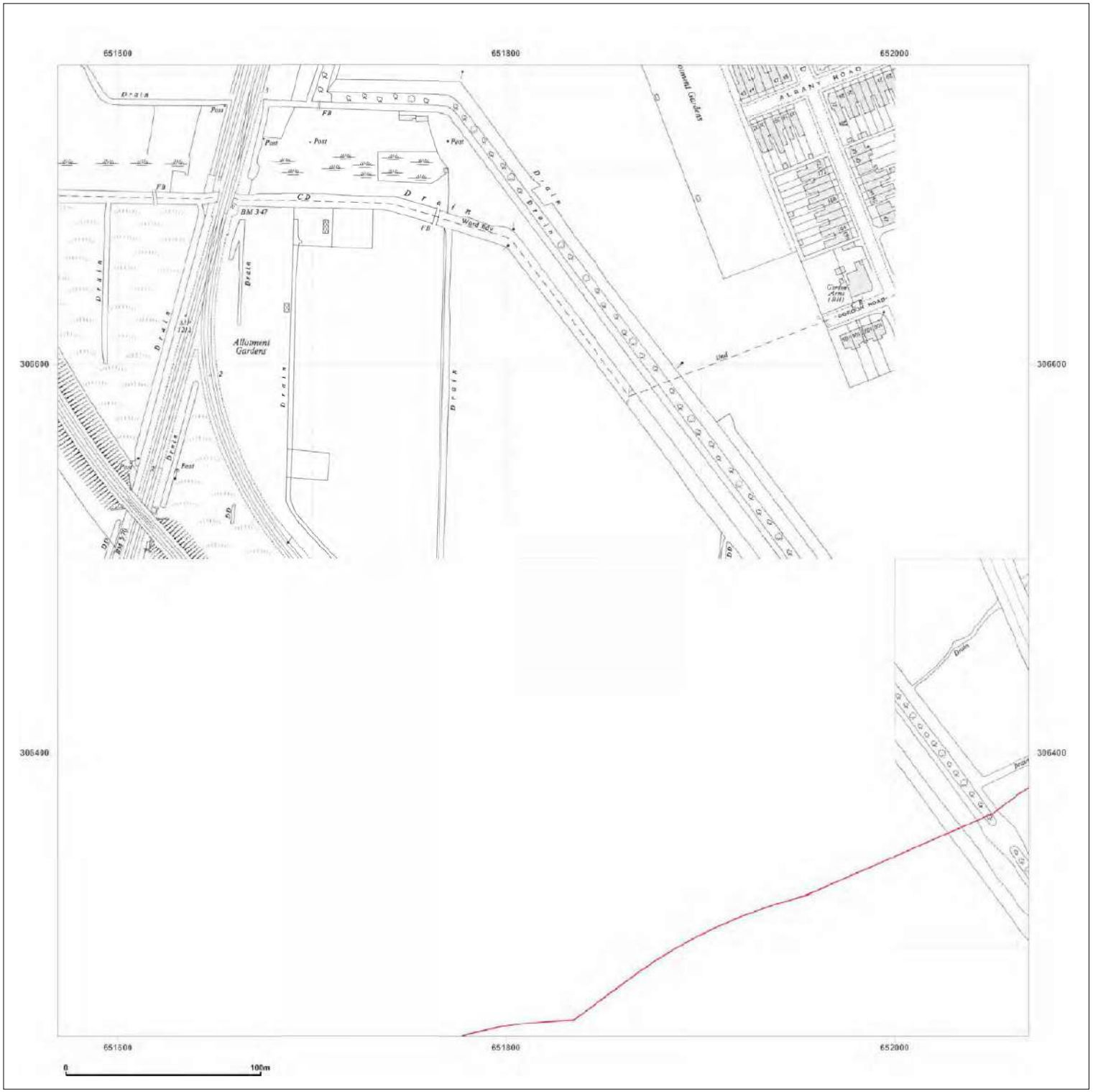

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Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

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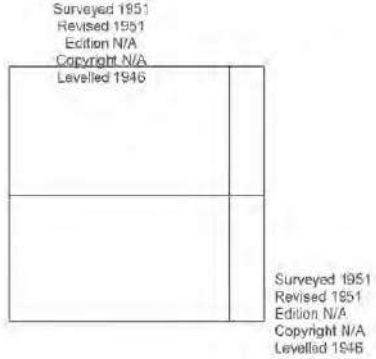

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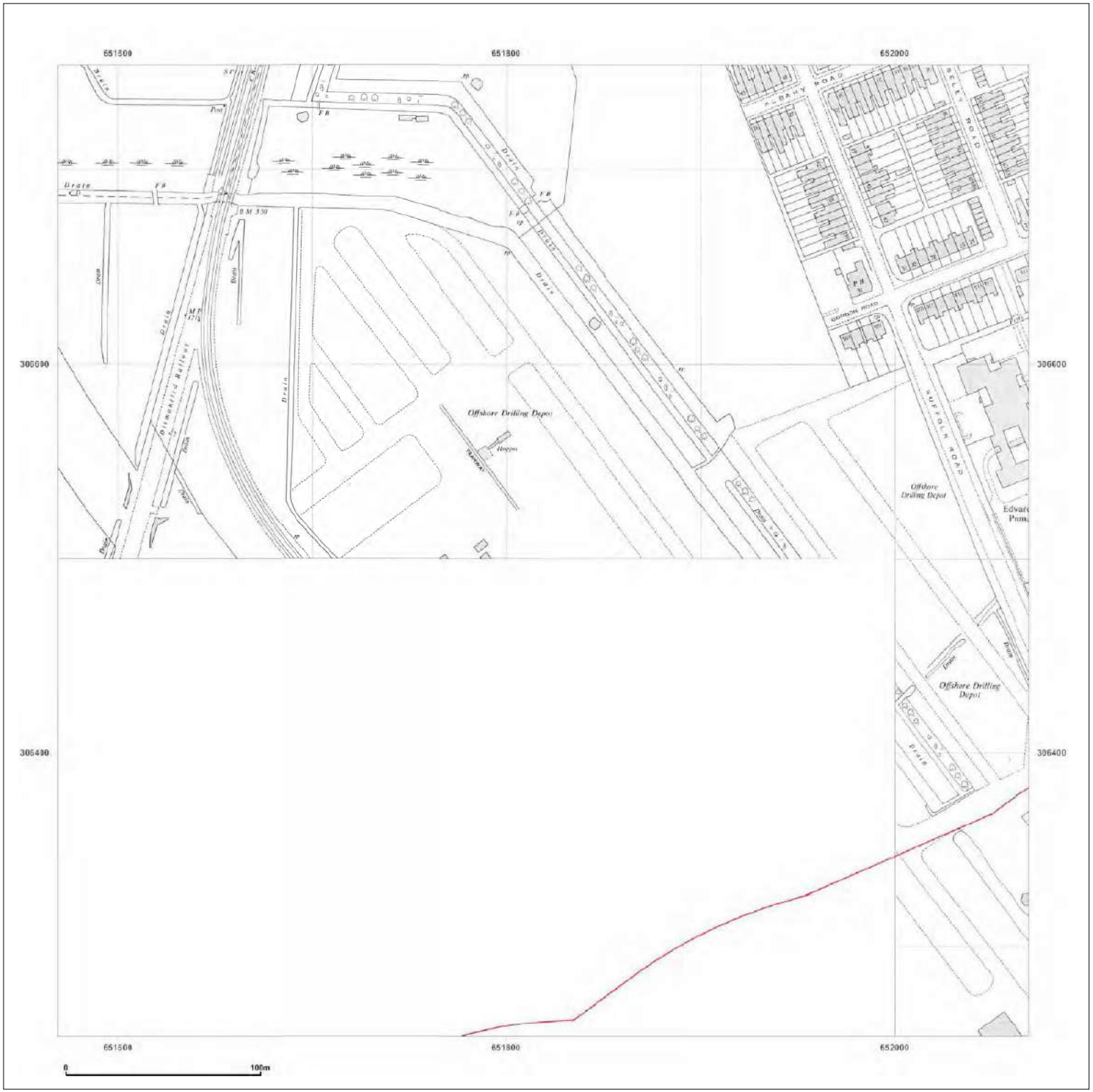

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Site Details:

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Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1968
Scale: 1:1,250
Printed at: 1:2,000

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Revised 1967
Edition N/A
Copyright 1968
Levelled 1958

Surveyed 1967
Revised 1967
Edition N/A
Copyright 1968
Levelled 1958

Surveyed 1949
Revised 1967
Edition N/A
Copyright 1968
Levelled 1958

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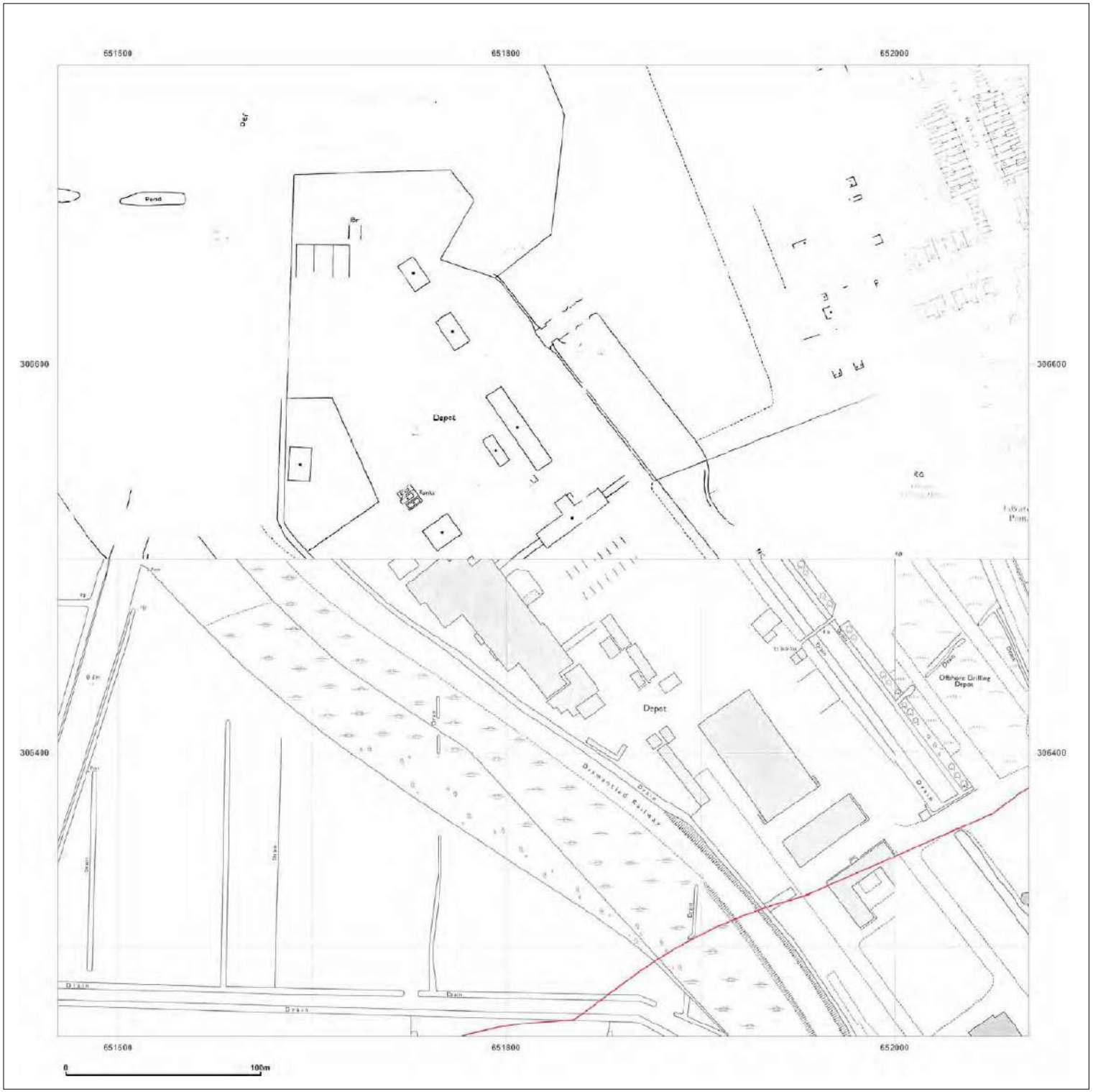

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1975-1978
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1978
Revised 1978
Edition N/A
Copyright 1978
Levelled 1958

Surveyed 1949
Revised 1975
Edition N/A
Copyright 1975
Levelled 1958

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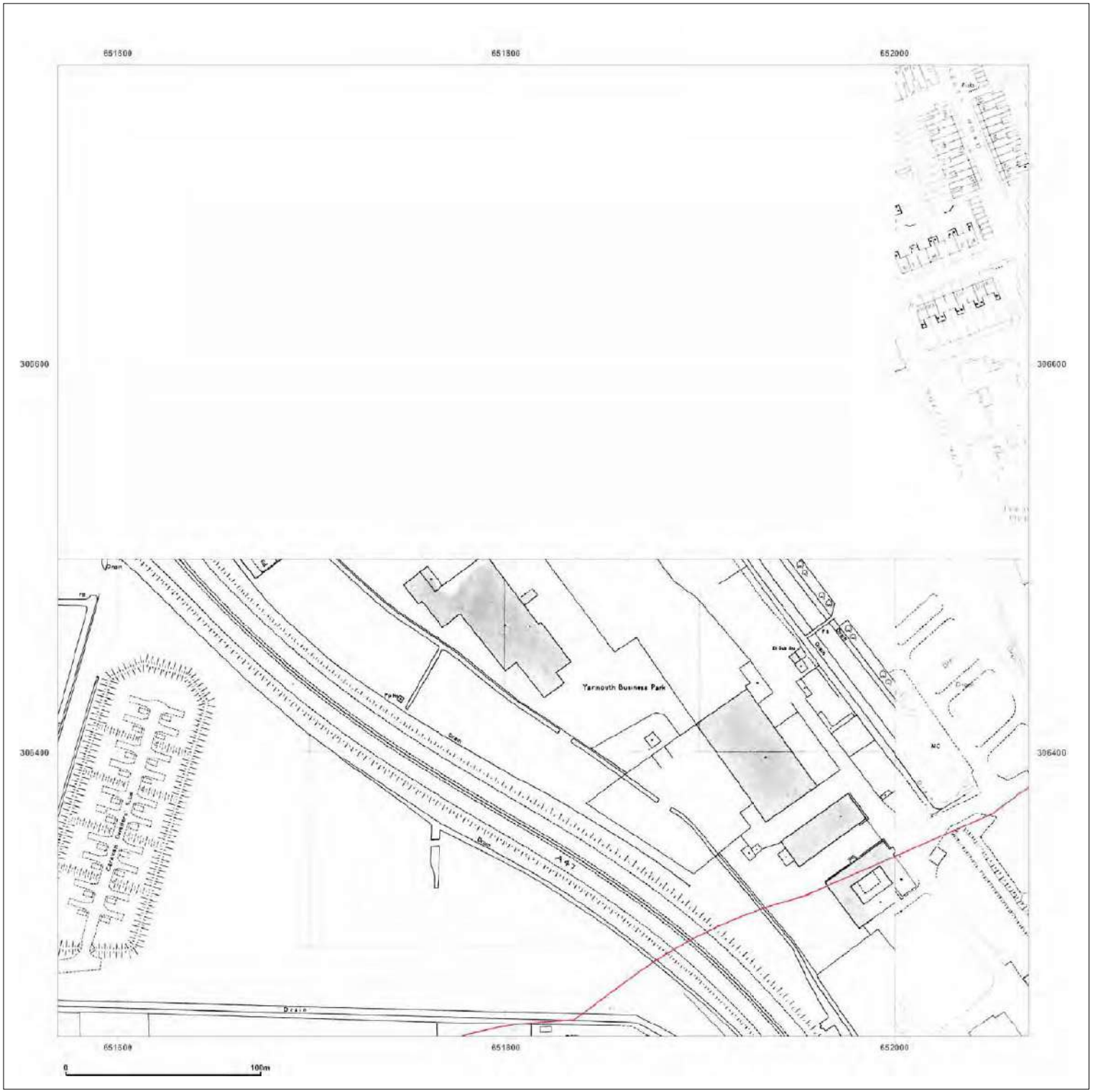

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1978-1980
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1956
Revised 1980
Edition N/A
Copyright 1980
Levelled 1956

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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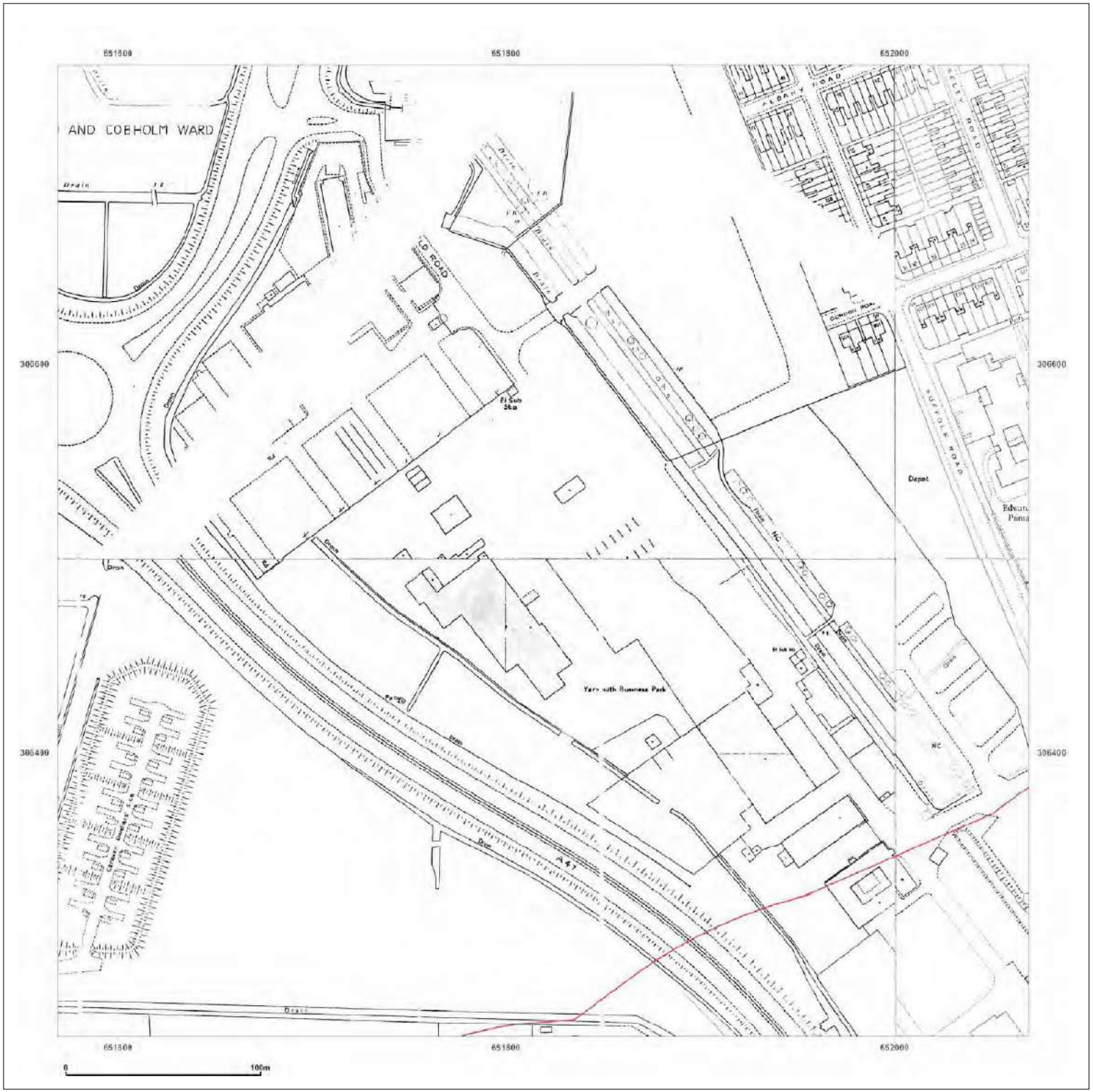

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1986-1990
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1958 Revised 1987 Edition N/A Copyright 1987 Levelled 1958	Surveyed 1956 Revised 1987 Edition N/A Copyright 1987 Levelled 1956
Surveyed N/A Revised N/A Edition N/A Copyright N/A Levelled N/A	Surveyed 1958 Revised 1986 Edition N/A Copyright 1986 Levelled 1958

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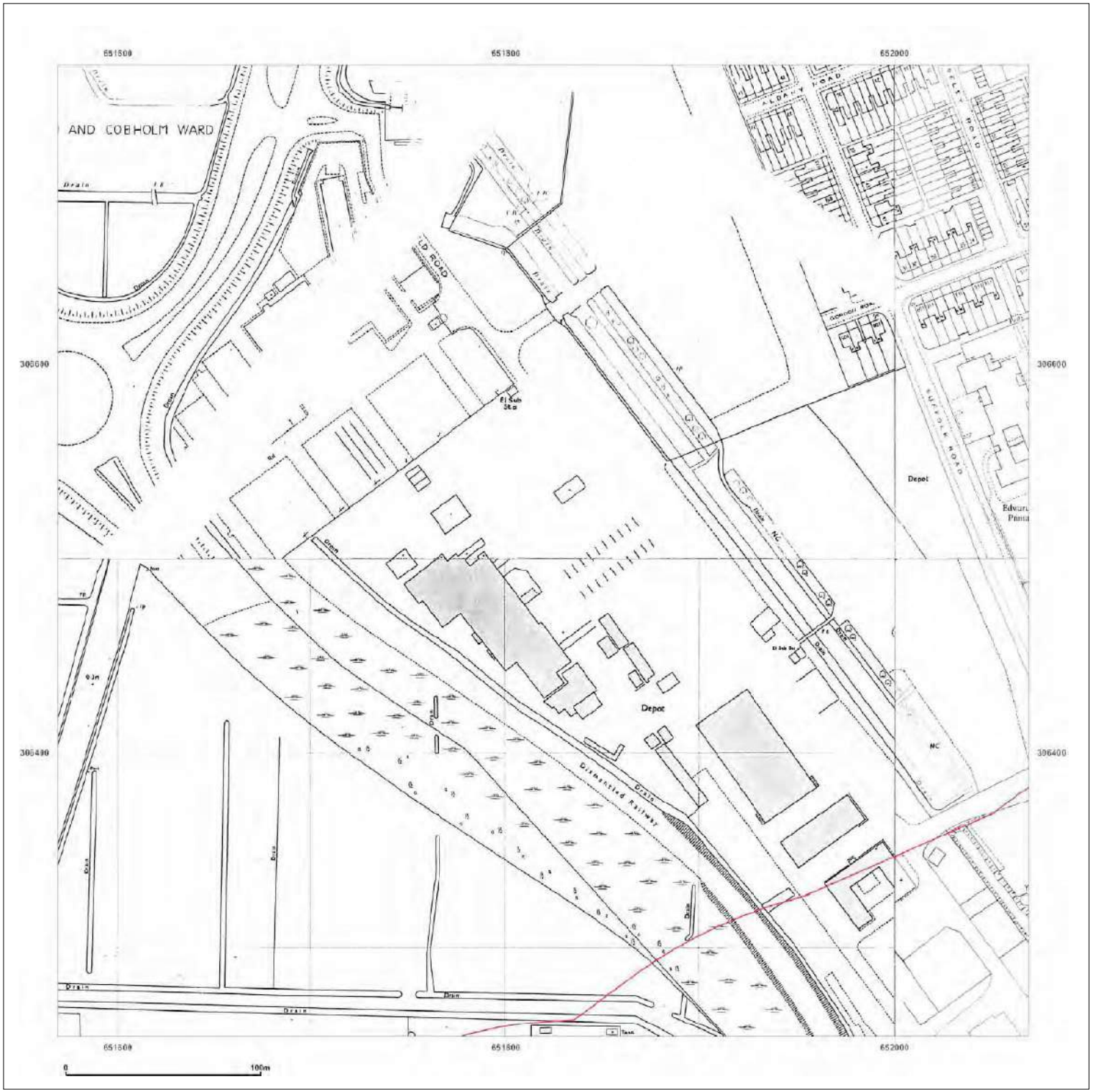

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1985-1990
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1958 Revised 1987 Edition N/A Copyright 1987 Levelled 1958	Surveyed 1958 Revised 1987 Edition N/A Copyright 1987 Levelled 1958
Surveyed 1958 Revised 1985 Edition N/A Copyright 1985 Levelled 1958	Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958

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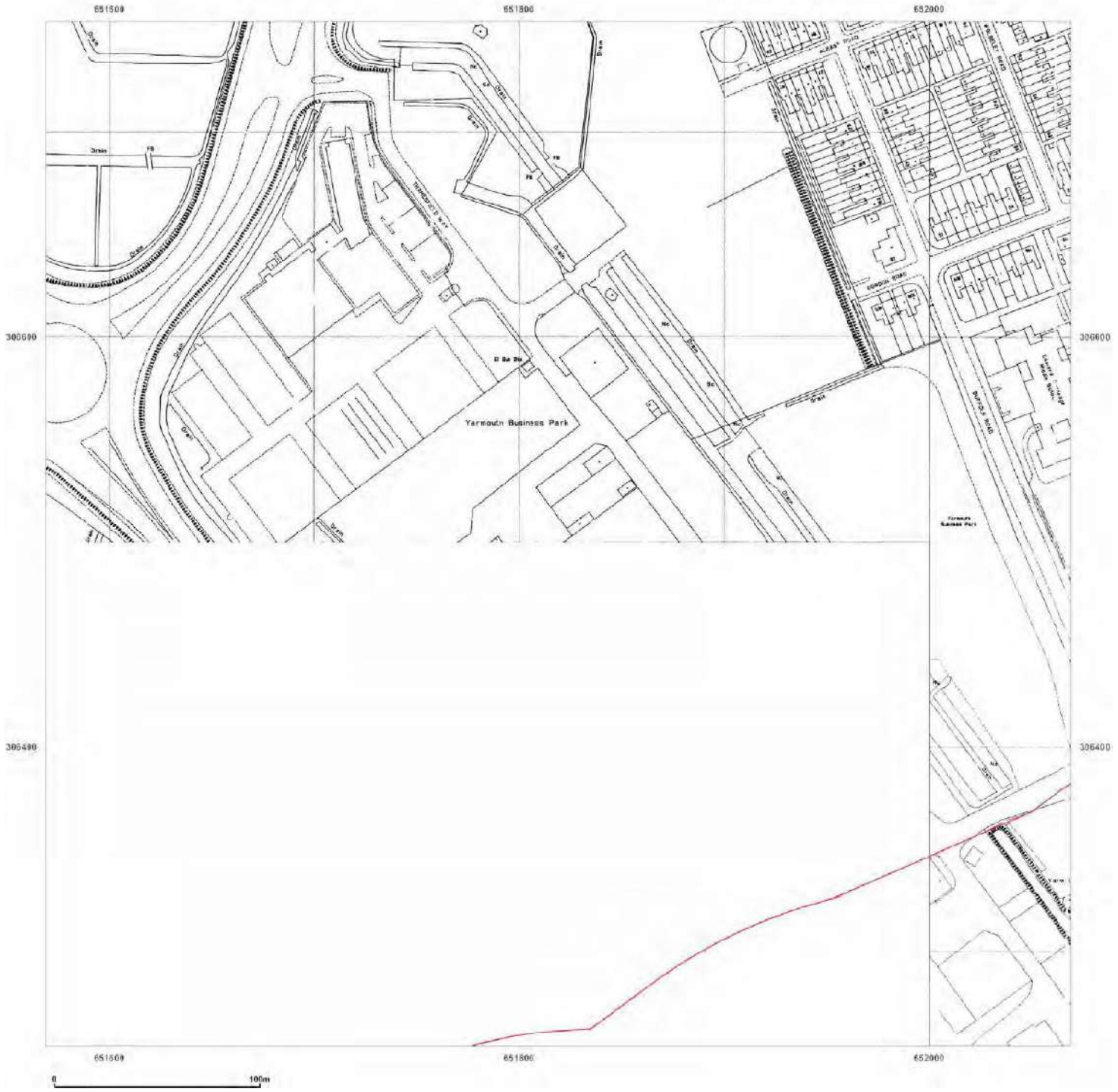

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1994
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

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Revised N/A
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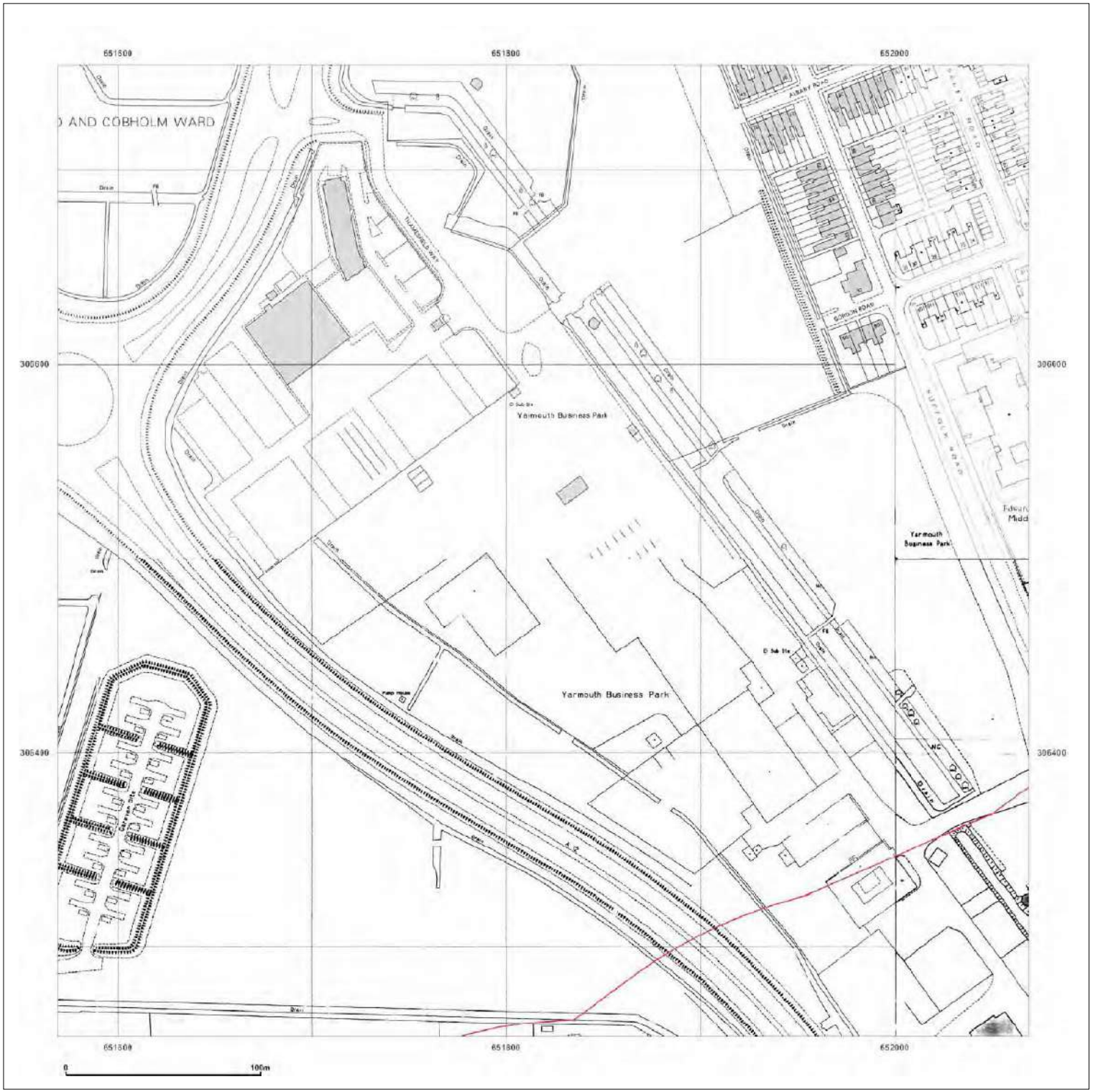

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 651819, 306504

Map Name: National Grid
Map date: 1989-1994
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1959 Revised 1988 Edition N/A Copyright 1989 Levelled N/A	Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958
Surveyed N/A Revised N/A Edition N/A Copyright 1994 Levelled N/A	Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: County Series Town Plan
Map date: 1885
Scale: 1:500
Printed at: 1:1,000

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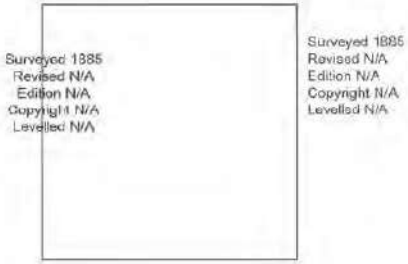

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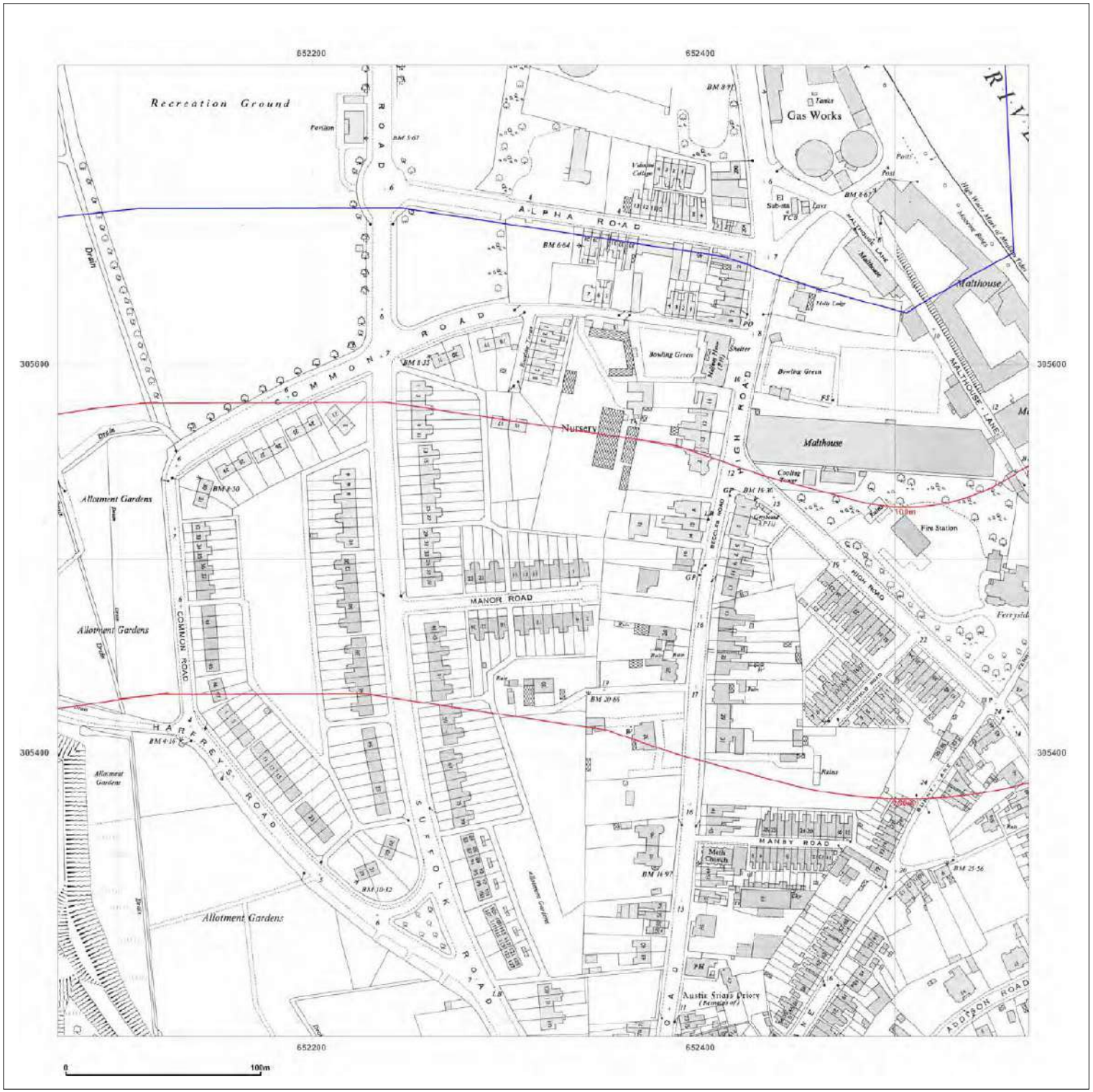

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1949
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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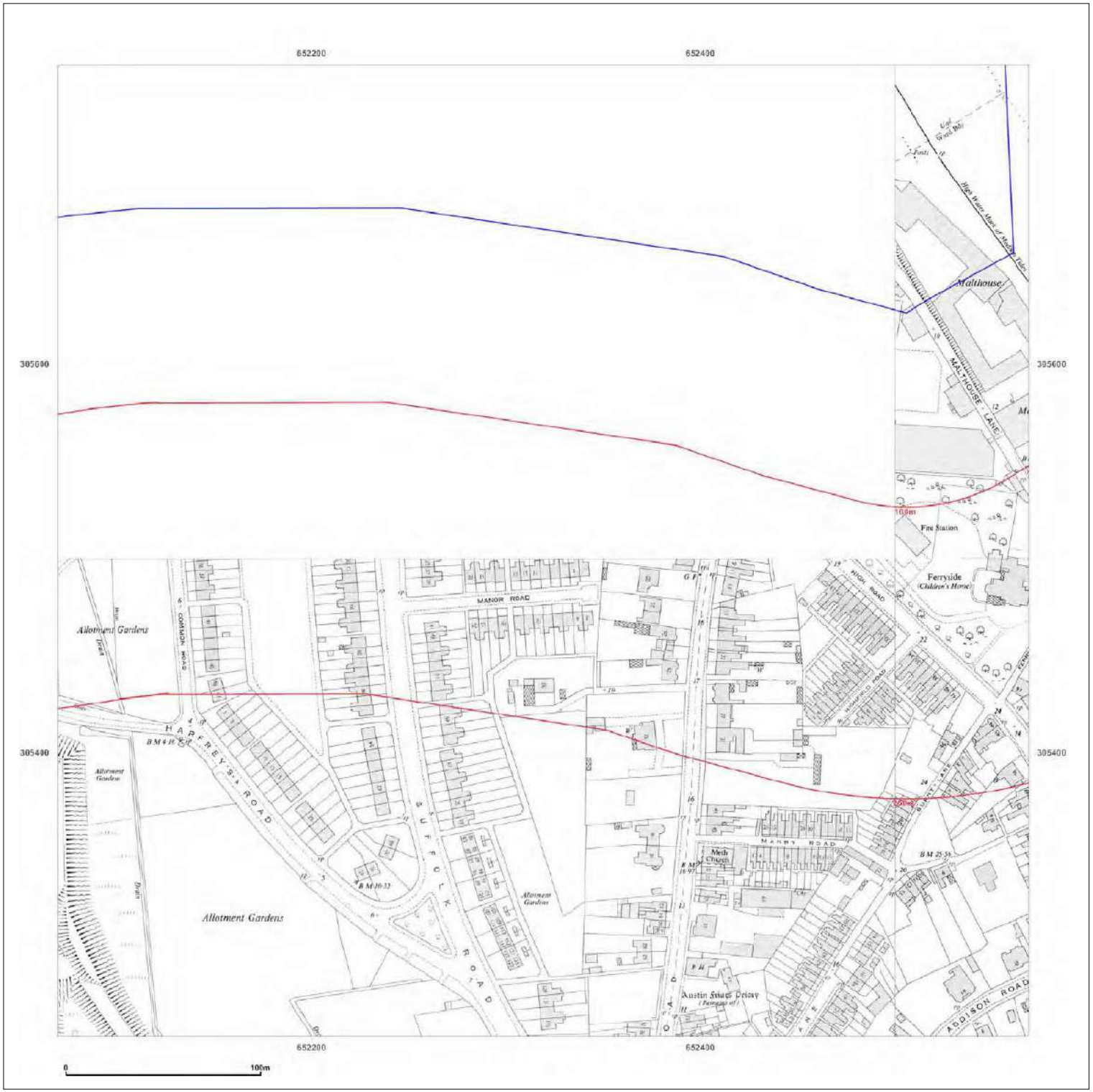

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1953-1957
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949
Revised 1957
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1953
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1957
Edition N/A
Copyright N/A
Levelled 1946

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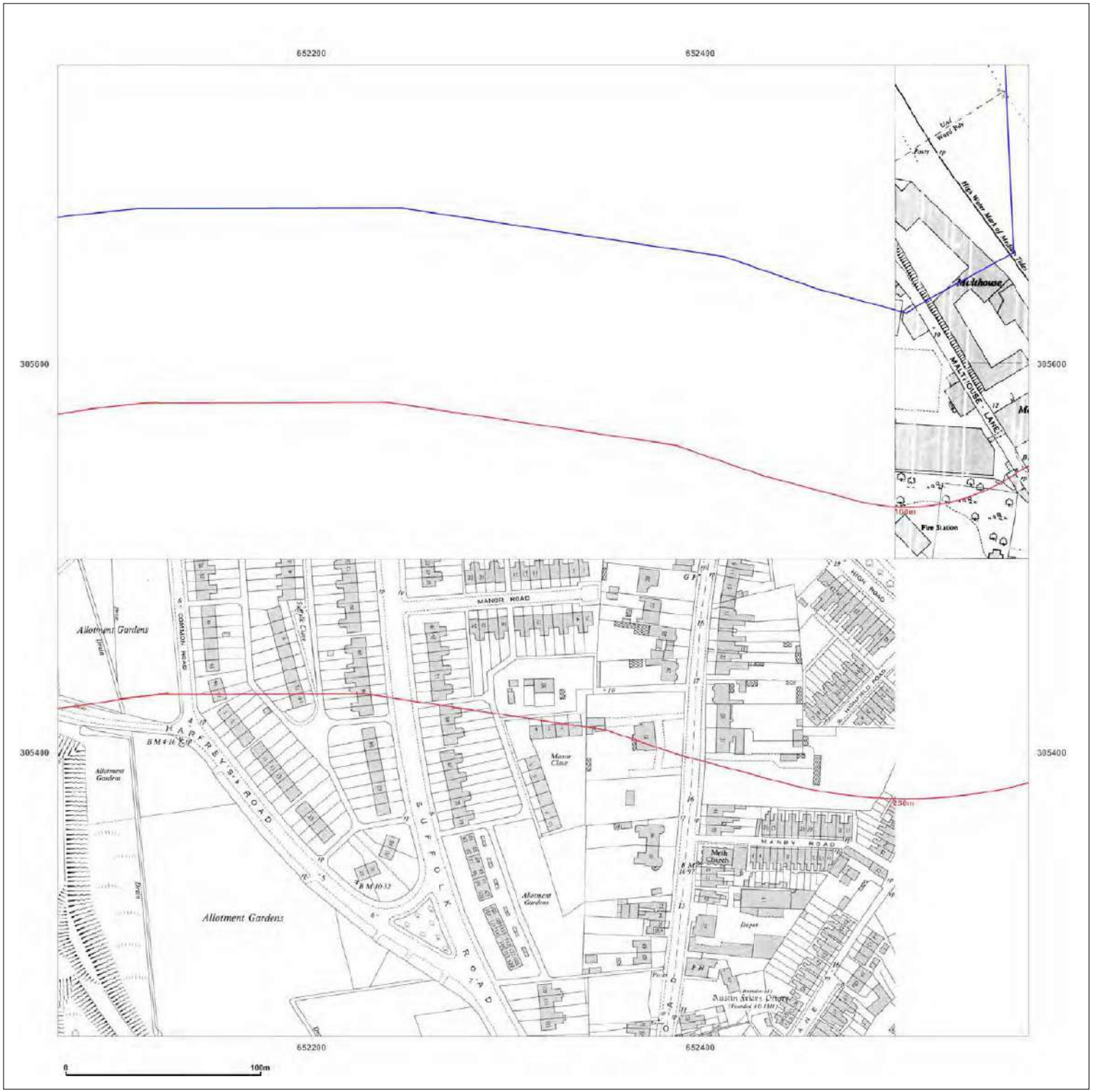

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1958
Scale: 1:1,250
Printed at: 1:2,000

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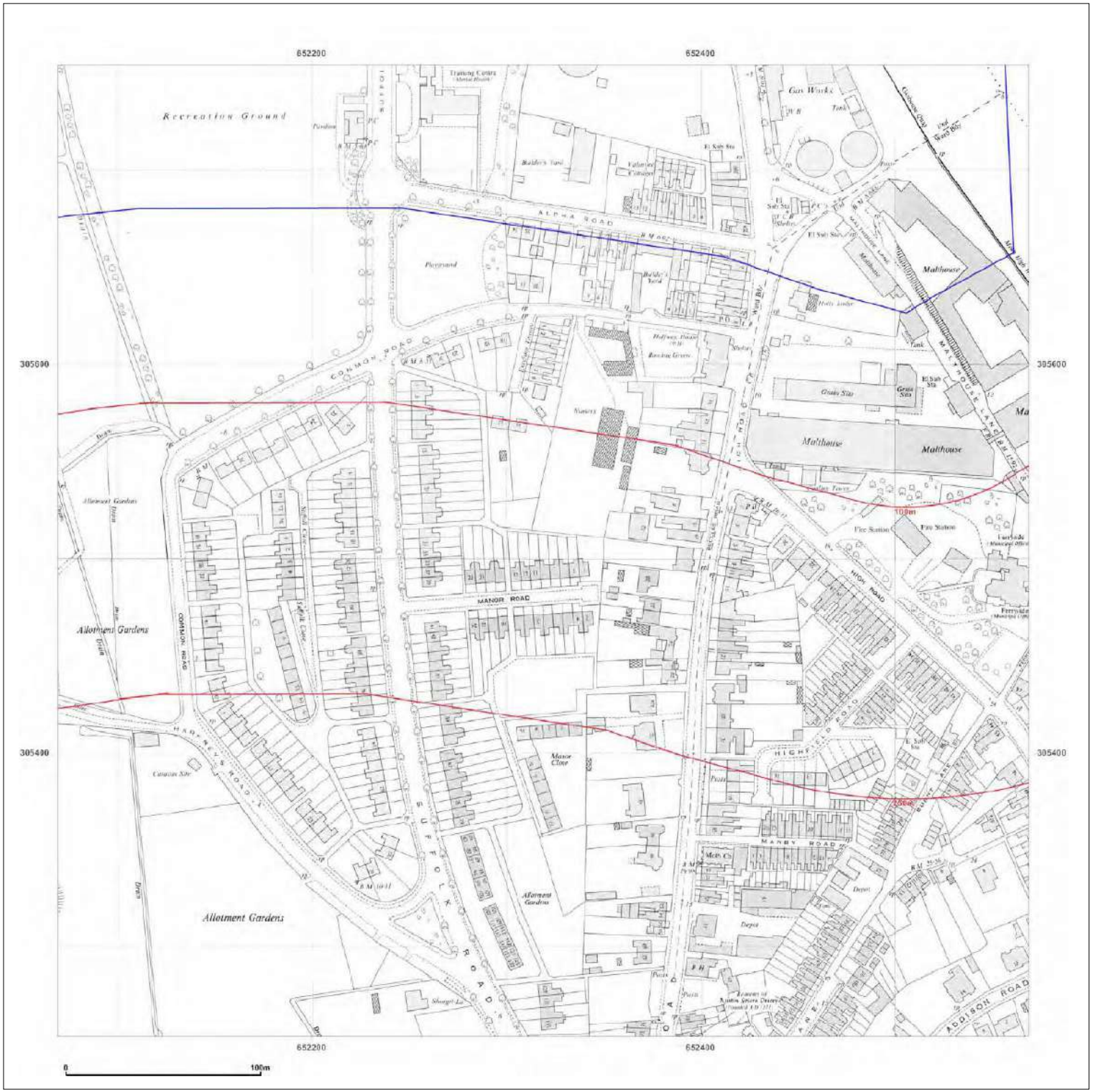

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1967-1968
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949 Revised 1966 Edition N/A Copyright 1967 Levelled 1958	Surveyed 1949 Revised 1967 Edition N/A Copyright 1968 Levelled 1958
Surveyed 1967 Revised 1967 Edition N/A Copyright 1968 Levelled 1958	Surveyed 1949 Revised 1966 Edition N/A Copyright 1967 Levelled 1958

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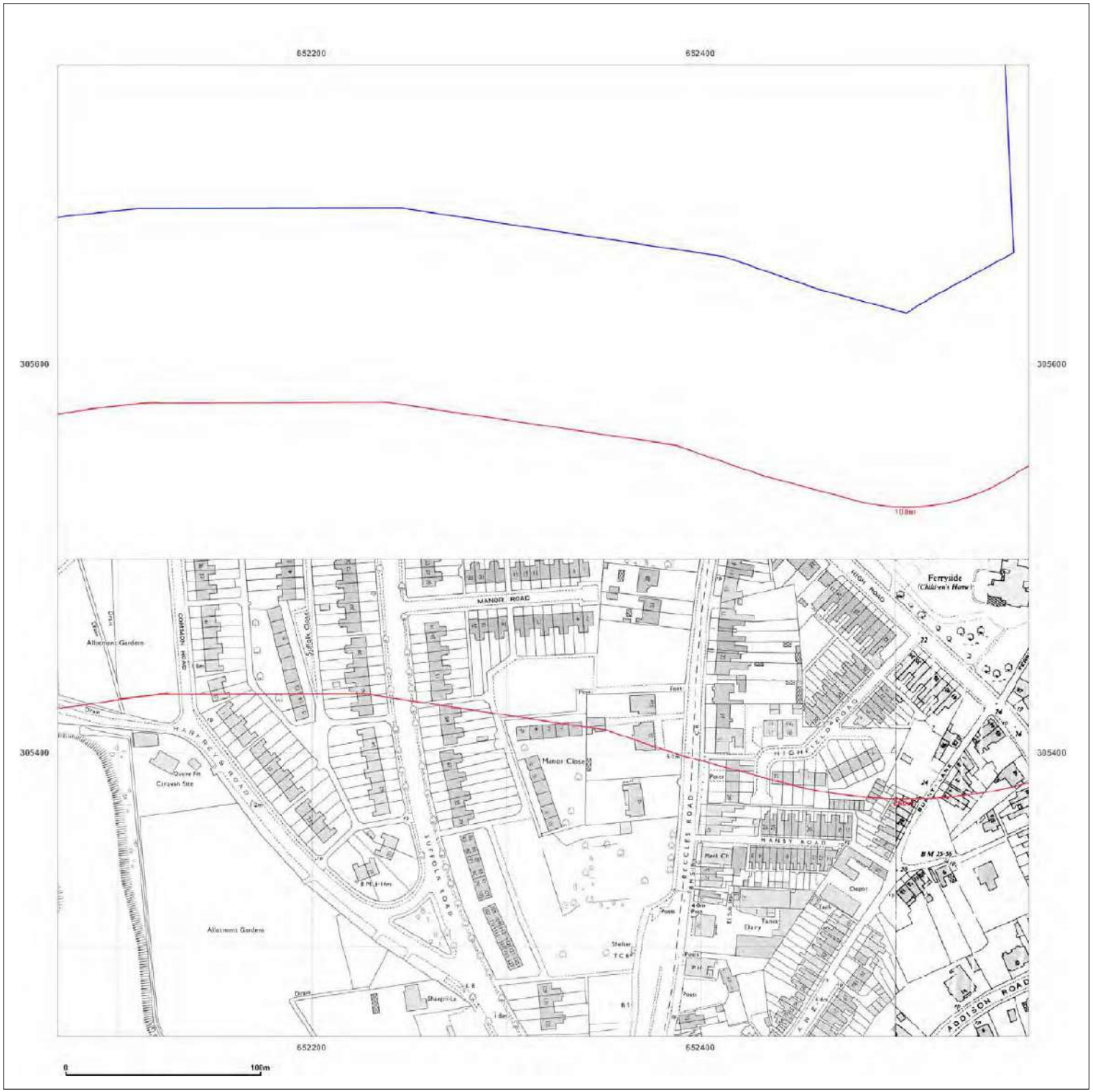

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1968-1972
Scale: 1:1,250
Printed at: 1:2,000

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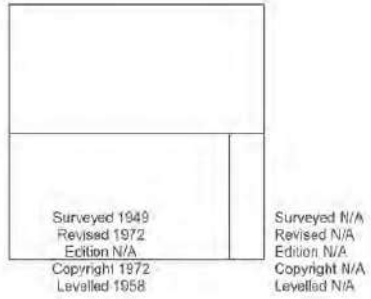

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1975-1977
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1949
Revised 1975
Edition N/A
Copyright 1976
Levelled 1958

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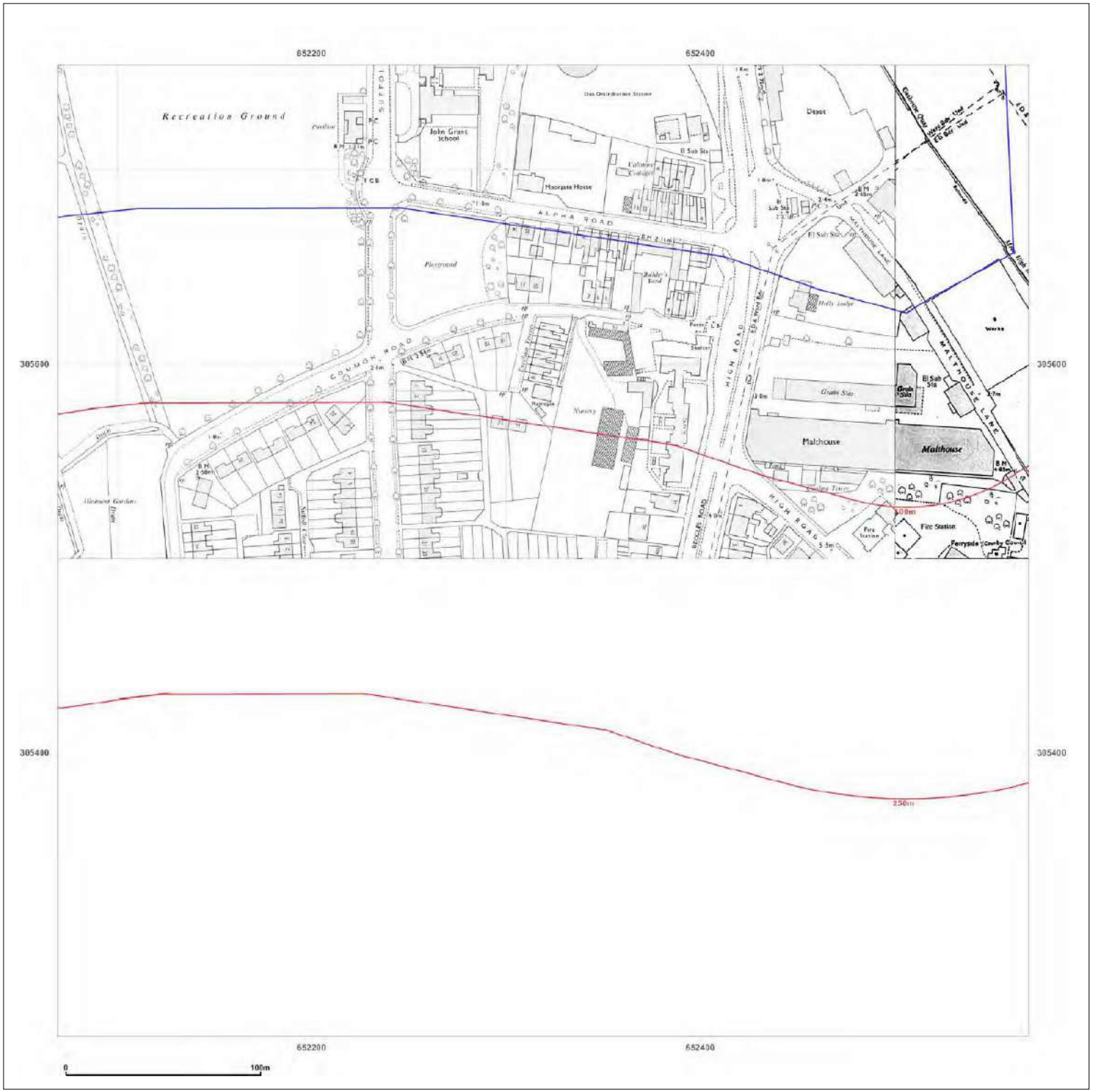

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1976-1981
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949 Revised 1975 Edition N/A Copyright 1976 Levelled 1958	Surveyed 1958 Revised 1981 Edition N/A Copyright 1981 Levelled 1958

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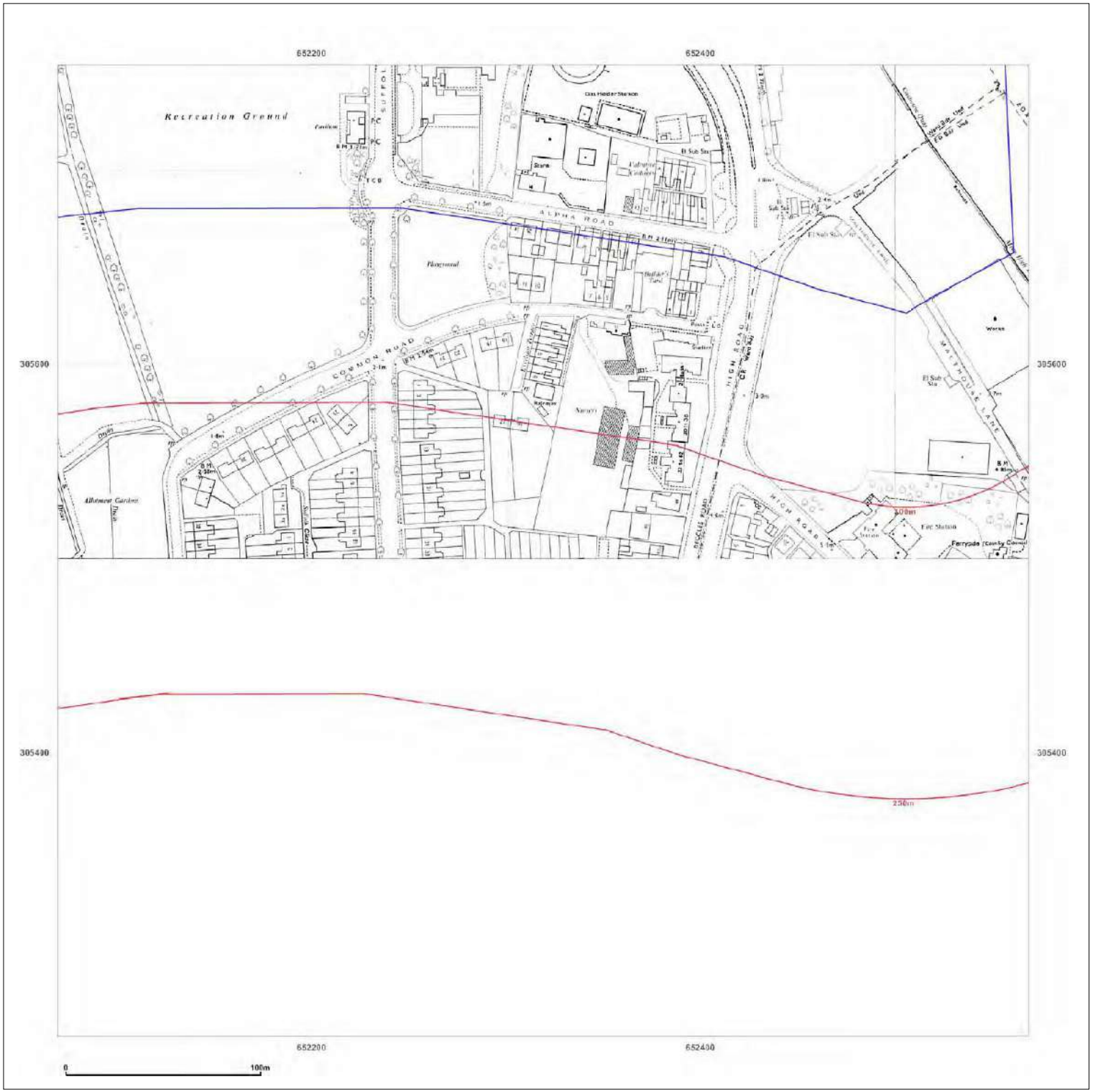

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1984-1986
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1958
Revised 1986
Edition N/A
Copyright 1986
Levelled 1958

Surveyed 1958
Revised 1984
Edition N/A
Copyright 1984
Levelled 1958

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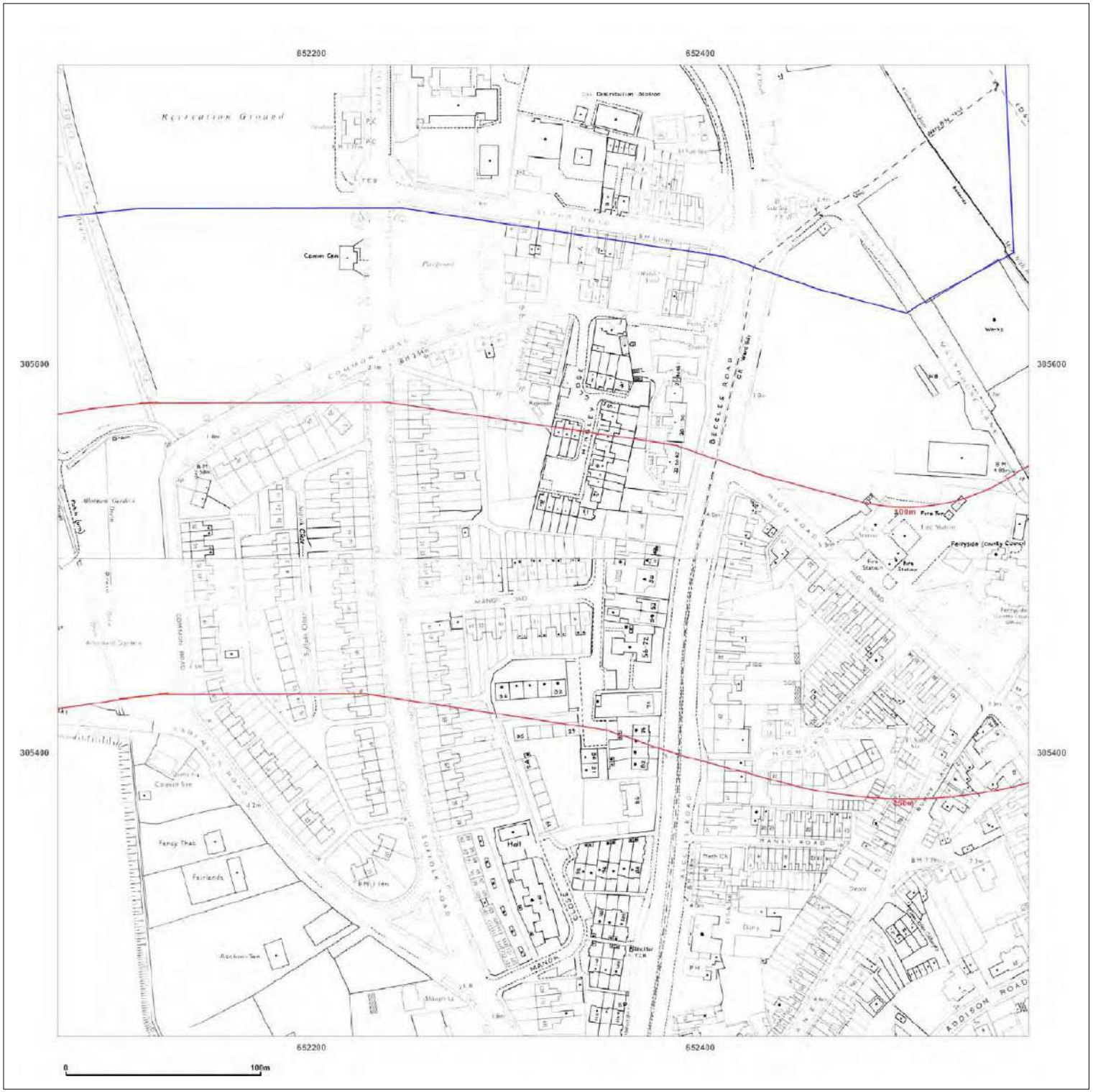

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1990
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1990
Levelled 1958

Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 305504

Map Name: National Grid
Map date: 1994
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: County Series Town Plan
Map date: 1885
Scale: 1:500
Printed at: 1:1,000

N
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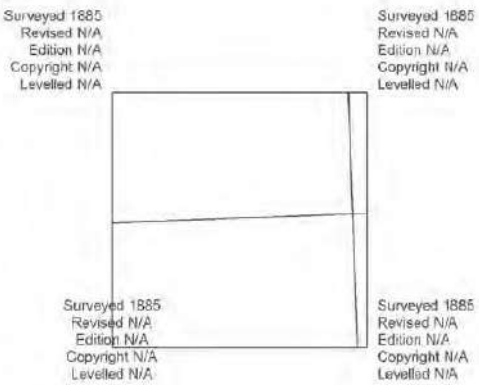

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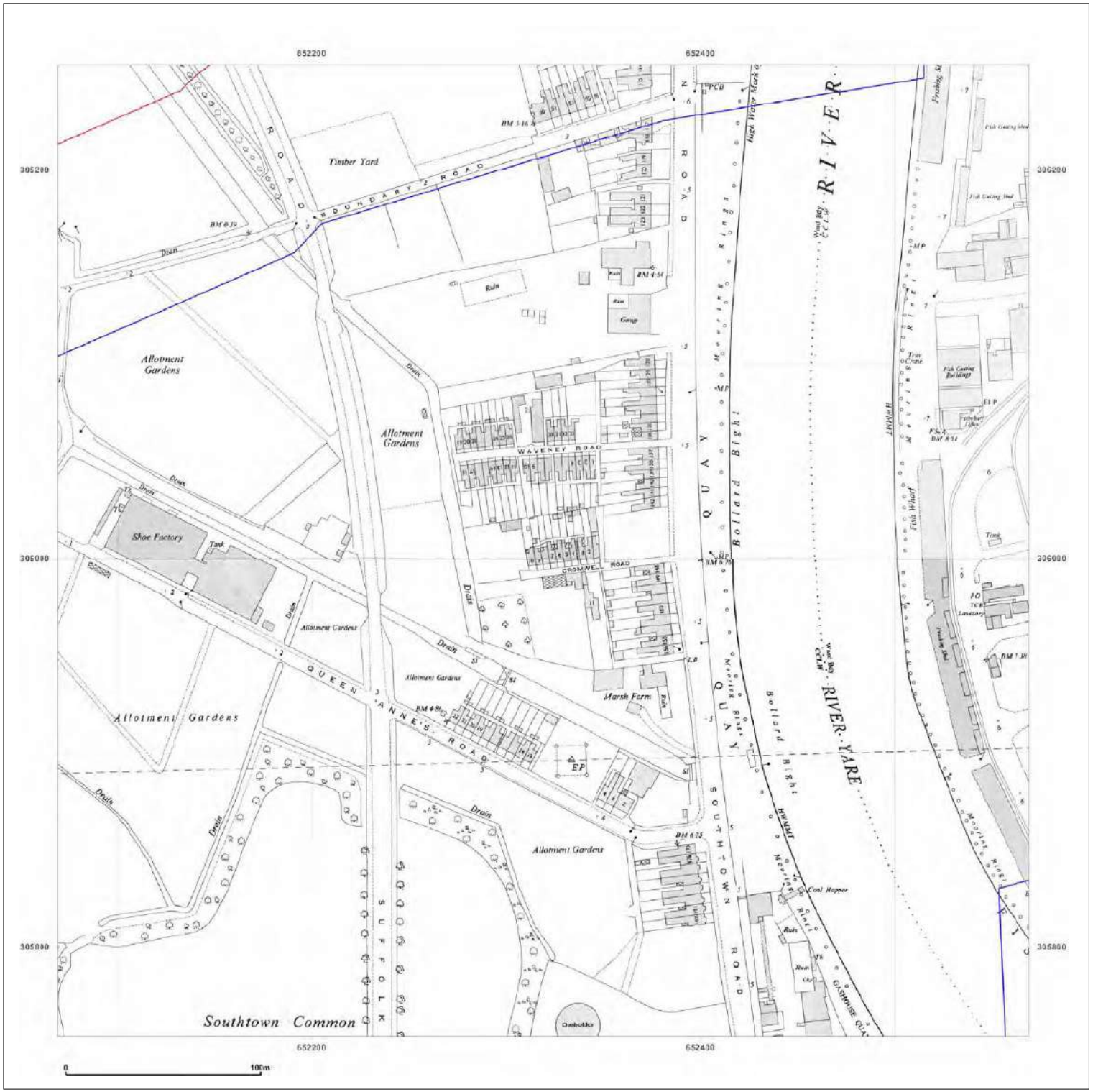

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1949
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946	Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946
Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946	Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946

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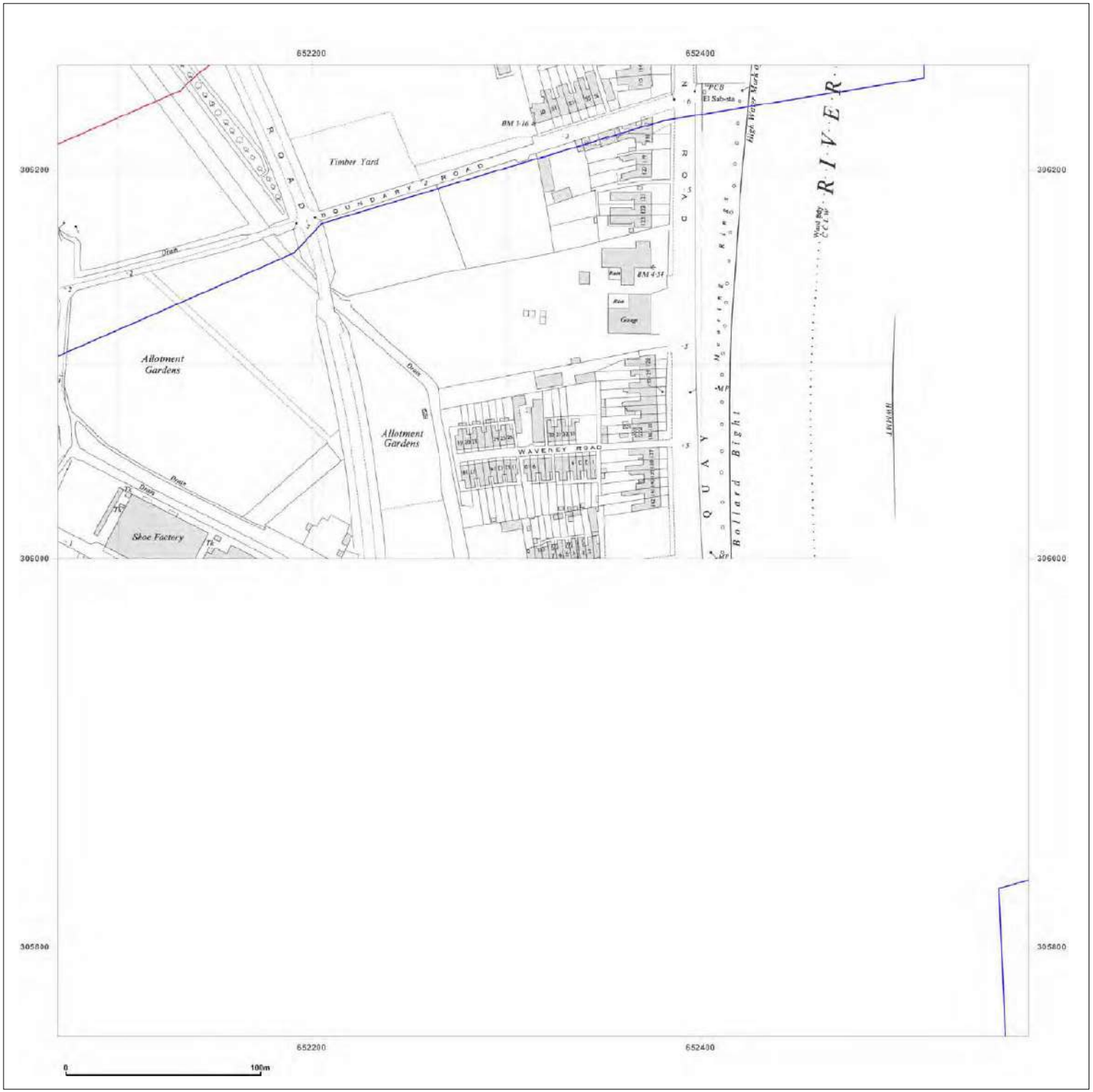

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1951
Scale: 1:1,250
Printed at: 1:2,000

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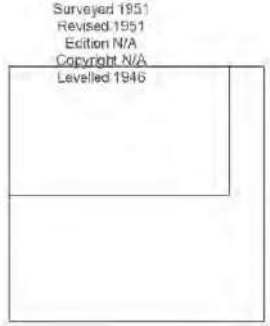

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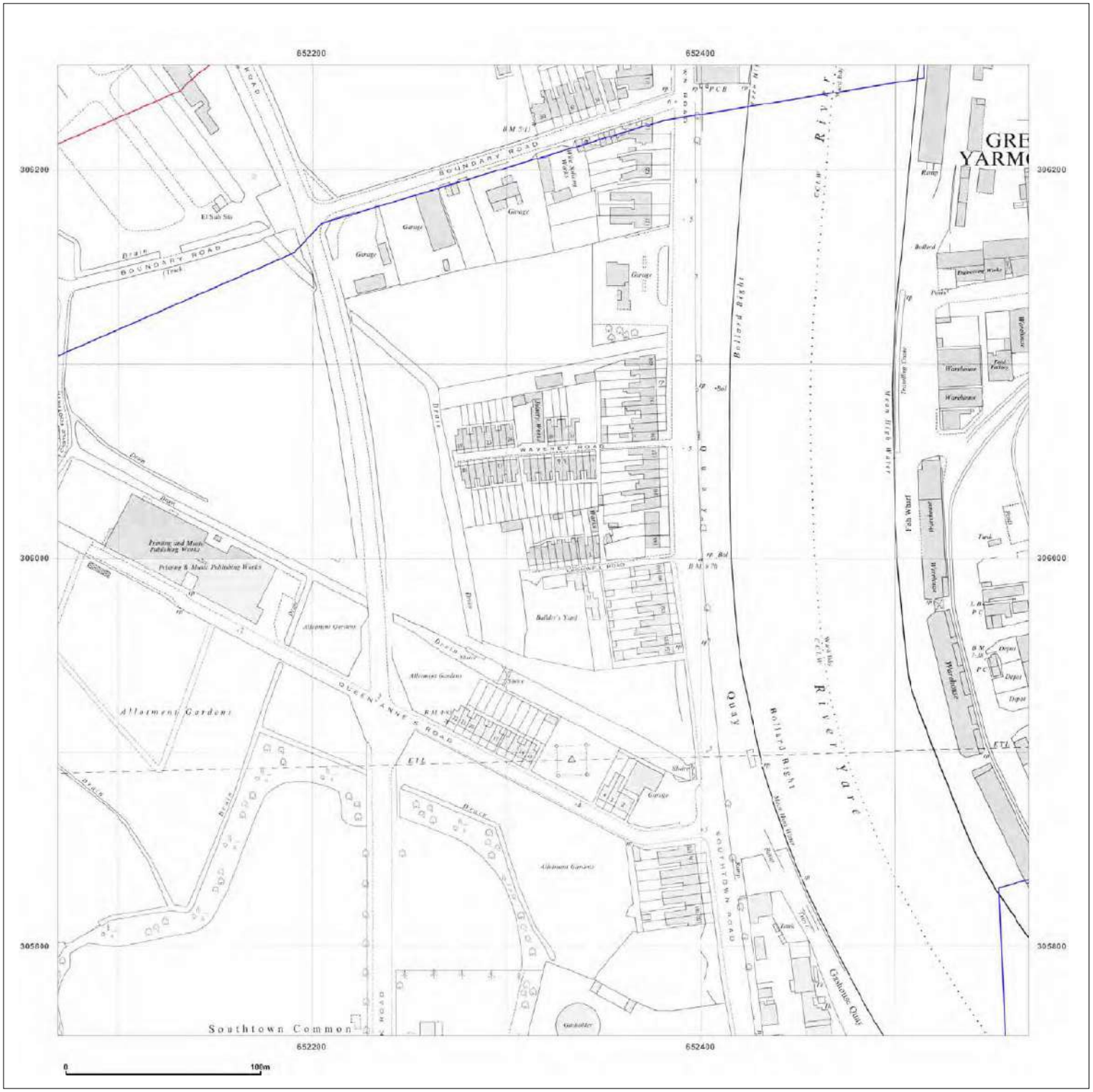

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1966-1968
Scale: 1:1,250
Printed at: 1:2,000

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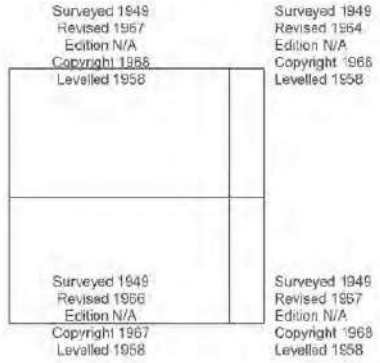

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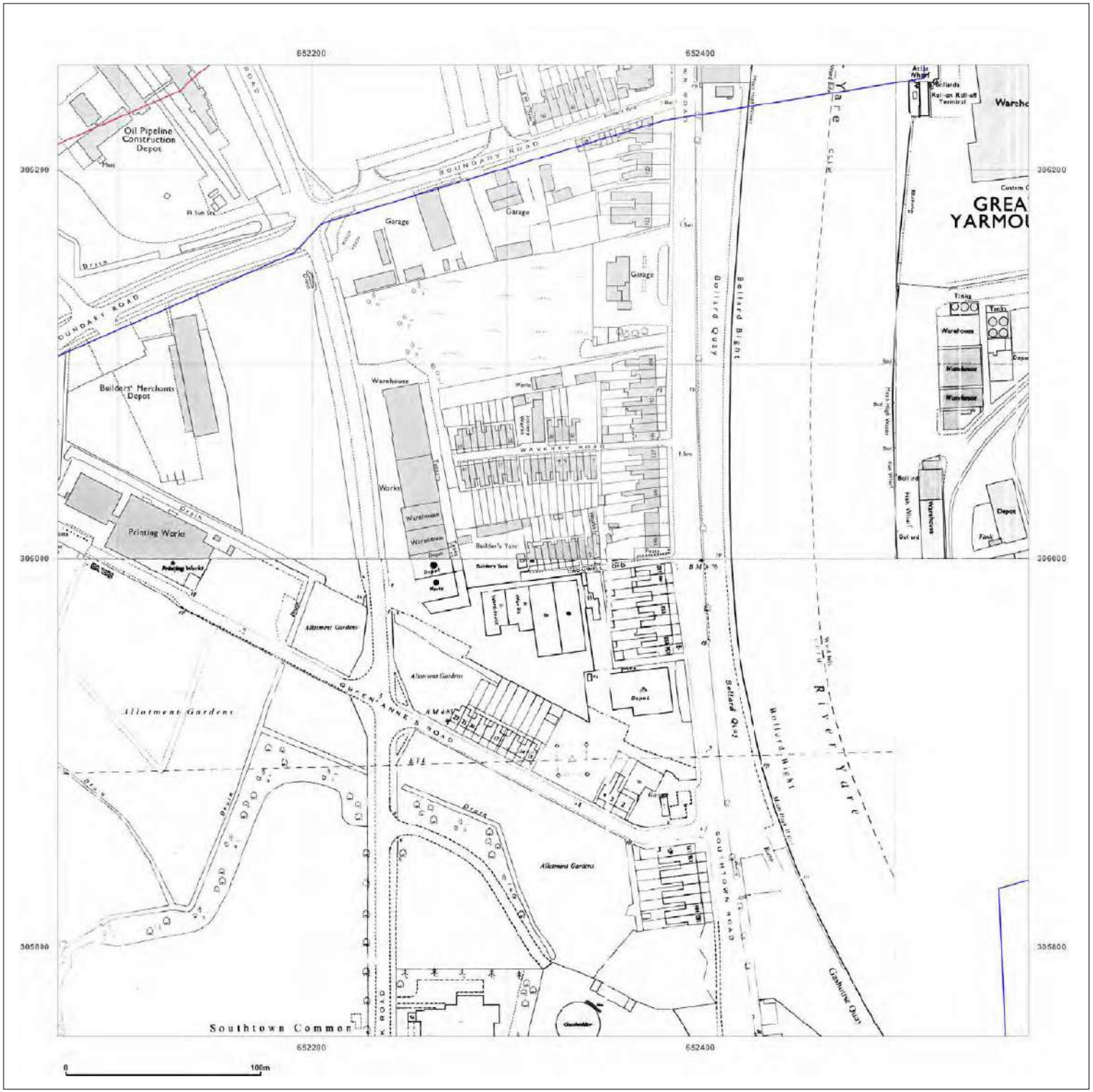

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1970-1975
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949 Revised 1975 Edition N/A Copyright 1975 Levelled 1958	Surveyed N/A Revised N/A Edition N/A Copyright N/A Levelled N/A
Surveyed N/A Revised N/A Edition N/A Copyright N/A Levelled N/A	

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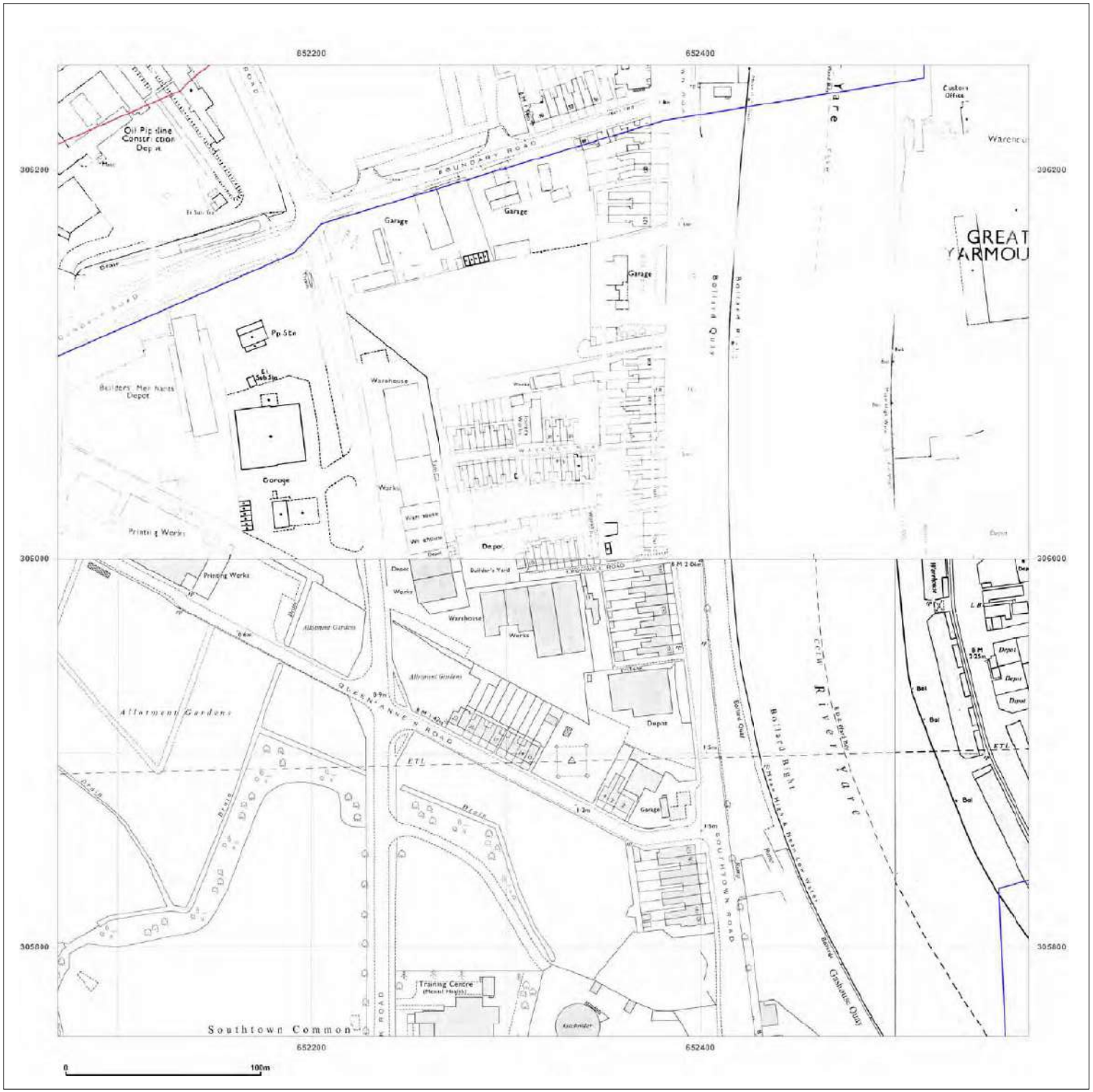

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1976-1981
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1949
Revised 1975
Edition N/A
Copyright 1976
Levelled 1958

Surveyed 1958
Revised 1981
Edition N/A
Copyright 1981
Levelled 1958

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1984-1986
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1958 Revised 1986 Edition N/A Copyright 1986 Levelled 1958	Surveyed N/A Revised N/A Edition N/A Copyright 1984 Levelled 1958
Surveyed 1958 Revised 1986 Edition N/A Copyright 1986 Levelled 1958	Surveyed 1958 Revised 1984 Edition N/A Copyright 1984 Levelled 1958

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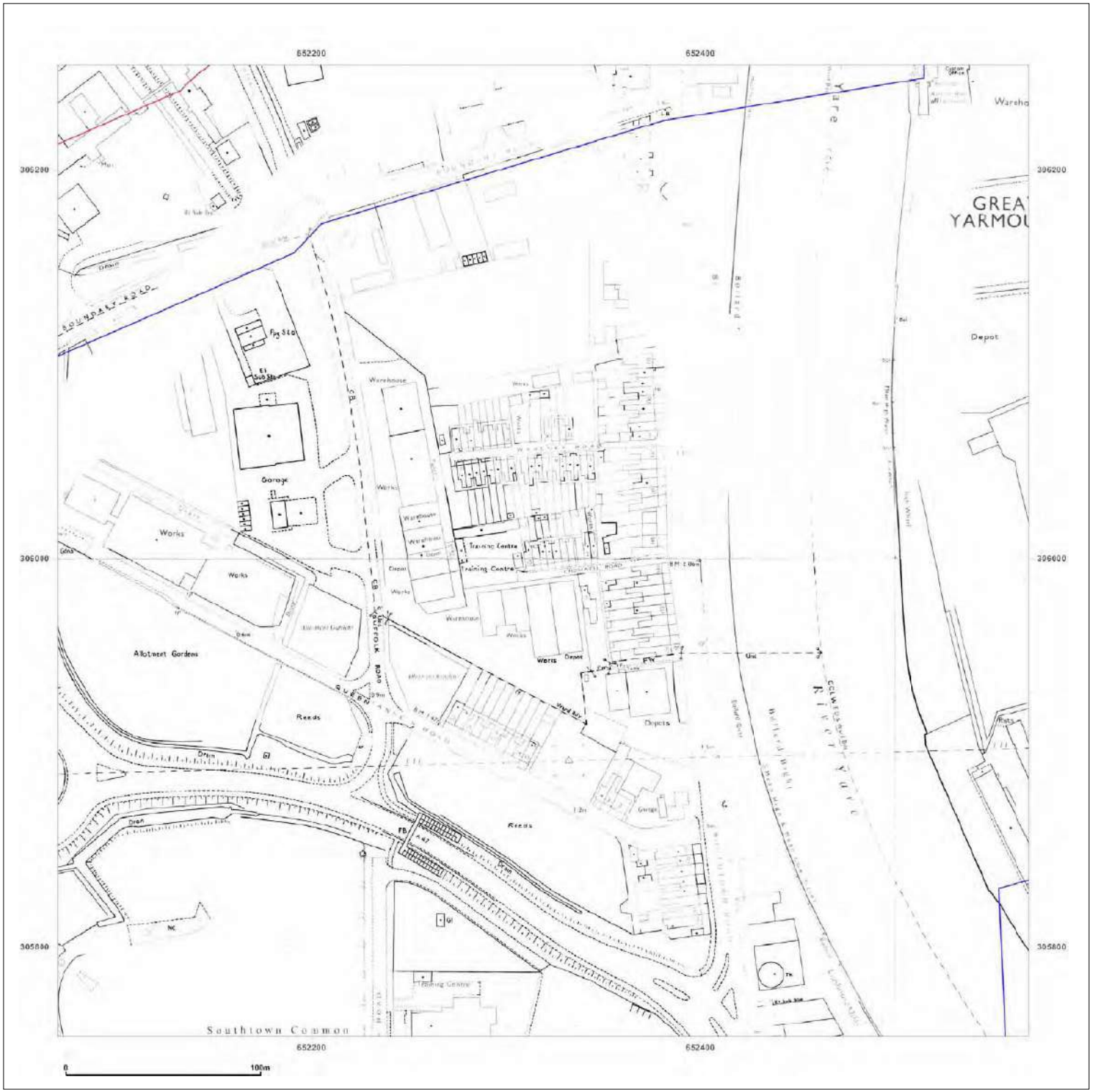

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1990
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1990
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Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1990
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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1994
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
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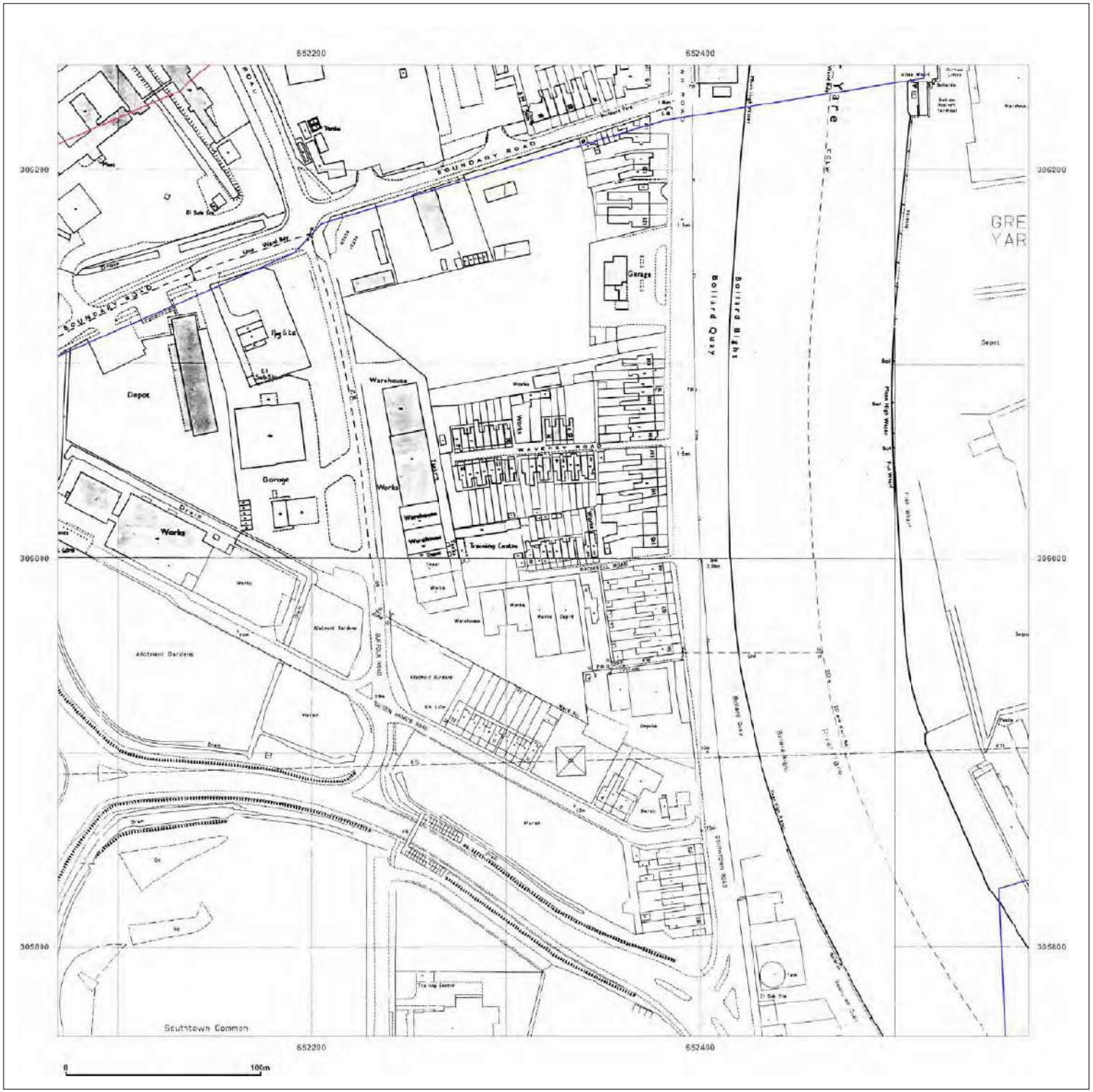

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1990-1994
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958	Surveyed N/A Revised N/A Edition N/A Copyright 1994 Levelled N/A
Surveyed N/A Revised N/A Edition N/A Copyright 1994 Levelled N/A	Surveyed N/A Revised N/A Edition N/A Copyright 1994 Levelled N/A

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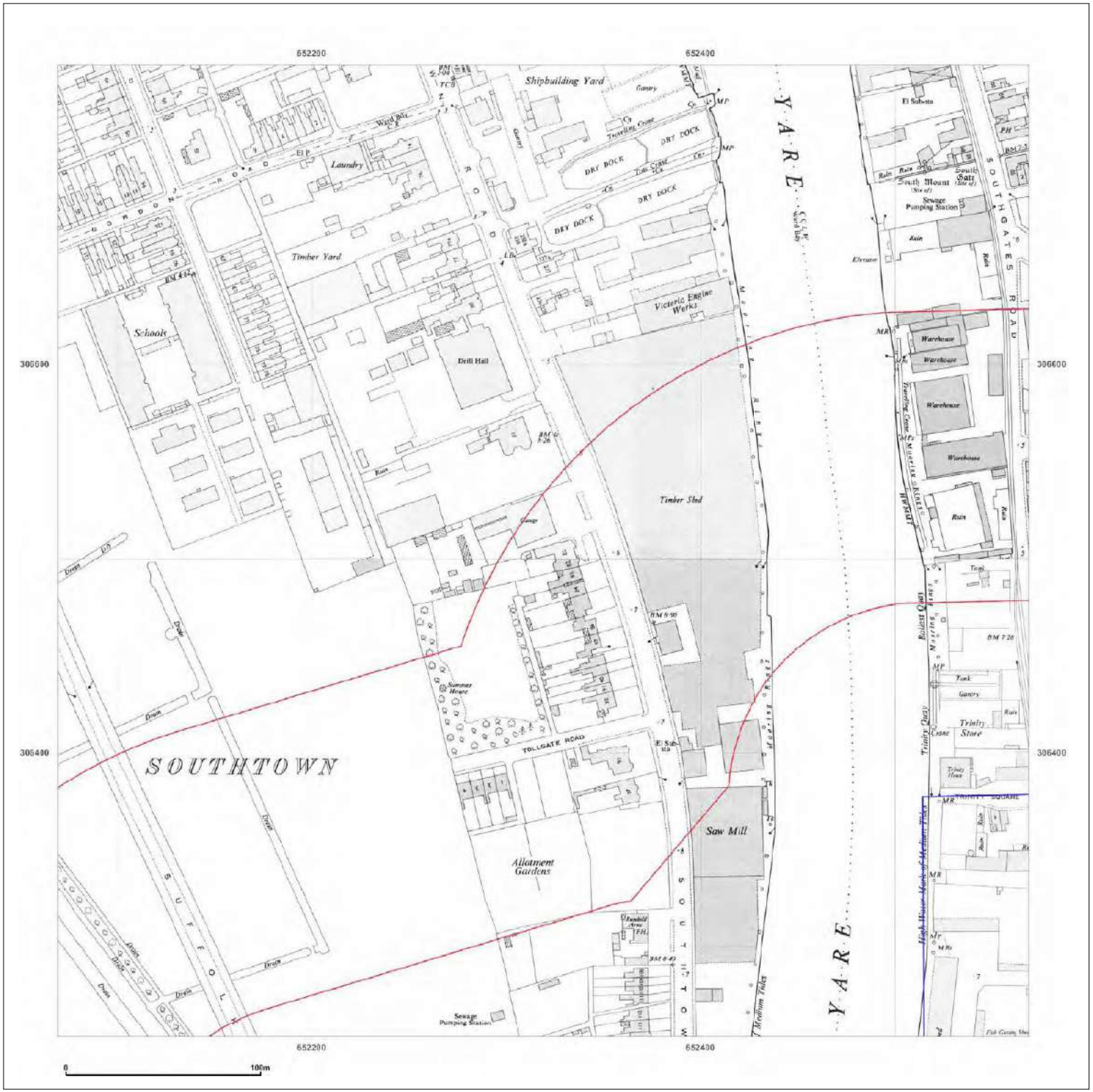

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1949
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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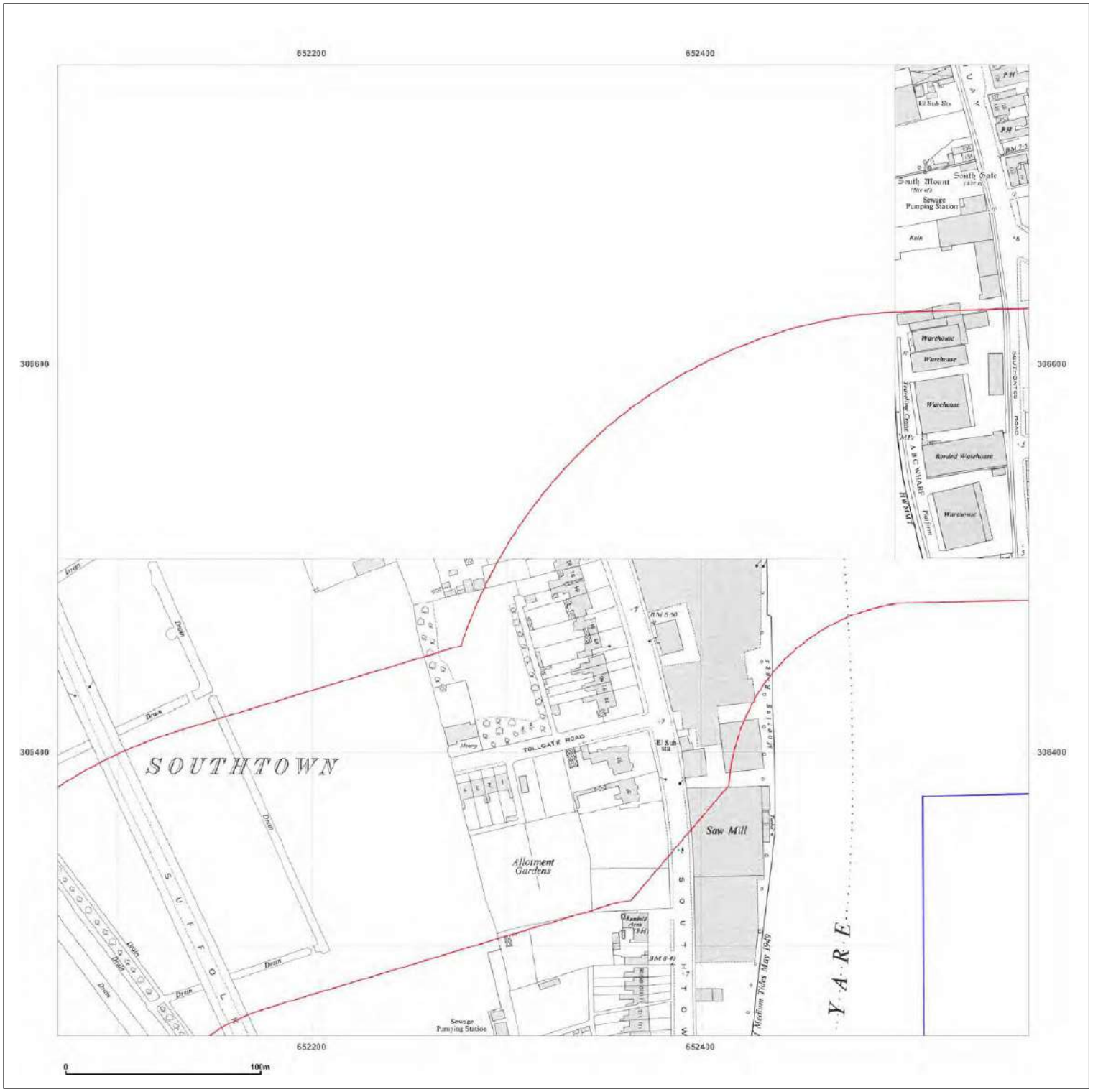

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1951-1954
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1949
Revised 1954
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1951
Revised 1951
Edition N/A
Copyright N/A
Levelled 1946

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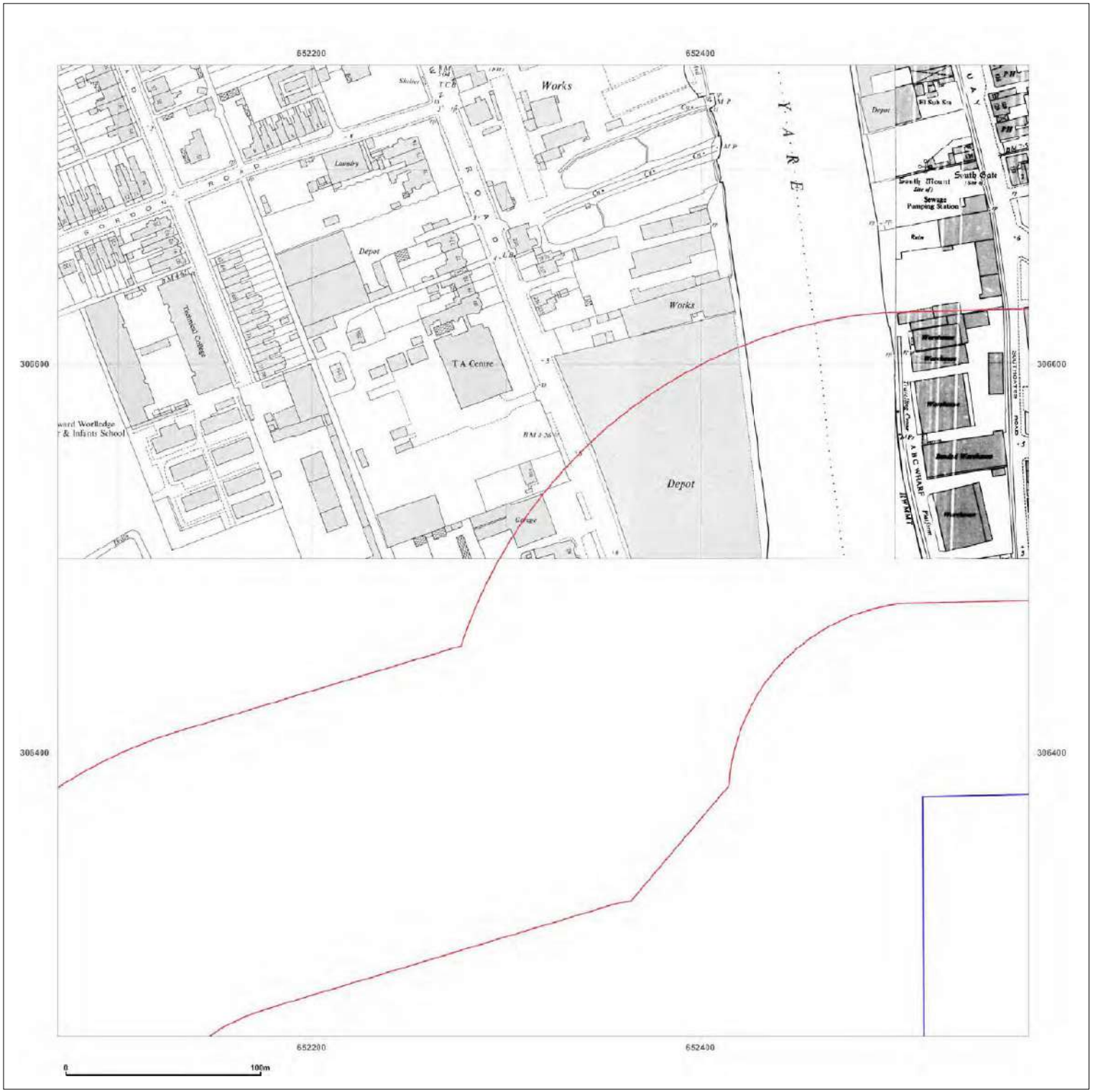

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid

Map date: 1955-1957

Scale: 1:1,250

Printed at: 1:2,000

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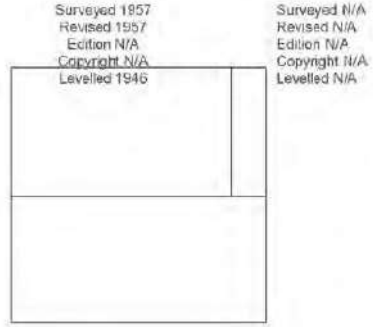

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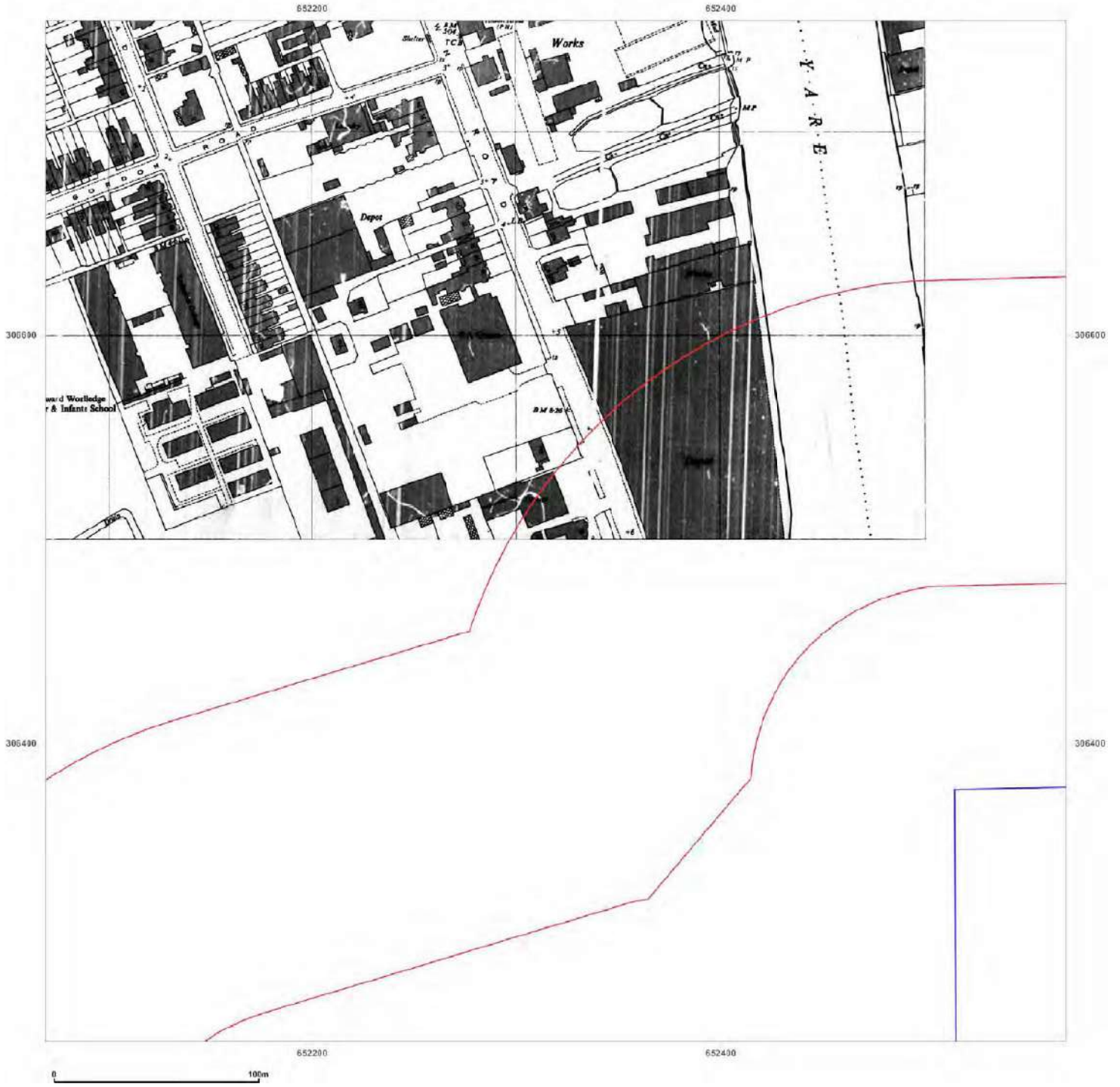

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1958
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
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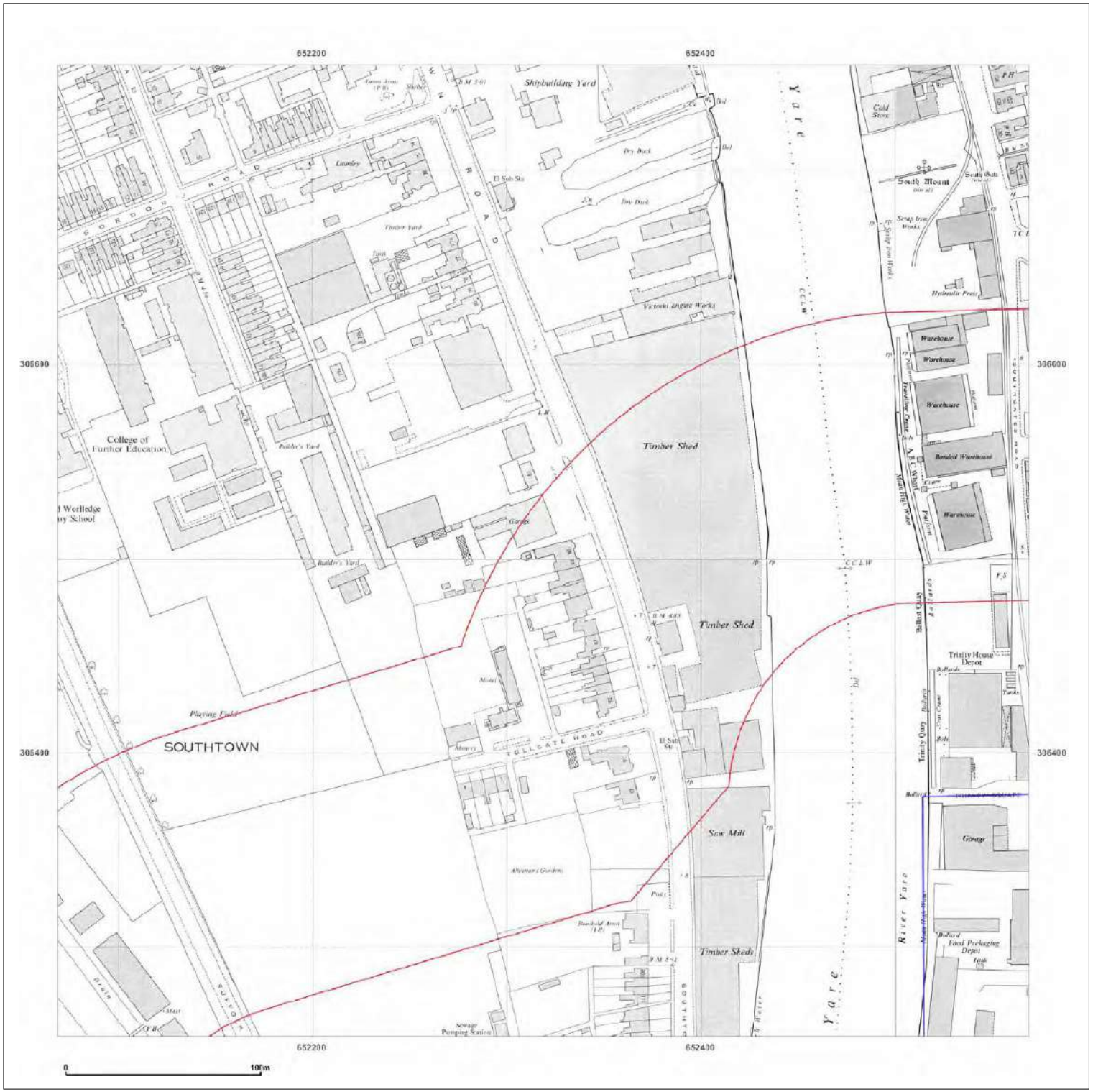

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1966-1968
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1967
Revised 1957
Edition N/A
Copyright 1966
Levelled 1958

Surveyed 1949
Revised 1966
Edition N/A
Copyright 1966
Levelled 1958

Surveyed 1949
Revised 1957
Edition N/A
Copyright 1966
Levelled 1958

Surveyed 1949
Revised 1964
Edition N/A
Copyright 1966
Levelled 1958

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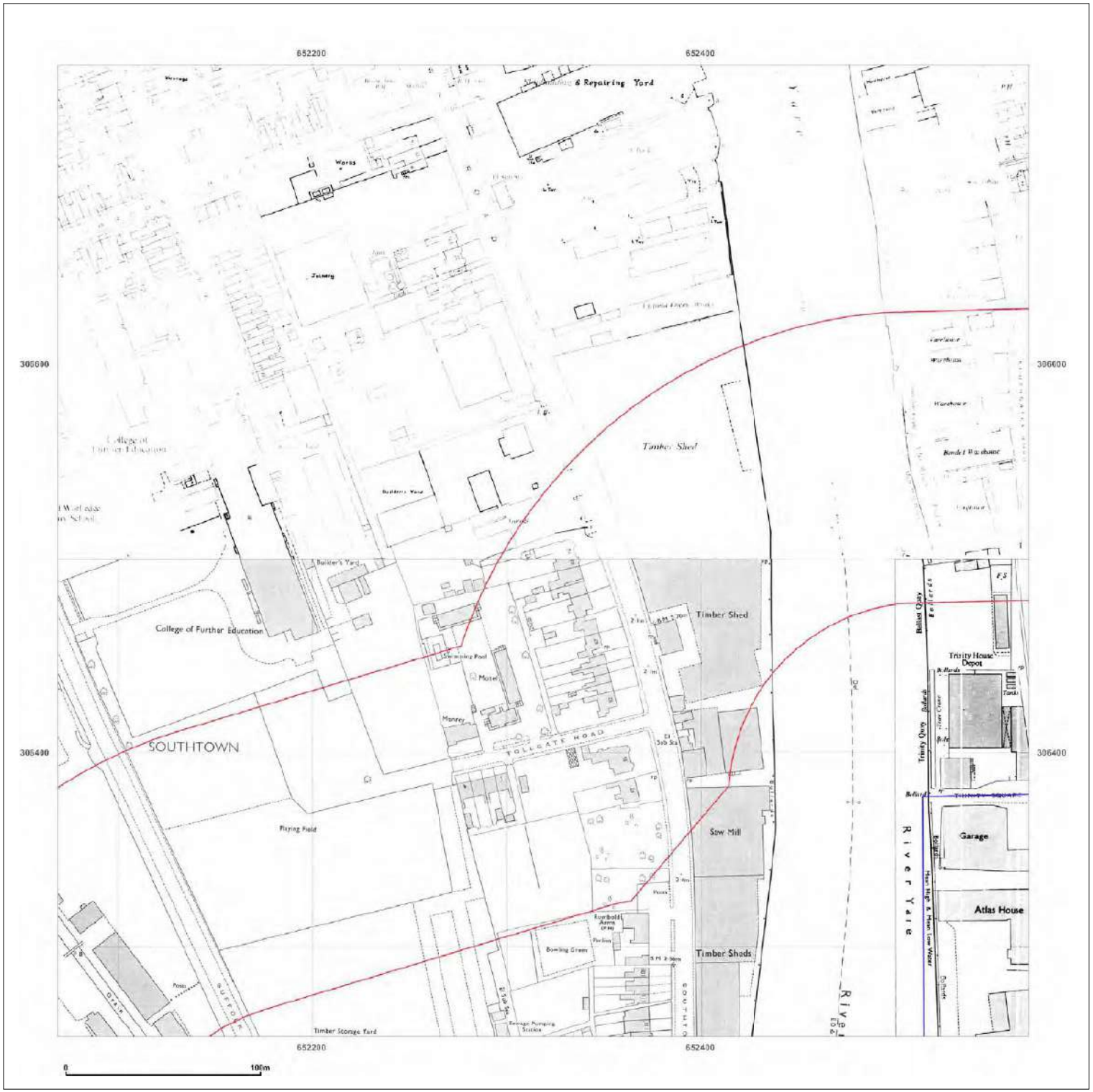

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1970-1975
Scale: 1:1,250
Printed at: 1:2,000

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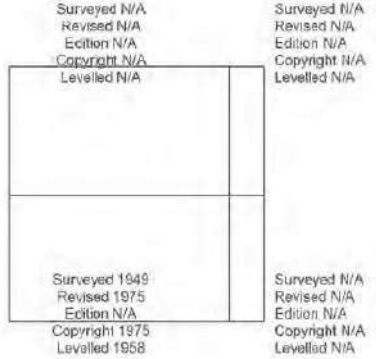

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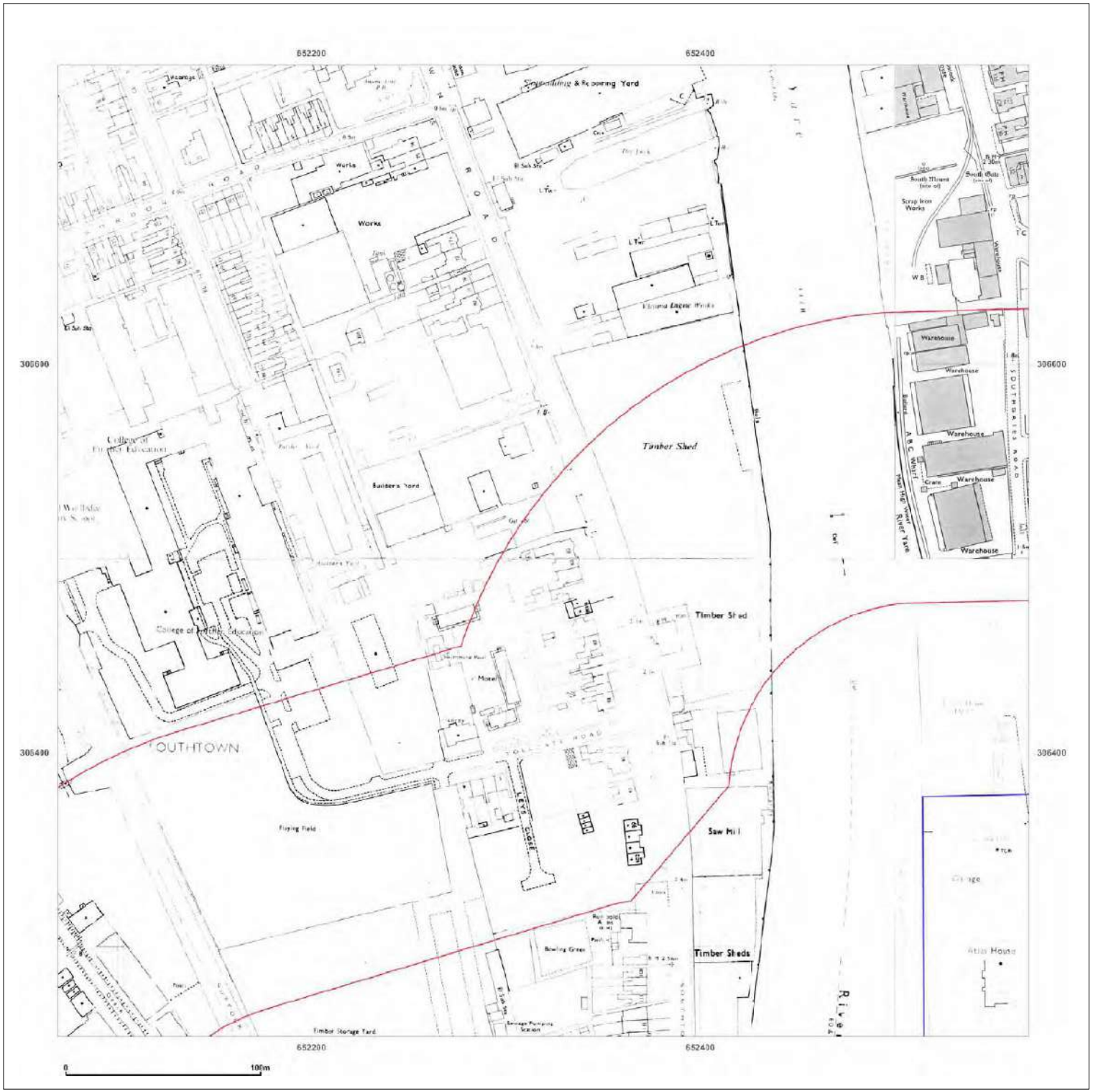

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1975-1978
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed N/A Revised N/A Edition N/A Copyright N/A Levelled N/A	Surveyed 1949 Revised 1975 Edition N/A Copyright 1975 Levelled 1958
Surveyed N/A Revised N/A Edition N/A Copyright N/A Levelled N/A	Surveyed N/A Revised N/A Edition N/A Copyright N/A Levelled N/A

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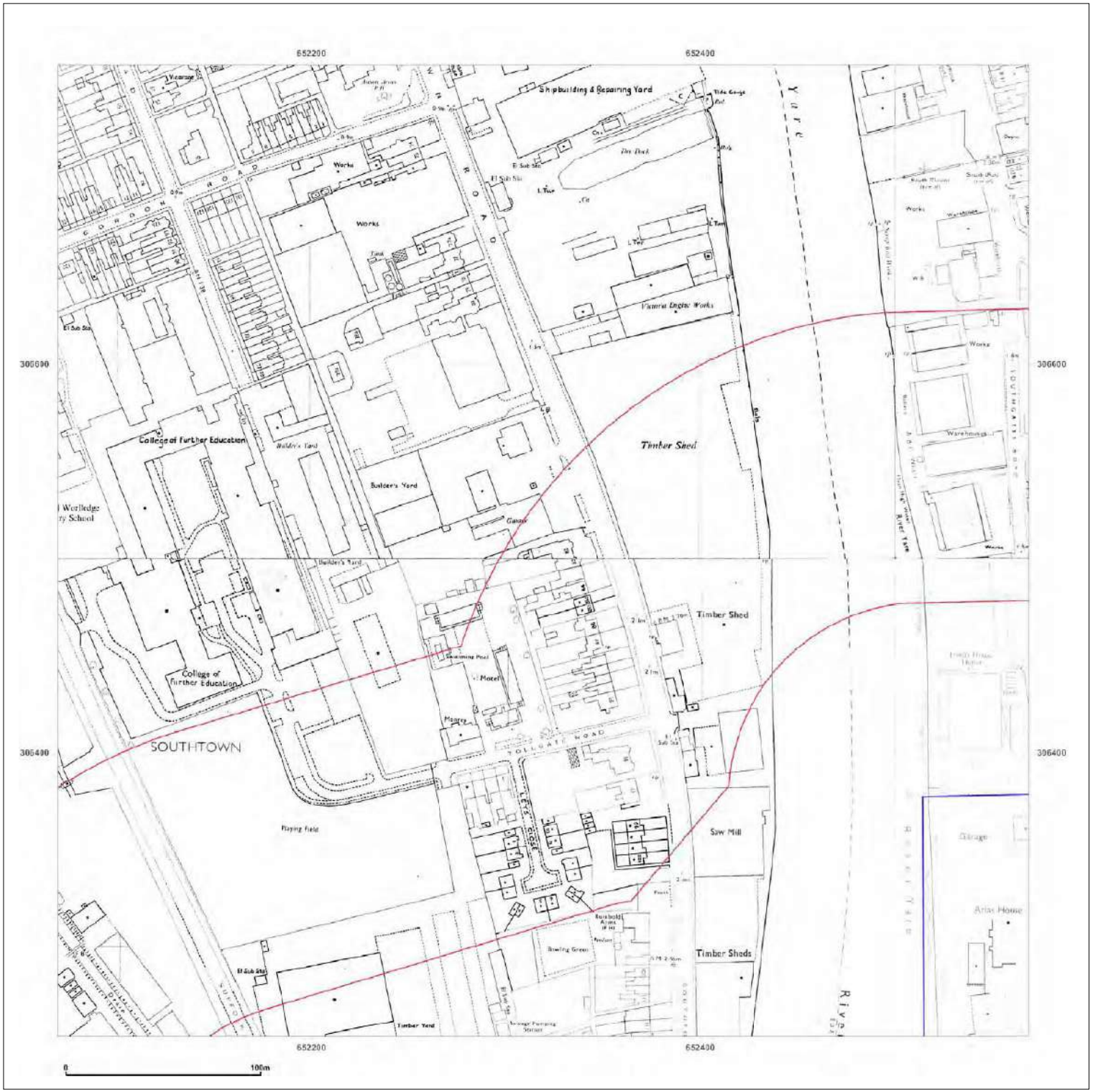

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1986-1990
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1956
Revised 1987
Edition N/A
Copyright 1987
Levelled 1956

Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed 1958
Revised 1986
Edition N/A
Copyright 1986
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1990
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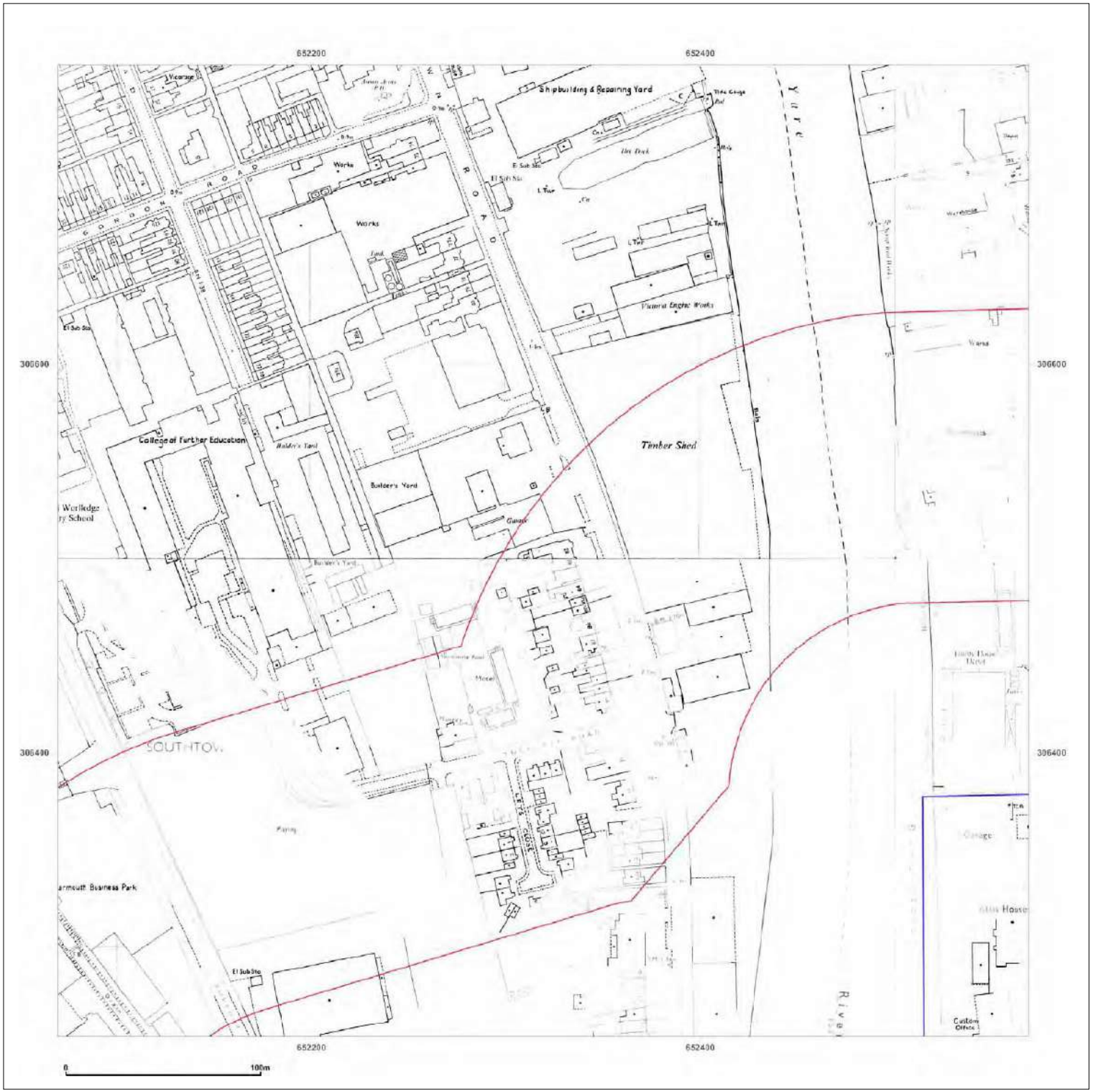

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1984-1990
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1958
Revised 1987
Edition N/A
Copyright 1987
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1990
Levelled 1958

Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1984
Levelled 1958

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1990-1994
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed 1958
Revised 1990
Edition N/A
Copyright 1990
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
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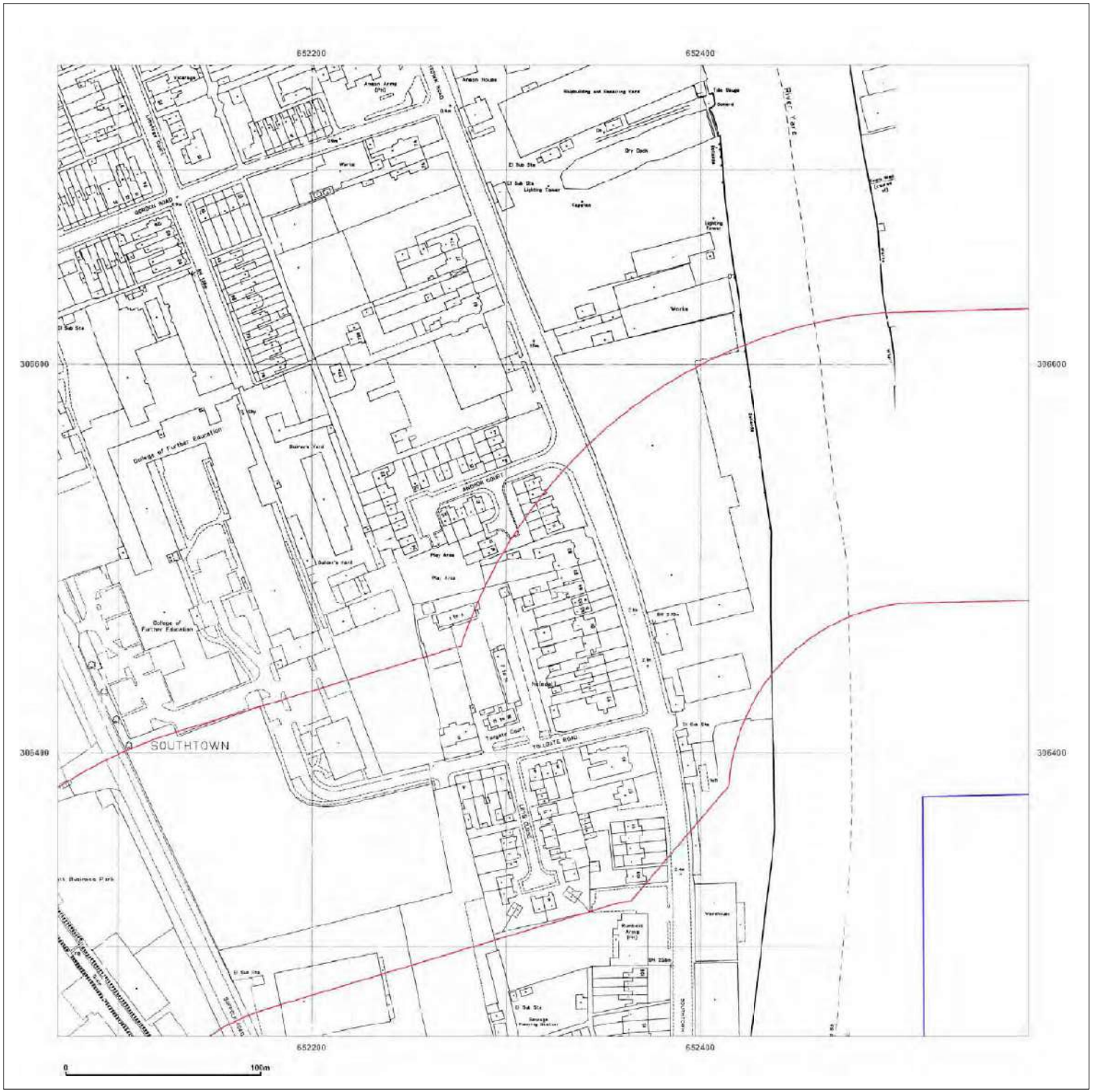

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652319, 306504

Map Name: National Grid
Map date: 1994
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

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Revised N/A
Edition N/A
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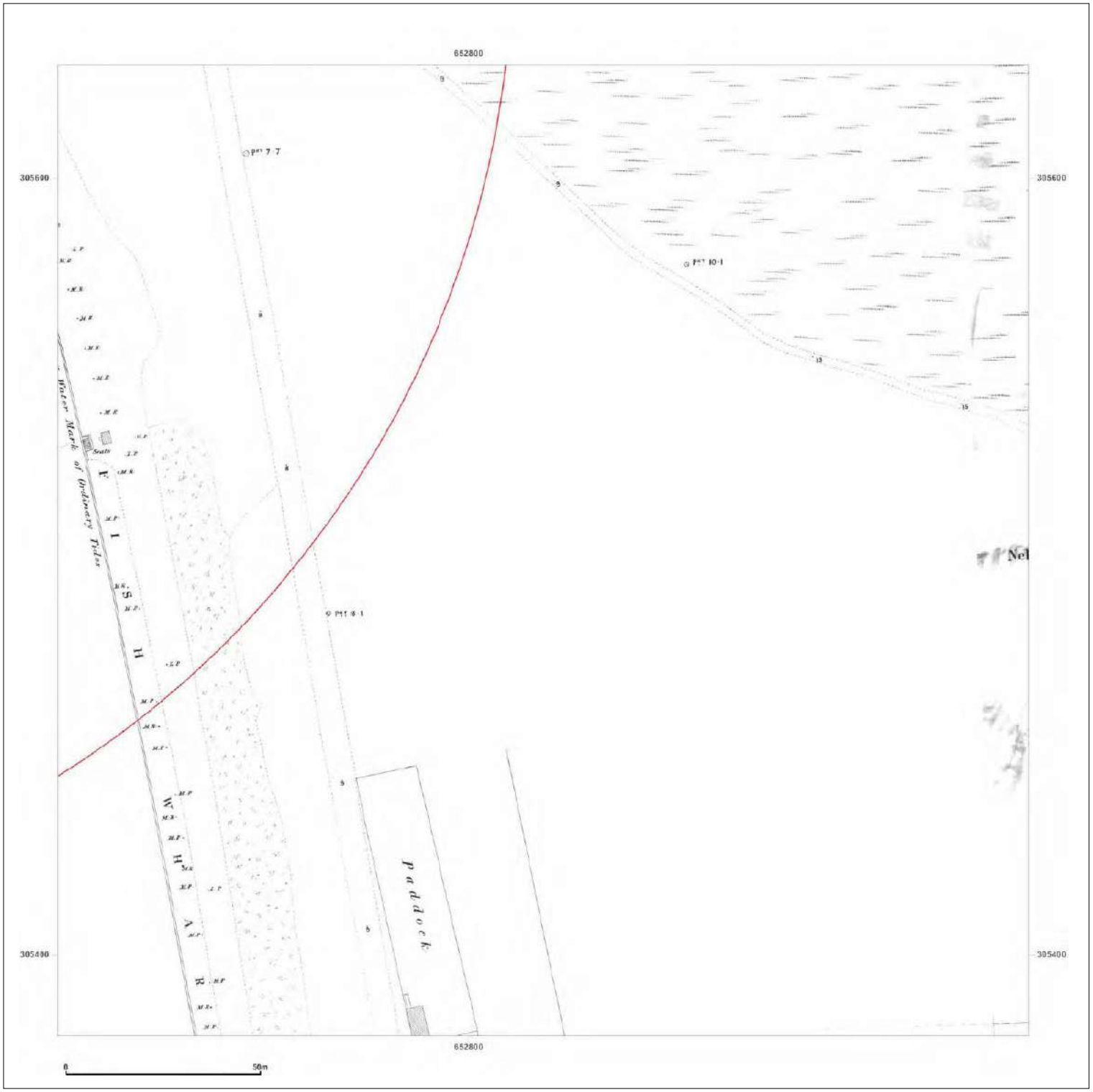

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: County Series Town Plan
Map date: 1884-1885
Scale: 1:500
Printed at: 1:1,000

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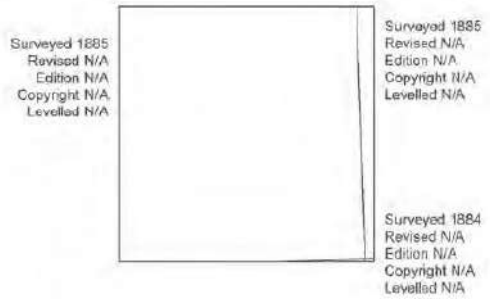

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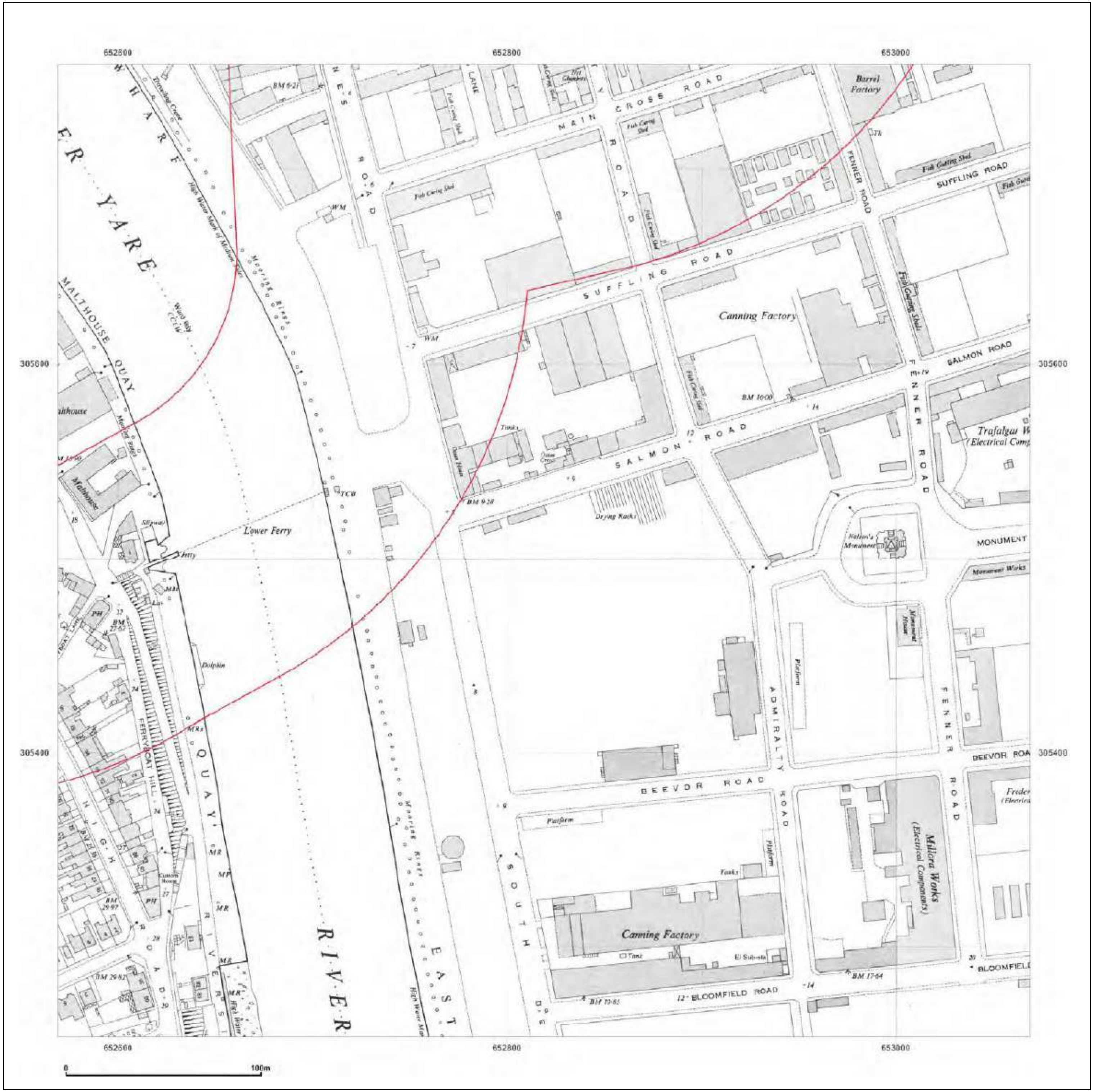

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid

Map date: 1949

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946	Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946

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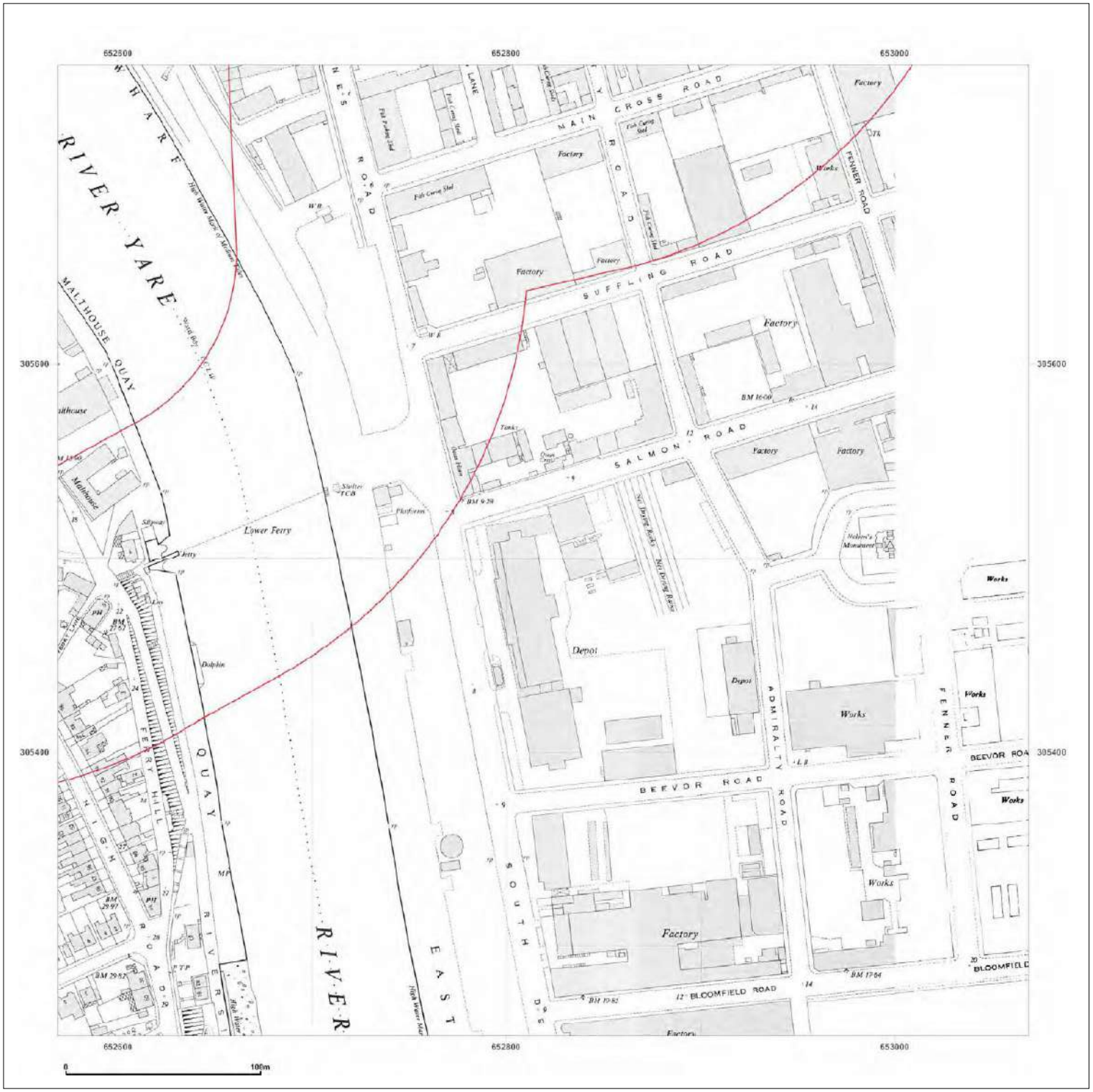

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid
Map date: 1957-1958
Scale: 1:1,250
Printed at: 1:2,000

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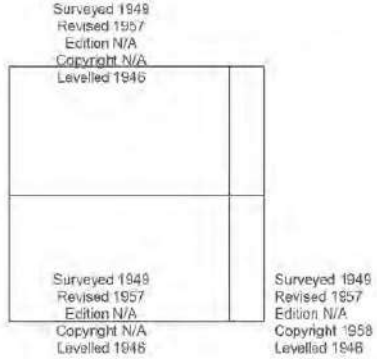

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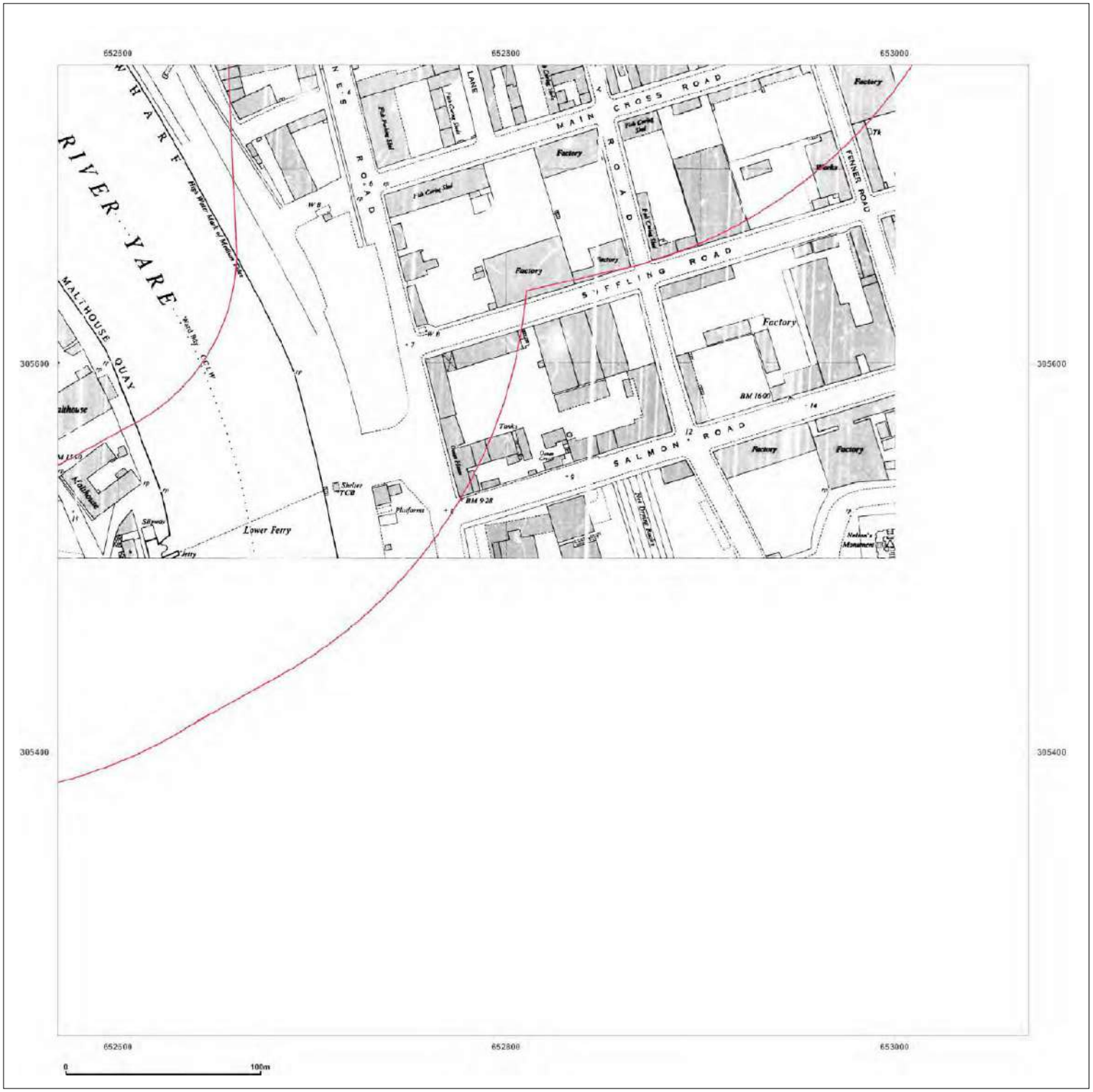

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid
Map date: 1958
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
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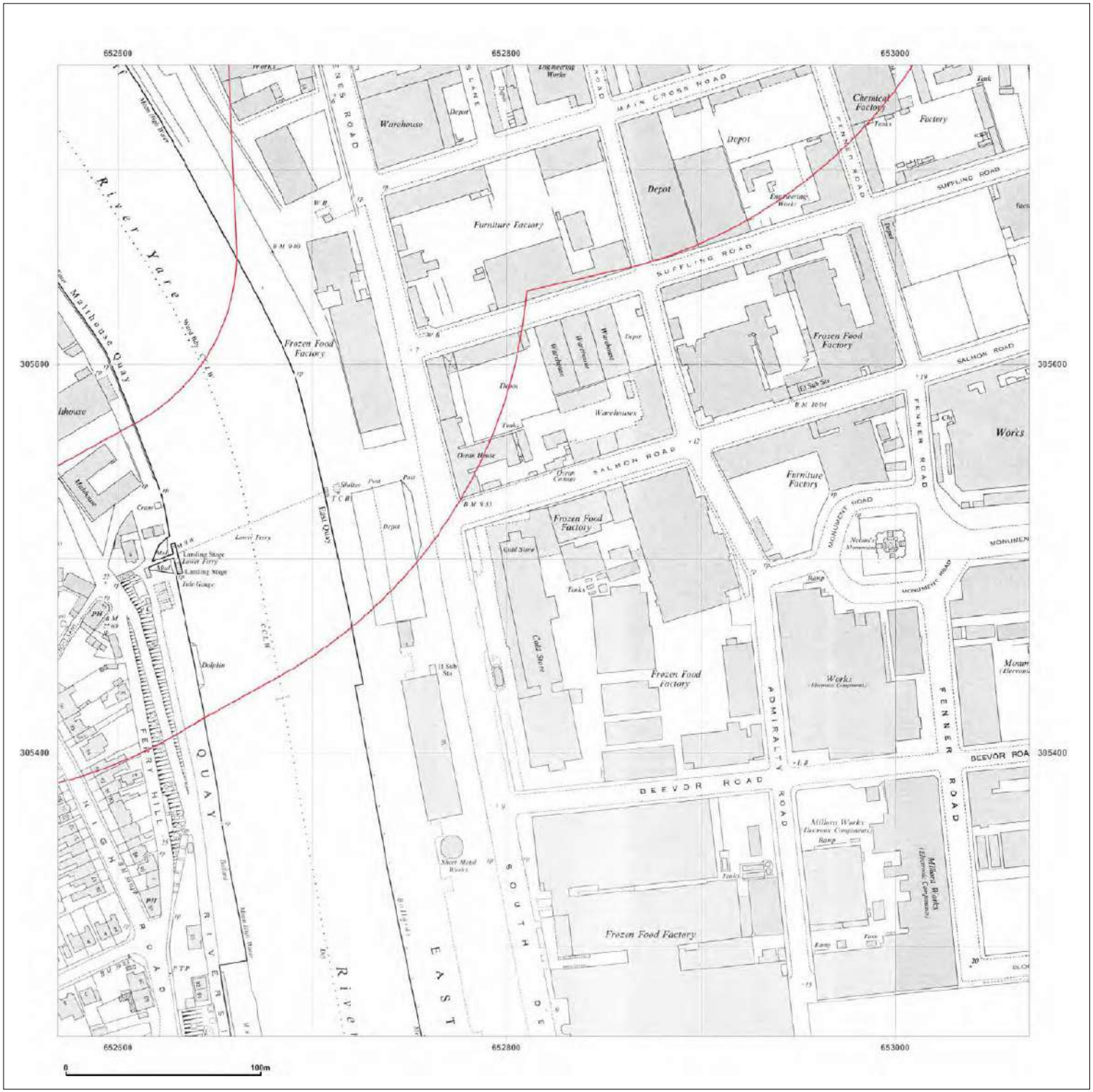

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid
Map date: 1964-1968
Scale: 1:1,250
Printed at: 1:2,000

N
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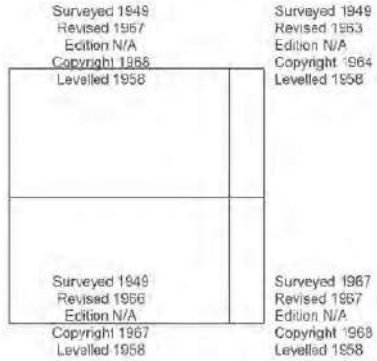

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Production date: 03 July 2017

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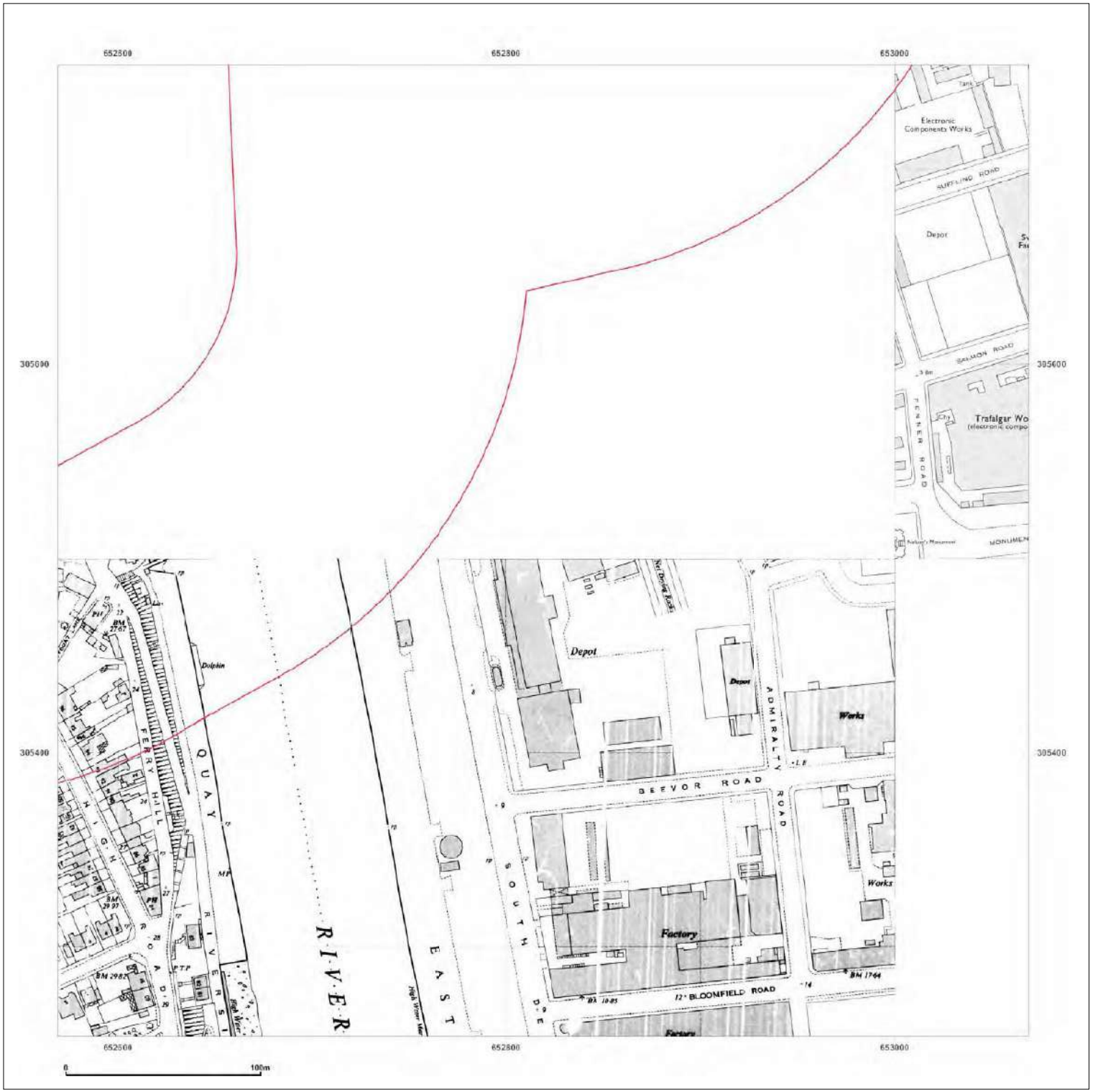

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid
Map date: 1968-1971
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed 1949
Revised 1970
Edition N/A
Copyright 1971
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid
Map date: 1975-1976
Scale: 1:1,250
Printed at: 1:2,000

N
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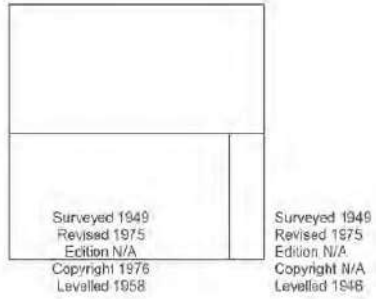

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Production date: 03 July 2017

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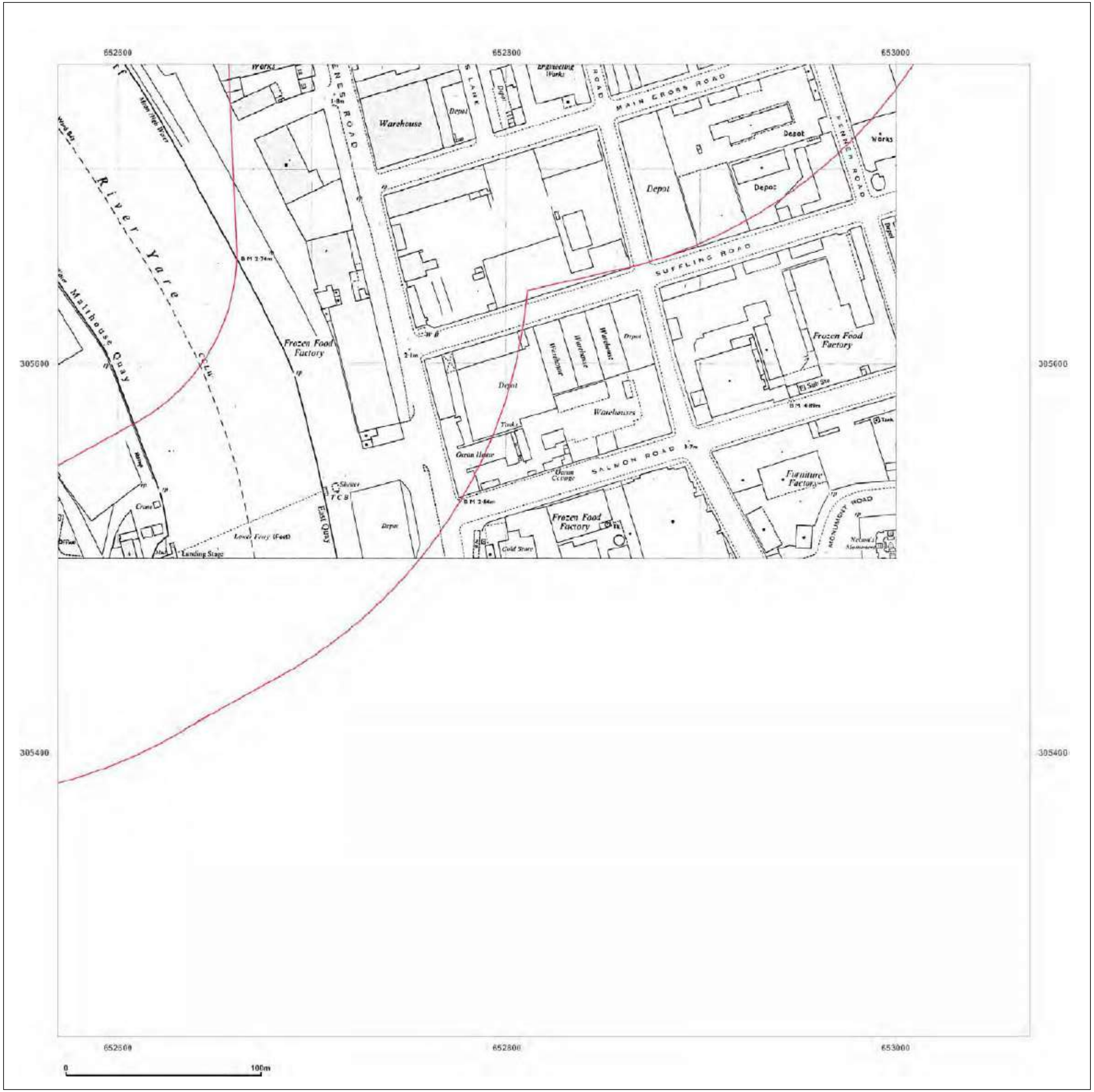

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid

Map date: 1981

Scale: 1:1,250

Printed at: 1:2,000

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Production date: 03 July 2017

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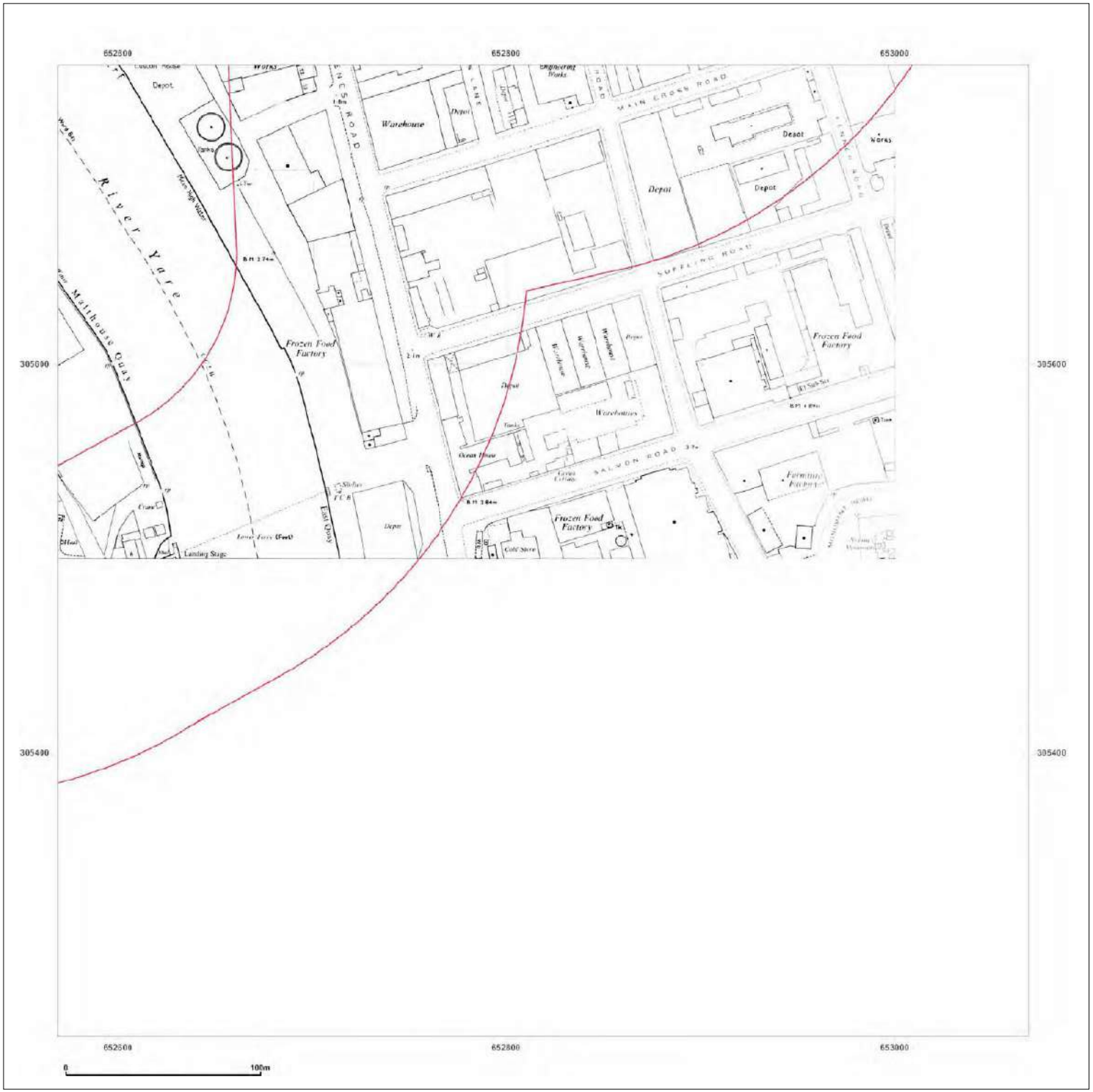

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid
Map date: 1984
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed 1958
Revised 1984
Edition N/A
Copyright 1984
Levelled 1958

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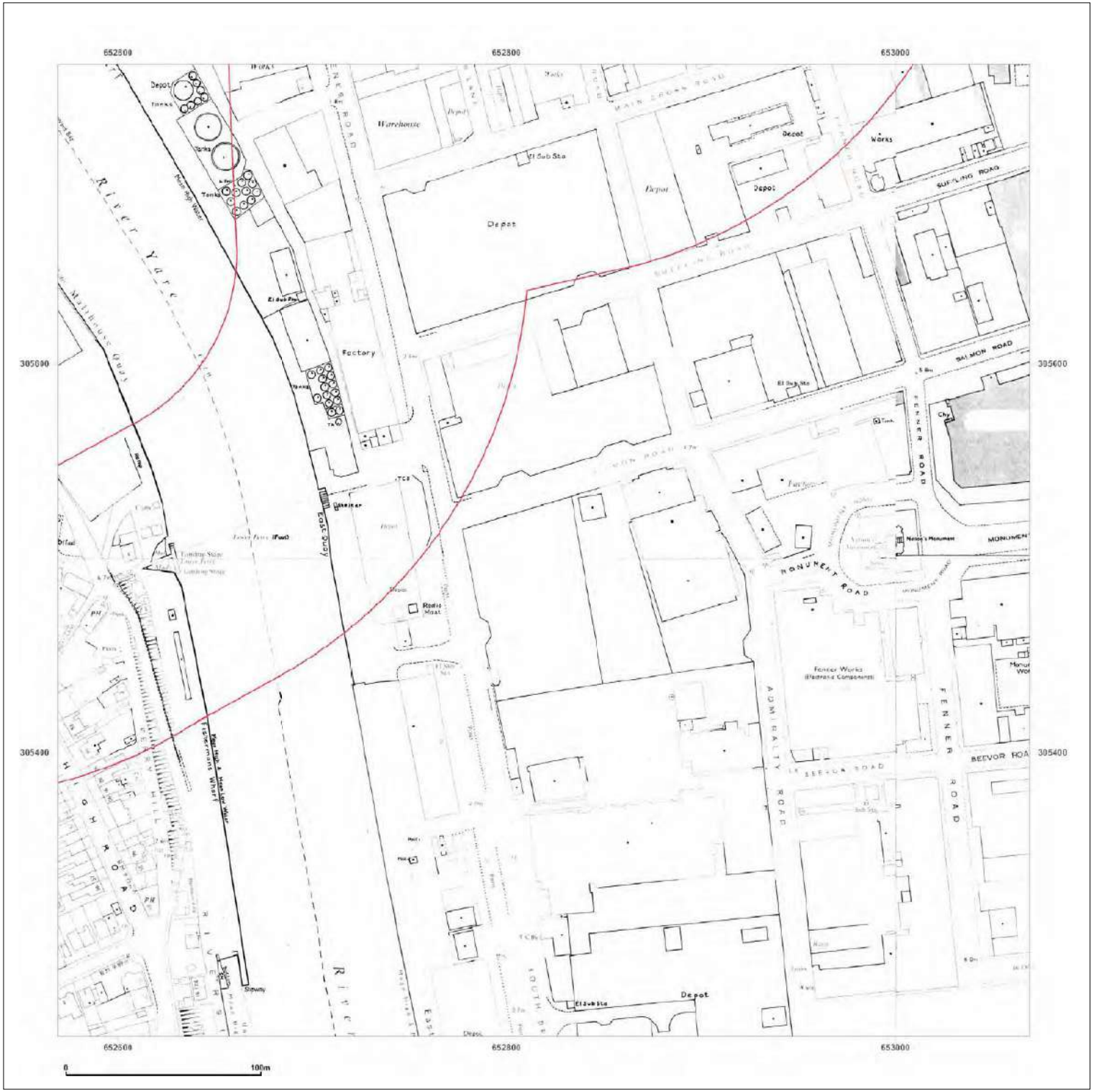

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 305504

Map Name: National Grid
Map date: 1990
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed N/A Revised N/A Edition N/A Copyright 1990 Levelled 1958	Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958
Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958	Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958

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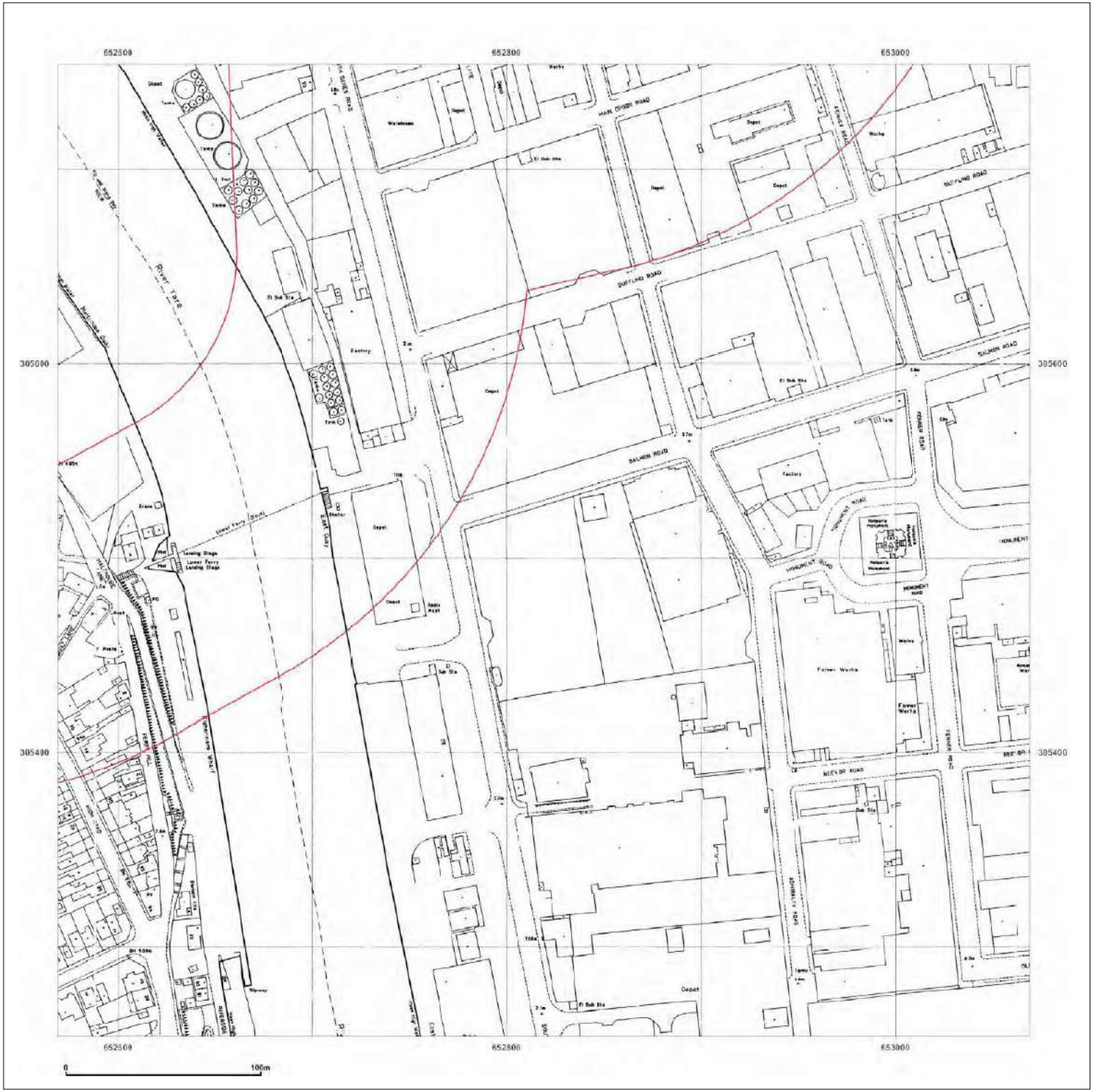

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 452819, 305504

Map Name: National Grid
Map date: 1994
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

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Production date: 03 July 2017

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CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: County Series Town Plan
Map date: 1885
Scale: 1:500
Printed at: 1:1,000

N
W E
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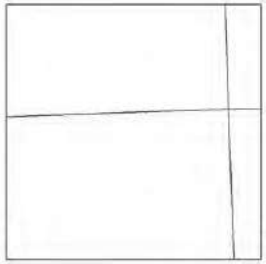
Surveyed 1885
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1885
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1885
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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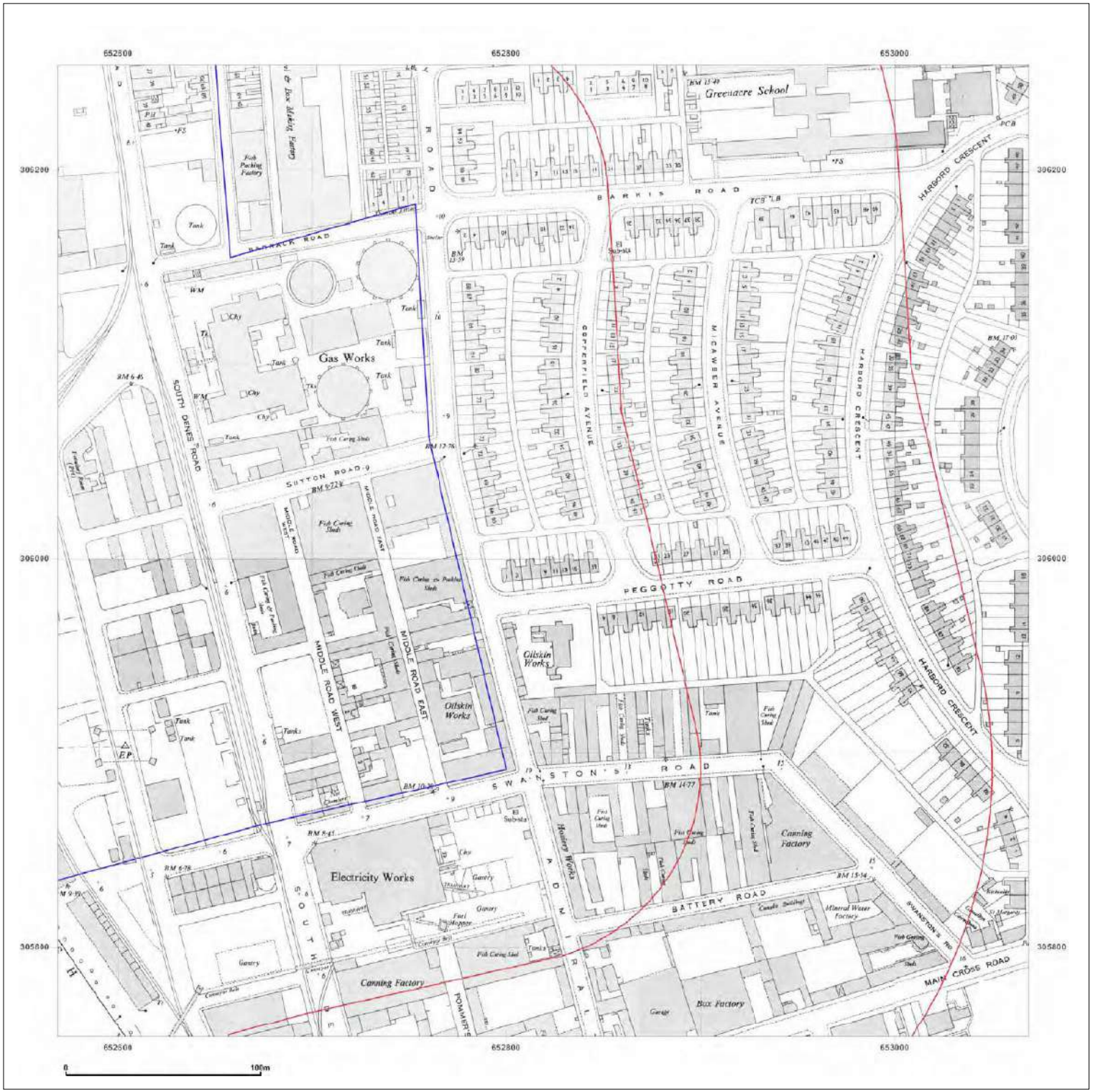

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1949
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946	Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946
Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946	Surveyed 1949 Revised 1949 Edition N/A Copyright N/A Levelled 1946

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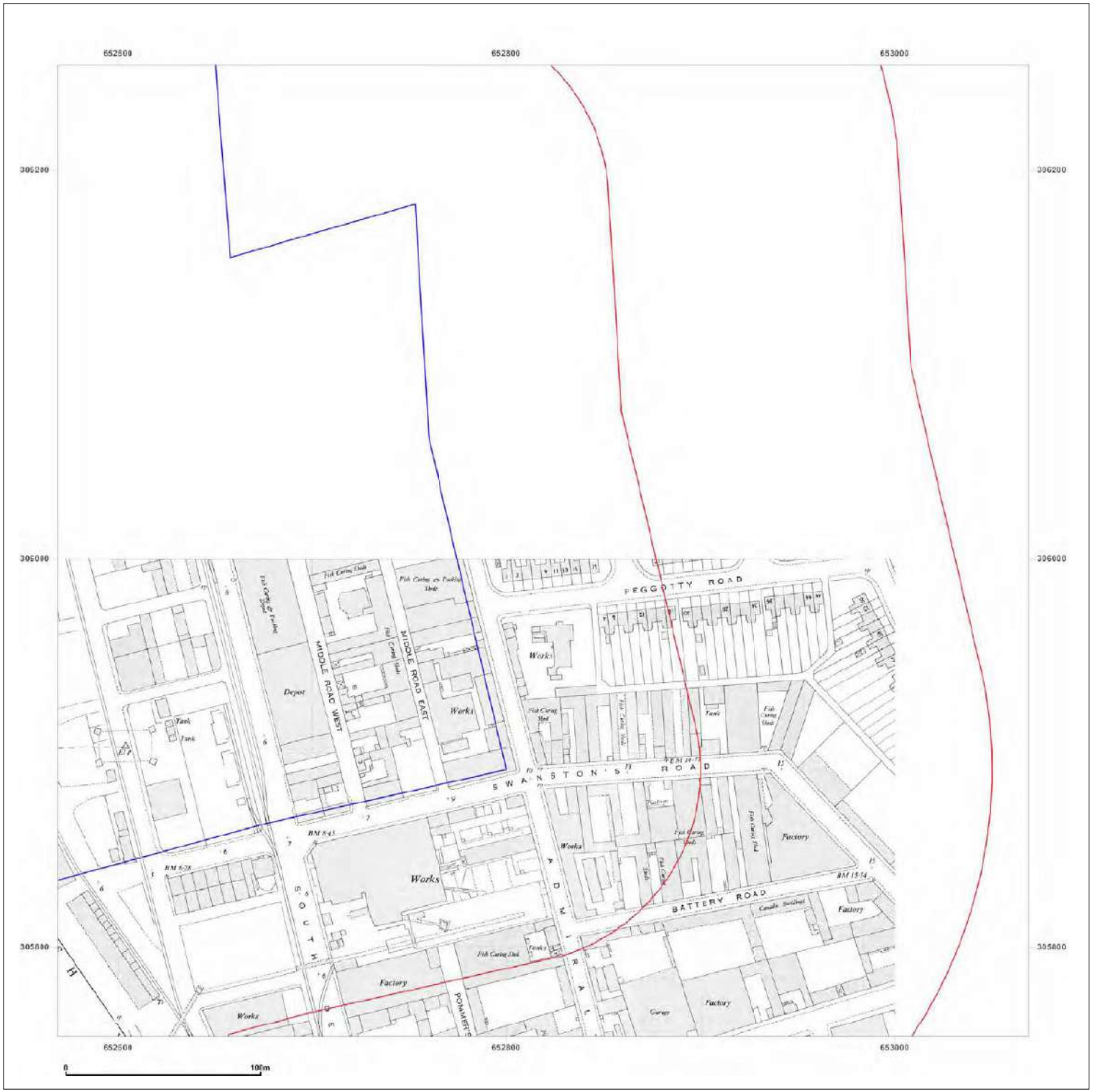

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1957
Scale: 1:1,250
Printed at: 1:2,000

N
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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1958
Scale: 1:1,250
Printed at: 1:2,000

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FOR A BETTER PROPERTY VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1964-1968
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed 1949
Revised 1964
Edition N/A
Copyright 1966
Levelled 1958

Surveyed 1949
Revised 1967
Edition N/A
Copyright 1968
Levelled 1958

Surveyed 1949
Revised 1953
Edition N/A
Copyright 1964
Levelled 1958

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1970-1971
Scale: 1:1,250
Printed at: 1:2,000

N
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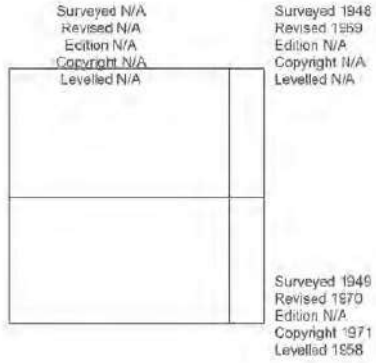

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1978-1981
Scale: 1:1,250
Printed at: 1:2,000

N
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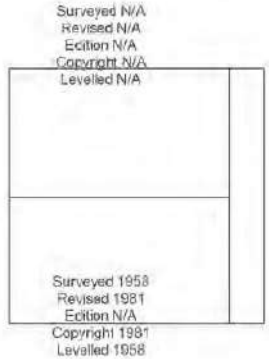

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Production date: 03 July 2017

To view map legend click here Legend

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1984
Scale: 1:1,250
Printed at: 1:2,000

N
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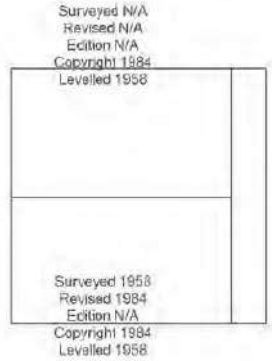

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Production date: 03 July 2017

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CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1990
Scale: 1:1,250
Printed at: 1:2,000

N
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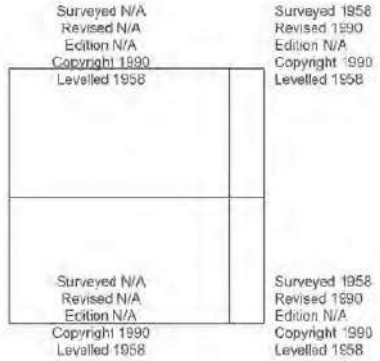

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Production date: 03 July 2017

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306004

Map Name: National Grid
Map date: 1994
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

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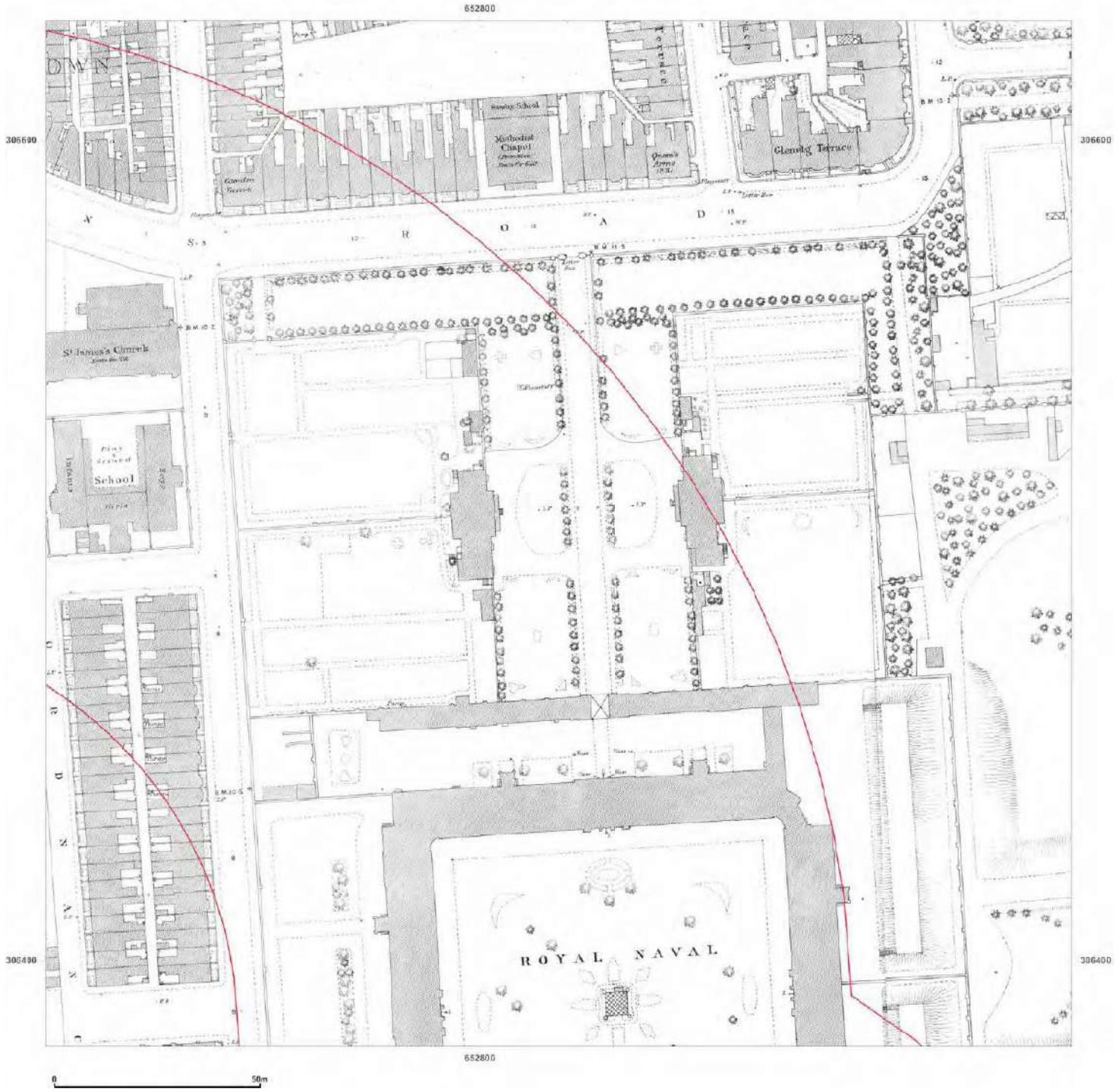

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: County Series Town Plan
Map date: 1885
Scale: 1:500
Printed at: 1:1,000

N
W E
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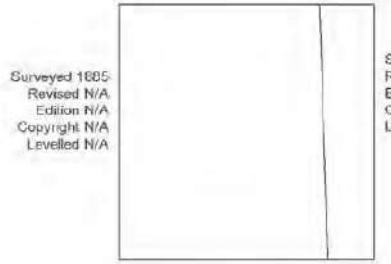

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Production date: 03 July 2017

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CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1949
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1954
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed 1949
Revised 1954
Edition N/A
Copyright N/A
Levelled 1946

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CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1955
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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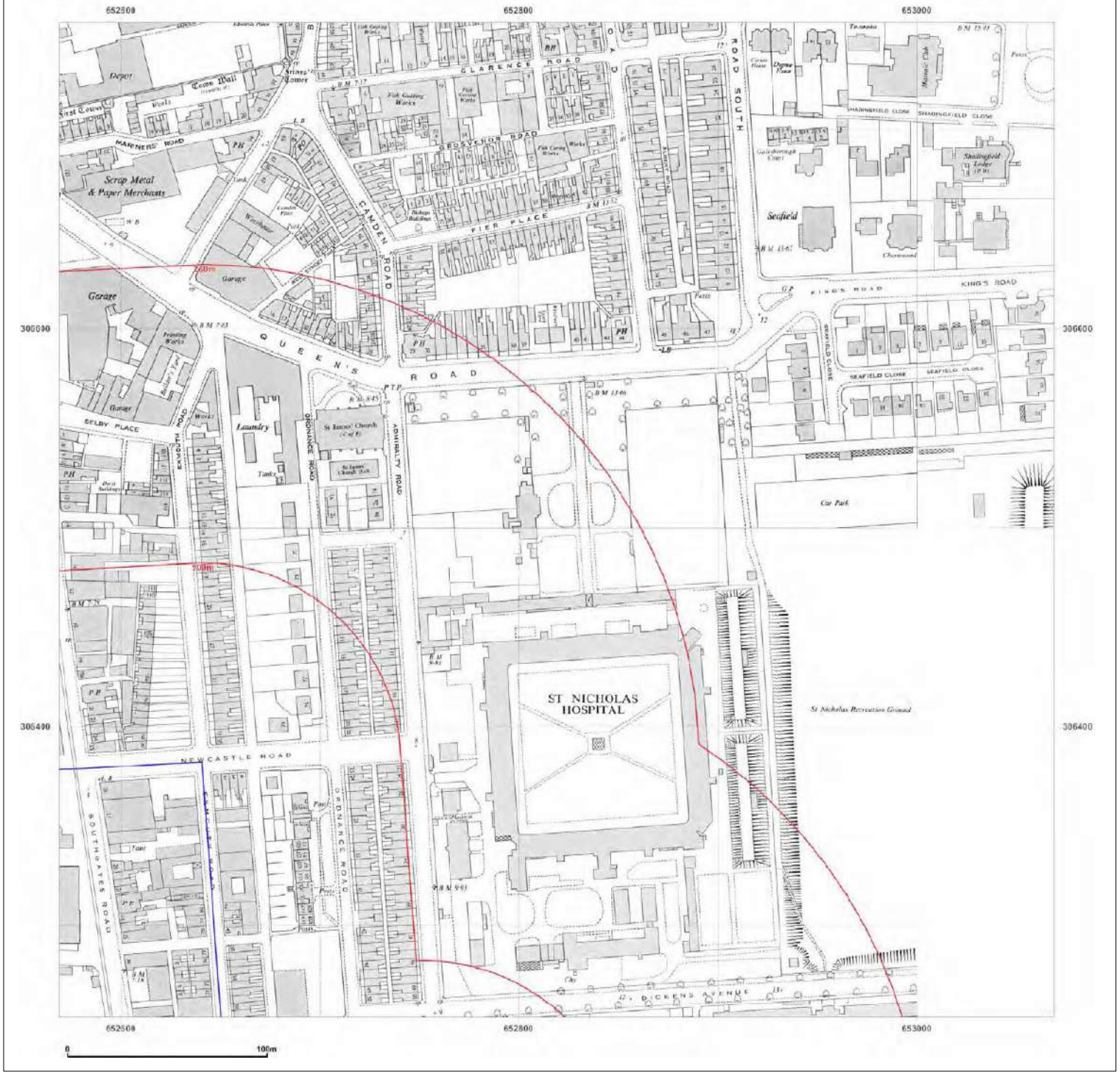

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1964-1966
Scale: 1:1,250
Printed at: 1:2,000

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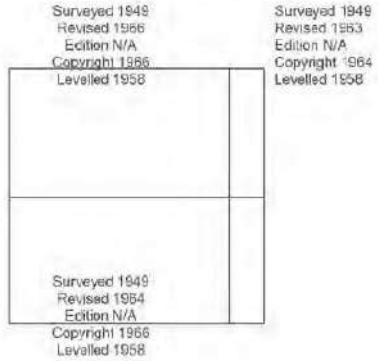

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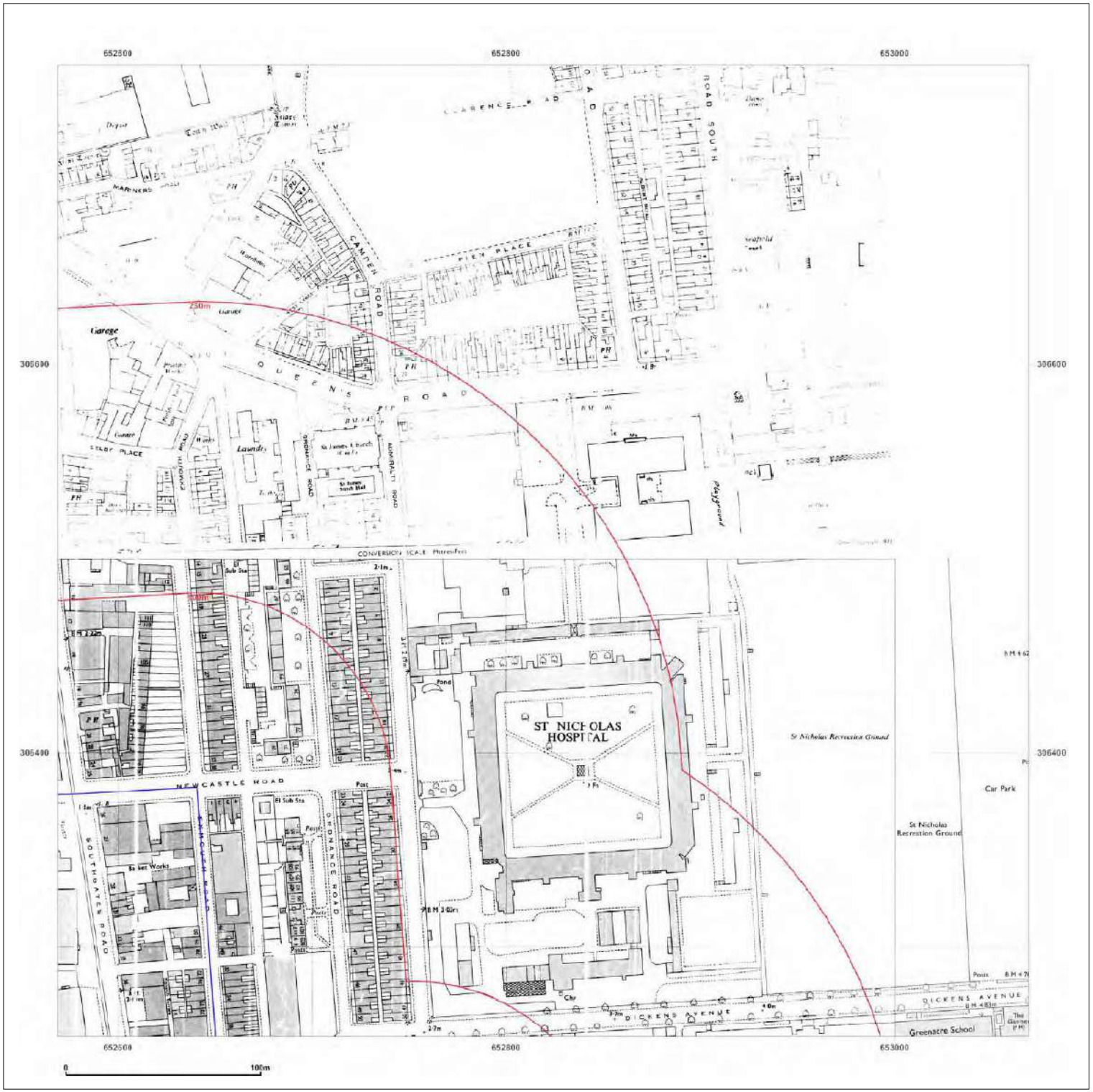

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1970-1973
Scale: 1:1,250
Printed at: 1:2,000

N
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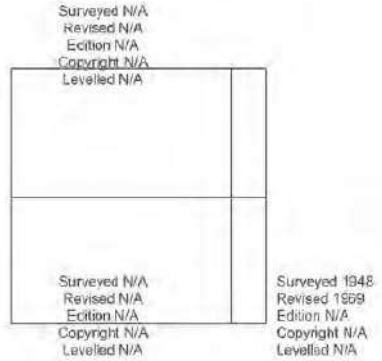

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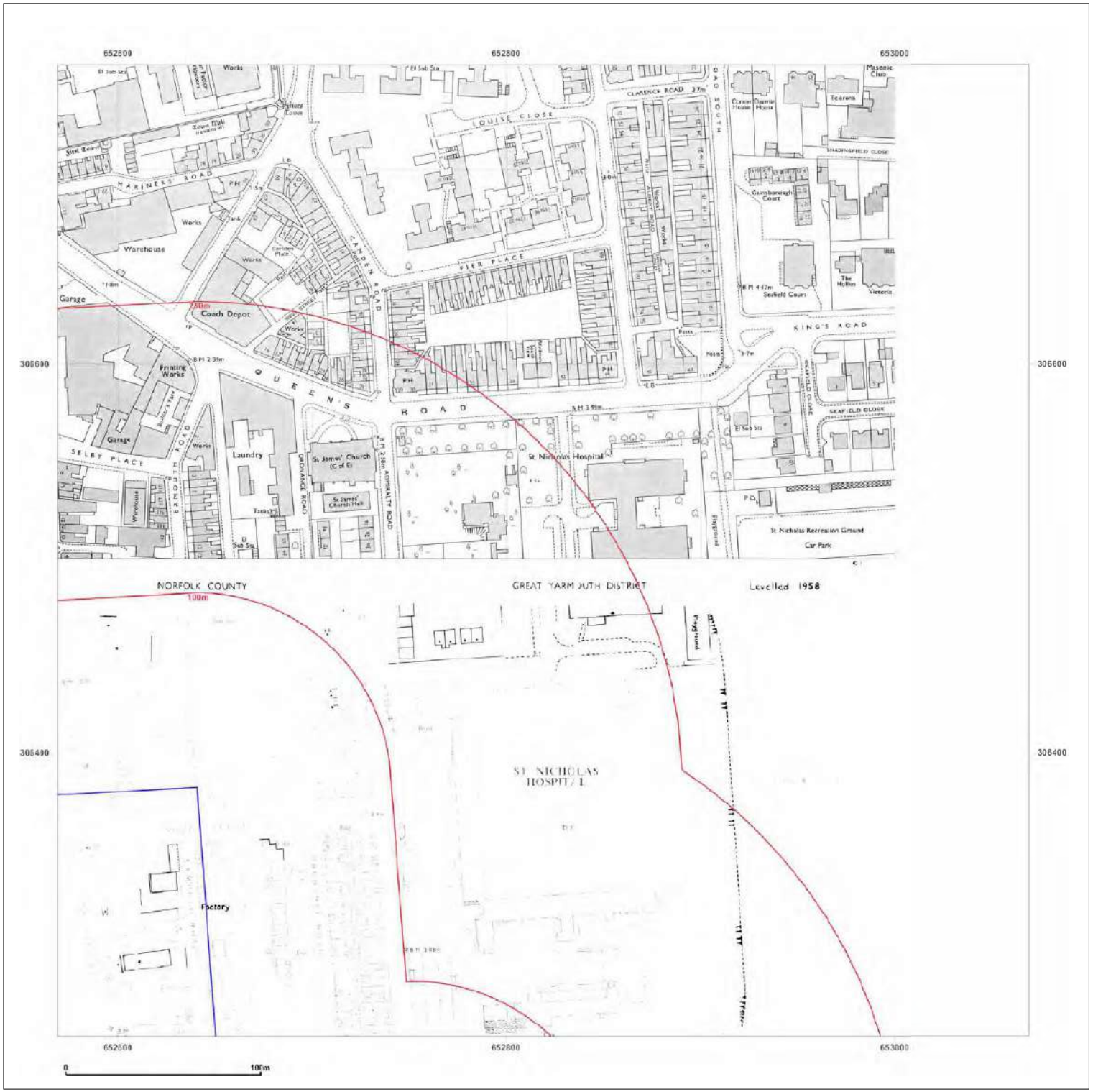

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1975-1978
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed 1949
Revised 1975
Edition N/A
Copyright 1975
Levelled 1958

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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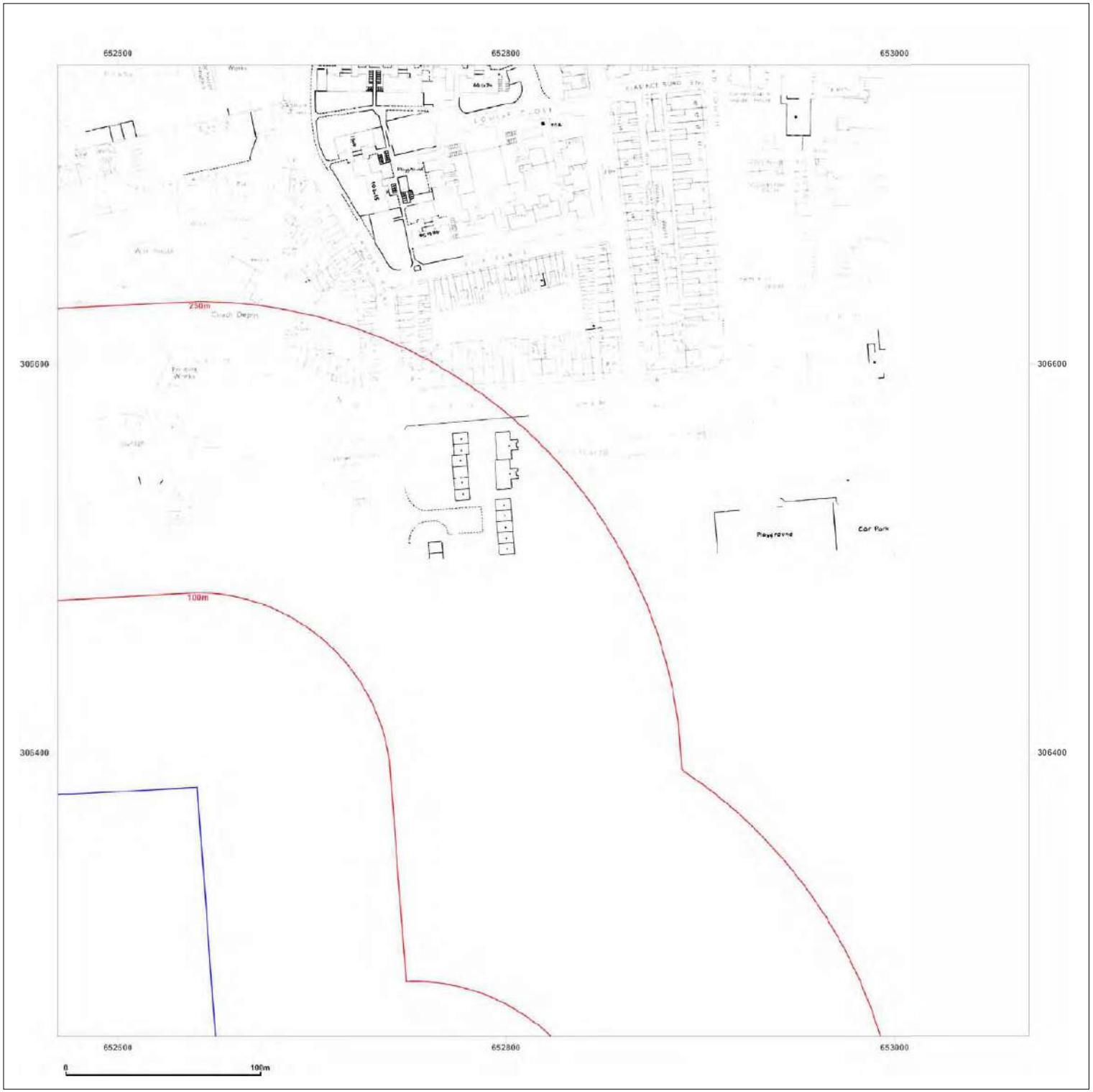

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1978
Scale: 1:1,250
Printed at: 1:2,000

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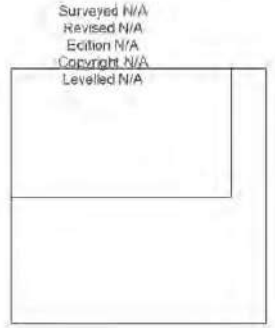

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Production date: 03 July 2017

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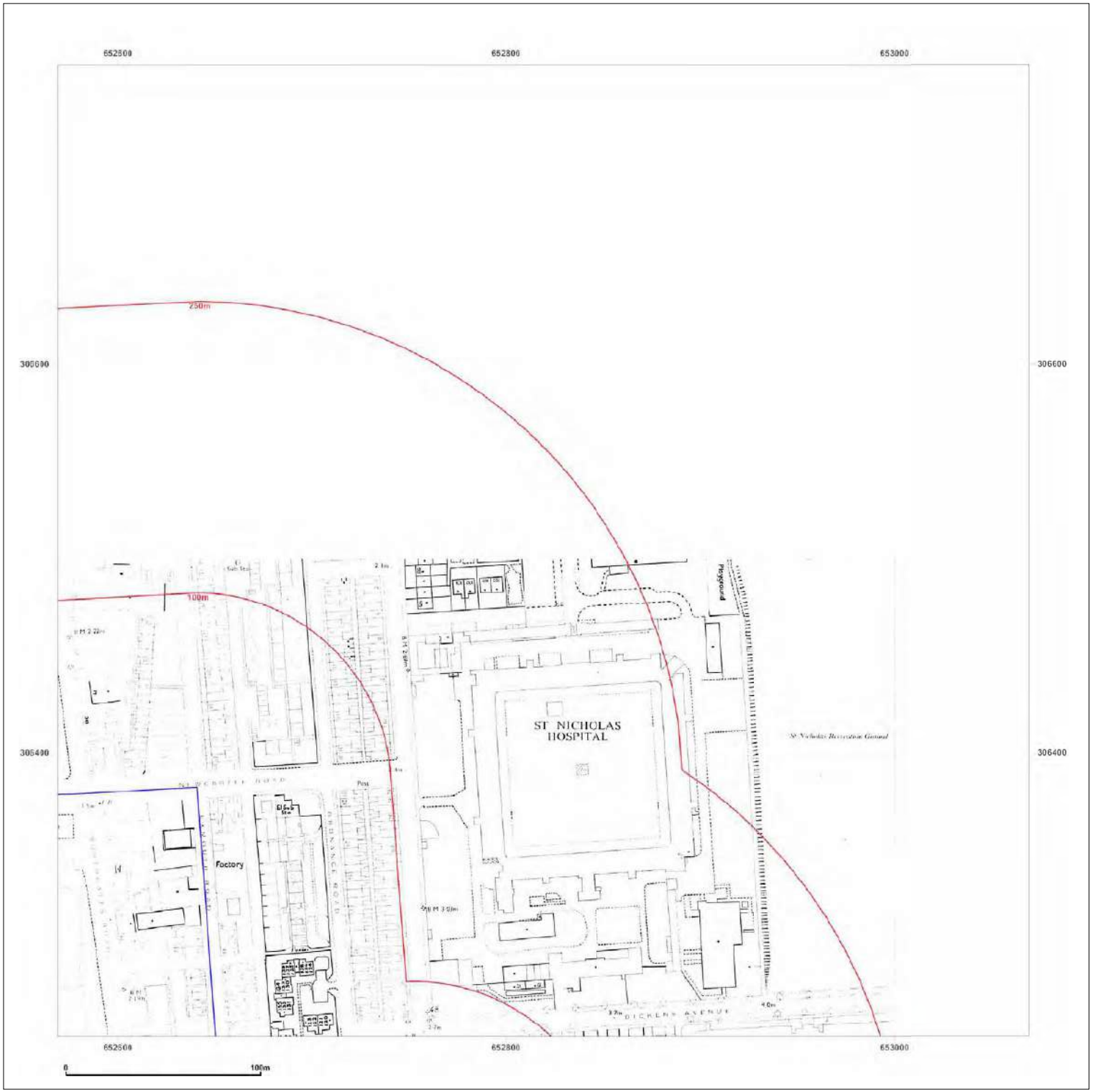

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1984
Scale: 1:1,250
Printed at: 1:2,000

N
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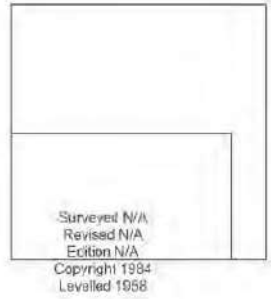

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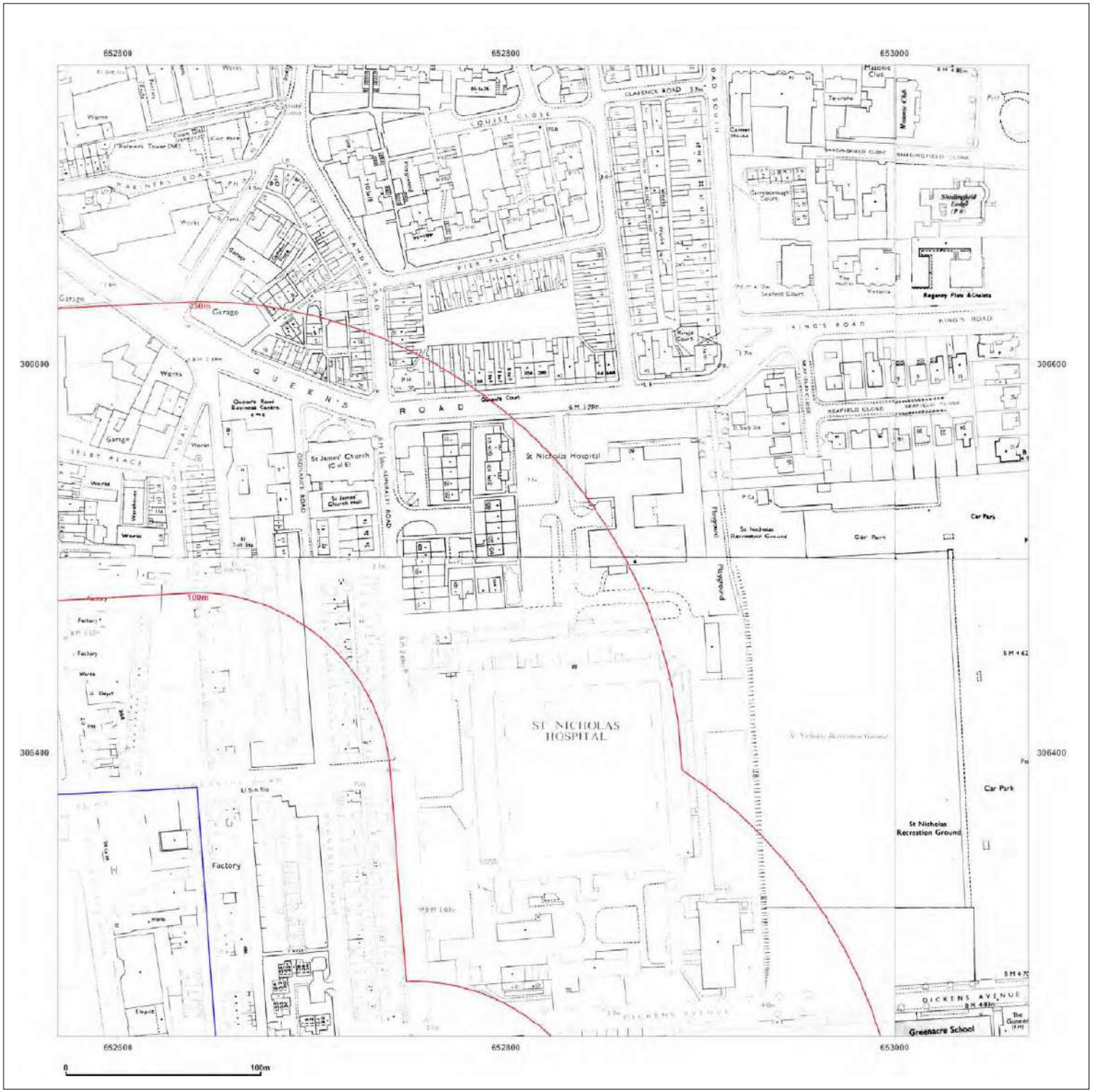

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1990
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958	Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958
Surveyed N/A Revised N/A Edition N/A Copyright 1990 Levelled 1958	Surveyed 1958 Revised 1990 Edition N/A Copyright 1990 Levelled 1958

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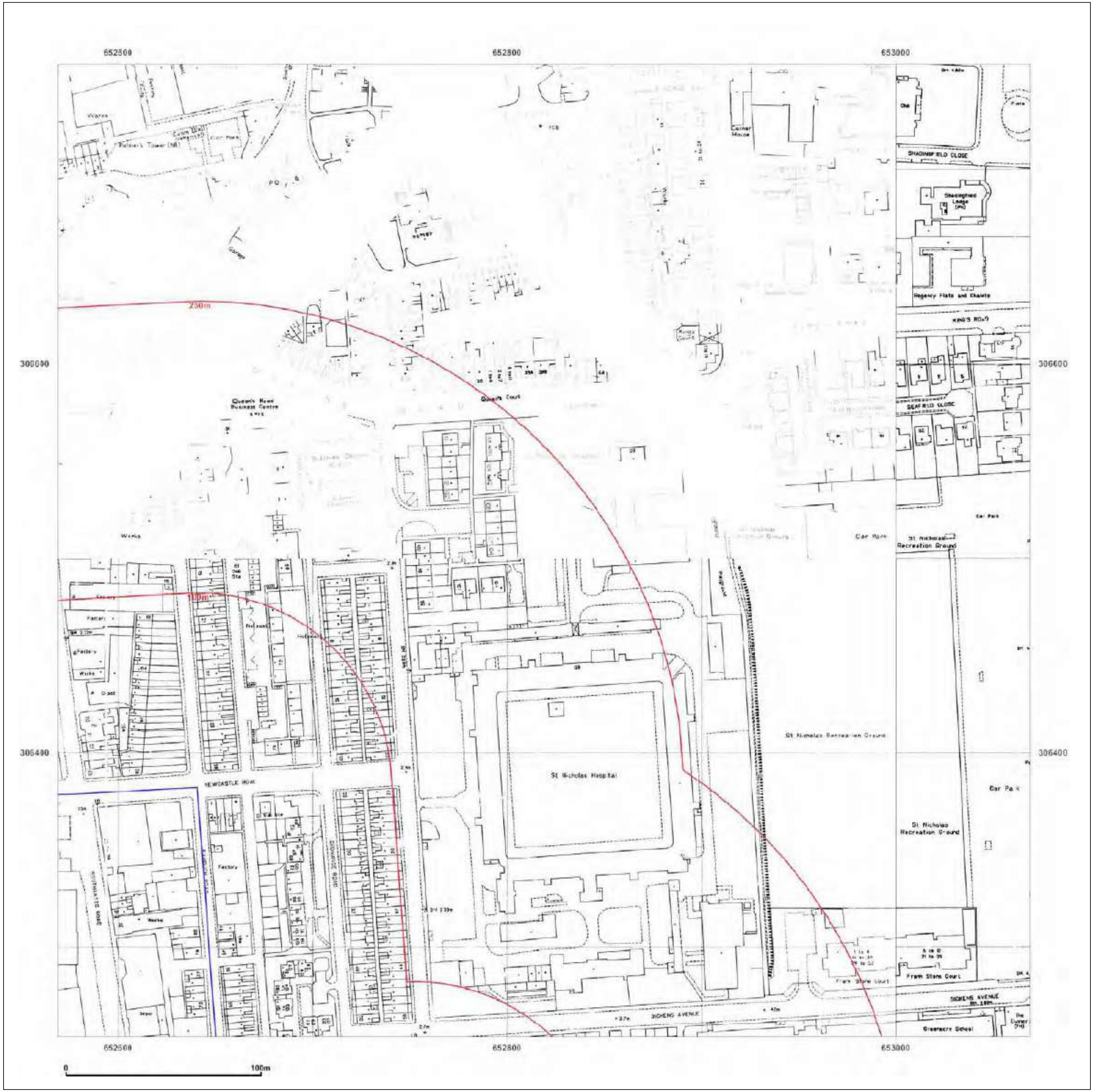

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid

Map date: 1990-1994

Scale: 1:1,250

Printed at: 1:2,000

Surveyed N/A Revised N/A Edition N/A Copyright 1990 Levelled 1966	Surveyed N/A Revised N/A Edition N/A Copyright 1994 Levelled N/A
Surveyed N/A Revised N/A Edition N/A Copyright 1994 Levelled N/A	Surveyed N/A Revised N/A Edition N/A Copyright 1994 Levelled N/A

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Production date: 03 July 2017

To view map legend click here Legend

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_1250scale
Grid Ref: 652819, 306504

Map Name: National Grid
Map date: 1994
Scale: 1:1,250
Printed at: 1:2,000

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

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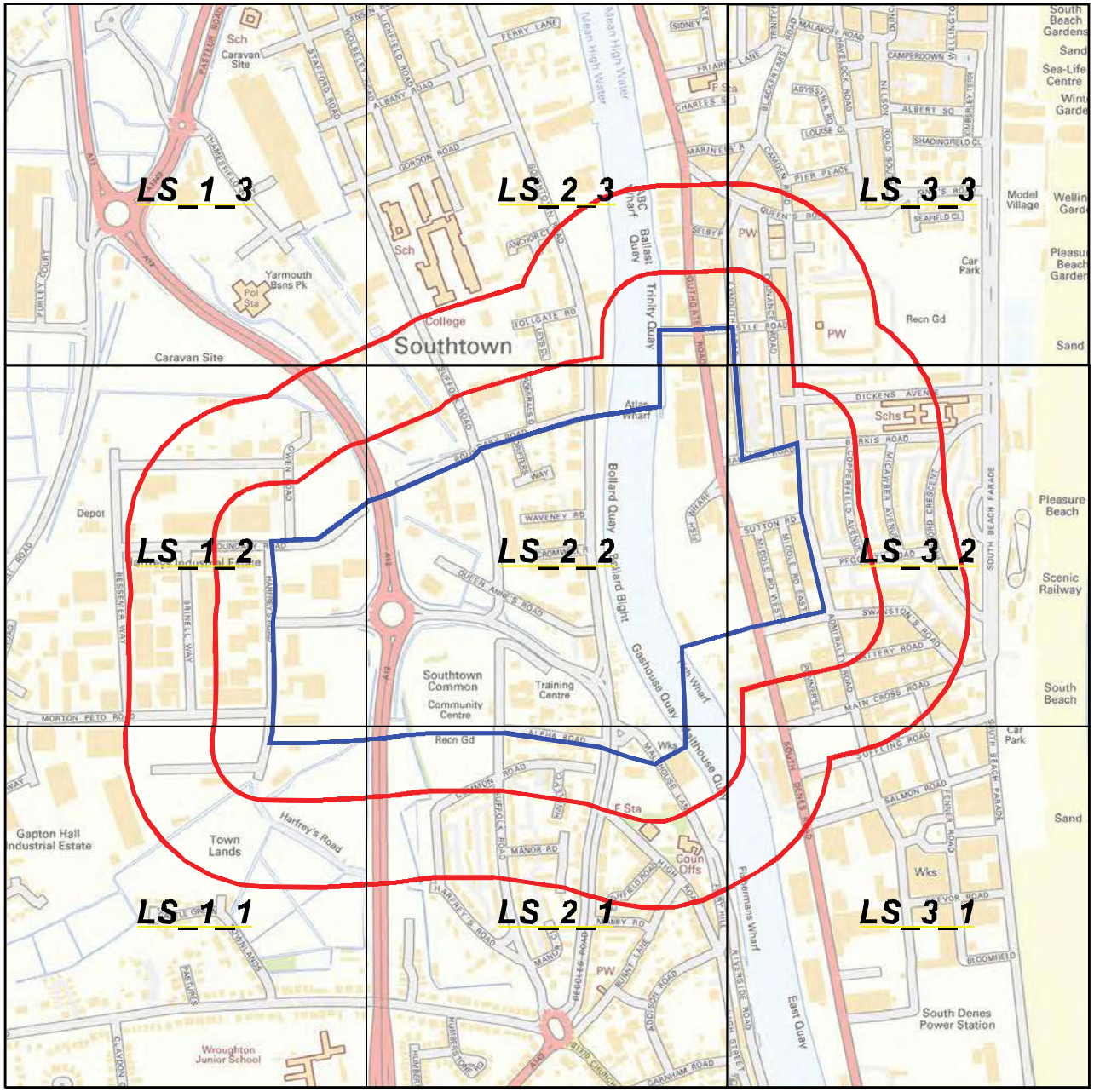

Groundsure INSIGHTS

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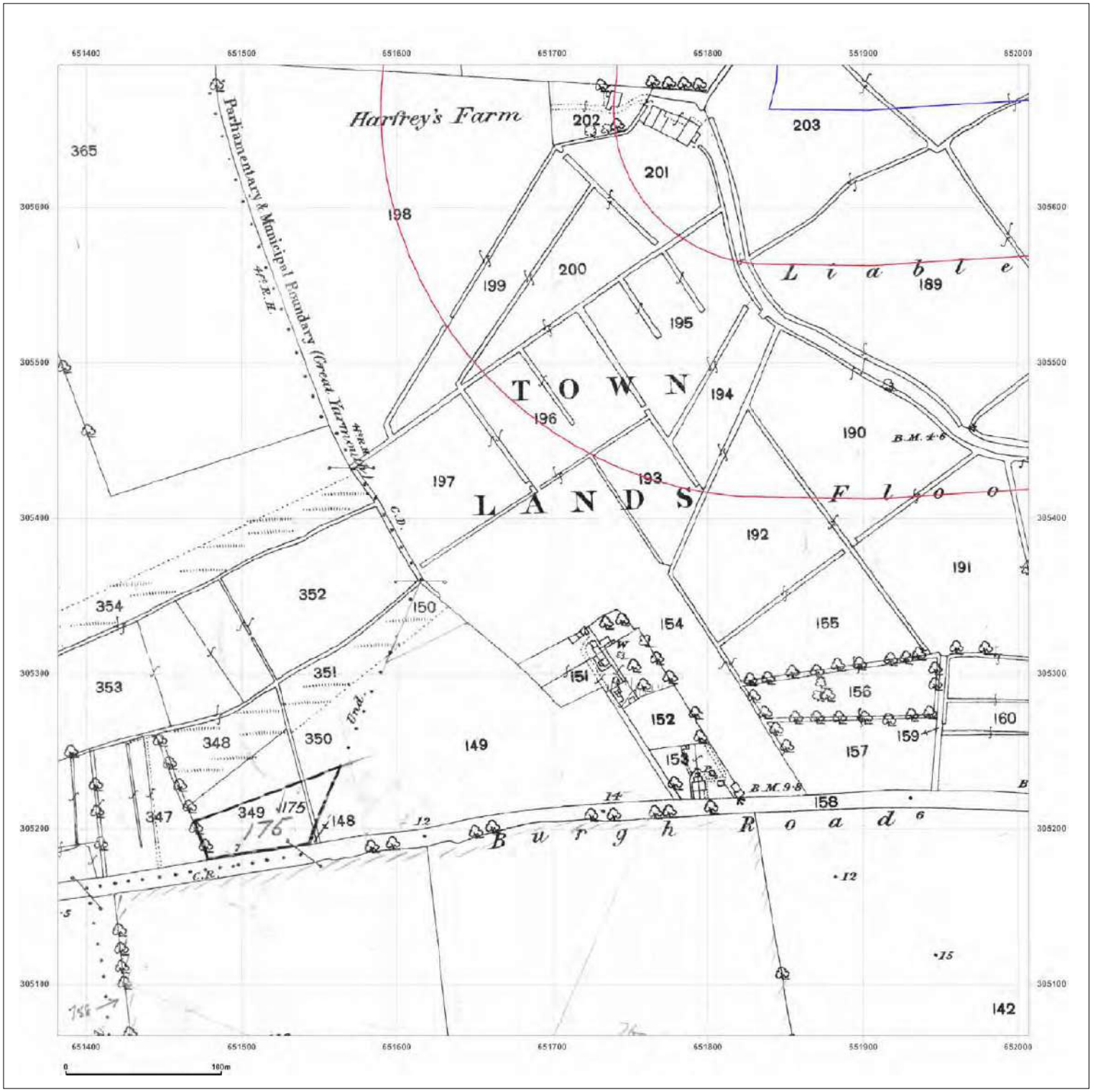
1:2500 Scale Grid Index



CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_1
Grid Ref: 651694, 305379

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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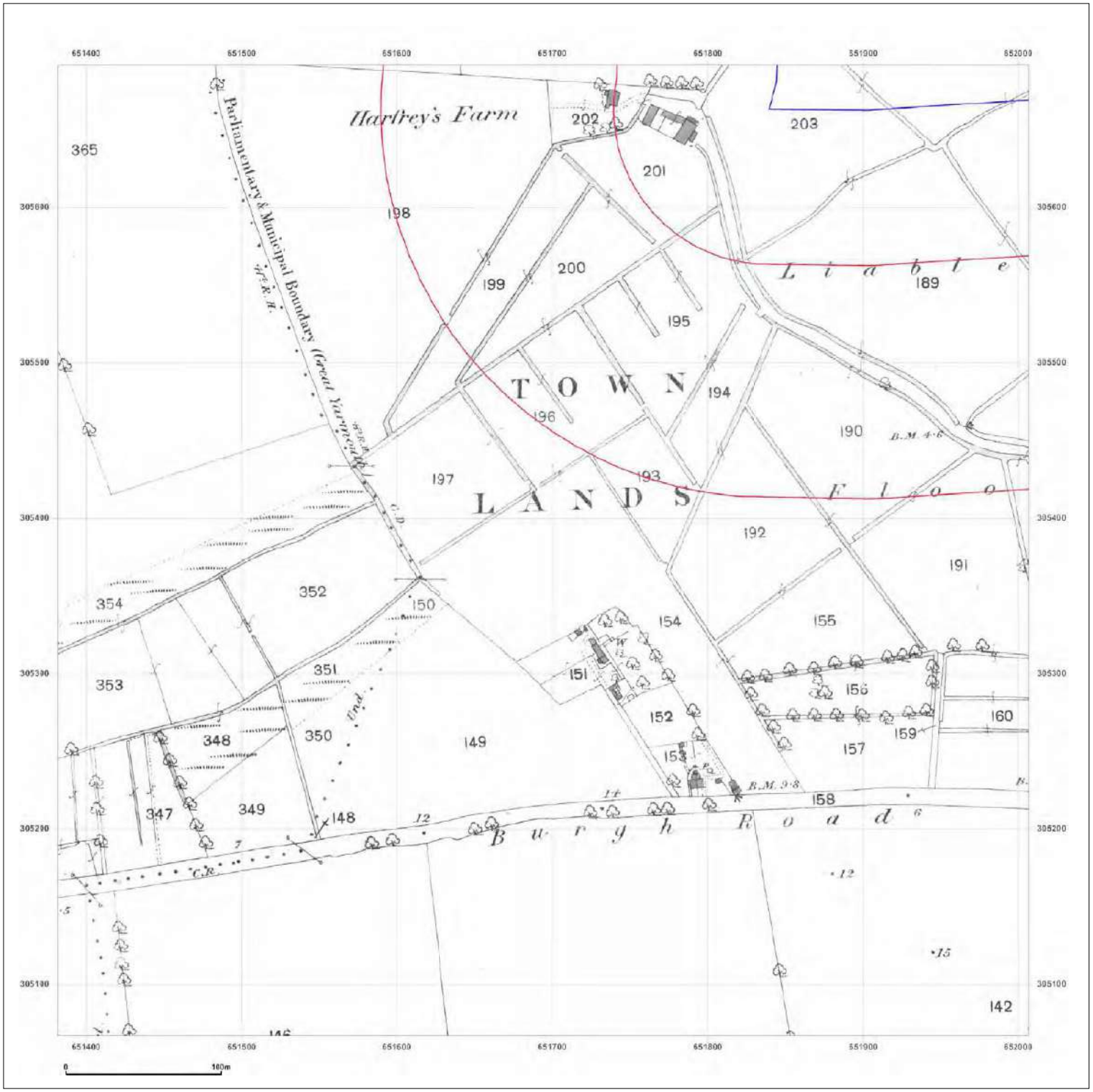

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_1
Grid Ref: 651694, 305379

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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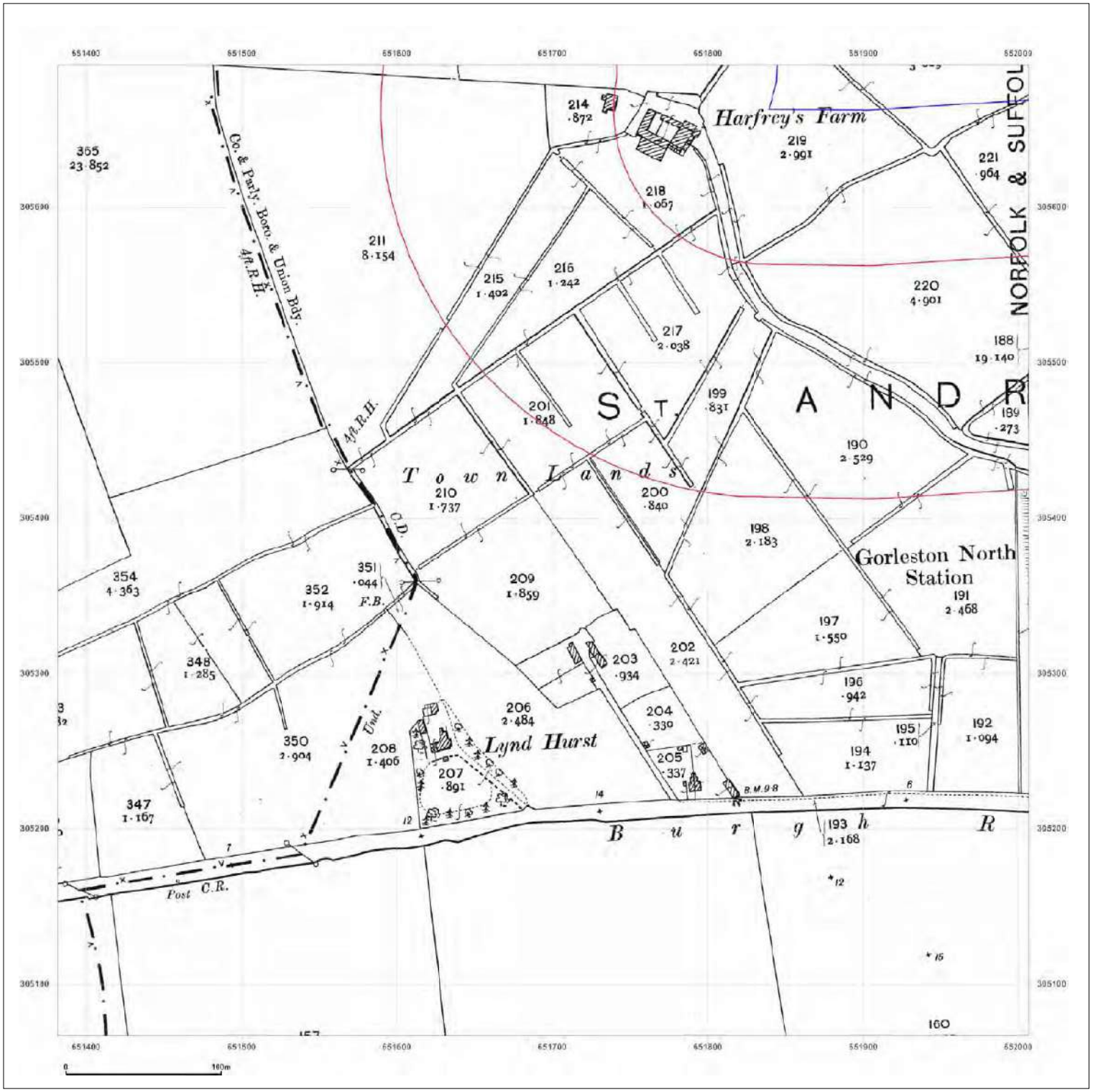

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_1
Grid Ref: 651694, 305379

Map Name: County Series
Map date: 1906
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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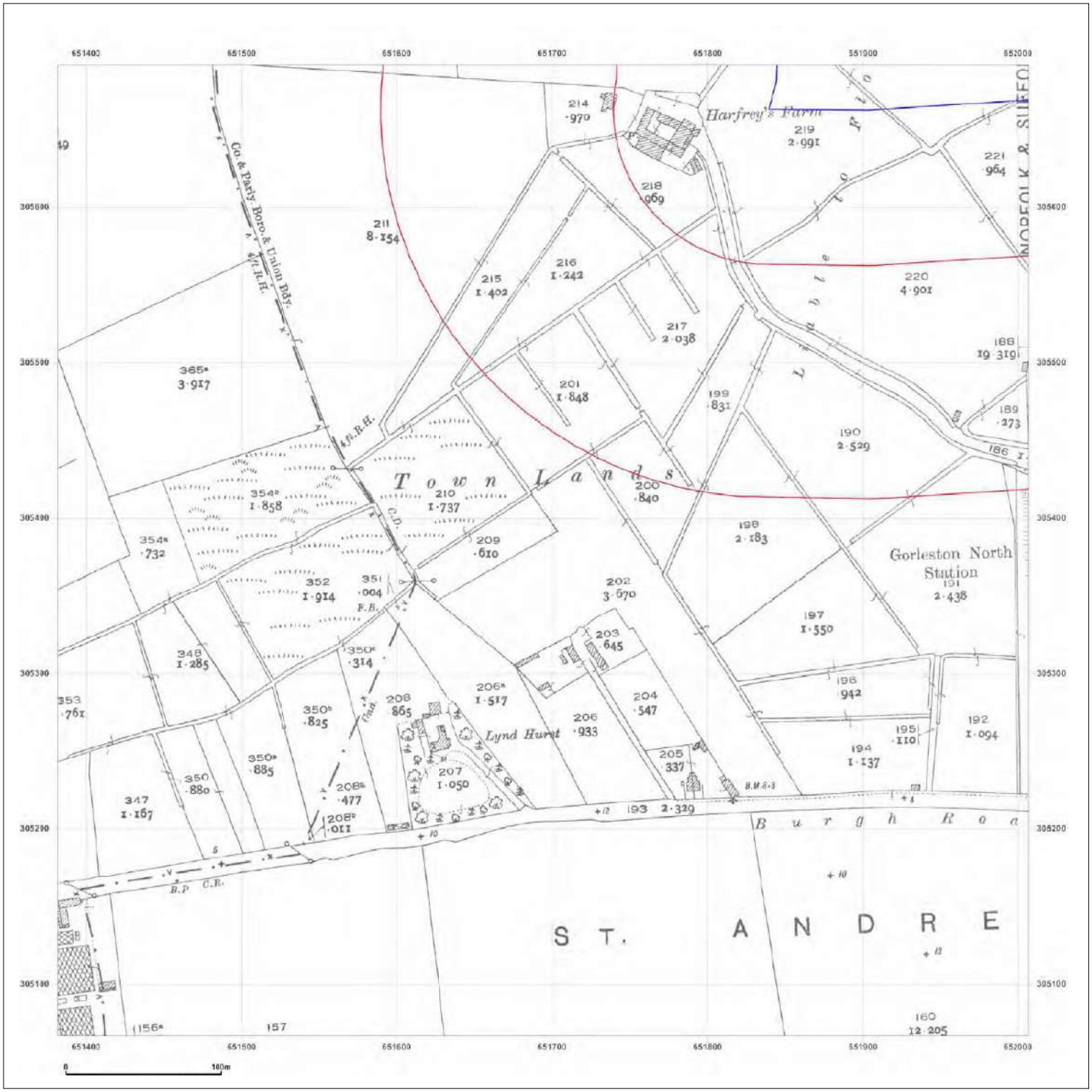

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_1
Grid Ref: 651694, 305379

Map Name: County Series
Map date: 1927
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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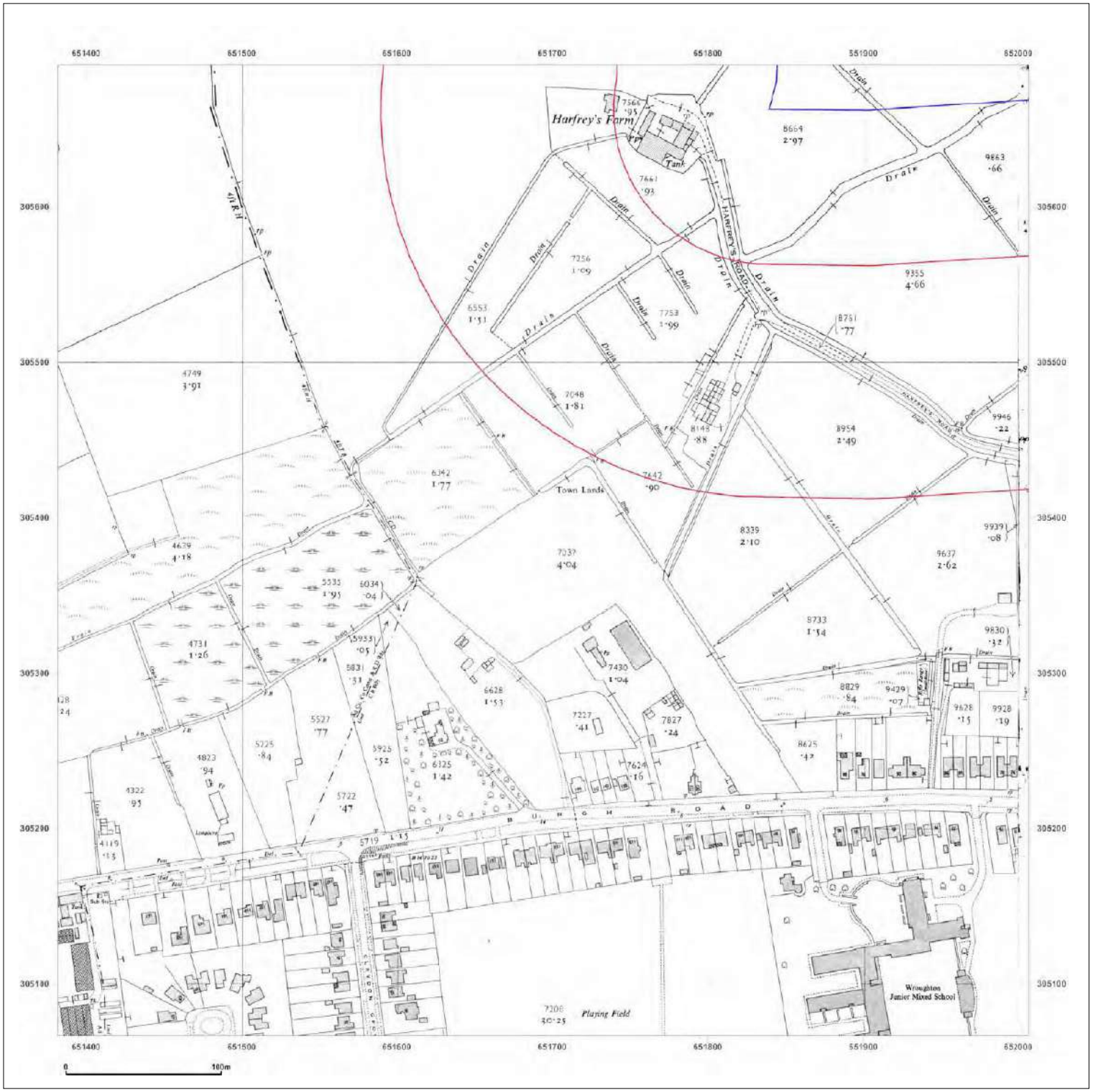

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_1
Grid Ref: 651694, 305379

Map Name: National Grid
Map date: 1951-1955
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1955	Surveyed N/A
Revised 1956	Revised N/A
Edition 1957	Edition N/A
Copyright N/A	Copyright N/A
Levelled 1948	Levelled N/A

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Production date: 03 July 2017

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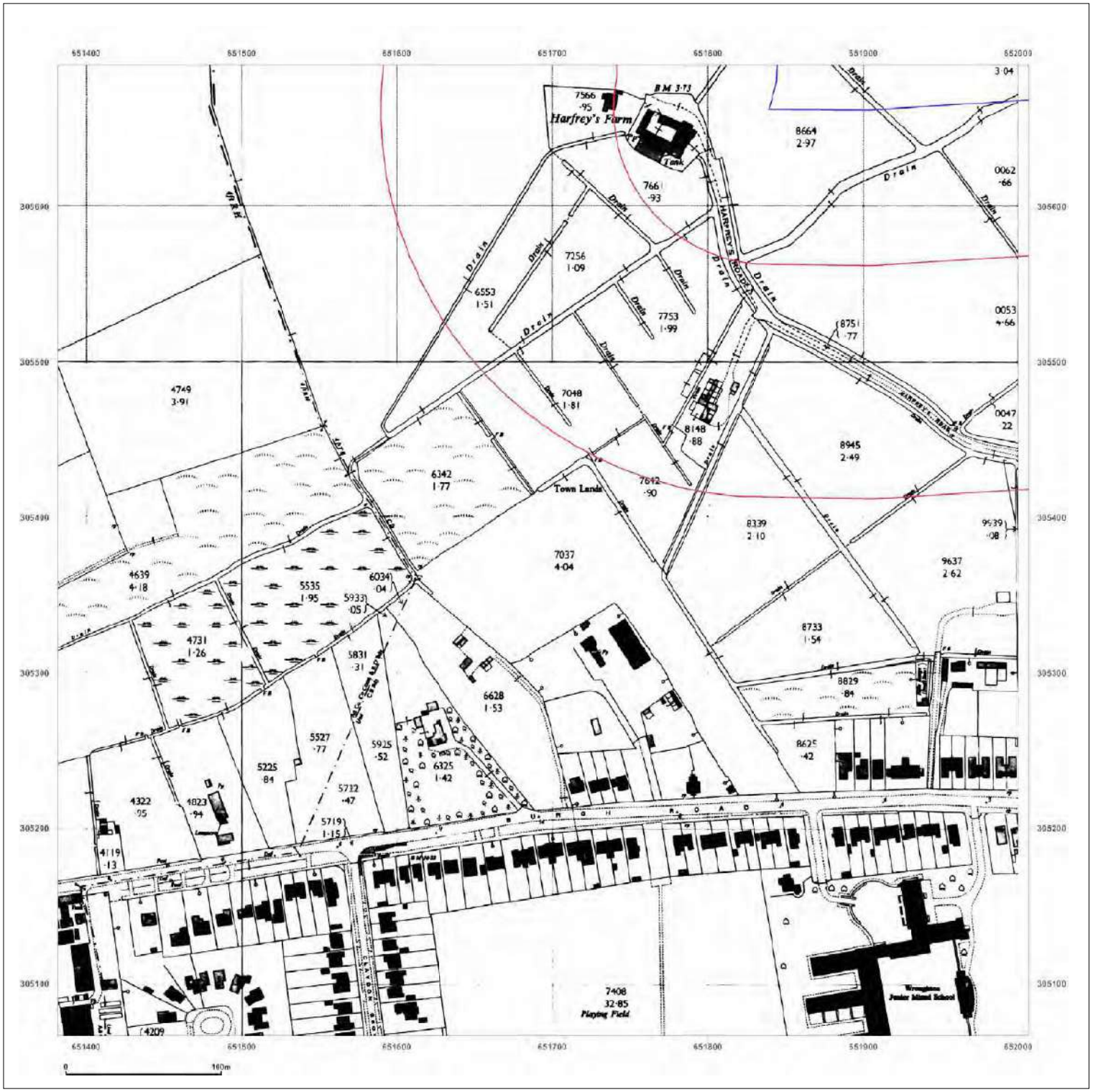

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_1
Grid Ref: 651694, 305379

Map Name: National Grid
Map date: 1965
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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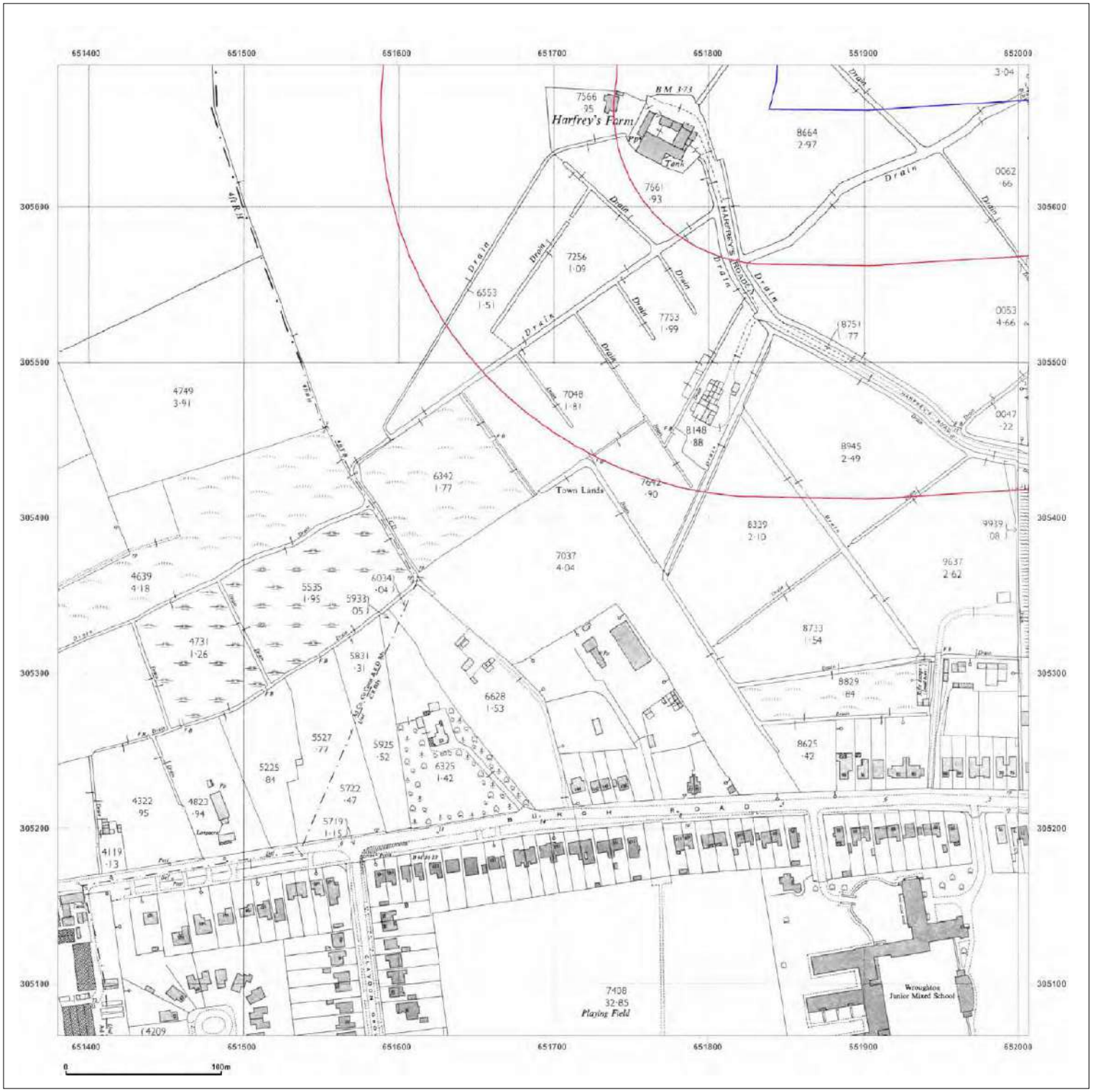

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_1
Grid Ref: 651694, 305379

Map Name: National Grid
Map date: 1964-1968
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1964
Revised 1964
Edition 1965
Copyright 1965
Levelled 1958

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1969
Levelled 1958

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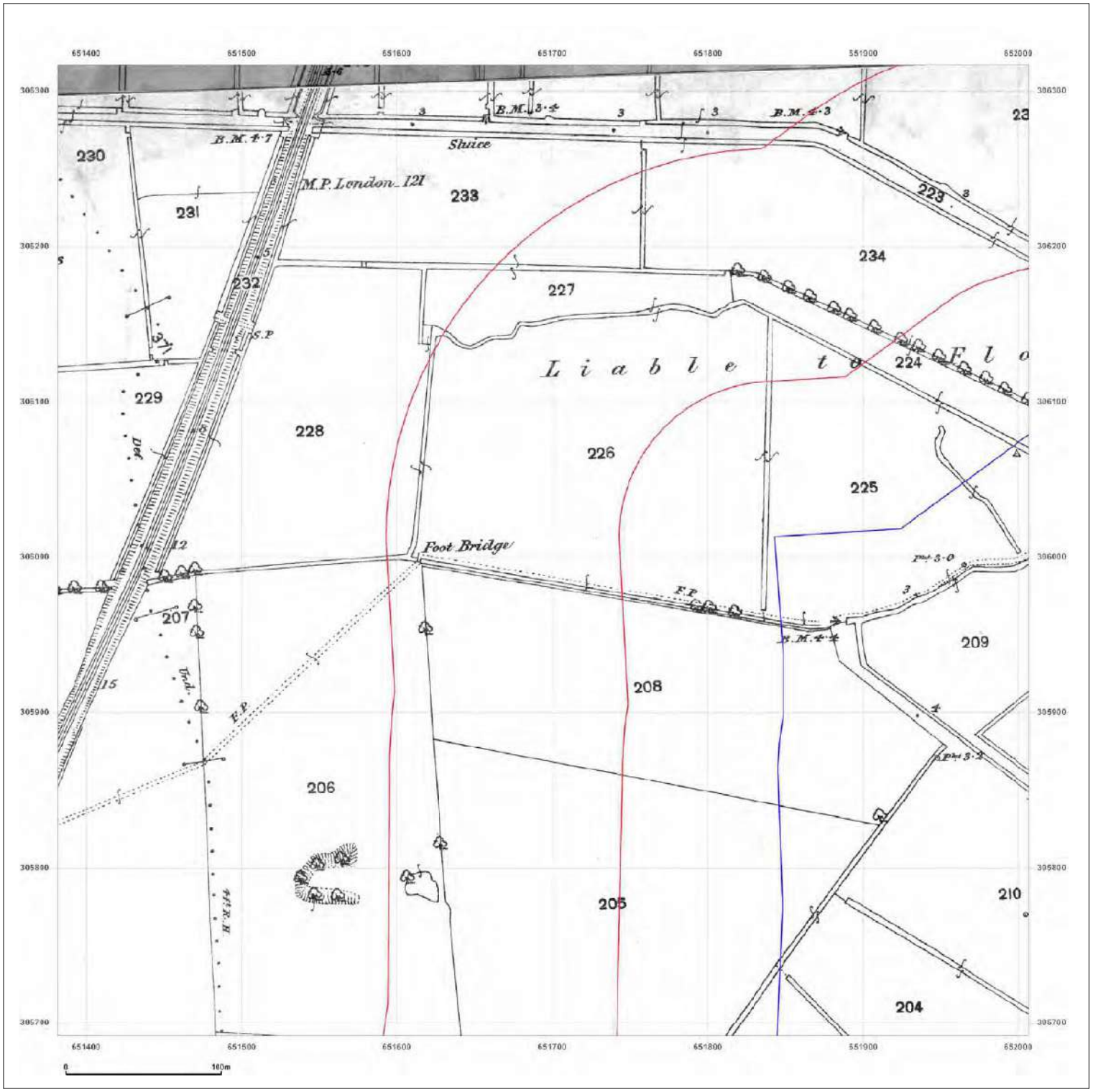

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
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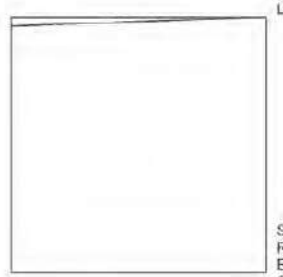

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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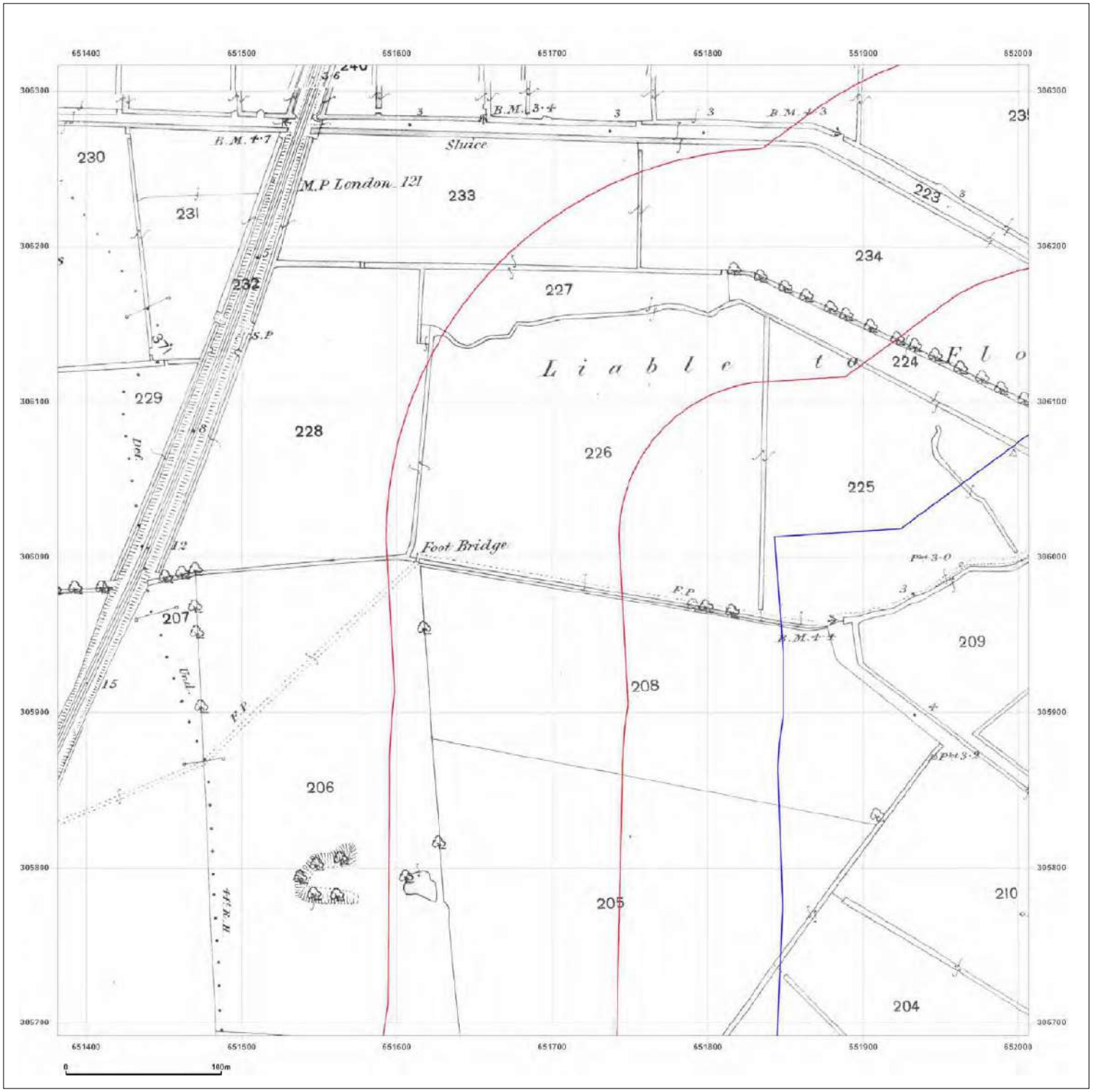

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
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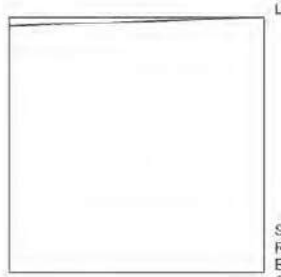

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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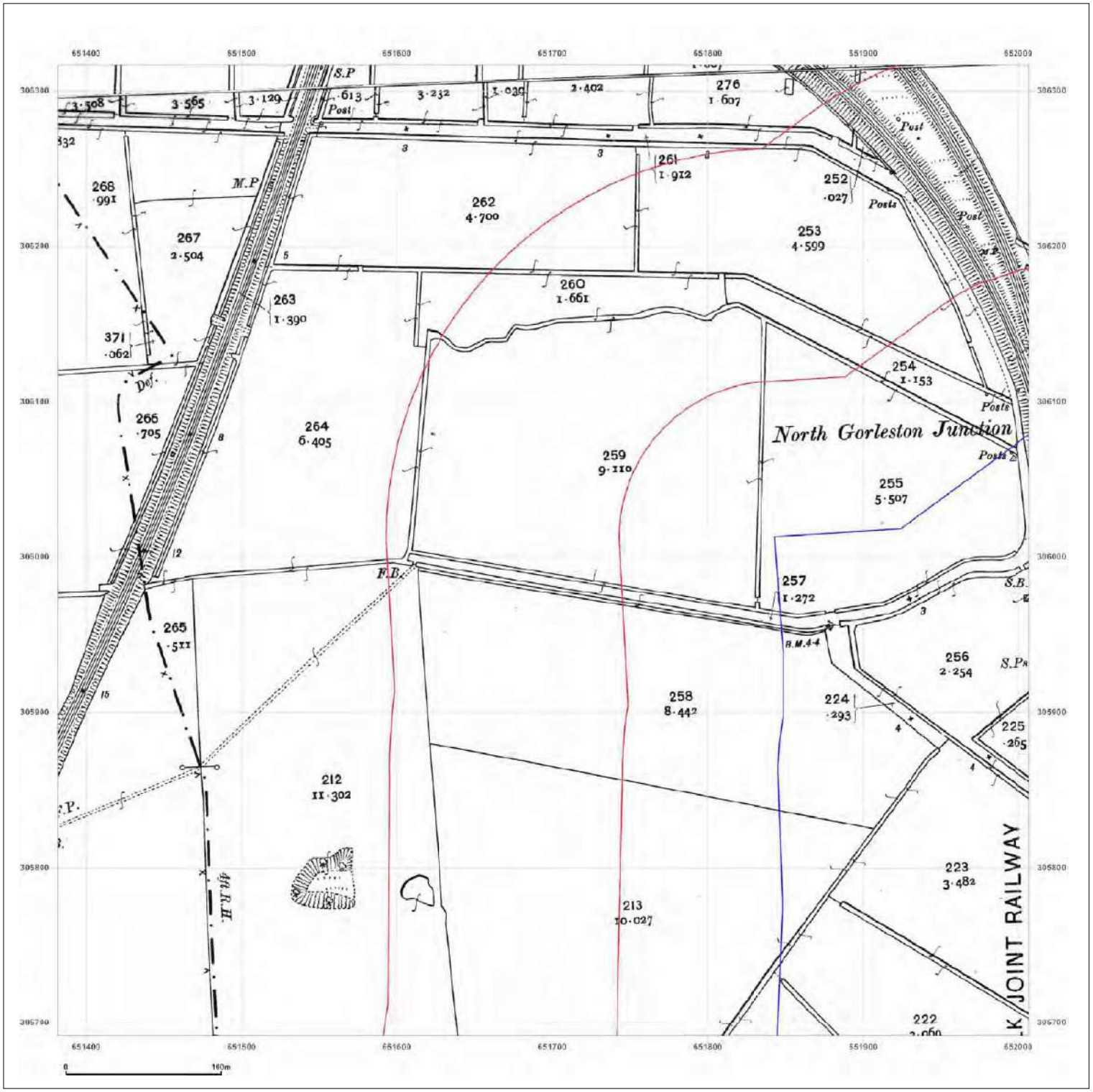

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: County Series
Map date: 1905-1906
Scale: 1:2,500
Printed at: 1:2,500

N
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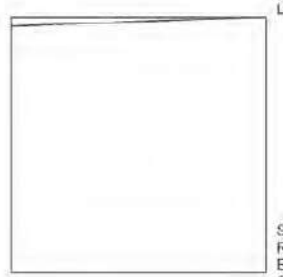

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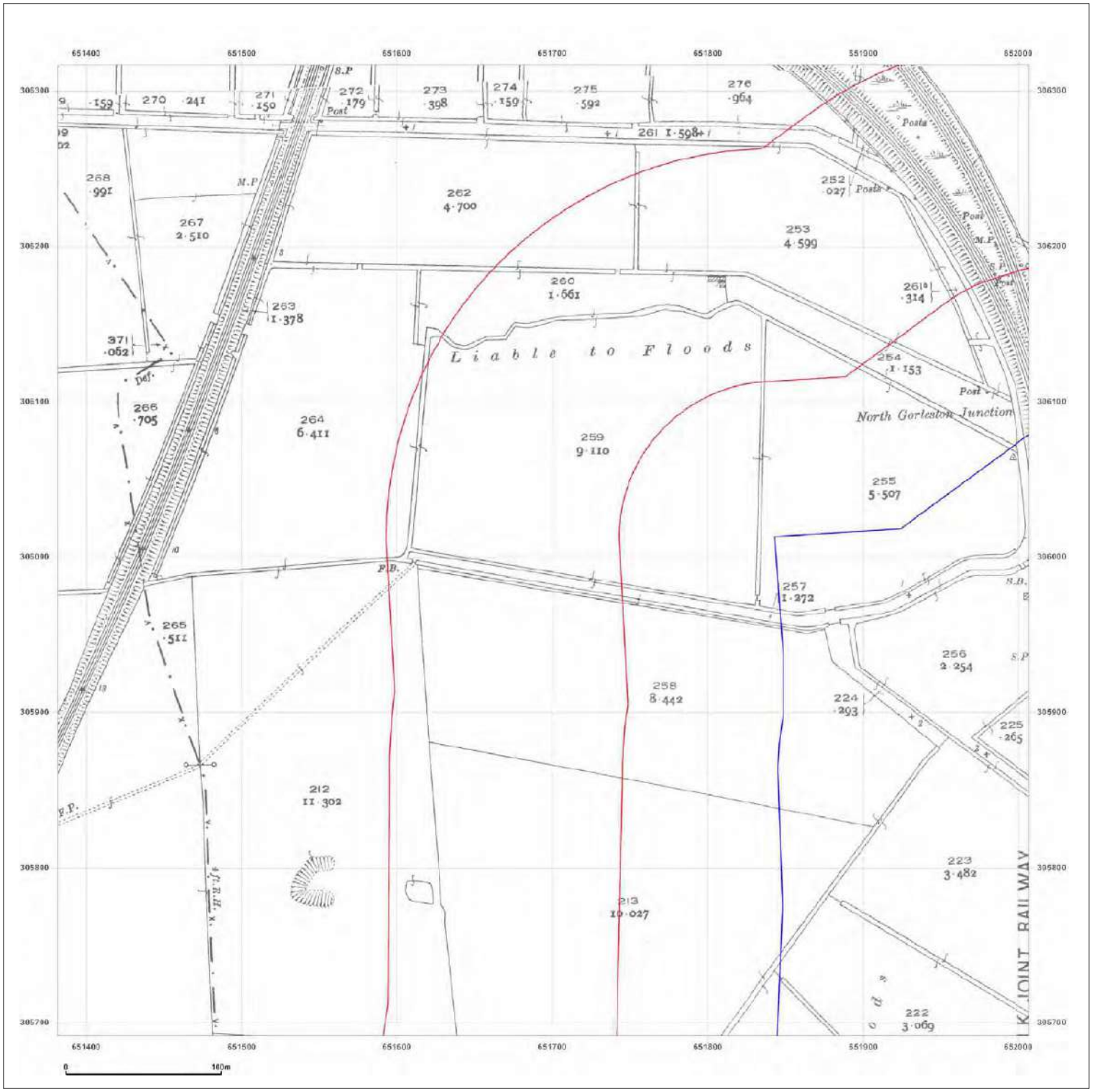

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: County Series
Map date: 1927-1928
Scale: 1:2,500
Printed at: 1:2,500

N
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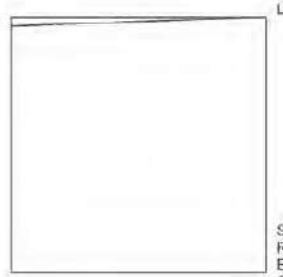

Surveyed 1928
Revised 1928
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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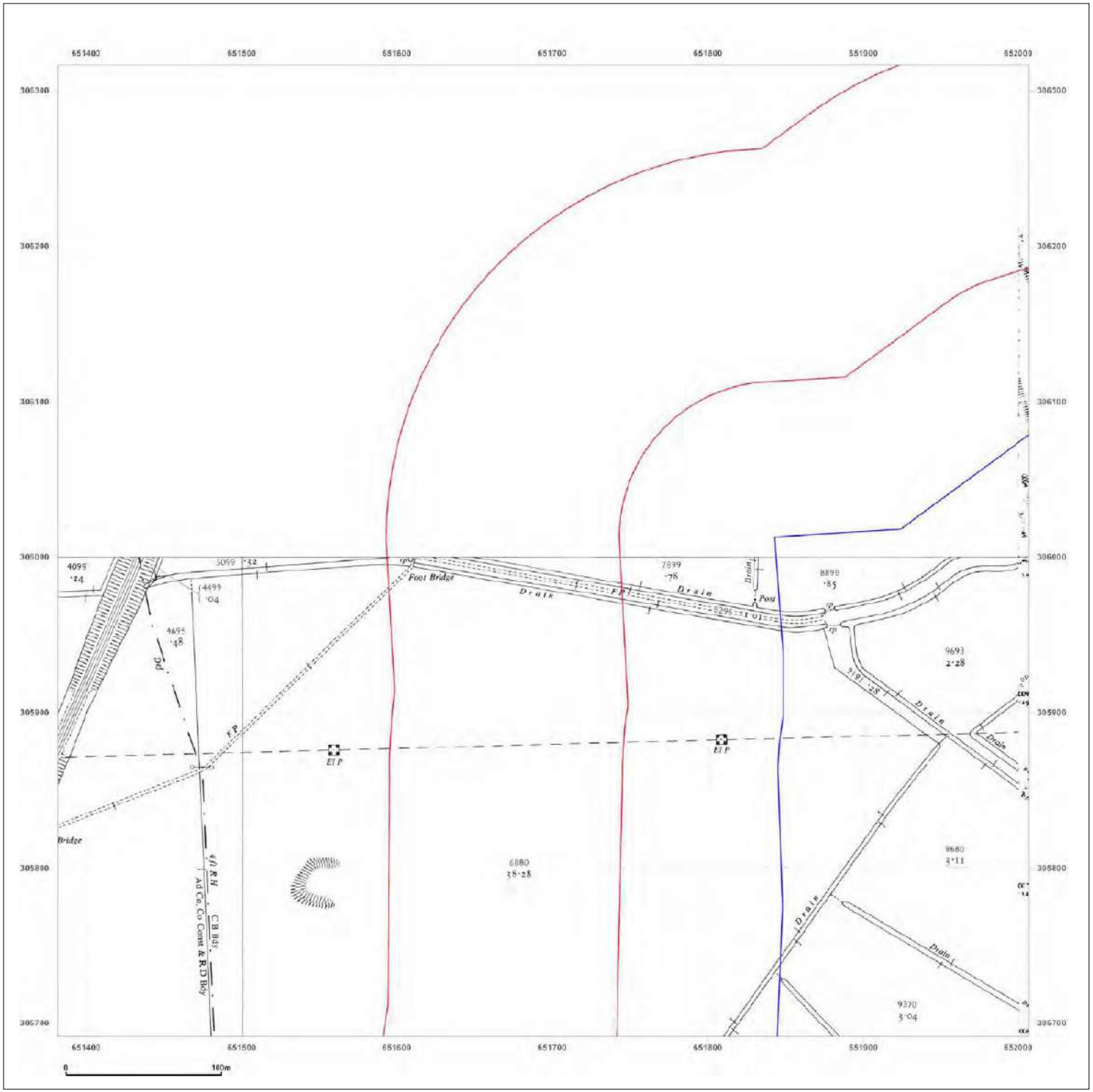

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: National Grid
Map date: 1951-1955
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1955
Revised 1955
Edition 1957
Copyright N/A
Levelled 1946

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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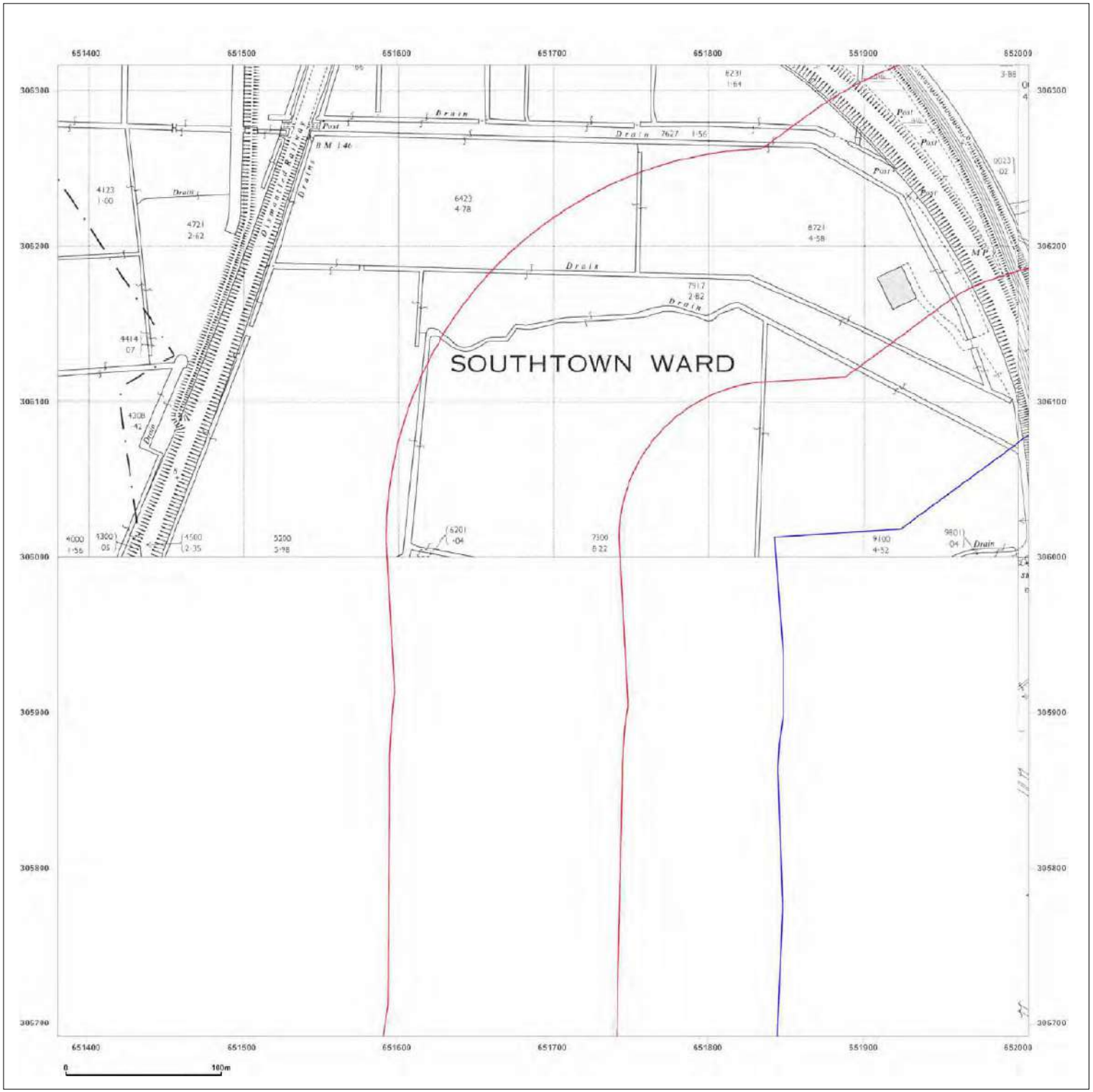

CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: National Grid
Map date: 1958-1963
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1962
Revised 1962
Edition 1964
Copyright 1964
Levelled 1958

Surveyed 1963
Revised 1963
Edition 1965
Copyright 1965
Levelled 1958

Surveyed 1958
Revised 1958
Edition 1960
Copyright 1960
Levelled 1946

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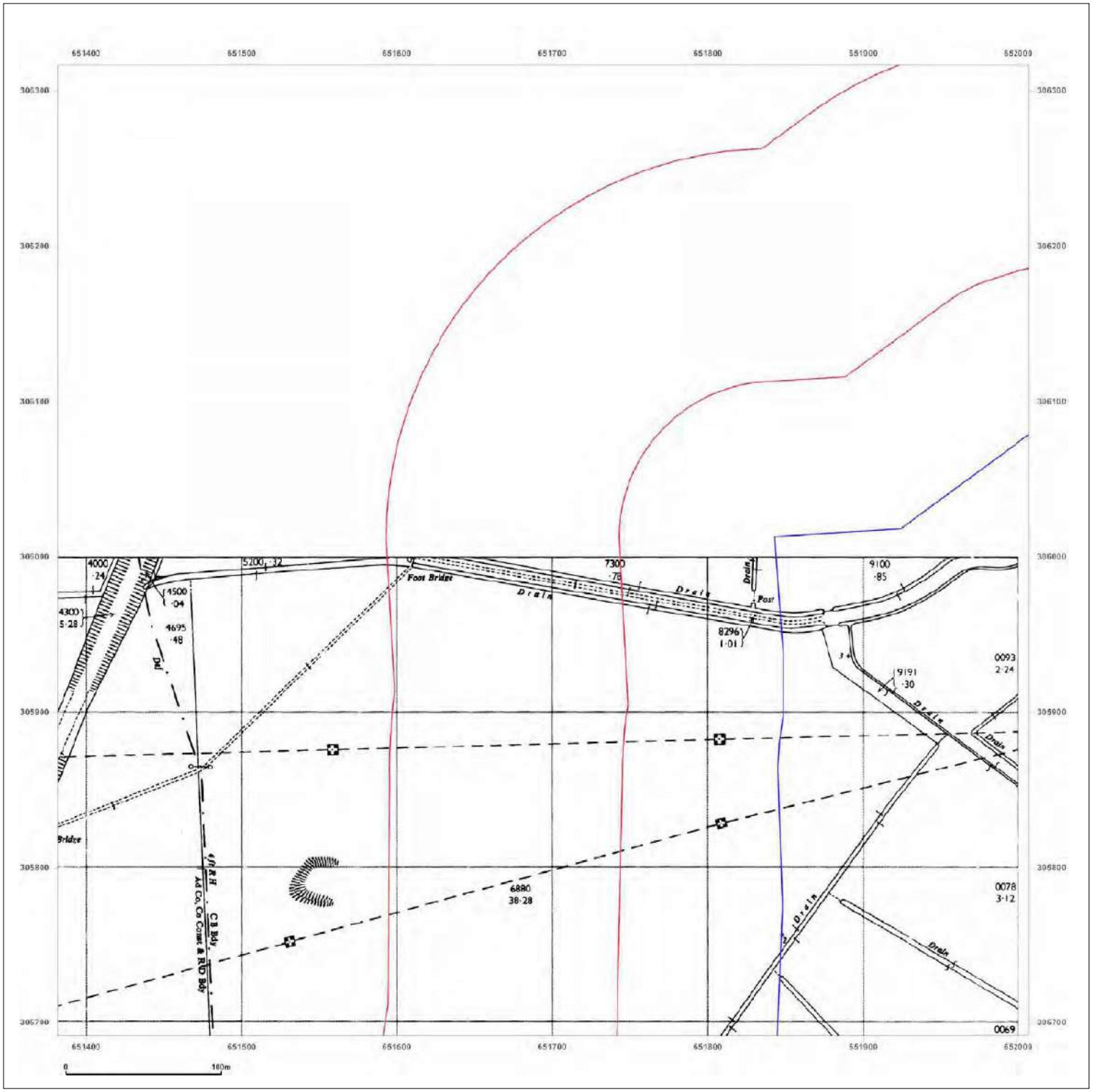

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: National Grid
Map date: 1965
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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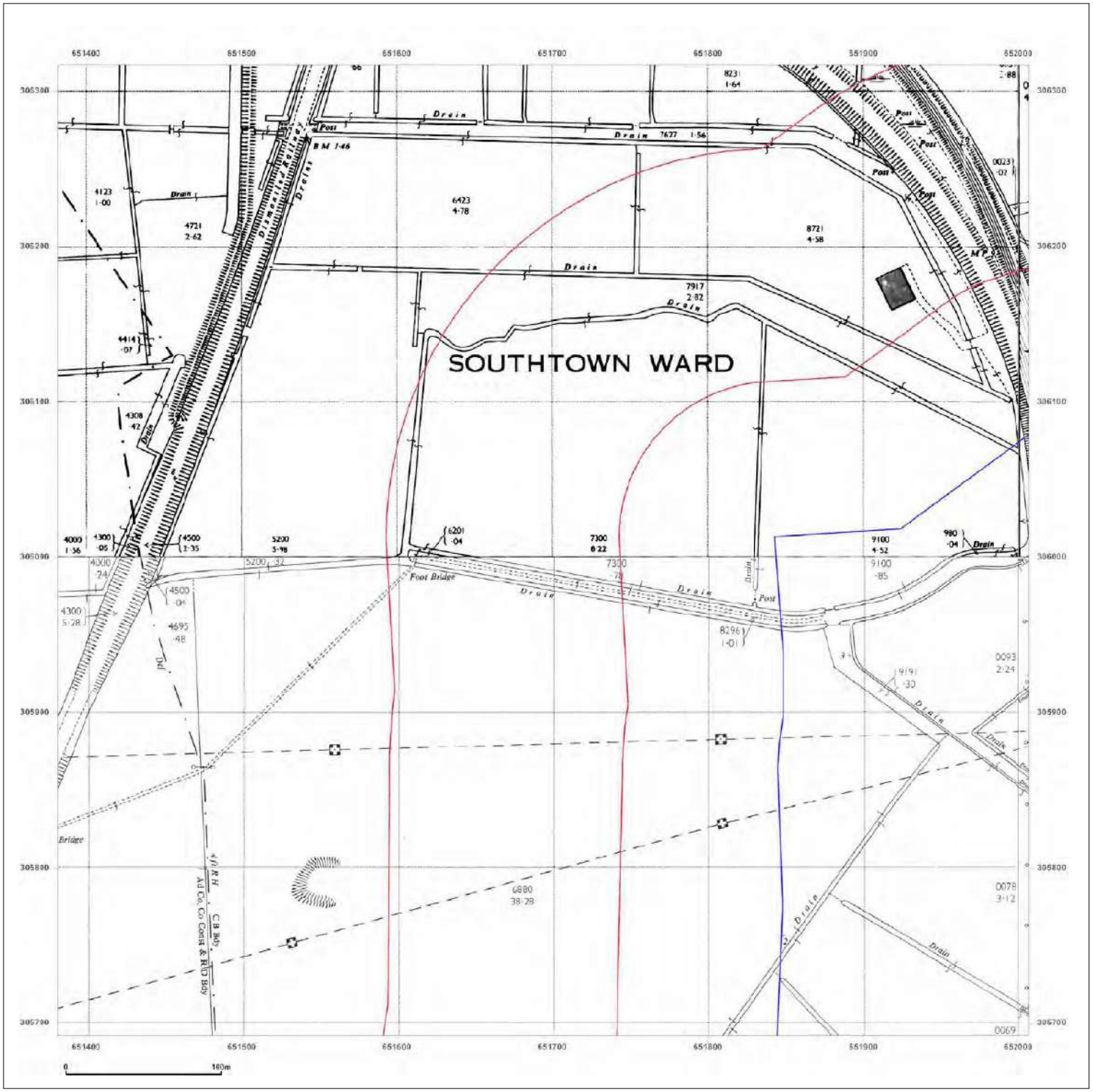

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: National Grid
Map date: 1964-1968
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1964
Revised 1964
Edition 1965
Copyright 1965
Levelled 1958

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1969
Levelled 1958

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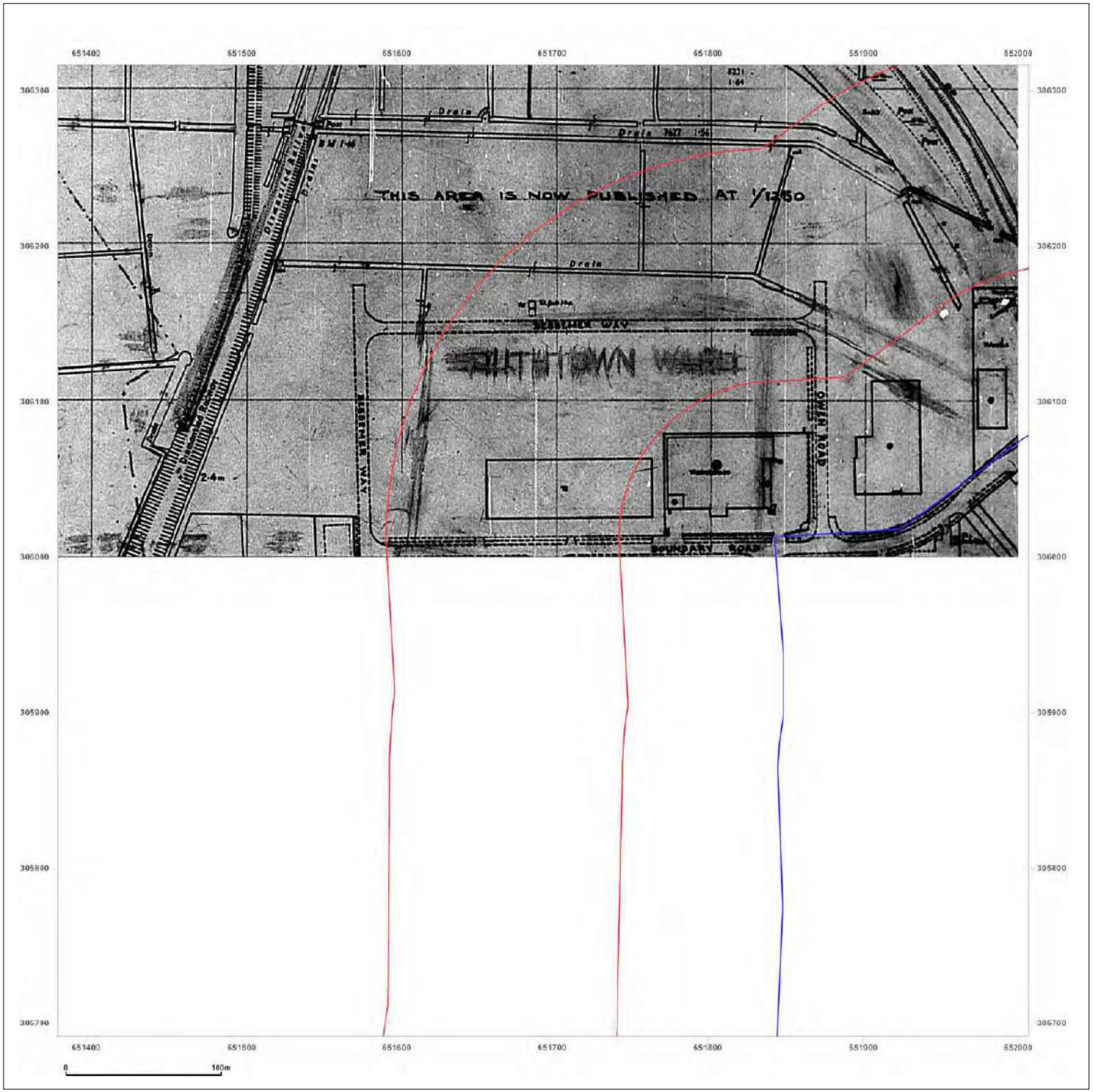

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_2
Grid Ref: 651694, 306004

Map Name: National Grid
Map date: 1978
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1978
Revised 1978
Edition N/A
Copyright 1978
Levelled N/A

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Production date: 03 July 2017

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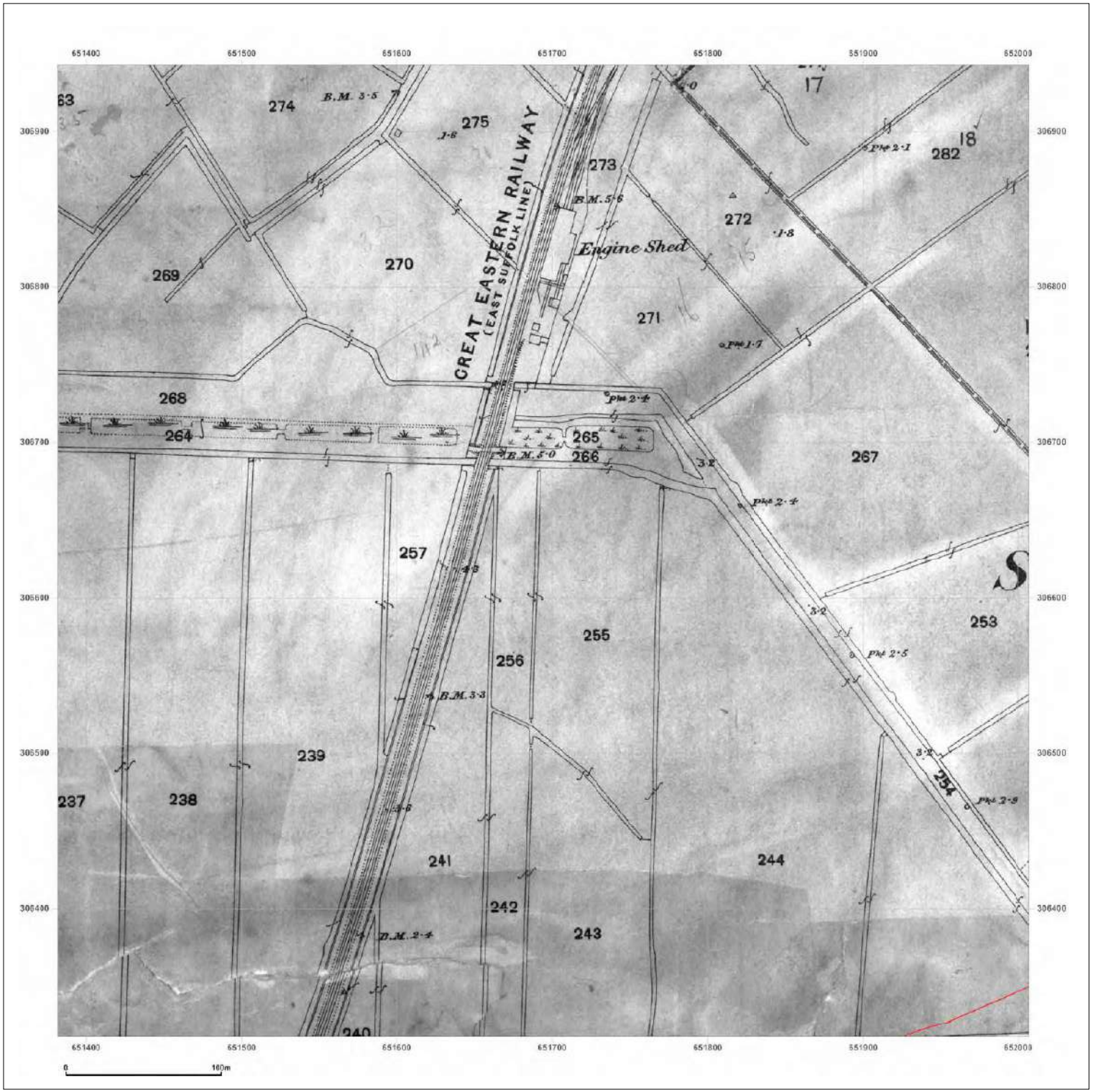

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_3
Grid Ref: 651694, 306630

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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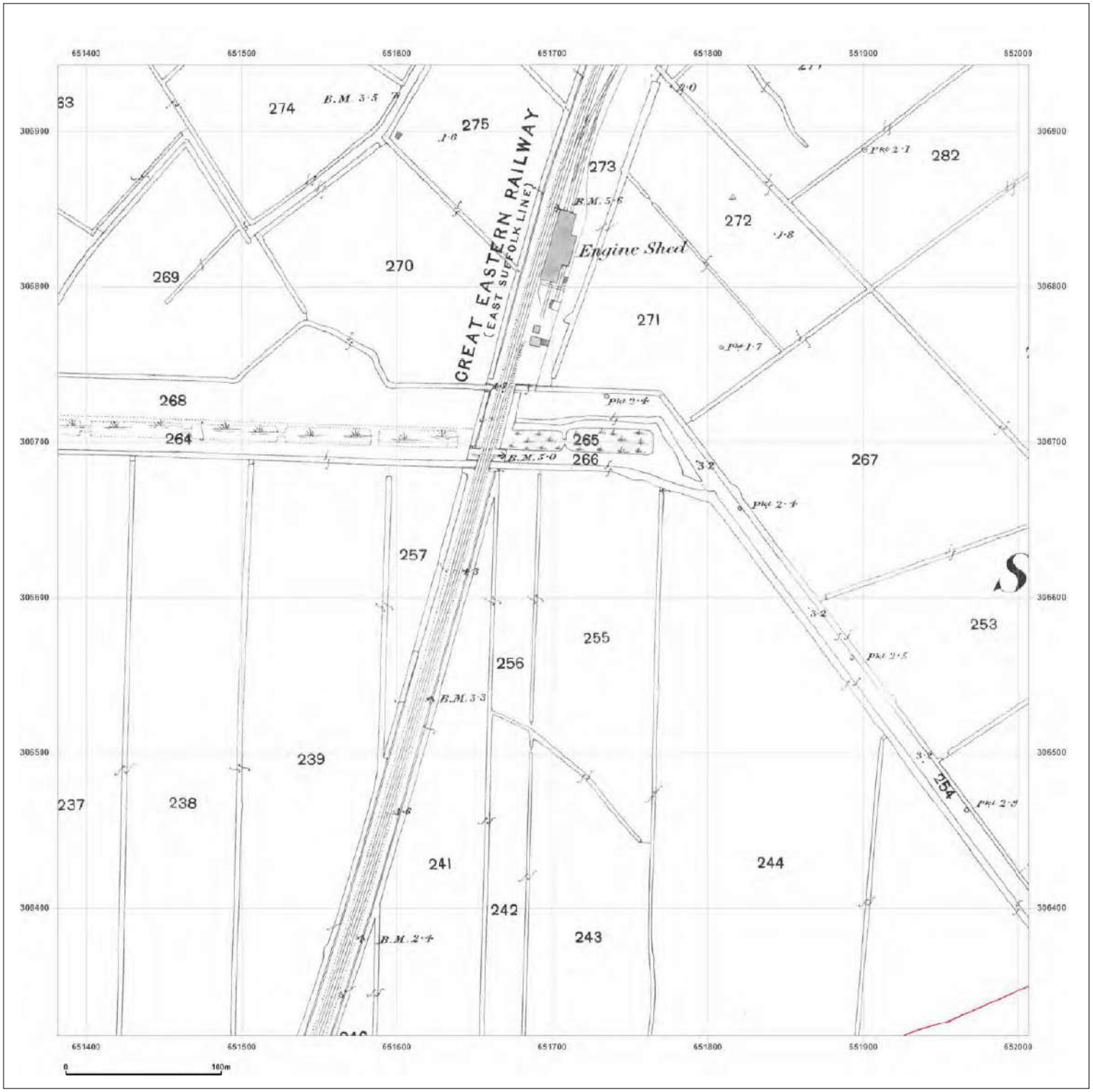

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_3
Grid Ref: 651694, 306630

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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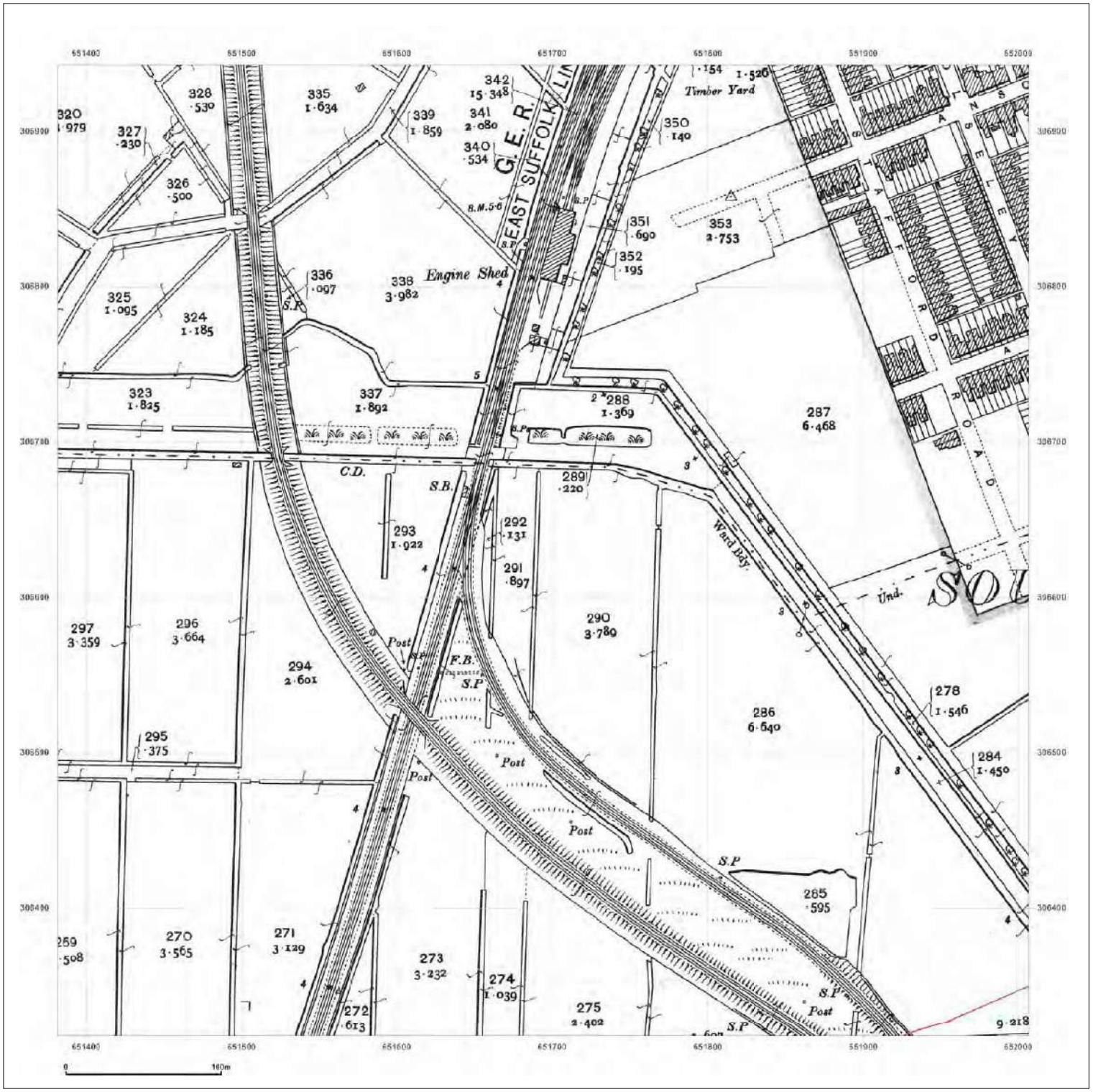

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_3
Grid Ref: 651694, 306630

Map Name: County Series
Map date: 1905-1906
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1905
Revised 1905
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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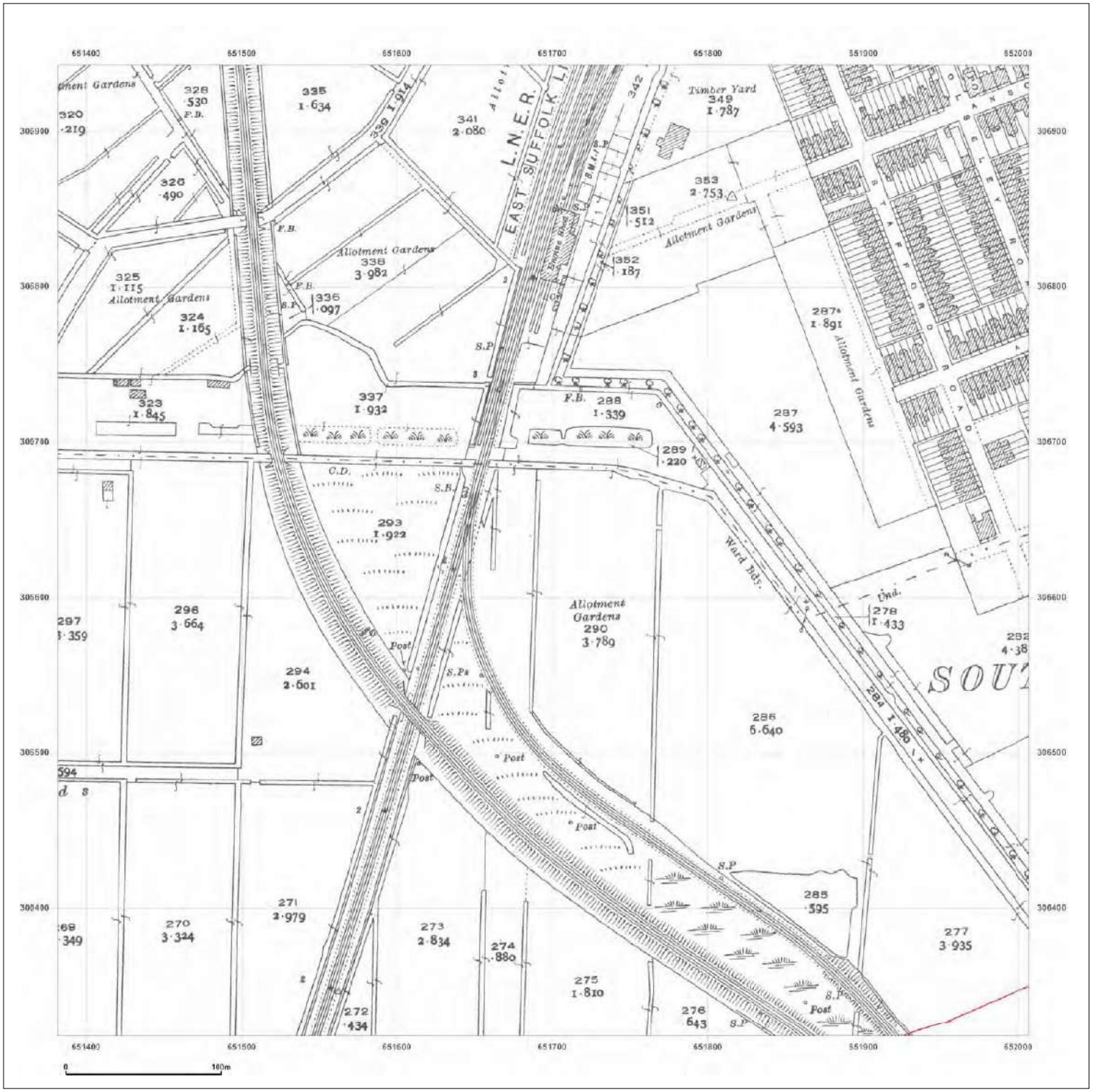

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_3
Grid Ref: 651694, 306630

Map Name: County Series
Map date: 1927-1928
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1928
Revised 1928
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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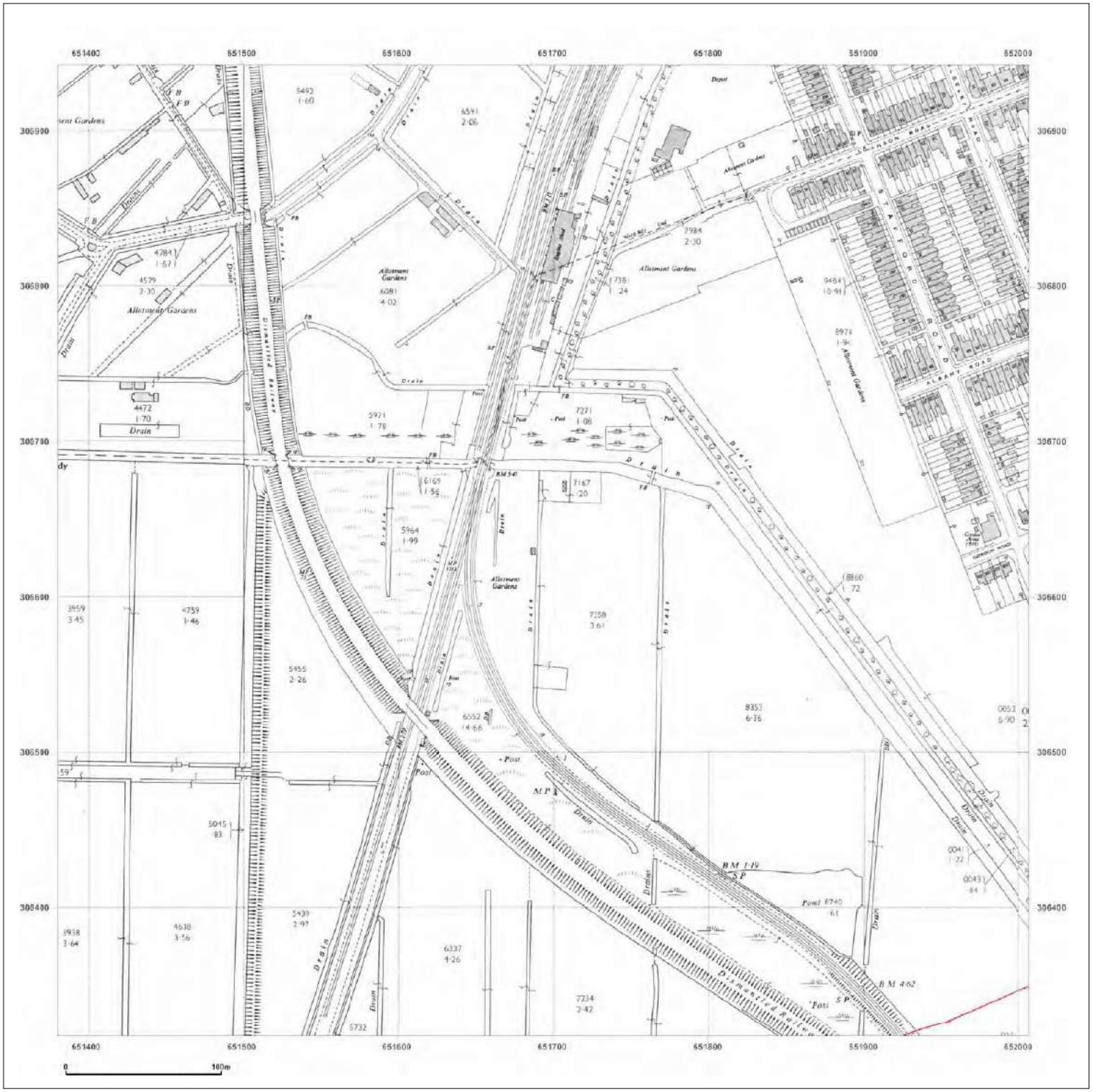

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_3
Grid Ref: 651694, 306630

Map Name: National Grid
Map date: 1962-1963
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1962
Revised 1962
Edition 1964
Copyright 1964
Levelled 1958

Surveyed 1963
Revised 1963
Edition 1965
Copyright 1965
Levelled 1958

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Production date: 03 July 2017

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_3
Grid Ref: 651694, 306630

Map Name: National Grid
Map date: 1964-1965
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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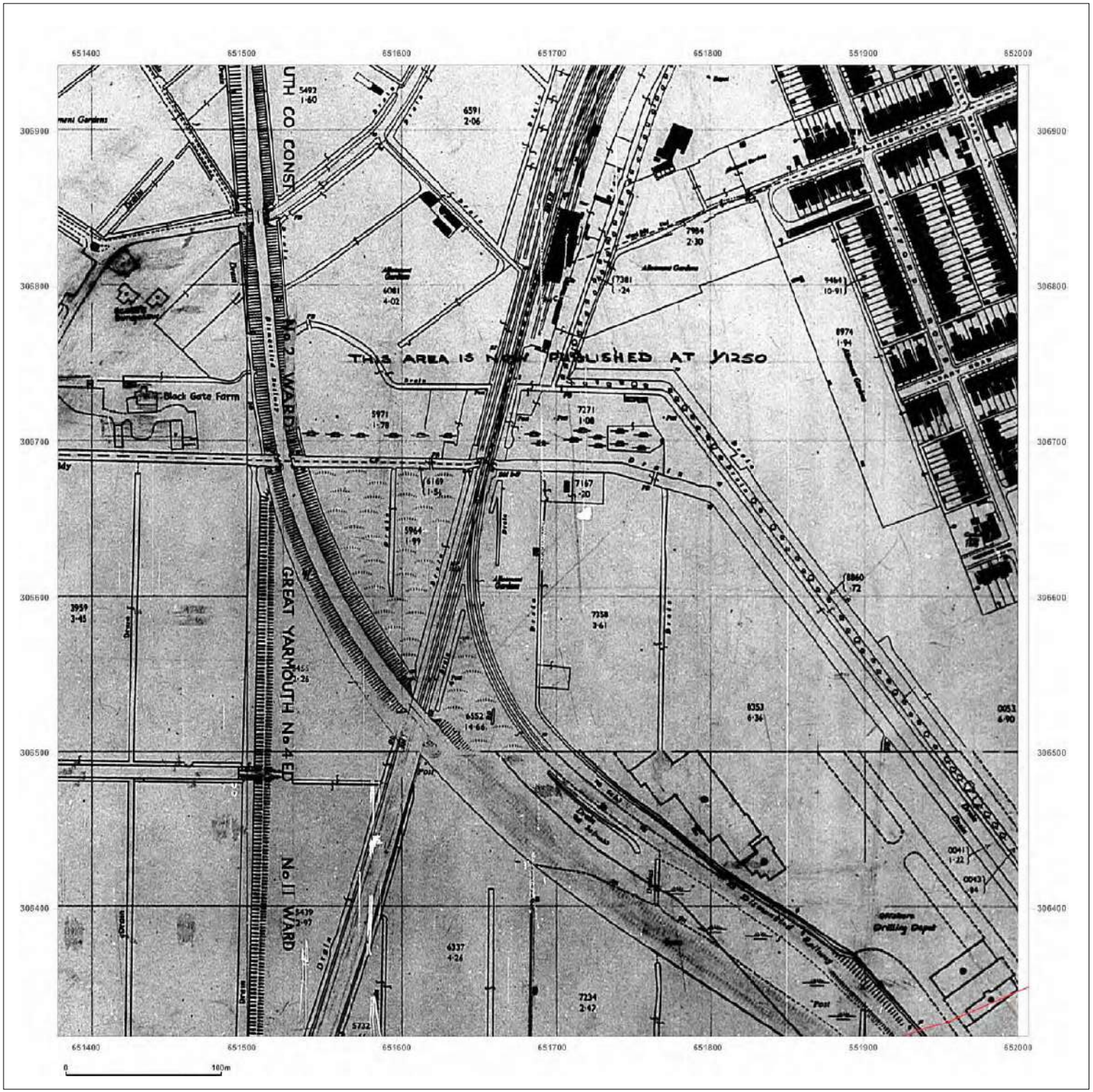
Production date: 03 July 2017

To view map legend click here Legend



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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_1_3
Grid Ref: 651694, 306630

Map Name: National Grid
Map date: 1978
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1978
Revised 1978
Edition N/A
Copyright 1976
Levelled N/A

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Production date: 03 July 2017

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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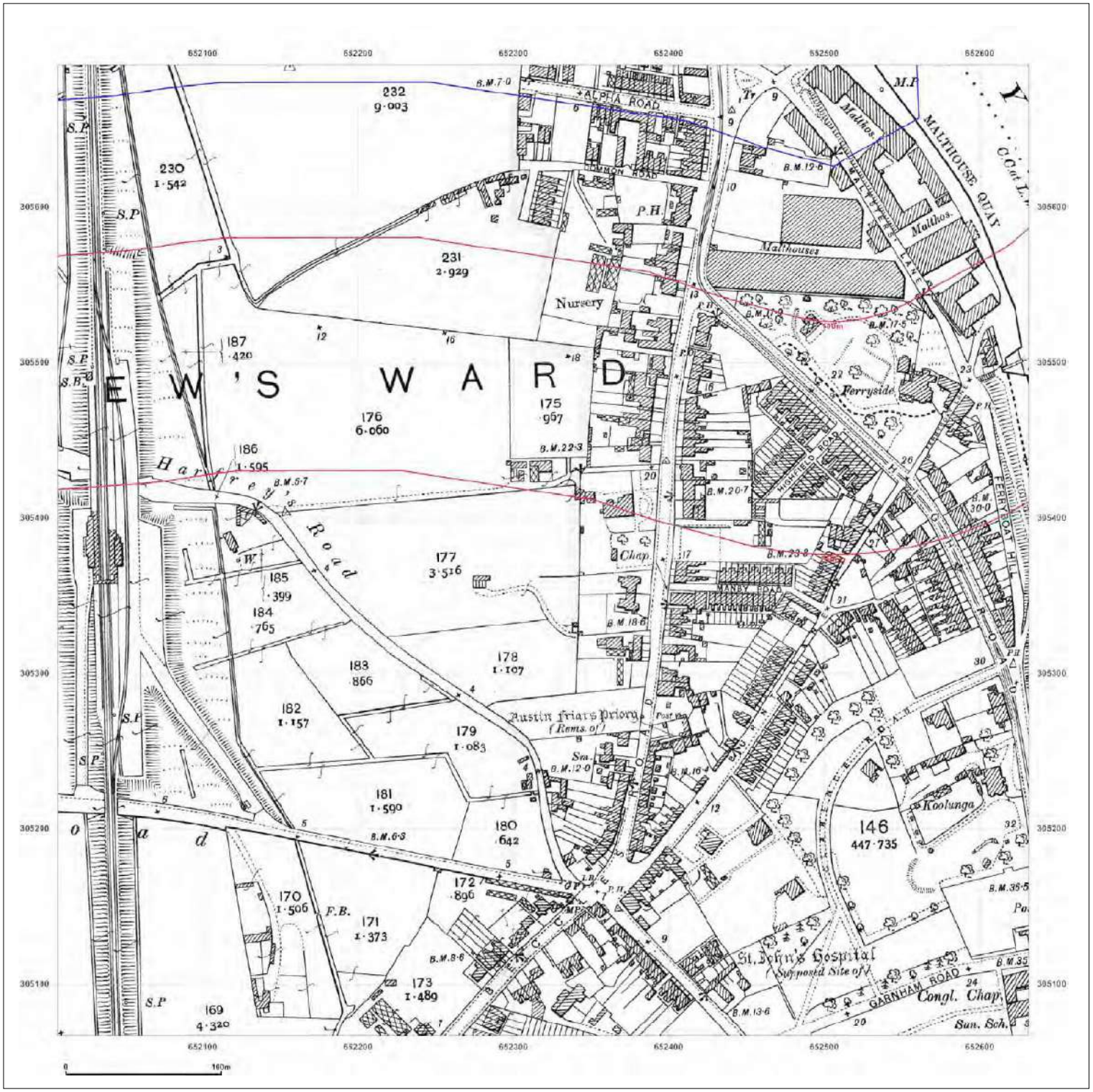

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: County Series
Map date: 1906
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: County Series
Map date: 1927
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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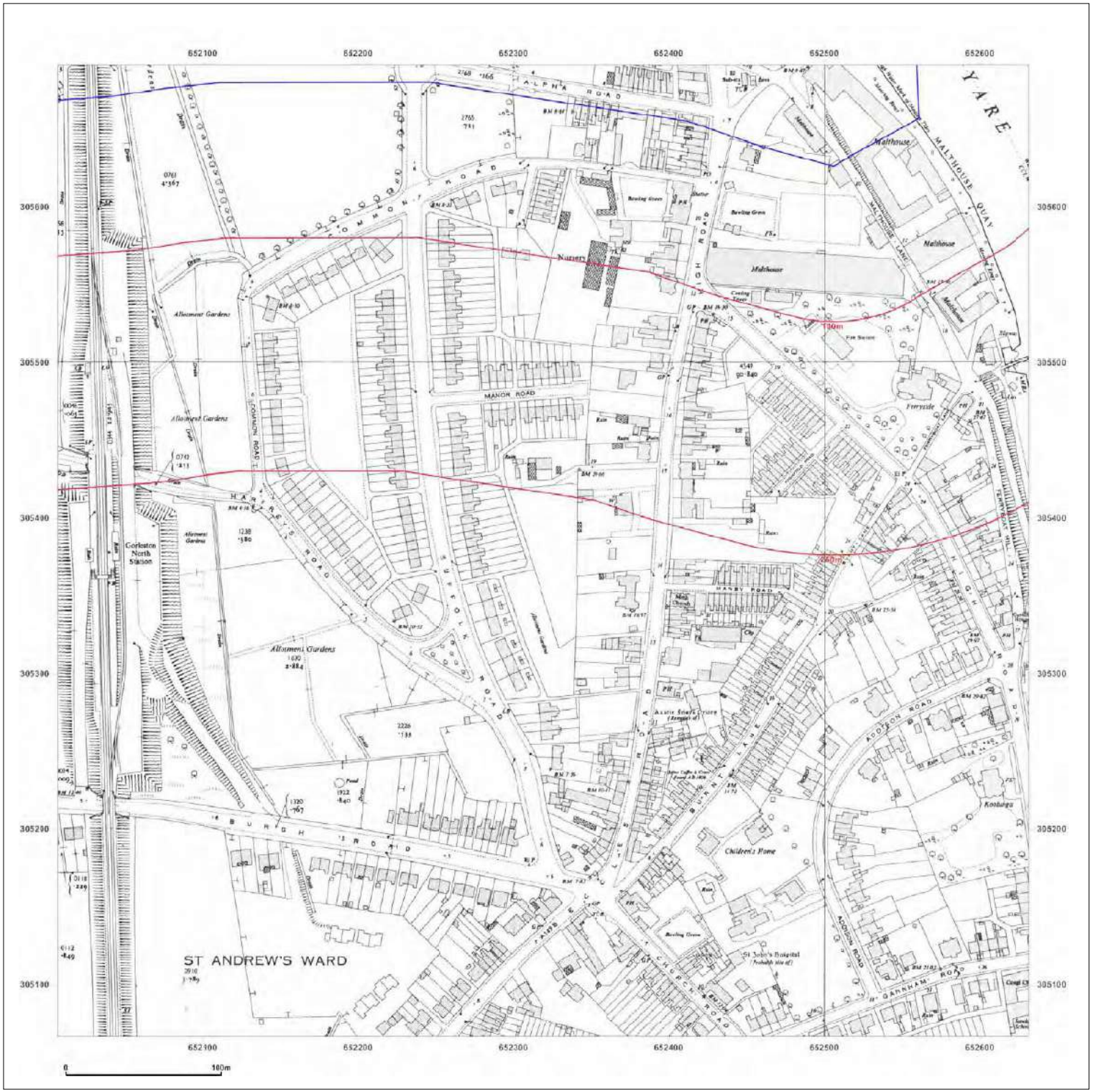

CENTRE MAPS LIVE.
FOR A BETTER PORTFOLIO VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: National Grid
Map date: 1949
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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Production date: 03 July 2017

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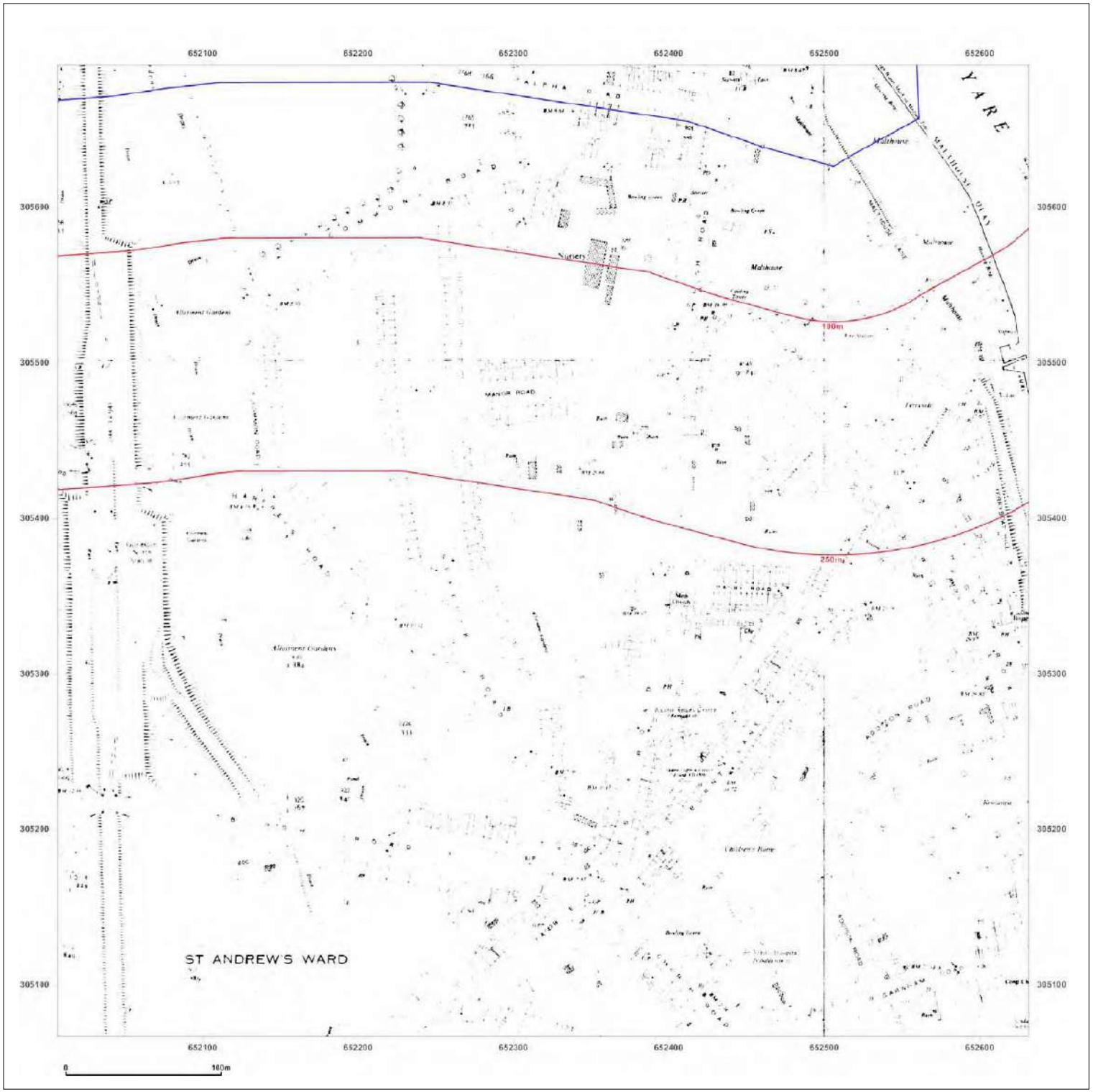

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: National Grid
Map date: 1951
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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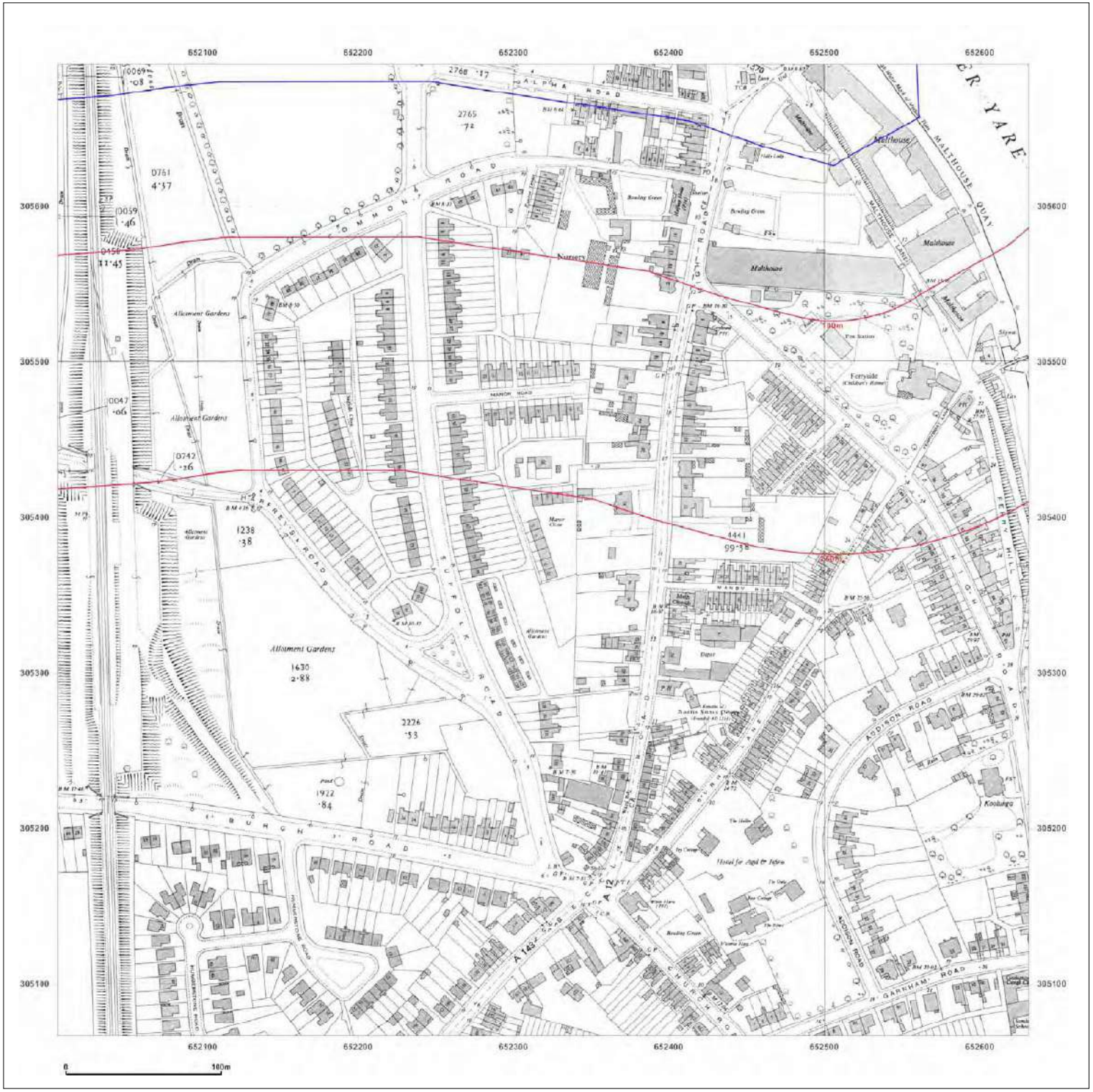

CENTRE MAPS LIVE.

FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: National Grid
Map date: 1958
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1958
Revised 1958
Edition 1960
Copyright 1960
Levelled 1946

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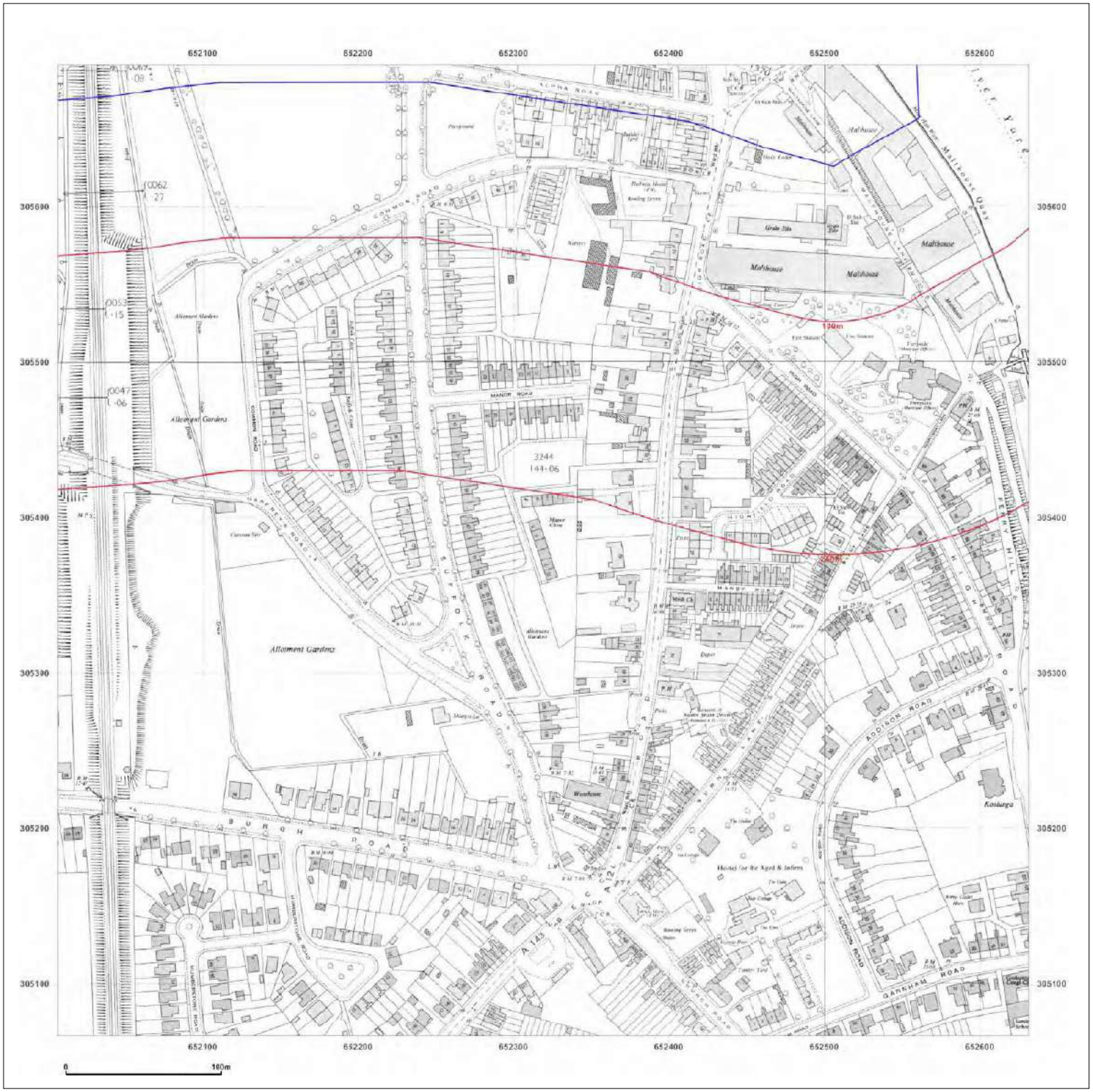

CENTRE MAPS LIVE.

FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_1
Grid Ref: 652319, 305379

Map Name: National Grid
Map date: 1968
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1969
Levelled 1958

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Production date: 03 July 2017

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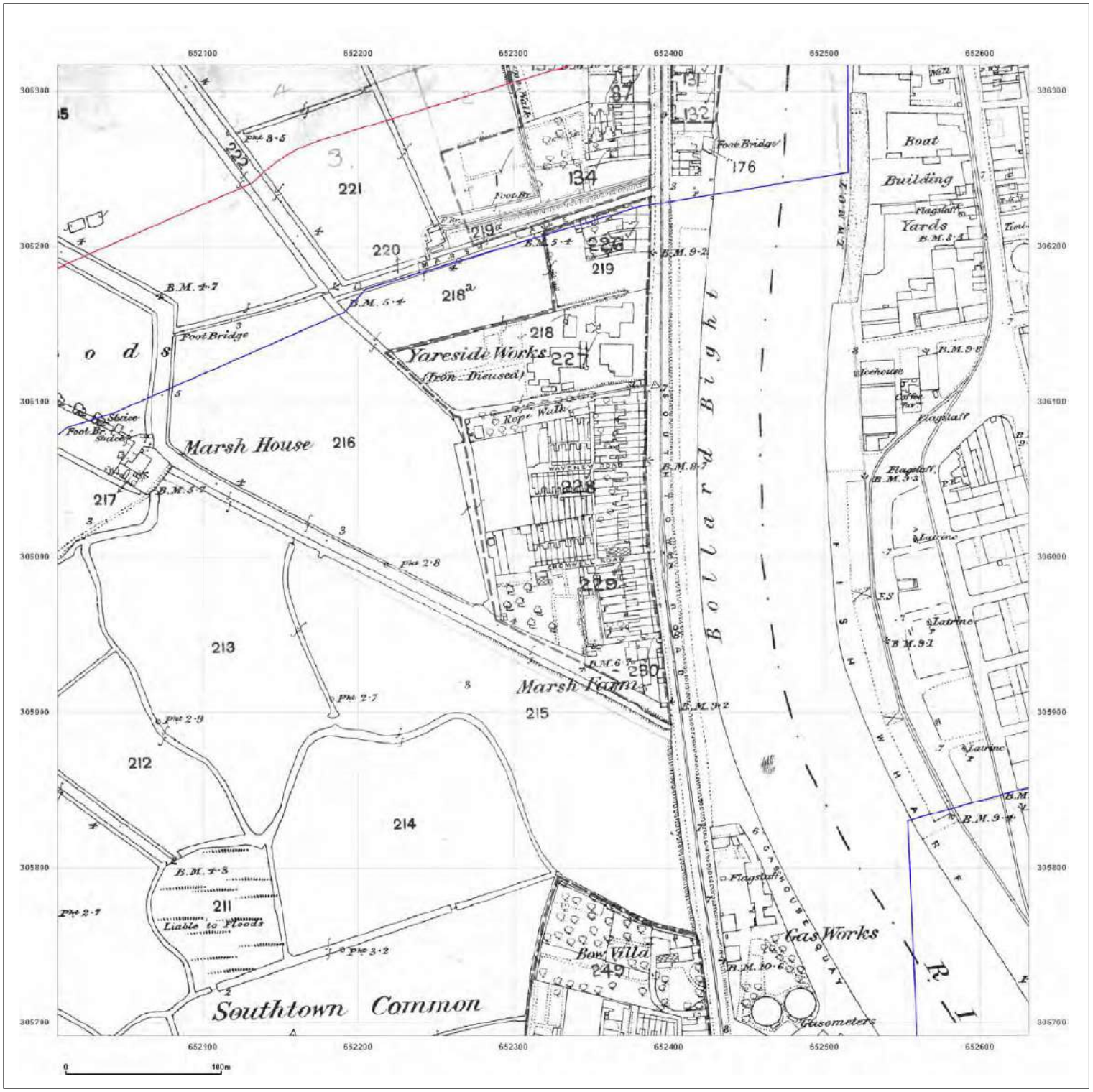

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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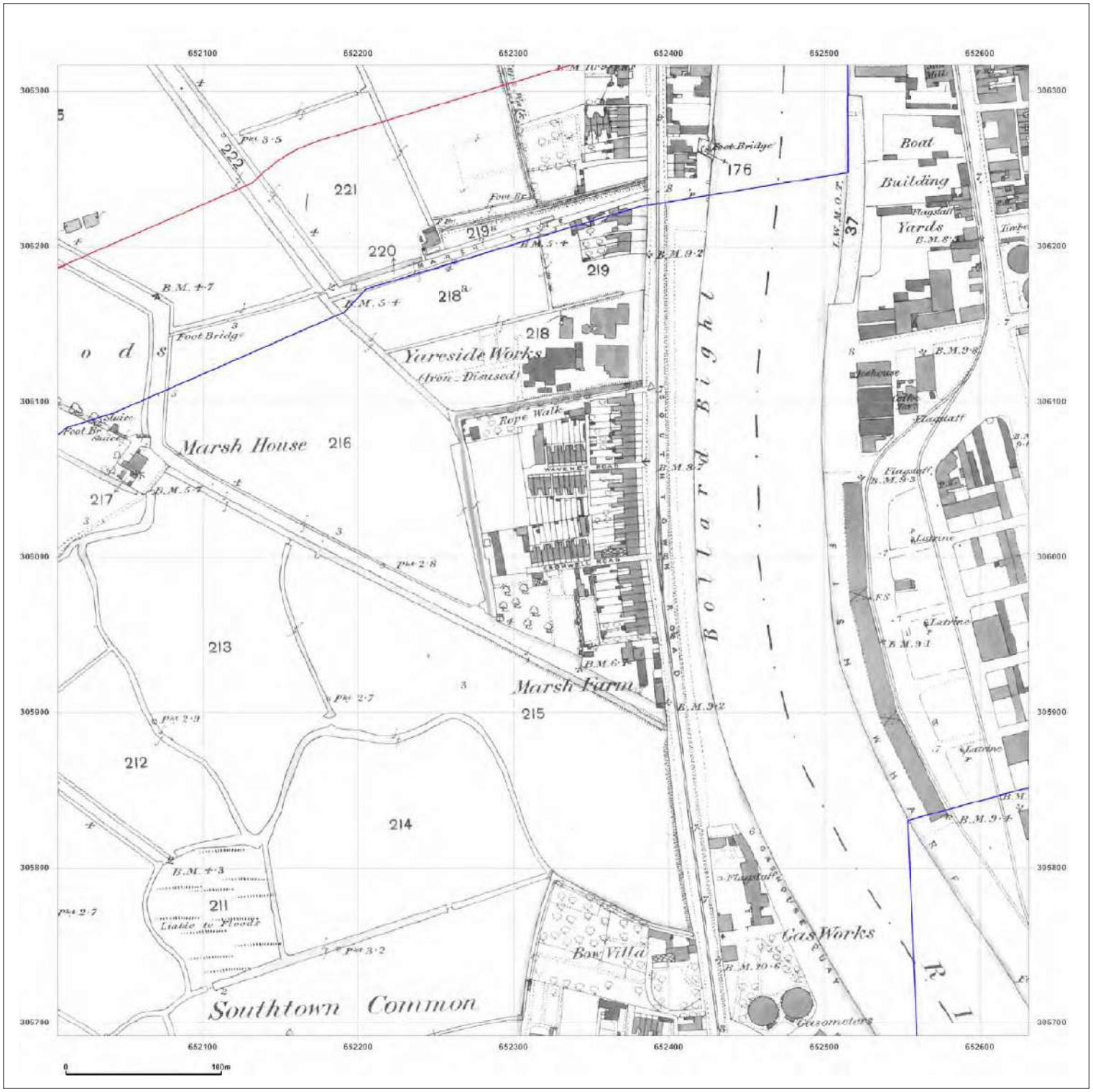

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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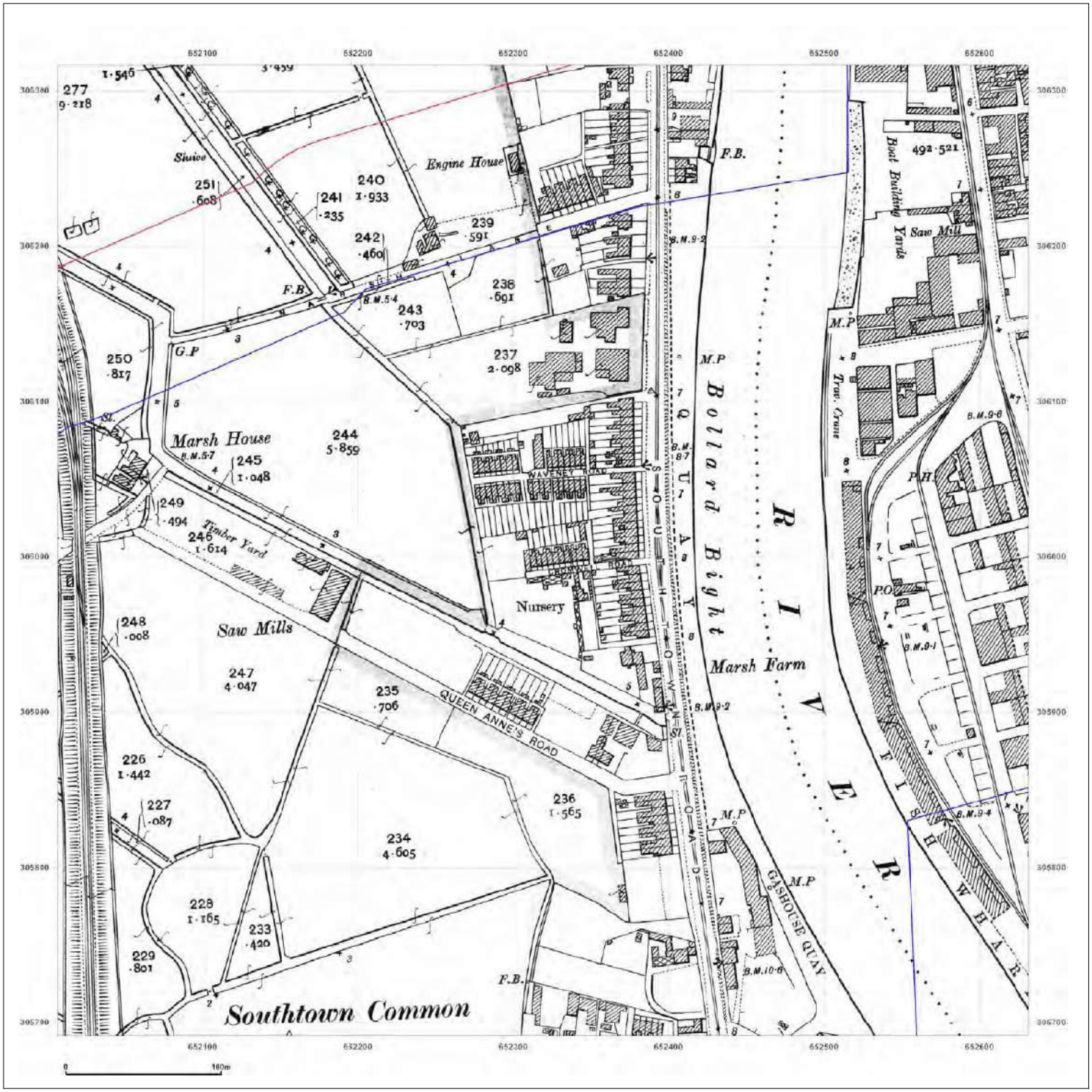

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: County Series
Map date: 1906
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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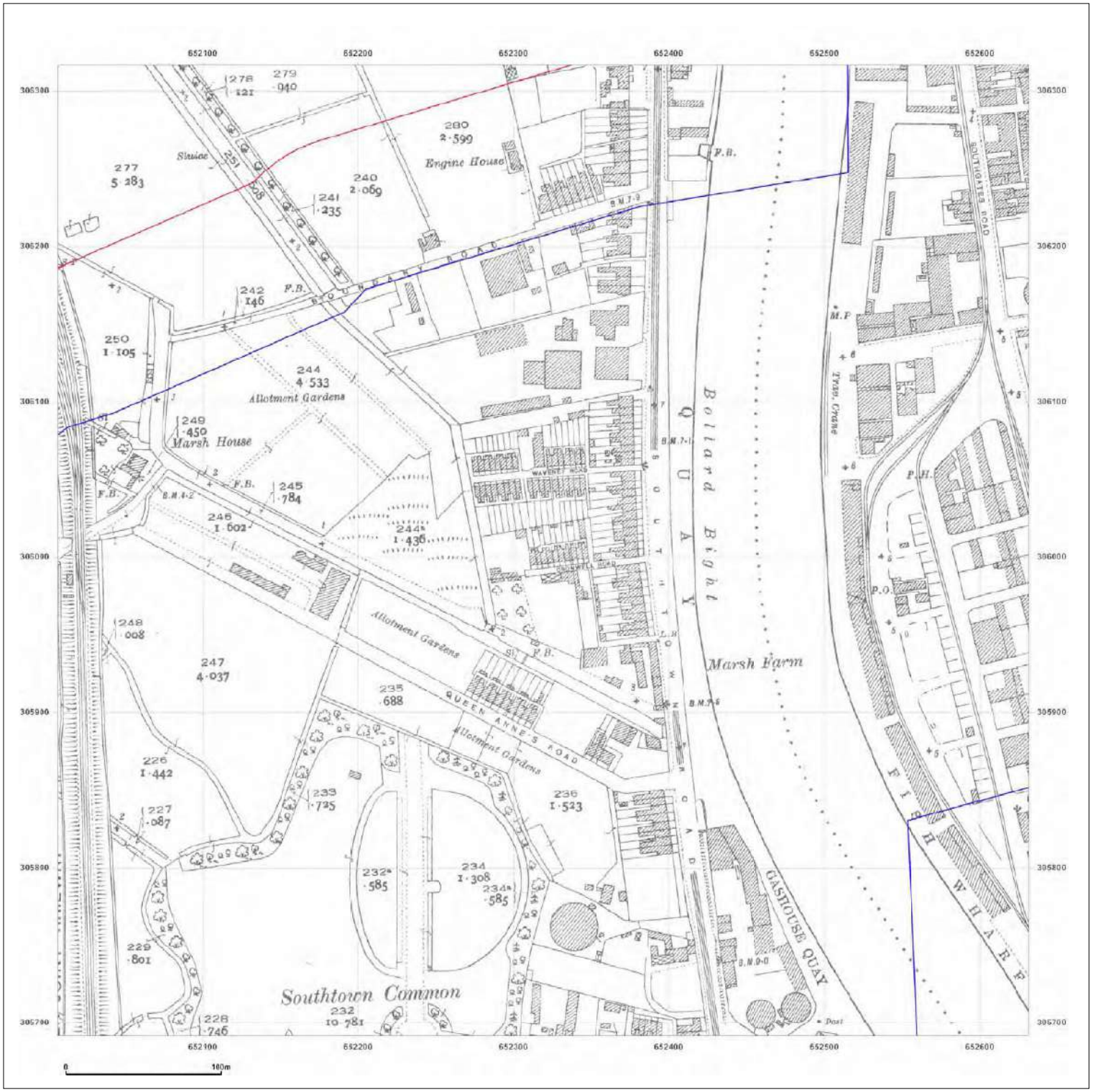

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: County Series
Map date: 1927
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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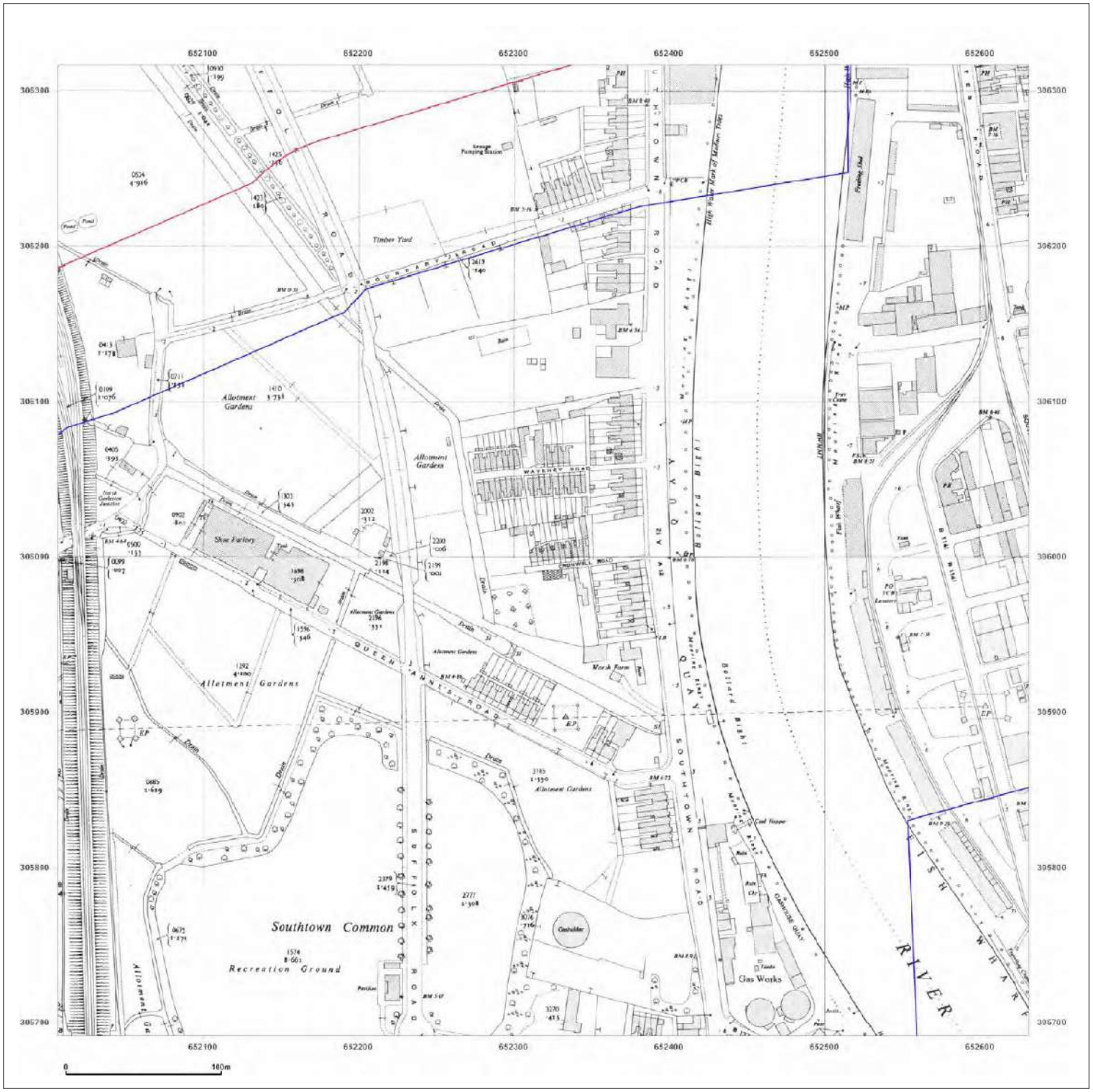

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1949
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1948

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1948

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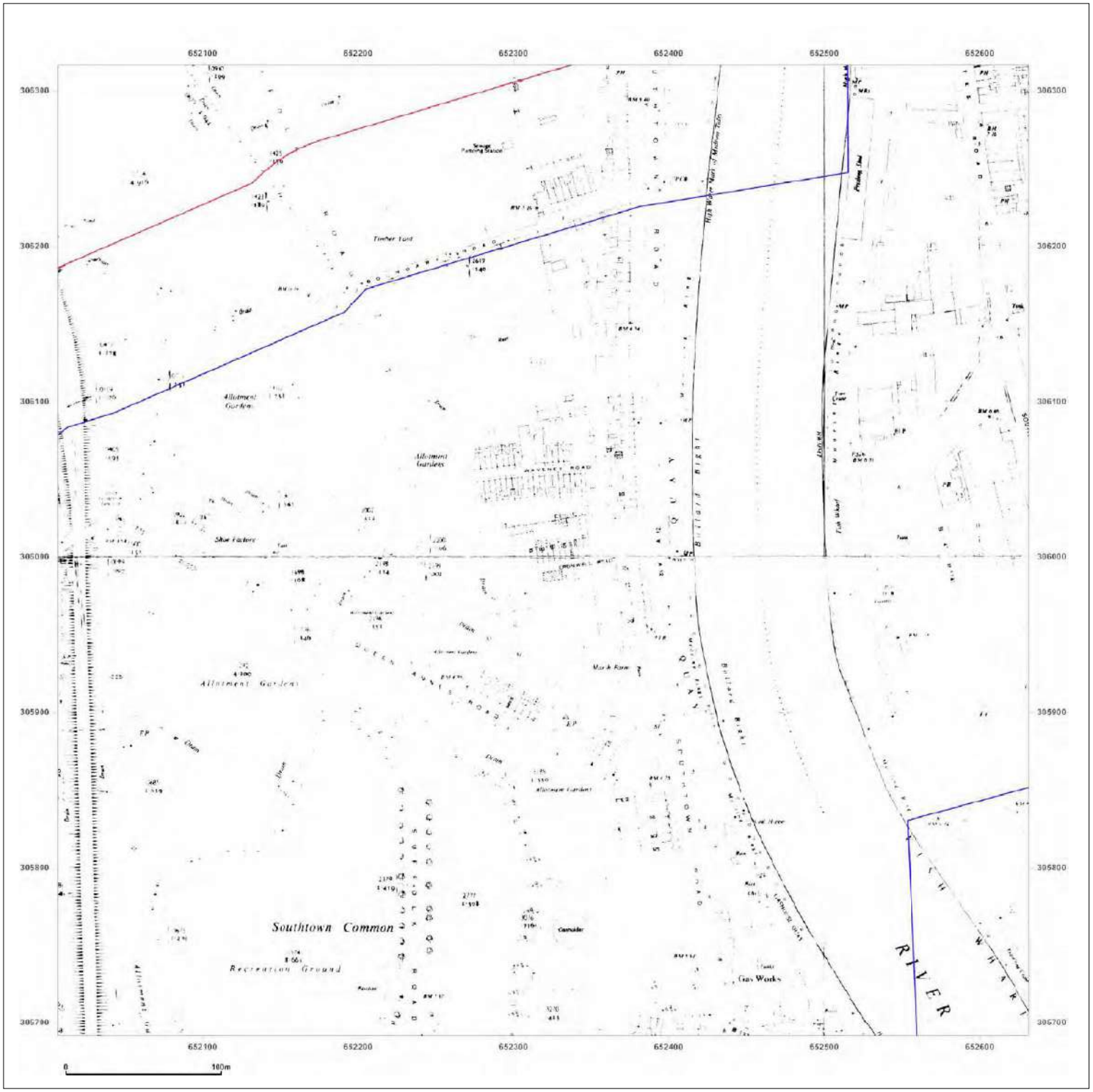

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1951
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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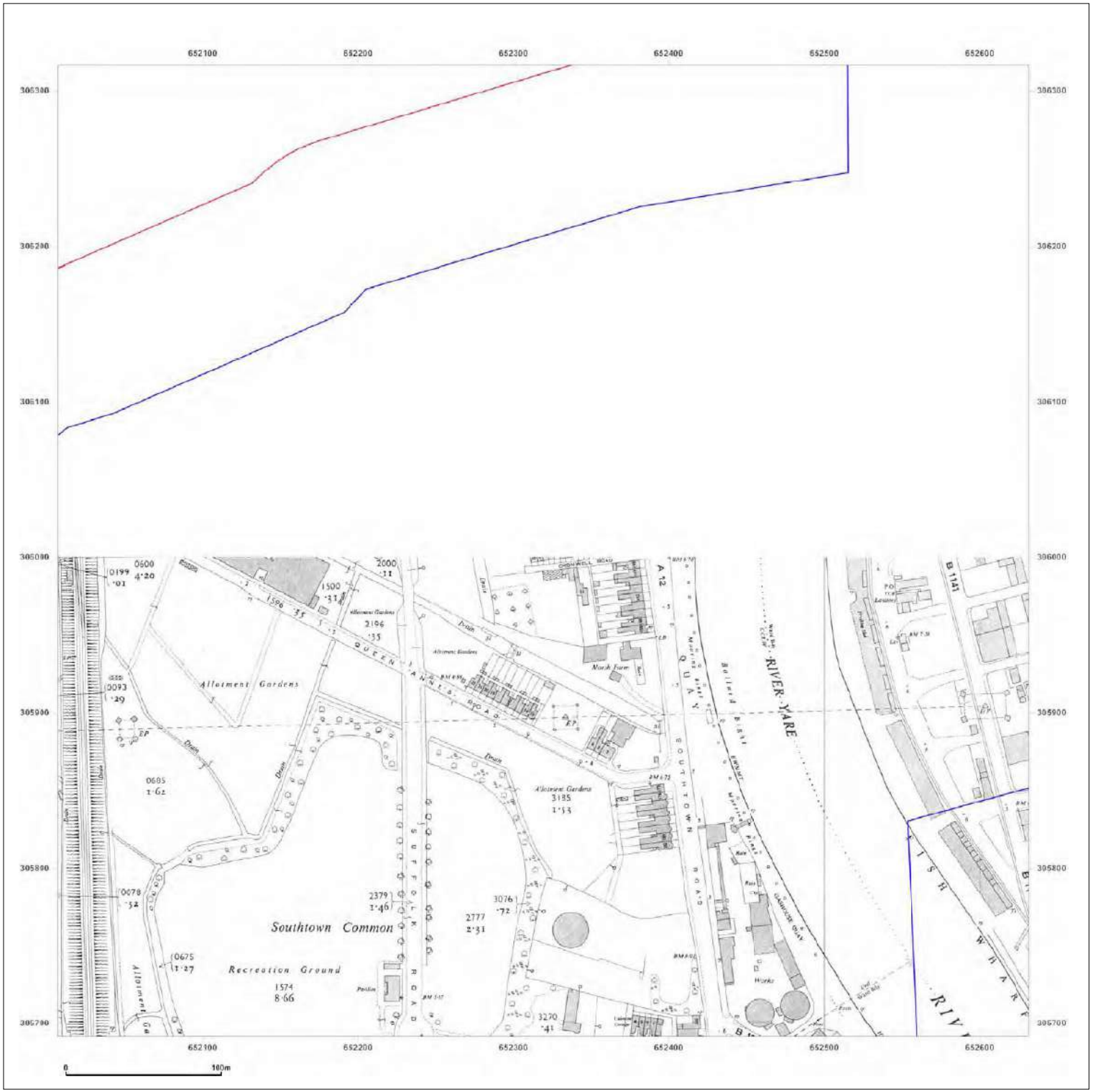


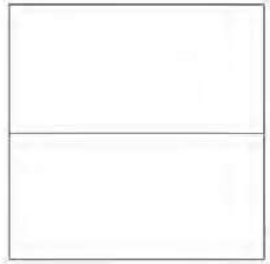
CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1958
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S



Surveyed 1958
Revised 1958
Edition 1960
Copyright 1960
Levelled 1948

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Production date: 03 July 2017

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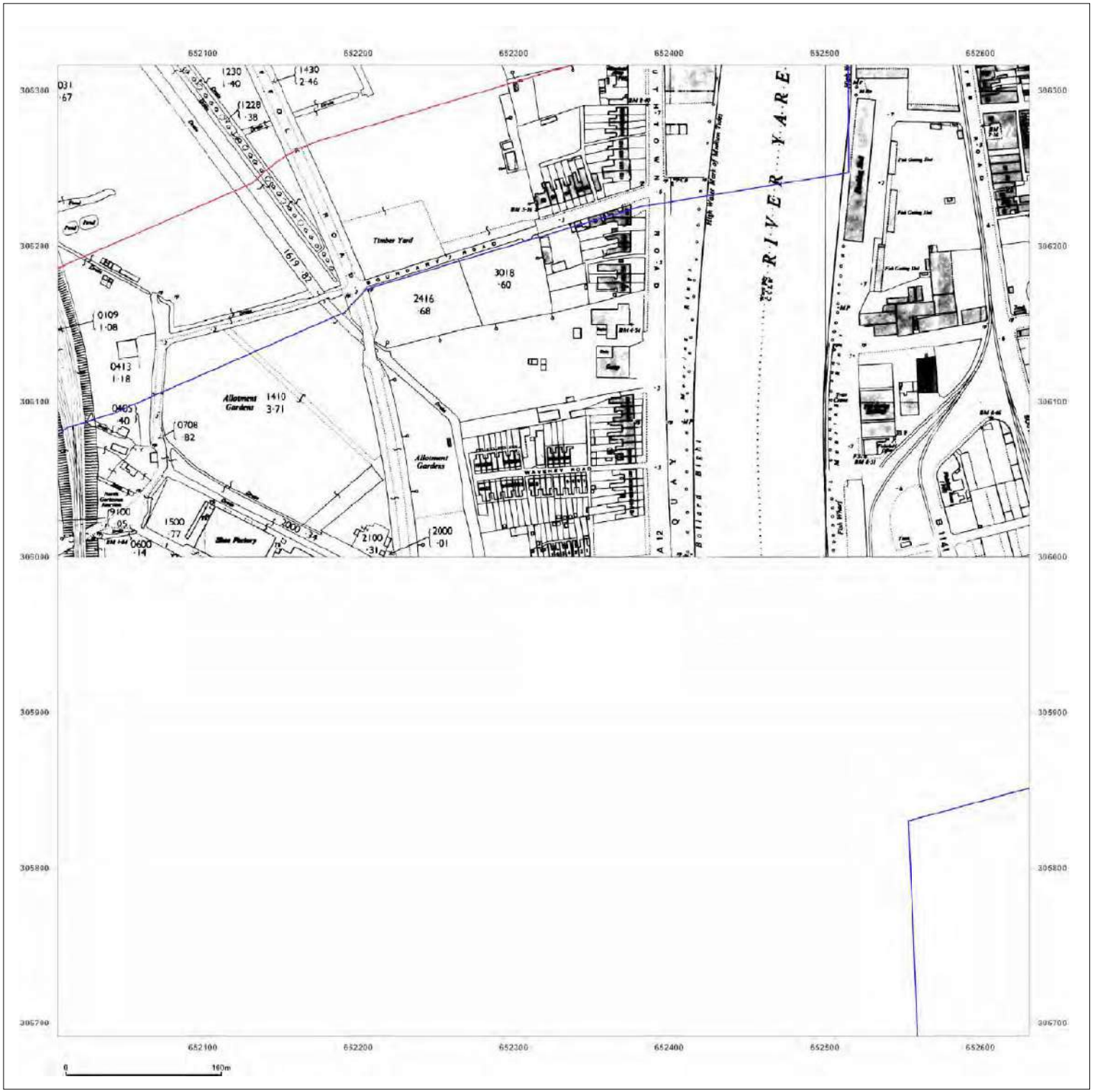

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1965
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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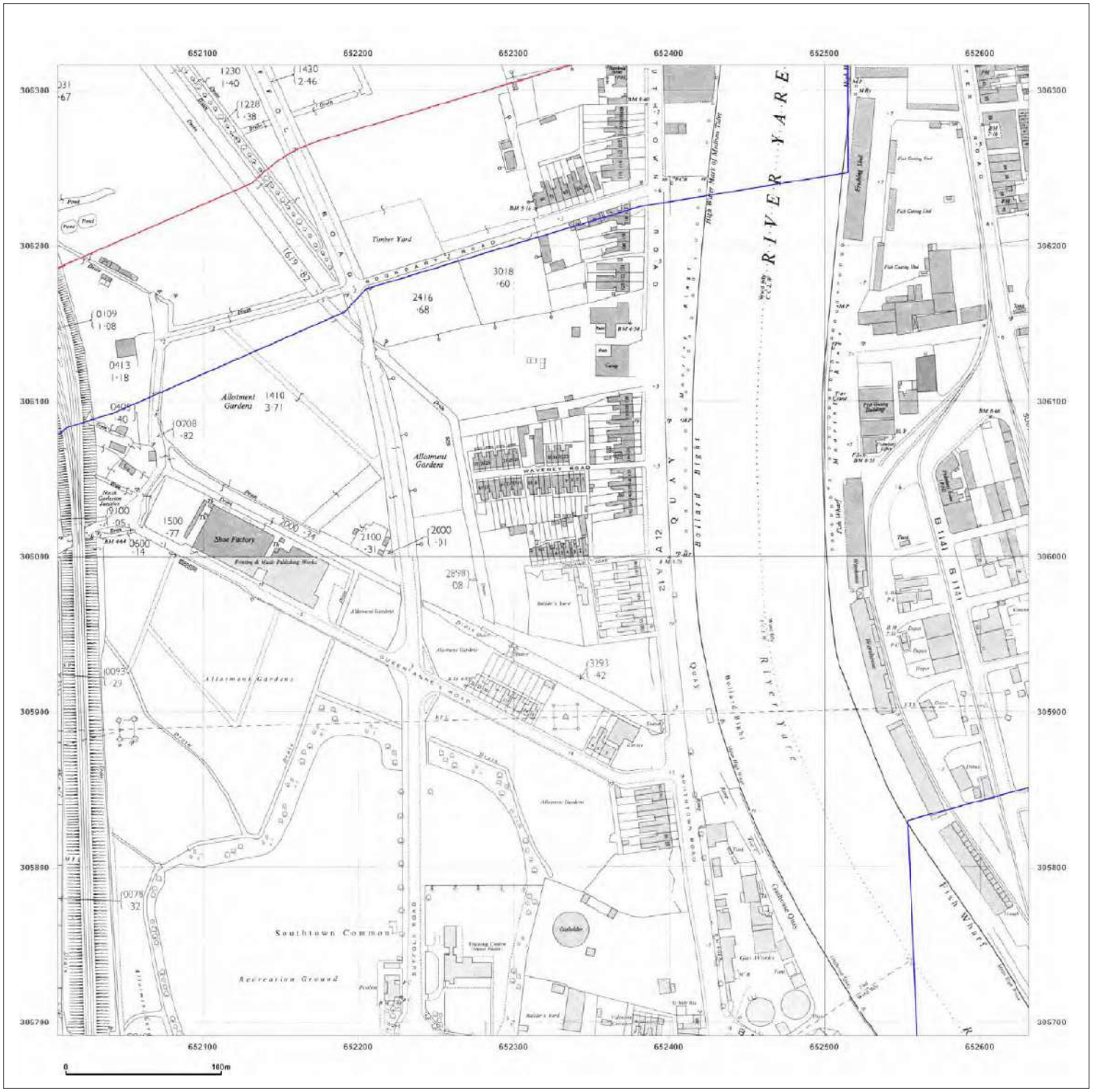

CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_2
Grid Ref: 652319, 306004

Map Name: National Grid
Map date: 1963-1968
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1963
Revised 1963
Edition 1965
Copyright 1965
Levelled 1958

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1969
Levelled 1958

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Production date: 03 July 2017

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CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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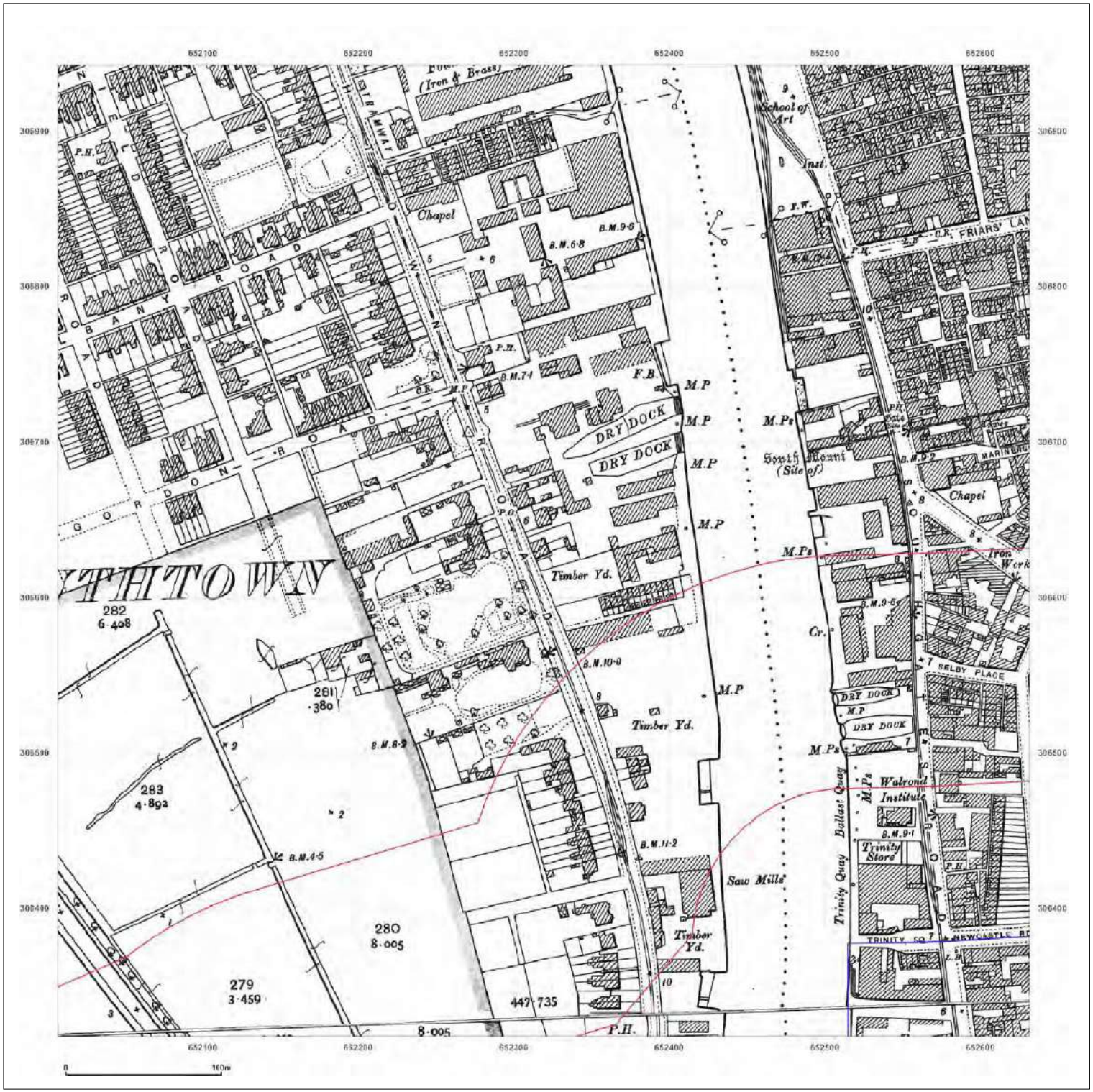

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: County Series
Map date: 1905-1906
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1905
Revised 1905
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: County Series
Map date: 1927-1928
Scale: 1:2,500
Printed at: 1:2,500

N
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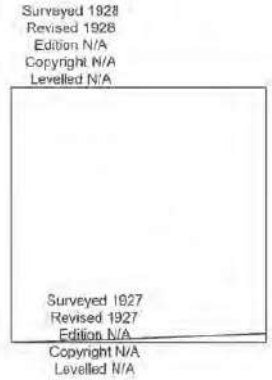

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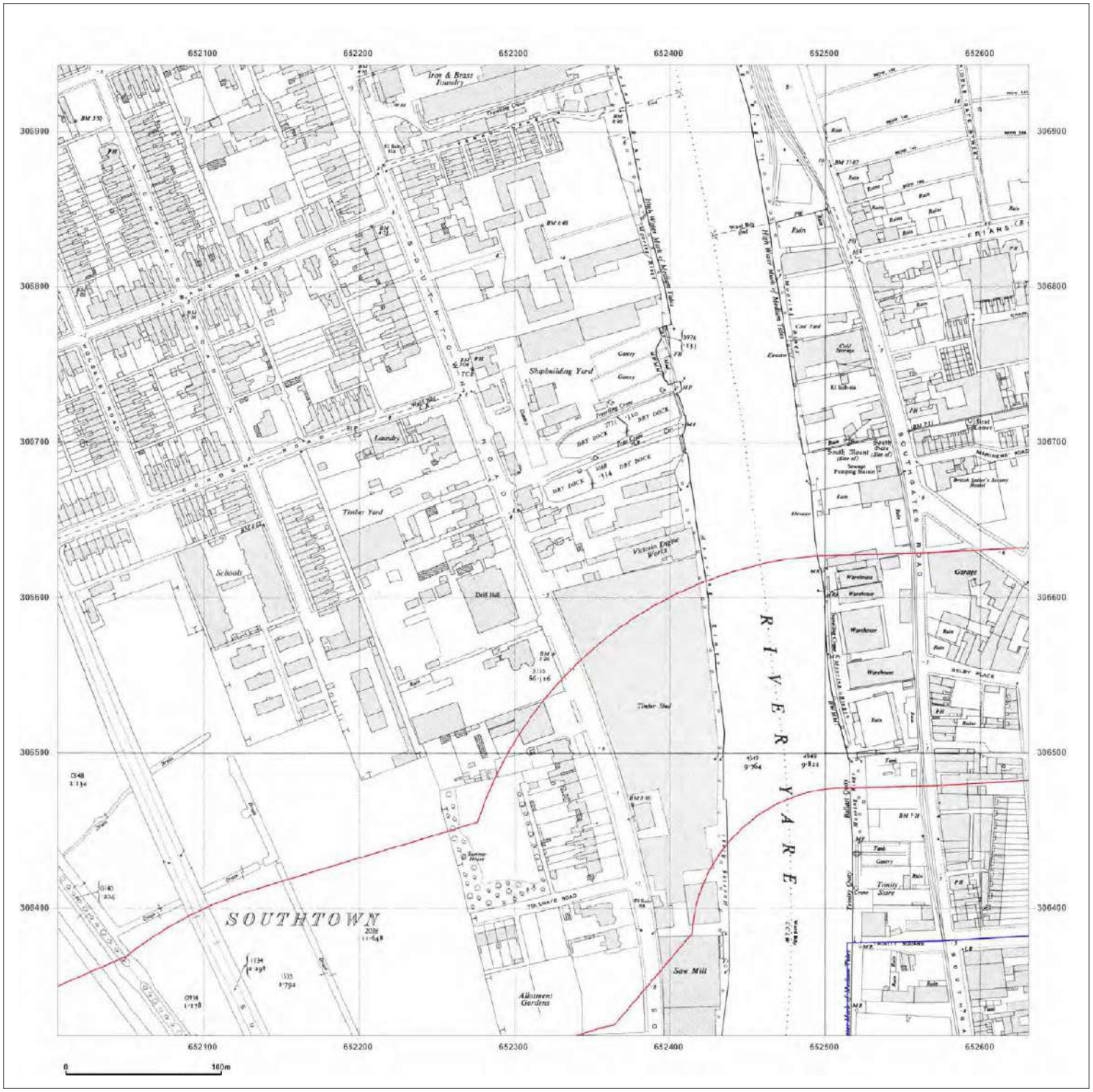

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: National Grid
Map date: 1949
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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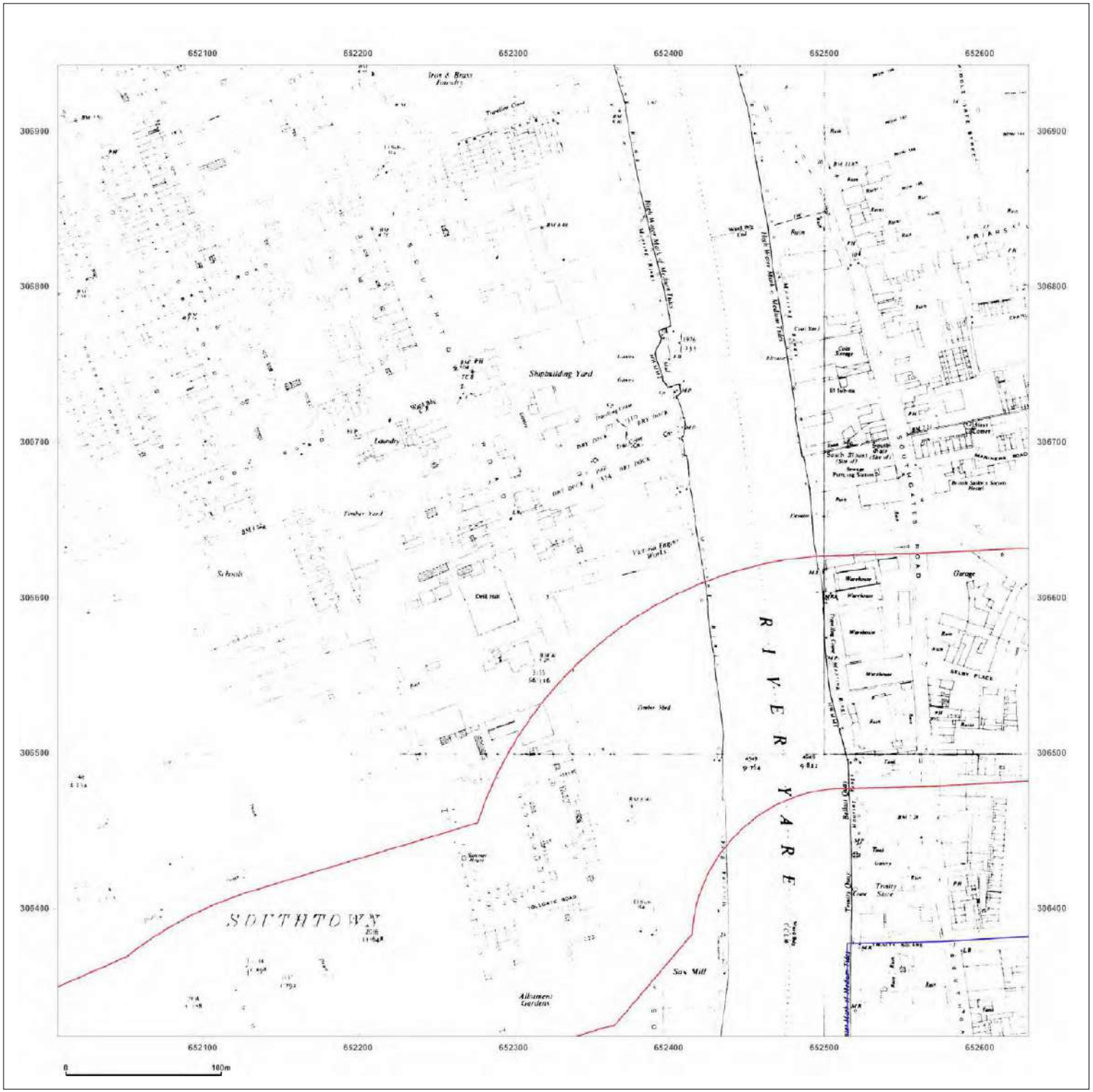

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: National Grid
Map date: 1951
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: National Grid
Map date: 1963
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1963
Revised 1963
Edition 1965
Copyright 1965
Levelled 1658

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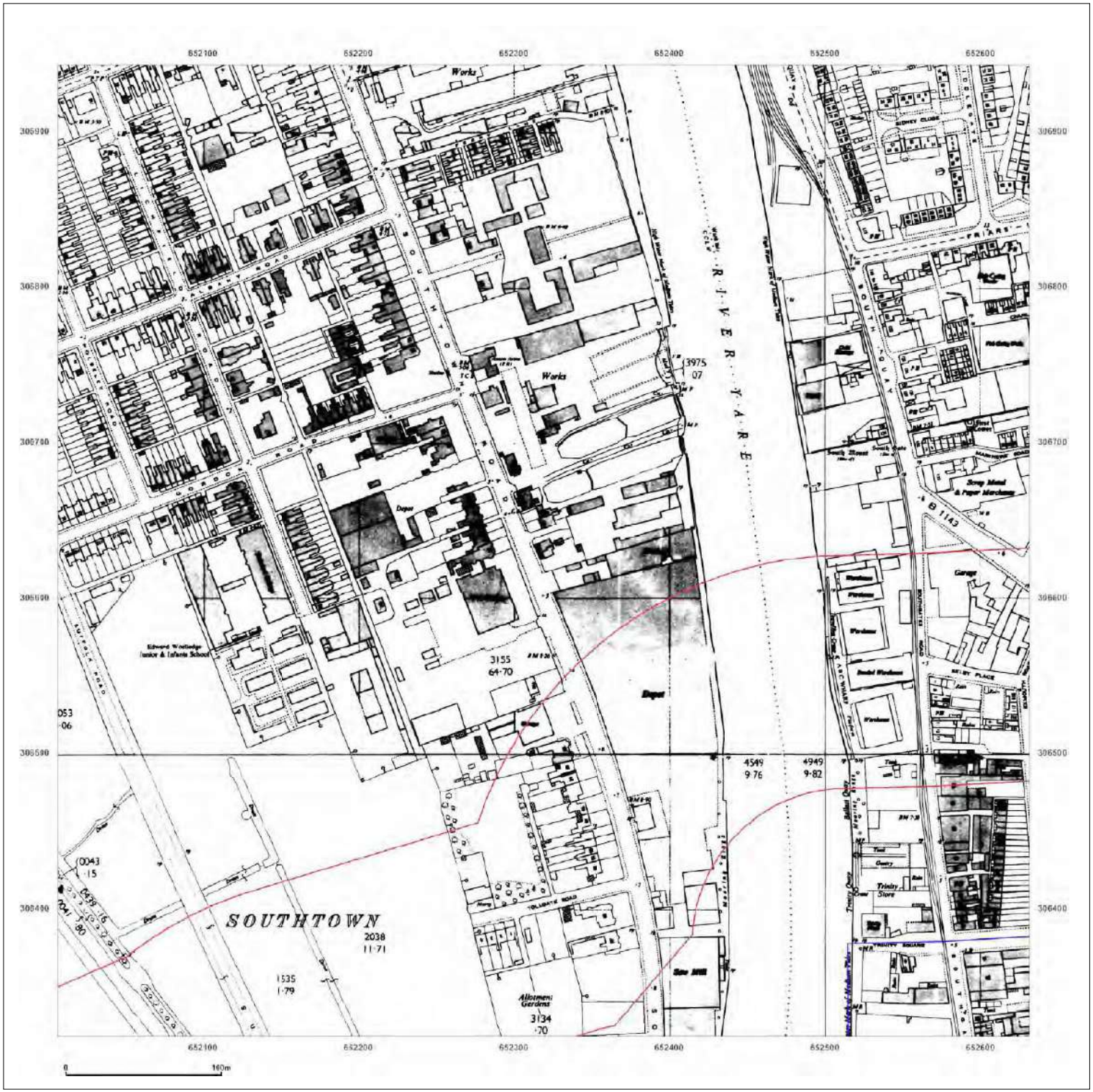

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_2_3
Grid Ref: 652319, 306630

Map Name: National Grid
Map date: 1965
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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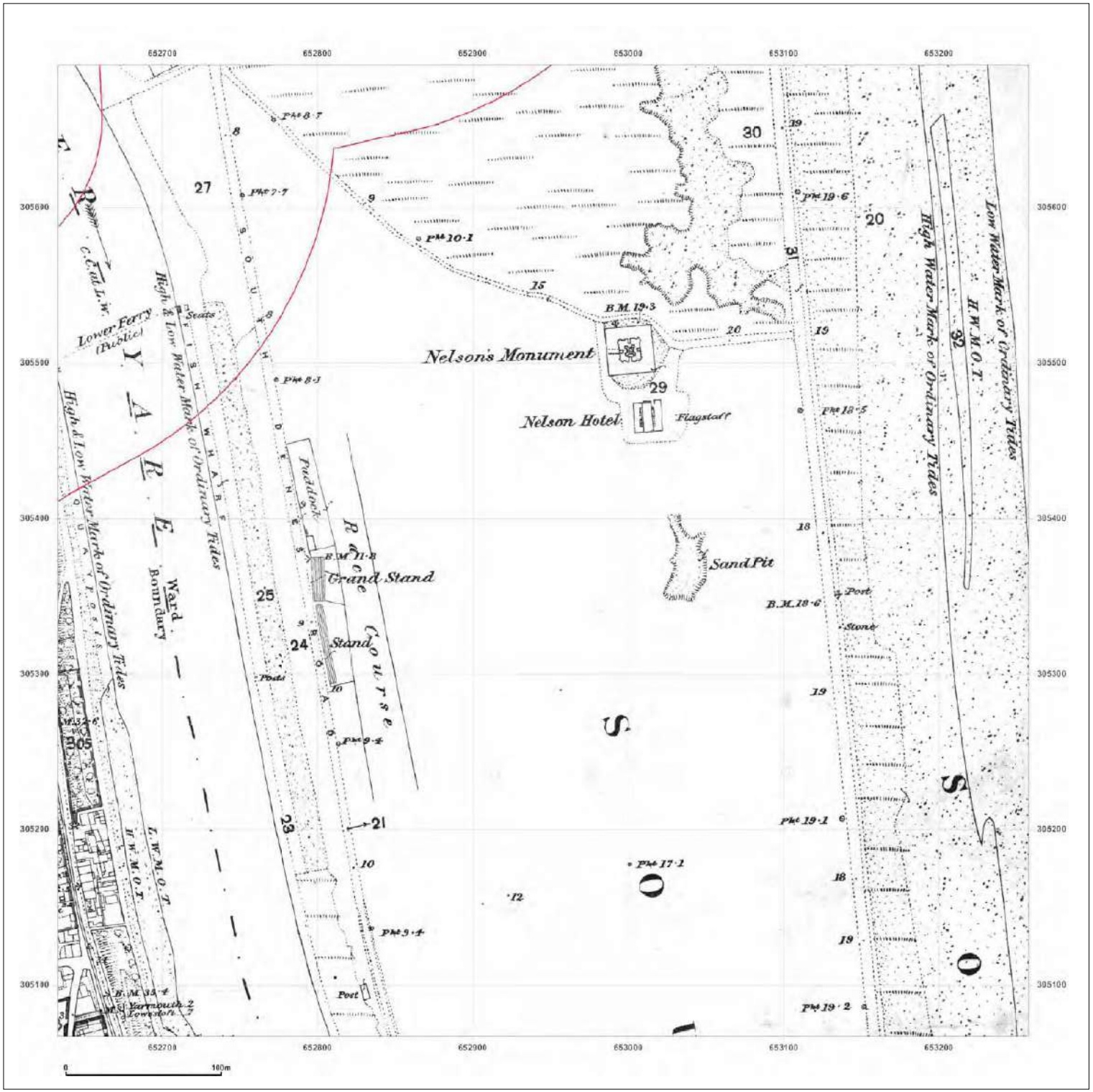

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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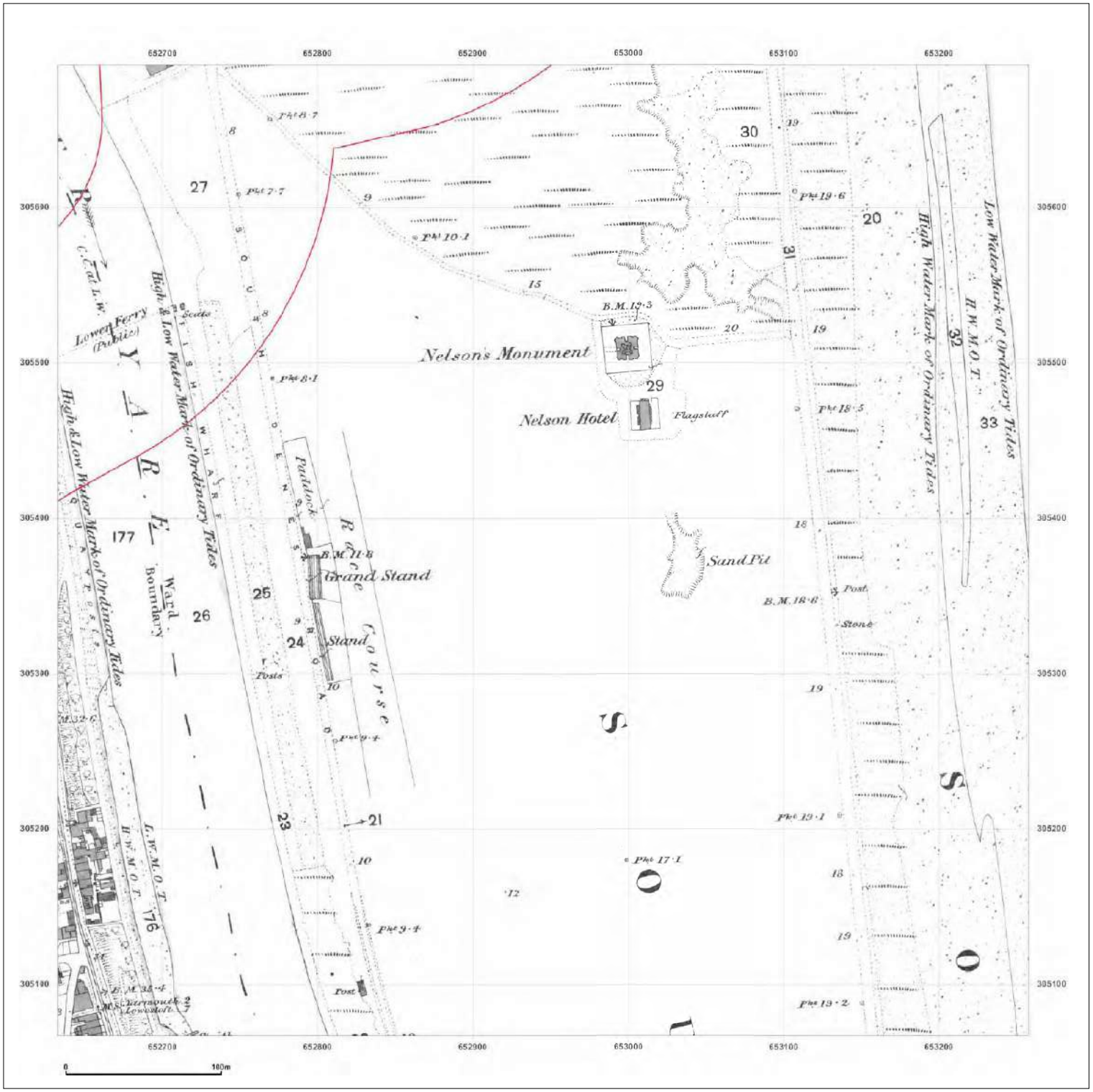

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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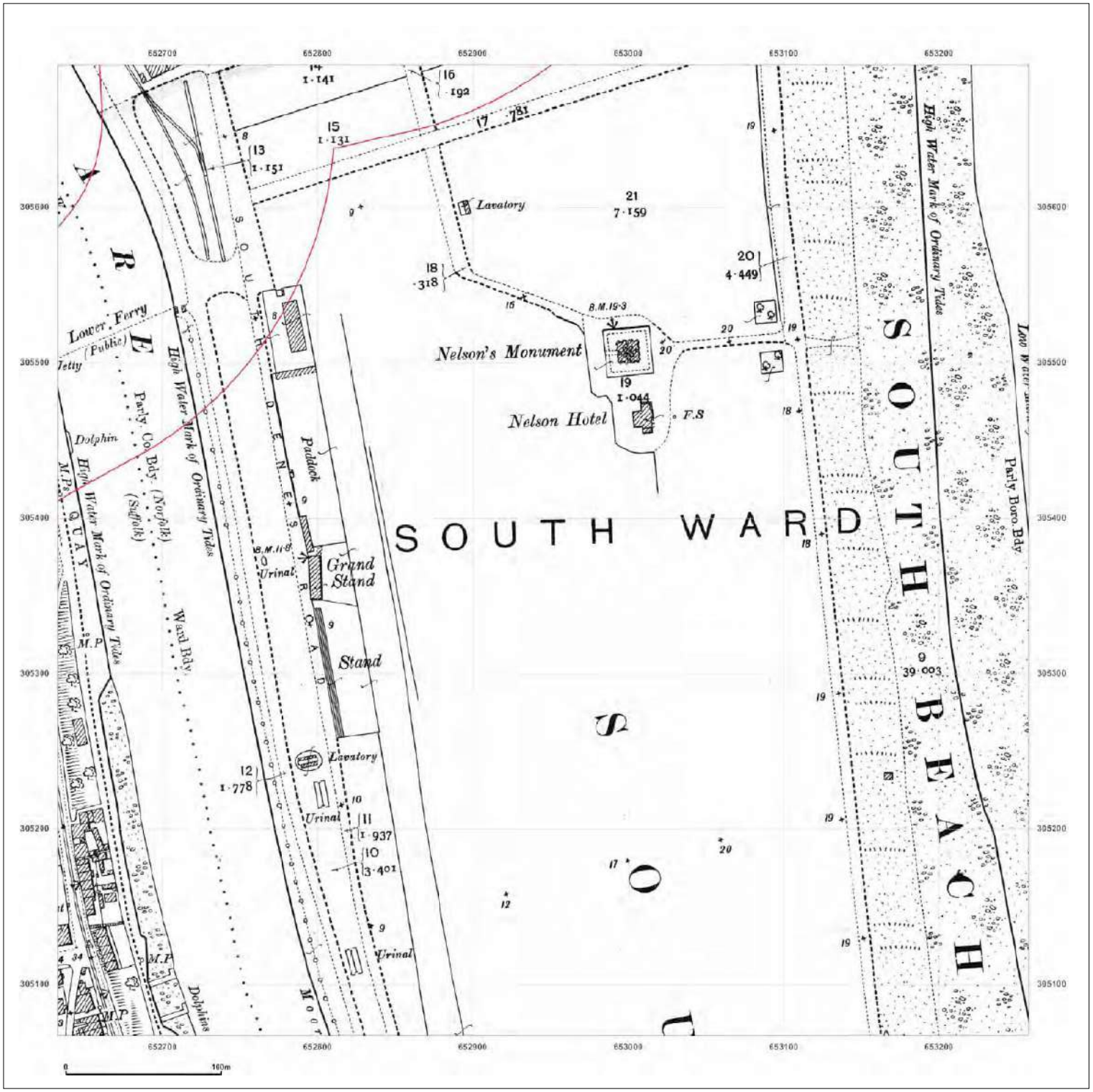

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: County Series
Map date: 1906
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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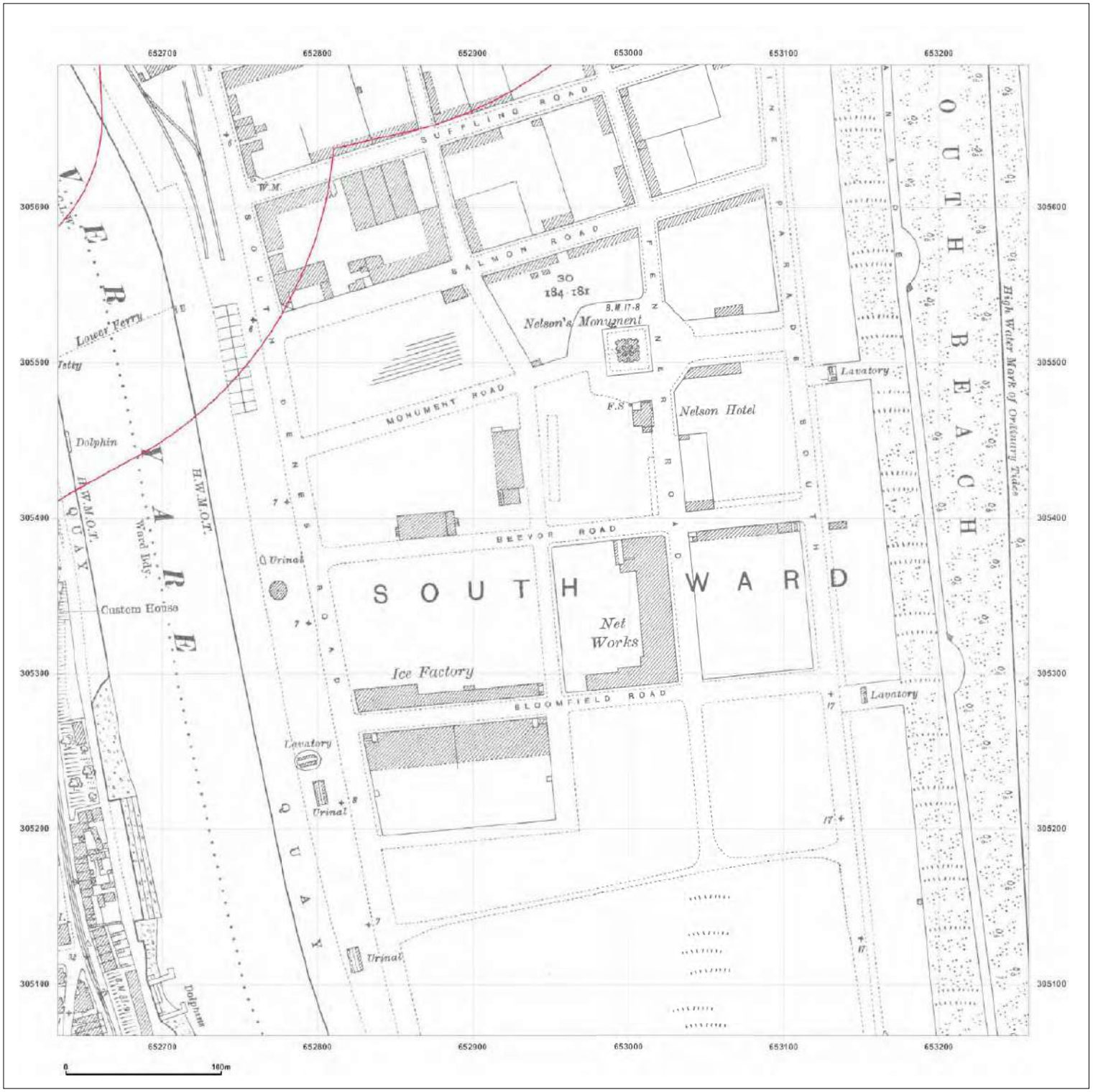

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: County Series
Map date: 1927
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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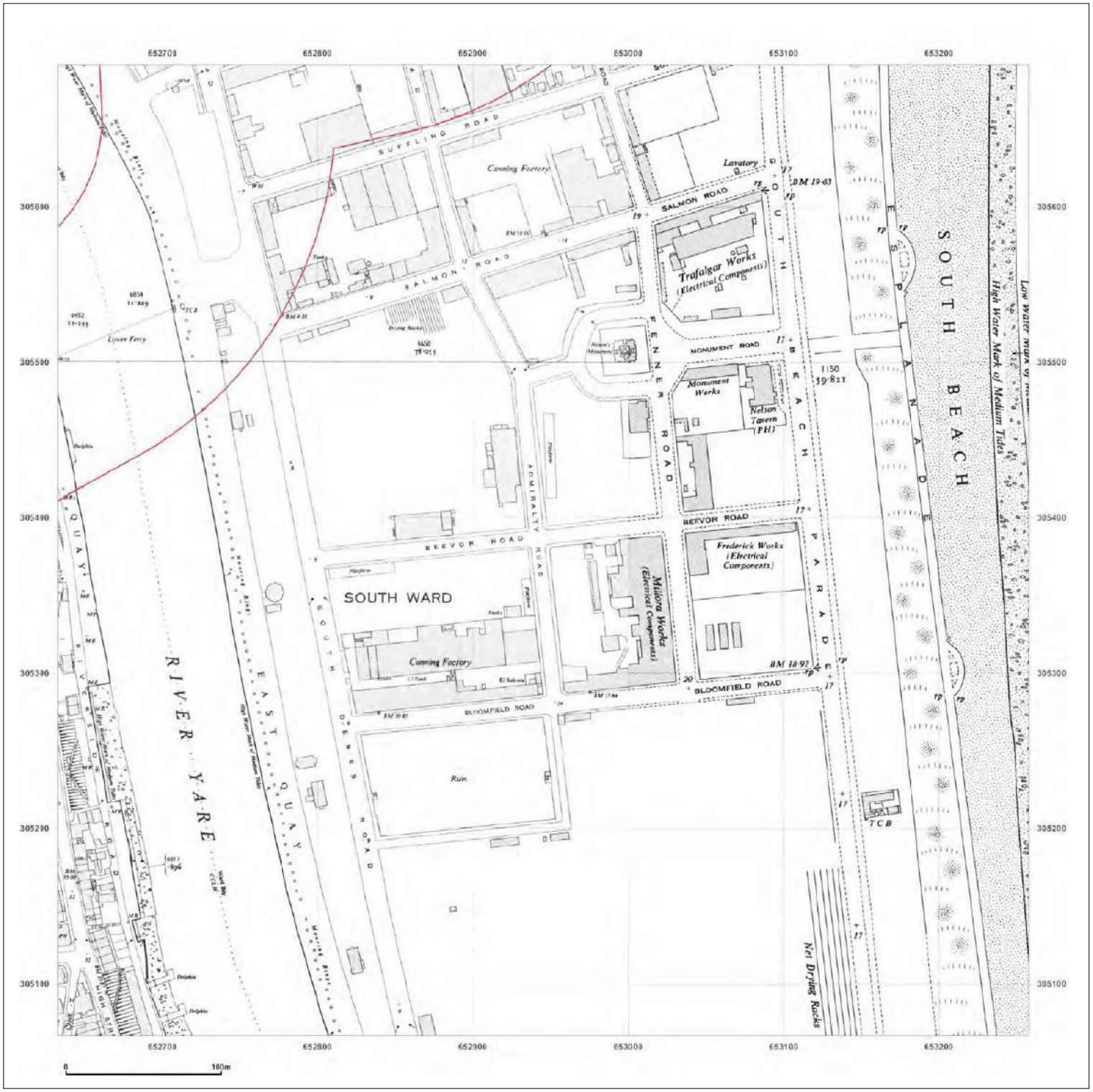

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: National Grid
Map date: 1949
Scale: 1:2,500
Printed at: 1:2,500

N
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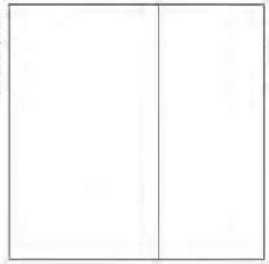
Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946



Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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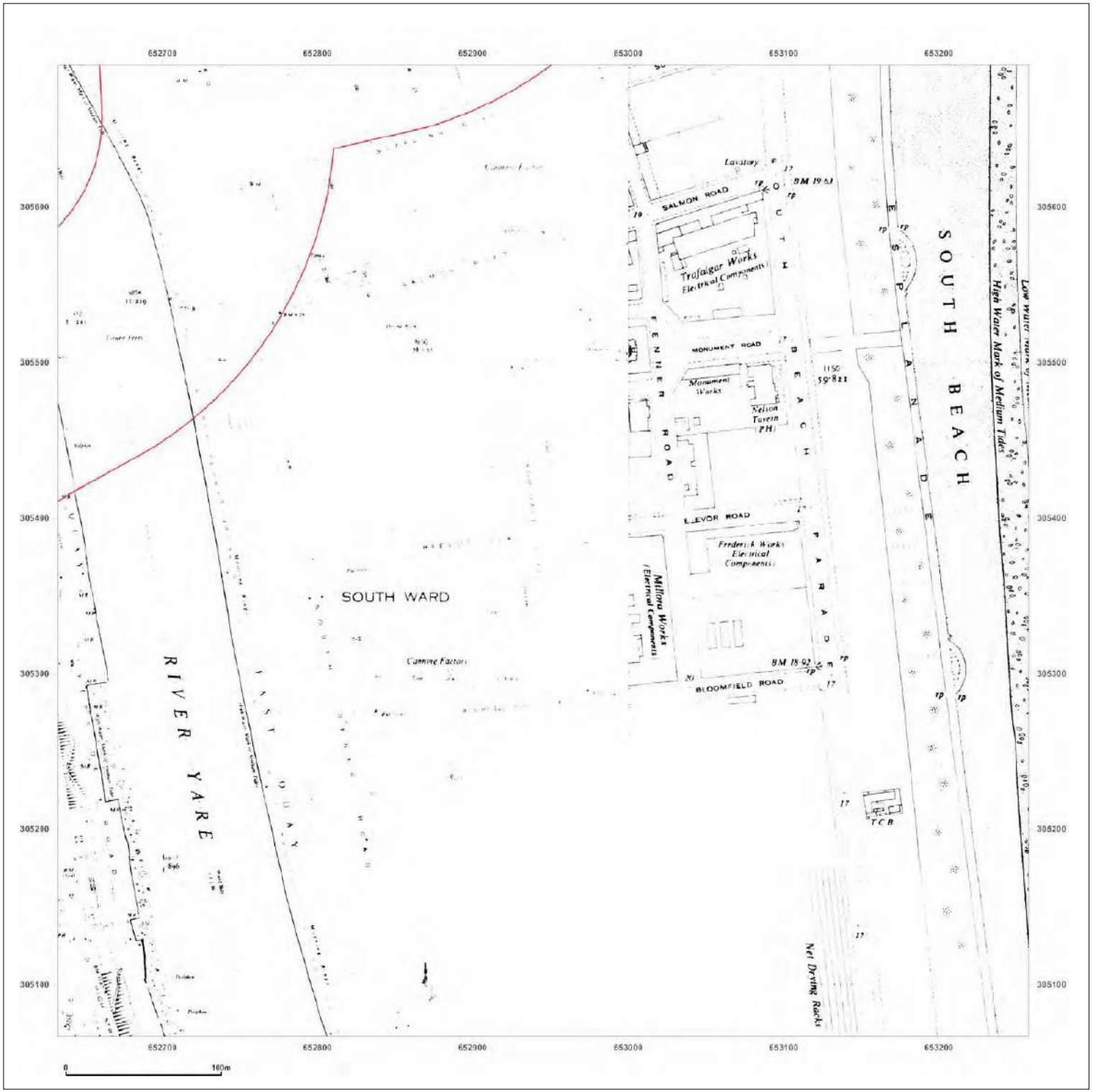

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: National Grid
Map date: 1950-1951
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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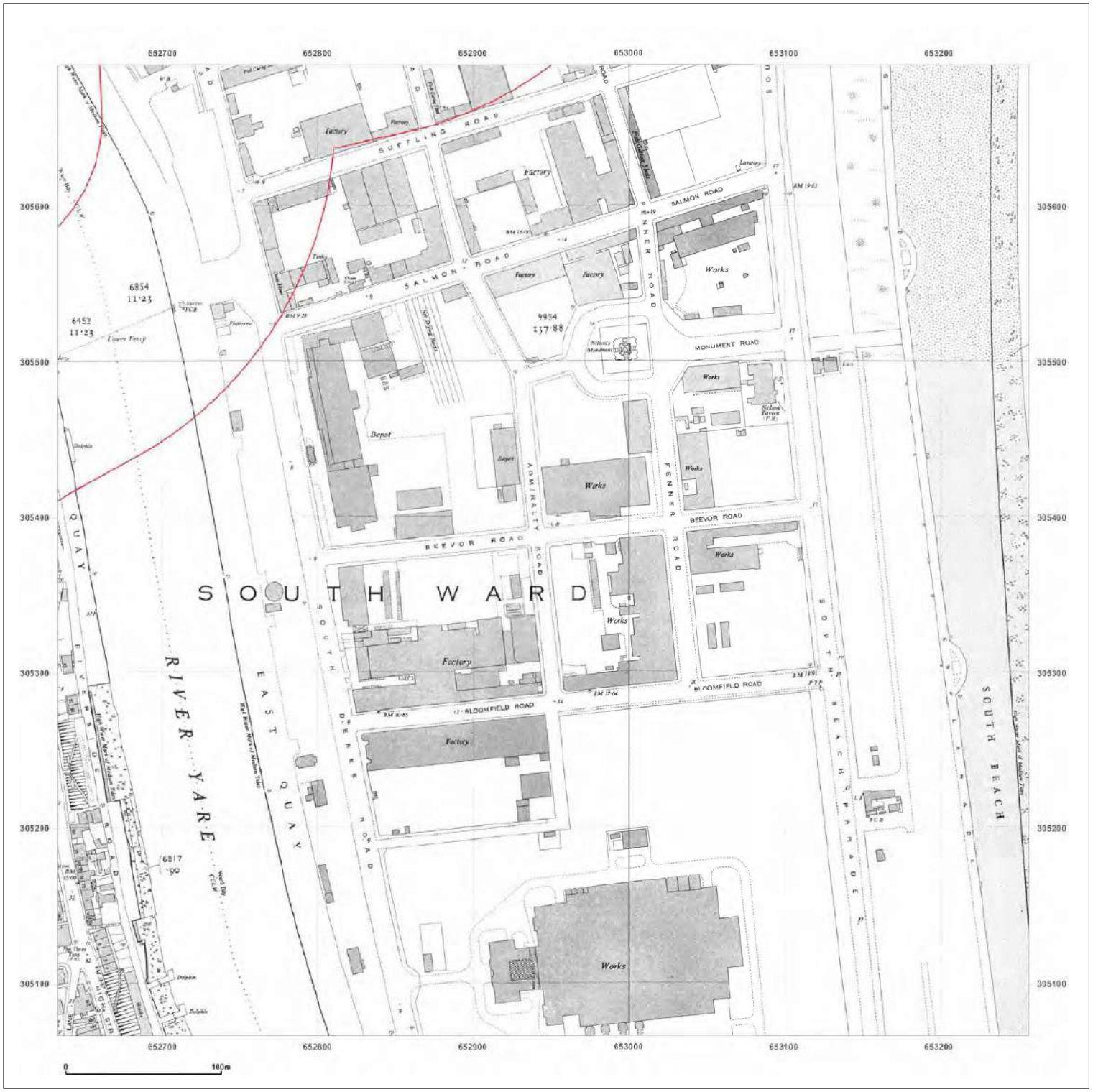

CENTRE MAPS LIVE.

FOR A BETTER PORTFOLIO VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: National Grid
Map date: 1958
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1958
Revised 1958
Edition 1960
Copyright 1960
Levelled 1940

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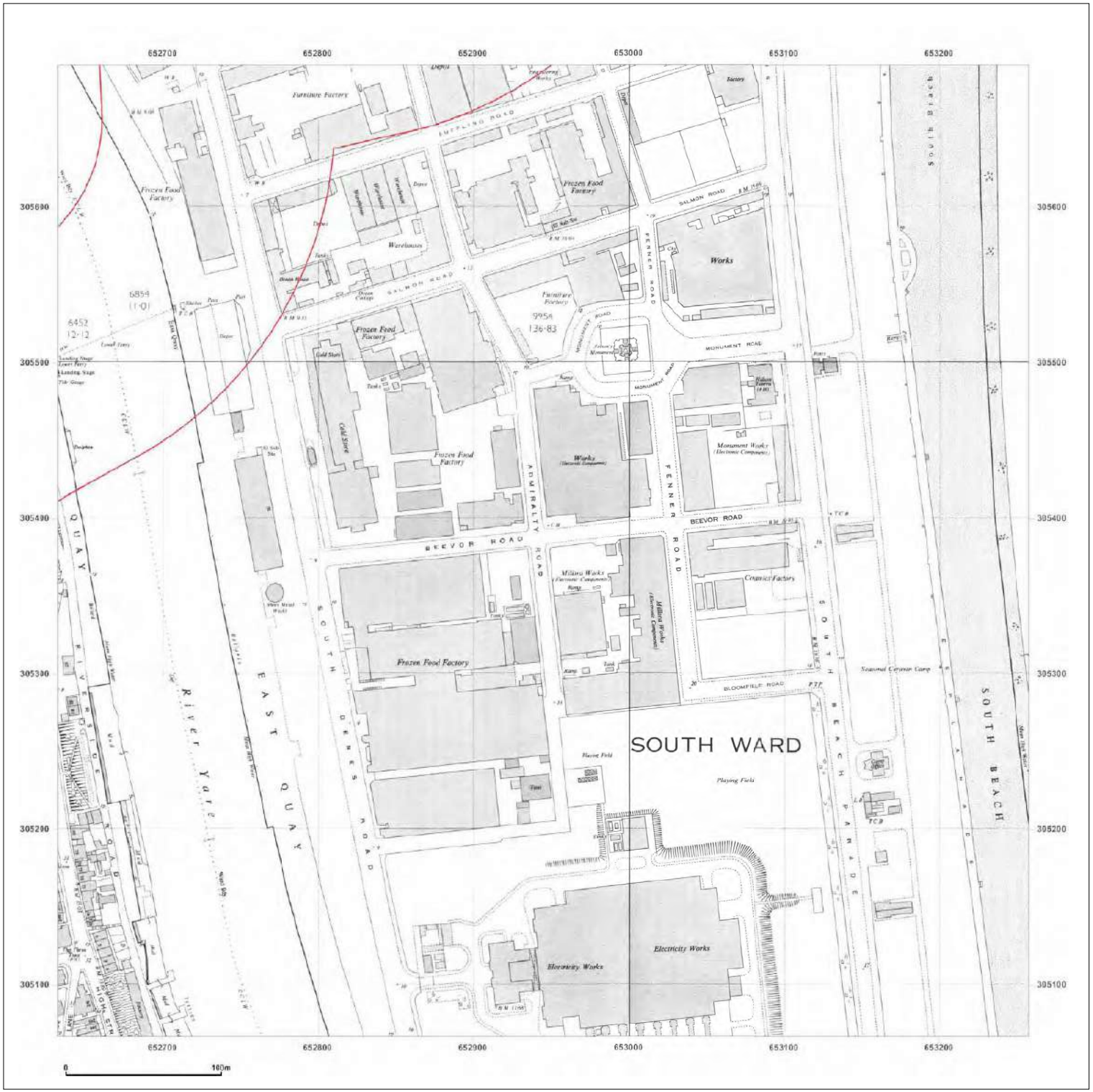

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: National Grid
Map date: 1968
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1969
Levelled 1958

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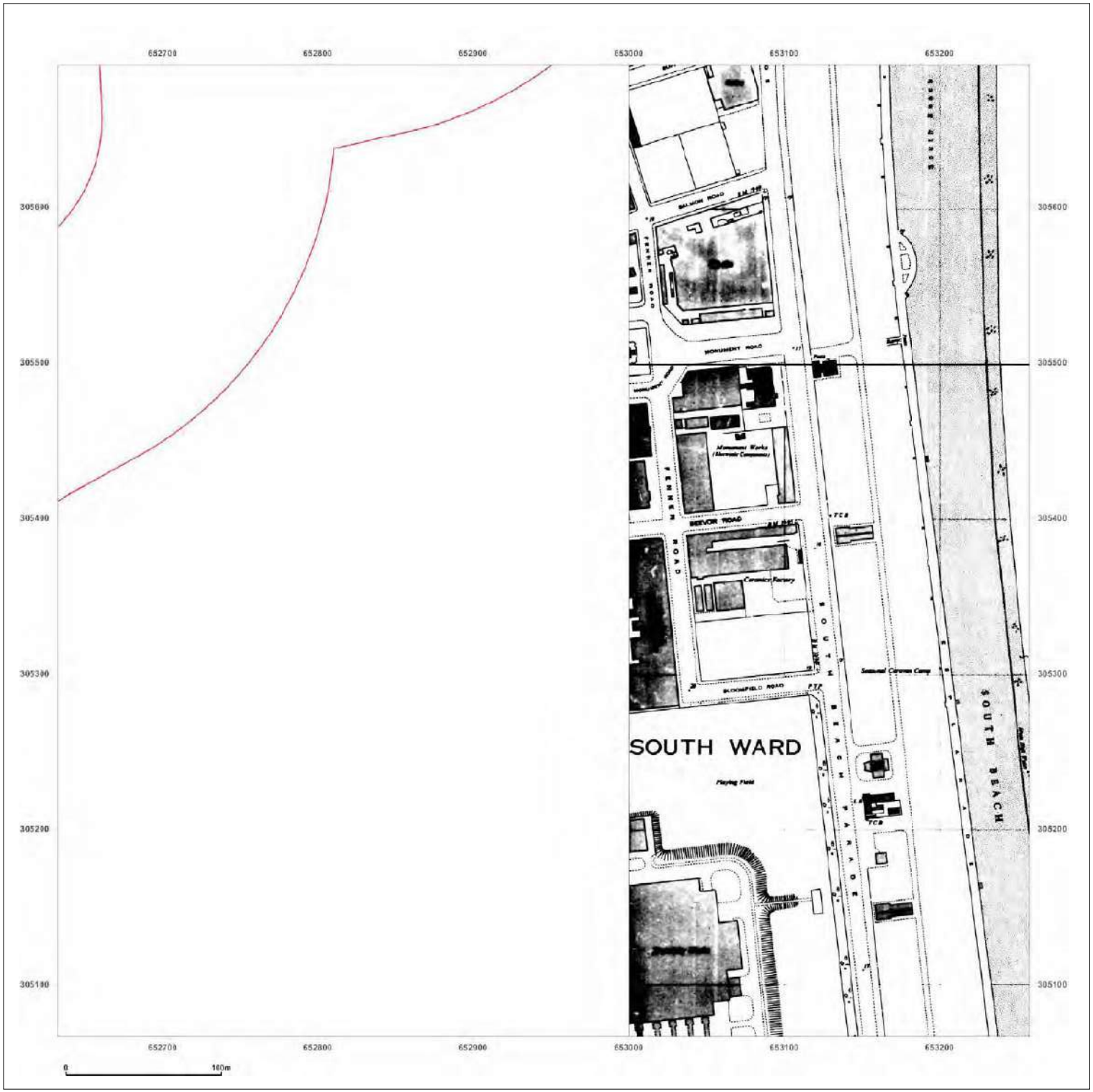

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: National Grid
Map date: 1969
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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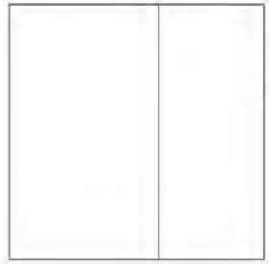

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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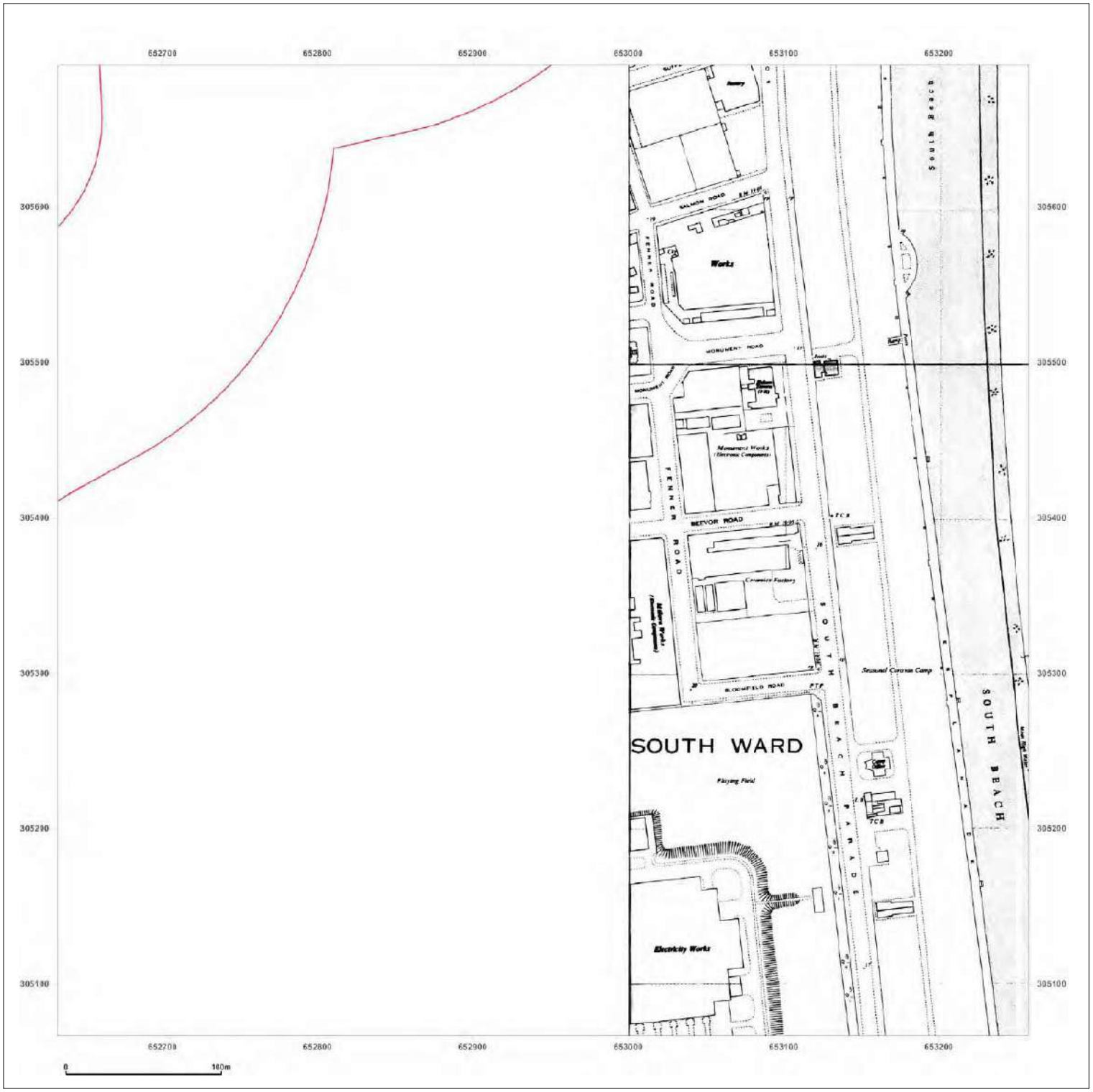

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_1
Grid Ref: 652945, 305379

Map Name: National Grid
Map date: 1969
Scale: 1:2,500
Printed at: 1:2,500

N
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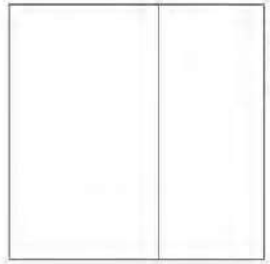

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
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Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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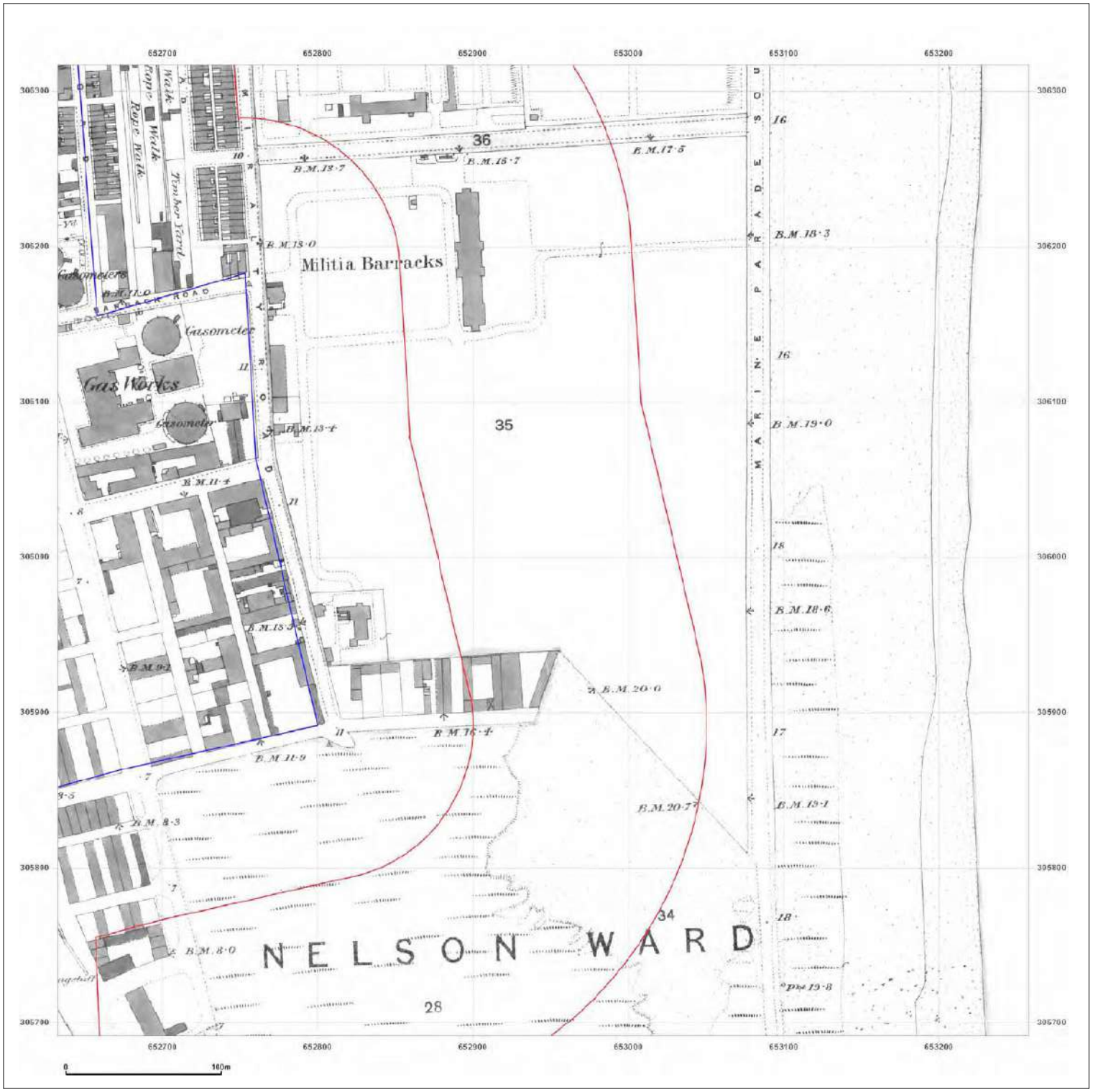

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FOR A BETTER PORTFOLIO VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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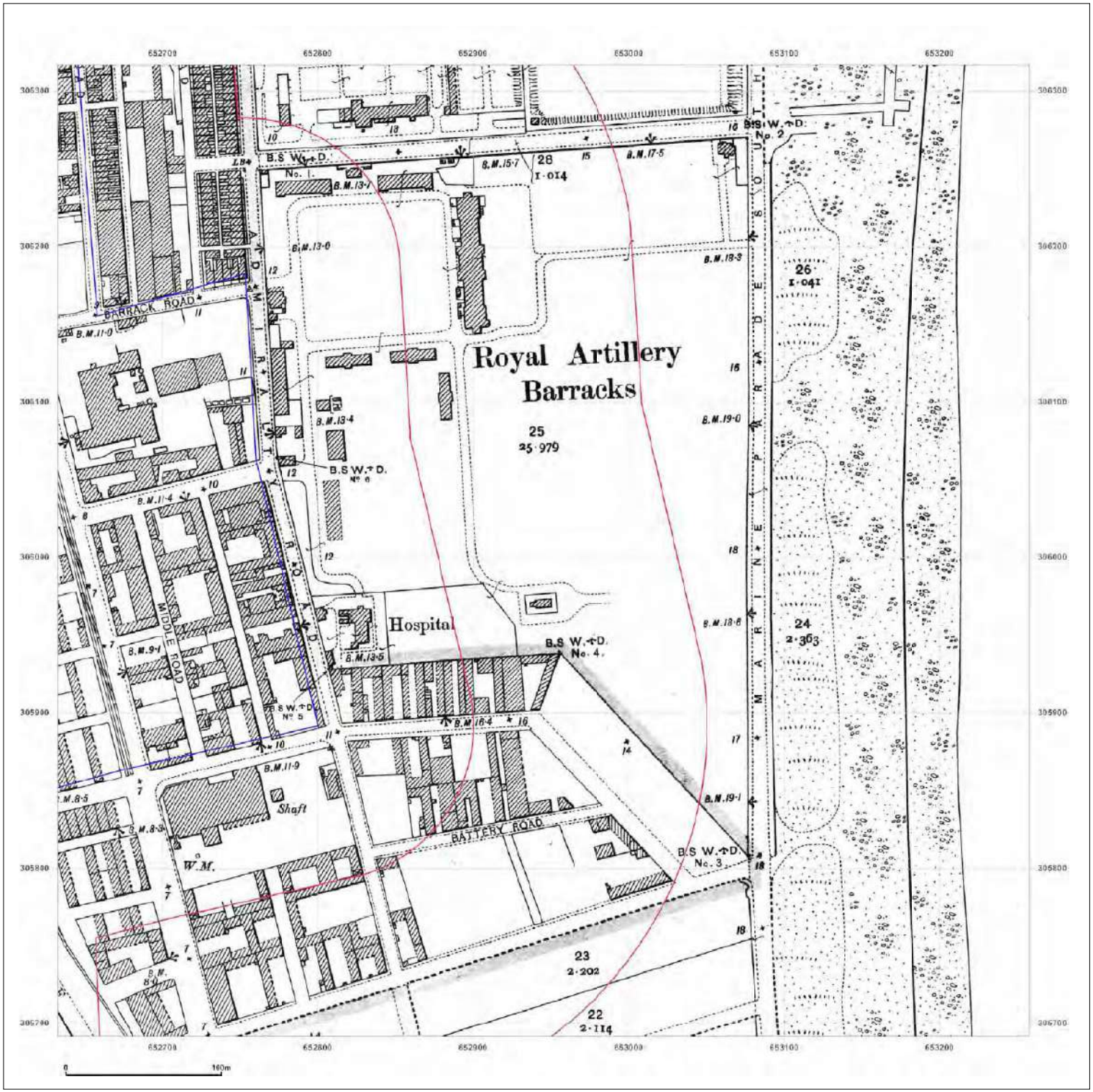

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: County Series
Map date: 1906
Scale: 1:2,500
Printed at: 1:2,500

N
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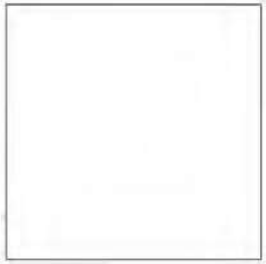

Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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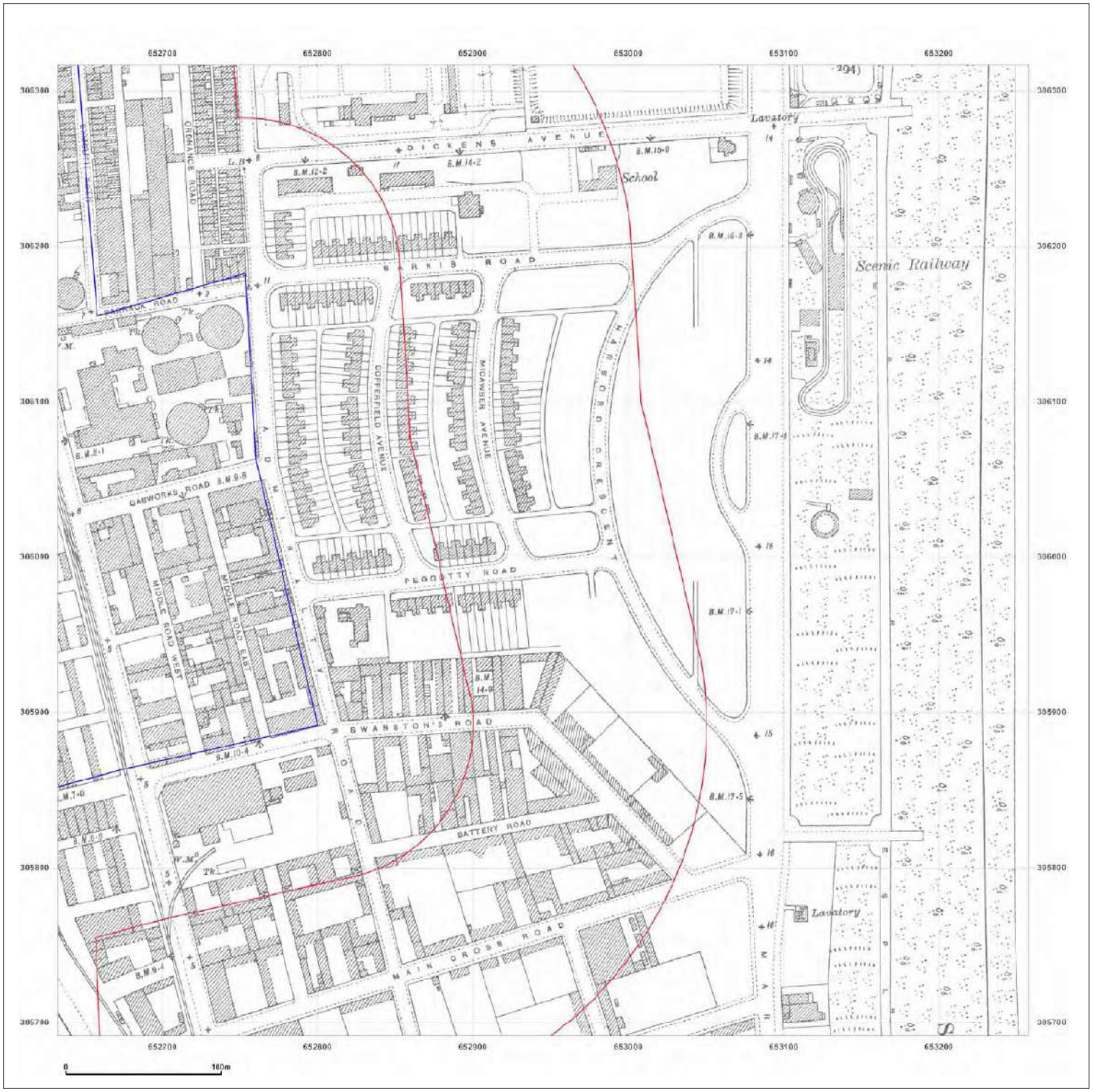

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: County Series
Map date: 1927
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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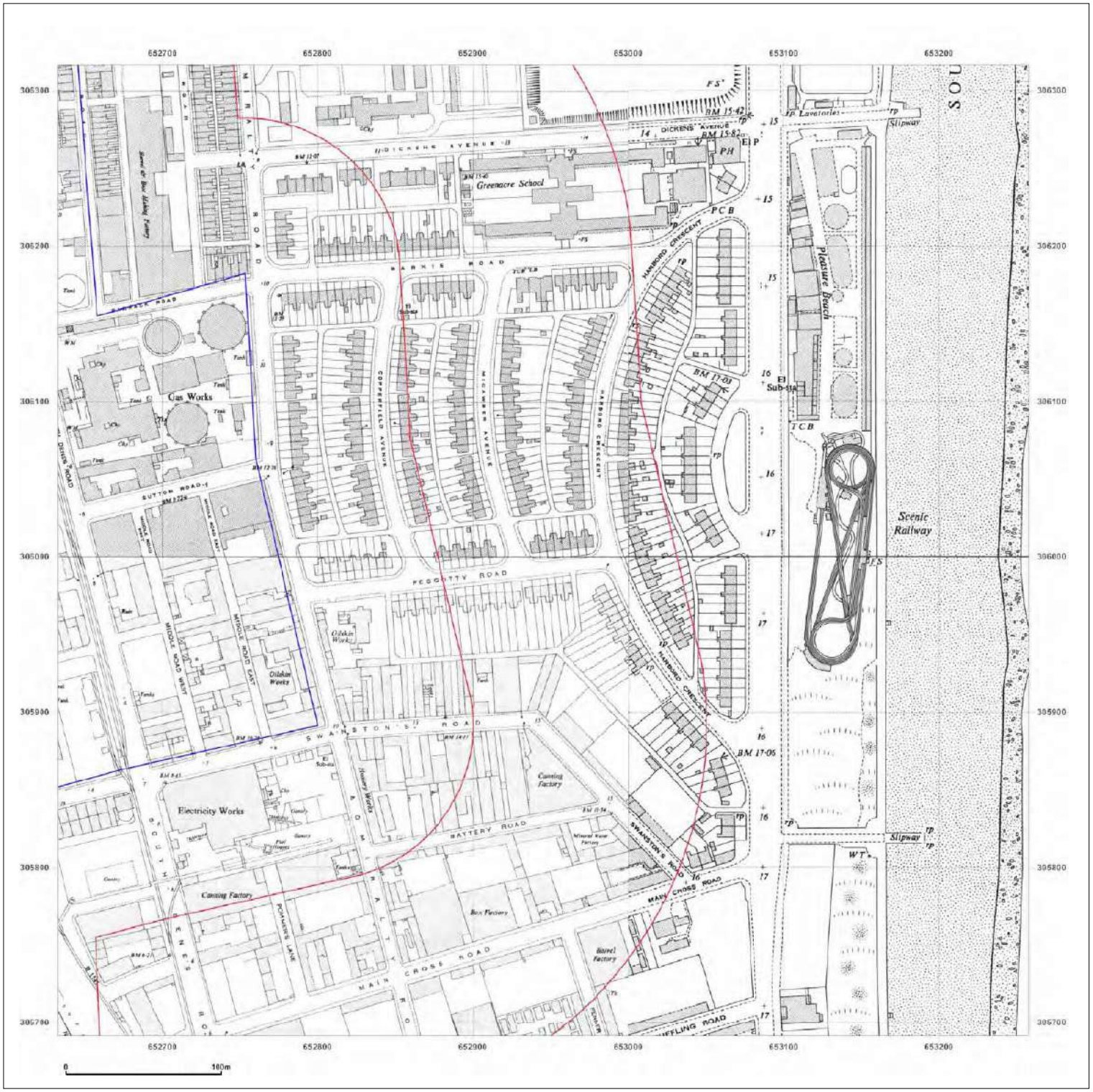

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: National Grid
Map date: 1949
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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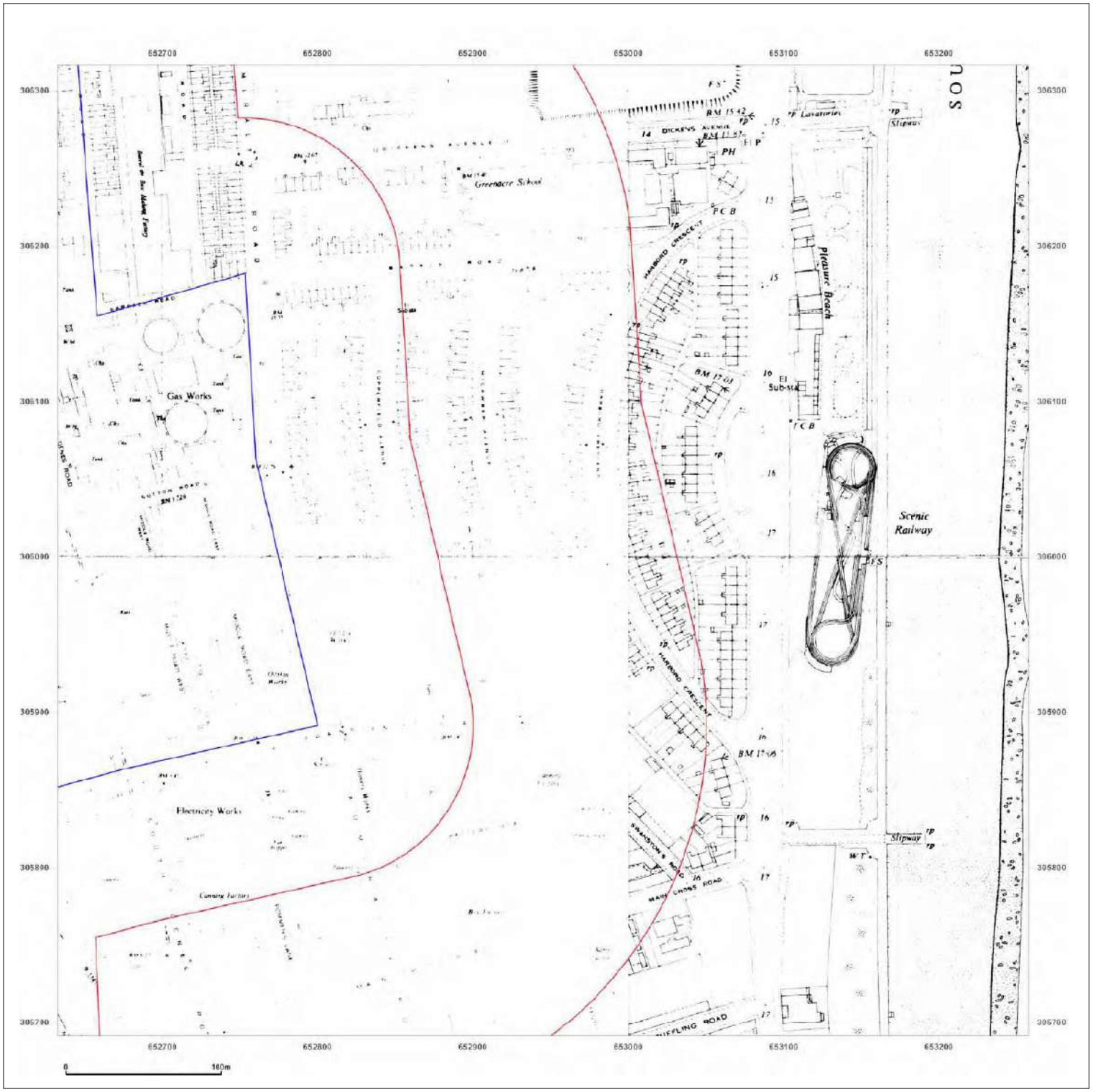

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FOR A BETTER PORTFOLIO VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: National Grid
Map date: 1950-1951
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: National Grid
Map date: 1958
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1958
Revised 1958
Edition 1960
Copyright 1960
Levelled 1946

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Production date: 03 July 2017

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: National Grid
Map date: 1963-1968
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed 1963
Revised 1963
Edition 1965
Copyright 1965
Levelled 1958

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1969
Levelled 1958

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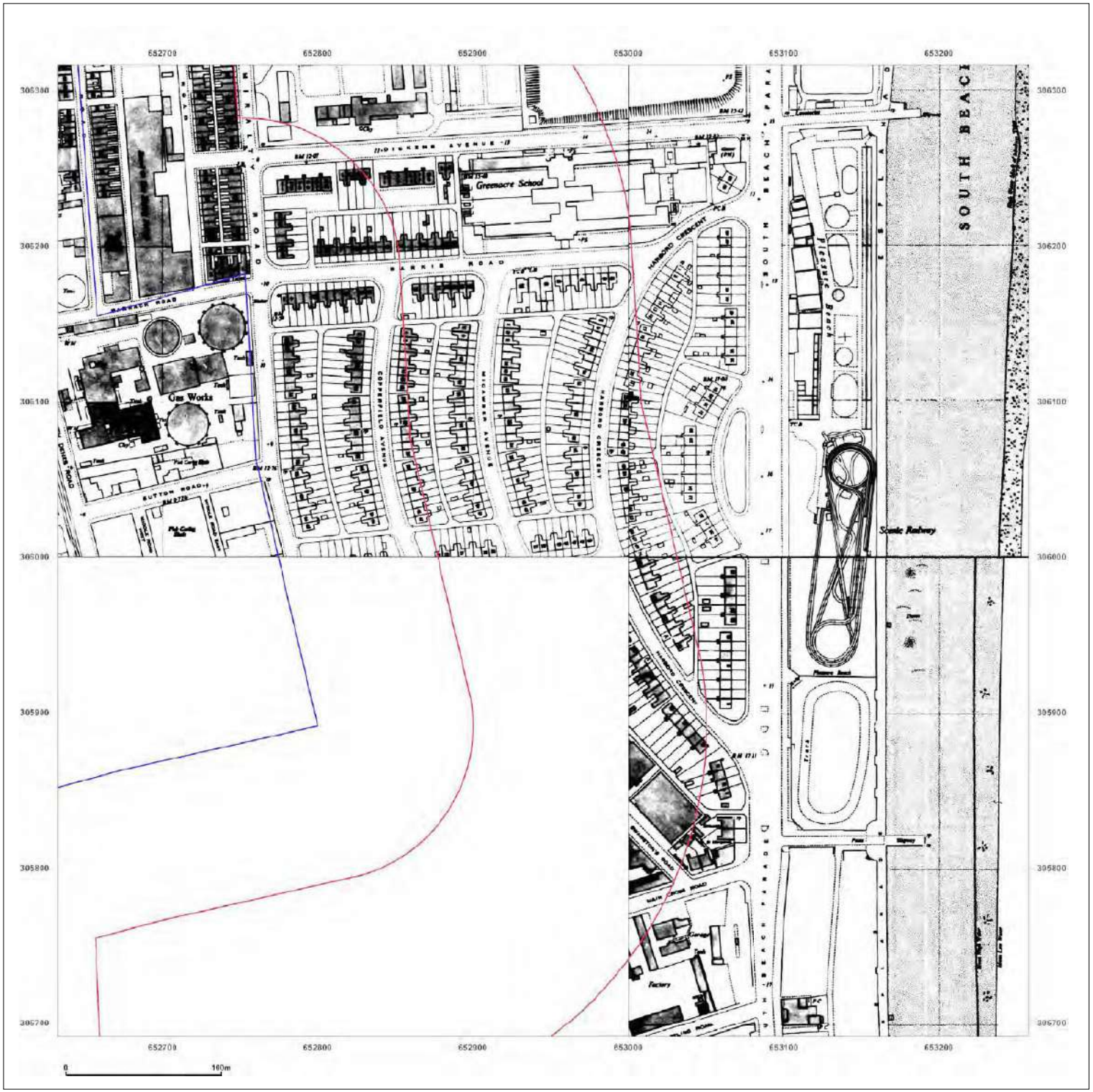

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: National Grid
Map date: 1965-1969
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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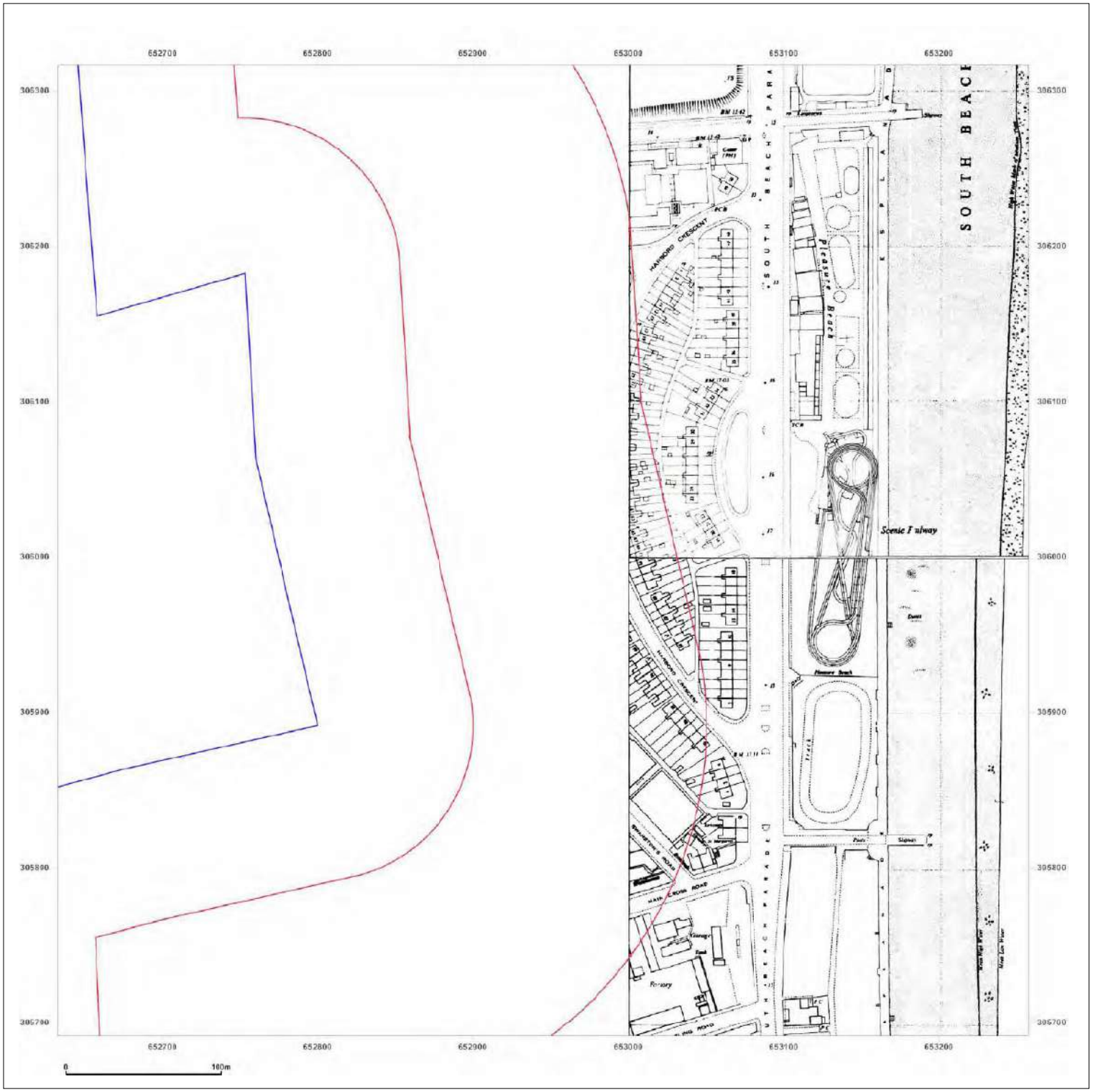

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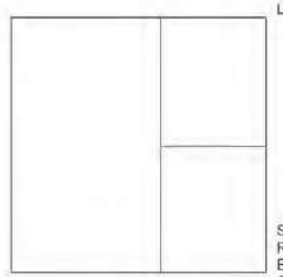
Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_2
Grid Ref: 652945, 306004

Map Name: National Grid
Map date: 1965-1969
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S



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Production date: 03 July 2017

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FOR A BETTER POINT OF VIEW

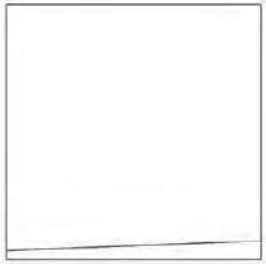
Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: County Series
Map date: 1883
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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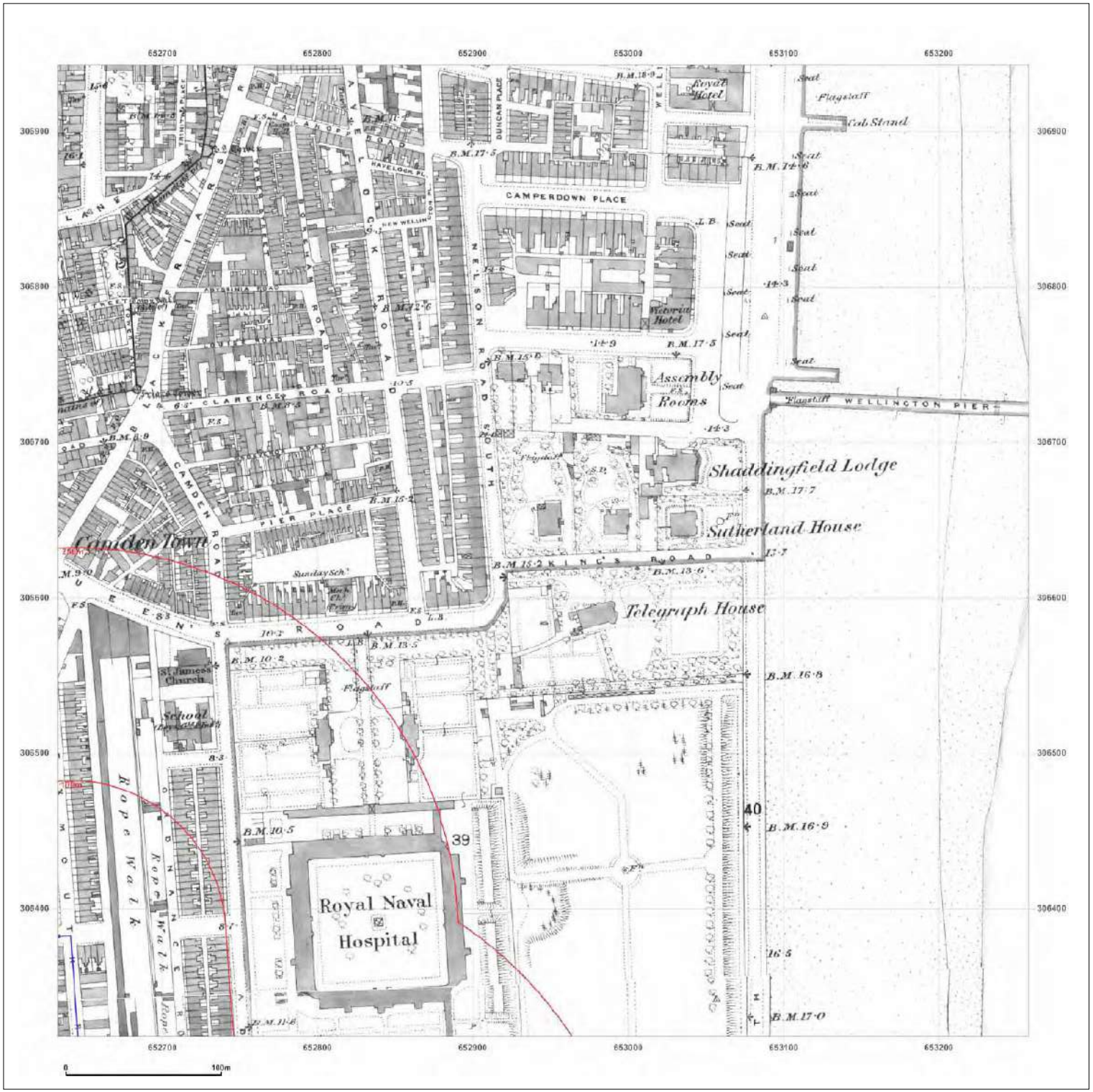
Production date: 03 July 2017

To view map legend click here Legend



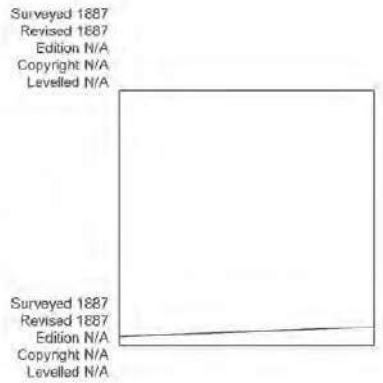
CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: County Series
Map date: 1887
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S



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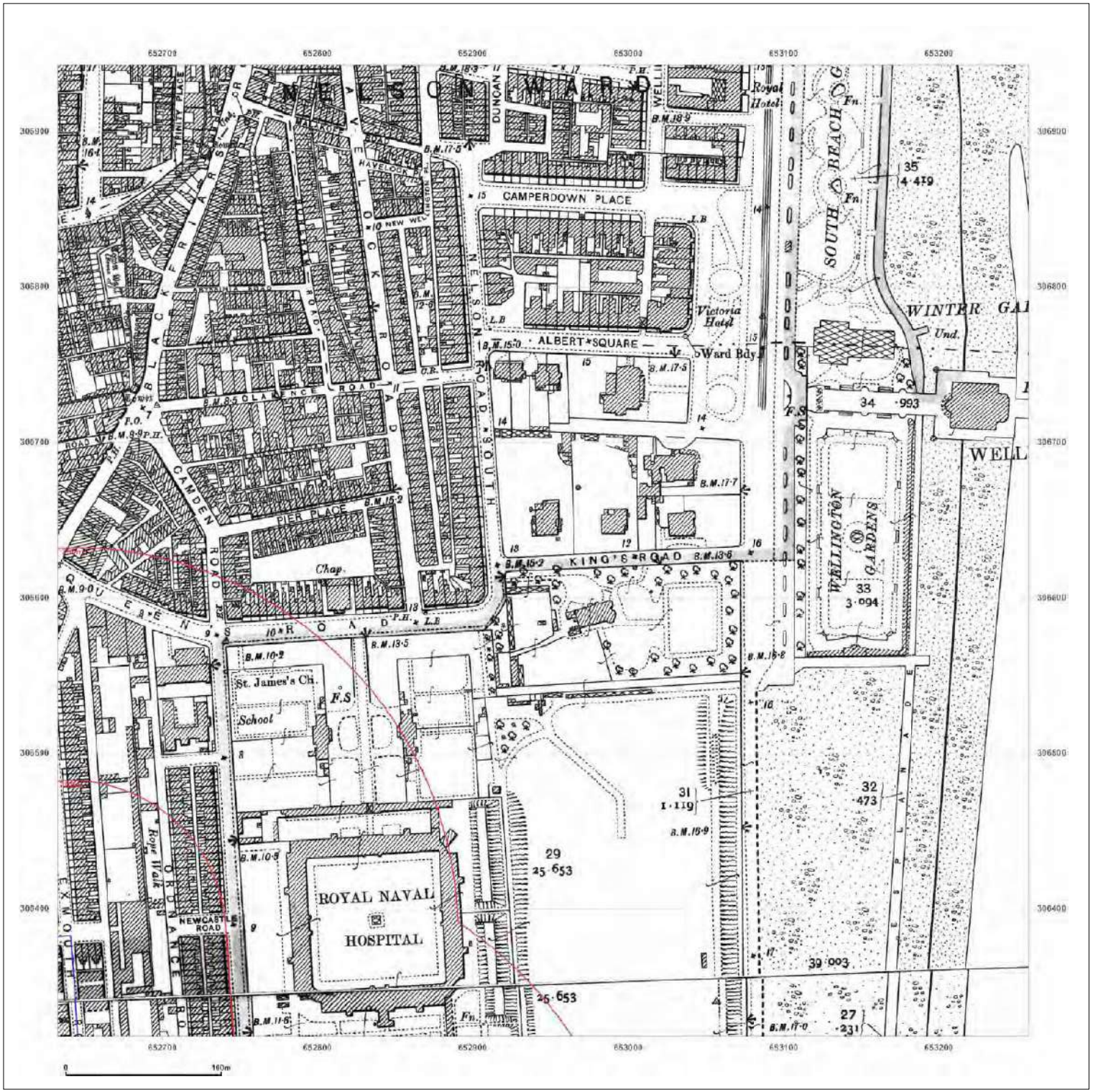


CENTRE MAPS LIVE.

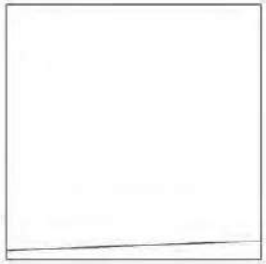
Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: County Series
Map date: 1905-1906
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1905
Revised 1905
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1883
Revised 1904
Edition 1906
Copyright N/A
Levelled N/A

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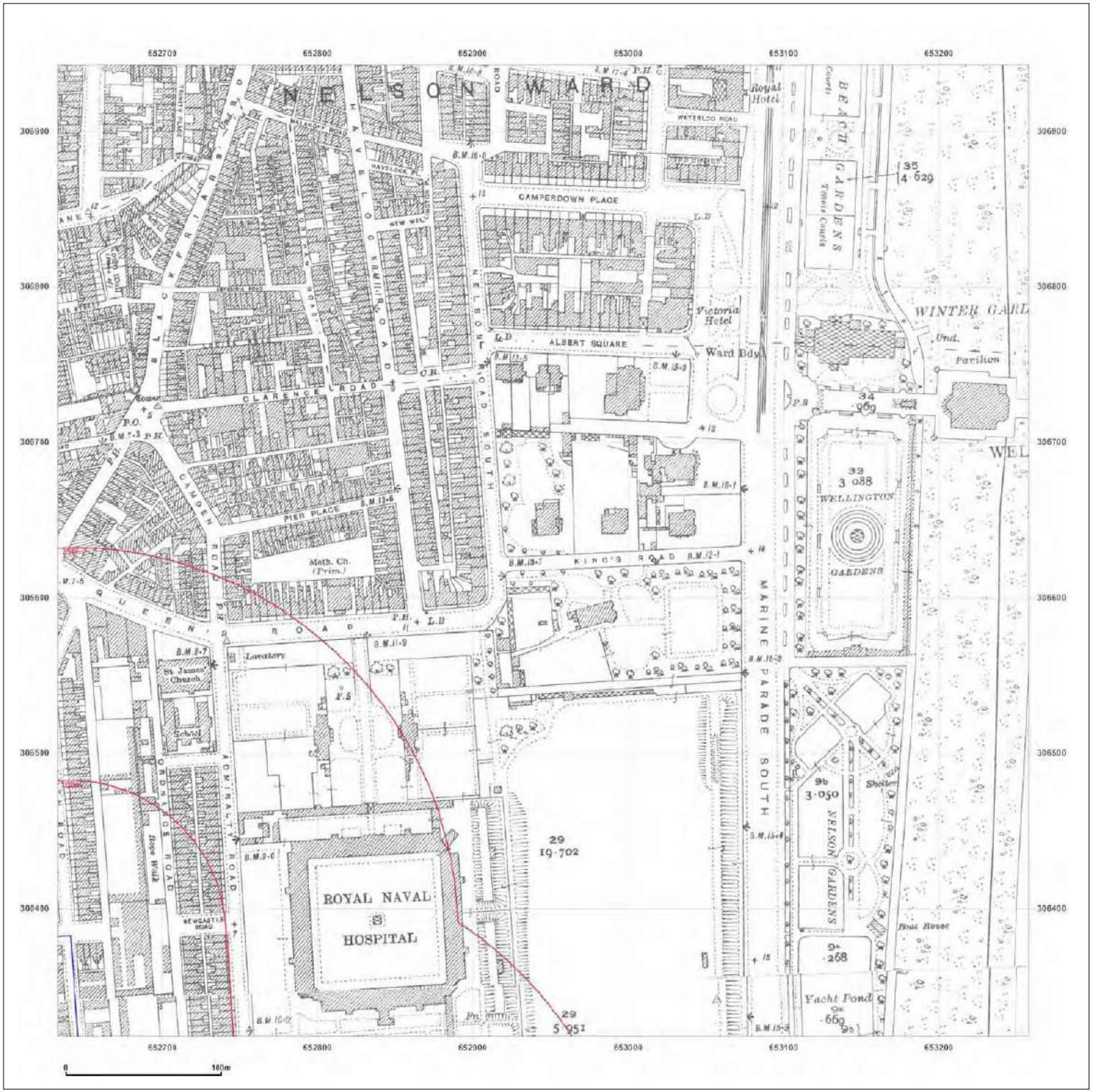

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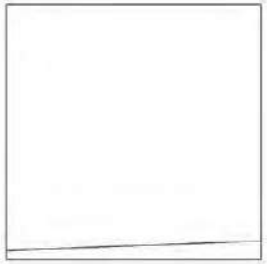
Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: County Series
Map date: 1927-1928
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1928
Revised 1928
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1927
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

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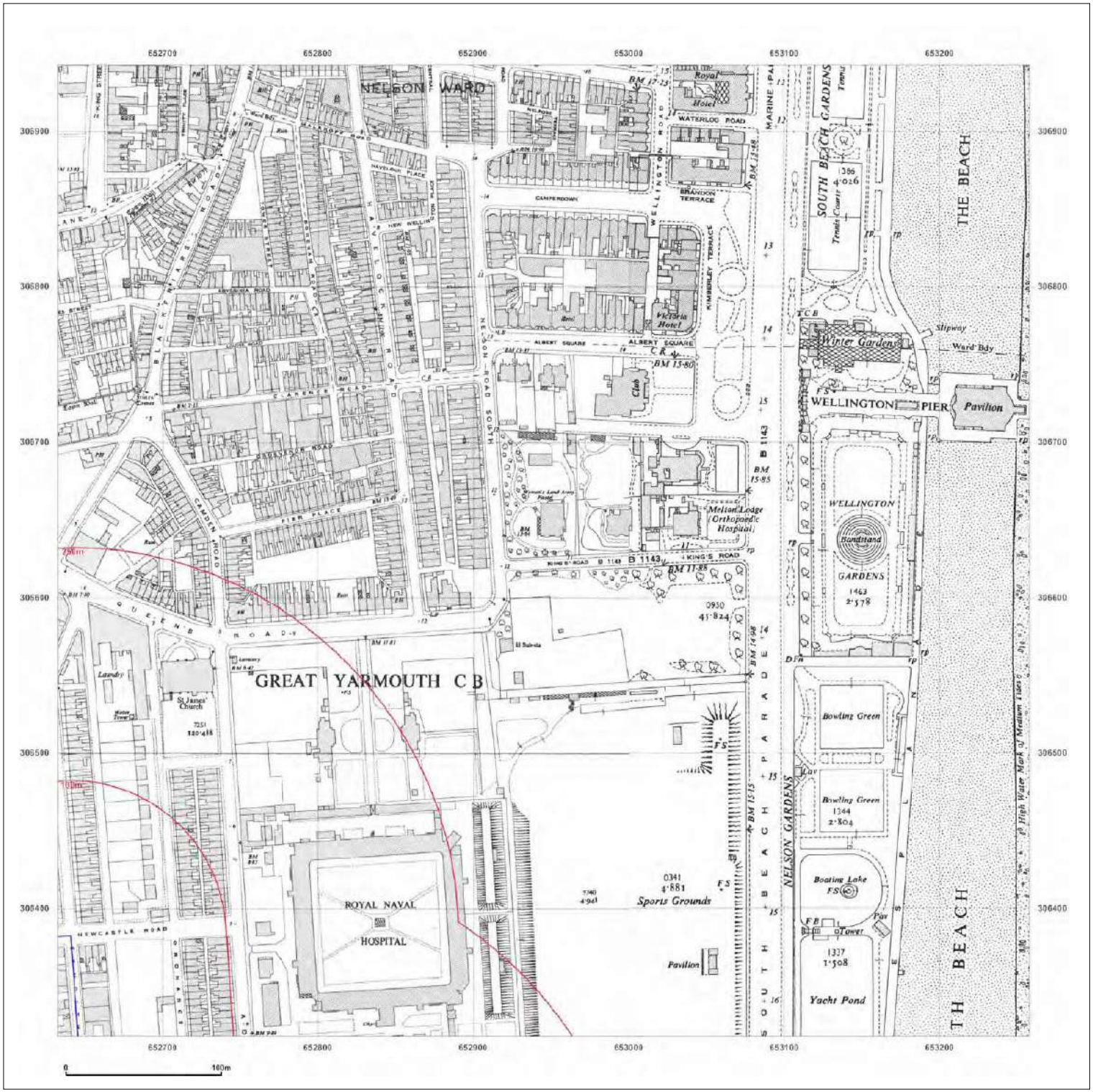

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: National Grid
Map date: 1949
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled 1946

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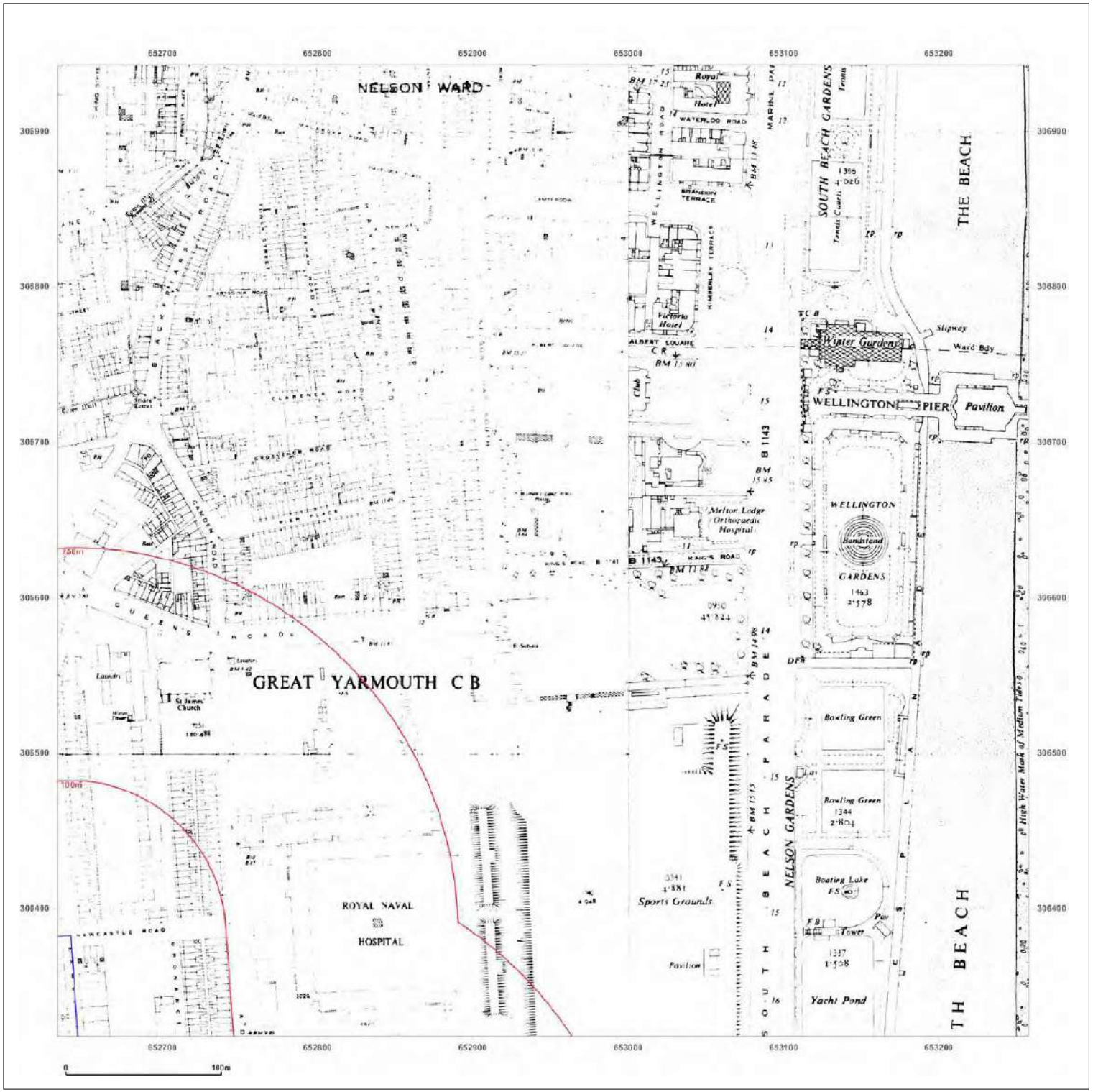

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: National Grid
Map date: 1950-1951
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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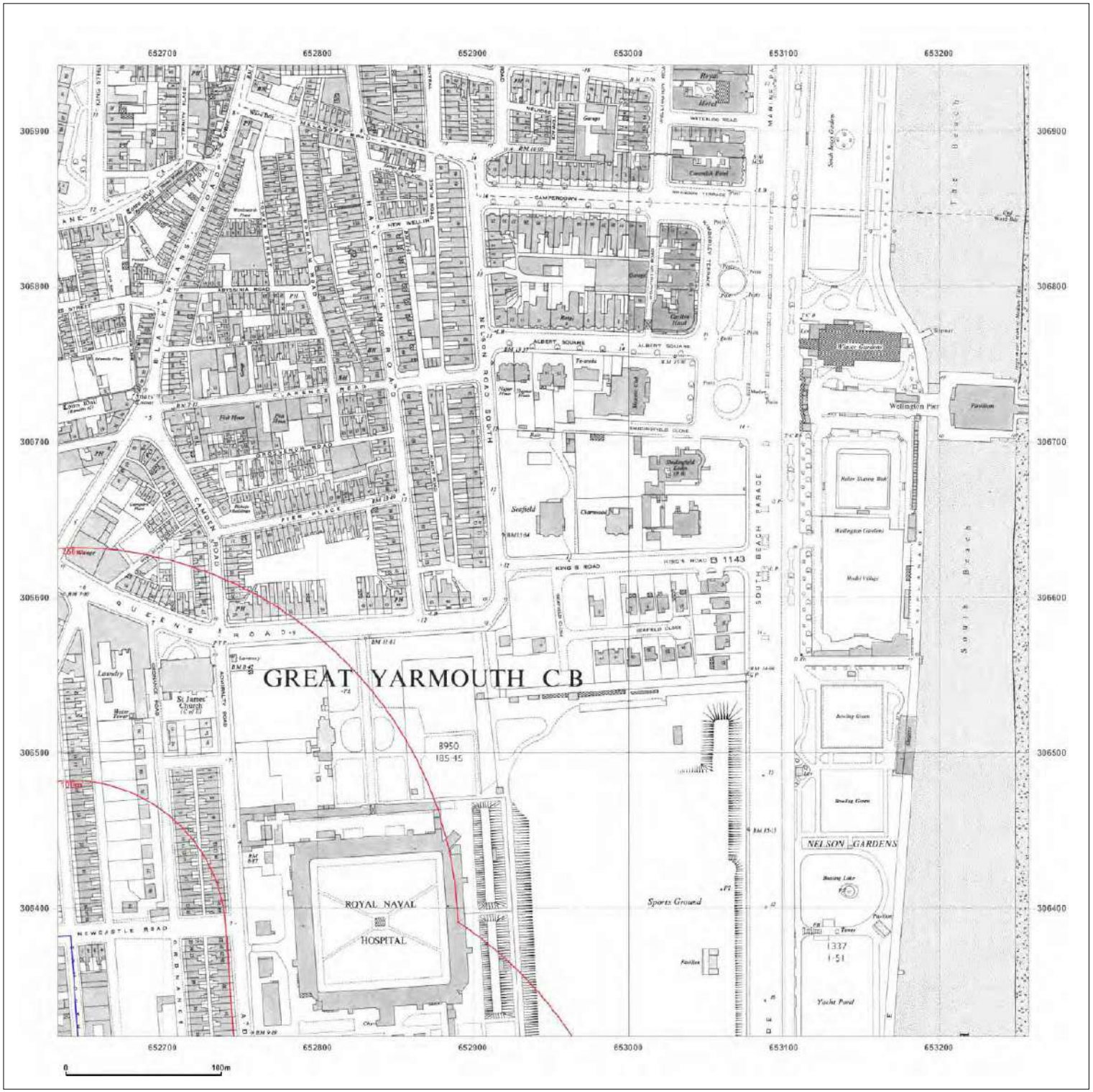

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: National Grid
Map date: 1963
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1963
Revised 1963
Edition 1965
Copyright 1965
Levelled 1958

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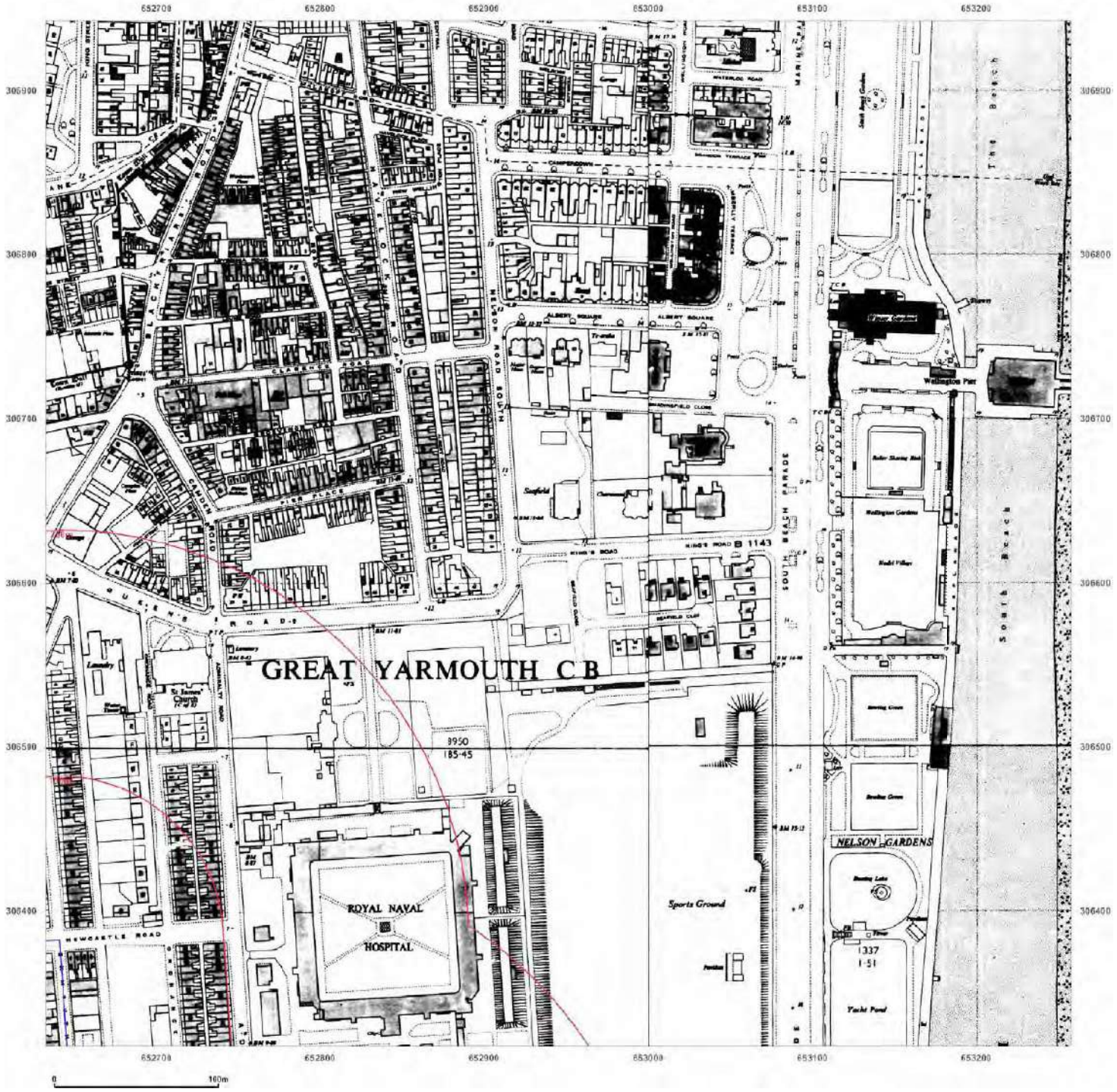

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: National Grid
Map date: 1965
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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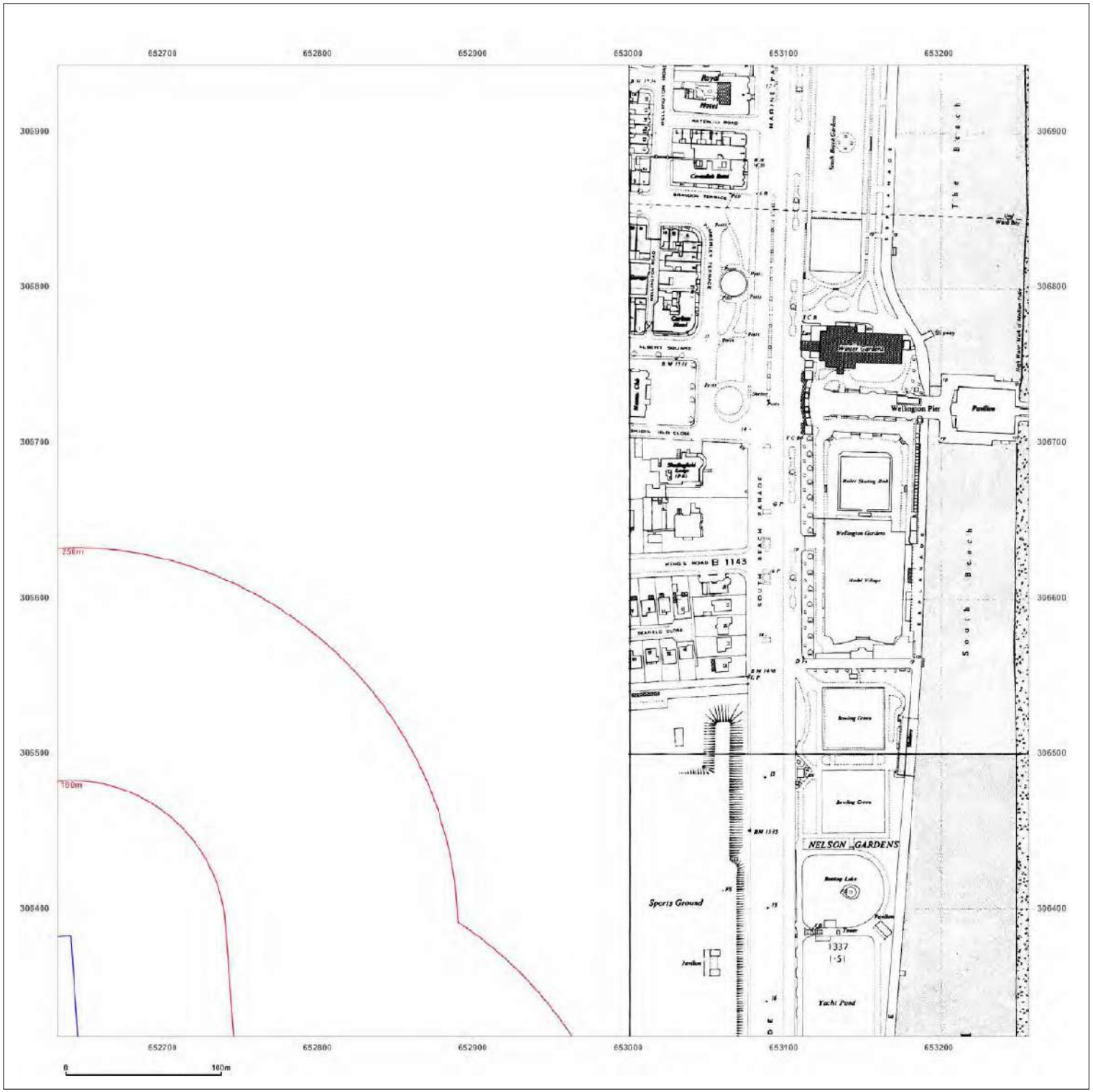

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS_LS_3_3
Grid Ref: 652945, 306630

Map Name: National Grid
Map date: 1965
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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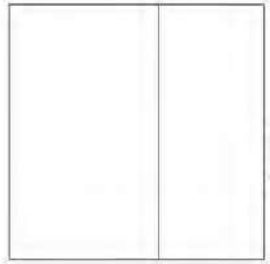

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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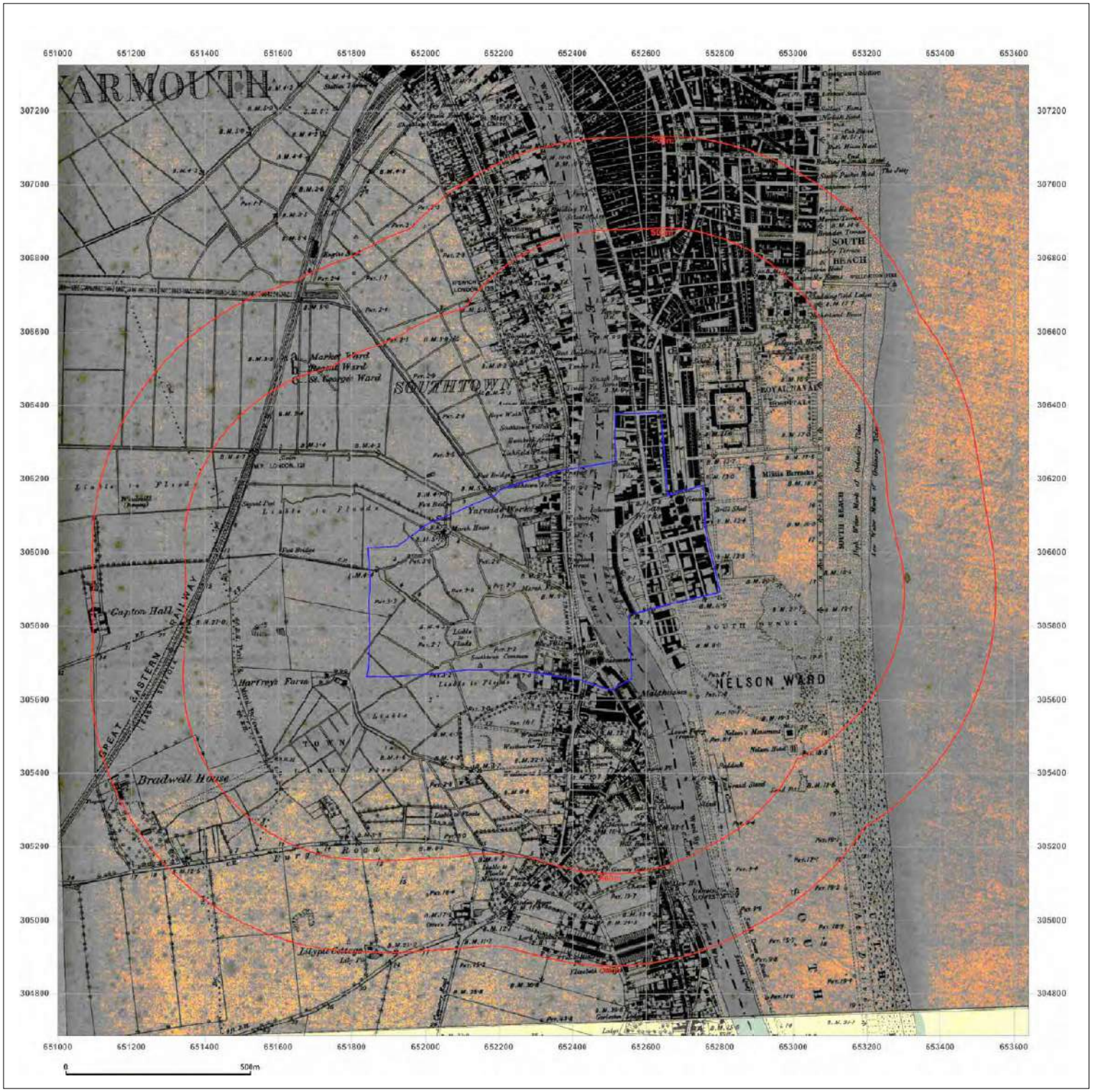

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1883-1886
Scale: 1:10,560
Printed at: 1:10,560

N
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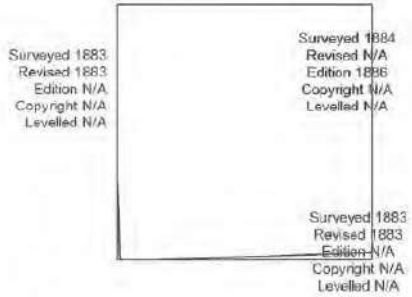

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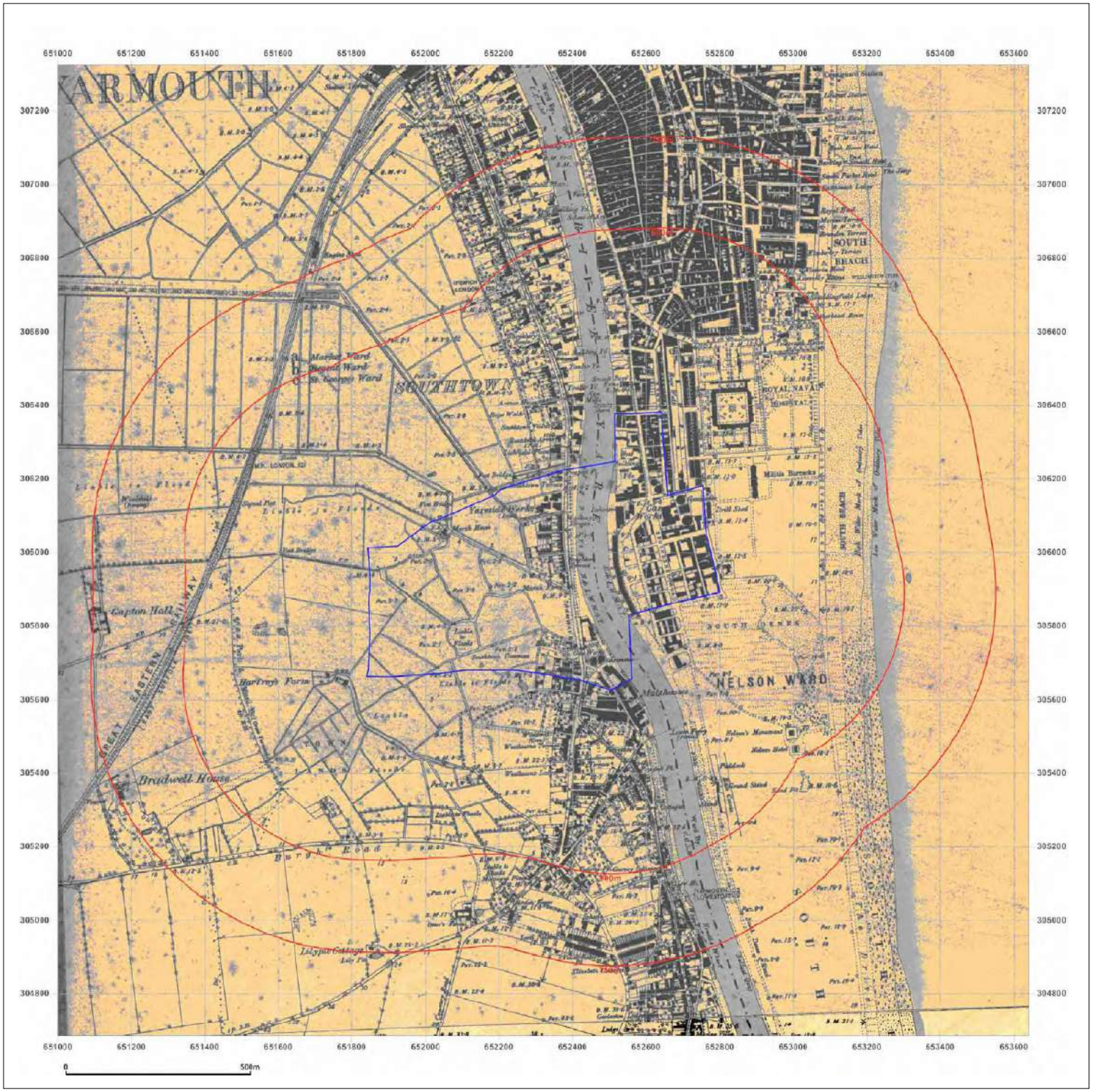

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1884-1888
Scale: 1:10,560
Printed at: 1:10,560

N
W E
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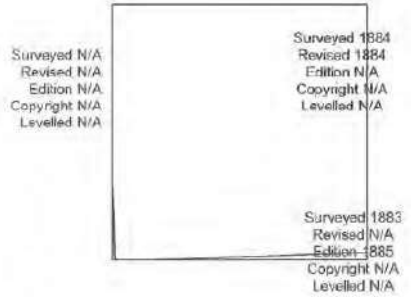

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1901-1904
Scale: 1:10,560
Printed at: 1:10,560

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series

Map date: 1905

Scale: 1:10,560

Printed at: 1:10,560

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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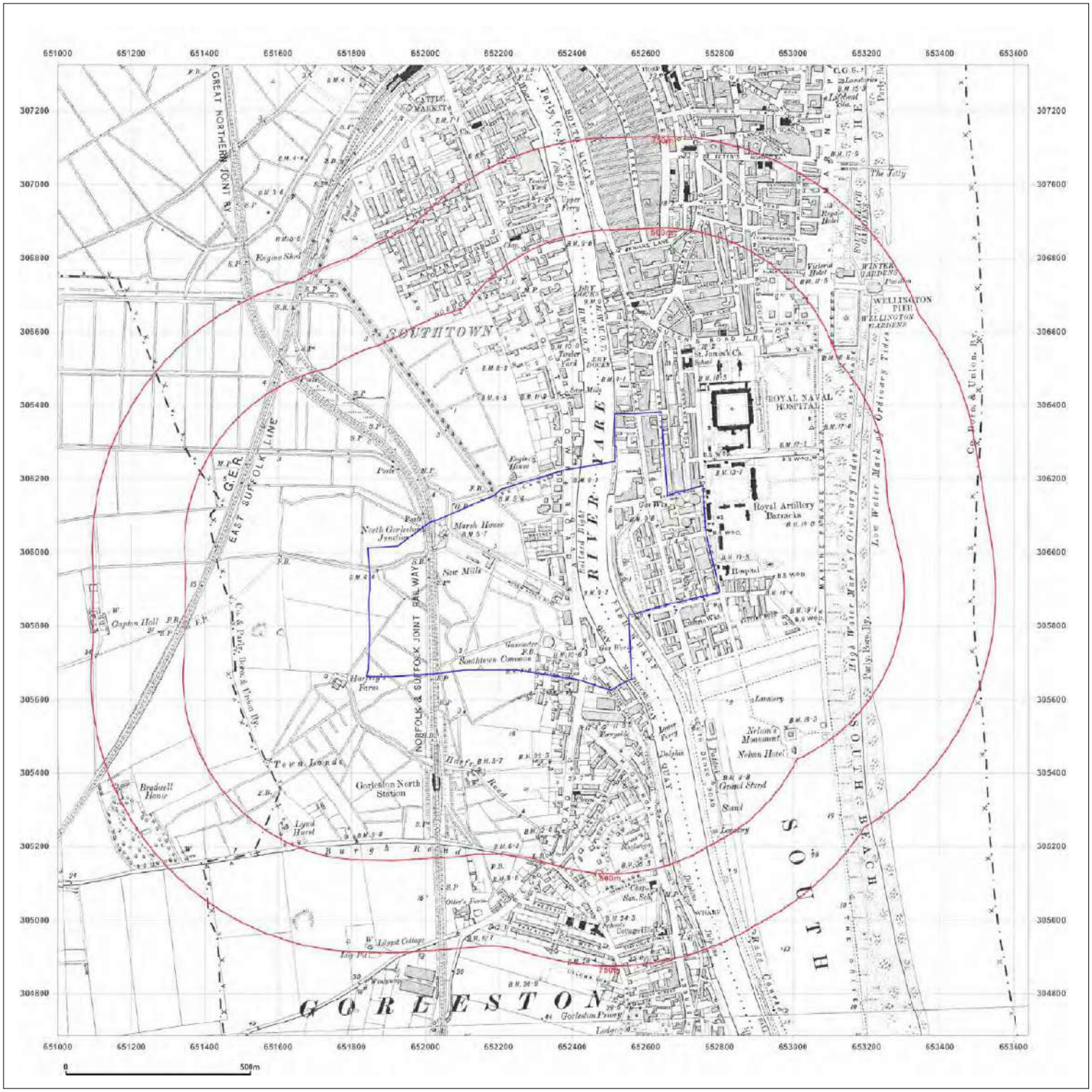
Production date: 03 July 2017

To view map legend click here [Legend]



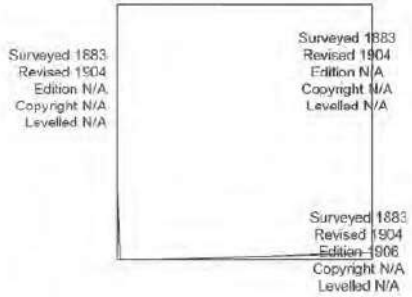
CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1904-1906
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S



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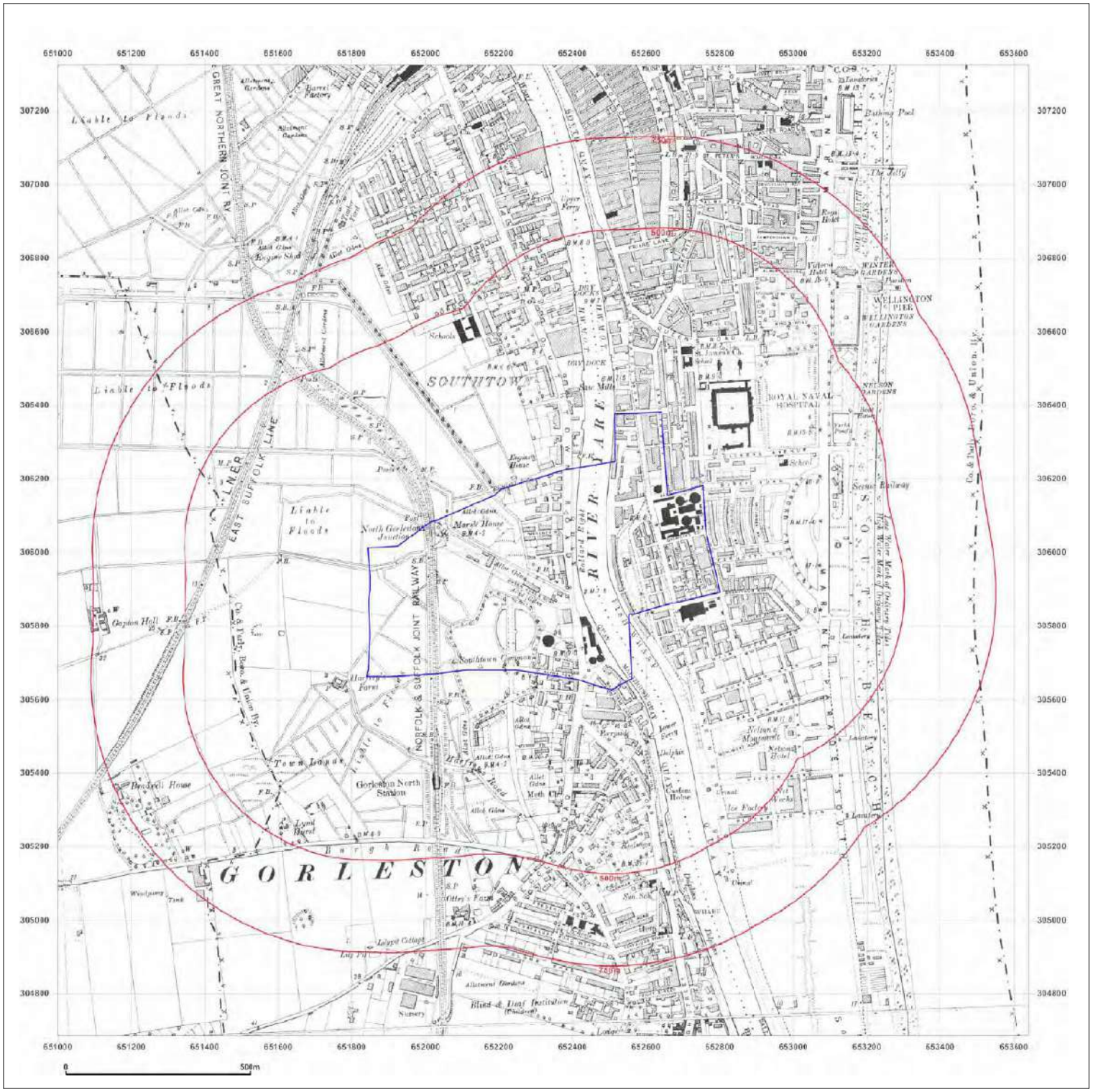

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1926-1928
Scale: 1:10,560
Printed at: 1:10,560

N
W E
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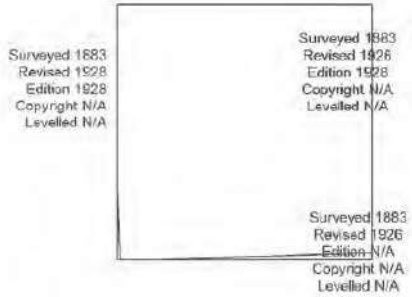

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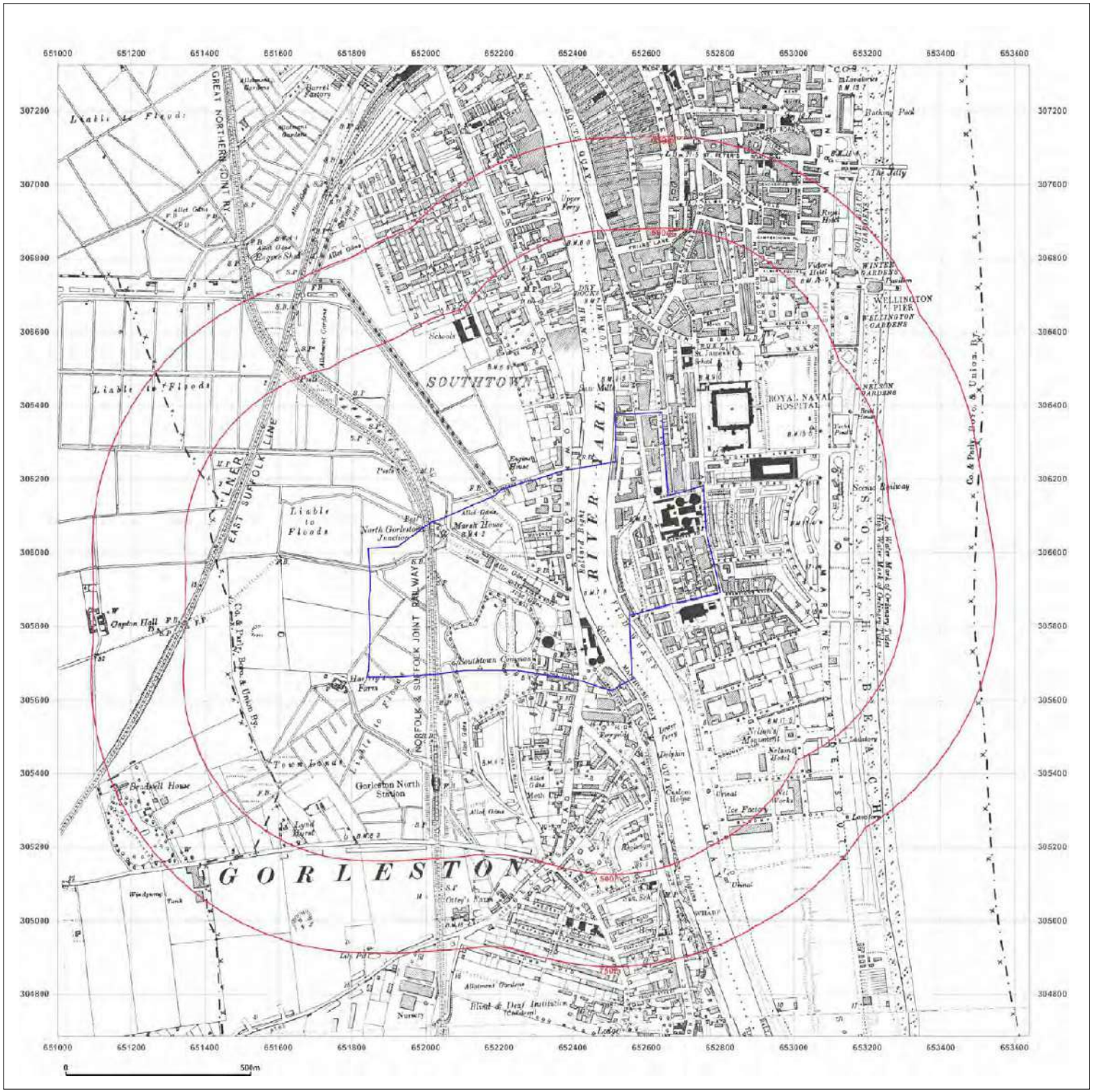

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Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1938
Scale: 1:10,560
Printed at: 1:10,560

N
W E
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Surveyed 1883
Revised 1938
Edition N/A
Copyright N/A
Levelled 1926

Surveyed 1883
Revised 1938
Edition 1938
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1938
Scale: 1:10,560
Printed at: 1:10,560

N
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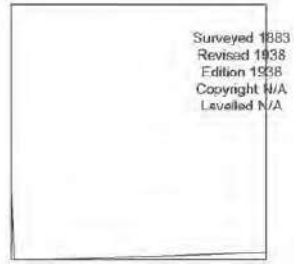

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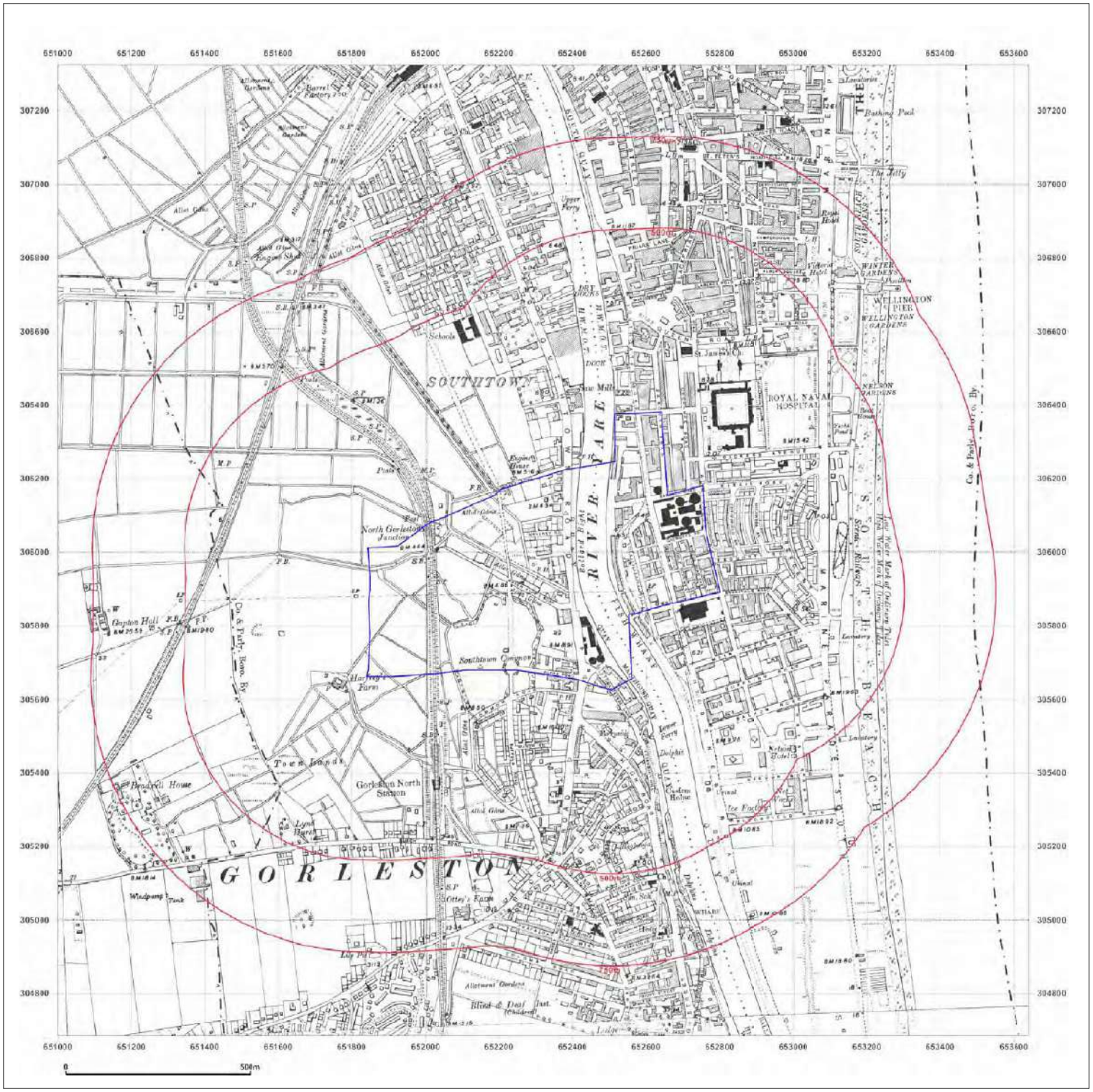

CENTRE MAPS LIVE.

FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: County Series
Map date: 1946
Scale: 1:10,560
Printed at: 1:10,560

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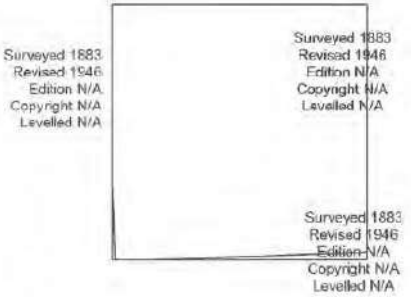

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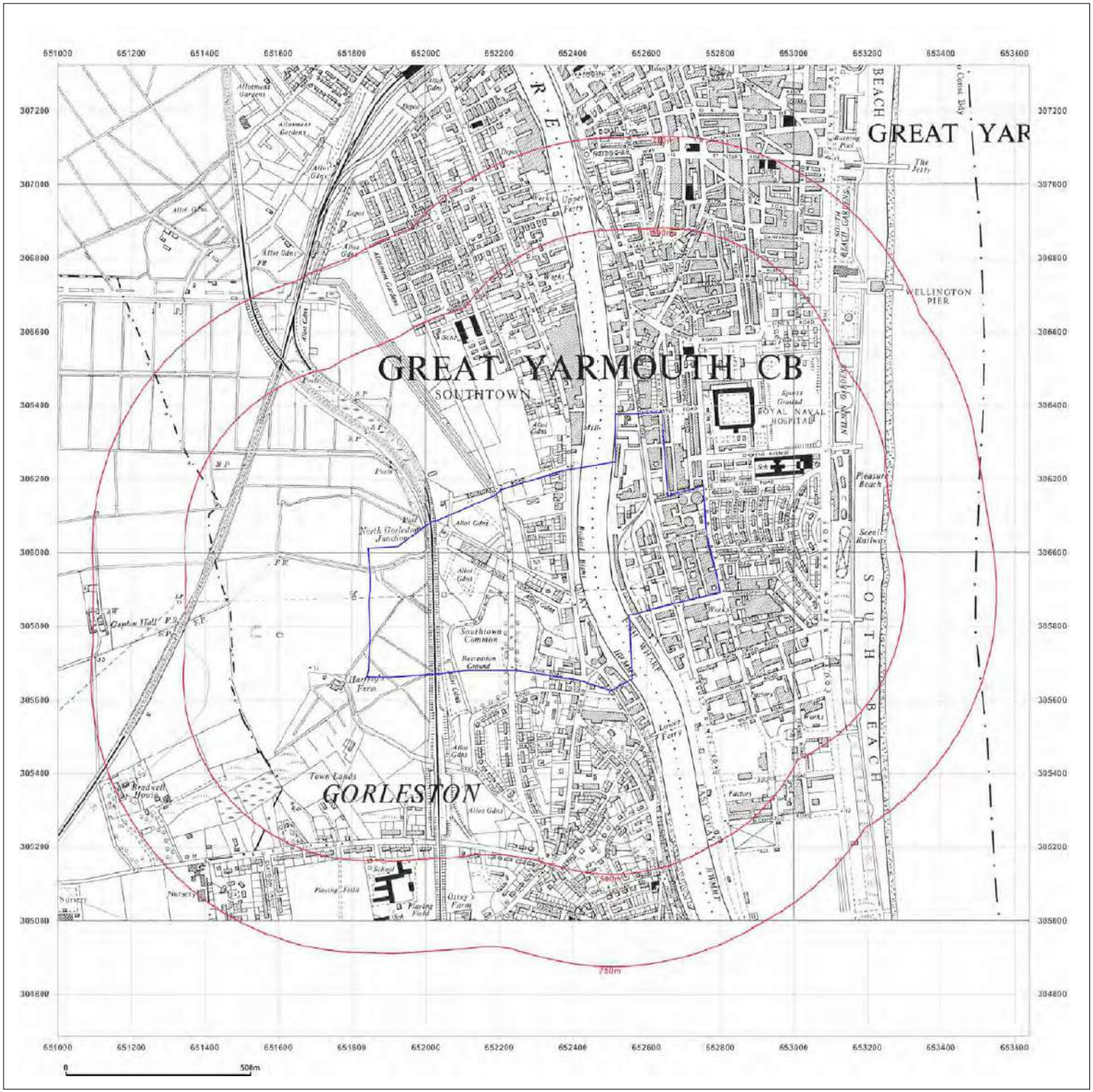

CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: Provisional
Map date: 1958
Scale: 1:10,560
Printed at: 1:10,560

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Surveyed 1956
Revised 1956
Edition N/A
Copyright 1958
Levelled N/A

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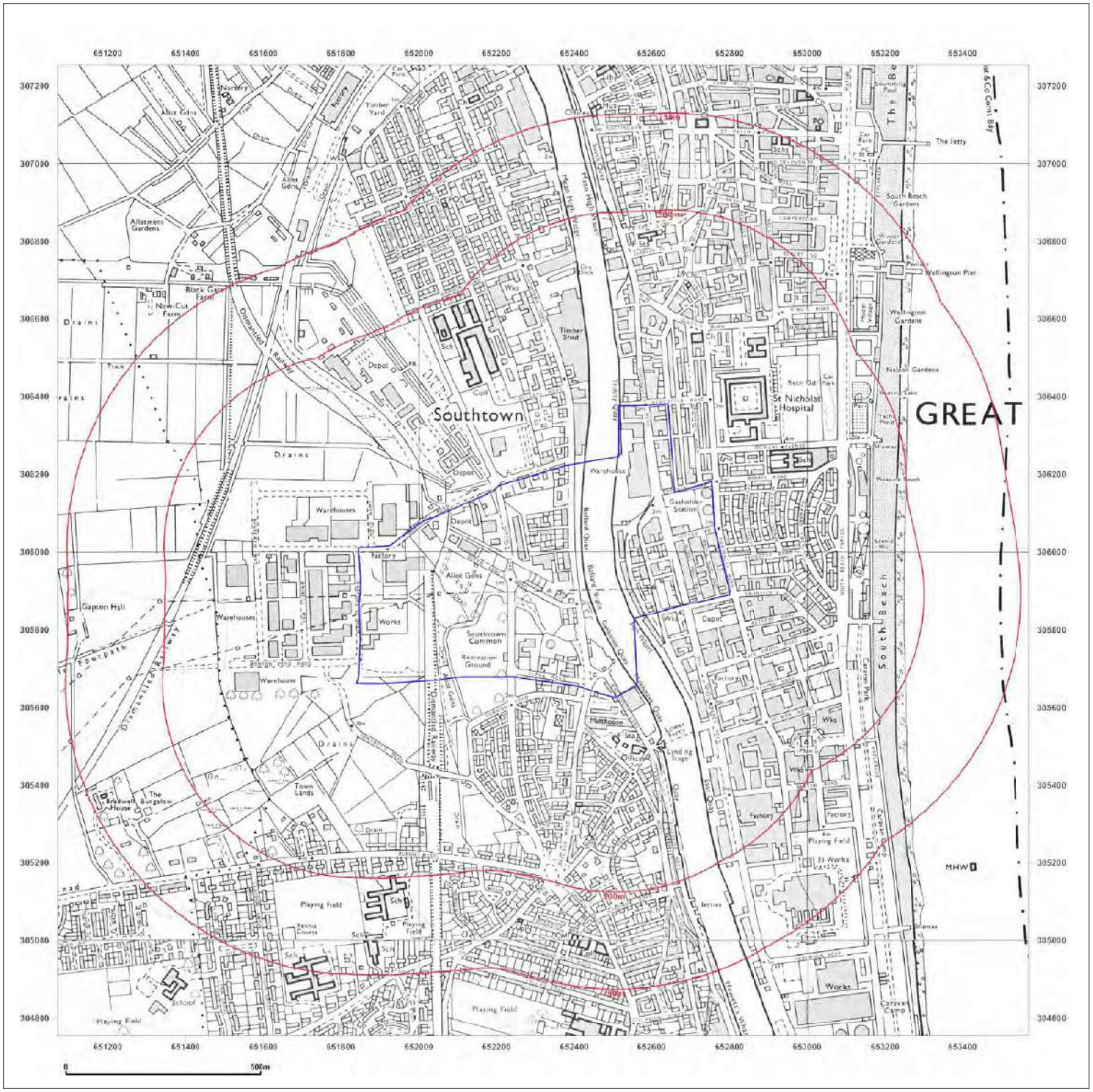

CENTRE MAPS LIVE.

FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: National Grid
Map date: 1978-1981
Scale: 1:10,000
Printed at: 1:10,000

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Surveyed 1978
Revised 1978
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1980
Revised 1981
Edition N/A
Copyright N/A
Levelled N/A

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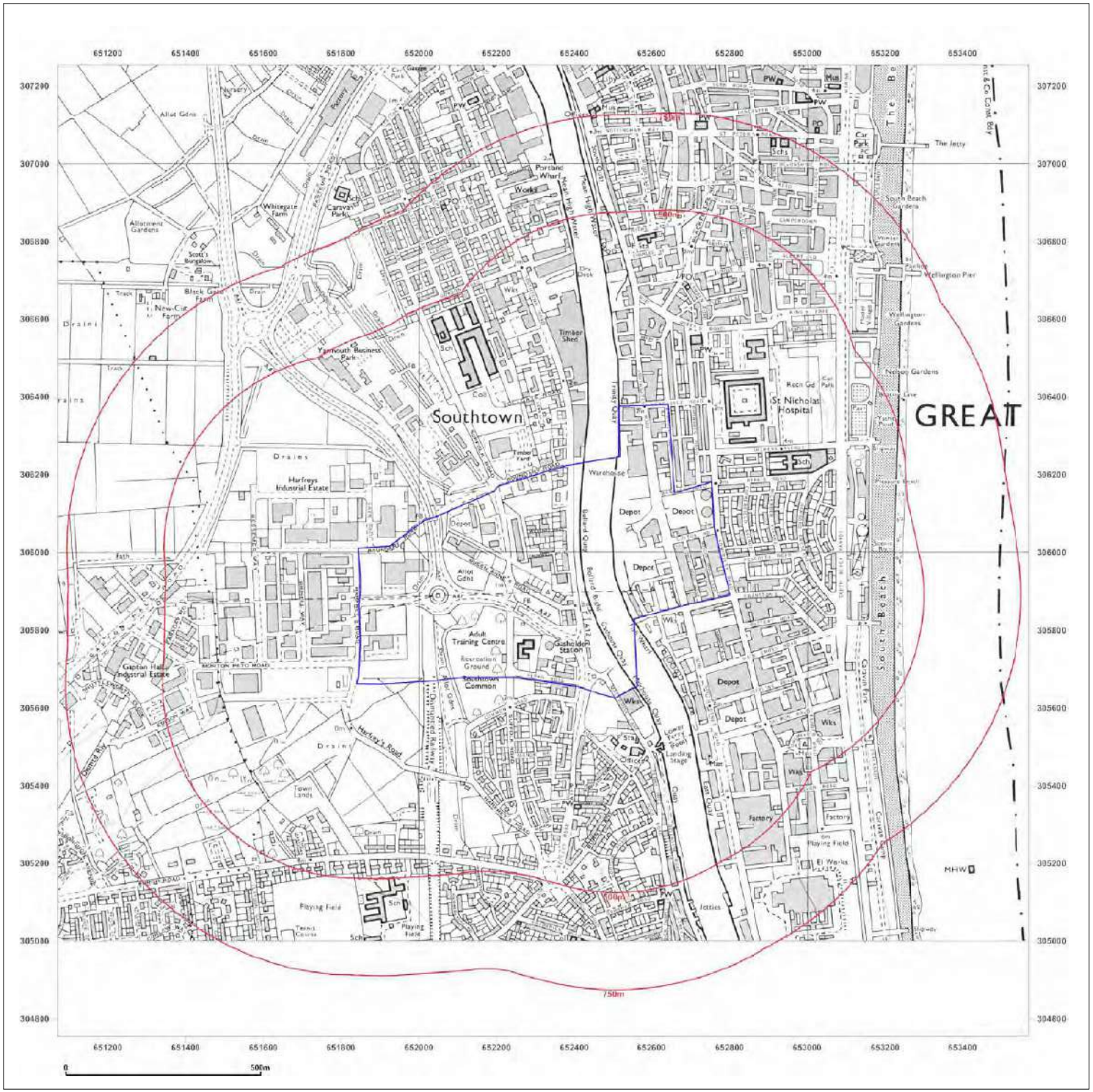
To view map legend click here *Legend*



CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: National Grid
Map date: 1988
Scale: 1:10,000
Printed at: 1:10,000

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Surveyed 1984
Revised 1988
Edition N/A
Copyright N/A
Levelled N/A

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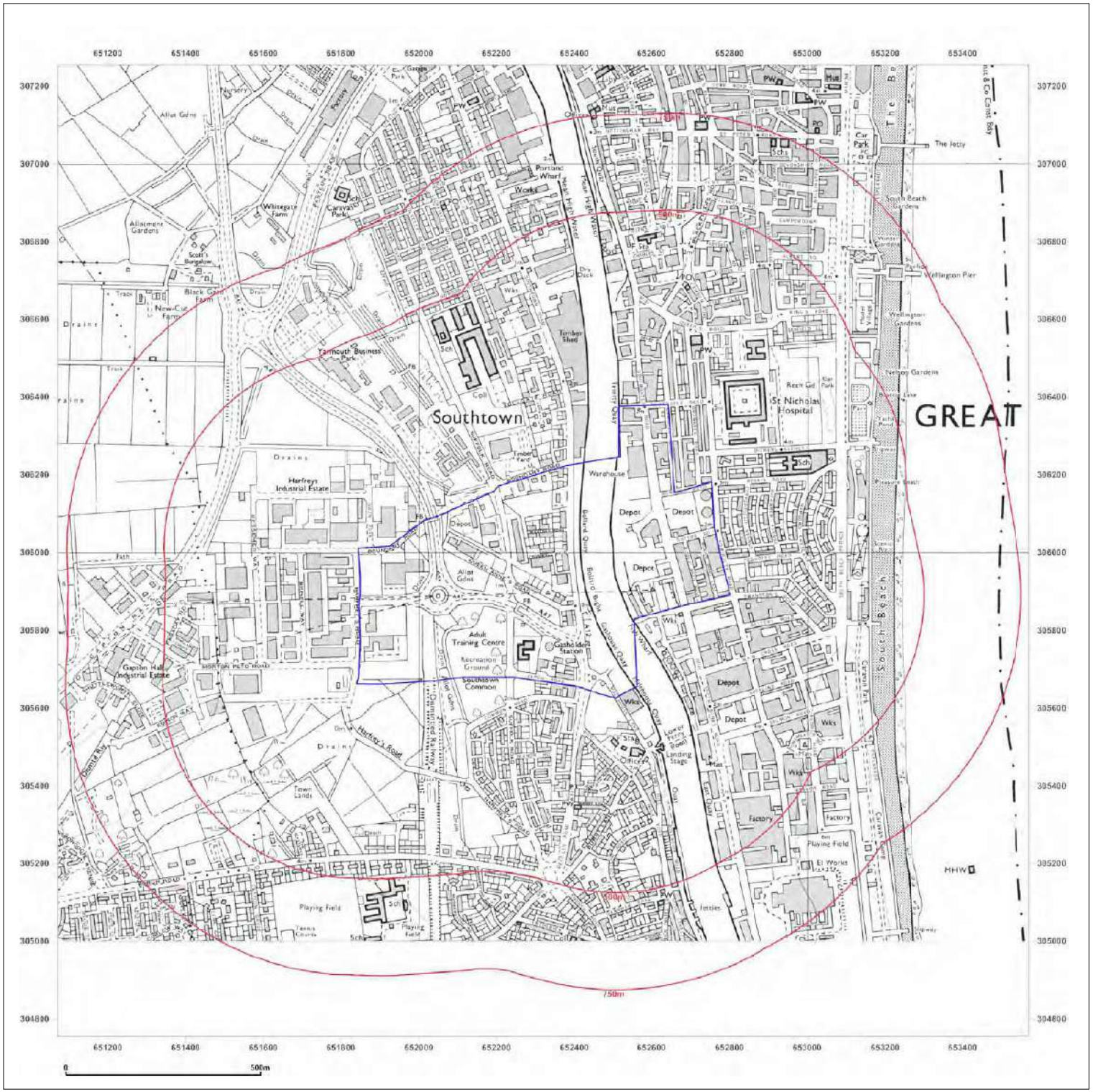

CENTRE MAPS LIVE.

FOR A BETTER POINT OF VIEW

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: National Grid

Map date: 1988

Scale: 1:10,000

Printed at: 1:10,000

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Surveyed 1984
Revised 1988
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 03 July 2017

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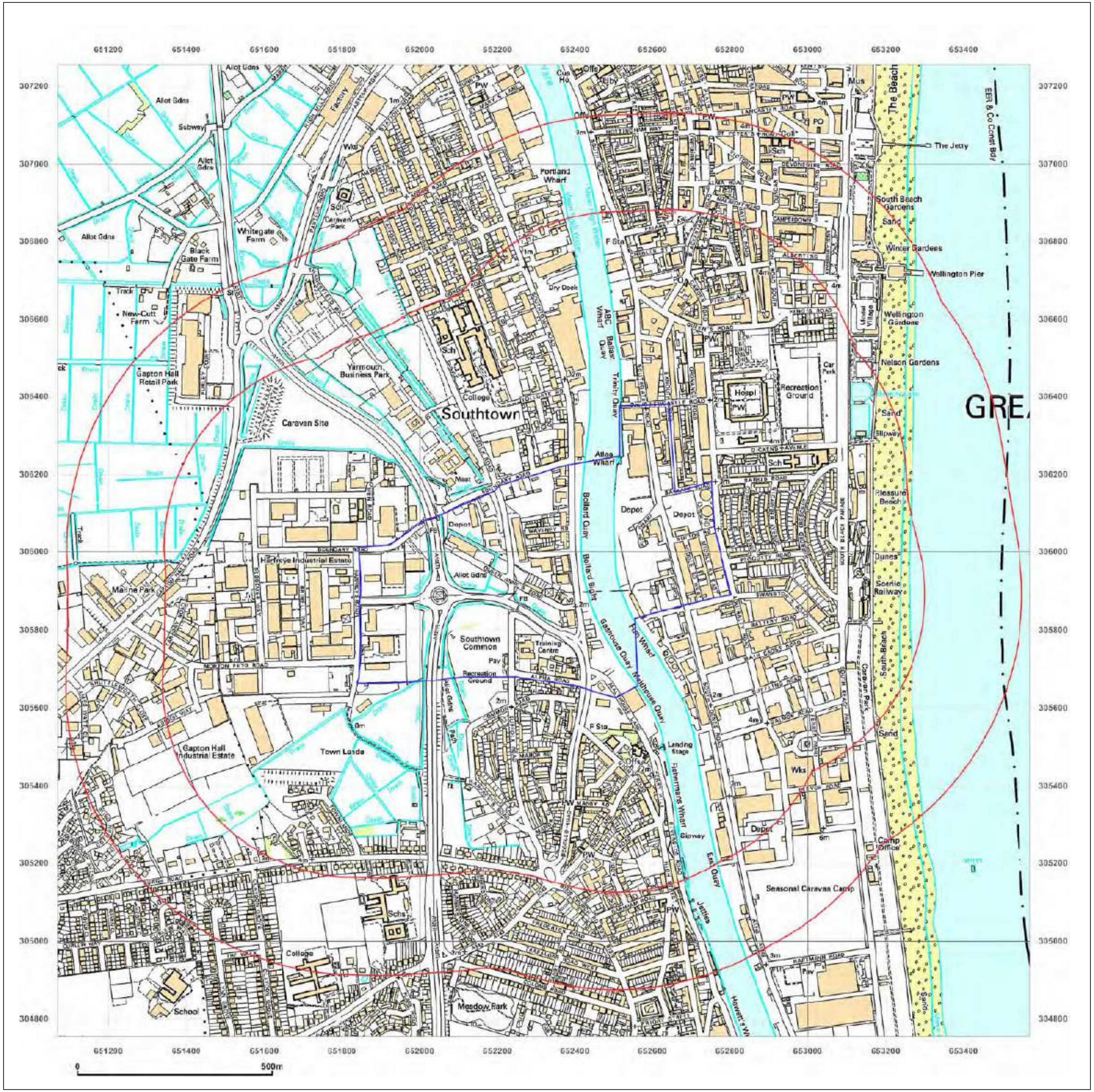

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: 1:10,000 Raster

Map date: 2002

Scale: 1:10,000

Printed at: 1:10,000

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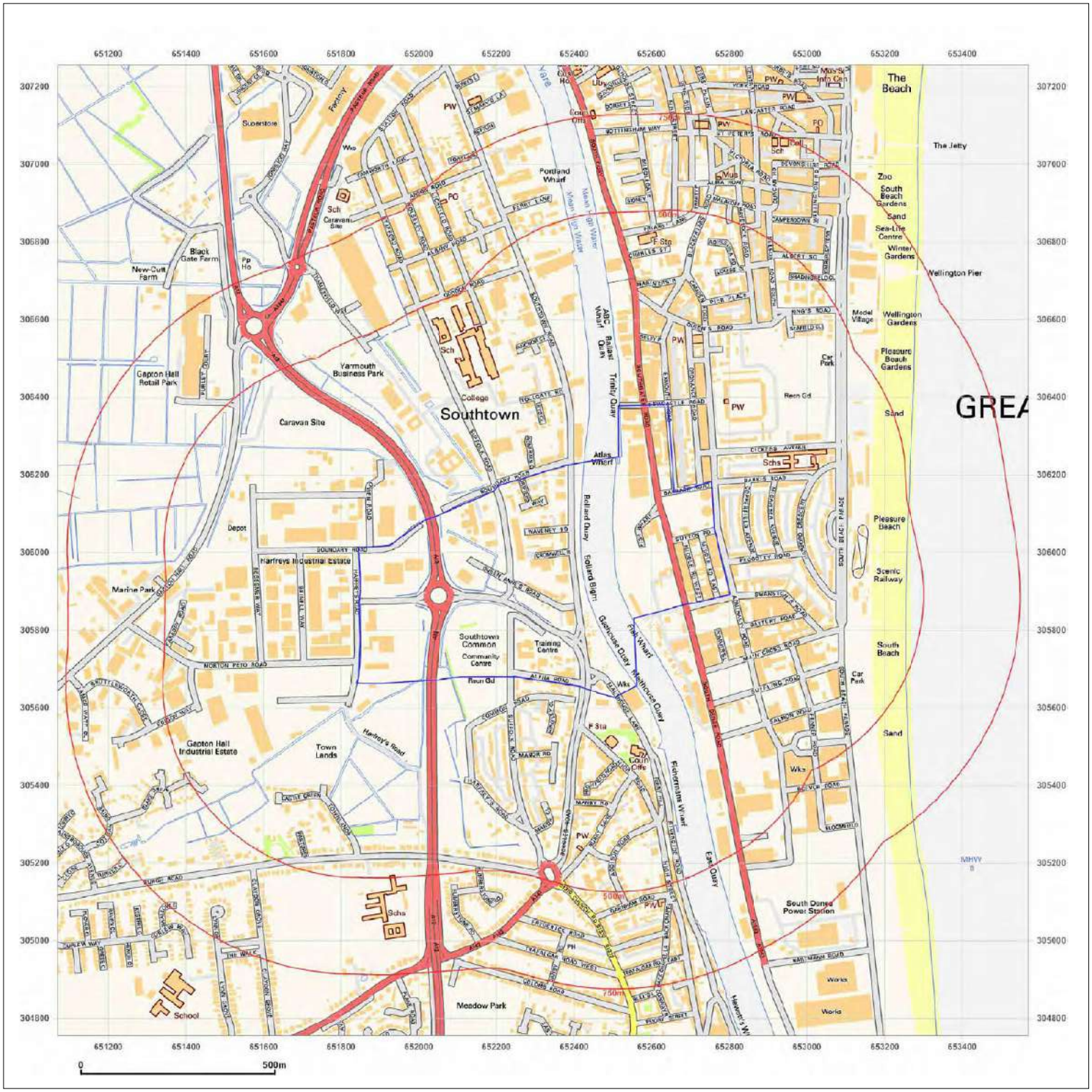
Production date: 03 July 2017

To view map legend click here Legend



CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: National Grid
Map date: 2010
Scale: 1:10,000
Printed at: 1:10,000

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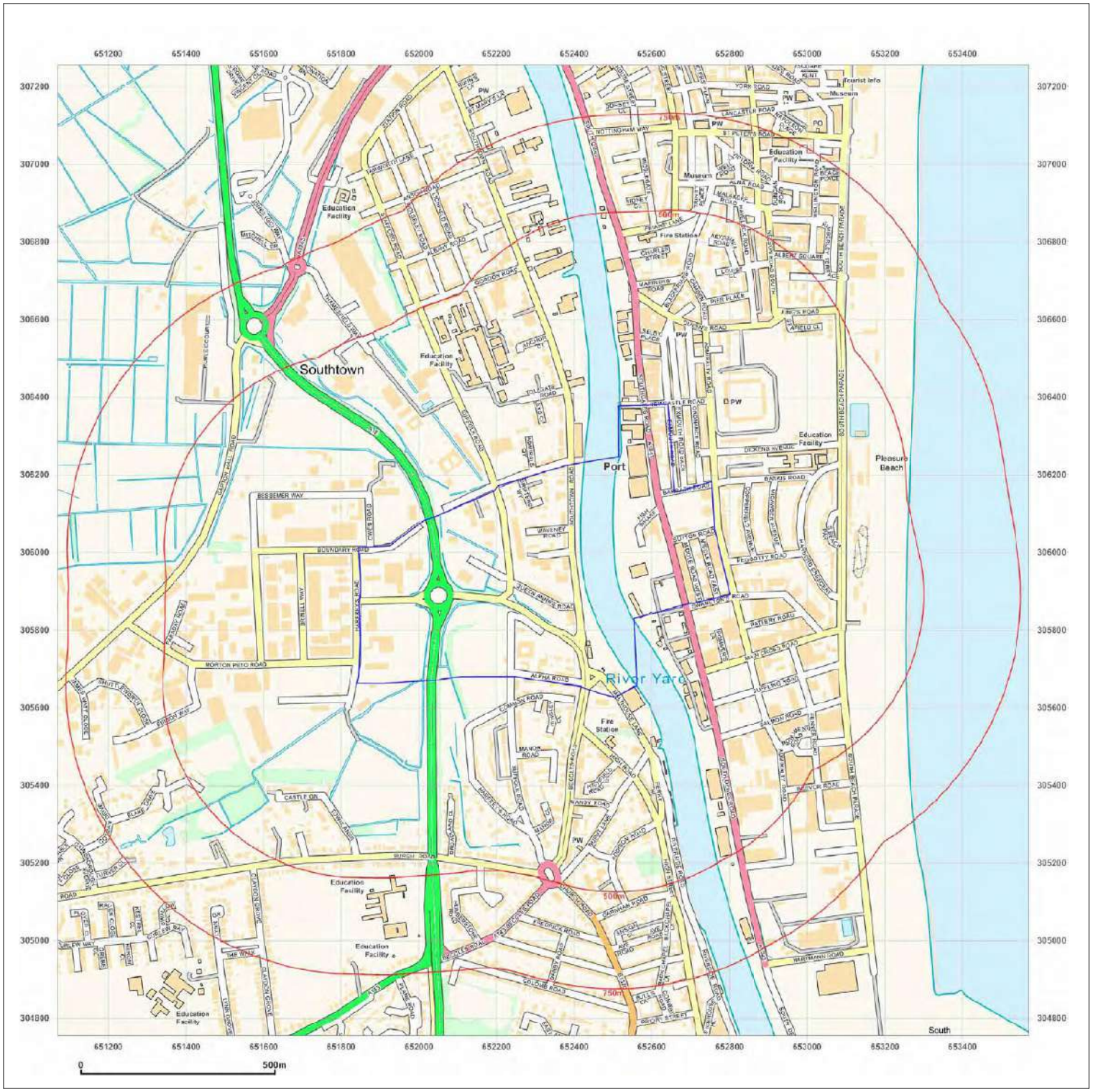
Production date: 03 July 2017

To view map legend click here Legend



CENTRE MAPS LIVE.

Site Details:

Client Ref: 16287
Report Ref: CMAPS-CM-636391-16287-030717HIS
Grid Ref: 652320, 306005

Map Name: National Grid
Map date: 2014
Scale: 1:10,000
Printed at: 1:10,000

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APPENDIX C - SITE HISTORY

GYTRC Site History

Map	Scale.	On Site	Off Site
1883	1:10,560	The eastern area is fully developed. Labelled buildings includes gasworks, gasometer, boat building yard and icehouse. In the western area, only the land closest to the waterfront is developed. Elsewhere to the west is agricultural land. Site uses in the developed area are labelled as iron works, residential properties, farm, gas works and gasometer.	The surrounding land immediately adjacent to the River Yare is developed with the land closest to the river occupied by industry including saw mills, timber yard, boat building, icehouse and a malthouse. In the eastern area, away from the river towards the sea is the Royal Naval Hospital, militia barracks, a rope walk, residential properties to the north east and open land to the south east. On the western side of the river , the development is less with residential properties and open land beyond.
1883	1:2,500	Rail lines are marked on the eastern area quayside. A number of malthouses are marked on the southern boundary of the western site areas waterfront. A rope walk is marked adjacent to the iron works.	Land uses to the south include malthouses, residential properties, a windmill and an old gravel pit.
1884	1:10,560	No significant changes.	No significant changes.
1887	1:2,500	No significant changes.	No significant changes.
1901	1:10,560	No significant changes.	No significant changes.
1904-1906	1:10,560	No significant changes.	No significant changes.
1905	1:10,560	Railway line marked at the western end of the site running north south. Saw mill labelled towards the site centre. New gasometer marked on the southern boundary. Boat yard, ice house and iron works no longer labelled.	The militia barracks is now labelled as the Royal Artillery Barracks. Some additional development towards the west. The railway line that crosses site continues to the north and south off site.
1906	1:2,500	A travelling crane is labelled on the eastern area waterfront.	
1926	1:10,560	None of the previous industry is labelled but the gasometers are still identified from their outline. Formal gardens are marked on the western central part of the site.	The Barracks are no longer marked and appear to have been replaced by residential properties. Further residential development in all directions except to the west. Allotments are marked to the south.
1927	1:2,500	Allotment gardens are marked within the western area.	No significant changes.
1938	1:10,560	No significant changes.	No significant changes.
1946	1:10,560	No significant changes.	No significant changes.
1949	1:1,250 / 1:2,000	An oilskin works is labelled in the eastern area together with fish canning factories and various tanks on unlabelled sites. In the western area, the gasworks close to the southern boundary includes two gas holders and tanks. The saw mill is now labelled as a shoe factory.	An electricity works is labelled adjacent to the southern boundary of the eastern area. An oilskin works is labelled adjacent to the east boundary and a barrel and box making factory is labelled adjacent to the northern boundary.
1951	1:2,500	No significant changes.	No significant changes.

Map	Scale.	On Site	Off Site
1958	1:10,560	No significant changes.	No significant changes.
1958	1:2,500	No significant changes.	No significant changes.
1965	1:2,500	Partial coverage. Fish canning factories labelled in the eastern area waterfront.	No significant changes.
1963-1968	1:2,500	In the eastern area, a haulage depot is marked adjacent to the gas works and one of the fish curing factories is now labelled as a chemical factory. In the western area, the shoe factory is partly labelled as a printing and music publishing works.	No significant changes.
1966-1968	1:1,250 / 1:2,000	Along the northern boundary, three garages are marked.	No significant changes.
1970-1975	1:1,250 / 1:2,000	A builders merchants is marked towards the north west corner.	An oil pipeline construction depot is marked close to the north west corner.
1975-1977	1:1,250 / 1:2,000	The two gas holders on the southern boundary gasworks are no longer marked and the site is labelled as a depot.	No significant changes.
1976-1981	1:1,250 / 1:2,000	No significant changes.	No significant changes.
1978	1:10,000	Former boat building yard in the east area is now developed as a warehouse. The gasworks in the west area adjacent to the River Yare is no longer marked but one gas holder is marked nearby. Factory and works have been developed on the western boundary. The railway line towards the western boundary is marked as dismantled.	The hospital has been renamed St Nicholas Hospital. Significant development in most directions; – to the south east development appears to be commercial industrial; to the north a school and depots are now marked and the saw mill is now labelled as a timber shed; to the west a large number of commercial / industrial buildings and now marked with three labelled as warehouses. The railway to the north and south is labelled as dismantled.
1975-1978	1:1,250 / 1:1,2000	Precast concrete works labelled in the north west corner of the site.	At this scale, the commercial / industrial buildings are labelled as factory, warehouse, works, store, workshop and depot. No further indication of use is provided. A works adjacent to the north west corner of the site includes a number of tanks.
1984-1986	1:1,250 / 1:1,2000	No significant changes.	Two large tanks are marked close to the southern boundary of the eastern area.
1988	1:10,000	Some layout changes have occurred in the eastern area and three depots are labelled. Two gas holders are still marked. In the western area, the route of the railway is being developed as a dual carriageway and the large roundabout currently in the centre of the site is marked including the spur roads off to the east and west. Formal gardens are now marked as a recreation ground but do also include an adult training centre.	The commercial / industrial buildings to the west are labelled as Harfreys Industrial Estate and the depots to the north are now marked as Yarmouth Business Park. A dual carriageway follows the route of the former railway offsite to the north west.

Map	Scale.	On Site	Off Site
1990	1:1,250 / 1:1,2000	The gas holder towards the southern boundary is no longer marked and the site is labelled as a gas distribution station.	The two large tanks close to the southern boundary of the eastern areas are now surrounded my multiple smaller tanks.
1990-1994	1:1,250 / 1:1,2000	No significant changes.	No significant changes.
1994	1:1,250 / 1:1,2000	No significant changes.	No significant changes.
2002	1:10,000	The dual carriageway on the former railway line is now complete. Some changes to buildings.	The dual carriageway on the former railway now continues offsite to the south.
2010	1:10,000	No significant changes.	No significant changes.
2014	1:10,000	No significant changes.	No significant changes.

APPENIDX D - ZETICA UXO RISK

REGIONAL UNEXPLODED BOMB RISK

NORFOLK

DENSITY OF BOMBS PER BOROUGH

Borough	High explosive	Anti-personnel	Incendiary
Cromer	48	0	4
Downham Market	17	0	0
East Dereham	26	0	0
Great Yarmouth	910	9	19
King's Lynn	71	0	33
Hunstanton	16	0	0
Norwich	561	0	110
Sheringham	31	0	4
Swaffham	30	0	0
Wymondham	66	2	10

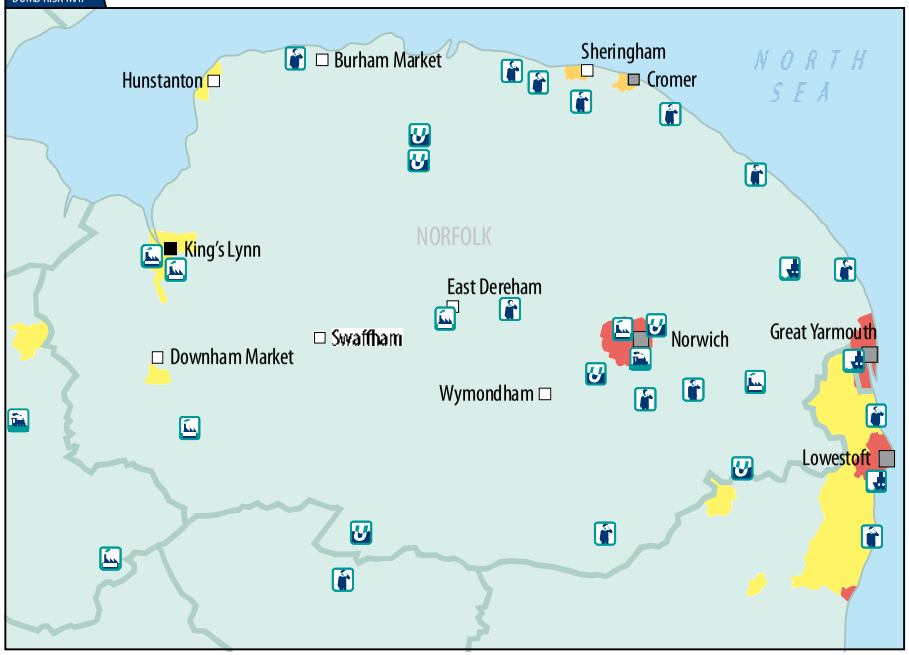
On average, 10% of high explosive and 50% of incendiary bombs failed to explode.

BOMB TONNAGE
- > 1000
- > 500
- > 100
- > 0
- unverified

BOMB RISK
- high
- moderate
- low

OTHER WWII TARGETS
- military
- transport
- utilities
- industry
- docks
- other

BOMB RISK MAP



The information in this regional UXB risk map is derived from a number of sources and should be read in conjunction with the "Users' Guide" (printed overleaf). Zetica cannot guarantee the accuracy or completeness of the information or data.

This map covers regions of coast with beaches, estuaries and alike. Further consideration of the bomb risk is required in these areas. The often inaccessible nature and changing ground conditions (e.g. movement of silt that may contain ordnance) means that historical bombing records for these areas are often poor or inaccurate and further assessment of the bomb risk may be required as part of a site specific study.

A FOUR-STEP PROCESS

Risk assessment and method statement from a qualified explosive ordnance clearance (EOC) operative.

Surface geophysical survey to allow shallow groundwork.

MAGCONE detects UXBs and obstructions on piling layout to the no-risk depth.

Detected UXBs can be dealt with by our EOC engineers and a Clearance Certificate issued for the site.

zetica

For more details on this and related services, telephone: +44 (0) 1993 886682 or visit our website: www.zetica.com

BOMB MAP USERS' GUIDE

Sources of information and explanation of bomb risk

Why?

Unexploded bombs (UXB) still present a risk to construction projects long after the end of the Second World War (WWII). UXBs often entered the ground unnoticed at high velocity and penetrated to a depth of several metres. Here they remain – vulnerable to disturbances from construction work. Beyond the depth of shallow excavation work, the greatest risk is to piling, drilling and probing crews. A piling rig could repeatedly hit a UXBs with considerable force before the crew realises an obstruction has been impacted. It could then be up to 72 hours before the detonator activates.

Who?

The responsibility for avoiding UXB risk usually lies with construction companies or house builders particularly those who are redeveloping urban sites. In addition, project engineering or environmental consultants are expected to advise their clients of a site's history. Other interested parties include those organisations whose employees are physically at most risk from intrusive works, normally piling companies, drillers or probing operators.

How?

UXB risk should be assessed for every site, but especially those in known heavily bombed areas or those situated near war-time strategic installations that were priority targets for enemy aircraft, for example, airfields. Zetica's regional bomb risk map is therefore a first point of reference from which the relative, potential abundance of UXBs can be judged. Consultants then advise their clients that an ordnance-risk desk study is required, which they may obtain from external sources. Construction companies or house builders who assess their own risk could choose to come direct to Zetica.

When?

Do not wait for the piling or drilling company to be on site before thinking about UXB risk – it will inevitably cause delays and higher costs. Request the regional bomb risk map from Zetica as soon as a site is being considered, and then use it to help you or your clients to decide if an ordnance-risk desk study is required.

Where?

Maps can be obtained for any county in England, Scotland, Wales or Northern Ireland – or for any London borough. They can help determine the areas that were most heavily bombed – but no part of the country should be considered 100% safe from UXB risk. Even remote rural areas can have a high risk if, for example, they were locations for decoy airfields or beacons that were lit to fool enemy pilots into thinking they had located a burning city that had been successfully hit by others in the raid.

How to use this regional map

This map is designed to give you an indication of the potential risk from UXBs in your area. If you are conducting work that involves excavation, piling or other disturbance of the ground, then you should use the map to identify the category of risk for your site.

The risk boundaries are a guide, compiled from data based on the political areas for which records are held; being just outside a high-risk area does not mean there is no UXB risk. You should use the map to assist in your decision of whether to investigate the UXB risk further.

Information on the regional risk remaining from UXBs in the UK

Zetica has built the largest UXB database of its kind in the UK. It includes a unique digital library of bomb census data, and maps showing key strategic points and bombing densities from the First and Second World Wars. The main sources of information include records from central government (Public Records Office), the Ministry of Defence, and the German Luftwaffe.

Using information from this database, Zetica has published maps of UXB risk on a regional, county and borough scale. The maps indicate relative degrees of UXB risk based on available records for bombing densities and known targeted areas for regions within the UK. The risk is broken down into individual boroughs, towns or cities. The data are based on the historical boroughs and are then overlaid onto the modern map. It is important to note that more-detailed research may be required for individual sites, particularly where proximity to a potential WWII target means the local risk may be higher.

High risk

Areas designated as high risk are those that show a high density of bombing hits (50+ bombs per 1000 acres) and abundant potential WWII targets. In high-risk regions, further action to mitigate UXB risk is considered essential.

Moderate risk

Moderate-risk regions are those that show a bomb density of between 11 and 50 bombs per 1000 acres and that may contain potential WWII targets. Action to mitigate the risk is considered essential, albeit more likely that a reduced scope of work is required compared with that needed for high-risk regions.

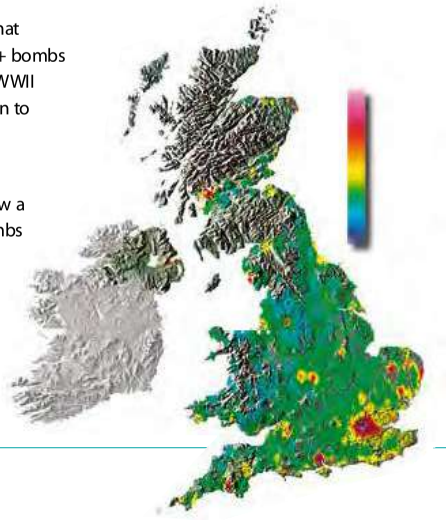
Low risk

Low-risk regions are those with a bombing density of up to 10 bombs per 1000 acres. These areas are considered to have a significant but low UXB risk. In general, further action to mitigate the risk is considered prudent, although not essential. Care is required when assessing the risk for specific sites where the risk may be higher because of local wartime activity.

Other WWII targets

Other regions with the risk of UXBs are key strategic points as defined by the government during WWII as representing potential enemy targets. Where these exist outside areas mapped as high, moderate or low risk, a site-specific assessment of the UXB risk may be required.

Relative UXB risk across UK



What to do if...

...you have a site that has a potential UXB risk

In the absence of current legislation requiring you to address the risk from UXBs, your responsibilities under health and safety legislation and regulations such as construction design and management require that you address all identified risks. The first stage is to request further advice from a professional adviser such as Zetica, or to gain more site-specific information by commissioning an ordnance-risk desk study. Then a strategy to deal with the risk can be established that is tailored to your proposed work.

...you find a suspect item or require advice

If during site works you find a suspect (ordnance-related) item, it is very important that you do not touch or move it (even if it has already been moved by an excavator). If it is clearly ordnance related, then dial 999 and ask for the police. Ensure that the area around the item is kept as clear as possible without placing yourself at risk. If you are unsure and do not wish to cause undue alarm, or you just require some advice, then you can call Zetica. We have experienced qualified UXB specialists on hand who can offer support and advice during any site works.

More-detailed procedures should be established in advance if you are in an area where the risk of finding a UXB is shown to be significant (moderate to high).

Site-specific desktop studies

Zetica is able to provide high-quality, site-specific UXB risk information for any residential, industrial or commercial property in the UK. These desktop studies provide details of the bombing density within an area and for the site itself, in order to indicate the risks of UXBs still being present. A risk assessment is provided to facilitate informed decision making on whether any further risk mitigation measures are required.

APPENDIX E - RISK CLASSIFICATION MATRICES

Consequence of Risk Being Realised (based on C552 CIRIA, 2001)

Consequence of risk being realised			
Classification	**Category**	**Definition**	**Examples**
Severe short-term (acute) risks only	Humans	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part 2A.	High concentrations of cyanide on the surface of an informal recreation area.
	Controlled Waters	Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource.	Major spillage of contaminants from site into controlled water.
	Property	Catastrophic damage to buildings/property.	Explosion causing building collapse (can also equate to a short-term human health risk if buildings are occupied.
	Ecological System	A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.	
Medium chronic (long-term) risks; "significant harm"	Humans	Chronic damage to Human Health ("significant harm" as defined in Defra 2006).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria
	Controlled Waters	Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution).	Leaching of contaminants from a site into a major or minor aquifer.
	Ecological System	A significant change in a particular ecosystem	Death of a species within a designated nature reserve.
Mild chronic (long-term) risks; less sensitive receptors	Controlled Waters	Pollution of non-sensitive water resources.	Pollution of non-classified groundwater.
	Property	Significant damage to buildings, structures and services ("significant harm" as defined in Circular on Contaminated Land, Defra, 2006). Damage to sensitive buildings/structures/services	Damage to building rendering it unsafe to occupy (e.g., foundation damage resulting in instability)
	Ecological System	Significant damage to crops. Damage to the environment.	
Minor chronic (long-term) risks; mild	Financial / project	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve.	
	Humans	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc).	The presence of contaminants at such concentrations that protective equipment is required during site works.
	Property	Easily repairable effects of damage to buildings, structures and services	The loss of plants in a landscaping scheme. Discolouration of concrete.

Probability of Risk Being Realised (C552 CIRIA, 2001)

Probability of risk being realised	
Classification	**Definition**
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the sort term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Risk Classification Matrix (C552 CIRIA, 2001)

Risk classification matrix					
(CIRIA C552, 2001, page 82)		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High	High	Moderate	Moderate/ Low
	Likely	High	Moderate	Moderate/ Low	Low
	Low Likelihood	Moderate	Moderate/ Low	Low	Very Low
	Unlikely	Moderate/ Low	Low	Very Low	Very Low

Risk Classification Definitions (C552 CIRIA, 2001)

Risk classification definitions	
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Moderate / Low	
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

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Appendix 17A

PRELIMINARY TRANSPORT ASSESSMENT

Norfolk County Council

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Transport Impact Assessment

GYTRC-WSP-TGN-XX-RP-TP-0001
JUNE 2018

CONFIDENTIAL

Norfolk County **Council**

GREAT YARMOUTH THIRD RIVER CROSSING

Preliminary Transport Impact Assessment

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70046035
OUR REF. NO. GYTRC-WSP-TGN-XX-RP-TP-0001

DATE: JUNE 2018

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft	PEIR version		
Date	28 January 2018	June 2018		
Prepared by	Rob Surl	Inaki Gaspar		
Signature				
Checked by	Amanda Fogg	Amanda Fogg		
Signature				
Authorised by	Joanna Lyon	Amanda Fogg		
Signature				
Project number	70046035	70046035		
Report number	GYTRC-WSP-TGN-XX-RP-TP-0001	GYTRC-WSP-TGN-XX-RP-TP-0001		
File reference	\\uk.wspgroup.com\central data\Projects\62240xxx\62240375 - GYTRC\02 WIP\EI EIA and flood risk\03 Document\00 PEIR\00 PEIR Vol III - Appendix\Appendix 17 - Traffic and Transport			

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1 INTRODUCTION

1.1 THE SCHEME

1.1.1. The Great Yarmouth Third River Crossing (the Proposed Scheme) will provide a new double leaf bascule bridge carrying a new dual carriageway road across the River Yare. The location of the Proposed Scheme is shown in Figure 1 below. It will create a new direct link between the western and eastern parts of the town. Specifically the scheme will provide a connection between the A47, part of the Strategic Road Network (SRN) and the South Denes Business Park, Enterprise Zone, Great Yarmouth Energy Park and Outer Harbour, all of which are located on the South Denes peninsula.

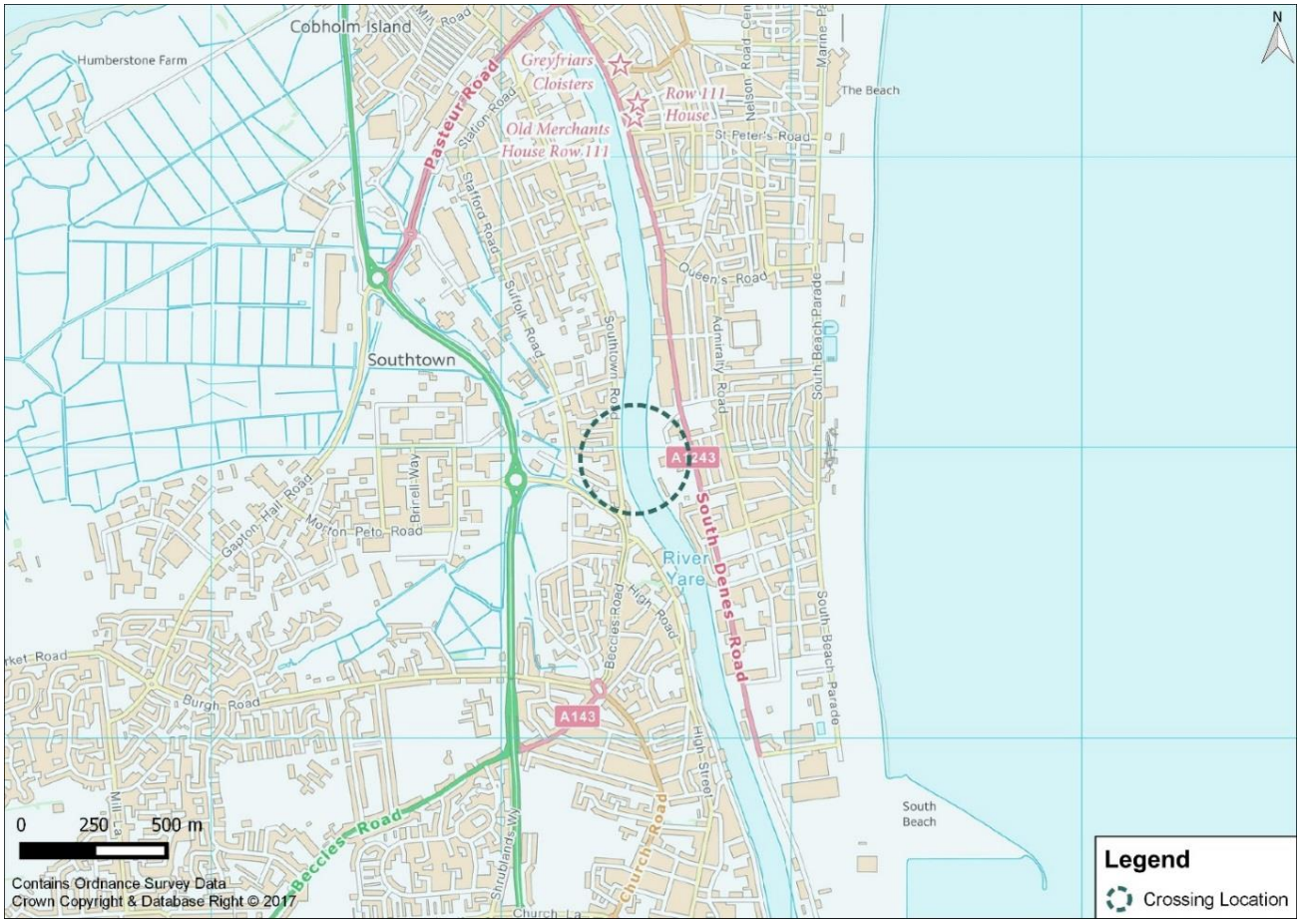

Figure 1 – Location of the scheme

1.2 THE NEED FOR THE SCHEME

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

1.2.2. The national significance and need for the Proposed Scheme derives from the considerable improvement in connectivity and resilience it will deliver to the Great Yarmouth Port ("the Port"), which itself has a nationally significant role in the renewable energy sector and the offshore gas and oil industry. The Proposed Scheme objectives are as follows:

- To support Great Yarmouth as a centre for both offshore renewable energy and the offshore oil and gas industry, enabling the delivery of renewable energy NSIPs and enhancing the port's role as an international gateway;
- To improve access and strategic connectivity between Great Yarmouth port and the national road network thereby supporting and promoting economic and employment growth (particularly in the Enterprise Zone);
- To support the regeneration of Great Yarmouth, including the town centre and seafront, helping the visitor and retail economy;
- To improve regional and local access by enhancing the resilience of the local road network, reducing congestion and improving journey time reliability;
- To improve safety and to reduce road casualties and accidents, in part by reducing heavy traffic from unsuitable routes within the town centre;
- To improve access to and from the Great Yarmouth peninsula for pedestrians, cyclists and buses, encouraging more sustainable modes of transport and also reducing community severance; and
- To protect and enhance the environment by reducing emissions of greenhouse gases and minimising the environmental impact of the Proposed Scheme.

1.2.3. The Department for Transport's (DfT) recently published study Transport Infrastructure for our Global Future: A Study of England's Ports Connectivity[1] ("the DfT Study") states that "at present around 95% of all goods entering and leaving the UK are moved by sea and the UK port sector directly contributes £1.7billion to the UK economy". The DfT Study also notes that "if our ports are to continue to thrive then the national, regional and local infrastructure supporting them has to be effective and efficient". The DfT Study further recognises that renewable energy sectors are closely linked to the port industry and that "port access will be an issue for their supply chains and their employees".

1.2.4. Great Yarmouth's proximity to the Strategic Road Network (SRN) plays an important role in relation to the Port, and the Proposed Scheme is identified in the DfT Study as a Port Connectivity Project. The Autumn Budget 2017[2] pledged a contribution of £98 million towards the Proposed Scheme's £120 million programme budget.

1.2.5. The Port, South Denes Business Park, Enterprise Zone and Great Yarmouth Energy Park are located towards the southern end of the peninsula. Supporting this area is a key objective of both the New Anglia Strategic Economic Plan (SEP) (2014)[3] and Great Yarmouth Local Plan Adopted Core Strategy 2013-2030[4] . Furthermore, the relationship between the provision of essential infrastructure and economic growth is well documented; most notably in the NPS NN[5] , the Department for Business, Energy & Industrial Strategy's White Paper Industrial Strategy: Building a Britain fit for the Future (2017)[6] and in the DfT Study.

[1] Department for Transport (April 2018), Transport Infrastructure for our Global Future, A Study of England's Port Connectivity https://www.gov.uk/government/publications/transport-connectivity-to-ports-review-of-the-current-status-and-future-infrastructure-recommendations

[2] https://www.gov.uk/government/publications/autumn-budget-2017-documents

[3] New Anglia new Enterprise Partnership for Norfolk and Suffolk (2014) New-Anglia-Strategic-Economic-Plan. https://newanglia.co.uk/wp-content/uploads/2017/10/New-Anglia-Strategic-Economic-Plan.pdf

[4] Great Yarmouth Borough Council (2015) Great Yarmouth Local Plan: Adopted Core Strategy 2013-2030 https://www.great-yarmouth.gov.uk/CHttpHandler.ashx?id=1884&p=0

[5] Department for Transport (2104) National Policy Statement for National Networks https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

[6] Department for Business, Energy & Industrial Strategy (2017) Industrial Strategy: Building a Britain Fit for the Future https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

1.2.6. The Department of Transport's publication Action for Roads[7] (2013) identifies capacity issues on the A47 past Great Yarmouth to Lowestoft and predicts that congestion will be severe on that entire section of the road by 2040 (also pointed in Appendix A of the NPS NN).

1.2.7. This evidence further confirms the need for a third crossing, as under the current situation the only access from the SRN to the Port and employment areas is via the Haven Bridge or Breydon Bridge located at the northern end of the peninsula. Neither bridges are considered suitable to accommodate the Port's on-going use and projected growth.

1.2.8. The mix of Port-related and local traffic congestion, particularly on the Haven Bridge, is attributed to delays and unreliable end to end journey times; ultimately Great Yarmouth has become to be perceived as remote, potentially discouraging inward investment. Alternative transport modes such as bus users, cyclists and pedestrians often have long, indirect journeys, discouraging sustainable commuting.

1.2.9. In the Outline Business Case[8] , the Proposed Scheme was demonstrated by an adjusted Benefit Cost Ratio (BCR) of 3.5 , meaning the proposal shows high value for money.

1.2.10. By creating a more efficient connection, the Proposed Scheme will address the congestion and severance within Great Yarmouth, accommodate future growth and improve strategic connectivity between the town, the Port and the Strategic Road Network, which in turn will facilitate the establishment of the Port as a centre for offshore oil and gas industries and its role as an International gateway. Without a new crossing the full potential for growth in the Enterprise Zone and Port may not be fully realised.

1.3 THE NEED FOR A TRANSPORT ASSESSMENT (TA)

1.3.1. Paragraph 32 of the National Planning Policy Framework (NPPF), states that all developments that generate significant amounts of movements should be supported by a Transport Assessment (TA). This should be prepared and submitted with a planning application for the development.

1.3.2. The scheme has potential to cause significant changes to the pattern of movement in Great Yarmouth. Although this will mainly involve the reassignment of trips to different routes, rather than the generation of new trips, it is considered that the scheme will require a TA.

1.3.3. Following a direction from the Secretary of State (SoS) under Section 35 of the Planning Act 2008, the scheme has been categorised as a Nationally Significant Infrastructure project (NSIP). Planning and other consents for a NSIP require an application to the Planning Inspectorate (PINS) for a Development Consent Order (DCO).

1.3.4. A full Transport Assessment (TA) will therefore be prepared in support of an application by Norfolk County Council (the applicant) for a Development Consent Order (DCO) for the scheme.

1.4 PRELIMINARY TRANSPORT ASSESSMENT (PTA)

1.4.1. This document is a preliminary Transport Assessment (PTA) for the scheme. It accompanies the preliminary Environmental Impact Report (PIER), and should be read in the context of that document.

1.4.2. The PTA provides an initial assessment of the expected transport impacts of the scheme, based on the information currently available. Some of this information may change, including updates to the design of the scheme and the transport models used for the assessment, and the full TA will reflect any changes.

[7] Department for Transport (July 2013), Action for Roads, A Network for the 21st Century
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/212590/action-for-roads.pdf
[8] Mouchel (2017) Great Yarmouth Third River Crossing: Outline Business Case

1.5 SCOPE OF THE PTA

1.5.1. WSP has been commissioned by the applicant to assess the transport impacts of the scheme. The assessment is being undertaken in line with the National Planning Policy Framework (NPPF), National Planning Practice Guidance (NPPG) and national and regional standards and guidelines.

1.6 STRUCTURE OF THE PTA

1.6.1. This PTA comprises:

- Chapter 1 Introduction
- Chapter 2 Policy context
- Chapter 3 Existing conditions – Site information
- Chapter 4 Existing conditions - Baseline transport data
- Chapter 5 The Proposed Scheme
- Chapter 6 Assessment methodology
- Chapter 7 Transport Impacts
- Chapter 8 Mitigation of transport impacts
- Chapter 9 Residual and cumulative impacts

2 POLICY CONTEXT

2.1 INTRODUCTION

2.1.1. This chapter describes how the scheme aligns with relevant national, sub-national and local strategies and policies.

2.2 NATIONAL POLICY CONTEXT

2.2.1. The following national planning and transport policies are relevant to the scheme:

- National Transport Objectives
- National Planning Policy Framework 2012
- Planning Act 2008
- National Policy Statement for National Networks 2015
- National Infrastructure Delivery Plan 2016-2021
- Government's Industrial Strategy
- Action for Roads: A network for the 21st Century
- National Policy Statement for Ports 2012
- UK Marine Policy Statement 2011
- International Gateways and the SRN

NATIONAL TRANSPORT OBJECTIVES

2.2.2. The national transport objectives, set by government, are:

- To ease congestion and provide upgrades on important national, regional or local routes
- To unlock economic and job creation opportunities
- To enable the delivery of new housing developments

2.2.3. The scheme will contribute to the first and, especially, the second of these objectives.

NATIONAL PLANNING POLICY FRAMEWORK 2012

2.2.4. The National Planning Policy Framework (NPPF) replaces all Planning Policy Statement and Planning Policy Guidance documents previously detailing the Government's planning policies for England. The framework has been drafted to reflect the law following the implementation of the Localism Act 2011.

2.2.5. Paragraph 32 of the NPPF states:

- "All developments that generate significant amounts of movement should be supported by a Transport Statement or Transport Assessment."

2.2.6. The NPPF does not contain specific policies for NSIPs, for which particular considerations apply. These are determined in accordance with the decision-making formula set out in the Planning Act 2008 and relevant national policy statements (NPS) for major infrastructure, as well as any other matters that are considered both important and relevant (which may include the NPPF). National policy statements form part of the overall framework of national planning policy and are a material consideration in decisions on planning applications.

NATIONAL PLANNING POLICY FRAMEWORK: DRAFT TEXT FOR CONSULTATION (MARCH 2018)

2.2.7. The National Planning Policy Framework (NPPF) draft text for consultation builds on the first National Planning Policy Framework published in 2012 and is part of the Government's strategy to reform housing and planning policy. In line with the first National Planning Policy Framework, the Draft Text for Consultation continues to have a presumption in terms of sustainable.

2.2.8. The National Planning Policy Draft Text for consultation incorporates proposals from previous consultations, changes in planning policy implemented through Written Ministerial Statements since publication of the first Framework in 2012, the effect of case law on the interpretation of planning policy since 2012 and improvements to the text to increase coherence and reduce duplication.

2.2.9. The policy changes and amendments in relation to promoting sustainable transport is summarised below:

- Authorities should identify additional development opportunities arising from strategic infrastructure investment;
- Transport issues should be considered from the earliest stages of plan-making so that:
  - the potential impacts of development on transport networks can be addressed;
  - opportunities from existing or proposed transport infrastructure, and changing transport technology and usage, are realised – for example in relation to the scale, location or density of development that can be accommodated;
  - opportunities to promote walking, cycling and public transport use are identified and pursued;
  - the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for mitigation and for net gains in environmental quality; and
  - patterns of movement, streets, parking and other transport considerations are integral to the design of schemes, and contribute to making high quality places; and
- Designs should prioritise pedestrian and cycle movements, followed by access to high quality public transport (so far as possible) as well as to reflect the importance of creating well-designed places.

PLANNING ACT 2008

2.2.10. Section 104 of the Planning Act 2008 (PA 2008) provides that DCO applications must be determined in accordance with the relevant NPS. For highway schemes, the relevant NPS is the NPS on National Networks (December 2014) (NNNPS). The Secretary of State will use this NPS as the primary basis for the decision on the DCO application.

2.2.11. Under section 104, the SoS must also have regard to the appropriate marine policy documents. These include the National Policy Statement for Ports (PNPS) and the UK Marine Policy Statement (MPS) and Marine Plans.

2.2.12. Under section 104, the SoS must also have regard to any local impact report, any matters prescribed in relation to development of the description to which the application relates, and any other matters which the SoS thinks are both important and relevant to the decision. These might include relevant policies in the NPPF and in the local development plan documents.

2.2.13. The National Policy Statement for National Networks (NPSNN) was designated as a NPS by the SoS in January 2015. It sets out the need for, and Government's policies to deliver, NSIPs on the national road networks in England. The NPSNN works to complement the overall strategic aims of the NPPF. However, whilst the NPPF does not contain specific policies for NSIPs, where particular considerations apply, the NPSNN assumes that function, and provides transport policy to guide individual transport schemes.

2.2.14. The Government sets out its vision and strategic objectives for the national road network in the NPSNNas follows[9]:

- "The Government will deliver national networks that meet the country's long term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system.

This means:

- Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs;
- Networks which support and improve journey quality, reliability and safety;
- Networks which support the delivery of environmental goals and the move to a low carbon economy; and
- Networks which join up our communities and link effectively to each other".

2.2.15. The NPSNN highlights the need for development of the national road network and delivers the above aims in the context of Government policy for economic performance, environment, safety, technology, sustainable transport, accessibility and journey reliability. The national road network connects towns, cities and regions and there is a critical need to address congestion issues to provide safe and resilient networks. The pressure on this network is predicted to increase as the long term drivers for demand to travel, GDP (Gross Domestic Product) and population, are also forecast to increase. Therefore, integrating improvements into the network via NSIPs is just one step to delivering world class transport infrastructure.

2.2.16. The scheme aligns with the aims and objectives of the NPSNN. It will increase capacity and reduce congestion on Great Yarmouth's highway network, and improve its safety, resilience and connectivity to the SRN. It will facilitate economic growth through improved journey reliability, and will reduce community severance by providing an additional east-west link across the River Yare.

2.2.17. Section 4 of the NPS sets out the principles of assessment to be followed by NSIP applications. The decision makers should account of a scheme's:

- potential benefits, including the facilitation of economic development, including job creation, housing and environmental improvement, and any long-term or wider benefits
- potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.

2.2.18. A detailed assessment of the expected benefits of the scheme is provided in Chapter 7of this PTA.

[9] Department for Transport (January 2015), National Policy Statement for National Networks, page 9, paragraph 2

NATIONAL INFRASTRUCTURE DELIVERY PLAN 2016 – 2021

2.2.19. The National Infrastructure Delivery Plan (NIDP), published in March 2016, updates and replaces the previous NIP, outlining details of £483 billion of investment in over 600 infrastructure projects and programmes in all sectors and spread across the UK, to 2020-21 and beyond.

2.2.20. The NIDP bring together the government's plans for economic infrastructure over the next 5 years with those to support delivery of housing and social infrastructure based on the principle that investment in infrastructure will drive wider economic benefits, including:

- supporting growth and creating jobs;
- raising the productive capacity of the economy;
- driving efficiency; and
- boosting international competitiveness.

2.2.21. The NIDP recognises that the Strategic Road Network (SRN) of motorways and 'A' roads is vital to businesses and the successful functioning of the economy. It states that local roads are a crucial element of the transport system and their maintenance and improvement is the responsibility of Local Authorities. The NIDP emphasises the government's commitment to addressing congestion challenges by building a better network with smarter roads that use technology and modern road building techniques. In this way it can ensure the country has a road network that drives, instead of constrains, growth.

2.2.22. The scheme aligns with the key principles of the NIDP. It will relieve congestion on Great Yarmouth's local highway network and the town centre by providing a new east-west link across the River Yare. It will greatly improve access to the port and employment areas. The scheme is expected to stimulate regeneration and economic growth, and help attract inward investment.

2.2.23. Support for the scheme was provided in November 2017 when the then Chancellor Phillip Hammond pledged £98m of funding towards the construction of the proposed crossing in the Autumn Budget.

GOVERNMENT'S INDUSTRIAL STRATEGY

2.2.24. At the heart of the government's economic agenda is the February 2017 Green Paper "Building our Industrial Strategy[10]". This aims to improve living standards and economic growth by driving productivity and growth across the whole country. The strategy identifies two important areas of priority for energy: affordability and maximising industrial opportunities for UK economy from energy innovations. This includes offshore oil and gas and clusters of excellence such as the east coast.

2.2.25. The Industrial Strategy presents an opportunity for Great Yarmouth to develop its offshore energy cluster further, by building on the existing offshore oil, gas and decommissioning activities, while capitalising on the low carbon agenda with continued investment in offshore wind. If Great Yarmouth is to realise this opportunity, transport connectivity improvements will be needed in order to support the growth of the sector and ensure its future success.

2.2.26. The government has set up six Centres for Offshore Renewable Engineering (CORE) across the UK, one of which is in Great Yarmouth and Lowestoft. CORE's aim is to maximise the ability of areas to benefit from opportunities in offshore engineering. Support structures that are in place include the establishment of Enterprise Zones with simplified planning regimes and enhanced capital allowances, among other incentives.

[10] Department for Business, Energy & Industrial Strategy (2017) Building our Industrial Strategy: 10 pillars

ACTION FOR ROADS: A NETWORK FOR THE 21ST CENTURY

2.2.27. "Action for Roads" was published by the DfT in July 2013 and sets out a vision for the future of the road network. It recognises the growing challenge of making best use of the network whilst planning ahead in order to help the economy grow. In order to achieve this balance, strategic roads must be transformed through investment in improving, upgrading and maintaining the network.

2.2.28. The importance of the local road network is also recognised. Preventing local roads from entering a long-term cycle of decline is vital. Decision-making has therefore been decentralised so that local communities and authorities have the freedom, flexibility and capacity to shape that future. This strategy highlights the biggest change to highways management in over 50 years and marks a new era for England's roads.

2.2.29. The scheme aligns with the vision set out in "Action for Roads" by delivering a high quality upgrade to Great Yarmouth's local highway network, transforming it for future generations. The scheme has the support of the local community, stakeholders and local authorities. The provision of a new bridge across the River Yare represents a significant investment which will encourage economic growth in the town and wider region in the long term.

NATIONAL POLICY STATEMENT FOR PORTS 2012

2.2.30. The NPSP, which was designated by the SoS in January 2012, sets out the framework for making decisions on proposals for new port development, recognising the essential role they play in the UK economy and the wider economic benefits that they can bring. In addition, it sets out the vital role that UK ports play in the energy sector in terms of import and export of energy supplies and in the construction and servicing of offshore energy installations and in supporting oil and gas pipelines. It is also noted that port handling needs to energy may change as renewables play an increasingly important part as an energy source.

2.2.31. Whilst the application does not propose new port development, the scheme will provide greatly improved accessibility to the recently constructed Outer Harbour, and will enable this important facility to achieve its full potential.

UK MARINE POLICY STATEMENT 2001

2.2.32. The UK MPS is the framework for preparing Marine Plans and for taking decisions that affect the marine environment. Marine Plans set out how the MPS will be implemented in specific areas. According to paragraph 1.3.1 of the MPS, the MPS and marine planning systems will sit alongside and interact with existing planning regimes across the UK. These include town and country planning and other legislation, guidance and development plans in each administration. In England and Wales this also includes the development consent order regime for NSIPs.

2.2.33. A marine licence will almost certainly be required as part of the development consent, and under section 42 of the PA 2008 (as amended by section 23 of the Marine and Coastal Access Act 2009) there is a statutory duty on applicants to consult the Marine Management Organisation (MMO) on NSIPs which would affect, or would be likely to affect, any relevant areas. In this case, parts of the scheme will be located in "waters in or adjacent to England up to the seaward limits of the territorial sea."

2.2.34. Further information will be provided in the full TA.

INTERNATIONAL GATEWAYS AND THE SRN

2.2.35. In 2016, Highways England commissioned a report11 on key international gateways (ports and airports) and their importance to England's economy, and the role of the Strategic Road Network in supporting this critical infrastructure. It noted that:

- Ports serve manufacturing sectors and are key inter-modal points for the logistics and distribution sector.
- Ports are highly dependent on road connectivity for the inward and outward movement of freight.
- Ports are significant employment areas.
- Congestion, causing increased travel times and reduced journey time reliability, can increase freight costs and diminish the competitive advantage of parts of the UK, by reducing the effective catchment area of a port.

2.2.36. In 2015, the port of Great Yarmouth handled over 1 million tonnes of traffic , including oil and other bulk liquids (195,000 tonnes), agricultural products and other dry bulk products (726,000 tonnes) and general cargo (174,000 tonnes)12. Although it is smaller than the major ports on which the HE report focuses, the principles hold true. The port of Great Yarmouth, especially the new deep water outer harbour, does not enjoy good access to the strategic road network. The scheme will greatly improve the port's connectivity to the A47 trunk road and the SRN, helping to improve its efficiency and viability, and stimulate port-related growth.

2.3 SUB-NATIONAL POLICY CONTEXT

2.3.1. The following sub-national planning and transport policies are relevant to the scheme:

- New Anglia Strategic Economic Plan 2014
- Lowestoft-Great Yarmouth Enterprise Zone and Local Development Order
- East Inshore and East Offshore Marine Plan (2014)

NEW ANGLIA STRATEGIC ECONOMIC PLAN 2014

2.3.2. The New Anglia Strategic Economic Plan (SEP) sets out the ambition of the Local Enterprise Partnership (LEP) to transform the economies of Norfolk and Suffolk and establish the 'New Anglia' area as a centre of global business excellence. It seeks to deliver more jobs, new businesses, new housing, and increased productivity including.

- 95,000 growth in jobs from 2012 to 2026
- 15,000 new businesses[13] from 2012 to 2026
- Increasing GVA by 10% to equal the national average

2.3.3. Great Yarmouth is identified as a Growth Location with a strong base in manufacturing and food processing, and strong tourism and leisure industries with potential for growth.

2.3.4. The area's main growth opportunity is in the energy sector, for which it has been designated one of six Centres for Offshore Renewable Engineering (CORE). The Port of Great Yarmouth is a major base for the construction, operations and maintenance and servicing of North Sea wind farms and is very important to the offshore energy

[11] "International gateways and the strategic road network". Commissioned by Highways England to inform the emerging Strategic Economic Growth Plan. (Atkins, for HE, 2016)
[12] Source: Port Freight Statistics PORT0418 (DfT Statistics, 2015)
[13] Increased from 10,000 (SEP Impact Report, NCC, September 2016)

industry. Great Yarmouth and Lowestoft are the closest ports to the East Anglia Array Wind Farm, which has up to 1,800 wind turbines, 14km from the coast. Plans are also being developed for the Galloper Wind Farm, 27km from the Suffolk Coast.

2.3.5. The SEP identifies eight growth locations – areas which are expected to grow by at least 1,000 jobs and 1,000 dwellings[14], including Lowestoft and Great Yarmouth. Transport performs a pivotal role in connecting and accessing these growth locations, and a programme for New Anglia's strategic transport infrastructure investment is essential to deliver the objectives of the SEP. For this reason, most of the strategic interventions in the SEP are transport-related, and include:

- Improvements on national trunk roads in the area;
- Schemes to directly unlock employment or housing growth; and
- Sustainable urban transport packages – public transport, walking and cycling schemes, network management measures and maintenance schemes.

2.3.6. The SEP initiatives in Great Yarmouth are focused on parts of the town which are presently isolated with poor accessibility by land. The SEP acknowledges that Great Yarmouth suffers from congestion arising from bottlenecks, including at North Quay and the Haven Bridge, and that the limited river crossings force traffic onto a few congested routes. It specifically supports the preparation of a third river crossing scheme. The SEP, which pre-dates the announcement of the Local Majors Fund, envisaged that this work would lead to the inclusion of the scheme in the (then) Highways Agency's national programme, as this was the expected delivery route for the scheme at the time (2014).

2.3.7. Subsequently an Outline Business Case for the scheme was submitted and approved, and will be followed through in the Development Consent Order (DCO) process.

2.3.8. A key part of the SEP "offer" is the Enterprise Zone (EZ) which designates two sites in Great Yarmouth for energy businesses, offshore engineering, ports and logistics.

LOWESTOFT-GREAT YARMOUTH ENTERPRISE ZONE AND LOCAL DEVELOPMENT ORDER

2.3.9. The Great Yarmouth and Lowestoft Enterprise Zone (EZ) is one of 24 such zones created in England since 2011. The EZ designation applies to two sites in Great Yarmouth, Beacon Park and South Denes totalling 75.5 hectares, for energy businesses, offshore engineering, ports and logistics in Great Yarmouth.

2.3.10. The South Denes EZ is centred on the deep water outer harbour on the South Denes peninsula, to the south of Great Yarmouth town centre and northeast of Gorleston-on-Sea on Norfolk's east coast. It is covered by a Local Development Order (LDO) which facilitates energy related development. The LDO also covers the Great Yarmouth Energy Park and South Denes Business Park.

2.3.11. The Enterprise Zone and LDO area are discussed in more detail in Paragraphs 3.4.16 to 3.4.20 and are illustrated in Figure 8 on Page 26.

2.3.12. The scheme will support economic growth in Great Yarmouth and the wider sub-region and aligns with the aims of the EZ and LDO.

[14] Over the relevant Local Plan period

EAST INSHORE AND EAST OFFSHORE MARINE PLAN (2014)

2.3.13. Policy PS3 of the Marine Plan for East (Inshore) states that proposals need to demonstrate, in order of preference:

- that they will not interfere with current activity and future opportunity for expansion of ports and harbours
- how, if the proposal may interfere with current activity and future opportunities for expansion, they will minimise this
- how, if the interference cannot be minimised, it will be mitigated
- the case for proceeding if it is not possible to minimise or mitigate the interference.

2.3.14. Policy DD1 states that proposals need to demonstrate, in order of preference:

- that they will not adversely impact dredging and disposal activities
- how, if there are adverse impacts on dredging and disposal, they will minimise these
- how, if the adverse impacts cannot be minimised they will be mitigated
- the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.

2.3.15. Further information will be provided in the full TA.

2.4 LOCAL POLICY CONTEXT

The following local planning and transport policies are relevant to the scheme:

- Great Yarmouth Local Plan: Core Strategy 2013 – 2030
- Great Yarmouth Waterfront Area Action Plan 2010
- Norfolk Local Transport Plan: Connecting Norfolk
- Great Yarmouth: The Plan 2015 – 2020
- Great Yarmouth Borough Infrastructure Plan 2014
- Great Yarmouth Economic Growth Strategy 2017 – 2021
- Great Yarmouth Town Centre Masterplan (draft) 2016

GREAT YARMOUTH LOCAL PLAN: CORE STRATEGY 2013 – 2030

2.4.1. The Great Yarmouth Local Plan Core Strategy is the main document in Great Yarmouth Borough Council's Local Plan (2013 – 2030). It establishes the spatial vision and objectives for how the borough will develop and grow in the future. It also sets out strategic policies and site allocations. Consultation on the publication draft was undertaken in September 2013 before the strategy was submitted and adopted by the Borough Council in December 2015.

2.4.2. The Core Strategy envisages that approximately 35% of new development will take place in the borough's main towns at Gorleston-on-Sea and Great Yarmouth (Policy CS2) with a further 30% being allocated in the borough's Key Service Centres at Bradwell and Caister-on-Sea.

2.4.3. Provision for at least 7,140 new homes over the plan period (Policy CS3) will be achieved by allocating two strategic Key Sites; at the Great Yarmouth Waterfront Area (Policy CS17) for approximately 1,000 additional new homes (a minimum of 350 of which will be delivered within the plan period) and at the Beacon Park Extension, South Bradwell (Policy CS18) for approximately 1,000 additional new homes (all of which will be delivered within the plan period).

2.4.4. A third crossing over the River Yare is envisioned in the Core Strategy, along with improvements to public transport and the creation of attractive walking and cycling routes from the train station to the waterfront, town centre and seafront, which will relieve congestion and provide essential links to key facilities and services, including the outer harbour.

GREAT YARMOUTH WATERFRONT AREA ACTION PLAN 2010

2.4.5. The Area Action Plan (AAP) provides a detailed spatial policy framework to deliver the regeneration ambitions of the Borough Council for the waterfront areas of central Great Yarmouth. It covers a total area of approximately 40 ha of predominantly brownfield waterfront land. It seeks to ensure that development within this area comes forward in a coordinated manner by setting out a policy framework to guide the delivery of new housing, employment space, retail, leisure and tourism facilities, community facilities, open space, transport initiatives and environmental enhancements.

2.4.6. The AAP is has been significantly influenced by a number of consultation events that took place between 2006 and 2011 involving many local people, businesses and organisations.

2.4.7. The AAP recognises that all traffic from the south must use one of two bridges that cross the River Yare, Haven Bridge and Breydon Bridge. These routes are frequently congested particularly in the summer, when, as a result of tourism, the population of the town swells to almost double the size.

2.4.8. To facilitate development, the AAP acknowledges that a series of road improvements will be required dependant on securing appropriate levels of funding from Central Government and developments within the town. As a long term ambition (10-15 years) for the town a third river crossing has been identified to the south of Haven Bridge. This will provide an alternative route from the SRN (A47) for the traffic associated with the industrial uses in the Port area that currently travels through the town.

2.4.9. The scheme falls outside the revised AAP boundary. AAP development is described in Section 3.4 on Page 22

NORFOLK LOCAL TRANSPORT PLAN: CONNECTING NORFOLK

2.4.10. DfT guidance on Local Transport Plans (LTPs) required local authorities to develop strategies and implement programmes to achieve five goals originally developed in the DfT's discussion document, 'Towards a Sustainable Transport System':

- Maximising economic growth through competitiveness and productivity;
- Tackling climate change;
- Protecting people's safety, security and health;
- Improving quality of life; and
- Promoting greater equality of opportunity.

2.4.11. In response, Norfolk County Council adopted a strategy intended to deliver first class transport infrastructure in the county. Norfolk's LTP3 sets out the Council's transport objectives, strategies and policy framework for transport up to 2026 and describes its transport vision as:

'A transport system that allows residents and visitors a range of low carbon options to meet their transport need and attracts and retains business investment in the county'.

2.4.12. This vision will be achieved by:

- Making the best use of existing infrastructure to facilitate reliable journeys;
- Reducing the need to travel;
- Influencing others and ensuring transport is integrated into development plans;

- Working with communities and our partners to seek new solutions and new ways of delivering; and
- Lobbying for and pursuing improvements to Norfolk's strategic transport network.

2.4.13. Six strategic aims underpin the vision, they are: maintaining and managing the highway network; delivering sustainable growth; enhancing strategic connections; reducing emissions; improving road safety; and improving accessibility.

2.4.14. Ten main transport issues are addressed in LTP3. These include:

- Current and future resilience of the transport network
- Poor road and rail connections to other major centres in the UK and the impact this has on business investment
- Connections to Norfolk's international transport gateways
- Poor transport accessibility and isolation

2.4.15. LTP3 recognises that to bring about an improvement in journey time reliability in and around Norfolk, local agencies should work together to enhance the strategic network which includes, among other schemes, a Third River Crossing for Great Yarmouth. The LTP noted that the scheme 'will provide an enhanced link to the port and help remove freight traffic from the town centre'.

2.4.16. The Proposed Scheme will also contribute to the LTP3 goals by reducing congestion and improving connectivity, access to jobs, and journey time reliability for customers, commuters and freight. It would provide an improved crossing for cycles and pedestrians as well as for cars and freight vehicles.

GREAT YARMOUTH: THE PLAN 2015 – 2020

2.4.17. Great Yarmouth Borough Council has approved an updated plan for the borough's future, which will help target investment in public priorities identified in a major consultation.

2.4.18. As a key priority, the plan highlights an ambition for Great Yarmouth to be a fast-growing coastal "Enterprise Town". Efforts will be focused on creating the conditions to ensure the borough and its residents are best placed to benefit from new jobs and investment, including from the next generation of offshore energy developments.

2.4.19. These priorities are:

- Economic growth
- Housing
- Neighbourhoods, communities and the environment
- Tourism, culture and heritage
- Great Yarmouth town centre
- Transport and infrastructure

2.4.20. The Council has already achieved much within each of these six priorities and has a clear plan on what needs to be undertaken up to 2020.

2.4.21. The Plan describes how transport and infrastructure will be joined up and much improved. Residents, businesses and visitors will access and travel throughout the borough with ease. Great Yarmouth will become a smart borough utilising technology to enable all to live with ease and convenience. It highlights the Third River Crossing as:

- 'a strategic priority for Great Yarmouth to unlock future economic growth in the area and ease congestion'

2.4.22. The Council will not only continue to support the scheme but champion and lobby with partners including the LEP, Norfolk County Council and others to achieve this.

GREAT YARMOUTH BOROUGH INFRASTRUCTURE PLAN 2014

2.4.23. The Borough Council published an Infrastructure Plan in 2014 to identify the physical, social and green infrastructure needed to support the borough's growth ambitions set out in the emerging Local Plan over the plan period (2014 - 2029).

2.4.24. The plan describes how the towns of Great Yarmouth and Gorleston-on-Sea suffer from congestion within their built up areas. This is primarily because there are only two crossings over the River Yare (Haven Bridge and Breydon Bridge) and these can become very congested. The South Denes peninsula in Great Yarmouth is particularly inaccessible and problems are exacerbated by industrial and freight traffic needing to access this area.

2.4.25. The need for a Third River Crossing is recognised in the plan by the Council, the Norfolk and Suffolk Local Transport Body, New Anglia LEP and the A47 Alliance as a strategic priority for unlocking future economic growth in the area. It will also ease existing congestion problems and improve accessibility in Great Yarmouth, including access to the seafront, South Denes and outer harbour areas.

2.4.26. The proposed scheme aligns with the priorities set out within the Infrastructure Plan and will help to mitigate the congestion issues described along with providing new cycling provision for those wishing to access the peninsula from the southern parishes including Gorleston-on-Sea.

GREAT YARMOUTH ECONOMIC GROWTH STRATEGY 2017 – 2021

2.4.27. The Great Yarmouth Borough Council's Economic Growth Strategy 2017-2021 has been developed through a review of previous documents, policies and commissioned studies as well as consultations with local stakeholders and sets out the planned approach to support the growth of the local economy over the next four years up to 2021.

2.4.28. The strategy is realised through the implementation of the Action Plan which aims to deliver the growth and development in each field. The individual actions are grouped under the four broad aims that encompass the strategy's vision on Place, Key Sectors, Workforce Development and Infrastructure:

- A Destination In Which To Invest, Work, Visit and Live
- Key Sector Development and Sustainability
- Developing communities, entrepreneurship and the workforce
- A Prosperous Physical Environment and Improved Infrastructure

2.4.29. One of the key objectives of the strategy to help achieve the above aims is for transport and infrastructure to be joined up and much improved.

2.4.30. The strategy lists the Third River Crossing as a key component to support the new development in the Great Yarmouth Local Plan.

GREAT YARMOUTH TOWN CENTRE MASTERPLAN (DRAFT) 2016

2.4.31. The Borough Council's draft Town Centre Masterplan covers the area between the seafront, the Yare riverfront, and the old town walls. Its vision is for new investment and employment in the town centre, generating renewed pride in Great Yarmouth and building confidence for the future. The plan aims to deliver this vision by focusing on six interconnected objectives, which have been developed in consultation with stakeholders and the general public:

- Strengthening the heart of the town centre

- Improving the market and the Market Place
- Transforming the Conge
- Creating a sense of arrival at the train station
- Unlocking the potential of Hall Plain
- Linking it all together

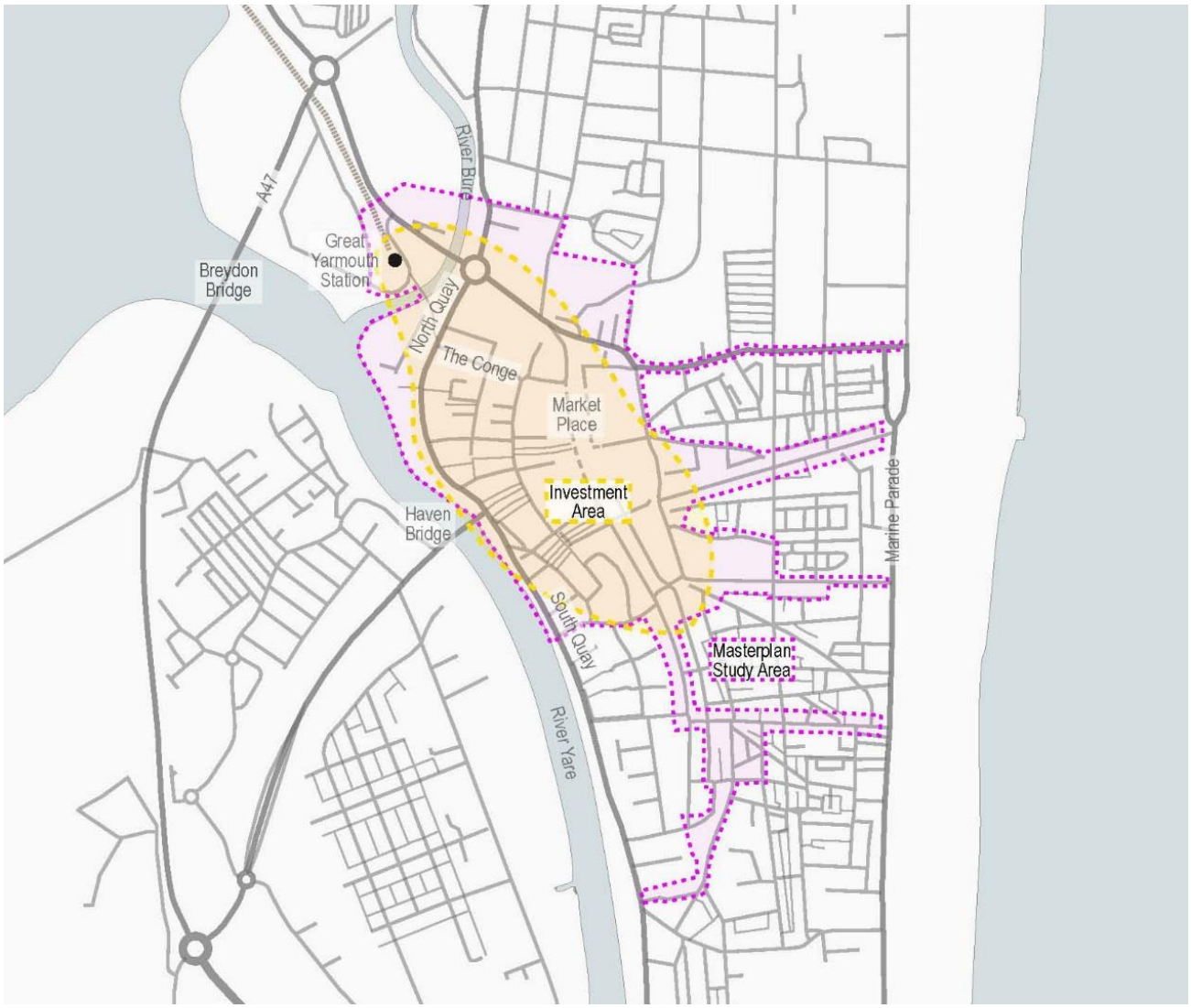

Figure 2 - Town Centre Masterplan investment area (Source: GYBC)

2.4.32. The Masterplan envisages three phases of improvement, with the third phase (2021 – 2024) linked to the provision of the Great Yarmouth Third River Crossing. In the short term, the Local Growth Fund allocated £1m in both 2017/18 and 2018/19 to invest in the link from Great Yarmouth's rail station via The Conge to the Market Place. The improvements at The Conge and North Quay were finished in the first half of 2018 and at the time of writing this document the improvements of the Rail Station Forecourt were under construction.

2.4.33. In the medium term, the Masterplan concludes that no single investment is likely to do more to boost the regeneration of the town centre than the proposed Great Yarmouth Third River Crossing, as it has the potential to significantly relieve the town centre of port-related traffic. The challenge for the town centre will then be to take the opportunity to reallocate road space and invest in the public realm. This has the potential to unlock the value of what were historically the town's most prosperous areas with its finest buildings, along the riverside from Fullers Hill to Hall Quay and South Quay.

2.4.34. Of the six objectives, the regeneration of Hall Quay is most closely linked to the provision of the third river crossing as it will benefit directly from the reduction in traffic using Haven Bridge. It has potential as a focus for leisure uses. The Borough Council will seek consensus among the public and stakeholders on a design concept and development brief which will encourage the refurbishment and regeneration of buildings in the context of the third crossing.

2.5 POLICY CONTEXT – SUMMARY AND CONCLUSIONS

2.5.1. Common themes in the above policies are:

- The need, and opportunities, for economic regeneration in Great Yarmouth
- The potential for growth associated with the offshore energy industry, especially in the Enterprise Zone and outer harbour
- The lack of adequate links between potential development areas on the peninsula and the strategic road network, especially to the A47 (south)
- The problem of heavy traffic on the existing bridges, and congestion in adjacent parts of the town centre
- The need for a third crossing of the River Yare to provide traffic relief, and better access to strategic routes, supporting regeneration and growth on the peninsula and the town centre

2.5.2. In essence, the vision for Great Yarmouth is for a once prosperous town to take advantage of the new opportunities for growth and regeneration afforded by offshore energy, commercial and port-related development and tourism, by dramatically improving accessibility and by providing traffic relief to the historic centre: a more prosperous town, and a better place in which to live.

2.5.3. The scheme will support this vision.

3 EXISTING CONDITIONS – SITE INFORMATION

3.1.1. This chapter describes the location of the scheme in relation to:

- The surrounding area
- The local transport system
- Existing land uses
- Planned or potential future land uses
- Air Quality Management Areas
- Abnormal load routes

3.2 THE SURROUNDING AREA

3.2.1. The scheme is located in Great Yarmouth, on Norfolk's North Sea coast, about 30 km east of the County town, Norwich. It is further east than any other town in Britain, apart from Lowestoft, as shown in Figure 3 below. The Great Yarmouth urban area has a population of about 68,000[15] people, and the wider Borough of Great Yarmouth a population of about 97,000[16].

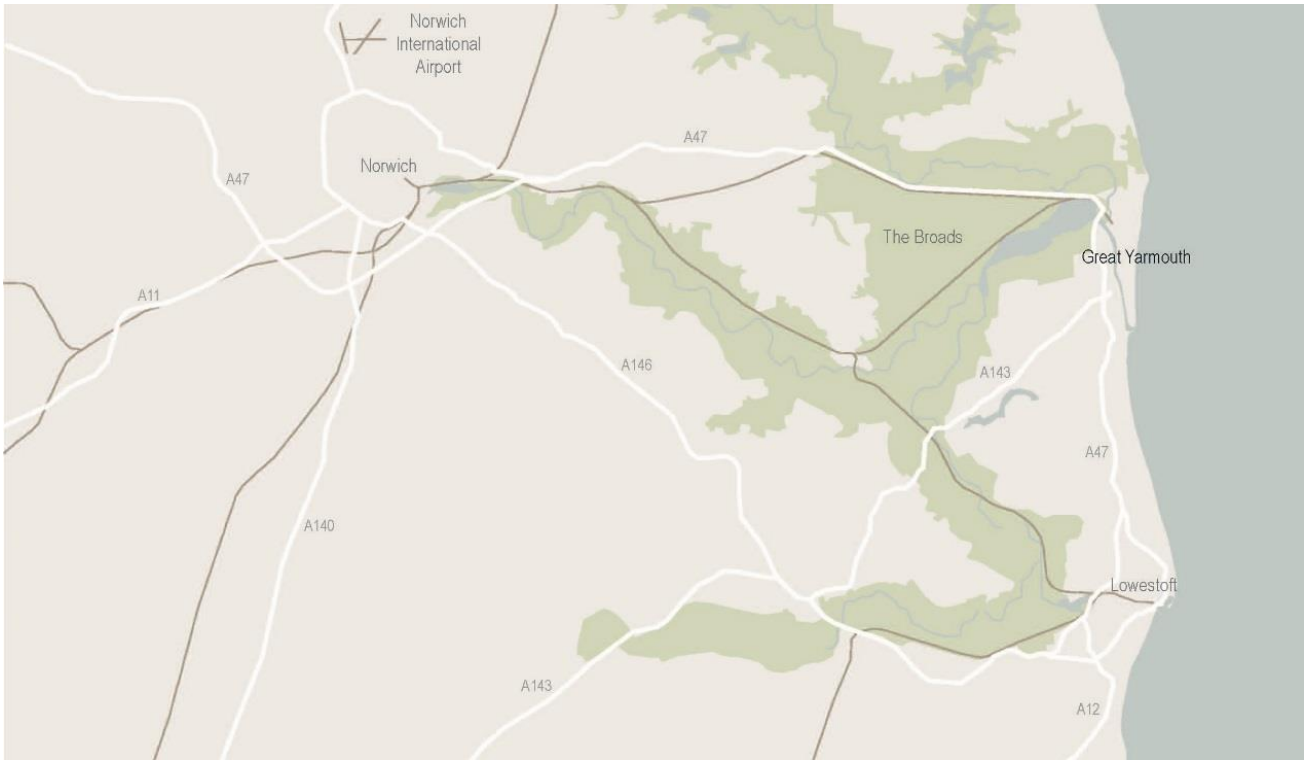

Figure 3 – Location of Great Yarmouth

3.2.2. Great Yarmouth is located at the mouth of the River Yare, one of the main waterways providing access to the Norfolk Broads. As illustrated in Figure 4 below, the river divides Great Yarmouth in two, with the town centre, seafront, industrial areas and outer harbour located on the narrow, 4 km long, South Denes peninsula between

[15] Population 68,317 (ONS, 2002)
[16] Population 97,277 (2011 Census)

the river and the sea, isolated from the rest of the town. To the west of the River Yare, Gorleston-on-Sea is just a few hundred metres away as the crow flies, but over 7km distant by road.

3.2.3. By virtue of its location, Great Yarmouth is relatively isolated. Despite this, it is an important employment centre and tourist destination, with over 1 million staying visitors and about 4 million visitor trips each year, generating a direct and indirect spend of £532 million[17].

3.2.4. The scheme will provide a new crossing of the River Yare, creating a direct link into the southern part of the peninsula. It will greatly improve access to the port, outer harbour, employment areas, the seafront and residential areas.

Figure 4 – Location of the scheme

[17] Source: Great Yarmouth Borough Council

3.3 THE LOCAL TRANSPORT SYSTEM

3.3.1. As shown in Figure 3 above, Great Yarmouth is connected to Norwich by rail, and by the A47 road which is part of the Strategic Road Network (SRN). It is linked to Lowestoft by rail, and by the A47 road (formerly the A12) also part of the SRN. Figure 4 above shows the scheme in relation to the town's road network

MAIN ROADS

3.3.2. Figure 5 below shows the location of the scheme in relation to the main roads into and through Great Yarmouth.

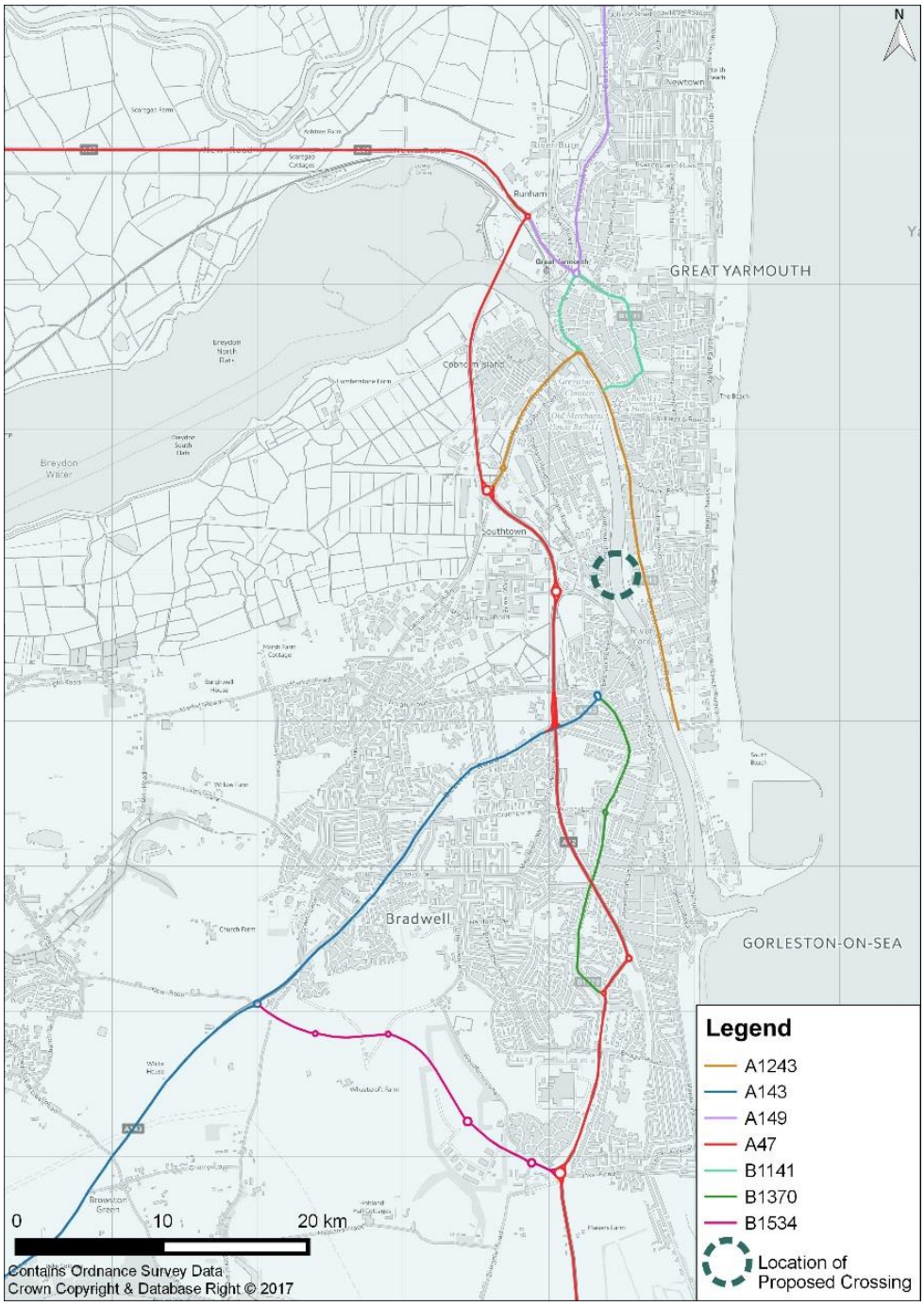

Figure 5 - Main roads, Great Yarmouth

A47 (formerly A47/A12)

3.3.3. The A12 trunk road between Lowestoft and Great Yarmouth was re-numbered A47 in March 2017. This means that the A47 is now a continuous trunk road from Peterborough to Lowestoft via Great Yarmouth, part of the SRN. The A12 designation now only applies to the trunk road between Ipswich and London.

3.3.4. The A47 runs due east from Norwich to Great Yarmouth, does not enter the town centre, but crosses the River Yare on a north-south alignment on the Breydon Bridge. Breydon Bridge is a single carriageway lifting bridge with one lane in each direction. It is opened frequently, but irregularly to allow passage of river traffic.

3.3.5. South of Breydon Bridge, the A47 skirts the western side of Great Yarmouth. It is a modern, single carriageway road with 1m margins and is subject to a 50 mph speed limit. There are no frontage accesses. It intersects with A1243 Pasteur Road (which leads into the town centre, Haven Bridge, sea front and port area) at a large at-grade roundabout.

3.3.6. The A47 continues as a two-lane dual carriageway and intersects with William Adams Way at another large at-grade roundabout known as Harfreys Roundabout.

3.3.7. It continues southwards as a two lane dual carriageway with a north-facing grade-separated intersection with A143 Beccles Road and bridges over local roads through Gorleston-on-sea before connecting to local roads Victoria Road and Middleton Road at a pair of large at-grade roundabouts junctions.

3.3.8. South of Middleton Road the A47 is a four-lane single carriageway with frontage access, an at-grade signal controlled junction with B1141 Brazenose Avenue and Bridge Road (the bridge in this case being a former railway bridge). It continues south as A47 Lowestoft Road, and eventually narrows to a single carriageway before intersecting with B1534 Beaufort Way and Links Road at the southern edge of the built-up area.

A1243

3.3.9. The A1243 Pasteur Road/ Bridge Road starts at the A47 roundabout in Southtown before crossing the Haven Bridge into Great Yarmouth itself where it joins the B1141 North Quay to the north and runs alongside the River Yare on Hall Quay and South Quay to the south before terminating at the Hartmann Road junction.

A143

3.3.10. The A143 from Bury St Edmunds is the primary route from Great Yarmouth to Haverhill in Suffolk. It ties in with the A47 just south of the scheme location before terminating at the Beccles Road roundabout. The A143 provides the main route to the area south west of Great Yarmouth, joining up with the A146 at Gillingham and the A140 at Scole.

A149

3.3.11. The A149 runs along the North Norfolk coast from Great Yarmouth to King's Lynn. It is a single carriageway road and provides direct access to Great Yarmouth railway station via Breydon Bridge at the Fuller's Hill roundabout. The route expands north towards Caister-on-Sea and on towards Cromer making it the main north-south route within the town of Great Yarmouth.

B1141

3.3.12. The B1141 is a circuitous route starting at the eastern end of the Haven Bridge. The road heads north along North Quay to cannon off the A149 at the Fuller's Hill roundabout. It skirts the eastern edge of the town centre before terminating at Yarmouth Way.B1370

B1370

3.3.13. The B1370 starts at the A47 / Middleton Road roundabout in Gorleston and heads generally northwards along the residential Middleton Road before terminating at the A47 / Beccles Road roundabout.

B1534

3.3.14. The B1534, opened in 2015, runs between the A143 and A47, to the south-west of Great Yarmouth. It is a single carriageway road with at-grade roundabout junctions.

RIVER CROSSINGS AND TOWN CENTRE ROADS

3.3.15. Great Yarmouth lies at the mouth of the River Yare, which separates the town from the other parts of the Borough. The River Yare is navigable to small coastal vessels between Norwich and the North Sea. The historic town centre and sea front lie on a narrow peninsula, sandwiched between the river and the sea. It is linked to Gorleston-on Sea and other parts of the Borough by two bridges over the river:

- The A1243 Haven Bridge (two lanes in each direction, single carriageway)
- The A47 Breydon Bridge (one lane in each direction, single carriageway) as described in Paragraph 3.3.4 above.

3.3.16. These are the only routes into and out of the peninsula. Both are lifting bridges, to enable boats and ships to pass through. To the west of Breydon Bridge lies Breydon Water, a large, sheltered estuary which forms the gateway to the Norfolk Broads.

3.3.17. The Breydon Bridge, constructed in 1985, enables A47 traffic to bypass the centre. The Haven Bridge provides access into the northern part of the town centre. There are, however, no bridges further south than this. As a result, the southern part of Great Yarmouth, which is built on the peninsula, is effectively isolated from the rest of the Borough.

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

3.3.19. Breydon Bridge and Haven Bridge are subject to high traffic flows and become severely congested during peak hours. Great Yarmouth and Gorleston also experience a dramatic increase in traffic flows during the holiday season. This extra traffic conflicts with town centre, port and commercial traffic, creating congestion problems on the town centre road network, particularly on the A47, South Quay, North Quay, Fullers Hill and Lawn Avenue.

3.3.20. The lack of a direct river crossing into the peninsula makes Great Yarmouth seem remote, and discourages inward investment. Bus users, cyclists and pedestrians have long, indirect journeys into the peninsula, which discourages commuting to work by more sustainable modes.

3.4 EXISTING, PLANNED AND POTENTIAL LAND USES

3.4.1. The existing land uses in the area surrounding the River Yare consist mainly of employment (business and retail) and the port and marine industries, extending from the Norfolk Broads in the west to the Outer Harbour in the east, as shown in Figure 6 below.

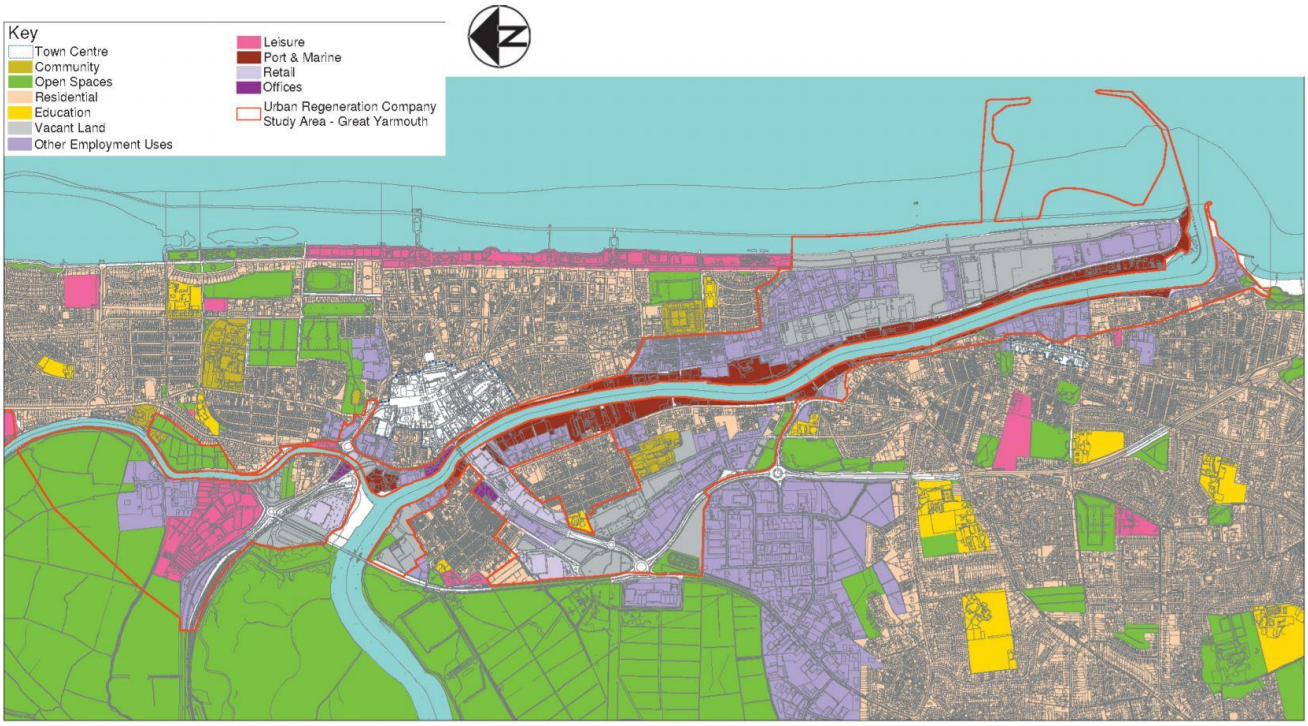

Figure 6 – Existing land use

3.4.2. Both the eastern and western edge of the River Yare are flanked by the prominent port and marine industries, including major offshore energy companies and maritime operations.

3.4.3. Beyond the immediate environments associated with the banks of the river, land use on the western side quickly reverts to residential development which extends to the north and south. To the south are the large tight knit communities of Gorleston and Bradwell which are regular in pattern. This type of housing breaks down to the north where pockets of smaller scale housing can be found. Besides housing, the land to the west of the River Yare is largely characterised by industrial land use with both Harfreys Industrial Estate and Yarmouth Business Park dominating large sections of the land.

3.4.4. On the eastern side of the river, the southern section of the Peninsula is partly designated as an EZ and is dominated by industrial use and the outer harbour. In contrast, land to the north of the Peninsula, including the town centre, consists mainly of residential, retail and open space. The seafront has a more recreational character and includes leisure facilities such as the Pleasure Beach and the Sea Life Centre.

AREA ACTION PLAN (AAP) ALLOCATIONS

3.4.5. The AAP identifies specific site allocations within the area which need to be developed to support the regeneration of Great Yarmouth. The sites surrounding the River Yare in vicinity of the proposed Third River Crossing are illustrated in Figure 7 and listed below:

- North Quay
- The Conge
- Runham Vauxhall
- Bure Harbour Quay
- Ice House Quay

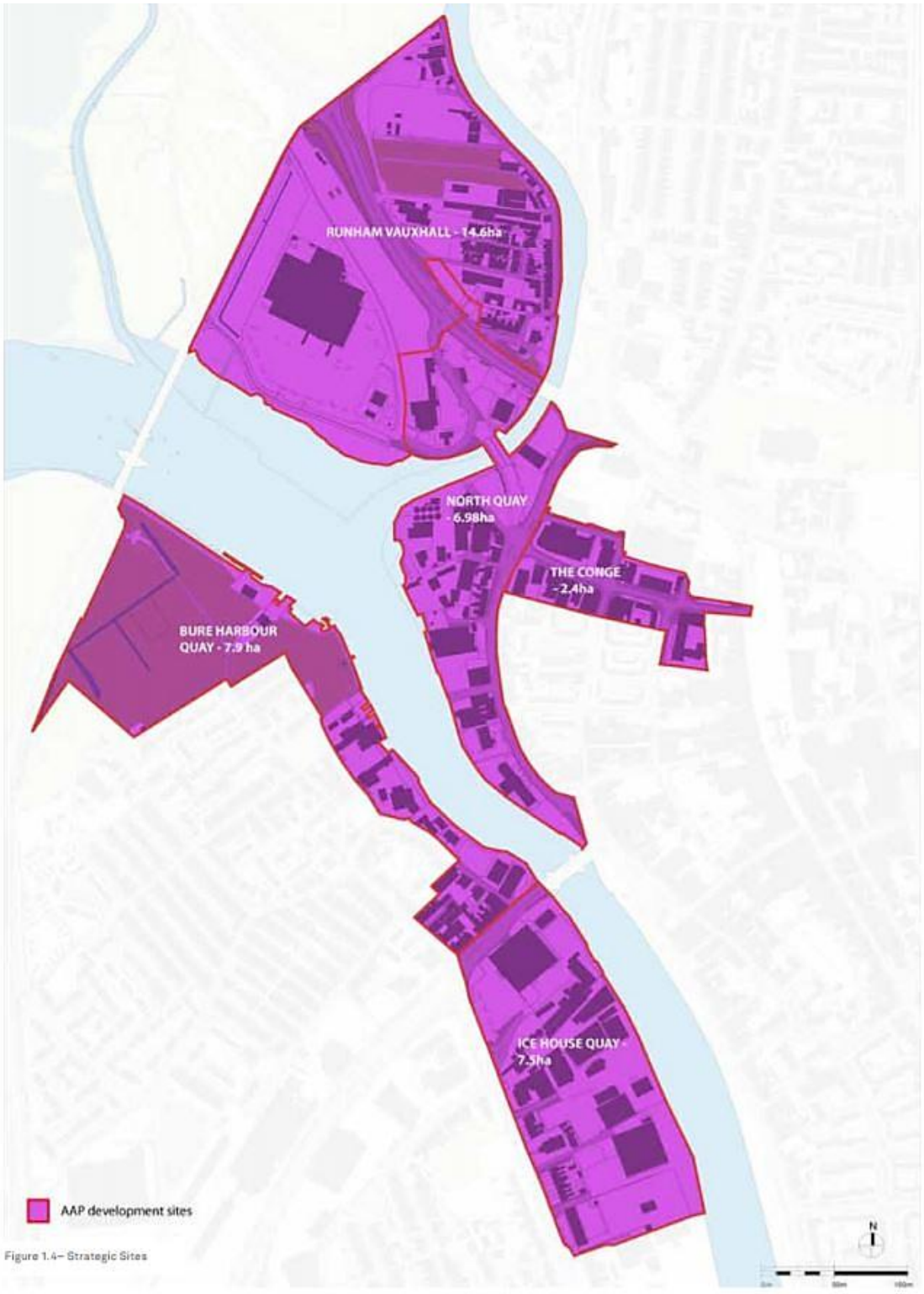

Figure 7 – Area Action Plan site allocations

North Quay

3.4.6. North Quay is the area located north west of the Peninsula bounded by both the River Yare and the River Bure and is an important gateway to the town. It is currently dominated by traffic from the A47 crossing over the Acle Bridge. Much of the site is occupied primarily by retail and commercial businesses with a small number of houses toward the northern end. There is a lack of frontage along the waterfront and the estate is poorly maintained with an ageing building stock. The site is also home to the newly refurbished Havenbridge House, a large office building occupied by a number of businesses and Norfolk County Council.

The Conge

3.4.7. The Conge is a key strategic link from Great Yarmouth Station to the Town Centre and the seafront. It is currently occupied by a number of retail businesses and Great Yarmouth Police Station.

3.4.8. The Conge is part of the Town Centre Masterplan and has been identified by Great Yarmouth Borough Council as a potential addition to the AAP area due to its development potential and linkage between the town centre, station and North Quay intervention area. The Conge has been earmarked as the most appropriate location for new mixed-uses, including retail, commercial and leisure uses.

Runham Vauxhall

3.4.9. Runham Vauxhall is another key gateway to Great Yarmouth with which it is immediately joined via the Acle Bridge and Vauxhall Suspension Bridge, on the western bank of the River Bure. The area is characterised by the terminus of the Norwich and Yarmouth railway with Great Yarmouth Station located on the western side of Acle New Road.

3.4.10. Whilst the area is largely residential, there is also a large supermarket and hotel along with allotment space and several commercial businesses. The area, a former site of fish-offices and manure-works, lacks any landscaping to screen traffic on the A47 and Acle New Road which can become very busy during the peak periods.

Bure Harbour Quay

3.4.11. Bure Harbour Quay is a waterfront location in Cobholm on the western bank of the River Yare and is predominantly characterised by energy industries and other businesses. It acts as the primary vehicular western gateway into the town and has been earmarked for mixed use development.

3.4.12. Development proposals for Bure Harbour Quay include reconnecting Cobholm with Great Yarmouth's waterfront and providing improved frontage to Bridge Road. Large residential developments are proposed along with a series of open spaces to provide amenity new and existing residents. The existing mill building may provide scope for provision of small scale employment units.

Ice House Quay

3.4.13. Ice House Quay is a strategic gateway site located at the setting of the historic grade II listed Ice House building on the western bank of the River Yare and is accessed via Southtown Road. A number of offshore and energy companies are located within Ice House Quay including EnerMech and Seatrax along with retail businesses to the north of the site.

3.4.14. Residential development has been identified as the dominant land use within Ice House Quay is also along with retail and office development on the northern fringe. The former site of the blue Bunns warehouses which were demolished in 2013 has been allocated for offshore firms and light engineering plants.

3.4.15. The proposed Third River Crossing will span the River Yare approximately 1km south of the Ice House Quay site.

Figure 8 - Local Development Order and Enterprise Zone, South Denes

3.4.16. The Great Yarmouth and Lowestoft Enterprise Zone (EZ) is one of 24 such zones created in England since 2011. It aims to stimulate growth by providing a portfolio of strategic sites, with concessions/incentives offered to businesses locating there. It is covered by a Local Development Order (LDO) which facilitates energy related development. Incentives include business rates relief worth up to £275,000 over five years; simplified planning regulations; and Government support for the provision of super-fast broadband. Business rates growth within the Zone will be retained by the LEP to support economic priorities for at least 25 years. The Enterprise Zone as a whole is expected to create up to 9,000 direct jobs and 4,500 indirect jobs by 2025.

3.4.17. The Enterprise Zone (EZ) designates two sites in Great Yarmouth, Beacon Park and South Denes totalling 75.5 hectares, for energy businesses, offshore engineering, ports and logistics in Great Yarmouth. Both sites have been allocated for B1 (light industrial / business), B2 (general industrial) and B8 (storage and distribution uses).

3.4.18. The South Denes EZ is centred on the deep water outer harbour on the South Denes peninsula, to the south of Great Yarmouth town centre and northeast of Gorleston-on-Sea on Norfolk's east coast. The area is characterised by the activities of the Port and related industries. There is significant land for development within the site, most of which is in the ownership of Peel Ports. GYBC has recently sought to expand the EZ at South Denes with the inclusion of three additional sites. The outer harbour is discussed in more detail in Paragraphs 3.4.21 to 3.4.26 below.

3.4.19. The LDO also covers the Great Yarmouth Energy Park and South Denes Business Park. The South Denes area is especially relevant to the scheme as it is very close to the proposed crossing location and will benefit from the improved accessibility to the A47 (part of the SRN) which the scheme will provide. The area is illustrated in Figure 8 on Page on page 26 above.

3.4.20. The Beacon Park site lies to the south of the town, adjacent to the A12 corridor between Great Yarmouth and Lowestoft. The scheme will improve connectivity between the two EZ sites in Great Yarmouth.

THE OUTER HARBOUR

3.4.21. Great Yarmouth is considered to be England's premier offshore support port. The deep water outer harbour at the southern end of the peninsula is strategically located to serve the oil and gas fields of the southern North Sea, as well as existing and planned offshore wind developments off the UK east coast. It provides state-of-the art facilities for the larger offshore vessels, complementing the long established facilities for offshore operations and maintenance in the river port. Great Yarmouth is also an established general and cargo port, offering the shortest North Sea crossing between Great Britain and continental Europe. It is owned and operated by Peel Ports who began operations in December 2015.

3.4.22. Over the last 50 years, the port has had a pivotal role in the offshore and renewable energy sectors. The decline in the fishing industry led to a decline in related employment, and many sites around the port fell vacant. However the advent of North Sea oil and gas exploration, extraction and servicing brought new industry to the town in the 1960s.

3.4.23. In recent years, the offshore wind power industry has provided a further stimulus. Several energy related firms (BH Bus, STATOIL, Petersons and Seajacks) have recently located to the peninsula and others are considering moving there. The County and Borough Councils are actively pursuing the regeneration of the area, establishing the Enterprise Zone, Local Development Order and Energy Park.

3.4.24. The new outer harbour, completed in 2010, has the potential to further stimulate growth on the eastern side of the town. It has transformed Great Yarmouth from a declining river port into a modern deep water port.

3.4.25. The decision by Scottish Power Renewables to use the new harbour as their construction and marshalling point for North Sea operations has been highly significant. A £7 million investment by Siemens, their main contractor, means that the port is now very busy with contractors' vehicles, and further growth is expected. Norfolk County Council is in discussion with a number of offshore wind component manufacturing businesses who are considering locating in Great Yarmouth. They need deep water access and there are sites close to the outer

harbour which are ready to accommodate them. Each component – towers, foundations, blades, cables, or turbines – involves a substantial supply chain and this requires good transport links.

3.4.26. Existing transport links into the new deep water harbour are inadequate. The lack of a direct bridge in to the outer harbour area makes Great Yarmouth seem remote and discourages inward investment. Currently, port-related traffic is forced to use one of the existing bridges to the north of the town before navigating along unsuitable routes within the Town Centre including the historic South Quay. The addition of local traffic leads to congestion, especially on the Haven Bridge, causing delays and making journey times unreliable.

AIR QUALITY MANAGEMENT AREAS

3.4.27. Great Yarmouth does not have any air quality management areas.

ABNORMAL LOAD USES

3.4.28. At present, the road delivery route for large wind turbine blades to the outer harbour is via the Haven Bridge. The scheme is being designed to provide an alternative route for these abnormal loads, removing them from the town centre.

4 EXISTING CONDITIONS - BASELINE TRANSPORT DATA

4.1 INTRODUCTION

4.1.1. This chapter describes the data which have been used to determine the existing conditions on Great Yarmouth's transport network.

4.1.2. It includes:

- Description and functional classification of the local road network
- Current traffic flows
- Existing public transport facilities
- Existing pedestrian and cycle facilities
- Existing parking facilities
- Accident record
- Critical links and junctions
- Other planned transport improvements
- Current peak periods
- Current noise and air quality issues
- Baseline carbon emissions, my mode

4.1.3. Further detail and analysis will be provided in the full TA.

4.2 DESCRIPTION AND FUNCTIONAL CLASSIFICATION OF THE LOCAL ROAD NETWORK

4.2.1. The local road network is illustrated in Figure 4 and Figure 5 above and has been described in Section 3.3 on Page 20.

4.3 CURRENT TRAFFIC FLOWS

TRAFFIC SURVEYS 2018

4.3.1. Automatic traffic counts (ATC) were undertaken at 20 locations within Great Yarmouth town centre. Each recorded data for at least two weeks from the Monday 5 July 2018. Data was classified according to ARX classification.

4.3.2. The ATC survey locations are listed in below and illustrated Table 1 and in Figure 9.

Table 1 – Automatic traffic count locations 2018

Ref. No.	Location	Ref. No.	Location
1	A47 - Breydon Bridge	11	S Denes Rd
2	Haven Bridge	12	S Beach Parade
3	Lawn Avenue	13	A47 New Rd
4	Northgate Street	14	Caister Rd

Ref. No.	Location	Ref. No.	Location
5	N Denes Road	15	A149 Caister By-Pass
6	North Drive	16	B1370 Middleton Rd
7	Gapton Hall Rd	17	Southtown Rd
8	Burgh Rd	18	B1141 Priory Plain
9	Beccles Rd	19	Euston Rd
10	A47/Beccles Rd	20	Acle New Rd

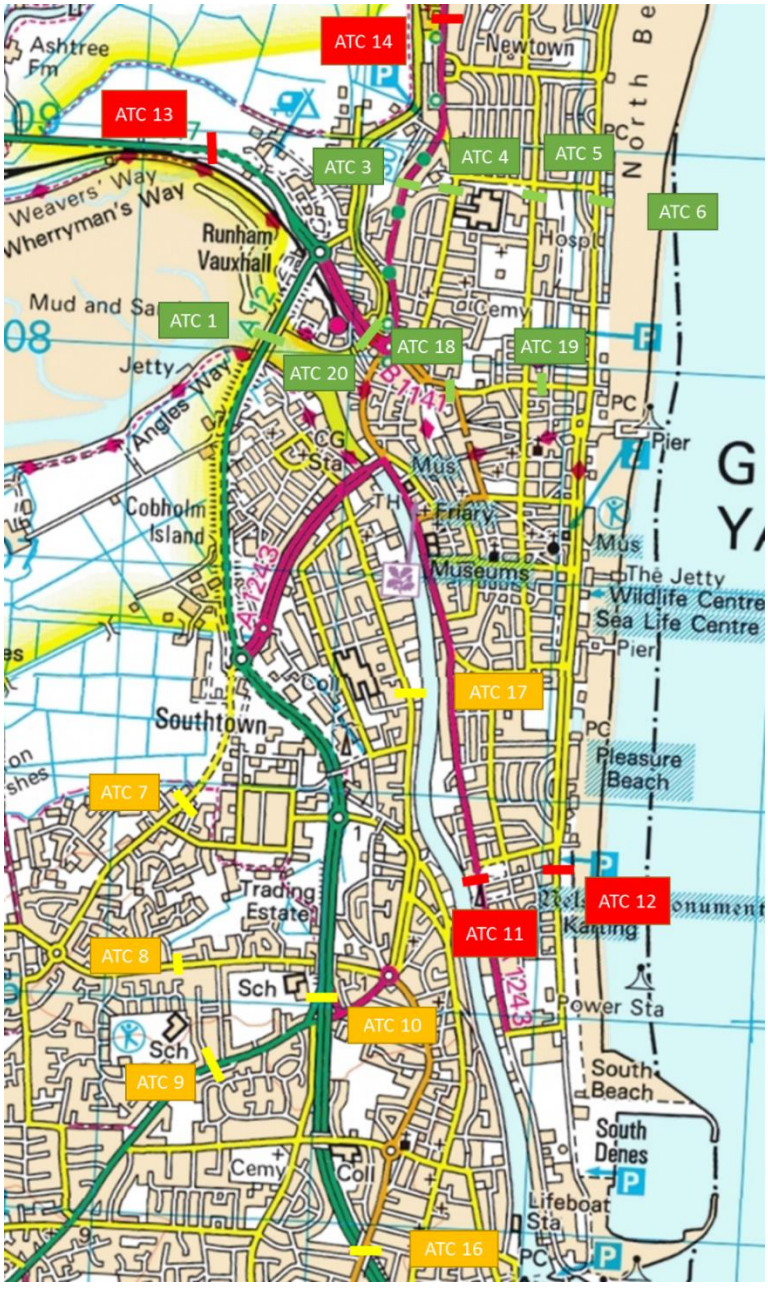

Figure 9 – Automatic traffic count locations 2018

4.3.3. Manual classified traffic counts (MCC) were undertaken at 15 junctions within Great Yarmouth town centre. Each covered twelve hours (07:00 – 19:00) on Thursday 8 March 2018. Data was classified according to six vehicle types:

- Pedal cycle / motorcycle
- Car
- LGV
- OGV1
- OGV2
- PSV.

4.3.4. The MCC survey locations are listed in Table 2 below and illustrated in

4.3.5. Figure 10.

Table 2 – Manual classified count locations 2018

Ref No.	Junction
1	Fuller's Hill roundabout
2	Vauxhall roundabout
3	Gapton Hall roundabout
4	Harfreys roundabout
5	Hall Quay
6	A149 Acle New Rd / Great Yarmouth Station access
7	Beccles Rd / Burgh Rd roundabout
8	Beccles Rd / William Adams Way / Southtown Rd
9	Southtown Rd / Pasteur Rd / Bridge Rd / Mill Rd
10	Fuller's Hill / Priory Plain / Northgate St / Market Place
11	Nicholas Rd / Nelson Rd / Euston Rd
12	North Dr / Car Park Access / Euston Rd / Marine Parade
13	South Quay / Yarmouth Way
14	Alexandra Rd / Dene Side / King St / Yarmouth Way
15	Alexandra Rd / Trafalgar Rd

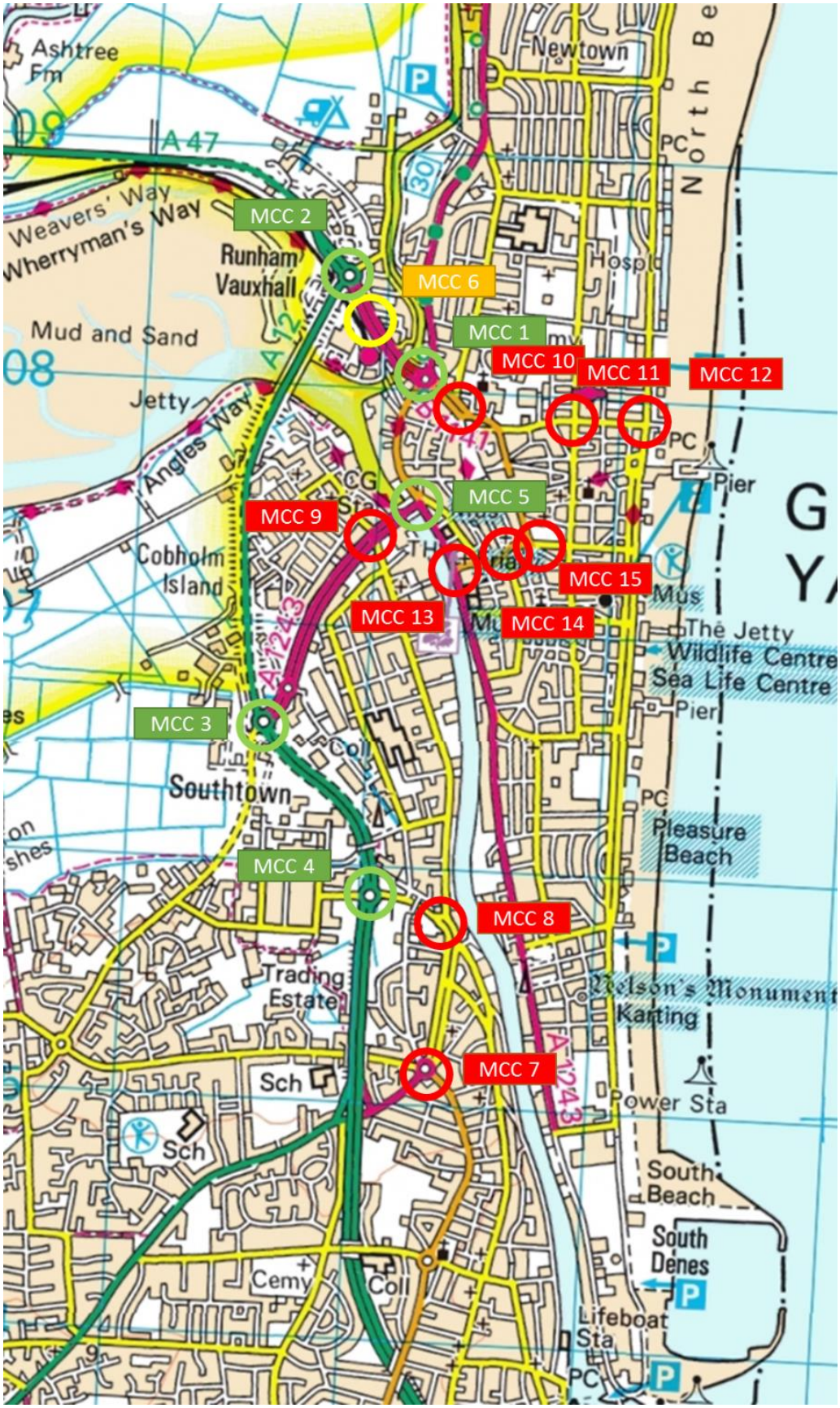

Figure 10 – Manual classified count locations 2018

TRAFFIC SURVEYS 2016

4.3.6. Manual classified traffic counts (MCC) were undertaken at 41 junctions within Great Yarmouth town centre, Gorleston, Bradwell and Caister. Each covered twelve hours (07:00 – 19:00) on Tuesday 4 October 2016 and Wednesday 5 October 2016. Data was classified according to six vehicle types:

- Pedal cycle / motorcycle
- Car
- LGV
- OGV1
- OGV2
- PSV.

4.3.7. The MCC survey locations are listed in Table 3 below and illustrated in Figure 11.

Table 3 – Manual classified count locations 2016

Location	Surveyed Area No.	Junction I.D.
Euston Rd / North Dr Roundabout	1	Junction 1
Euston Rd / Marine Parade	1	Junction 2
Euston Rd / Wellesley Rd	1	Junction 3
St Nicholas Rd / Nelson Rd	1	Junction 4
St Nicholas Rd (Sainsbury's)	1	Junction 5
The Conge / Fuller's Hill / King St / Car Park	1	Junction 6
Alexandra Rd / Trafalgar Rd	1	Junction 7/8
Yarmouth Way / King St	1	Junction 7/8
N quay/Aldi	1	Junction 9/10
Brewery Street /Aldi	1	Junction 9/10
The Conge / Howards St N/Northern road	1	Junction 11
Howard Street South Car Park	1	Howard St Car Park
King Street Car Park	1	King Street Car Park
Norwich Rd / Caister By-Pass Roundabout	2	Junction 1
Yarmouth Rd / Caister By-Pass Roundabout	2	Junction 2
Marine Parade / North Dr	2	Junction 3
S Beach Parade / Kings Rd Roundabout	2	Junction 4
S Beach Parade / Harbord Cres (north junction)	2	Junction 5
S Beach Parade / Harbord Cres (south junction)	2	Junction 6
S Denes Rd / Salmon Rd	2	Junction 7
S Denes Rd / Suffling Rd	2	Junction 8
S Denes Rd / Main Cross Rd	2	Junction 9

Location	Surveyed Area No.	Junction I.D.
S Denes Rd / Swanston's Rd	2	Junction 10
South Beach Parade Car Park	2	South Beach Car Park
A12 (Rugby Club)	3	Junction 12
Pasteur Rd / Jones Way Roundabout	3	Junction 13
A12 / Beccles Rd	3	Junction 14
Beccles Rd / High Rd	3	Junction 15
Beccles Rd / Malthouse Ln / Alpha Rd	3	Junction 16
William Admas Way / Suffolk Rd	3	Junction 17
Southtown Rd / Boundary Rd	3	Junction 18
Southtown Rd / Tollgate Rd	3	Junction 19
Southtown Rd / Gordon Rd	3	Junction 20
Pasteur Road/GC Way road (Pasta Foods/API Capacitors)	3	Junction 21
Beccles Rd / New Rd Roundabout	3	Junction 22
Beccles Rd / Church Ln / Long Ln	3	Junction 23
A12 / Links Rd / Beaufort Way Roundabout	3	Junction 24
A12 / Brasenose Ave / Bridge Rd	3	Junction 25
A12 / Victoria Rd Roundabout	3	Junction 26
Lidl Car Park	3	Lidl Car Park
James Paget University Hospital	3	James Paget Hospital

Figure 11 – Manual classified count locations 2016

HISTORICAL TRAFFIC SURVEYS 2012 - 2016

4.3.8. The Department for Transport (DfT) conducts traffic counts to determine traffic volumes for major routes. The DfT Traffic Count database provides a historical insight of traffic volumes for several count sites in close proximity to the location of the scheme, including a permanent traffic count site on the approach to the Breydon Bridge in Great Yarmouth. There is no DfT traffic count data for the Haven Bridge. The traffic count locations are illustrated Figure 12 below.

Figure 12 – DfT traffic count sites

4.3.9. The traffic flows for each site over the six years to 2017 are set out in Table 4 below.

Table 4 – Traffic flows at DfT count sites 2012 - 2017

DfT Traffic Count Site	Average Annual Daily Traffic (AADT) Flow					
	2012	2013	2014	2015	2016	2017
1 – A47 Breydon Bridge (Approach)	33,069	32,973	33,464	33,788	33,423	33,293
2 – A47 (South of Harfreys Roundabout)	32,426	32,306	32,693	36,532	36,172	38,239
3 – A143 Beccles Road	4,945	4,940	5,091	5,200	5,354	5,330
4 – A1243 South Denes Road	5,554	5,595	5,781	5,904	6,148	6,183
5 – A149 Acle New Road Bridge	33,793	34,327	34,631	34,323	33,968	32,034
6 – A149 Lawn Avenue	17,323	17,312	17,860	18,250	18,804	18,750

4.3.10. In addition, traffic data was obtained from:

- Roadside interview surveys in 2016
- Automatic traffic counts at 30 locations in 2016
- Journey time surveys on 8 routes in 2016
- Data collected prior to 2016, including ANPR, MCC, ATC, queue surveys and Trafficmaster data.

4.3.11. The collection and processing of this data is detailed in the Data Collection Report, (submitted with the OBC as Supporting document 3)

4.3.12. The use of this data in the development of the strategic and microsimulation models for the assessment of the scheme is described in Chapter 6 below. This will include re-basing the models to 2018, with some additional traffic surveys to be undertaken in March 2018.

4.3.13. The full TA will include an assessment of traffic conditions in Great Yarmouth based on the most up-to-date data.

4.4 EXISTING PUBLIC TRANSPORT FACILITIES

BUS NETWORK

4.4.1. Bus services cover the main corridors through the town, with all routes from outlying areas serving the town centre and Market Gates bus station. The majority of bus services in Great Yarmouth are operated by First in Norfolk and Suffolk, with a small number operated by other local bus operators.

4.4.2. The majority of bus services in the town run in north / south direction connecting Great Yarmouth with the Caister-on-Sea to the north and / or Gorleston-on-Sea to the south. Notable exceptions to this this are bus service 2, a circular route serving the town centre and peninsular only, and bus service 74 between Great Yarmouth Town Centre and Little Plumstead to the west.

4.4.3. Great Yarmouth Market Gates bus station is located in the town centre, 2 km north of the scheme, and is approximately 550m from the sea front, or a 5 to 7 minute walk. Public realm improvements are currently being undertaken at Market Hill Bus Station, this includes new Real Time Passenger Information (RTPI) displays along, new lighting and new railings.

4.4.4. There are a number of bus stops within the immediate vicinity of the proposed scheme and are illustrated in Figure 12 below.

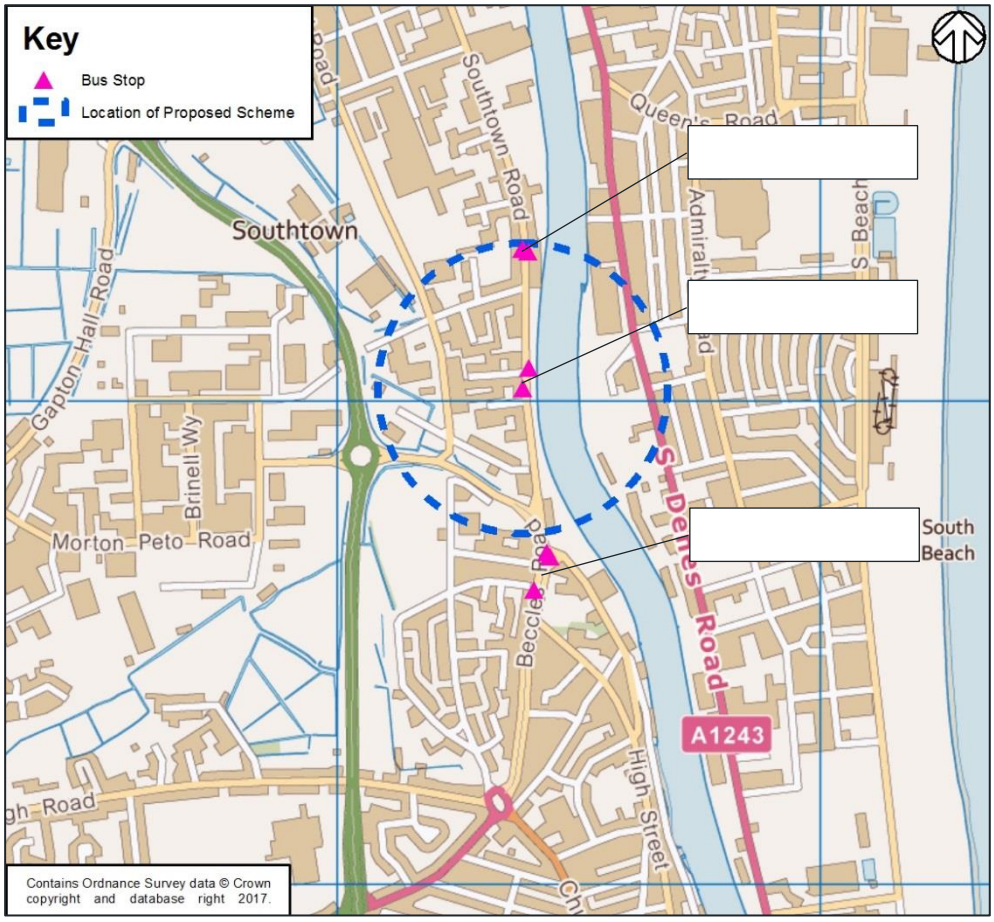

Figure 13 – Bus stops close to the scheme

4.4.5. Figure 12 above shows that all of the bus stops within the immediate vicinity of the proposed scheme are situated on Southtown Road and Beccles Road to the west of the River Yare. The most central of these are Waveney Road bus stops and are comprised of a flag and pole only.

4.4.6. To the east of the River Yare there are no bus stops within the immediate vicinity of the proposed scheme. The closest bus stop on the east side of the River Yare is Battery Road bus stop on Admiralty Road. This is the southernmost bus stop on the peninsula and is severed by service 2 only. This is a circular route that connects the peninsular with Great Yarmouth town Centre. There are no bus stops along the A1243 South Denes Road.

4.4.7. A summary of the bus services operating along Southtown Road and Beccles Road to the west of the River Yare is detailed below:

- Coastal Clipper 1

  The Coastal Clipper 1, operated by First in Norfolk and Suffolk, is a coastal route between Martham and Lowestoft. The service operates at hourly intervals during the morning and afternoon before running at 30 minute intervals during the evening, Monday to Friday. Saturday services are no different and run at hourly intervals throughout the morning and afternoon and then at 30 minute intervals in the evening. Services are reduced on Sundays, running at 2 hour intervals in the morning and afternoon and at hourly intervals in the evening.

- Coastal Clipper 1A

  The Coastal Clipper 1A is also operated by First in Norfolk and Suffolk and operates a similar route to that of Coastal Clipper 1, with an hourly service during the morning and afternoon. Together the Coast Clipper 1 and 1A services offer passengers a half hourly service, Monday to Friday between Martham and Lowestoft. The Coastal Clipper 1 A operates no weekday evening service and is replaced instead by the Coastal Clipper 1 service. The Saturday is the same as the weekday service, with an hourly frequency during the morning and afternoon, running concurrently with Coastal Clipper 1. Buses run at 2 hour intervals on Sundays, running concurrently with Coastal Clipper 1, offering passengers an hourly service during the morning and afternoon. The Coastal Clipper 1A service operates no evening services at weekends.

- Bus route X1

  The X1 service, operated by First in Norfolk and Suffolk, is an express bus service that runs between Norwich and Lowestoft via Great Yarmouth. Services run twice per hour, Monday to Saturday, reduced to once per hour on Sundays.

- Bus route X11

  The X11, operated by First in Norfolk and Suffolk, is an express bus service that runs between Norwich and Belton via Great Yarmouth. Between Norwich and Great Yarmouth it follows the same route as the X1 service. It operates a half hourly service, Monday to Saturday, and hourly service on Sundays.

- Bus route 5

  Bus Route 5, operated by First in Norfolk and Suffolk, is a circular service running between Great Yarmouth and Burgh Castle via Gorleston and Burgh Castle. There are 10 hourly services Monday to Saturday, with no early morning or late evening services The service runs on Sundays but is very limited with 4 buses per day

- Bus route 6

  Bus Route 6, operated by Sanders Coaches, is a local stopping service that runs between Bradwell and Great Yarmouth via Gorleston. Buses run every 30 minutes during the morning and afternoon Monday to Saturday. There are also 3 hourly services running afterwards in to the evening. Sunday services are reduced to hourly intervals but still provide evening buses up until after 9pm.

- Bus route 7

  Bus Route 7, operated by First in Norfolk and Suffolk, runs between Belton and Great Yarmouth. The service follows a similar to the X11, but with an additional stop in Bradwell and no stop at James Paget Hospital. This service operates is a morning and evening only. Monday to Friday there are 3 buses per day towards Belton and 4buses per day towards Great Yarmouth. On Saturdays there are 2 buses a day towards Belton and 4 buses per day towards Great Yarmouth. On Sundays there are two buses per day in both directions in the evening.

- Bus route 8

  Bus Route 8, operated by First in Norfolk and Suffolk, provides over 50 services per day Monday to Saturday between James Paget Hospital in Gorleston and Caister-on-Sea. These run approximately every 15 minutes and offer early morning and late evening services. Sunday services are reduced to 30 minute intervals but still run from early morning to late evening, offering over 30 services throughout the day.

- Bus route 9

Bus Route 9, operated by First in Norfolk and Suffolk, runs between Great Yarmouth and James Paget Hospital. Services are generally provided every 30 minutes Monday to Saturday. There are no evening or Sunday services.

- Bus route 271

  Bus Route 271, operated by Our Bus, runs between Hemsby and Great Yarmouth. The service runs 2 buses per day Monday to Friday in both directions (mid-morning and early afternoon) with first bus of the day continuing towards / originating from Bradwell. There are no weekend services.

- Bus route 580

  Bus Route 580, operated by Boarder Bus, runs between Bungay and Great Yarmouth. The service operates 1 bus per hour Monday to Saturday and no service on Sundays. The earliest service from Bungay is just after 8am and the latest service to depart Great Yarmouth towards Bungay is just before 4pm. The last service to Beccles departs Great Yarmouth just after 5pm.

- Bus route 922

  Bus Route 922, operated by First in Norfolk and Suffolk, is a school service that runs between Great Yarmouth and Cliff Park Ormiston Academy This operates 1 service per day Monday to Friday in each direction and no service at the weekends.

4.4.8. As noted above, no bus services operate close to the proposed scheme on the east side of the River Yare. The nearest bus stop on the east side of the River Yare is Battery Road bus stop on Admiralty Road. It is approximately 300m to the east of the River Yare and served by Route 2 only. This is a circular route, operated by First in Norfolk and Suffolk, between Market Gates bus station and the Pleasure Beach. This is the only route that serves the south of the peninsular. Buses run approximately every 10 minutes Monday to Saturday, with a reduced service in the early morning and late evening. On Sundays buses run approximately every 20 minutes, with no early morning service and reduced late evening service.

RAILWAY SERVICES

4.4.9. Great Yarmouth Station is one of two terminuses on the Wherry Line from Norwich. The station is located approximately 1.5 miles, or a 30-minute walk, from the proposed scheme. No bus services currently serve Great Yarmouth station forecourt bus stop, however it is approximately 1km from the town centre, or a 10 to 15 minute walk via Vauxhall Bridge where a number of bus services can be accessed.

4.4.10. All train services from Great Yarmouth Station are operated by Abellio Greater Anglia. According to the Office of Rail Regulation usage figures for 2016-2017, Great Yarmouth was the fifth-busiest railway station in Norfolk, after Norwich, King's Lynn, Diss and Downham Market.

4.4.11. The majority of services from Great Yarmouth run direct to Norwich via Acle, however two trains per day run direct to Norwich via Berny Arms. On both routes, the majority of services call at all intermittent stations. The approximate journey time between Great Yarmouth and Norwich is 35 minutes.

4.4.12. During the AM peak period (07:00-10:00), four services depart from Great Yarmouth to Norwich. In the PM peak period (16:00-19:00), there are five services to Norwich. The Monday to Friday services from Great Yarmouth to Norwich are summarised in 5.

Table 5 – Summary of weekday rail services from Great Yarmouth to Norwich

Destination	Weekday Frequency (trains/hr)							Number of trains per day	First to Depart	Last to Depart
	AM Peak			Inter-Peak	PM Peak					
	0700-0800	0800-0900	0900-1000	1000-1600	1600-1700	1700-1800	1800-1900			
Norwich	1	2	1	1	1	2	2	23	05:34	23:34

4.4.13. On Mondays and Fridays between 20 May and 9 September four additional direct non-stopping services operate between Great Yarmouth and Norwich, of which 1 is in the AM Peak and 3 are in the inter-peak.

4.4.14. At weekends, the Saturday timetables to Norwich operate similarly to weekdays. However, there are a reduced number of Sunday services, whereby services operate only every other hour to Norwich. Weekend rail services to Norwich from Great Yarmouth are summarised in 6.

Table 6 – Summary of weekend rail services from Great Yarmouth to Norwich

Destination	Saturday			Sunday		
	Total Daily No. of Trains	First to Depart	Last to Depart	Total Daily No. of Trains	First to Depart	Last to Depart
Norwich	22	06:15	23:34	16	08:17	23:17

4.5 EXISTING PEDESTRIAN AND CYCLE FACILITIES

4.5.1. The River Yare divides the western side of Great Yarmouth from the town centre, sea front, harbour and other destinations on the South Denes peninsula. To access these facilities, all pedestrian and cycle journeys between east and west have to cross the existing bridges. For pedestrians this means using Haven Bridge, as the Breydon Bridge has no footways.

4.5.2. For many trips, the time and distance involved is significant when compared with the equivalent “crow fly” distance. An example is shown in Figure 14 below in which the shortest distance between two population centroids, a distance of less than 1 km ‘as the crow flies’, is more than 4 km via the Haven Bridge. For a pedestrian, this means a journey of nearly an hour. By cycle, it would take about 15 minutes.

Figure 14 – Example pedestrian or cycle journey

4.5.3. The impact of the limited opportunities to cross the River Yare on walking and cycling accessibility from the location of the Proposed Scheme on the west side of the River Yare is provided in Figure 15 and 16 below.

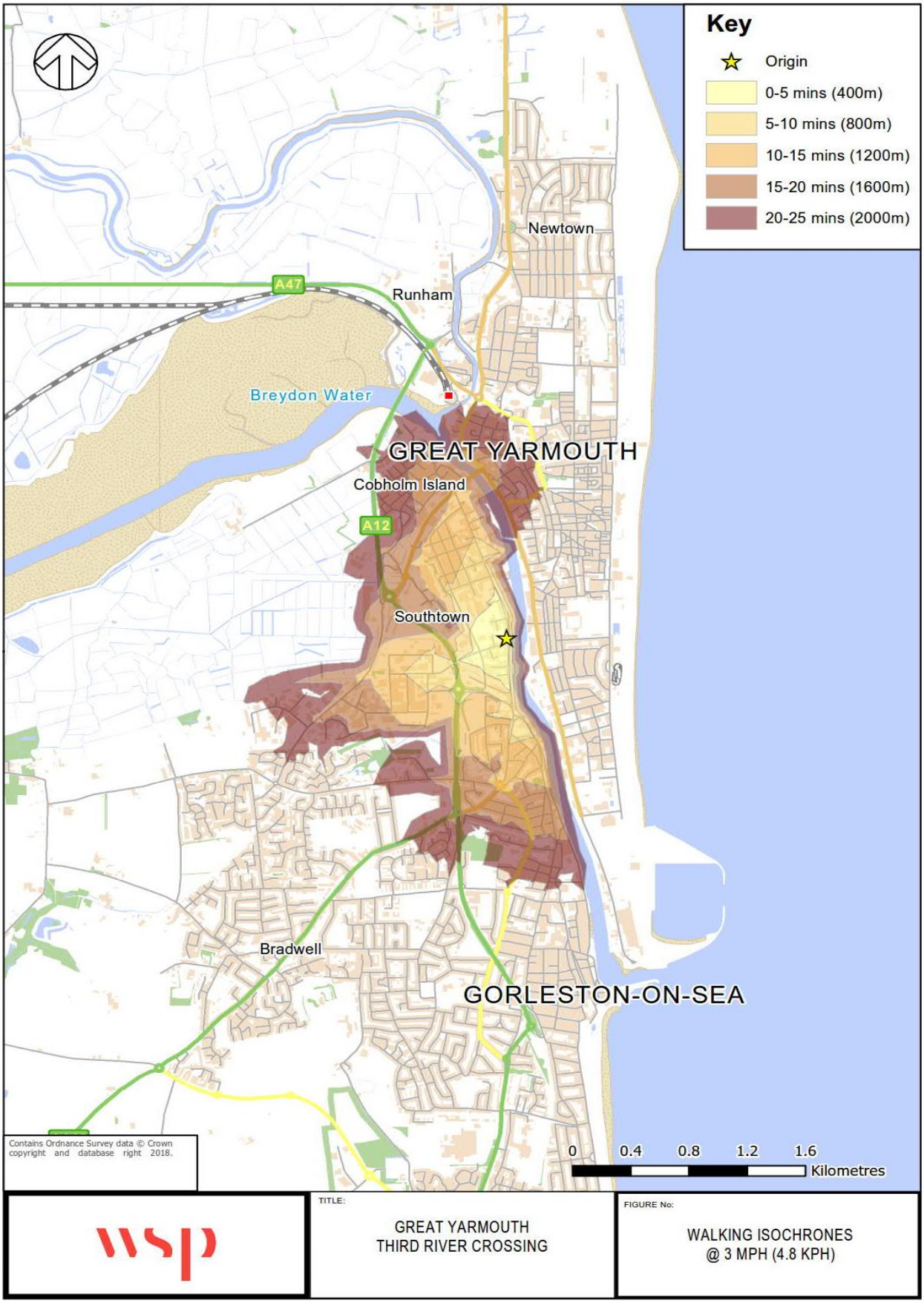

Figure 15 – Walking Isochrones

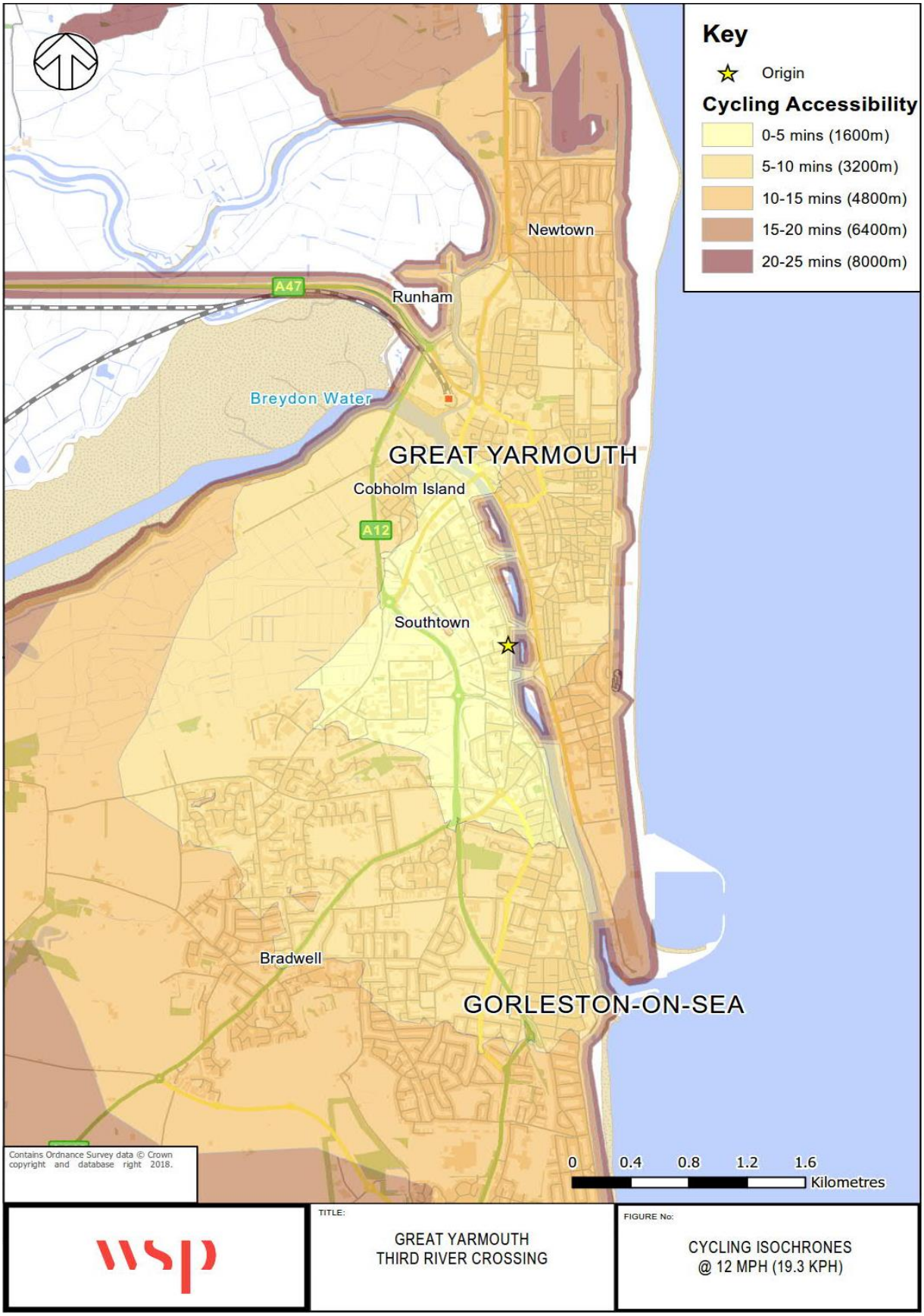

Figure 16 – Cycling Isochrones

4.5.4. Figure 15 above shows that despite the relatively short “crow fly” distance to the South Denes Peninsular, Great Yarmouth Town Centre is only just accessible within a 25 minute walk. Figure 17 above shows that despite the relatively short “crow fly” distance between the east and west sides of the River Yare at the location of the proposed scheme, the current cycle time is approximately 15 to 20 minutes.

PEDESTRIAN NETWORK

4.5.5. The pedestrian network along the eastern bank of the River Yare is adequate, with footways generally provided on both sides of the A1243. Along South Quays Road the footways are generally between 1.5m and 2.0m in width, however as you travel further south these become very narrow, with footways of between 1.0 and 1.5m in width on both sides of Southgates Road and South Denes Road. South of Hartman Road there is also large stretches South Denes with no footway provision.

4.5.6. On the western side of the river, the pedestrian network is less comprehensive with no public realm space or footway directly alongside the river due to the existing industrial units that occupy this space.

4.5.7. On Southtown Road, which runs parallel to the River Yare, there are footways of between 1.2 to 1.5m on both sides the carriageway and at the signalised junction of William Adams Way / Beccles Road / Southtown Road there are pedestrian crossing facilities. To the south of Southtown Road there is limited footway provision along Malthouse Lane and Riverside Road.

4.5.8. Footways of about 2m in width are provided along the south side of William Adams Way, however at the A47 / William Adams Way roundabout, only informal pedestrian crossing facilities are provided. There is a ramped pedestrian and cycle bridge on William Adams Way which provides access to Suffolk Road and Queen Anne’s Road.

4.5.9. Haven Bridge is the main crossing for pedestrians travelling between Gorleston and Great Yarmouth. Footways of approximately 2m in width are provided on Bridge Road on approach and across the River Yare on both sides of the carriageway. Breydon Bridge to the north has no footways and is not considered suitable for use by non-motorised users due to the 50mph speed limit.

4.5.10. To understand existing pedestrian use of Haven Bridge a Non-Motorised User Audit Survey was undertaken in 2016, this found that there is typically 4,700 pedestrian crossing movements across Haven Bridge each day. The typical weekday pedestrian flow across Haven Bridge is summarised in Table 7 below.

Table 7 – Pedestrian trips over Haven Bridge (typical weekday from 7 AM to 7 PM)

	Haven Bridge
	Pedestrian Trips
Eastbound	2,443
Westbound	2,299
Total	4,742

4.5.11. Surveys undertaken as part of the Non-Motorised User Audit Survey in Great Yarmouth found that a significant proportion of home to work journeys within the town are short trips undertaken at morning peak times with return journeys at evening peak times. The busiest time for pedestrian activity at Haven Bridge is during the evening peak period, reflecting its use for journeys to and from work.

Table 8 – Pedestrian trips at peak periods, Haven Bridge

	Haven Bridge	
	Pedestrians Trips	Percentage of Daily Trips
07:00-09:00	581	9%
16:00-18:00	848	16%

CYCLE NETWORK

4.5.12. Great Yarmouth's cycle network, as shown in Figure 17, comprises sections of National Cycle Network (Routes 30 and 517) and the Regional Cycle Network, as well as other signposted on-road cycle routes (referred to as pedalways), advisory cycling routes and some traffic free cycle routes.

4.5.13. Exiting opportunities for cyclists to cross the River Yare is limited. The Breydon Bridge has designated cycle lanes on either side of the carriageway, however, these are unsegregated and pose a risk to cycle users due to the nature of the road (50mph speed limit). The Haven Bridge has a shared use path leading up to it on either side of the river as part of the National Cycle Network Route 517, however, there is no provision on the crossing itself and cycle users have to dismount.

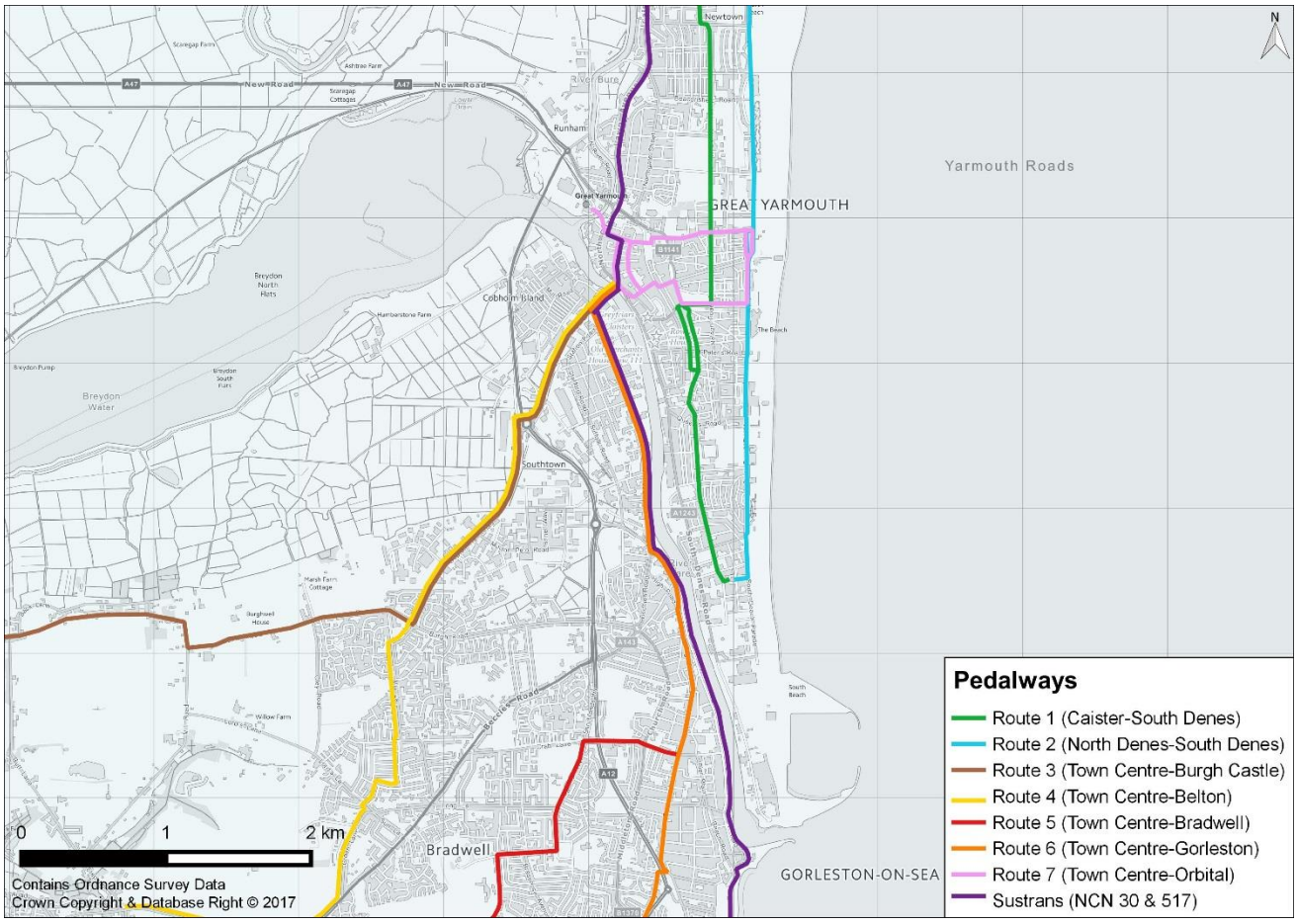

Figure 17 – Cycle network

4.5.14. Along the east bank of the River Yare, there is a wide segregated footway/cycleway along the western side of A13243 South Quay between Haven Bridge and Nottingam Way. South of Nottingham Way and towards the location of the proposed scheme there is no designed cycle route or infrastructure along the A1243. Pedalway Route 1 runs parallel to the A1243 along Blackfriars Road, Camden Road and Admiralty Road and connects with Pedalway Route 2 which runs along the beach front. This route is principally on-street along quieter residential with limited provision for cyclists.

4.5.15. Opposite the Haven Bridge, there is a dedicated cycle lane on Regent Street (Pedalway Route 7) which provides cycle access to the town centre. To the north of Haven Bridge, an on-road cycle route starts at Stonecutters Way and runs through to George Street, and The Conge, before linking in with National Cycle Route 30 at the North Quay junction.

4.5.16. On the western side of the River Yare, Southtown Road is designated as National Cycle Network Route 517, it is non-segregated apart from a section close to the Pasteur Road junction. The route continues on to Malthouse Lane and Riverside Road before reaching Gorleston. Pedalway Routes 5 and 6 follow the same route before turning on to Ferry Hill at the Riverside Road junction towards Bradwell and Gorleston respectively. Pedalways Routes 3 and 4 follow Pasteur Road on an off-carriageway footway/cycleway from Haven Bridge before continuing on to Gapton Hall Road towards Burgh Castle and Belton.

4.5.17. A non-motorised user survey of Haven Bridge found that on a typical weekday, there are 1,056 cycle crossing movements across Haven Bridge each day. The typical flow of cyclists across Haven Bridge on weekday is summarised in Table 9 below.

Table 9 – Cycle trips over Haven Bridge (typical weekday from 7AM to 7PM)

	Haven Bridge
	Cycle Trips
Eastbound	533
Westbound	523
Total	1,056

4.5.18. Surveys undertaken as part of the Non-Motorised User Audit Survey in Great Yarmouth found that a significant proportion of home to work journeys within the town are short trips undertaken at morning peak times with return journeys at evening peak times. The busiest time for cycle activity at Haven Bridge is during the evening peak period, reflecting its use for journeys to and from work.

Table 10 – Cycle trips at peak periods, Haven Bridge

	Haven Bridge	
	Cycle Trips	Percentage of Daily Trips
07:00-09:00	206	17%
16:00-18:00	261	21%

4.6 EXISTING PARKING FACILITIES

4.6.1. Great Yarmouth Borough Council operates 36 car parks, of which 22 are pay and display. In the car parks located in the town centre, long-term parking is discouraged in order to maximise usage.

4.6.2. There are 955 free and 2,549 charged off-street parking spaces within the borough. The locations of these car parks are shown in Figure 18 below.

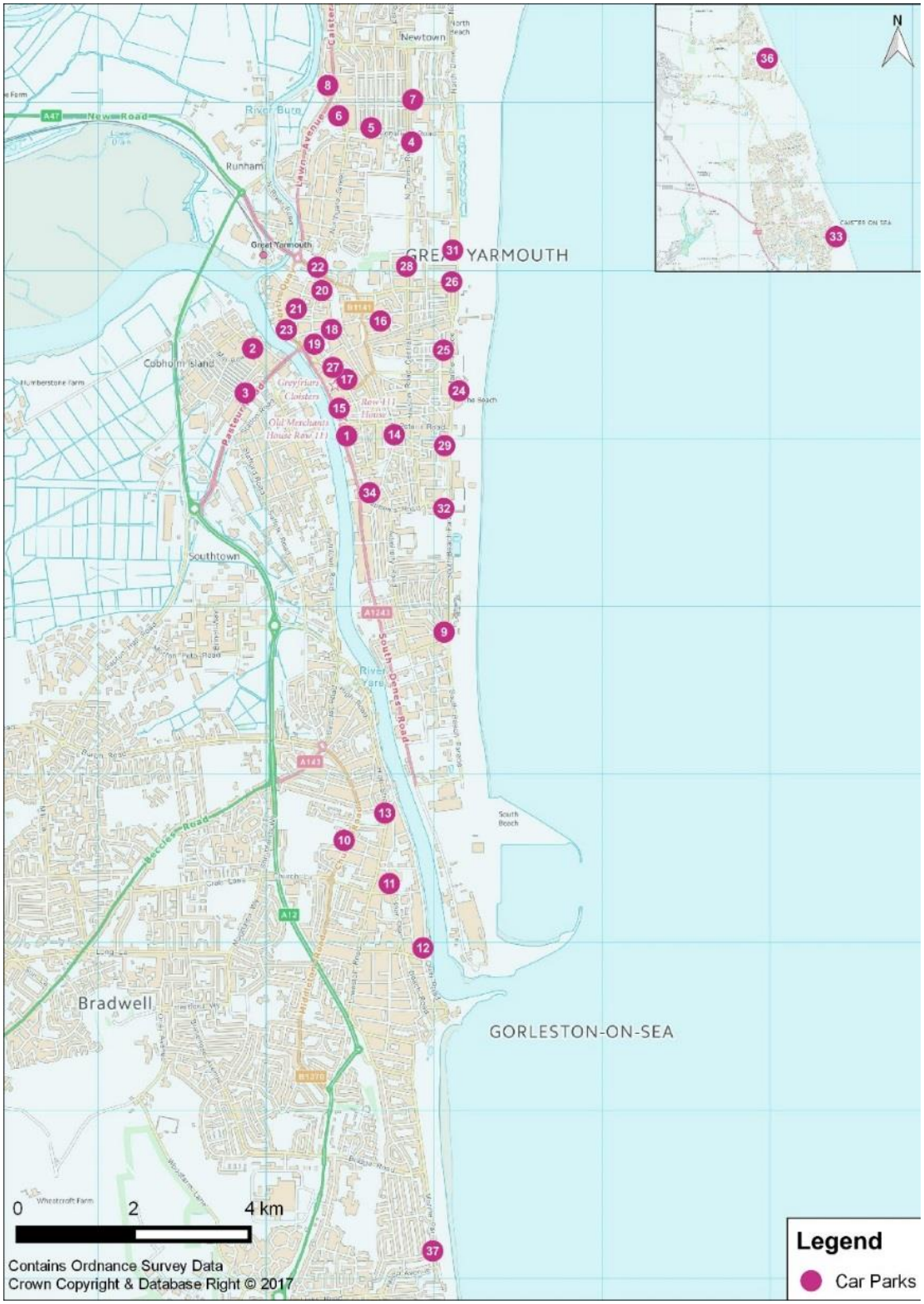

Figure 18 – Car parks

4.6.3. An audit of car parking spaces of Great Yarmouth Controlled Parking Enforcement Area was undertaken by Great Yarmouth Borough Council Car Parking Strategy Steering Group in 2013. This identified a total of 3,098 spaces in car parks and 3,051 spaces on street. The Great Yarmouth CPE area is shown in Figure 19 below and a breakdown of the total number of car parking spaces in the CPE area is provided in Table 11 below.

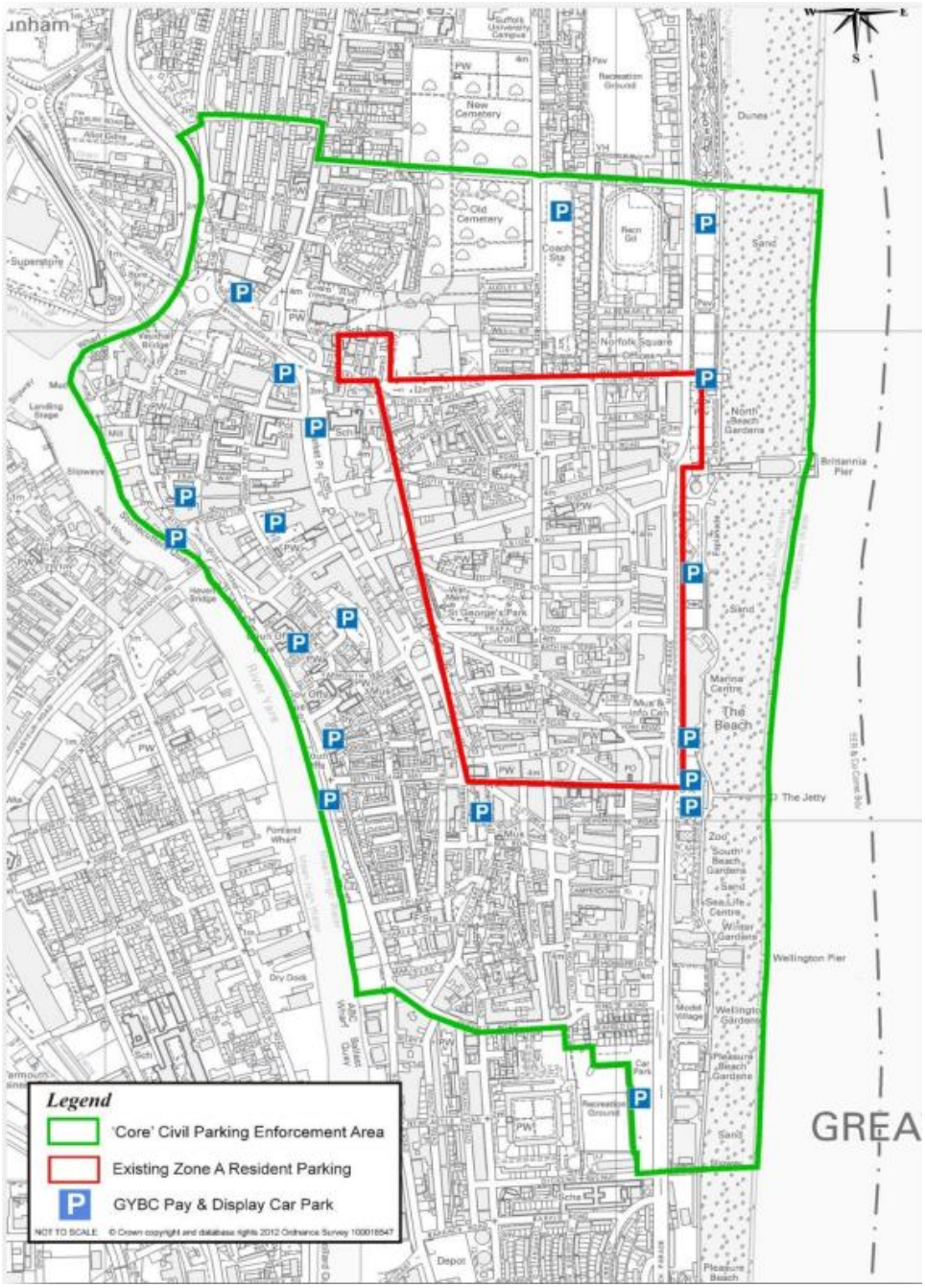

Figure 19 – Car parks

Table 11 – Car Parking Audit

Car Parking Audit Results (Core CPE Area)	
Pay and Display	
Town Centre	881
Sea Front	945
Free Parking	
Town Centre	57
Private Parking	3,098

Car Parking Audit Results (Core CPE Area)	
On Street Parking	
Town Centre	1,265
Sea Front	1,786

4.6.4. A residents parking scheme is in place by Great Yarmouth Borough Council to help residents in Great Yarmouth park within close proximity to their homes. It only applies to residents of certain streets and designated areas in the town centre and permits are provided for an annual fee with only one permit per household allowed. Non-residents can buy vouchers that allow them to park in shared use parking bays between 9am and 4pm.

4.6.5. Car parking is prohibited along the majority of Southtown Road, enforced by double yellow lines, with the exception of a small stretch (approximately 100m) of space for on street residential parking between the Waveney Road and Queen Anne's Road junctions.

4.6.6. On South Denes Road, there are designated bays for residential parking to the north of the Friar's Lane junction. There is also a stretch of approximately 150m south of the Newcastle Road junction which allows free on-street parking on the eastern side of South Denes Road without a residents permit, however, for the most part, on-street parking is prohibited along South Denes Road and is enforced by double yellow lines.

4.7 ACCIDENT RECORD

4.7.1. In the five years from 2011 to 2015, there were 394 recorded collisions in the Great Yarmouth area, involving 489 casualties.

4.7.2. Of the 489 casualties, 99 (20%) were pedestrians and 50 (10%) were cyclists with 72 casualties (15%) involving motorcycle accidents. There are clusters of accidents on the approaches to the existing bridges, including at North Quay.

4.7.3. Figure 20 below shows the locations of all injury collisions in the study area in the five year period 2011 to 2015. Table 12 below details the collisions on key links and junction during the six years to the end of October 2016.

Table 12 – Collisions (Nov 2010 – Oct 2016)

Location	Fatal	Serious	Slight	TOTAL	Peds	Cyclists
Links						
Pasteur Road and Bridge Road	1	4	6	**11**	4	4
Southtown Road	0	5	21	**26**	4	8
South Quay and Southgates Road	0	0	14	**14**	2	2
William Adams Way	0	0	1	**1**	0	0
A47 (Formally A12)	0	0	6	**6**	0	0
Junctions						
A47 / Pasteur Road	0	0	9	**9**	0	0
A47 William Adams Way	0	0	16	**16**	0	0
Pasteur Road / Southtown Road	0	0	2	**2**	1	0
Bridge Road / Hall Quay	0	0	6	**6**	2	0
Southtown Road / William Adams Way	0	1	1	**2**	0	1

4.7.4. On Pasteur Road and Bridge Road, accidents are grouped around the Pasteur Road/Thamesfield Way roundabout and the Bridge Road link between Southtown Road and Hall Quay signals. Of most concern is the prevalence of accidents on Bridge Road. Six of these involved vulnerable road users suggesting problems in this motor vehicle dominated environment around the existing crossing of the River Yare.

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

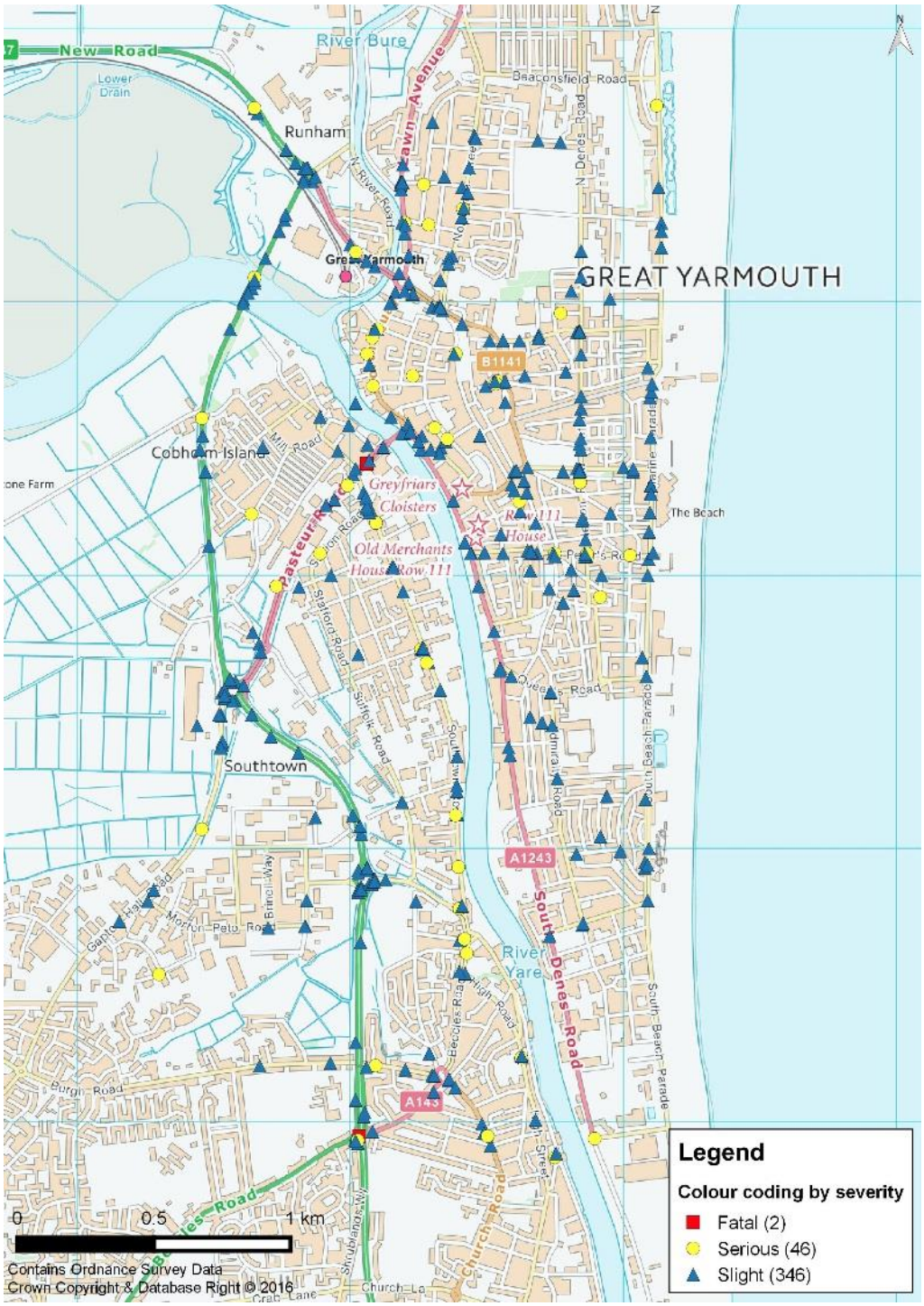

Figure 20 – Collisions 2011-2015

4.8 CRITICAL LINKS AND JUNCTIONS

4.8.1. The OBC (2017) identified the main transport-related problems which the scheme is designed to address:

- Inadequate access to employment areas and the harbour
- Traffic congestion, resulting in queuing and delays to journeys
- Difficulty in accessing the town centre, seafront and leisure facilities
- Inefficient and indirect bus services into the southern part of the peninsula
- Lack of direct walking and cycle routes into the southern part of the peninsula
- Community severance
- Impact of traffic on historic areas
- Impact of traffic on local air quality and CO2 and greenhouse gas emissions
- Road accidents
- Lack of resilience in the local road network.

4.8.2. As noted in the OBC, a survey of local residents had identified traffic congestion as the most serious transport problem to be tackled, by a considerable margin, as illustrated in

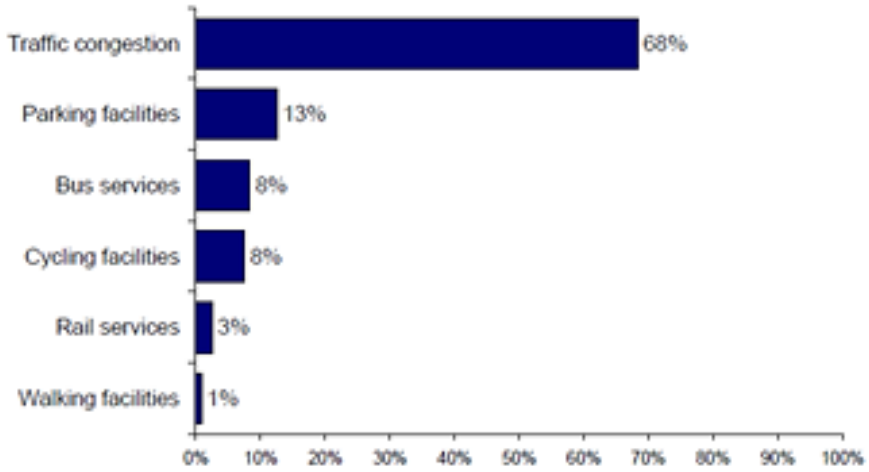

Figure 21 - Residents' survey on aspects of transport most important to improve

As it can be quite difficult to measure congestion in absolute terms, a range of survey results, open source data, and model investigations were used to illustrate the severity of queuing and delay on town centre roads. Taken together in the OBC, these provided evidence that congestion is a very real problem for people in Great Yarmouth, not just a perception.

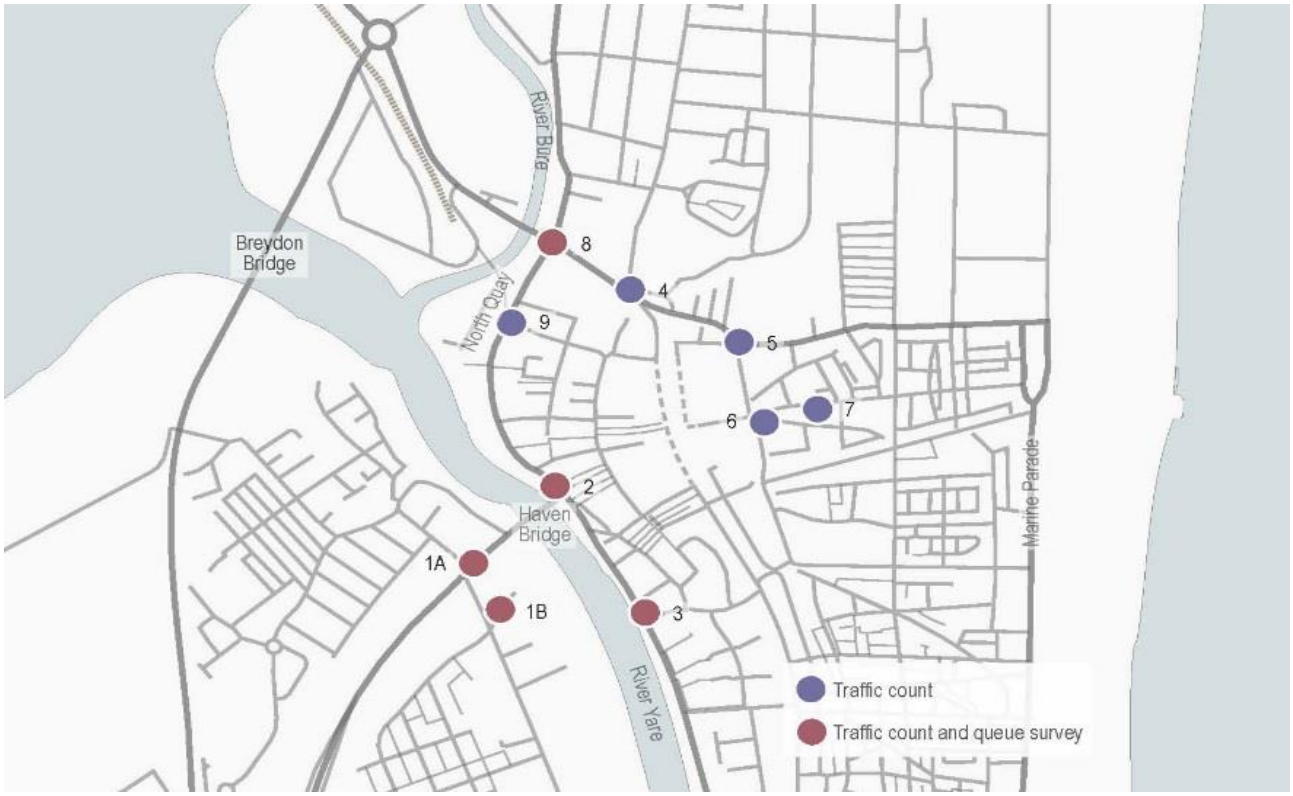

Figure 22 - Traffic counts and queue survey locations, 2015

Detailed classified traffic counts and queue length surveys were undertaken at key locations in the vicinity of the Haven Bridge and town centre on Thursday 15 October 2015 and 8 March 2018. The survey locations are shown in Figure 22 above and the observed maximum queue lengths are set out in Table 13.

Table 13 - Maximum queue lengths observed (metres)

Location	Direction	October 2015	March 2018
1A	From Pasteur Road	>150	>150
1A	From Bridge Road	>150	124
1A	From Southtown Road	100	110
2	From North Quay	127	73
2	From South Quay	>150	74
2	From Bridge Road	142	>150
3	From the north	137	>150
3	From the south	92	68
8	From Acle New Road	>150	88
8	From North Quay (north)	>150	>150
8	From Fullers Hill	40	39
8	From North Quay (south)	>150	72

4.8.3. This queuing is associated with the high volumes of traffic using the Haven Bridge and nearby roads, as shown in Table 14 below.

Table 14 – Two-way traffic volumes of 12 hrs (7 am – 7 pm)

Location	October 2015	March 2018
A1243 Haven Bridge (across River Yare)	22,513	22,354
South Quay, south of Haven Bridge	19,697	23,308
North Quay, north of Haven Bridge	11,709	13,436
Acle New Road (across River Bure)	22,226	24,746
Fullers Hill	9,316	9,392
Temple Road	21,816	No data

4.8.4. Journey times are significantly longer in peak periods than in the off-peak. Open access mapping data was used to compare journey times on various routes at different times of the day in November 2016. The start and end points of these routes, all of which cross Haven Bridge, are illustrated in Figure 23 and the difference between peak and off-peak journey times is set out in Table 15.

Figure 23 - Journey time start/finish locations

Table 15 - Journey times (from open source data)

	To:	To E			To F			To G			To H		
From:		AM	OP	PM	AM	OP	PM	AM	OP	PM	AM	OP	PM
E	Minutes				14	10	12	10	7	8	14	12	14
	% over OP				40%		20%	43%		14%	17%		17%
F	Minutes	7	7	8				6	6	7	5	5	5
	% over OP	0%		14%				0%		17%	0%		0%
G	Minutes	6	6	7	6	6	7				8	8	9
	% over OP	0%		17%	0%		17%				0%		13%
H	Minutes	9	9	10	6	5	9	10	9	14			
	% of OP	0%		11%	20%		80%	11%		56%			

4.8.5. A similar exercise was undertaken for routes using the Breydon Bridge and the results were set out in the 2016 Options Assessment Report[18].

4.8.6. The microsimulation model of Great Yarmouth, developed for the final phase of option assessment provides, a further insight into the location of congestion hotspots in and around the town centre. Figure 24 is a congestion "heat map" for the calibrated base year (2016) model, providing a snapshot of the locations and intensity of congestion on the local road network in the morning peak period.

[18] OBC supporting document 1

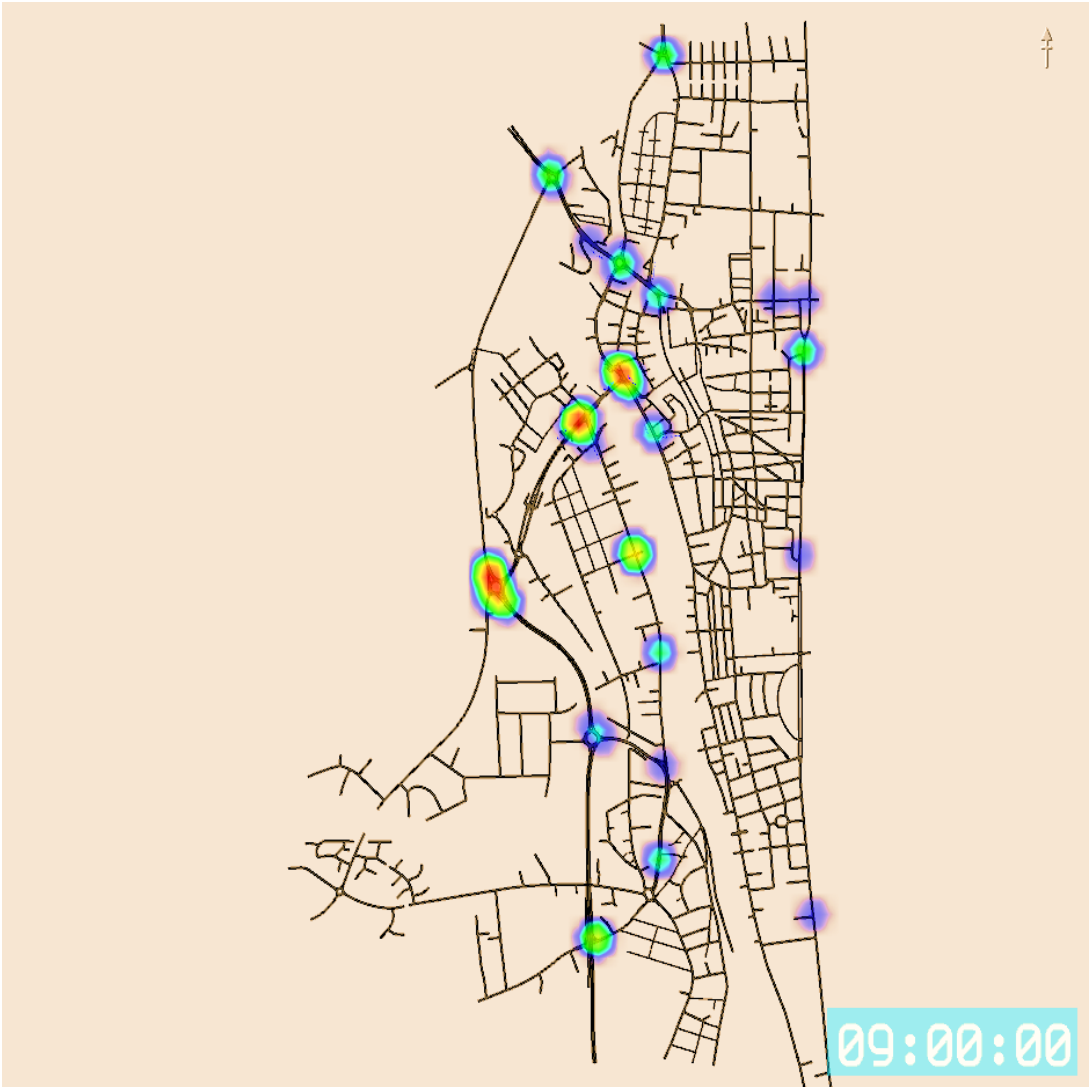

Figure 24 - Congestion "heat map" AM peak 2016 (from PARAMICS microsimulation model)

4.8.7. Because the heat map can only represent an instant of time, it should be seen as illustrative only, but it does give a further insight into which parts of the network are affected most by congestion. The results from the microsimulation model generally correspond with other surveys and anecdotal reports of congestion.

Figure 25 - Congestion on approach to Haven Bridge

4.8.8. Congestion is a problem in peak periods throughout the year, but also occurs during the summer when many tourists visit the town centre, pleasure beach and seafront attractions. An estimated 4 million people visit the resort every year, including about 1 million staying visitors per year with an estimated visitor spend of £398 million19. Seasonal events, such as festivals, fireworks displays and horse races are all associated with increased congestion and traffic delay. On days with especially fine weather, increased numbers of day trippers add to the traffic demand and congestion. The raising of the bridges to allow shipping to pass through creates further significant delays and long queues which can take a very long time to clear. The proposed third crossing, whilst also a lifting bridge, will provide additional network capacity, reducing overall traffic on Haven Bridge and the build-up of queues – in effect increasing resilience.

4.8.9. Critically, congestion at the bridges makes it difficult to provide adequate access to the important employment areas in the South Denes Enterprise Zone, including the new deep water outer harbour.

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

FURTHER WORK TO BE UNDERTAKEN FOR THE FINAL TA

4.8.11. The above section describes existing problems. The final TA will provide more detail on critical links and junctions, in particular those which are likely to experience increases in traffic as a result of the scheme. This will provide the basis for the assessment – using the transport models which are being updated in 2018 and the final scheme design – of the full impacts of the scheme and the identification of any mitigation needed.

[19] 2011 Statistics, Local Plan Core Strategy, Great Yarmouth Borough Council

4.9 CURRENT PEAK PERIODS

4.9.1. Peak hours have been determined from a review of all survey data:

- Morning peak 08:00 – 09:00;
- Inter-peak 13:00 – 14:00;
- Evening peak 16:30 – 17:30

4.10 OTHER PLANNED TRANSPORT IMPROVEMENTS

4.10.1. This section is based on information available at the time the OBC was submitted and will be updated for the final TA.

4.10.2. The County Council is aware that Highways England (HE) is consulting on possible improvements to junctions on the A47 Trunk Road (formerly the A47/A12 junction enhancements scheme) as part of the government's Road Investment Strategy for 2015-2020 (RIS 1). Two locations in Great Yarmouth (Illustrated in Figure 26) are being considered:

A47 Vauxhall Roundabout and station approach.

- Enlarged roundabout
- Widening and realignment of approaches
- Possible improvements for non-motorised users
- Minor improvements to existing layout and signals, and reinstated right turn at Station Approach (now complete and expected to be open to traffic ###)

A47 Gapton Roundabout

- Signalisation of roundabout
- Possible improvements for non-motorised users

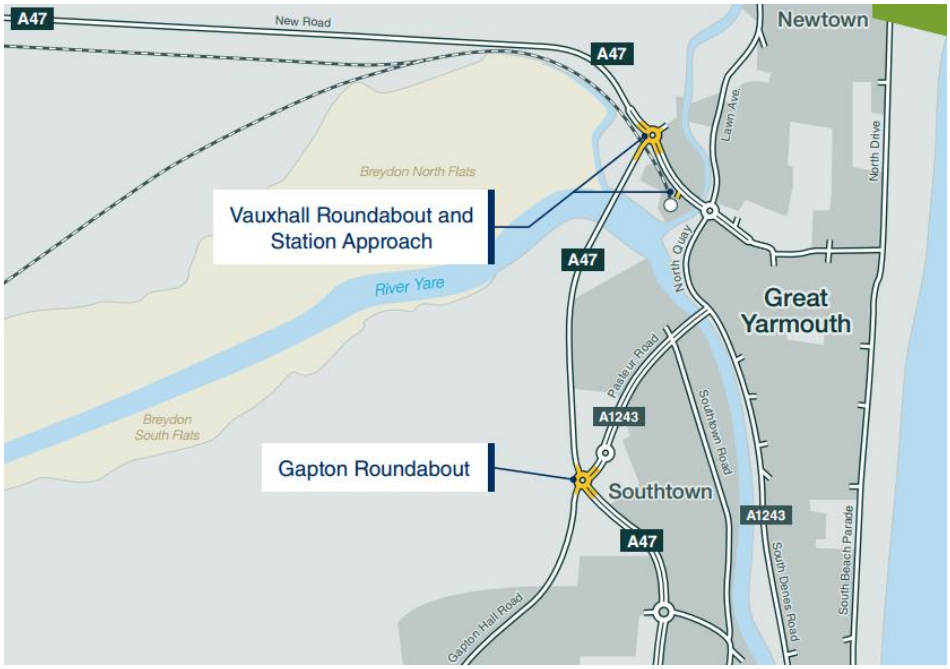

Figure 26 - Planned RIS - 2 junction improvements (Source: HE)

4.10.3. Subject to the consultation and further work to determine whether there is a compelling case for improvement, HE could announce a preferred route for these improvements in late 2017 and start the pre-application stage of the development consent process, leading to a start of construction in 2020.

4.10.4. Although there is no inter-dependence between these RIS 1 schemes and the proposed Third River Crossing, the County Council will liaise very closely with HE as their respective projects are developed and taken forward.

A47 HARFREY'S ROUNDABOUT

4.10.5. Highways England had also been considering improvements to Harfreys, Bridge Road and James Paget junctions on the A47, but their assessments have not identified improvements at these locations that would offer good value for money. HE have therefore removed these junctions from the current consultations but is keeping them under review[20].

LEP FUNDED ENHANCEMENTS

4.10.6. The New Anglia Local Enterprise Partnership Growth Deal allocation for 2016 to 2021 includes £9m funding for Great Yarmouth to help tackle congestion and create attractive alternatives to the car by improving facilities for public transport users, walking and cycling.

4.10.7. NCC, working with partners, is leading the development of these enhancement projects. Improvement schemes for Fuller's Hill roundabout, The Conge and access to the railway station are finished or currently under construction, and an evaluation of improvement packages for sustainable transport schemes is currently underway.

4.10.8. The development of all schemes has involved widespread consultation and engagement with local stakeholders and wherever possible this has been combined with the consultation and engagement activities undertaken on the third river crossing.

4.10.9. These schemes will, however, be delivered independently of the Great Yarmouth Third River Crossing, and have been included where appropriate in the "Do Minimum" scenarios.

4.11 CURRENT NOISE AND AIR QUALITY ISSUES

4.11.1. Refer to the Preliminary Environmental Impact Report (PEIR)

4.12 BASELINE CARBON EMISSIONS

4.12.1. Refer to the Preliminary Environmental Impact Report (PEIR)

[20] Improving the A47 – Great Yarmouth junction improvements: Public consultation. (Highways England, March 2017)

5 THE PROPOSED SCHEME

5.1.1. For details of the proposed scheme, to which this assessment applies, please see Chapter 2 of the PEIR. This section will be updated within the full Transport Assessment.

6 ASSESSMENT METHODOLOGY

6.1 INTRODUCTION

6.1.1. This section describes the methodology which will be used to assess the transport impacts of the scheme for the full Transport Assessment.

6.1.2. For details of the proposed scheme, to which this assessment applies, please see Chapter 2 of the PEIR.

6.1.3. The methodology has been discussed and agreed in principle with NCC Development Control, and takes into account feedback received from DfT on the modelling and appraisal work submitted with the OBC.

6.1.4. At the time of writing this PTA the agreed updates to the modelling work have not yet been completed, and the results of the new assessment are not available. For this reason, the PTA makes reference to the key conclusions drawn from the modelling undertaken at the OBC stage. It is considered unlikely that the new modelling work will lead to significantly different conclusions, but it will enable a more detailed assessment to be presented in the full Transport Assessment.

6.2 OVERVIEW OF AGREED METHODOLOGY

6.2.1. To support the OBC, extensive transport modelling and appraisal work was undertaken in order to select a preferred option, forecast the likely scheme impact and quantify its benefits.

6.2.2. This included the development of a tiered modelling approach, including

- a SATURN model (used for strategic analysis and to feed into the economic appraisal)
- a Paramics Discovery model (used in the option selection process and to forecast operational performance in more detail).

6.2.3. It has been agreed with NCC Development Control that a similar approach should be taken for the full Transport Assessment. Both models will be updated and re-run with some refinements including:

- Update the modelling with a 2018 base year (the OBC modelling used a 2016 base year)
- Review and update assumptions on committed developments and infrastructure
- Review and update the bridge opening schedule for the scheme in both models to ensure consistency
- Use the updated SATURN model to update the economic appraisal and calculate an updated BCR
- Input flows from the updated SATURN model into an updated Paramics Discovery model
- Make further refinements to the Paramics Discovery model to ensure good validation against additional traffic flow data to be collected in March 2018

6.2.4. The updated Paramics Discovery Model will then be used to assess the impact of the scheme on the local highway network, focussing on the anticipated opening year of 2023 and covering the area shown in Figure 27 below:

On the evidence of the earlier work, the overall impact of the scheme will be to reduce traffic on existing roads. The main exception will be roads in the immediate vicinity of the scheme, where traffic could increase, and

where physical changes will have been made to the existing roads and junctions to accommodate the scheme. Careful consideration has been given to the design of these tie-ins to minimise the risk of excessive queuing and delay. These parts of the network will be examined in greatest detail in the full TA. If required, detailed modelling will be undertaken using specialist tools such as LinSig and detailed junction models.

6.3 DETAILED METHODOLOGY: STRATEGIC MODELLING

THE SATURN MODEL

6.3.1. The Great Yarmouth Traffic Model (GYTM) is based on a SATURN model originally built by Mott MacDonald in 2008. This was recalibrated to create a new 2016 base model for the OBC. Subsequently, it was updated to represent the 2018 traffic conditions.

6.3.2. The first updating of the model included:

- Reviewing the network structure, taking account of changes to the highway infrastructure
- Refining the zone structure and zone connectors, especially close to the proposed scheme
- Updating traffic signal timings
- Adding development sites introduced between 2008 and 2016
- Updating demand matrices using new RSI survey and traffic count data

6.3.3. The development, validation and use of the new SATURN model are described in the following reports, provided as supporting documents to the OBC:

- Document 3: Data collection report
- Document 5: Local Model Validation Report (LMVR) (SATURN)
- Document 6: Demand Model Report
- Document 8: Forecasting Report (SATURN)

6.3.4. In order to carry out the most recent update to a 2018 base, changes from 2016 to 2018 in network, land use and traffic flows were analysed. Network and land use changes were provided by NCC. Again this showed minimal changes from 2016. Traffic counts from 2018 were compared to 2016 and the results showed that flows had not increased from 2016 levels. As a result the 2016 network was updated to 2018 and the 2016 demand assigned on it. This was considered to accurately represent the traffic conditions of 2018.

FEATURES OF THE MODEL

6.3.5. The SATURN software employs an iterative process of assigning flows and simulating delay. Within the simulated model area, capacity is restrained at junctions. In line with TAG Unit M2, variable demand modelling (VDM) has been used.

STUDY AREA

6.3.6. The simulation model area covers the whole of the Great Yarmouth conurbation, as shown in **Error! Reference source not found.**.

6.3.7. The simulation area is considered large enough to capture the biggest impacts expected with the scheme, and also includes an area where impacts are quite likely to occur, but are expected to be relatively small.

ZONING

6.3.8. The model comprises 240 zones, with the greatest level of detail being in the town centre and close to the proposed scheme. The zoning structure is illustrated in **Error! Reference source not found.** and is described in more detail in the LMVR.

HIGHWAY NETWORK

6.3.9. The simulation area of the model network is also shown in **Error! Reference source not found.** and described in more detail in the LMVR. All roads outside the core model area are coded as buffer links.

TRAFFIC DATA

6.3.10. Traffic data was obtained from:

- Existing data, including: ANPR, MCC, ATC, queue surveys, Trafficmaster.
- Roadside interview surveys in 2016
- Manual classified counts at over 40 locations in 2016 and at 15 locations in 2018
- Automatic traffic counts at 30 locations in 2016 and at 20 locations in 2018
- Journey time surveys on 8 routes in 2016

6.3.11. The collection and processing of this data is detailed in the Data Collection Report (Supporting document 3).

JUNCTION MODELLING

6.3.12. In order to represent the effects of traffic delay and queues at junctions, junction operation has been modelled in detail within the study (simulation) area.

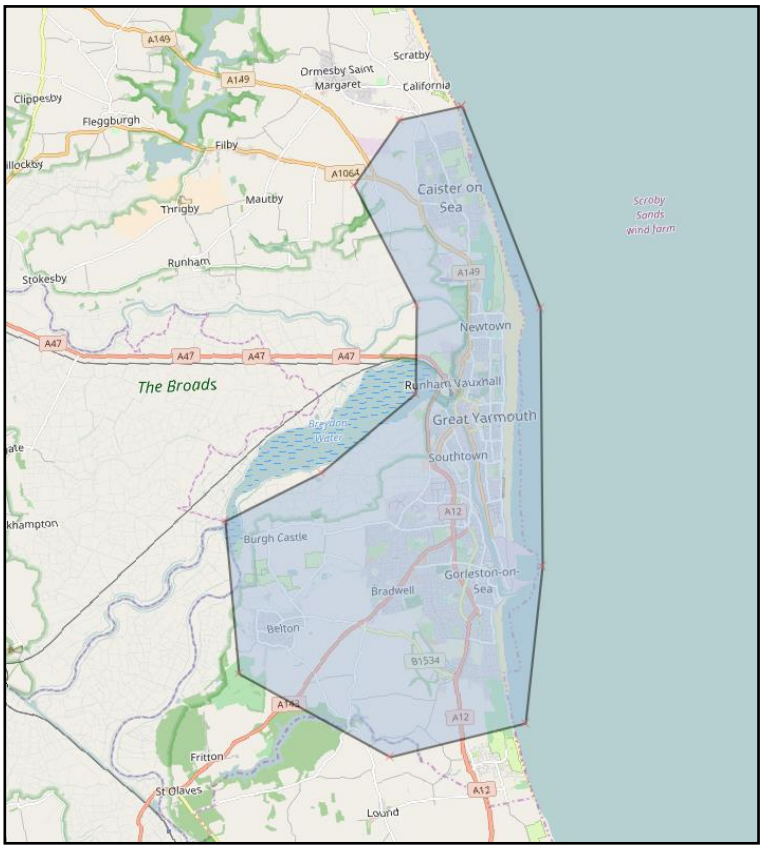

Figure 27 – SATURN model: detailed simulation area

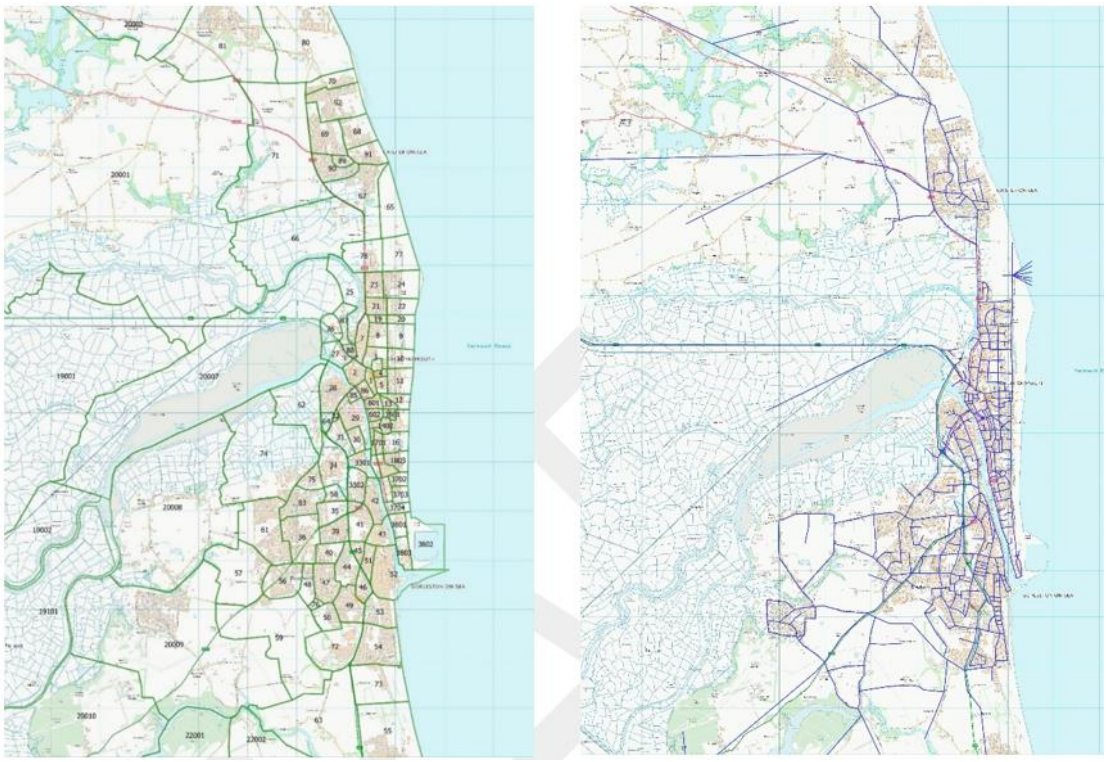

Figure 28 – SATURN model: zoning and highway network

MATRIX DEVELOPMENT

6.3.13. Base year trip matrices were originally developed for 2016. Three time periods were modelled in order to replicate trip patterns over a typical weekday:

- AM Peak hour (08:00 – 09:00)
- PM Peak hour (16:30 – 17:30)
- Average Inter-Peak hour (10:00 – 15:30).

Five user classes have been modelled:

- Cars: employer business
- Cars: commute
- Cars: other
- Light Goods Vehicles
- Heavy Goods Vehicles (OGV1, OGV2 and Coaches).

VALIDATION AND CALIBRATION

6.3.14. The SATURN model used to forecast future travel demand and traffic flows has been constructed in line with WebTAG and has been calibrated and validated to WebTAG criteria.

6.3.15. The development of the base year (2016) traffic model and its validation against observed traffic flows and journey times is fully documented in the LMVR. As described in 6.3.4 above these matrices are deemed to also represent traffic demand in 2018. The changes to the network (updating from 2016 to 2018) will cause some minor changes to the calibration and validation performance. An addendum to the LMVR will be produced in due course.

ADDITIONAL UPDATES TO THE SATURN MODEL

6.3.16. In response to comments received from DfT relating to the model produced for the OBC, an initial review process will be undertaken to increase the level of assurance. This will include:

- Undertaking sector analysis to compare unused RSI movements with SLA from model
- Comparing JTW census data with modelled commute matrices
- Considering recent updates to WebTAG
- Producing a specification for data collection

Also, to update the model for the TA and DCO, the following tasks will be undertaken:

- Verify land use changes
- Identify AADT growth and establish growth factors
- Collect and process survey data
- Update assignment model time and distance parameters
- Update networks and infill matrix with developments
- Process count data
- Compare new 2018 base model against counts to ensure adequate assurance
- Project model based on forecast update
- Iterate through demand model
- Provide data to enable a quantified assessment to be made of the impact of the proposed Scheme on noise and air quality
- Updated economic appraisal

6.4 DETAILED METHODOLOGY: MICROSIMULATION MODEL

6.4.1. The development of the microsimulation model for the scheme builds on previous work undertaken by Mouchel (now WSP) who were appointed by NCC to develop a Paramics Discovery model of Great Yarmouth Town Centre. The aim of the initial model was to test various local congestion relief schemes in the town centre.

6.4.2. In order to provide a model fit for the purpose of assessing the scheme, the initial town centre model was enlarged to include the area shown in Figure 29:

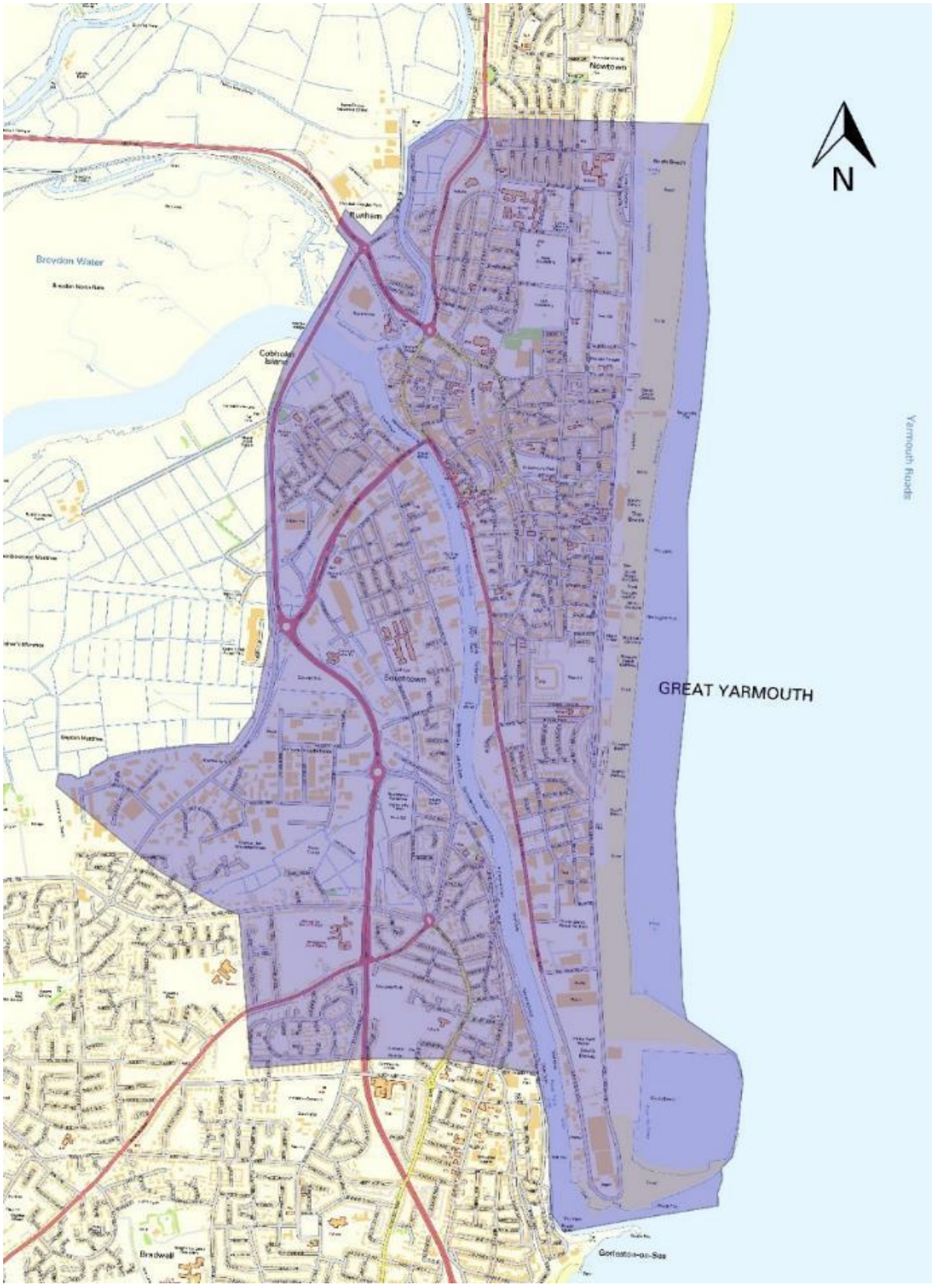

Figure 29 – Microsimulation model: study area

6.4.3. The development of this model is described in detail in the following documents which were submitted with the OBC:

- Document 3: Data collection report
- Document 4: Local Model Validation Report (Paramics)
- Document 7: Forecasting Report (Paramics)

DATA SOURCES

6.4.4. Existing traffic data from a variety of sources was collated and reviewed and this was supplemented by additional data collection commissioned by Mouchel. The final set of data used is shown in Figure 30.

Figure 30 – Final set of traffic counts for modelling and matrix manipulation

6.4.5. Journey time data was also collected from the Highways England Open data website.

PEAK PERIODS

6.4.6. Peak hours were determined from a review of all survey data:

- Morning peak 08:00 – 09:00;
- Inter-peak 13:00 – 14:00;
- Evening peak 16:30 – 17:30

TRAFFIC RELEASE PROFILES

6.4.7. It is important to replicate how traffic demand changes within the modelled period. Paramics Discovery allows replication of the proportion of vehicles released onto the network at 15 minute intervals. This makes it possible to reproduce the demand variation during the simulation, the 'peak within the peak' as well as the build-up and dissipation of queues.

6.4.8. In addition, depending on the land use, the peak demand at each zone may be reached at different hours, for instance, a school zone will be busiest in the 20 minutes before lessons commence. Therefore, where diverse land uses are expected, different release profiles must be built in order to replicate the behaviour of traffic.

6.4.9. The available surveys were used to calculate the release profiles of certain zones located near the junction or roads where the counts were carried out. However, it is impossible to create as many profiles as zones modelled due to the amount of data required to do so, and accordingly, some assumptions must be considered. Thus, the zones without enough traffic data to estimate their profile use one of the 34 existing profiles. These profiles were allocated depending on the land use of the zone and their proximity to the reference zone.

NORMALISATION OF TRAFFIC COUNT DATA

6.4.10. Because the surveys were carried out in different months and years, it was necessary to adjust the traffic data in order to represent a neutral month in 2016.

6.4.11. As a consequence, normalisation factors have been calculated in order to convert the traffic data to a neutral weekday. These factors were calculated using trustworthy, long-term traffic data within, or as near as possible to the study area. Highway England WebTRIS provided the necessary information to carry out the calculation of these factors by means of three permanent traffic counts locations. The factors were calculated for the day of the week, month and year allowing to change the traffic counts from different traffic surveys into an average weekday of 2016.

ROAD NETWORK

6.4.12. The model network was created with reference to Ordnance Survey AutoCAD mapping and as-built drawings provided by NCC. Both sources provide information regarding the physical features of Great Yarmouth highways, and the junction layouts allow accurate replication of stop line positions, signal staging phasing and timing.

6.4.13. Additional information such as speed limits, give-way priorities, banned movements, lane configuration, bus stop locations and vehicle behaviour were gathered from the CAD drawings, satellite and street images.

6.4.14. Paramics Discovery allows different road categories to be modelled which improves the accuracy of route choice. The main link categories are 'Major' and 'Minor' roads. These link types determine the road importance and likely utilisation depending on whether the drivers are familiar or not with the network.

6.4.15. NCC provided traffic signal controller specifications and as-built drawings where the data was available, for twenty-five signal controlled junctions and pedestrian crossings within the study area network. Signal timings for junctions and pedestrian crossings during the modelled periods were calculated using the controller specifications provided. NCC confirmed that most of the junctions run under SCOOT control and timing logs were provided for most junctions

MODELLING THE HAVEN BRIDGE

6.4.16. NCC provided historical data from 2014/15/16 for the number of Haven Bridge lifts per month. A more detailed log from June 16 provides the precise times when the bridge was opened and closed to traffic. It was closed to traffic for durations of between 5 to 10 minutes. The timings in the log file indicate that bridge lifts appear to be concentrated outside the peak hour period, and is likely to be dominated by tidal times.

6.4.17. Table 16 shows the frequency of bridge lifts varies significantly from one month to another. During summer 2015 the frequency was over 40 times per month with a peak of 61 in May. During the winter it was less than 20 times per month.

Table 16 – Haven Bridge: monthly number of lifts in 2015

Month	Total Lifts	Weekday	Weekend
January	13	12	1
February	17	15	2
March	26	21	5
April	41	30	11
May	61	42	19
June	49	32	17
July	49	27	13
August	39	26	13
September	28	19	9
October	20	11	9
November	14	13	1
December	9	8	1

6.4.18. Due to the limited number of bridge openings, and the fact that the port authority generally avoid bridge openings during peak times, Haven Bridge opening was not included in the base year model.

ZONING

6.4.19. The zone system represents specific areas within the model from which trips start and end. Each individual zone has access and egress points where vehicles are 'released' into the network or leave the model. Vehicles make their trip choice through the network based on the driver's perception of cost and then leave the network at their destination zone.

6.4.20. In order to optimise working flows and reduce the differences between the macroscopic and microscopic model, the SATURN model zone plan has been adapted to fulfil the microsimulation level of detail requirements. Therefore, to reach the desired level of detail at this stage of the study, several SATURN zones were split taking account of the following considerations:

- Land use of the SATURN zone:

  When different land uses categories were contained in the same zone, the aim was to split it into as many zones as land uses the main zone contained. The zone analysis was carried out according to TRICS categories.

- Most likely access/egress routes:

When different access and egress points could be reached using different although, not complementary routes, the zone was split in order to avoid reproducing unlikely route choices.

- The proximity of the zone to the future bridge location:

  The closer to the proposed location of the bridge, the more detailed the zones are. Thus, it is possible to replicate in a more realistic and appropriate manner the impacts of the new infrastructure in local movements.

6.4.21. The resulting zone plan is shown in Figure 31:

Figure 31 – Paramics model: zone plan

PUBLIC TRANSPORT

6.4.22. The main bus routes in Great Yarmouth have been included in the model. Information regarding the timetables and routes followed by the different services was obtained from the official sites of public transport operators in Norfolk such as FIRST and Anglian Bus. The location of the bus stop and public transport vehicle types was collected by visual inspection of both Google street view and maps.

6.4.23. After careful examination of the available information, twelve public transport services were modelled along with their complete timetables and bus stops within the study area. The modelled PT routes are shown in Figure 32.

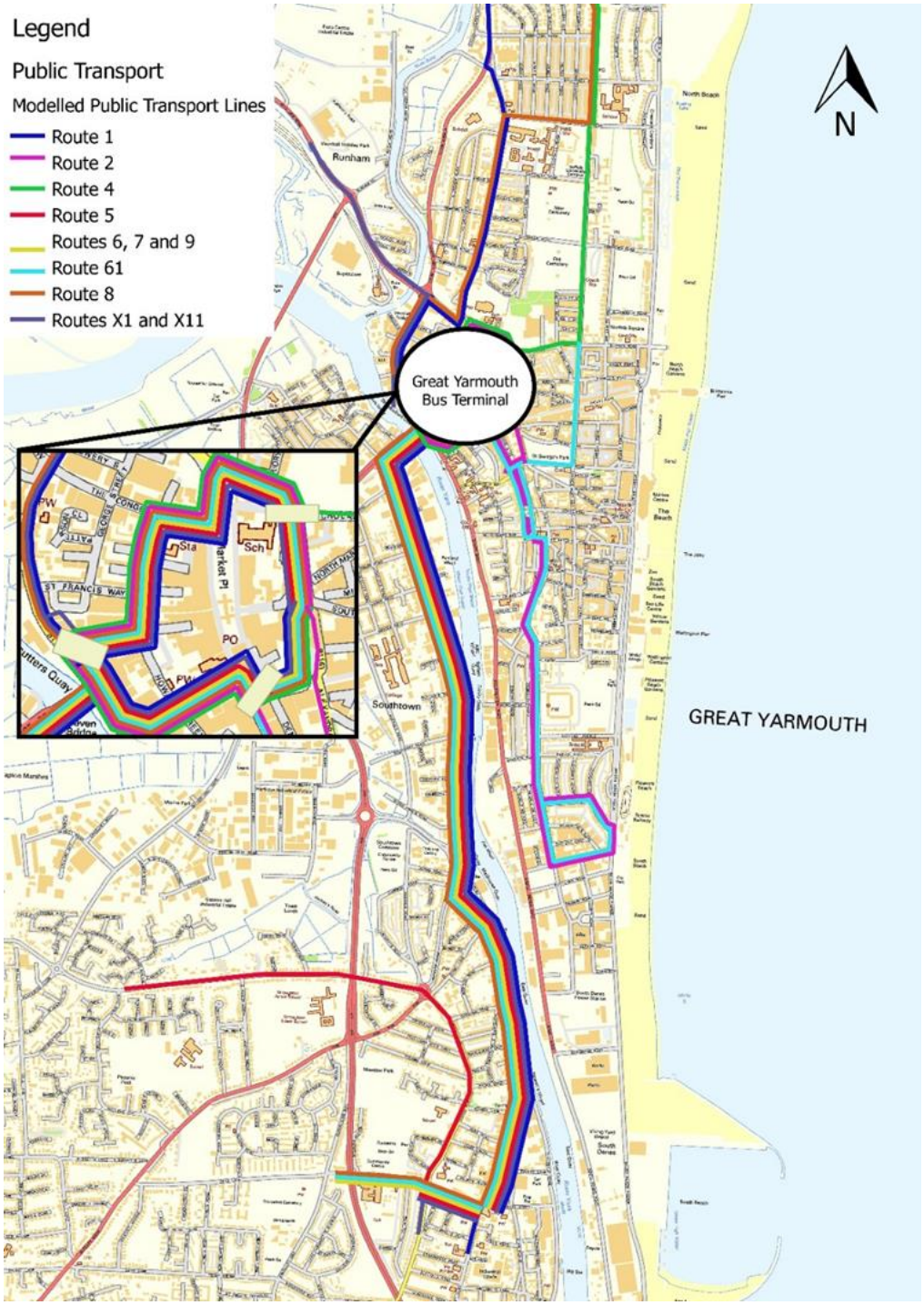

Figure 32 – Public transport lines modelled

Table 17 - Allocated vehicle types

Bus Line	Vehicle Type
2	Single Decker Bus
4	Double Decker Bus
5	Single Decker Bus
6	Double Decker Bus
7	Double Decker Bus
8	Double Decker Bus
9	Double Decker Bus
X1	Double Decker Bus
X11	Double Decker Bus
1	Double Decker Bus
1A	Double Decker Bus

MATRIX DEVELOPMENT

6.4.24. For the OBC, a version of the SATURN model developed by Mott MacDonald was cordoned around the boundaries of the Paramics Discovery model network and the morning and evening peaks, as well as the interpeak matrices, were extracted for all of the user types included in the SATURN model.

6.4.25. The SATURN zone plan was adapted to the requirements of the Paramics Discovery model as described in Chapter 3. It was necessary to estimate the proportion of trips that the split zones represent from the main SATURN zone. This estimation considered the land use of the microsimulation zones and made reference to trip rates derived from the input parameters from the TRICS database (Gross floor area, dwellings, parking lots, etc.).

6.4.26. The SATURN model has 5 user classes. The first three correspond to different purpose car trips. These three matrices were aggregated into one car matrix in order to keep the calibration and validation as simple as possible. The other two SATURN matrices correspond to LGV and HGV traffic.

6.4.27. Where traffic counts were available on boundary links of the microsimulation network, the O-D demand at the zone was factored up to the observed count. The cordoned SATURN matrices were only for one hour, so it was necessary to extend them in order to include the warm-up and cool-down periods. To do so, the traffic surveys are used to estimate the proportion of traffic between the peak hour and the previous and next hour. Next, the warm-up and cool-down matrices were added to the cordon matrix, thus creating the prior matrices for the full three hour period.

6.4.28. The prior matrix was run on the base network to check and adjust network coding. An initial test of validation with the prior matrix was undertaken and the results are set out in Table 18.

6.4.29. This was considered a good result for a prior matrix, nonetheless, in order to improve the accuracy of the model, it was considered necessary to use matrix estimation.

6.4.30. The Matrix Estimation (ME) tool has been used to complete the calibration and validation of the microsimulation model. The traffic surveys have been normalised and included in this process, in order to enhance the estimation results.

Table 18 - Prior Matrix Validation

Matrix	Vehicle type	Count Percentage within 5 GEH	Count Percentage within 10 GEH
AM Prior	CAR	73%	95%
	LGV	94%	100%
	HGV	97%	100%
IP Prior	CAR	68%	92%
	LGV	94%	100%
	HGV	99%	100%
PM Prior	CAR	64%	89%
	LGV	96%	100%
	HGV	100%	100%

6.4.31. The simulation of the prior matrices produced good results in terms of GEH. Nevertheless, the network experienced significant congestion which caused drivers to start using less desirable secondary routes or take long detours instead of the obvious routes along the main roads. An analysis of the prior matrices was undertaken and it was deemed that the demand was too large. The usual practice to produce better matrices in large and/or congested networks is to reduce the prior matrix demand by a percentage and use these matrices in the matrix estimation process. A reduction of 20% was applied to the prior matrices and then, the model was run again in order to generate routeing information which was fed into the matrix estimation process. This method reduces the likelihood of the prior matrix causing unrealistic delays which could then skew the matrix estimation process.

6.4.32. Changes made by matrix estimation to OD zone totals were reviewed after every round of ME in order to check the trips were reasonable for the zones land use and size. The final trip matrices were obtained through the matrix estimation tool of Paramics Discovery using a maximum of one hundred iterations per round of ME.

6.4.33. The ME settings such as the number of iterations, traffic surveys, network delay and constraints were adjusted in order to achieve the optimum balance between changing the prior matrix and matching the traffic counts.

6.4.34. After carrying out the matrix estimation an analysis of the results was conducted through the Data Analysis Tool (DAT), comparing the traffic flows within the network and checking inconsistencies in flow distributions. In addition, the trip length distributions were calculated in order to better understand the variation between the prior and the estimated matrices of the short and long trips.

VALIDATION – MODEL STABILITY

6.4.35. The test for stability for the model was conducted in accordance with the methodology recommended by SYSTRA (formerly SIAS), calculating the confidence interval to estimate the number of runs required. To calculate the confidence interval from a number (N) of randomly seeded runs the t statistic, as well as the Standard Error will be required.

6.4.36. In addition, a confidence level is needed to undertake the calculation; a typical value is 95% which means a significant level of 0.05 (p). Therefore, 95% of the time, the interval constructed would contain the true underlying population mean.

6.4.37. In summary, to demonstrate the stability of the model, the maximum and the minimum of the averages of journey times of each path and run must be included between the upper and lower limits of journey time values of the confidence interval.

6.4.38. The analysis was performed using a confidence level of 95% and 5 model runs. The stability of the model was carried out for AM, PM and IP periods.

6.4.39. Based on the log of 5 model runs, the journey time (JT) statistics along 14 routes were gathered. The average, maximum, minimum and the standard deviation of the journey times were calculated for each route and period.

6.4.40. 81% (34 of 42) of the journey time samples were within their corresponding confidence interval. For the samples which are not within the limits, the differences are all within 0.1 min which means maximum differences of 6 seconds.

PROPOSED UPDATES TO MICROSIMULATION MODELLING

6.4.41. The following tasks will be undertaken to update the Paramics Discovery model for the PTA:

- Update the public transport data in the model to reflect the 2018 conditions
- Process the additional traffic counts and normalise the old and new data to a neutral day of 2018
- Code in network change relating to local schemes which have come forward since 2016
- Update the zone system to ensure consistency with the Saturn model
- Update the release profiles for each zone
- Cordon the updated Saturn model to extract the matrices for the Paramics Discovery model
- Convert the 1 hour matrices of Saturn to the 3 hour matrices needed for Paramics Discovery
- Check the validation of the prior matrices
- If needed recalibrate the model to try to replicate the real conditions
- If needed use matrix estimation to improve the performance of the prior matrices
- If needed refine the recalibration of the model to try to replicate the real conditions.

7 TRANSPORT IMPACTS

7.1 INTRODUCTION

7.1.1. This section describes the expected transport impacts of the scheme.

7.1.2. Because the modelling updates described in Chapter 6 have not yet been completed, and because the design of the scheme is still being refined, this section of the PTA is based on information available from the versions of the models used to produce the OBC in 2017. The full TA will review and if necessary update this information.

7.1.3. The full TA will also present the results of a more detailed assessment of the impacts of the scheme itself, including the performance of links and junctions which are likely to experience significant changes in traffic demand as a result of traffic reassignment. This in turn will form the basis of any proposed mitigation.

7.1.4. Notwithstanding the above requirements, which apply to highway schemes as much as to other major developments, it is important to emphasise that all the work done to date indicates that the scheme will produce a very significant net benefit to the transport network. The scheme will reduce traffic flows and congestion over much of the study area and in particular at the existing Haven Bridge Crossing and in the town centre. This will contribute to the economic benefits (as measures by the BCR) and to the achievement of the schemes objectives.

7.2 SUMMARY OF TRANSPORT RELATED IMPACTS (FROM OBC)

TRAFFIC VOLUMES

7.2.1. The Great Yarmouth Third River Crossing will have a significant and beneficial impact on traffic in the town, and this will give rise to a range of benefits, helping to deliver the scheme's objectives.

7.2.2. The existing bridges will both experience a reduction in traffic – one of the key objectives of the scheme. Table 19 shows the impact of the scheme on bridge crossing flows in 2023.

Table 19 - Forecast traffic changes on all bridges Bridge AADT (from SATURN model)

Traffic flow (2 way) AADT	2023 DM	2023 DS	Difference %
A47 Breydon Bridge	34,846	32,208	-8%
A4123 Haven Bridge	26,186	13,458	-49%
Third River Crossing	-	20,114	-

7.2.3. The most dramatic reduction is in the traffic on Haven Bridge, where there will be a 49% reduction upon the opening of the Third River Crossing – a large beneficial impact which will be felt immediately by people in the town. Of the three bridges, Haven Bridge will in future be the least busy by a significant margin.

7.2.4. Traffic levels will be reduced on key links. **Error! Reference source not found.** shows the forecast changes in t raffic flow in the local road network – comparing "Do Something" (DS) and "Do Minimum" (DM) flows on key links in the opening year 2023 (pm peak).

7.2.5. Whilst there are some increases on the approaches to the new bridge, the general effect is to redistribute traffic between three, instead of two, river crossings, reducing the pressure of traffic in sensitive areas. This will contribute to the achievement of the schemes objectives.

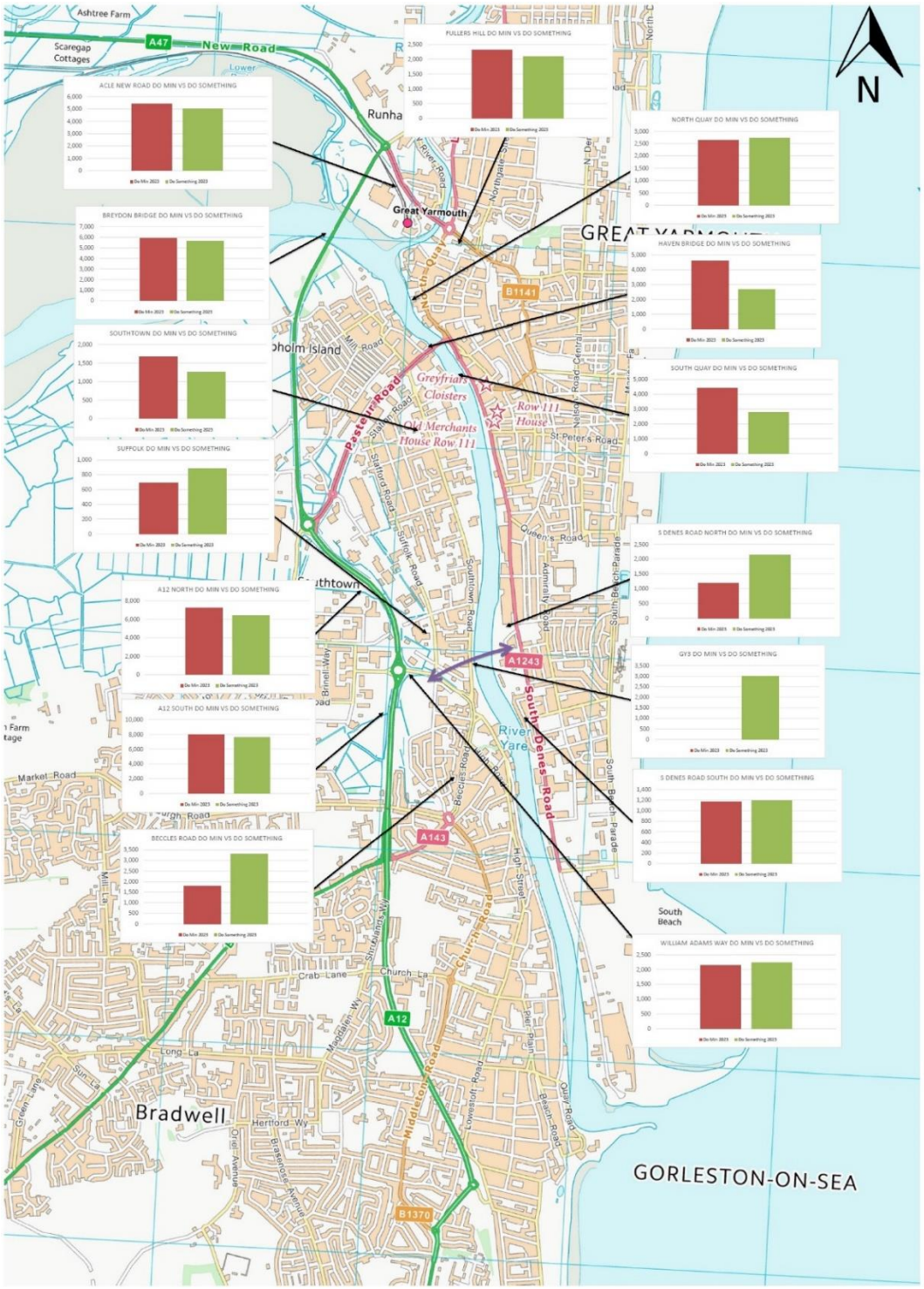

Figure 33 - Traffic flow changes due to the scheme 2023 pm peak

CONGESTION

7.2.6. Congestion will reduce. Figure 34 shows visual representations (heat maps) of predicted congestion in 2038 (PM peak), showing the reduced intensity of congestion hotspots as a result of the Third River Crossing.

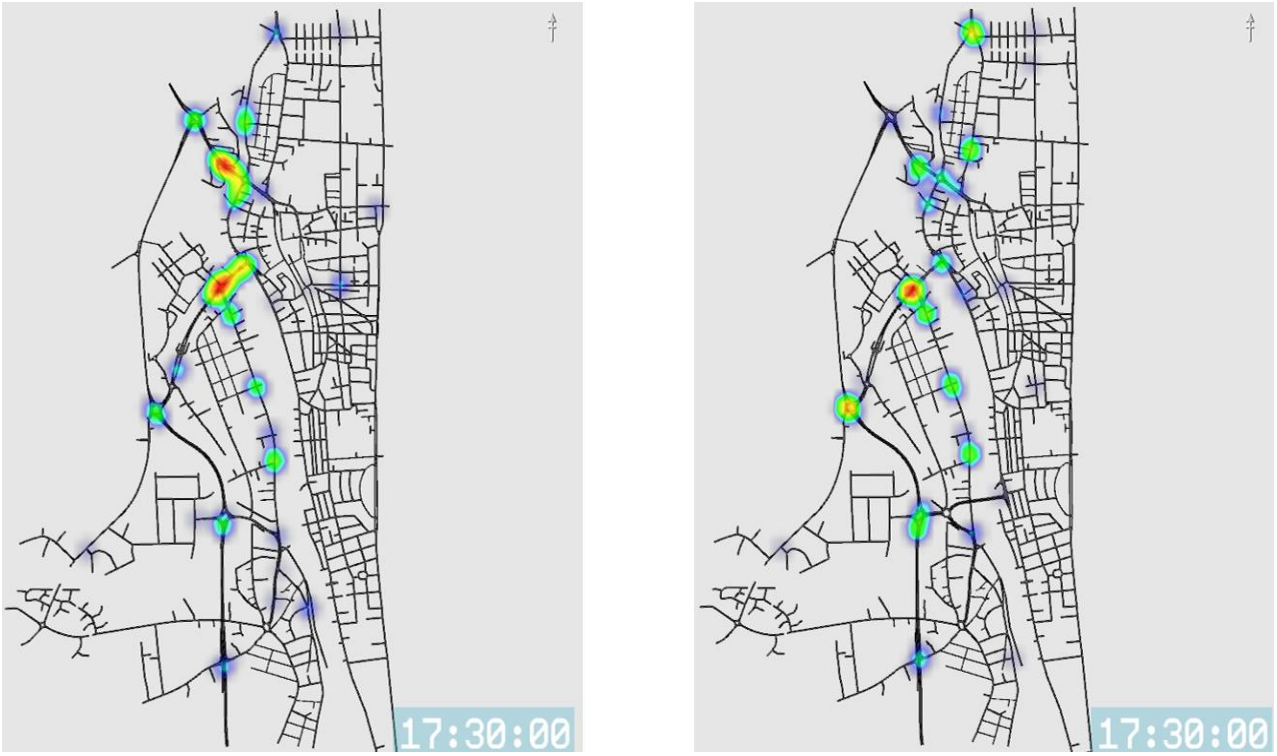

Figure 34 - Congestion hotspots 2038 PM peak in DM (left) and DS (right)

JOURNEY TIMES

7.2.7. Journey times on key routes will be reduced. Table 20 and Table 21 show the dramatic impact that the Great Yarmouth Third River Crossing will have on the times for journeys into the South Denes peninsula.

Table 20 - Forecast journey time savings (Gorleston to South Denes peninsula) 2023 AM peak

	Without scheme 2023 PM	With scheme 2023 PM	Time saving (minutes)
Gorleston to South Denes	16.00	8.06	7.54
South Denes to Gorleston	10.56	8.30	2.26

Table 21 - Forecast journey time savings (Gorleston to South Denes peninsula) 2023 PM peak

	Without scheme 2023 PM	With scheme 2023 PM	Time saving (minutes)
Gorleston to South Denes	15.27	8.01	7.26
South Denes to Gorleston	11.31	8.32	2.59

7.2.8. Journey time reliability will also be improved, as demonstrated in the OBC Economic Case, as a result of these changes in traffic flow.

TRAFFIC IN HISTORIC AREAS

7.2.9. Historic areas of the town will experience less traffic. Forecast changes in traffic on Haven Bridge and North and South Quay are set out in Table 22. Traffic will reduce significantly on the historic South Quay.

Table 22 - Forecast traffic changes near Haven Bridge PM peak (from SATURN model)

Traffic flow (2 way) PM peak	2023 DM	2023 DS	Difference %
North Quay	12,748	13,612	+7%
Haven Bridge	26,186	13,458	-49%
South Quay	26,610	15,332	-42%

ACCESSIBILITY

7.2.10. Vehicular access to South Denes and the Outer Harbour will be greatly improved, as the Third River Crossing will provide a much shorter route into the South Denes area for traffic from the SRN (A47).

7.2.11. Access for pedestrians and cyclists will be improved. The Third Crossing will provide a much more direct route for many trips. It will also be provided with excellent facilities for non-motorised modes

7.2.12. Accessibility plots (Figure 35 and Figure 36) show the significant improvement in accessibility for pedestrians and cyclists respectively.

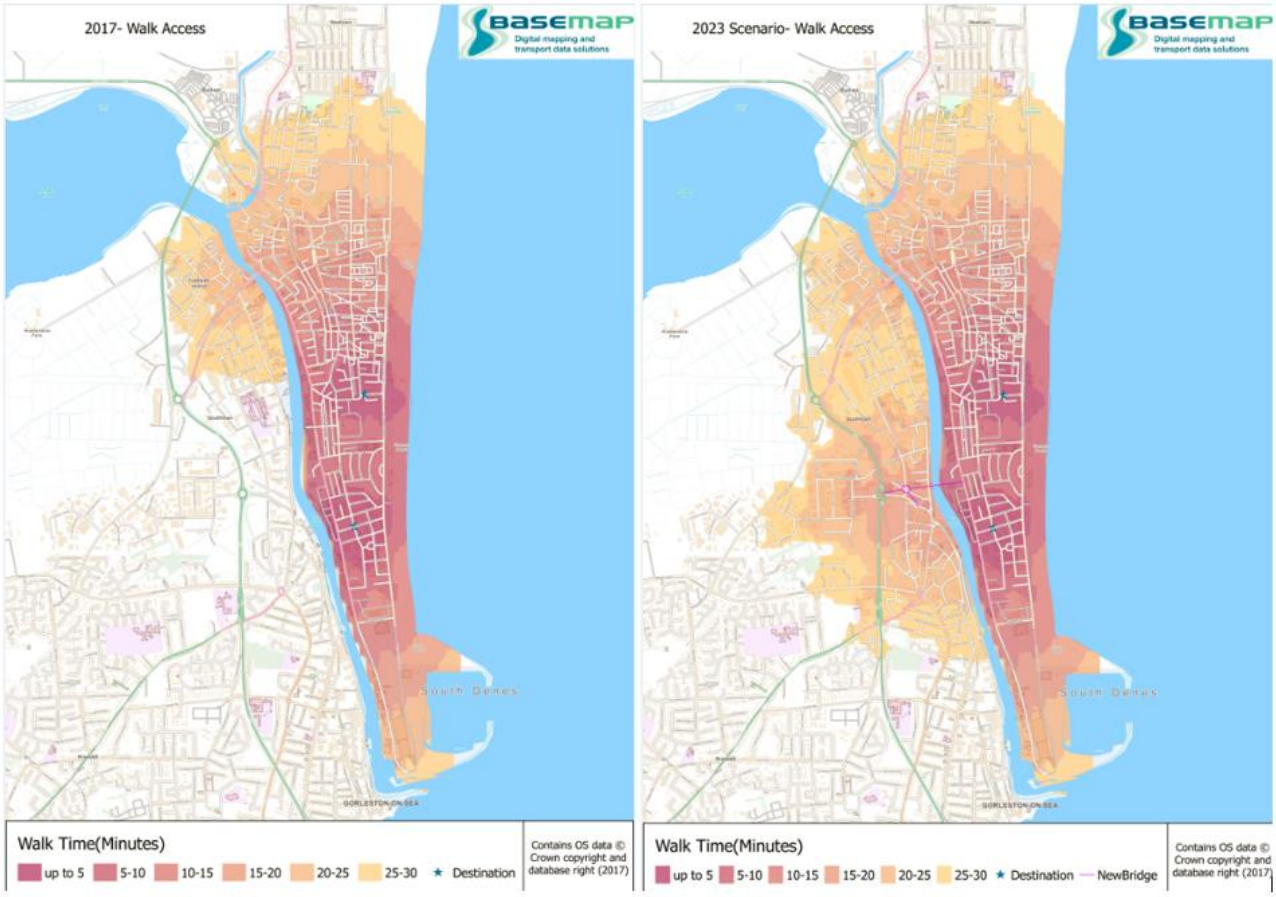

Figure 35 - Accessibility for pedestrians 2023 DM (left) and DS (right)

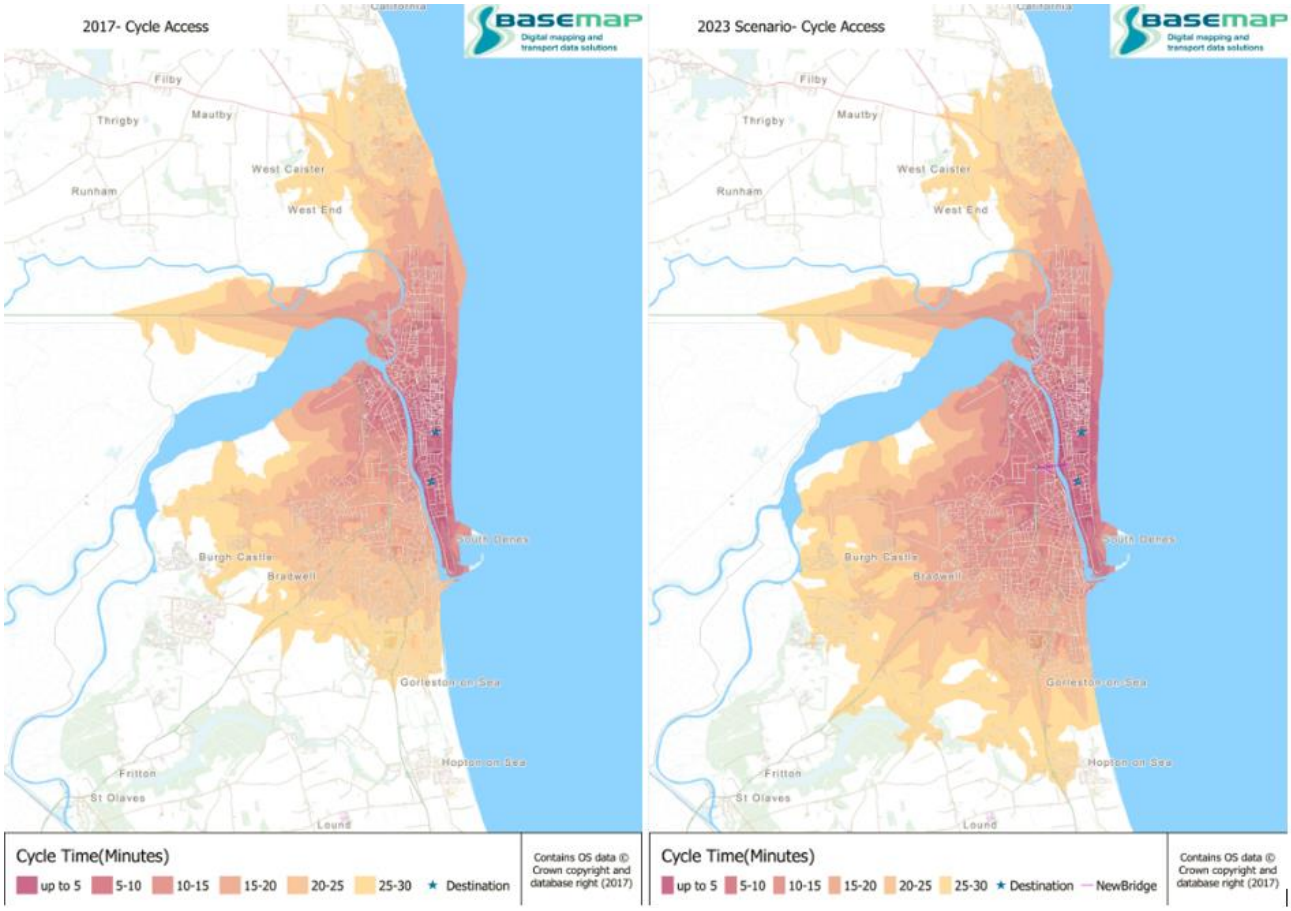

Figure 36 - Accessibility for cyclists 2023, DM (left), DS (right)

ACTIVE MODES IMPACTS

7.2.13. An Active Modes Appraisal (AMA) was undertaken as part of the work on the OBC. This used a DfT approved economic appraisal methodology to determine the changes in walking and cycling caused by the scheme, together with an assessment of the economic benefits, including health benefits.

7.2.14. The results are set out in detail in the Active Modes Appraisal Report (OBC Supporting document 10).

7.2.15. The AMA, which was based on the 2016 traffic model, estimated that 4,607 and 1,201 cyclists would use the scheme, including newly generated trips by active modes as a result of the new facility.

7.2.16. More information will be given in the full TA.

PUBLIC TRANSPORT IMPACTS

7.2.17. Bus users will benefit from:

- Less congestion on existing routes
- New waiting facilities near the Third River Crossing
- The opportunity to introduce new, more direct routes into the South Denes area

Road safety impacts

7.2.18. Road accidents will be reduced. In the OBC, this reduction was demonstrated using the DfT assessment tool, COBALT, which indicated that 269 casualties would be avoided by 2082 as a result of the scheme:

7.2.19. This calculation will be revised using the new modelling, but this is expected to show a similar level of benefits.

GREENHOUSE GASES

7.2.20. Greenhouse gas emissions will be reduced. In the OBC it was calculated that the present value of benefits associated with greenhouse gas reductions for the scheme over a 60 year assessment period would be £1.827 million (2010 prices discounted to 2010).

7.2.21. This calculation will be revised for the full TA using the new modelling, but this is expected to show a similar level of benefits.

RESILIENCE OF THE TRANSPORT NETWORK

7.2.22. The resilience of the local road network will be enhanced by the provision of additional capacity overall, reduced congestion and additional route options (for example when roads are closed due to incidents.

SUMMARY OF TRANSPORT RELATED IMPACTS: CONCLUSION

7.2.23. In summary, the scheme is expected to deliver on all of its specific objectives, in some cases with very large positive impacts.

8 MITIGATION OF TRANSPORT IMPACTS

8.1.1. Mitigation of any adverse impacts will be covered in the full TA.

9 RESIDUAL AND CUMULATIVE IMPACTS

9.1.1. Any residual and cumulative impacts will be identified in the full TA.

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