



## **Fuel Properties Norwich Ltd**

**Carrow Works, Norwich**

**Environmental Statement Addendum: Volume 1, Main Text**



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## 1 INTRODUCTION

1.1 Fuel Properties Norwich Ltd (henceforth known as ‘the Applicant’) is seeking to obtain planning permission for a proposed development at Carrow Works, Norwich.

1.2 Entran Ltd has been commissioned by the Applicant to prepare an Environmental Statement in support of an hybrid planning application (part full, part outline) which will be submitted alongside Listed Building Consent and Demolition within a Conservation Area.

1.3 The proposed development (hereafter referred to as ‘the Proposed Development’) comprises the following:

***Detailed (Full) Component:***

*“Full application comprising the construction of the principal means of access, the primary internal road and associated public spaces and public realm, including restoration and change of use of Carrow Abbey to former use as residential (Use Class C3), alteration and extension and conversion to residential use (Use Class C3) of the Lodge, Garage and Gardener’s Cottage and the Stable Cottages, development of the former Abbey Dining Room for residential use (Use Class C3), adaptation and conversion for flexible uses (Class E and/or C2 and/or C1 and/or C3 and/ or F1 and/or F2 and/or B2 and/or B8 and/or Sui Generis) for buildings 207, 92, 206, 7 (7a, 8 and 8a), 209, 35, the Chimney and Class E and/or B2 and/or B8 for the retained Workshop (Block 258), enhanced access to Carrow Abbey and Scheduled Ancient Monument and associated ancillary works”.*

*The full component of the application covers a site area of 5.02 ha.*

***Outline Component:***

*“Demolition of existing buildings and replacement with phased residential-led (Use Class C3 and/or Class E and/or F1 and/or F2 and/or C1 and/or C2 and/or B2 and/or Sui Generis), landscaping, open space, new and modified access, car parking and ancillary works.”*

*The outline component of the application covers a site area of 11.9 ha*

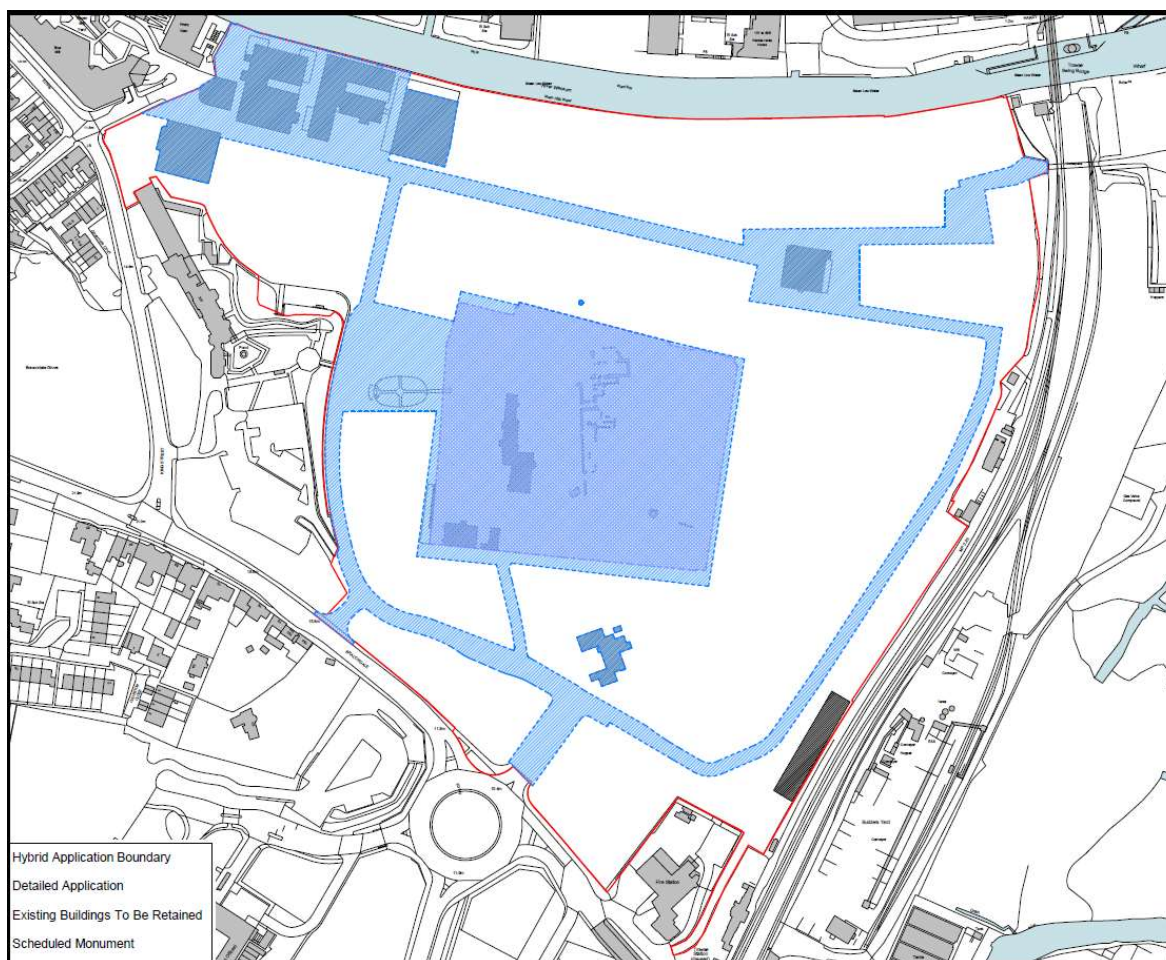


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1.4 This ES has been produced to provide an assessment of the environmental effects associated with the Proposed Development.

1.5 The location of the site (hereafter referred to as 'the Application Site') is identified in Figure 1.1, the area shaded blue is the extent of the detailed element of the application.

**Figure 1.1: Location of Application Site**



## **LEGISLATIVE FRAMEWORK FOR THE EIA**

1.6 This ES has been prepared in accordance with the requirements set out in *The Town and Country Planning (Environmental Impact Assessment) Regulations 2017* (hereafter referred to as the EIA Regulations) (Ref. 1.1).

1.7 The EIA Regulations require that, before consent is granted for certain types of development, an EIA must be undertaken. The EIA Regulations set out the types of development which must always be subject to an EIA (Schedule 1 development) and other developments which may require assessment if they give rise to significant environmental impacts (Schedule 2). The reporting of an EIA takes the form of an Environmental Statement (ES).

1.8 The Proposed Development falls within Schedule 2 10(b). An ES, to demonstrate the impacts and associated effects of the Proposed Development, has been prepared.



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## STRUCTURE OF THE ENVIRONMENTAL STATEMENT

1.9 The ES has been prepared on behalf of the Applicant, by a team of specialist consultants and also draws on existing studies and information where necessary.

1.10 The ES comprises three parts – the Main Text (Volume 1), the Figures and Technical Appendices (Volume 2) and the Non-Technical Summary (Volume 3). The ES forms part of a suite of reports that will support the planning application for the Proposed Development.

1.11 The ES provides:

- A description of the Application Site and its surroundings (Chapter 2);
- An overview of the approach and methodology of the EIA (Chapter 3);
- A description of reasonable alternatives considered in terms of design, technology, location, size and scale (Chapter 4);
- A description of the Proposed Development (Chapter 5);
- Identification of the development programme and construction (Chapter 6);
- The results of the analysis of the potentially significant environmental effects of the Proposed Development for the following disciplines: Transport and Access; Air Quality; Noise and Vibration; Biodiversity and Nature Conservation; Water Quality, Hydrology and Flood Risk; Soils, Geology and Contaminated Land; Archaeology ; Heritage, Townscape and Visual Impacts; Socio-Economics, Population and Human Health; Climate Change and Waste (Chapters 7-17). Cumulative impacts are assessed within each of the Chapters where relevant; and
- A conclusion based on the findings of the EIA (Chapter 18).

1.12 Each of the technical sections of the ES comprises: an introduction; a methodology of assessment, review of relevant policy context, a description of the baseline (existing) conditions; an assessment of the likely environmental effects of the Proposed Development; a description of mitigation measures; a discussion on residual effects; and a summary. Technical Appendices in relation to these Chapters are provided as **Volume 2**.

1.13 In conclusion, with reference to the EIA Regulations, the ES contains those matters which must be included:

- A description of the development comprising information on the Application Site, design, size and other relevant features of the development;



- A description of the likely significant effects of the Proposed Development on the environment;
- A description of any features of the Proposed Development, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;
- A description of the reasonable alternatives studied by the developer, 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 Proposed Development on the environment;
- A non-technical summary of the above information (**Volume 3**); and
- Any additional information relevant to the specific characteristics of the Proposed Development and to the environmental features likely to be significantly affected.

## **NATURE OF THE PLANNING APPLICATION**

1.14 The Proposed Development, which has been assessed by the EIA process, is the subject of the hybrid planning application being made to Ashford Borough Council (ABC) seeking:

*Hybrid planning application (part full, part outline), alongside Listed Building Consent and Demolition within a Conservation Area for the following:*

### ***Detailed (Full) Component:***

*“Full application comprising the construction of the principal means of access, the primary internal road and associated public spaces and public realm, including restoration and change of use of Carrow Abbey to former use as residential (Use Class C3), alteration and extension and conversion to residential use (Use Class C3) of the Lodge, Garage and Gardener’s Cottage and the Stable Cottages, development of the former Abbey Dining Room for residential use (Use Class C3), adaptation and conversion for flexible uses (Class E and/or C2 and/or C1 and/or C3 and/ or F1 and/or F2 and/or B2 and/or B8 and/or Sui Generis) for buildings 207, 92, 206, 7 (7a, 8 and 8a), 209, 35, the Chimney and Class E and/or B2 and/or B8 for the retained Workshop (Block 258), enhanced access to Carrow Abbey and Scheduled Ancient Monument and associated ancillary works”.*

*The full component of the application covers a site area of 5.02 ha.*





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**Outline Component:**

*“Demolition of existing buildings and replacement with phased residential-led (Use Class C3 and/or Class E and/or F1 and/or F2 and/or C1 and/or C2 and/or B2 and/or Sui Generis), landscaping, open space, new and modified access, car parking and ancillary works.”*

*The outline component of the application covers a site area of 11.9 ha*



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## REFERENCES

**Ref 1.1:** Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2017.



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## 2 THE SITE AND SURROUNDINGS

2.1 The Application Site lies within the administrative area of Norwich City Council (NCC) and is located to the southeast of Norwich Town Centre and occupies an area of 16.9 hectares (ha).

2.2 The Application Site is relatively flat and comprises previously developed land with a number of large buildings and pockets of grass and trees. It is bound by rail track to the east, Carrow House offices and associated carparks and soft landscaping to the west, the A147 and Bracondale Road to the south and the River Wensum to the north.

2.3 The Application Site encompasses in part two Conservation Areas; the Bracondale Conservation Area and Trowse Millgate Conservation Area.

2.4 The Application Site is not located within an Area of Archaeological Significance. The nationally designated 'Carrow Priory (ruined portions)' Scheduled Monument is located in the centre of the Application Site and the 'Norwich City Walls and Towers' Scheduled Monument is located approximately 120m northwest of the Application Site boundary. As well as the known potential for medieval archaeology, there is some potential for Palaeolithic, Mesolithic and Roman remains to survive on the Application Site along with Later Prehistoric palaeoenvironmental evidence along the northern edge of the area.

2.5 The Application Site does not comprise any statutory or non-statutory sites designated for their nature conservation value. The nearest statutory designated site of nature conservation importance is Whitlandham Local Nature Reserve (LNR), which is situated approximately 300m from the Application Site.

2.6 The majority of the Application Site is located within Flood Zone 1, indicating that it has a low risk of flooding from rivers and seas. A small area in the north-eastern corner of the Application Site is shown to be located within Flood Zone 2 (medium flood risk). Land within Flood Zone 2 and 3 is located 70m east of the Application Site.

2.7 The Application Site does not fall within a designated Air Quality Management Area (AQMA). However, the Central Norwich AQMA is located approximately to the west of the Application Site.



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### 3 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

3.1 This ES is submitted as a requirement of the EIA Regulations. The key requirements of the EIA Regulations with regards to the assessment methodology are as follows:

- Provision of a description of the relevant aspects of the current state of the environment (baseline scenario) and future baseline scenario;
- Description of the likely significant effects of the development on the environment resulting from:
  - a) The construction of the development, including where relevant demolition works;
  - b) The use of natural resources;
  - c) The emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances and disposal and recovery of waste;
  - d) The risks to human health, cultural heritage or the environment due to accidents or disasters;
  - e) The cumulation of effects with other existing or approved projects; and
  - f) The impact of the project on climate and the vulnerability of the project to climate change.
- Description of methods used to assess the significant effects and a description of the measures envisaged to avoid, prevent, reduce or offset identified significant adverse effects on the environment;
- Description of the expected significant adverse effects of the development on the environment from the vulnerability of the development to risks of major accidents or disasters where relevant.

3.2 The main objectives of the ES comprise:

- Establishing the existing baseline;
- Determine environmental conditions. This task was divided into two phases:
  - (i) collection and review of existing data relating to the Application Site, including a review of information held by statutory and non-statutory consultees; and



(ii) the enhancement of existing data, where necessary with information collected through site investigation and surveys.

- identifying, predicting and assessing the significance of the environmental impacts including beneficial, adverse, direct, indirect, long term, medium term, short term, temporary, permanent and cumulative impacts which could be expected as a result of the development proposals on those environmental issues that were considered to be potentially significant during the scoping process; and
- determining mitigation and management measures, which would be required in order to prevent, reduce or remedy any significant adverse effects along with consideration of enhancement measures which could be implemented to ensure positive benefits as a result of these proposals.

## **CONSULTATION**

3.3 Pre-application consultation is an essential part of the EIA process and has been used to:

- identify available baseline data and the need for any further field surveys; and
- identify the main environmental issues that need to be assessed in detail.

3.4 Both statutory and non-statutory consultees have been consulted as part of the EIA.

3.5 The Applicant has sought to engage with key stakeholders and interested parties through the pre-application process. Consultation has included pre-application meetings with NCC, Norfolk County Council Highways and LLFA and Historic England.

3.6 Pre-application consultation with the local community has included a public consultation with local residents and stakeholders which was held on 23<sup>rd</sup> & 24<sup>th</sup> June 2022.

## **SCOPE OF THE EIA**

3.7 The purpose of an EIA scoping exercise is to ensure that all relevant environmental issues with respect to a development are identified from the outset and to confirm that the EIA process would conform to the requirements of the EIA Regulations. The EIA Regulations require *'a description of the likely significant effects of the development on the environment.'*



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3.8 An assessment of all environmental effects is not required, only those likely to be significant. By applying relevant guidance and professional judgement it is possible to identify those environmental areas that should be assessed.

3.9 Following completion of the scoping process, a scoping report was issued to NCC. The scoping report detailed the findings of the scoping assessment and set out the proposed methodology for those technical areas deemed potentially likely to experience a significant effect as a result of the Proposed Development. These were identified as:

- Transport and Access;
- Air Quality;
- Noise and Vibration;
- Biodiversity and Nature Conservation;
- Water Quality, Hydrology and Flood Risk;
- Soils, Geology, Contaminated Land;
- Archaeology;
- Heritage, Townscape and Visual Impacts;
- Socio-Economics and Human Health; and
- Climate Change.

3.10 A scoping opinion was received from NCC in May 2022. A copy of the scoping opinion is included as **Appendix 3.1**.

3.11 In addition to the above topics, a waste chapter has also been included.

### **Environmental Topics Scoped out of ES**

3.12 The following environmental topics have been scoped out of the ES:

- Sunlight and Daylight;
- Microclimate / Wind Analysis; and
- Major Accidents and Disasters.

3.13 The application will be supported by a standalone sunlight and daylight report. Based on the proposed layout, heights, and distances from neighbouring receptors, impacts on sunlight and daylight are not anticipated to be significant. The standalone assessment will consider daylight amenity to all neighbouring receptors that do not meet the preliminary 25 degree and



45 degree line tests recommended in the BRE Report. Sunlight amenity will be considered to those neighbouring receptors that are served by windows orientated within 90 degrees of due south, as recommended in the BRE Report.

3.14 Based on the proposed layout, heights and distances from neighbouring receptors, impacts on microclimate are not anticipated to be significant.

3.15 The vulnerability of the Proposed Development to risks from major accidents and / or disasters was considered and a risk assessment completed. A summary of the findings of the risk assessment are presented in Table 3.1 below.

**Table 3.1: Vulnerability to Risks from Major Accidents and / or Disasters Risk Assessment**

Potential Major Accident / Disaster	Further Consideration Required	Where addressed in ES
Industrial Accident / Biological Hazard	No (screened out)	NA
Natural Disaster (Earthquake, Volcanic Eruptions, Severe Weather, Flooding)	Further assessment for Flooding only	Chapter 11: Water Quality, Hydrology and Flood Risk and Appendix 11.1: Flood Risk Assessment
Transport Accidents	No	NA
Terrorist Incident	No (screened out)	NA

## PROJECT TEAM

3.16 This ES has been completed by a team of specialist consultants with suitable qualifications as illustrated in Table 3.2 below. Further details of the qualifications and experience of the consultants undertaking the technical assessments are included in the statement of competence in **Appendix 3.2:**

**Table 3.2: Consultant Team**

Section	Consultant
Chapters 1 to 6	Entran Ltd
Chapter 7: Transport and Access	Entran Ltd
Chapter 8: Air Quality	Entran Ltd



Section	Consultant
Chapter 9: Noise and Vibration	Entran Ltd
Chapter 10: Biodiversity and Nature Conservation	Greengage
Chapter 11: Water Quality, Hydrology and Flood Risk	Curtins
Chapter 12: Soils, Geology and Contaminated Land	EAME
Chapter 13: Archaeology	Iceni
Chapter 14: Heritage, Townscape and Visual Impacts	Iceni
Chapter 15: Socio-Economics, Population and Human Health	Greengage
Chapter 16: Climate Change	Greengage
Chapter 17: Waste	EAME

## ASSESSMENT CRITERIA

3.17 A number of criteria have been used to determine whether or not the potential effects of the Proposed Development are significant. Where possible, the effects have been assessed quantitatively.

3.18 The significance of effects have been assessed using one or more of the following criteria:

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

3.19 The effects that were considered to be significant prior to mitigation have been identified within this ES. The significance of these effects reflects judgement as to the importance or sensitivity of the affected receptor(s) and the nature and magnitude of the predicted changes. For example, a large adverse impact on a feature or site of low importance will be of lesser significance than the same impact on a feature or site of high importance.

3.20 The following terms have been used to assess the significance of effects where they are predicted to occur:





- Major Beneficial or Adverse effect – where the Proposed Development would cause a significant improvement (or deterioration) to the existing environment;
- Moderate Beneficial or Adverse effect – where the Proposed Development would cause a noticeable improvement (or deterioration) to the existing environment;
- Minor Beneficial or Adverse effect – where the Proposed Development would cause a barely perceptible improvement (or deterioration) to the existing environment; and
- Neutral/ Negligible – no discernible improvement or deterioration to the existing environment.

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

3.22 A non-technical summary of the ES is provided as **Volume 3**.

## CUMULATIVE EFFECTS AND EFFECTS INTERACTIONS

3.23 Cumulative impacts from proposed or committed developments in the vicinity of the Application Site have been considered within each of the following technical chapters. The proposed or committed schemes considered are identified in Table 3.2.

**Table 3.2: Proposed or Committed Developments**

Site Name	Application No.	Distance from the Application Site	Description
Anglia Square	22/00434/F (Pending Determination)  Due to the size of this application, all plans and documents can be viewed online at <a href="http://www.norwich.gov.uk/angliasquare">www.norwich.gov.uk/angliasquare</a>	Approx 2km to northwest of the Application Site	Hybrid (Part Full / Part Outline) application for the comprehensive redevelopment of Anglia Square, and car parks fronting Pitt Street and Edward Street for: <ul style="list-style-type: none"> <li>• up to 1,100 dwellings and up to 8,000sqm (NIA) flexible retail, commercial and other non-residential floorspace including Community Hub;</li> <li>• upto 450 car parking spaces (at least 95% spaces for class C3 use; and</li> <li>• up tp 5% for class E/F1/F2/Sui Generis uses), car club spaces and associated works to the highway and public realm areas.</li> </ul>
Deal Ground	12/00875/O	Adjacent to Application Site to the east side of the railway line.	Outline planning application (full details of access) for a mixed development consisting of a maximum of 670 dwellings; a local centre comprising commercial uses (A1/A2/A3); a restaurant / dining quarter and public house (A3/A4); demolition of buildings on May Gurney



Site Name	Application No.	Distance from the Application Site	Description
			site (excluding the former public house); an access bridge of the River Yare; new access road; car parking; flood risk management measures; landscape measures inc earthworks to from new swales and other biodiversity enhancements including the re-use of the Grade II Listed Brick Kiln for use by bats.
Land north of Carrow Quay	17/01647/VC Variation of Condition 1 of the previous permission 13/01270/RM to allow revised plans	Adjacent site to the north of the River Wensum	Reserved Matters with full details of external appearance, landscape, layout and scale of development to provide 250 no. residential flats (Class C3), 113sqm offices (Class B1a), 279sqm groundsman's facilities (Class B8), and 401sqm of flexible office space (Class B1a) and community uses (Class D1/D2) with 126 No parking spaces, associated highways works and provision of a Riverside Walk.

3.24 Consideration has also been given to the effects arising from the interaction of effects on different environmental topic areas arising from the Proposed Development.



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## 4 ALTERNATIVES AND DESIGN EVOLUTION

### INTRODUCTION

4.1 This chapter sets out the need for the Proposed Development and the reasonable alternatives considered by the developer. The EIA Regulations (Ref 1.1) states that an ES should include:

*“a description of the reasonable alternatives studied by the developer, 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.”*

4.2 The following sections describe the reasonable alternatives considered by the developer in addition to the Proposed Development. Consideration has been given to and commentary is provided on the following:

- The 'No Development' alternative;
- Alternative Sites; and
- Alternative Designs and Layouts.

### 'NO DEVELOPMENT' ALTERNATIVE

4.3 The 'No-Development' option refers to leaving the Application Site in its current state, which comprises an area of undeveloped land. This alternative would not contribute to the housing delivery within the area.

4.4 The Proposed Development can contribute 1,859 dwellings to future housing supply and the Application Site is under the Applicant's control, the 'No Development' scenario has been dismissed.

### ALTERNATIVE SITES

4.5 The Proposed Development is specific to the Application Site and the Applicant has control of the land and it is available for development. Other sites in the immediate vicinity have therefore not been considered further for development by the Applicant.



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## ALTERNATIVE DESIGNS AND LAYOUTS

4.6 The design has evolved through the pre-application period to incorporate comments received during the pre-application consultations. The key amendments to the design as a result of comments received include:

- The east – west route was widened to improve public street and squares;
- Housing to the south amended to create better entrance experience around the main road;
- Massing and storey heights amended to create a better relationship between apartments along the river and houses to the south;
- Access and wayfinding from the underpass was improved through re-configuration of apartments;
- Housing parcel to the east reconfigured to front houses onto the main road;
- Housing to the south of the Abbey grounds re-configured to reinstate historic routes and respond more sensitivity to the Abbey, Garden Lodge and Stable Cottage;
- Housing on the footprint of the Dining Hall re-designed to sit on the existing floating foundation and have an inward facing, modest character to be subservient to the Abbey;
- Varied and playful roofscapes articulated along the river;
- Six houses to the south of the Abbey removed to ensure retention of the flint wall and glasshouses and preserve the Scheduled Ancient Monument area;
- Housing pulled back along the curved route up to the Abbey, following feedback from Historic England that this should be a green open route that allows visual connection from the Stable Cottage up to the Abbey;
- Reference to kitchen gardens made in Robinson’s Terraces, with fruit picking introduced along the green link;
- Existing access road re-configured to create parallel carriageways forming two means of access and egress;
- Secondary access road added from Bracondale;
- View created to Mustard Seed Drier from the underpass created by cutting away the ground floor to become a public square within colonnades;
- Green link in Robinson’s Terraces continued to create a route down to Trowse Railway.

4.7 The final layout of the Proposed Development is identified in Chapter 5 and **Appendix 5**.



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## 5 THE PROPOSED DEVELOPMENT

5.1 The Proposed Development is for the development of:

**Detailed (Full) Component:**

*“Full application comprising the construction of the principal means of access, the primary internal road and associated public spaces and public realm, including restoration and change of use of Carrow Abbey to former use as residential (Use Class C3), alteration and extension and conversion to residential use (Use Class C3) of the Lodge, Garage and Gardener’s Cottage and the Stable Cottages, development of the former Abbey Dining Room for residential use (Use Class C3), adaptation and conversion for flexible uses (Class E and/or C2 and/or C1 and/or C3 and/ or F1 and/or F2 and/or B2 and/or B8 and/or Sui Generis) for buildings 207, 92, 206, 7 (7a, 8 and 8a), 209, 35, the Chimney and Class E and/or B2 and/or B8 for the retained Workshop (Block 258), enhanced access to Carrow Abbey and Scheduled Ancient Monument and associated ancillary works”.*

*The full component of the application covers a site area of 5.02 ha.*

**Outline Component:**

*“Demolition of existing buildings and replacement with phased residential-led (Use Class C3 and/or Class E and/or F1 and/or F2 and/or C1 and/or C2 and/or B2 and/or Sui Generis), landscaping, open space, new and modified access, car parking and ancillary works.”*

*The outline component of the application covers a site area of 11.9 ha*

5.2 The proposed site masterplan is presented in Figure 5.1.

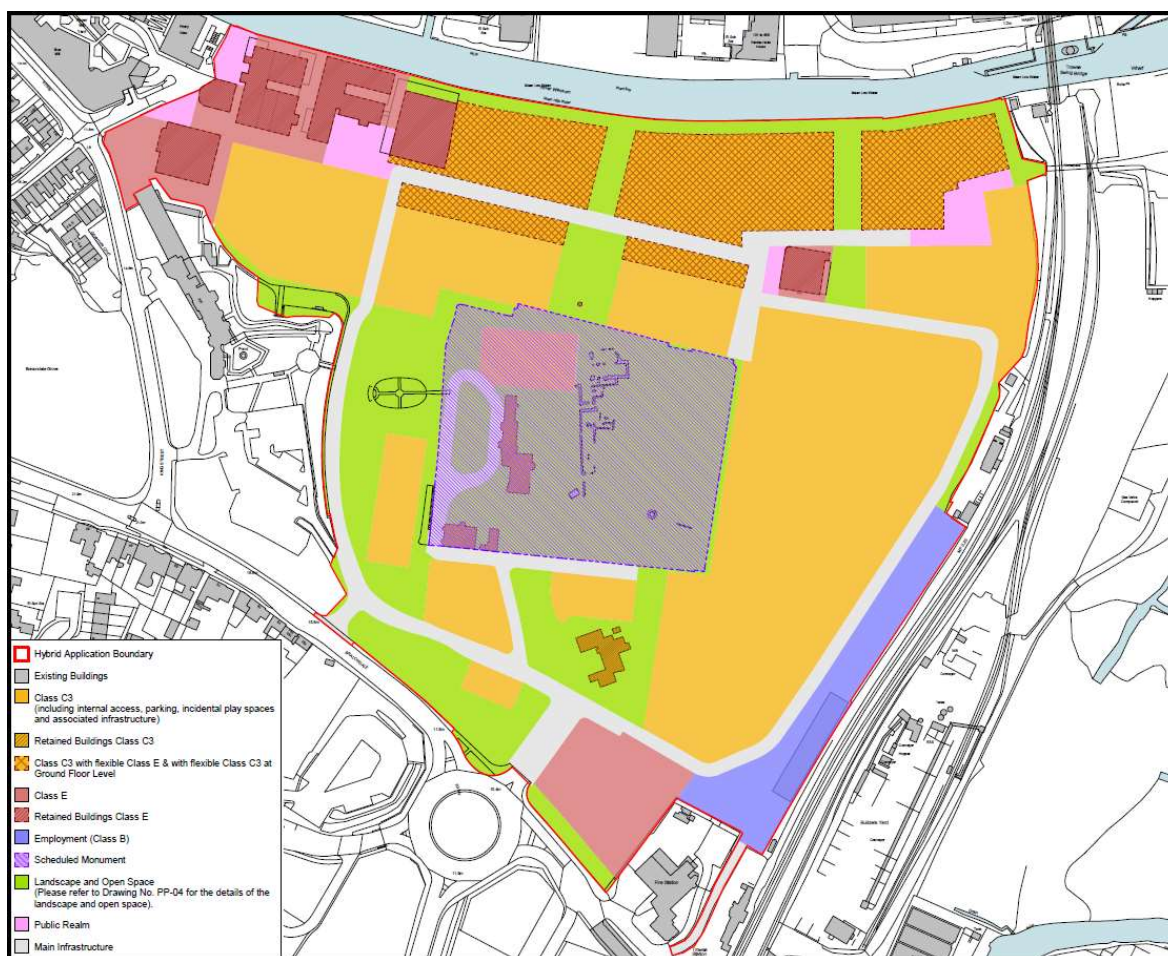
**Figure 5.1: Proposed Masterplan**



**Land Use**

5.3 The proposed land use is illustrated in Figure 5.2 below.

**Figure 5.2: Land Use Plan**



5.4 The maximum extent for the proposed land uses is illustrated in Table 5.1 below:

**Table 5.1: Land Use Summary**

Use	Area	%
Residential (Use Class C3)	5.882 ha (14.535 acres)	34.8
Residential use of Retained Buildings	0.150 ha (0.371 acres)	0.9
Residential use with mixed-use at Ground Floor	1.864 ha (4.606 acres)	11
Mixed-use (Use Class E)	0.976 ha (2.412 acres)	5.8
Mixed-use of retained buildings	0.622 ha (1.537 acres)	3.6
Employment (Use Class B)	0.636 ha (1.572 acres)	3.8
Landscape and Open Space	4.705 ha (11.626 acres)	27.8
Public Realm	0.382 ha (0.944 acres)	2.3
Main Infrastructure	1.707 ha (4.218 acres)	10.1
Hybrid Application Boundary	16.917 ha (41.803 acres)	100

5.5 The Proposed Development is divided into a number of discrete areas as illustrated in Figure 5.3 below:

**Figure 5.3: Masterplan Areas**



### Indicative Schedule of Residential Development

5.6 Table 5.2 presents the proposed schedule for the Residential Development and Figure 5.4 illustrates the location of the different building typologies.

**Table 5.2: Indicative Schedule**

	Refurbished Apartments	New Build Apartments	Refurbished Houses	New Build Houses	Total
<b>Gateway</b>	125	62	-	-	<b>187</b>
<b>Waterside</b>	-	530	-	-	<b>530</b>
<b>Railway Side</b>	-	330	-	-	<b>330</b>
<b>Build to Rent</b>	-	250	-	-	<b>250</b>



	Refurbished Apartments	New Build Apartments	Refurbished Houses	New Build Houses	Total
<b>Private Housing</b>	-	77	-	-	<b>77</b>
<b>Housing Area 1</b>	-	-	-	110	<b>110</b>
<b>Housing Area 2</b>	-	-	-	234	<b>234</b>
<b>Abbey Grounds</b>	-	-	6	9	<b>15</b>
<b>Abbey Gardens</b>	-	25	-	33	<b>58</b>
<b>Food Store &amp; Employment</b>	-	65	-	-	<b>65</b>
<b>Total</b>	<b>125</b>	<b>1139</b>	<b>6</b>	<b>386</b>	<b>1856</b>

**Figure 5.4: Indicative Typologies Plan**



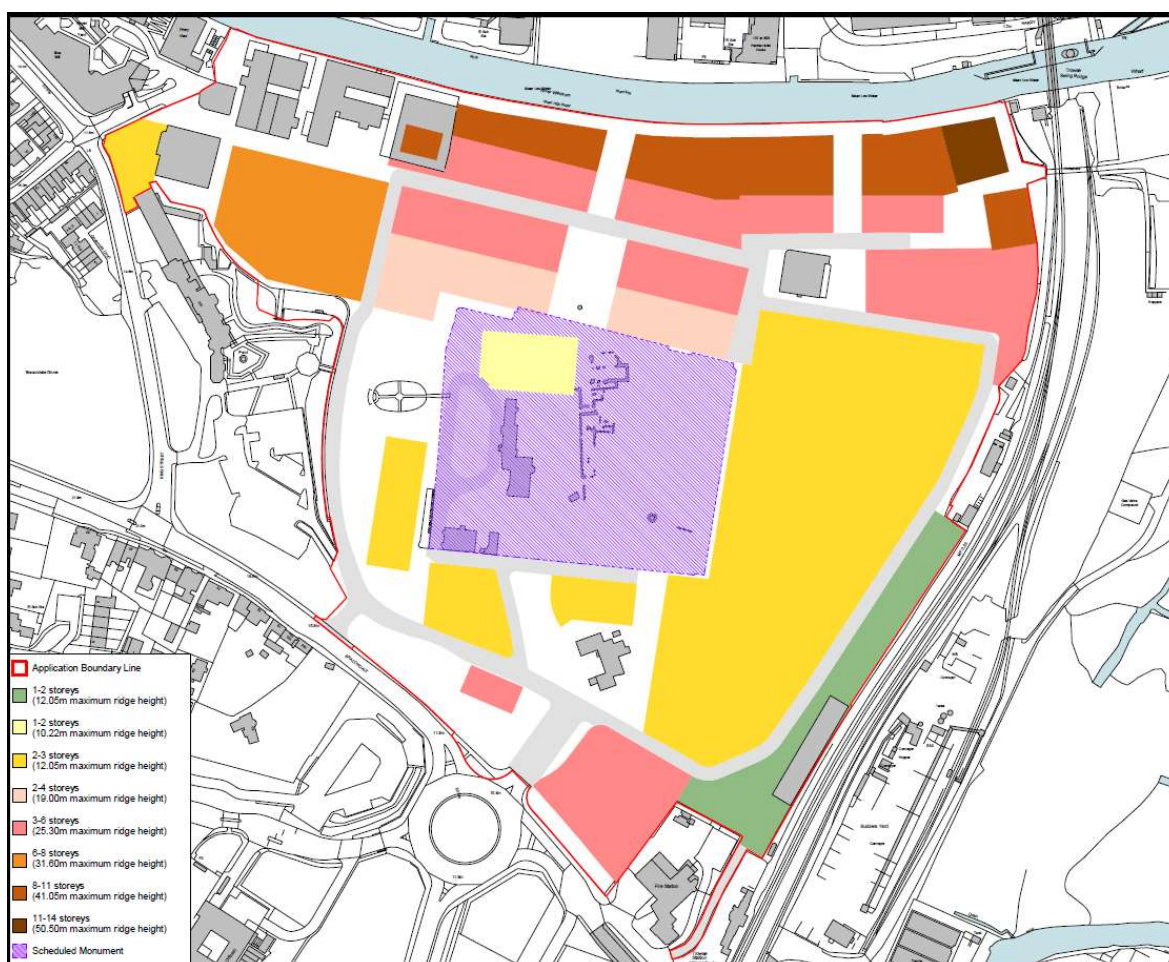
### Scale and Massing

5.7 The heights of the buildings will vary across the Application Site. The taller buildings are located along the river front and buildings heights step down around existing historic buildings. The proposed heights allow for pitched or flat roofs on residential and mixed-use

buildings in order to accommodate a varying roof-scape as is characteristic of the existing use of the Application Site and the surrounding area.

5.8 The proposed building heights are illustrated in the Building Heights parameter plan shown in Figure 5.5 below:

**Figure 5.5: Building Heights Plan**



### Character Areas

5.9 The Proposed Development will have six distinct character areas. Each character area will be identified by unique approaches to design, scale of buildings and their relationship to the adjacent open spaces and density. The six character areas are illustrated in Figure 5.6.

**Figure 5.6: Character Areas**



### *Coleman's Wharf*

5.10 Coleman's Wharf is located in the northwest corner of the Application Site at the location of the primary entrance. The design of this area establishes a gateway feature into the Proposed Development from the city centre. Visitors will be greeted by the feature curved wall of the Counting House and a view towards the Mustard Seed Driers at the end of the route. The existing 19<sup>th</sup> century warehouse buildings will be refurbished to provide creative mixed-use spaces at ground floor.

5.11 The architecture of the new buildings in this area will be simple forms and lighter brick to allow the exiting factory buildings to shine.

### *Mustard Quarter*

5.12 The Mustard Quarter is located in the north of the Proposed Development. The buildings are tall and dense. Buildings of 6 to 11 storeys front both the river and the new



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pedestrian Mustard Mill Way. At either edge, building heights step down to the heritage assets.

5.13 Inspired by the existing variation of buildings running along the south side of the River Wensum, the new buildings will each have their own unique identity which will be achieved through varied materials and playful roofscapes creating a varied view for pedestrians and residents alike.

#### *Mint Yard*

5.14 The Mint Yard is located in the northeast of the Proposed Development. It will mark the entrance to the Proposed Development from the east and further from Whitlingham Country Park. The route to and from the underpass will be instantly greeting by a vibrant public square lined with retail or food and beverage outlets.

5.15 The architecture will be contemporary, clean and rhythmic with inspiration of materials and form taken from the existing buildings.

#### *Robinson's Terraces*

5.16 Robinson's Terraces character area is located in the southeast of the Proposed Development between the railway and Abbey Gardens. The housing in this area is influenced by the architecture and character of the terraced housing within Norwich.

5.17 Uniform streets are divided by a central green corridor which will reflect the history of this part of the Proposed Development by providing a fruit picking trail as well as water gardens and create a link to the water and busier areas of the Proposed Development. A variety of housing sizes along each terrace will be encouraged ensuring mixed communities.

#### *The Abbey & Cottages*

5.18 The Abbey Cottages character area is located in the southwest of the Proposed Development where there are a number of historically significant buildings and a scheduled ancient monument. This area will form a more private and quiet residential area that respects the heritage of the area.

5.19 In the centre, the Grade I listed Abbey is the heart of this character area. The proposals will reinstate the most important historical routes, views and spaces around the Abbey and restore much of the hardstanding to green wildflower gardens.

5.20 Larger family homes with gardens will sit in the landscape replacing the existing 20<sup>th</sup> century buildings with sympathetic forms and massing that frame the Abbey. The architecture of the new buildings are proposed to be simple in form, with subtle inspiration taken from the Abbey reflecting its roof pitches, materials and fenestration.

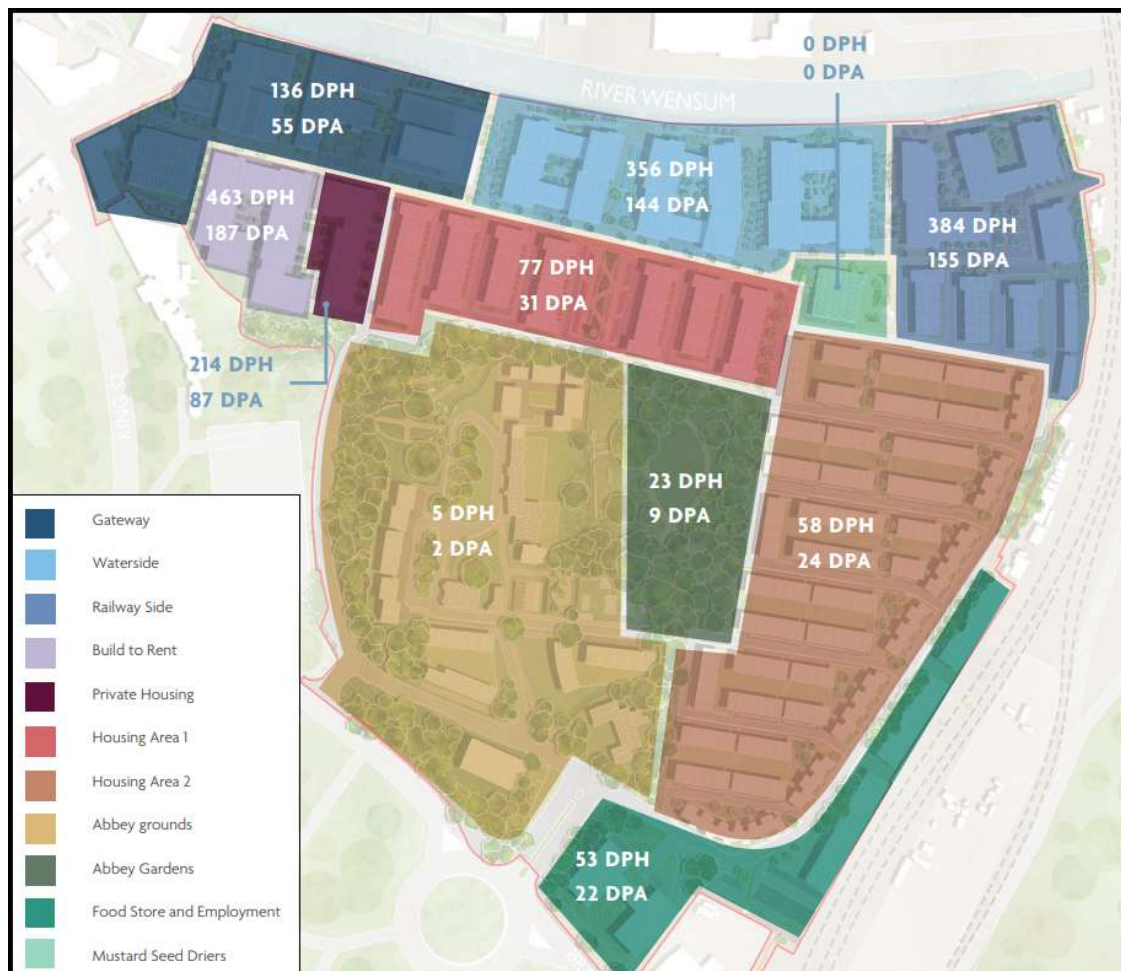
### Workers Yard

5.21 The Workers Yard character area is located in the south of the Proposed Development. This area will comprise a large food store at the entrance to the Proposed Development which will serve the wider area as well as the new Proposed Development. New residential apartments are proposed over the food store.

### Density

5.22 The densities of the residential areas within the Proposed Development vary across the Application Site and are illustrated in Figure 5.7 below.

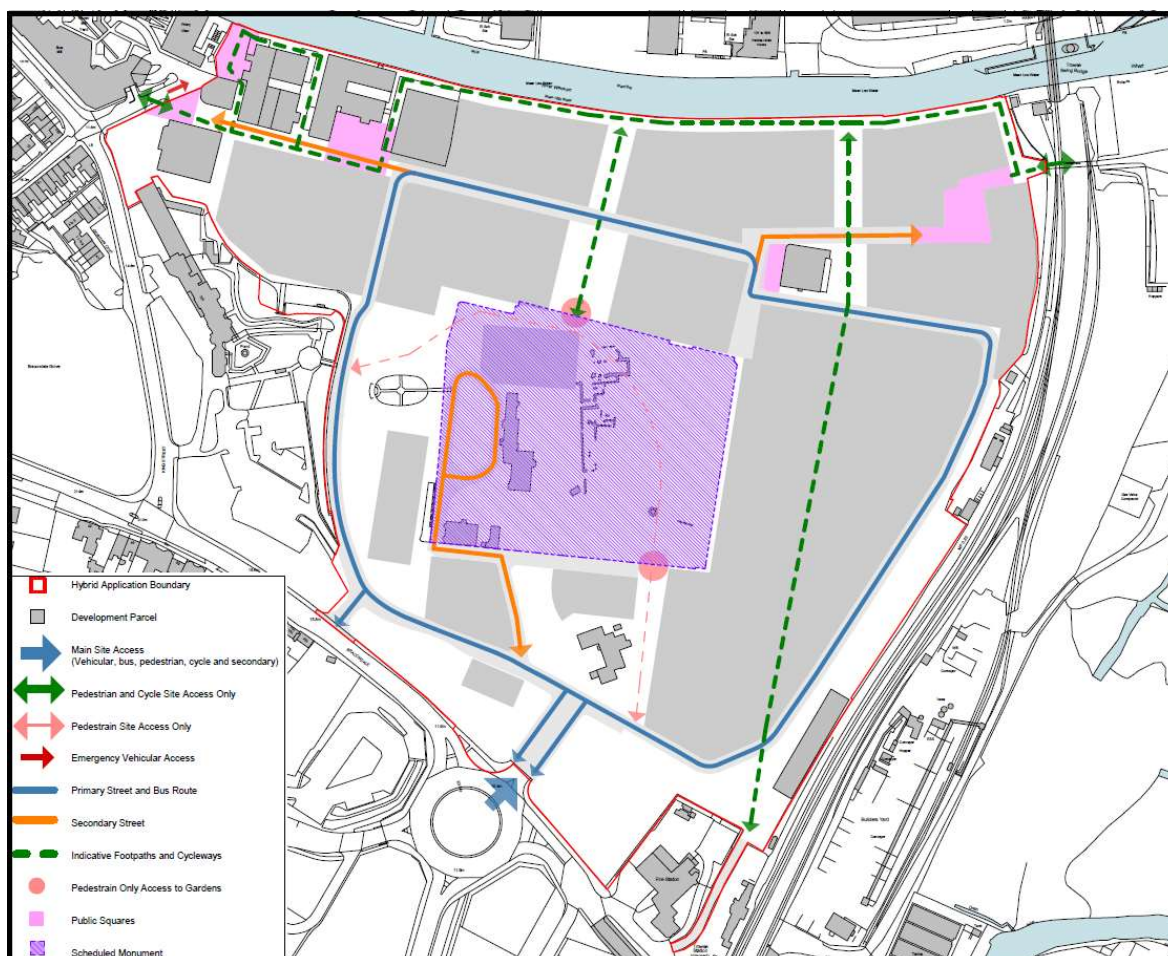
**Figure 5.7: Densities**



## Access

5.23 The access and movement proposals include the provision of one primary and one secondary vehicle access from the public highway and pedestrian and cycle access and routes across the Application Site. A plan showing the vehicle, cycle and pedestrian accesses to the Application Site is shown in Figure 5.8.

**Figure 5.8: Access**



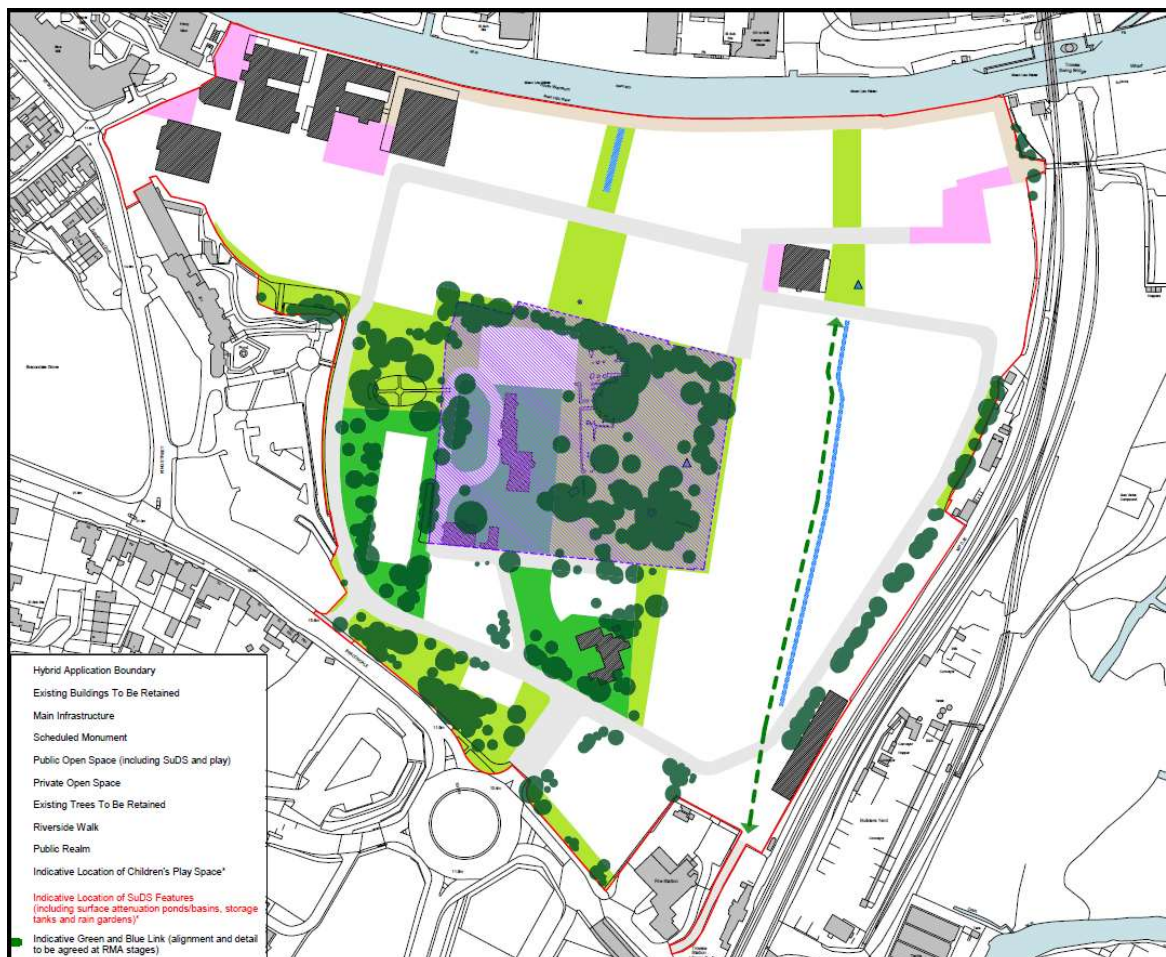
## Open Space

5.24 The proposed masterplan is landscape driven; a network of spaces connect the historic buildings together and open up the currently inaccessible areas to the public by providing new and existing green spaces.

5.25 A range of open spaces will link to the surrounding green infrastructure and provide a connection between Norwich City Centre and Whitlingham Country Park. The Abbey grounds

open space would be made publicly accessible with multiple access points both ramped and stepped.

**Figure 5.9: Open Space**



## Recreation

5.26 A variety of play spaces will be distributed across the Proposed Development which incorporate a range of different play experiences. These will take the form of LEAP's, several LAPs and a variety of informal play spaces located within the various character areas onsite as illustrated in Figure 5.10 below. The informal play spaces will be located within amenity green space to offer doorstep play experiences. There will also be opportunities to include playful leaning within community growing spaces.

**Figure 5.10: Play Spaces**

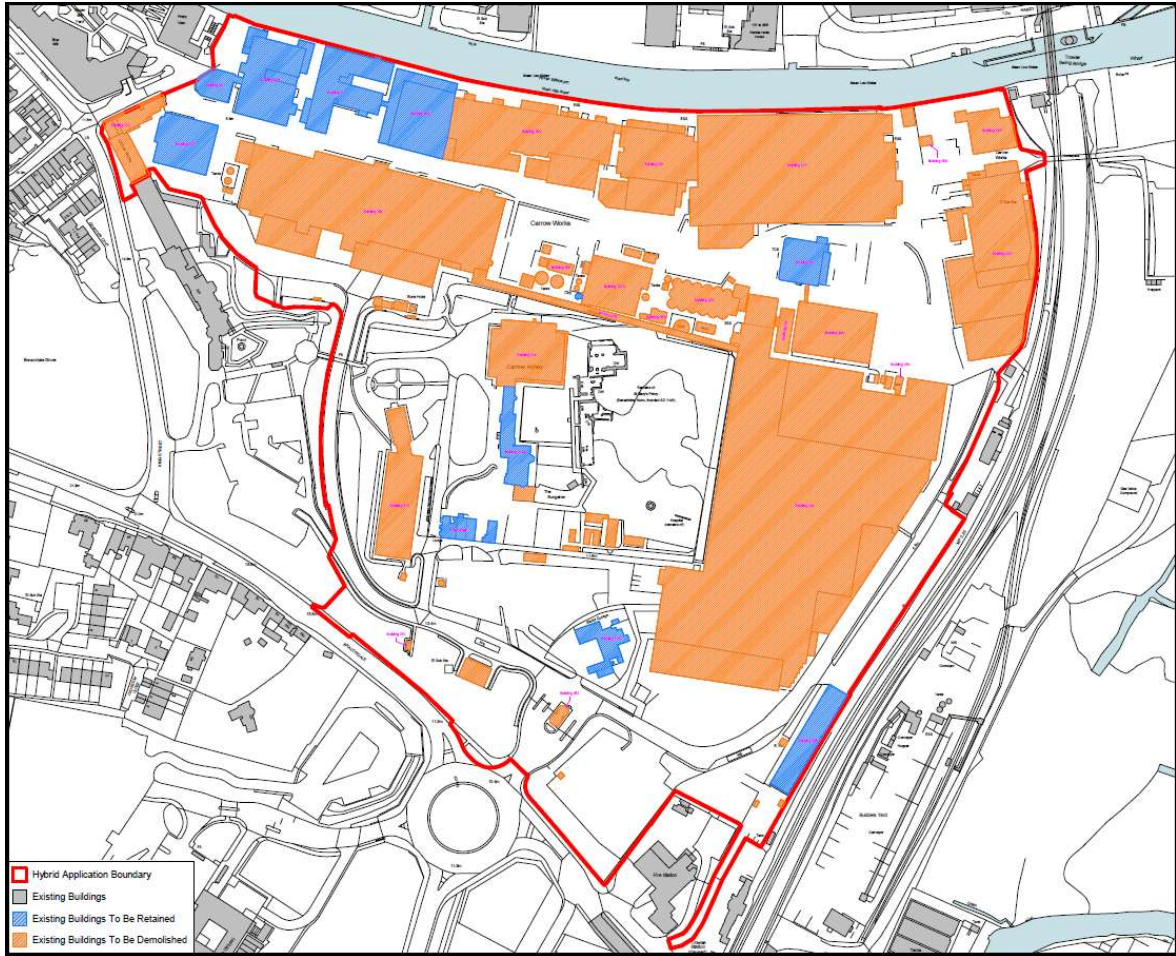


## Demolition

5.27 The buildings proposed for retention and demolition are illustrated in Figure 5.11 below. The buildings to be retained are located in three different areas of the Application Site and form the character of these areas.



**Figure 5.11: Demolition Plan**





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## 6 DEVELOPMENT PROGRAMME AND CONSTRUCTION

### INTRODUCTION

6.1 This chapter describes the anticipated programme of development works and the key activities that would be undertaken during the construction phase of the project. It identifies, in general terms, the potential effects associated with construction activities and outlines proposals for their mitigation. Detailed consideration of construction-related environmental effects upon the various technical topics assessed, together with their associated mitigation measures, are provided in each of the technical assessment chapters of this ES.

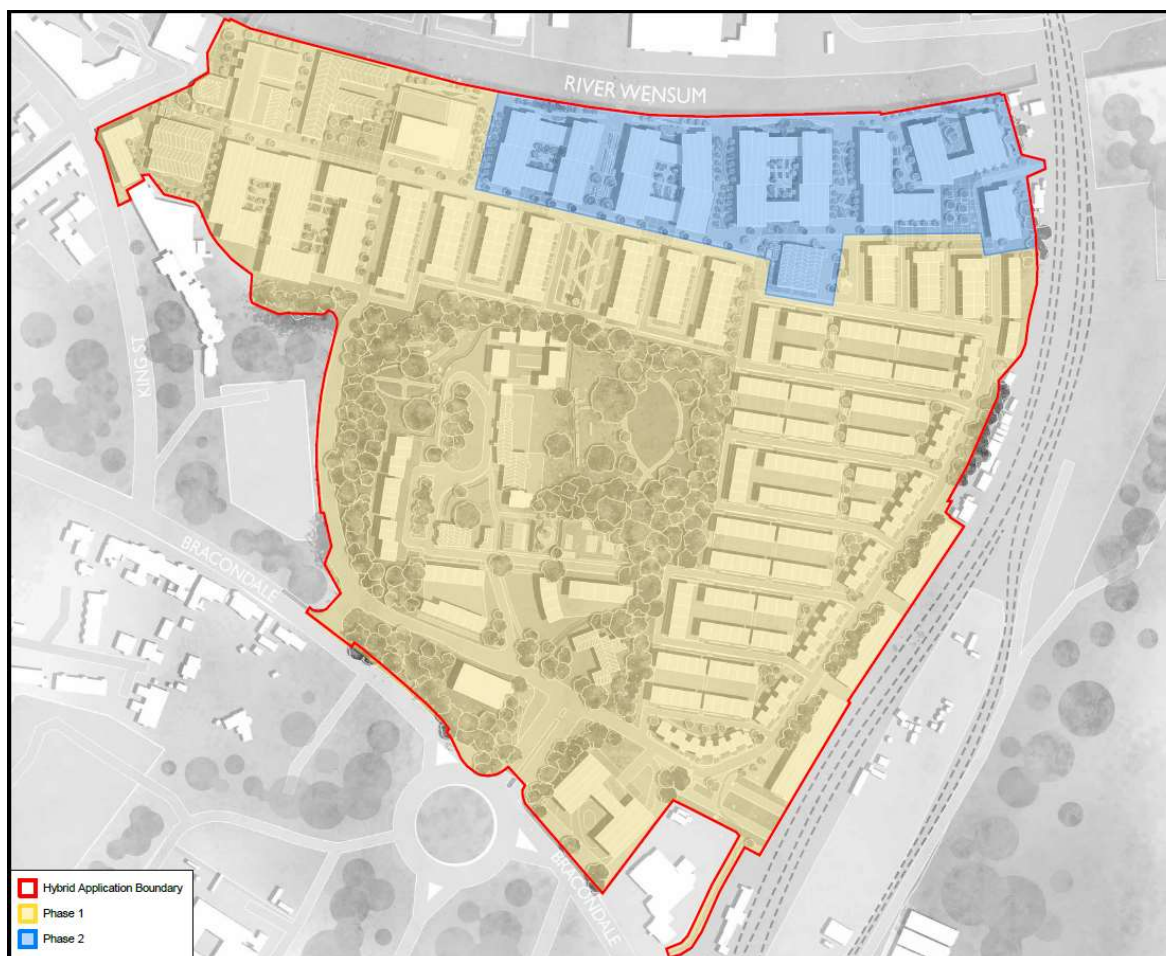
6.2 It is proposed that a Construction Environmental Management Plan (CEMP) would be prepared and implemented for the construction phase of the Proposed Development. This would be discussed and agreed with the relevant planning officers at NCC prior to the commencement of works. An outline of the content of the CEMP is provided in this Chapter.

6.3 Planning for construction is necessarily broad at this stage and may be subject to modification. For example, specific construction activities could vary in frequency depending upon the particular stage of works. Consequently, where uncertainty exists, the assessment has assumed a 'worst-case' situation. It is considered, however, that sufficient information is available at this stage to enable the likely significant environmental effects relating to the construction works to be identified and their significance assessed.

## PROGRAMME OF WORKS

6.4 The Proposed Development will be constructed in two Phases. It is anticipated that the duration of the construction works for Phase 1 will be to be approximately 5 years commencing in 2024 and completed by end 2028 and Phase 2 will be approximately 13 years commencing in 2028 and completed by end 2040.

**Figure 6.1: Phasing Plan**



## DESCRIPTION OF THE WORKS

6.5 The proposed construction works can be divided into the following main stages:

- Enabling works;
- Site preparation;
- Construction of the mixed use development; and
- Removal of remaining construction elements.



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### Enabling Works

6.6 Enabling works will be undertaken prior to the start of the main construction works. The extent of these works would include:

- Establishment of site project offices and construction compound including car designated parking areas for contractors;
- Isolation or diversion of utility services impinging upon excavation areas;
- Provision of temporary electrical supplies and other required services for the duration of the construction works; and
- Erection of site hoardings including provision of a site security system.

### Site Preparation

6.7 All existing non-critical infrastructure will be removed. All works will be strictly managed to ensure that vehicle movement and dust are controlled and kept to a minimum. Further details on the management of dust are included in Chapter 8: Air Quality.

6.8 All live utilities and any live drainage would be capped off or diverted before any excavation works commence. A method statement will be produced outlining the process for identifying and disconnecting existing services as necessary.

6.9 Once the temporary works are in place, any groundworks or earthmoving would proceed. All material will be re-used on-site where possible, or otherwise transported off-site where reuse is not possible.

### Construction of Proposed Development

6.10 The operation of construction vehicles and general construction activities may give rise to the potential for surface runoff to become contaminated with hydrocarbons, silt or other construction materials. This may in turn lead to a contamination event should site drainage be allowed to enter watercourses. Excavations may require dewatering (of accumulated rainfall or runoff) during construction. In such circumstances, it will be important to ensure that the quality of this water is sufficiently high to allow discharge to an appropriate point. Further details on drainage are provided in Chapter 11: Water Quality, Hydrology and Flood Risk.



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### Removal of Remaining Construction Elements

6.11 This last phase will be undertaken at the end of the main construction works or where the construction has progressed to a stage where it can be undertaken at an earlier time. The extent of these works would include:

- Removal of site project offices and construction compound;
- Decommissioning of temporary electrical supplies and other required services utilised for the construction works; and
- Removal of site hoardings and site security system.

### **HOURS OF WORK**

6.12 It is proposed that hours of work during the construction phase would be as follows:

- 0800-1800hrs on weekdays;
- 0800-1300hrs on Saturdays; and
- No working on Sundays or bank holidays.

6.13 These proposed hours would be agreed with the Local Authority Planning department prior to commencement of the works. Special working outside these hours, such as heavy plant activities and crane and equipment assembly, would be kept to a minimum and would be subject to prior agreement with reasonable notice by the Local Authority's Environmental Health Officer (EHO).

6.14 It is anticipated that none of the works outlined above will be carried out on Sundays or Bank Holidays without special prior agreement with NCC and other relevant parties.

### **PLANT AND EQUIPMENT**

6.15 The following plant and equipment is anticipated to be used during the construction works.



**Table 6.1: Indicative Plant used during Construction**

Plant and Equipment	Enabling works and Site Preparation	Construction	Services installation	Fit out	Landscaping
Concrete silo and ready-mix lorries		X	X		X
Concrete cutter, saws and splitters	X	X	X		X
Cranes and hoists	X	X			
Cutters, drills and small tools		X	X	X	
Excavators and breakers	X	X	X		X
Floodlights	X	X		X	
Fork lifts trucks		X	X	X	
Hydraulic benders and cutters		X	X	X	
Road Brush Vehicles		X	X	X	
Lorries/vans	X	X	X	X	X
Tarmac laying equipment		X			X
Scaffolding and access platforms		X		X	X
Temporary supports		X		X	
Tipper lorries		X			X
Wheel washers	X	X	X		X
Skips & Skip trucks	X	X		X	X



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## ENVIRONMENTAL MANAGEMENT AND MITIGATION

### Environmental Management Plan

6.16 A principal construction contractor will be responsible for all aspects of construction operations. In line with best practice, the construction contractor will subscribe to the CCS (Considerate Contractors Scheme).

6.17 A CEMP would be prepared by the Principal Contractor which would include details of all relevant environmental management controls necessary for environmental protection during the construction works. This would follow best practice guidelines and would be agreed with the Local Authority Environmental Health Department.

6.18 The CEMP would include:

- Restrictions and targets for specific work activities in order to minimise environmental effects, including disruption and disturbance to local residents (if relevant), workers and the general public;
- Details of the means by which appropriate environmental monitoring, record keeping and reporting would be managed to ensure the above targets are being met;
- Procedure(s) to deal with necessary 'abnormal' works that may result in deviation from the agreed procedures and targets; and
- Provision for a programme of regular environmental audits and reviews at key stages in the construction programme.

6.19 The CEMP would place stringent contractual and procedural performance obligations upon trade contractors. These would be maintained and reinforced by commitments detailed below and, where relevant, within Chapters 7-17 inclusive. Such obligations would be enforced through subsequent detailed agreements with and consents provided by the Local Authority. A clear management structure and description of the responsibilities and authority of a specific Project Environmental Manager (PEM) would be included.

6.20 The PEM would have primary responsibility for liaising with the Planning Authority and other statutory agencies on environmental matters. It is anticipated that regular meetings would take place to review progress and to agree necessary options. Notwithstanding this, it is recognised that positive action and reaction by site operatives at the time of any environmental incident or breach of targets are essential components for effective environmental management.



6.21 The CEMP would address requirements in relation to environmental controls and would allow for, and include, the following:

- The appointment of an experienced PEM responsible for the preparation and implementation of the CEMP;
- Details of the phasing of the works, including information on construction works that may be carried out by trade contractors;
- Procedures for construction activities, highlighting any operations likely to result in adverse environmental effects, with an indication of the mitigation measures to be employed;
- Wheel washing and highway cleaning procedures;
- Reference to and provision of a framework for compliance with all legislation that would be relevant;
- Emergency procedures that would be implemented on the Application Site;
- Prohibited or restricted operations;
- Control limits of target criteria for environmental issues, where practicable;
- Requirements for monitoring and record-keeping;
- Mechanisms for third parties to register complaints and the procedures for responding to complaints;
- Provisions for reporting, public liaison and prior notification, especially where dispensations would be required;
- Details of construction operations, highlighting the operations most likely to result in disturbance and/or working outside core working hours, together with an indication of the expected duration of each activity;
- Possible departures from target criteria and details of how any adverse effects would be minimised or potential complaints addressed;
- Details of proposed routes for HGVs travelling to and from the Application Site;
- Provisions for auditing by the PEM, NCC and other regulatory authorities, where appropriate;
- Details of plant to be used;
- Details of all construction works involving interference with a public highway, including temporary carriageway/footpath closures, realignments and diversions; and
- Housekeeping procedures and environmental management controls.





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### Contract Conditions

6.22 Individual trade contracts would incorporate appropriate requirements in respect of environmental control, based largely on the standards of 'good working practice' outlined in the EMP in addition to statutory requirements. Contractors would therefore be required to demonstrate how they would achieve the provisions of the EMP, how targets would be met and how potential adverse environmental effects would be minimised.

### Management of Construction Works

6.23 The PEM would deal with queries from the public and other complaints and enquiries. This nominated individual would be named at the site entrance, with a contact number and would be identified to the Local Authority and community groups, prior to the start of the onsite activities and whenever a change of responsibility occurs.

6.24 Any complaints would be logged and reported to the relevant individual within the Local Authority (and *vice versa*) as soon as practicable.

6.25 The CEMP would specify the roles and responsibilities of the PEM and the appropriate Officers within Local Authority in respect of any breaches or complaints from the public. The required actions would be different in each specific case, depending on the operation, equipment or location.

### Emergencies and Accidents

6.26 The building contractor would be required to maintain high safety standards on-site and to be fully compliant with current health and safety legislation.

6.27 An Emergency Incident Plan would be put in place to deal with potential spillages and/or pollution incidents. Any pollution incidents would be reported immediately to the regulatory bodies.

### Materials Storage and Handling

6.28 Environmental issues would be considered in the procurement of raw materials and manufactured building components and all such materials would be appropriately stored on the site to minimise damage by vehicles, vandals, weather or theft. Deliveries of hazardous



materials would be supervised and a just-in-time deliveries system would be implemented to minimise storage times and reduce the risk of spillage on-site. Tanks and drums of liquid chemicals and fuels would be stored in bunded compounds. Packaging materials would be returned, where possible.

6.29 Contractors and their sub-contractors would be expected to maintain a tidy site and, where practical, to operate a 'just-in-time' policy for the delivery and supply of materials for the works.

6.30 Mobile cranes would be used for general unloading and hoisting. Passenger/goods materials hoists, fork lift trucks and other electric or hydraulically operated plant may be used to distribute and transport materials around the site.

#### Waste Management and Minimisation

6.31 Waste would be generated during all stages of the construction works. Although specific materials cannot be identified at this stage of the design, potential sources of waste within the construction process are anticipated to comprise:

- Excavated material;
- Packaging – including plastics, wooden pallets, expanded foams;
- Waste materials generated from inaccurate ordering, poor usage, badly stored materials, poor handling, spillage; and
- Dirty water, for example from site runoff containing silt.

6.32 It is the intention of the project to use all excavated material, wherever possible within the Proposed Development.

6.33 A Site Waste Management Plan (SWMP) would be developed and implemented detailing how waste created during the construction phase would be managed. This would be prepared by the Contractor in accordance with the Site Waste Management Plan Regulations 2008 and non-statutory guidance on preparation of SWMPs. All relevant Contractors would be required to investigate opportunities to minimise waste arisings at source and, where such waste generation is unavoidable, to maximise the recycling and reuse potential of construction materials. Recycling of materials would take place off-site, where noise and dust are less likely to result in effects to the occupants of surrounding properties. Appropriate waste management and recycling centres close to the Application Site would be identified prior to the construction



works and contracts would be established with registered waste carriers and authorised waste disposers for construction waste.

6.34 All waste would be stored on the Application Site in accordance with the relevant legislation and no burning of construction waste would be undertaken at the Application Site.

6.35 The destination of all waste or other materials removed during construction would be notified to the relevant authority by the Contractor/Construction Manager for approval. Loads would only be deposited at authorised waste treatment and disposal sites. Deposition of waste would be in accordance with the requirements of the EA, Environmental Protection Act 1990 (EPA), the Controlled Waste Regulations 1992 as amended, the Hazardous Waste Regulations 2005 (Ref 6.2), the List of Wastes (England) Regulations 2005 (Ref 6.3) and the Waste (England and Wales) Regulations 2011.

#### Traffic and Access Management

6.36 Specific detail relating to the management of construction traffic will be presented within a dedicated construction transportation plan, which will be submitted for approval by the Local Authority post planning.

6.37 All construction traffic entering and leaving the Application Site would be closely controlled. Deliveries would be phased and controlled on a 'just-in-time' basis, wherever possible. This would minimise travel time and traffic congestion around the Application Site.

6.38 The majority of all deliveries would be made by standard HGVs, with no special access / delivery requirements.

6.39 No parking on public roads would be allowed and the Contractor/Construction Manager would be responsible for enforcing this requirement. Provision would be made within the Application Site for essential on-site parking. Any local traffic management measures for site access would be agreed with the relevant authorities.

#### Air Quality and Dust

6.40 Site-specific best practice measures would be implemented by contractors to minimise the disturbance to local residents and other potentially sensitive receptors. These measures would include:



- 
- Damping down surfaces during dry weather;
  - Providing appropriate hoarding and/or fencing to reduce dust dispersion and restrict public access;
  - Sheeting buildings, chutes, skips and vehicles removing wastes with the potential for dust generation;
  - Appropriate handling and storage of materials, especially stockpiled materials;
  - Restricting drop heights onto lorries and other equipment;
  - Fitting all equipment with dust control measures such as water sprays wherever possible;
  - Using a wheel wash, limiting speeds on the site to 5 mph, avoidance of unnecessary idling of engines and routing of site vehicles as far from sensitive properties as possible;
  - Using gas powered generators rather than diesel, if possible (these are also quieter) and ensuring that all plant and vehicles are well maintained so that exhaust emissions do not breach statutory emission limits;
  - Switching off all plant when not in use;
  - No fires would be allowed on the site; and
  - Ensuring that a road sweeper is available to clean mud and other debris from hardstanding, roads and footpaths.

6.41 Full assessments of the potential effects of the construction works on air quality are presented in Chapter 8: Air Quality.

#### Hazardous Materials and Contaminated Land

6.42 Prior to construction, the Contractor would be required to prepare a Method Statement and Risk Assessment demonstrating how the safety of construction workers and the public would be addressed in terms of potentially harmful substances. Protective measures would include:

- Provision of adequate facilities and procedures for personal washing and changing;
- Provision and use of personal protective equipment (PPE);
- Implementation of dust suppression methods; and
- Implementation measures to avoid surface water ponding and the collection and disposal of the site runoff.



6.43 Such measures should be carried out in accordance with the Protection of Workers and the General Public during the Development of Contaminated Land document and CIRIA Report 132: A Guide for Safe Working on Contaminated Sites (Ref 6.4).

6.44 Other practical methods of limiting risks from hazardous materials and contaminated land would include:

- The storage of all potentially hazardous materials on hard surfaced areas, with bunding to the satisfaction of the Environment Agency;
- The storage of ground tank oil in accordance with the Control of Pollution (Oil Storage) (England) Regulations, 2001 (Ref 6.5); and
- The treatment of any excess dewatering effluent prior to discharging to the foul sewerage system and only on the achievement of an approved discharge consent from Anglian Water.

#### Site Drainage and Effects on Water Resources

6.45 The assessment of the potential effects of the proposals on water resources is presented in Chapter 11: Water Quality, Hydrology and Flood Risk. Specific best practice pollution prevention measures will be in place during construction, with key requirements described within the assessment chapter. These measures will form part of the CEMP, together with an emergency mitigation plan should any accidents occur that involve spillage.

#### Protection of Ecological Resources

6.46 An assessment of the potential effects of the construction of the Proposed Development on ecological resources is presented in Chapter 1: Ecology and Nature Conservation.

6.47 Chapter 11 details the measures that will be taken to mitigate effects from the construction phase can be broadly summarised as follows:

- Screening during construction;
- No trenches or excavations to be left open, though if unavoidable, exit ramps will be put in place;
- No night-time working or lighting during construction;
- Adherence to the EA's Pollution Prevention Guidance Notes;
- Careful timing of works; and



- Ecologically-informed lighting strategy for operational phase.

## **CUMULATIVE EFFECTS**

6.48 Any cumulative effects during the construction phase are identified within Chapters 7-17 where relevant.

## **SUMMARY AND CONCLUSIONS**

6.49 The construction effects of the Proposed Development would be managed through the development of a project and site-specific CEMP. The CEMP would be agreed with the Local Authority and other relevant bodies prior to the commencement of works which, as a minimum, would comply with the mitigation measures set out in this ES. The CEMP would outline methods for contractor and general public liaison, hours of work, methods to deal with complaints and outline management practices to control dust, traffic and access, waste, water pollution, ecological and archaeological effects, ensuring a high level of control throughout the construction works.

6.50 The procedures within the CEMP would ensure the delivery of a high level of environmental control throughout the construction phase, thereby minimising the potential for adverse effects. Further detail regarding specific mitigation during construction works for the Proposed Development is presented within Chapters 7 to 17 of this ES.



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## REFERENCES

**Ref 6.1:** HMSO (2011) The Waste (England and Wales) Regulations 2011

**Ref 6.2:** Office of the Deputy Prime Minister (2005) The Hazardous Waste (England and Wales) Regulations, SI 2005 No.894. HMSO, Norwich.

**Ref 6.3:** HMSO (2005) The List of Wastes (England) Regulations 2005

**Ref 6.4:** CIRIA (2002) CIRIA Report 132 Good Practice Guidance For The Management of Contaminated Land. Safe Working Practices on Contaminated Sites.

**Ref 6.5:** HMSO (2001) Control of Pollution (Oil Storage) (England) Regulations.



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## 7 TRANSPORT AND ACCESS

### INTRODUCTION

7.1 This Chapter assesses the potential effects of the Proposed Development in relation to transport and access. It summarises the findings of the Transport Assessment (TA), Framework Travel Plan (FTP) and Delivery & Servicing Plan (DSP) prepared by Entran Ltd, which are included as Appendix 7.1.

7.2 The existing transport network in the vicinity of the Application Site has been described in the context of national, regional and local transport policy. The effects of the Proposed Development on the network have been assessed taking into consideration future changes resulting from committed developments in the area and the net changes in travel demand

### ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

#### Assessment Methodology

7.3 The Transport Assessment (TA) has been prepared in accordance with good practice guidance published by both the Department for Transport (DfT) and the (then) Department for Communities and Local Government (DGLG). The above guidance indicates that the assessment should set out the baseline conditions against which effects should be fully assessed. It also states that the TA should include details of the extant and lawful uses of the Application Site. For the purposes of the EIA, the existing observed baseline conditions are used as the basis of assessment.

7.4 It should be noted that the former use of the Application Site as large, complex industrial and distribution operation resulted in significant travel demand on the local transport network. The lawful use of the Application Site would allow the former factories to be brought back into use without the need for further planning permission. However, the factories closed in 2020 and all observed baseline conditions are based on the Application Site being vacant. It is acknowledged that a certain amount of activity is still taking place on-site in terms of security and maintenance, but this is negligible compared to the former employment and manufacturing operations. Pre-application discussions have been held with the local highway authority, Norfolk County Council (NcoC). Those discussions have informed the scope of the Transport Assessment (TA) and the ES Transport chapter.





## Significance Criteria

7.5 The potential effects and residual effects of the Proposed Development upon all transport modes have been assessed using the significance criteria in Table 7.1. These criteria have been based on professional judgement and outline the approach to categorising the significance of effects identified within the Transport Assessment.

**Table 7.1 – Significance Criteria for Transport**

Significance criteria	Description			
	Traffic	Public Transport	Walking & cycling	Construction traffic
Major adverse effect	>50% increase in either daily or peak hour traffic flows on any road.	>50% increase in either daily or peak hour passenger demand for public transport.	On and off-Site facilities for pedestrians and cyclists significantly degraded.	>50% increase in either daily or peak hour traffic flows on any road.
Moderate adverse effect	20%-50% increase in either daily or peak hour traffic flows on any road.	20%-50% increase in either daily or peak hour passenger demand for public transport.	On and off-Site facilities for pedestrians and cyclists degraded.	20%-50% increase in either daily or peak hour traffic flows on any road.
Minor adverse effect	5%-20% increase in either daily or peak hour traffic flows on any road.	5%-20% increase in either daily or peak hour passenger demand for public transport.	On Site facilities for pedestrians and cyclists degraded.	5%-20% increase in either daily or peak hour traffic flows on any road.
Neutral	<5% change in daily and peak hour traffic flows on all roads.	<5% change in daily and peak hour passenger demand for public transport.	Facilities for pedestrians and cyclists neither enhanced nor degraded.	<5% change in daily and peak hour traffic flows on all roads.
Minor beneficial effect	No increase in traffic on any road with 5%-20% reduction in daily and peak hour traffic flows on one or more roads.	5%-20% reduction in daily and peak hour passenger demand for public transport.	On Site facilities for pedestrians and cyclists enhanced.	5%-20% reduction in either daily or peak hour traffic flows on any road.



Significance criteria	Description			
	Traffic	Public Transport	Walking & cycling	Construction traffic
Moderate beneficial effect	No increase in traffic on any road with 20%-50% reduction in daily and peak hour traffic flows on one or more roads.	20%-50% reduction in daily and peak hour passenger demand for public transport.	On and off-Site facilities for pedestrians and cyclists enhanced.	20%-50% reduction in either daily or peak hour traffic flows on any road.
Manor beneficial effect	No increase in traffic on any road with >50% reduction in daily and peak hour traffic flows on one or more roads.	>50% reduction in daily and peak hour passenger demand for public transport.	On and off-Site facilities for pedestrians and cyclists significantly enhanced.	>50% reduction in either daily or peak hour traffic flows on any road.

7.6 In addition to the magnitude of effect as set out in Table 7.1 above, the duration and geographical extent of the effect are also considered. These are categorised as short term, medium term and long term; local, regional and national.

## LEGISLATION, PLANNING POLICY AND GUIDANCE

### National Planning Policy

7.7 Key national planning policy in relation to the transport effects of the Proposed Development comprises:

### Department for Transport, Delivering a Sustainable Transport System (2008)

7.8 In October 2007, The Department for Transport (DfT) published 'Towards a Sustainable Transport System' (TaSTS) (Ref 7.1) and in December 2008 DfT published 'Delivering a Sustainable Transport System' (DaSTS) (Ref 7.2) both in response to the Eddington study. These reports set five clear goals for the UK's transport system.

- To support national economic competitiveness and growth, by delivering reliable and efficient transport networks;
- To reduce transport's emissions of carbon dioxide and other greenhouse gases, with the desired outcome of tackling climate change;



- To contribute to better safety, security and health and longer life expectancy by reducing the risk of death, injury or illness arising from transport, and by promoting travel modes that are beneficial to health;
- To promote greater equality of opportunity for all citizens, with the desired outcome of achieving a fairer society; and
- To improve quality of life for transport users and non-transport users, and to promote a healthy natural environment.

7.9 All integrated planning and transport policy must therefore be considered under the aegis of these goals.

Department for Transport, Creating Growth, Cutting Carbon – Making Sustainable Transport Happen (2011)

7.10 In January 2011, the Government published this White Paper (Ref 7.3). This paper outlined the coalition Government's vision for a transport system that is an engine for economic growth, but one that is also greener and safer and improves quality of life in our communities. It stated that investment on its own is not enough, we also need to help people to make transport choices that are good for society as a whole; however, it also stated that the Government recognises that it is not possible for public transport, walking or cycling to represent viable alternatives to the private car for all journeys, particularly in rural areas and for some longer multi-leg journeys and so the Government is committed to making car travel greener by supporting greener automotive technology.

Department for Communities and Local Government, National Planning Policy Framework (2012) (Latest revision 2021)

7.11 Paragraph 113 of the NPPF (Ref. 7.4) requires that all developments which generate significant amounts of movement should be supported by a transport statement or transport assessment. Planning decisions should take account of whether the Proposed Development.

- Has taken up appropriate opportunities to promote sustainable transport modes, given the type of development and its location;
- Safe and suitable access to the site can be achieved for all users; and
- Any significant impacts from the development on the transport network (in terms of capacity and congestion), or on highway safety, can be cost effectively mitigated to an acceptable degree.



7.12 Paragraph 111 states that development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network would be severe.

Department for Transport Guidance on Transport Assessments (2007)

7.13 DfT guidance on transport assessments (Ref.7.5) stated that when preparing such reports due consideration should be given to factors such as environmental sustainability, managing existing networks and mitigating the residual effects of traffic. The guidance was intended to assist stakeholders in determining whether an assessment may be required and, if so, what the level and scope of that assessment should be. It also provided guidance on the content and preparation of transport assessments and transport statements.

7.14 A key difference between a Transport Assessment (TA) and the former Traffic Impact Assessment (TIA) is the requirement to seek to influence travel behaviour rather than merely predicting the transport effects of a development and providing for it. The DfT guidance is clear that this should be an iterative process whereby the impacts are determined and if they are not deemed acceptable the form of development should be reconsidered to maximise travel by sustainable modes of transport. Furthermore, unlike a TIA and an EIA, where a Site is unused or partially vacant the baseline conditions for a TA should take account of the extant uses of the Application Site.

Department for Communities and Local Government planning practice guidance (2014)

7.15 In 2014 the (then) DCLG published a suite of Planning Practice Guidance (PPG) including advice entitled “Travel plans, transport assessments and statements in decision taking” (Ref 7.6). The 2007 guidance has now been formally replaced by the PPG as current government guidance on the transport related effects of development; however, many highway authorities and practitioners still refer to the 2007 guide on certain matters detail.

**Regional Policy and Guidance**

Norfolk County Council Safe, Sustainable Development : Aims and Guidance Notes for Local Highway Authority Requirements in Development Planning (2019)

7.16 The NCC publication “Safe, Sustainable Development: Aims and Guidance notes for Local Highway Authority requirements in Development Management” was revised in 2019 (Ref



7.7). These guidance notes are in line with the National Planning Policy Framework (NPPF) and are intended to act as best practice and general guidance for use by local authorities, developers, designers, Councillors and the local community. The intention is to ensure good design is achieved, thereby improving the safety and quality of the places in which we live.

## **BASELINE CONDITIONS**

### Application Site

7.17 The Carrow Works site (Application Site) is located to the south of the River Wensum and forms part of the East Norwich Masterplan area. The East Norwich development represents a transformative opportunity for regeneration of this area and the wider city. It is an ambitious project to create a sustainable new urban quarter for the city, supported by the preparation of a joined-up development masterplan for east Norwich and a commitment to substantial future investment. The development of the masterplan is one of the eight projects funded by the Towns fund.

7.18 The Application Site was home to the famous Norwich manufacturer, Colman's for 160 years. At its peak, the company employed 2300 people. Colman's became part of Unilever UK Ltd in 1995 after which the Application Site was not only the home of Colman's mustard, but also Britvic soft drinks. The factory closed in 2020. The Application Site is also home to the Grade I listed Carrow Abbey and the scheduled monument Carrow Priory ruins.

7.19 The Application Site takes vehicular access from the ring road via the five-arm roundabout junction of Martineau Lane (A1054) and Bracondale (A147). Due to the former factory use, the access from Bracondale is 14m wide at the highway boundary, widening out within the Application Site to effectively provide three barrier-controlled entry lanes and two barrier-controlled exit lanes.

7.20 The existing site access has footways on both sides but due to the former factory having intensive HGV usage, the pedestrian routes are protected from the carriageway by barriers. The pedestrian routes are safe but not particularly convenient. There are no segregated cycle routes. Beyond the entry control barriers, an internal access road runs east and west from the control point and forms a complete circuit around the perimeter of the Application Site. The Application Site also benefits from pedestrian, cycle and emergency access at the north-western corner via Paper Mill Yard, and pedestrian/cycle access at the north-eastern corner via an existing underpass beneath the rail line. There is a further emergency access at the south-east corner which emerges onto Bracondale adjacent to the Fire Station.



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### Highway network.

7.21 Bracondale is a classified road (which forms part of the A147 running north from the Application Site into the City Centre. Some 250m north of the site access, the A147 diverges at a three-arm signal-controlled junction; Bracondale runs north-west towards the Bus Station and Notre Dame High School, and King Street runs north towards the City Centre. The A147 diverges again where Carrow Road heads north-east across Carrow Bridge towards Carrow Road football stadium and Riverside Retail Park. All roads to the north of the site access roundabout are subject to a 30mph speed limit and benefit from a comprehensive system of street lighting.

7.22 The Application Site takes access from a five-arm roundabout at the junction of the A147 and the A1054. Two of the arms are named Bracondale, the A1054 is names Martineau Lane and the remaining two arms of the site access and the vehicle access into County Hall. There are splitter islands acting as pedestrian refuges on all five arms; there are uncontrolled pedestrian crossings on all arms. The roundabout is subject to a 40mph speed limit.

7.23 The south-eastern Bracondale arm heads over the rail line towards Trowse Newton but also provides access to the leisure uses at Norfolk Snowsports Club, Whitlingham Country Park and Whitlingham Broads.

7.24 Martineau Lane heads south-west to a three-arm signal-controlled junction with the A146. This forms part of the Norwich Ring Road and also provides a link to the A47, part of the trunk road network under the jurisdiction of National Highways.

### Pedestrian movement

7.25 For security reasons, all pedestrian movement into the factory site has been via the main access on Bracondale. All staff and visitors have had to check in at the main gate security. The Application Site previously had additional pedestrian access from Paper Mill Yard at the north-western corner, and a footbridge link to Carrow House. However, these accesses have been gated and are not currently accessible.

7.26 The main pedestrian routes to the Application Site are via King Street and Bracondale to the north and west as well as a segregated route alongside Martineau Lane to the south-west. Surrounding the Application Site there are key facilities within a suitable walking distance



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such as the local leisure centre, primary and secondary schools, a number of employment uses and the Riverside Retail Park with Morrisons supermarket approximately 1km away.

7.27 The footways either side of Bracondale and King Street are a minimum of 2m wide, generally in good condition and with relatively little clutter caused by street furniture. All pedestrian crossing points have flush dropped kerbs (max upstand 6mm) but not all crossing points have tactile paving.

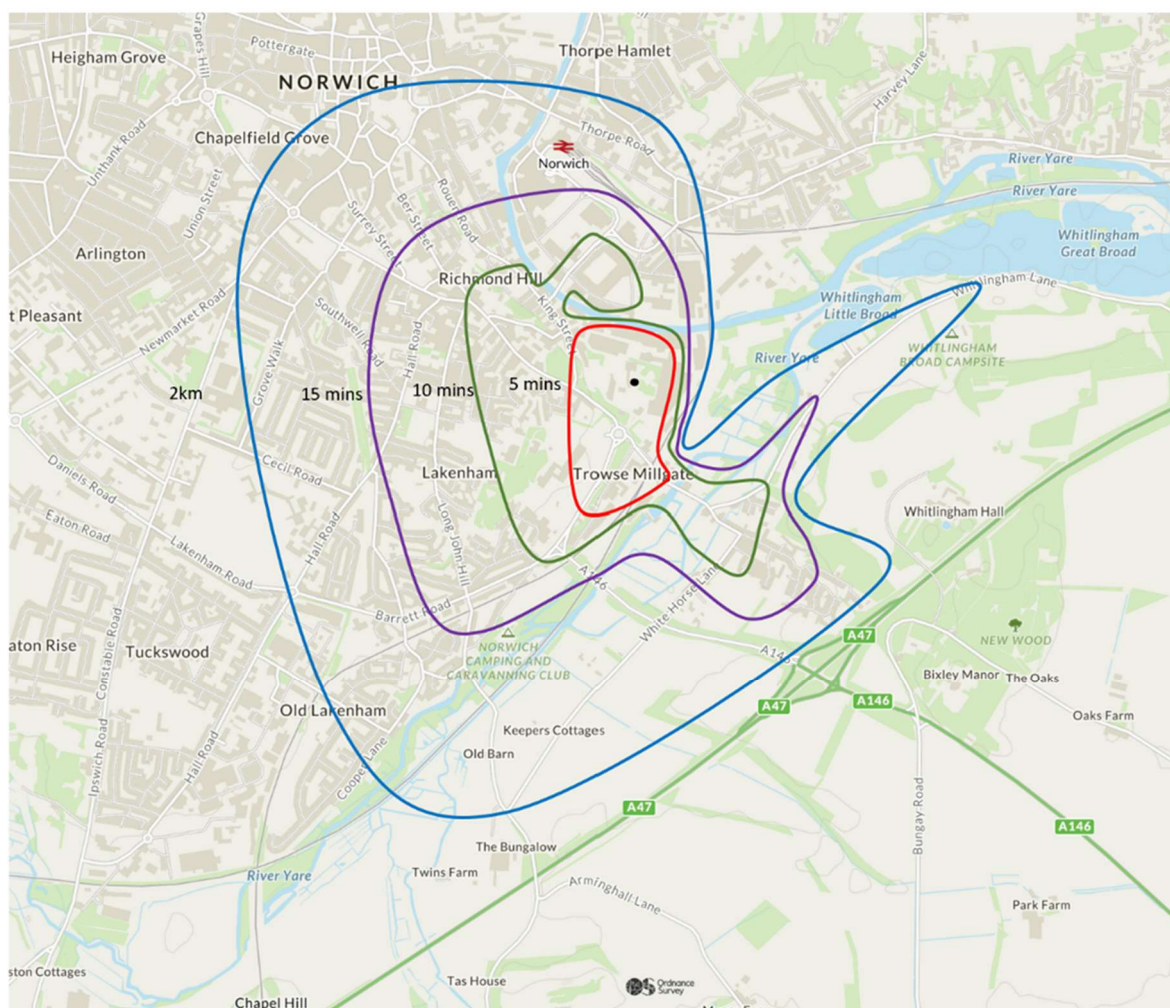
7.28 The three-arm signal-controlled junction of Bracondale and King Street has central pedestrian refuges on the northern and western arms, but none on the eastern arm. There are dropped kerbs but no dedicated pedestrian crossing phases.

7.29 Approximately 160m north of the junction a pelican crossing provides a controlled crossing over King Street.

7.30 Further north again, the junction of King Street and Carrow Road has an uncontrolled crossing on the northern arm, but none on the eastern arm (Carrow Road) or southern arm.

7.31 Figure 7.1 below shows 5, 10 and 15-minute walking isochrones as well as a 2km walking distance, measured from the centre of the Application Site.

**Figure 7.1 – Pedestrian isochrones.**



7.32 Figure 7.1 illustrates that the River Yare creates a degree of severance to the north and the rail line is a barrier to the east. Notwithstanding this, the carrow stadium and its environs are within a 10-minute walk of the Application Site. A large residential catchment in the Lakenham and Richmond Hill area are within a 15-minute walk of the Application Site as is the Riverside retail park.

7.33 Measures to increase permeability across the river and the rail line would significantly improve the pedestrian catchment to the north and east of the Application Site. This is covered in more detail in Section 9.

7.34 At present, Norwich station is slightly more than 15 minutes' walk from the Application Site, but well within the 2km walking distance. Importantly, the main city centre with its range of retail, leisure and employment facilities is around 2km walking distance from the Application Site.





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### Cycle movement

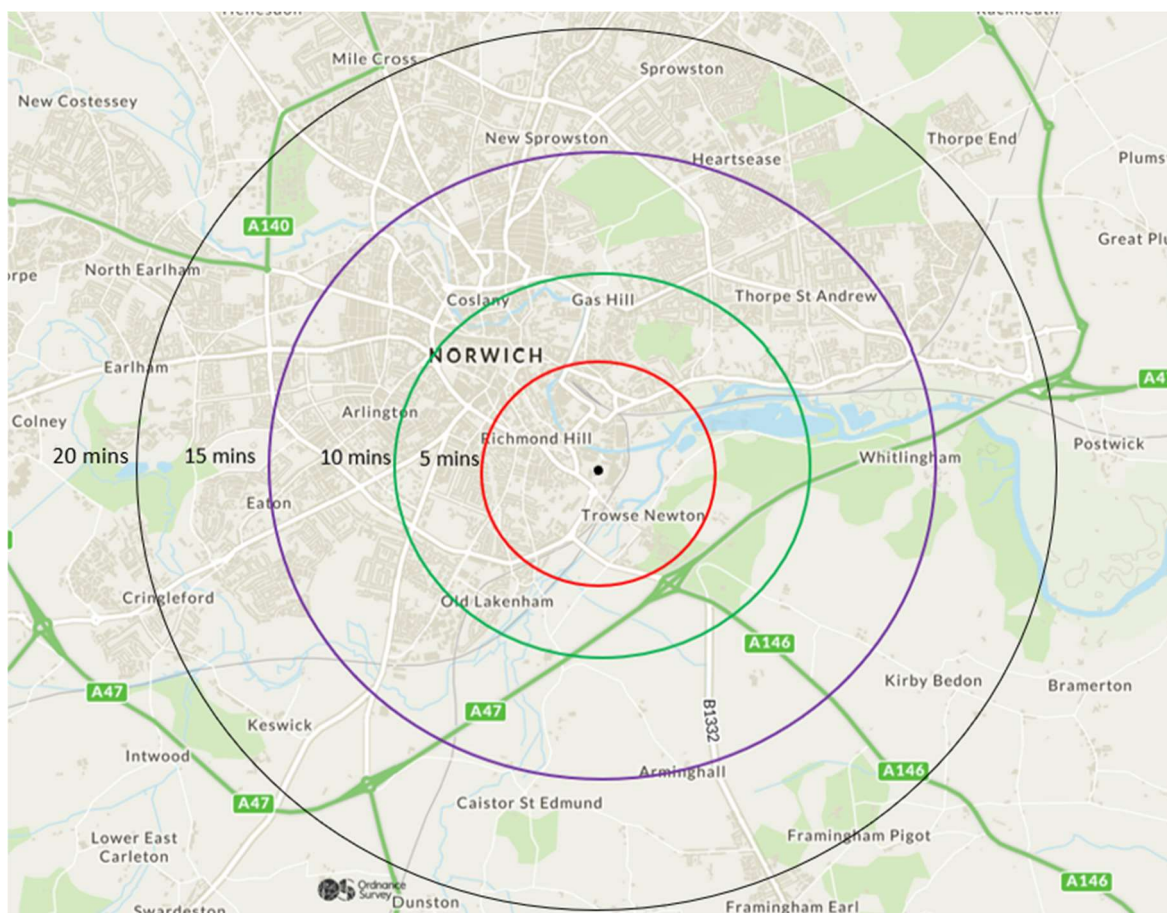
7.35 The National Cycle Network Route 1 (NCN1) runs past the south and west of the Application Site and straight through the centre of Norwich; this national cycle route intersects multiple other cycle routes such as the inner circuit and the West to East route to access the majority of the city.

7.36 As it passes the Application Site, NCN1 is in the form of a shared cycleway footway along the north-eastern side of Bracondale. NCN1 is a long-distance cycle route which runs in sections from Dover to the Scottish highlands; it is a much-loved and well used leisure route, however, locally it provides a direct and convenient route to Fakenham (north-west of Norwich) and Beccles (to the south-east). From Beccles, additional national routes run to Lowestoft and Southwold.

7.37 The outer circuit is located to the west of the Application Site and runs along King Street (A147) and across Carrow Bridge. The outer circuit as the name would suggest runs around the outer parts of the city.

7.38 Both NCN1 and the outer circuit are described as a “route along a busy road” at the junction of Bracondale and King Street. Figure 7.2 below shows 5, 10, 15 and 20-minute cycle isochrones.

**Figure 7.2 – Cycle isochrones**

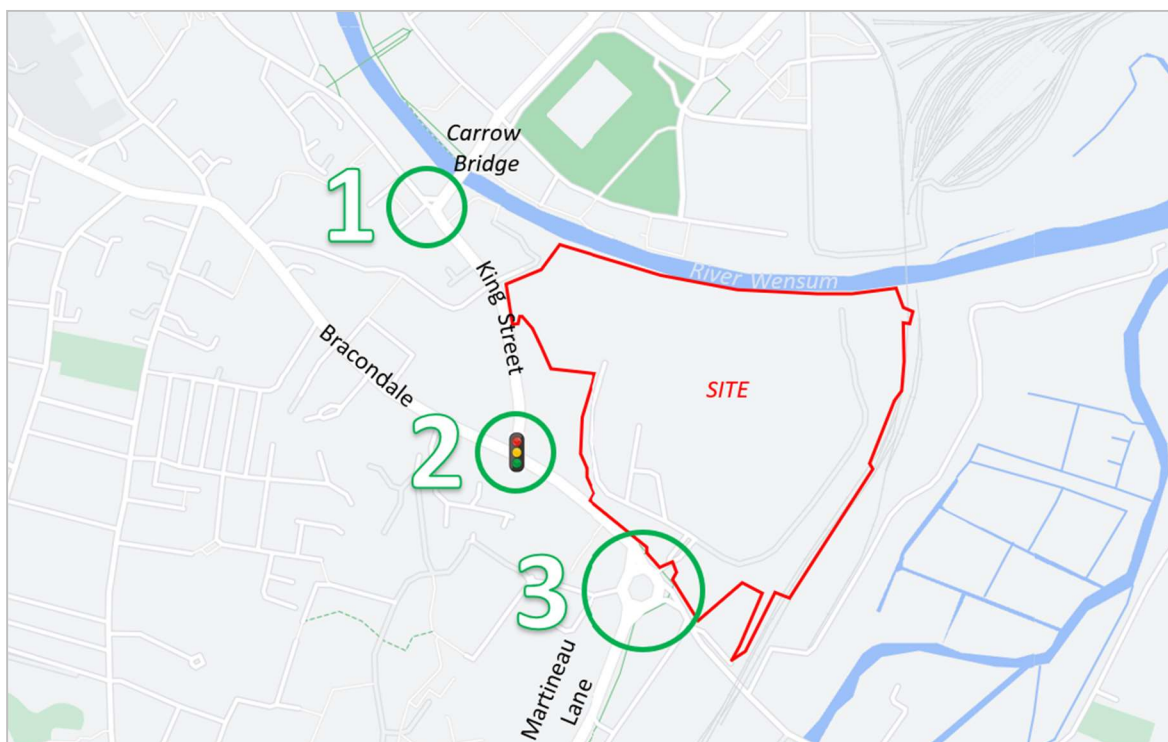


7.39 This illustrates that the city centre lies within easy cycling distance of the Application Site and that a large area of Norwich can be reached from the Application Site by bike within 20 minutes.

7.40 The combination of the National Cycle Network, local cycle routes and lightly trafficked residential roads make the Carrow Works site an excellent location to promote travel by bike.

7.41 During scoping discussions NCoC identified three junctions where cyclists currently experience delay, difficulties in crossing the carriageway or intimidation from traffic on busy roads. These are illustrated in Figure 7.3 below.

**Figure 7.3 – Existing junctions identified by NCoC as requiring improvement for cyclists**



7.42 The three junctions are:

- King Street j/w Carrow Road – simple priority junction (no right turn from Carrow Road during weekday peak hours)
- King Street j/w Bracondale – signal-controlled junction
- Bracondale j/w Martineau Lane – five-arm roundabout

7.43 It is noted that these three junctions are located on the route of NCN1 and form the main cycling route from the Application Site to the city centre. They also form the main cycling route from County Hall to the city centre. During scoping discussions, Entran requested details of any previous feasibility studies that had been carried out by NCoC to improve walking and cycling facilities in these locations, but none were forthcoming.

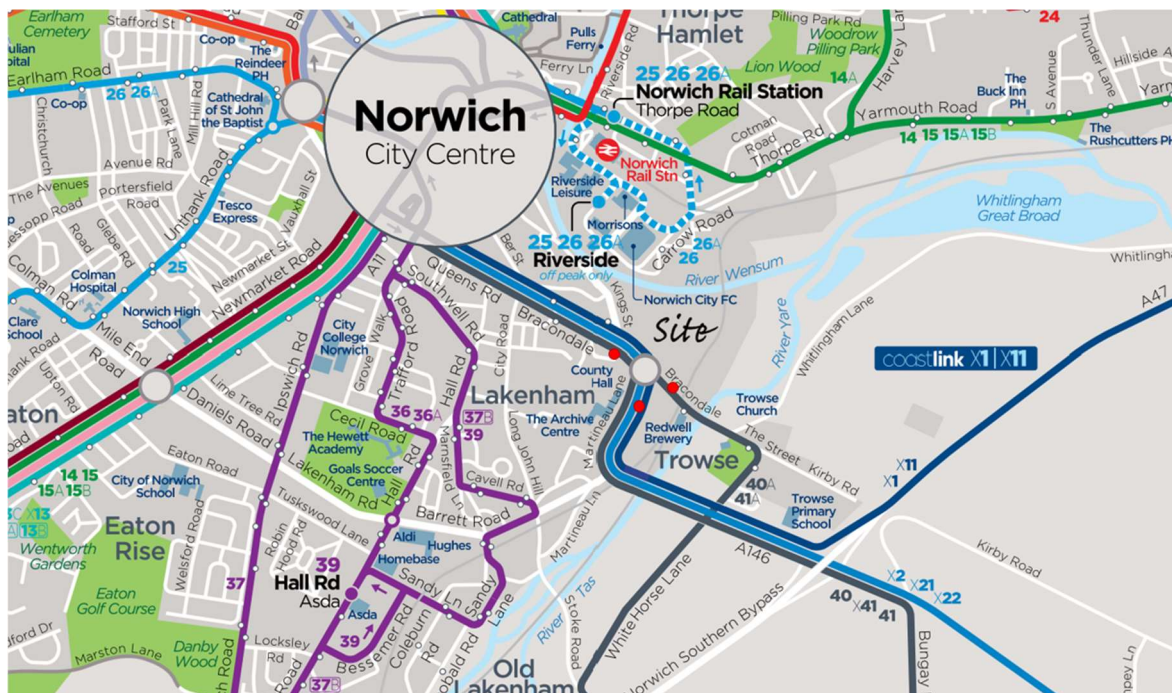
7.44 Further details of the assessment of improvement options are provided below.

#### Public transport

7.45 Three bus stops are located to the South of the Application Site. These are shown in red in Figure 3.3 below. A northbound stop is located on Bracondale outside County Hall (Stop D). This bus stop has a dedicated layby but no shelter or seating. A southbound bus stop is

located on Bracondale to the south-east of the roundabout (The Street), but this is served by a limited number of routes. An additional southbound stop is located on Martineau Lane (County Hall); this stop has a shelter, seating and timetable information. All three stops are within a 5-minute walk from the centre of the Application Site.

**Figure 7.4 – Local bus routes and stops.**



7.46 The bus routes serving these bus stops are summarised below (full bus timetables can be found on the NCoC website).

**Table 7.2 – Bus route summary**

No	Details	Duration	Frequency
85	Norwich-Claxton (Our bus)	0730-1700	1hr
86	Beccles-Norwich (Our Bus)	0700-1400	3 hours
146	Norwich – Southwold (Border bus)	0900-1900	30 mins
X2	Norwich – Lowestoft (First Norfolk and Suffolk)	0830-1900	30 mins
X21	Norwich- Lowestoft (First Norfolk and Suffolk)	0700-0830 1800-2030 2300	1hr20
X22	Norwich – Lowestoft (First Norfolk and Suffolk)	0700--2000	30 mins
X1	Norwich – Lowestoft (First Norfolk and Suffolk)	0700-2300	30 mins
X11	North-Belton (First Norfolk and Suffolk)	0745-1915	30 mins
40	Norwich-Poringland (First Norfolk and Suffolk)	0815-1700	1hr



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No	Details	Duration	Frequency
41	Norwich- Bungay (First Norfolk and Suffolk)	0845-1700	2hr
X41	Norwich-Bungay (First Norfolk and Suffolk)	0745-1750	2hr
41A	Norwich-Bungay (First Norfolk and Suffolk)	1730-2230	1hr

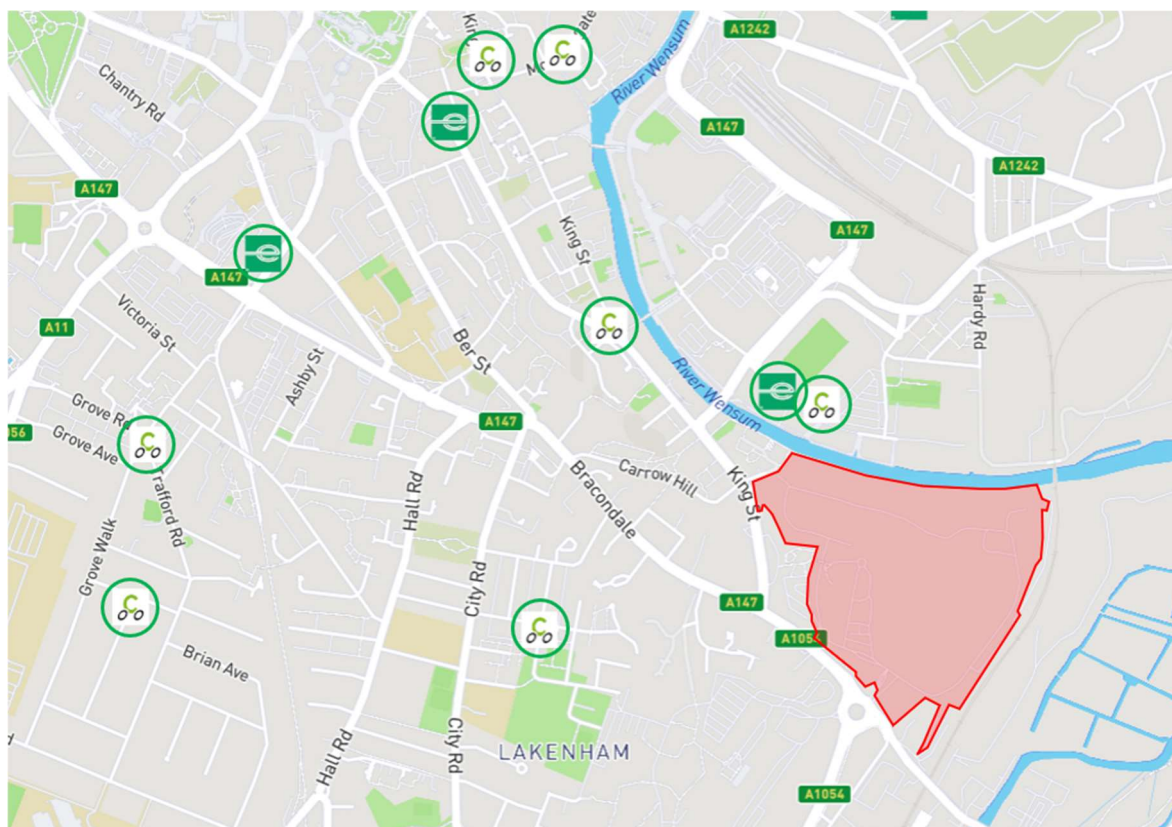
7.47 Figure 7.4 and Table 7.2 illustrate that the Application Site is well served by a range of existing bus services operating throughout the day to a wide catchment. A number of the services operate at a 30-minute frequency which is sufficient for passengers to simply turn up to a bus stop and catch the next bus rather than having to plan their journey around the timetable.

7.48 The nearest rail station is Norwich, some 1.2km to the north of the Application Site. This is within a 20-minute walk or 5-minute cycle. Norwich station benefits from a bus terminus and secure covered cycle parking. Trains from Norwich provide direct links to Stansted airport (2hr), London Liverpool Street (2hr), Great Yarmouth (35 mins), Sheringham (1hr), Lowestoft (45 mins) and Liverpool Lime Street (5hr 30 mins). This provides a wide catchment area for daily commuters and UK-wide travel connections.

#### Car Clubs

7.49 There are currently 109 Car Club vehicles in operation across Norwich. These are generally operated by Co-wheels and Enterprise Car Club. The closest of these are located on Geoffrey Watling Way next to the Carrow Road Stadium.

**Figure 7.5 – Existing Car Club locations**

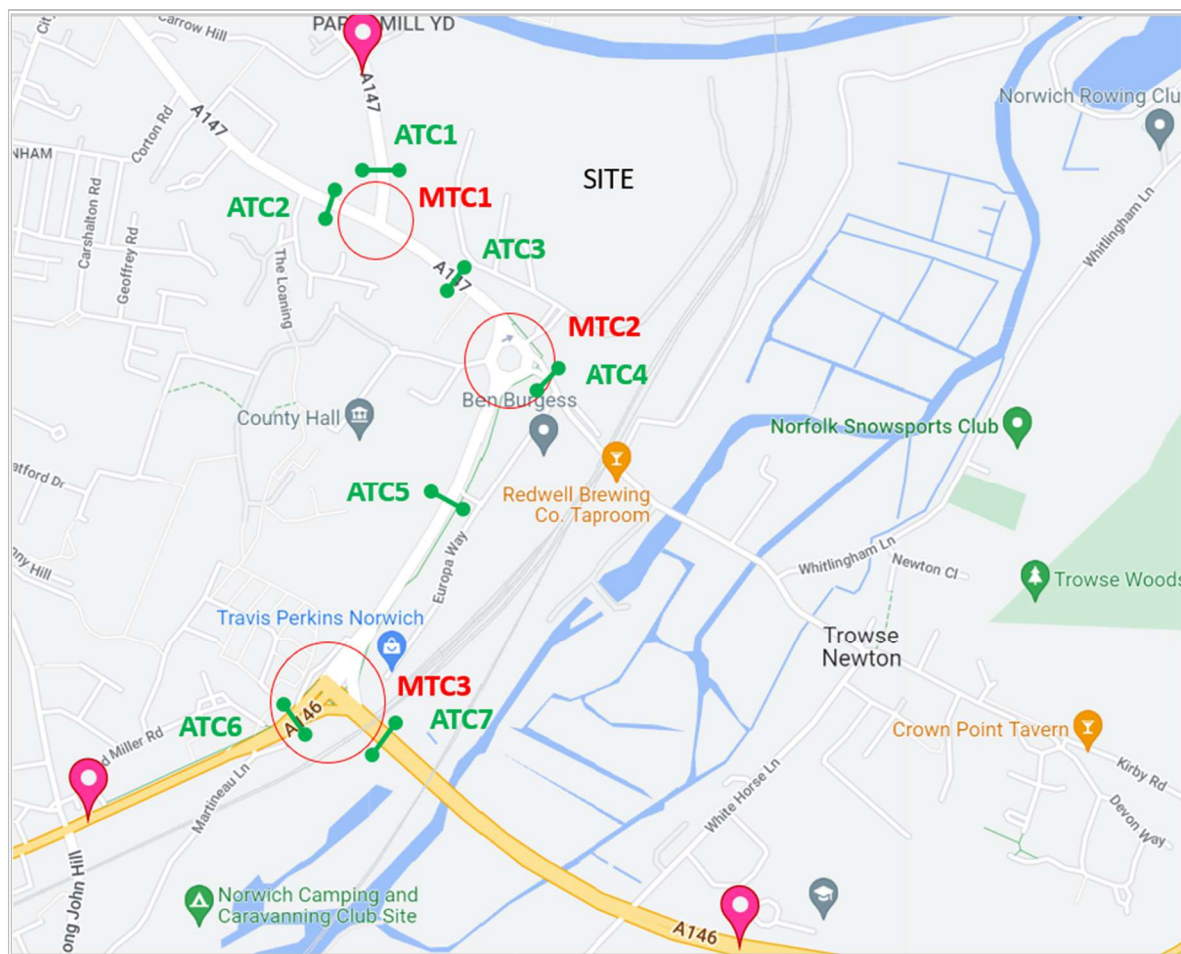


7.50 It is clear that ample opportunities exist to travel to and from the Application Site by foot, by bike, or using local public transport. This is a good site to promote sustainable travel and reduce reliance on the private car.

#### Baseline highway conditions

7.51 A number of traffic surveys have been undertaken on the surrounding highway network. A set of automatic traffic counters (ATCs) were installed to record 14 days of classified direction vehicle flows, including vehicle speeds in seven locations surrounding the Application Site. These are supported by manual peak hour turning counts (MTC) at three junctions. The survey locations are shown below.

**Figure 7.6 – Traffic survey locations**



7.52 The surveys were undertaken during a neutral month and avoiding school holidays. They were carried out during morning and evening peak periods (3 hours each) and across a Saturday lunchtime (4 hours). The ATCs include a Saturday during which Norwich City FC were playing a home game, and a Saturday when they were not. The combination of ATC and MTC data allows for peak hour junction capacity analyses to be carried out at the three junctions and to establish any proportional increase in vehicle movements beyond this study area.

7.53 Three permanent traffic count sites (shown pink) provide annual average daily flows (AADF) from 2000 to 2020. These show a marked reduction in 2020 due to the global pandemic; however, the available information from 2000 to 2019 allows an assessment of the ATC data to compare traffic flows in April 2022 to pre-pandemic conditions. This demonstrates that the observed daily flows in April 2022 were generally equivalent to the 2019 AADF. The only exception was that the data from ATC7 (A416 link road) was approximately 11% lower than the 2019 AADF for that link.



7.54 The observed daily flows are summarised in Table 7.3 below:

**Table 7.3 – Observed daily traffic flows**

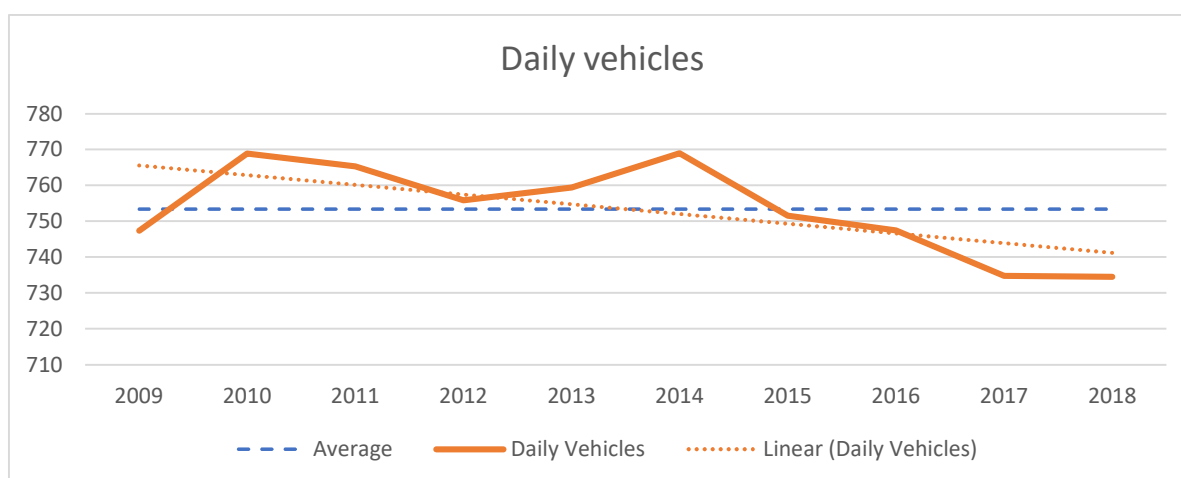
	Road Name	24hr AADT
1	A147 King Street	22193
2	A147 Bracondale	16447
3	A147 Bracondale	21902
4	Bracondale (south)	5130
5	A1054 Martineau Lane	27891
6	A146 Barrett Road	16321
7	A146 (link road)	31373

Former factory use

7.55 Daily traffic flows for the former factory use of the Application Site have been obtained from gate data, from 2010 to 2020. This data is split down into months of the year and is categorised into different visitor types. The gate data represents visitors (including all commercial deliveries and collections), but staff members had swipe cards and were recorded separately. Only partial data is available for 2019 and 2020 so the 2018 figures are considered to be the most recent representative flows.

7.56 Figure 7.7 below shows the decline in the average number of vehicles entering the site per day between 2009 and 2018 and in particular between 2014 and 2018.

**Figure 7.7 – Factory traffic, average daily vehicles**





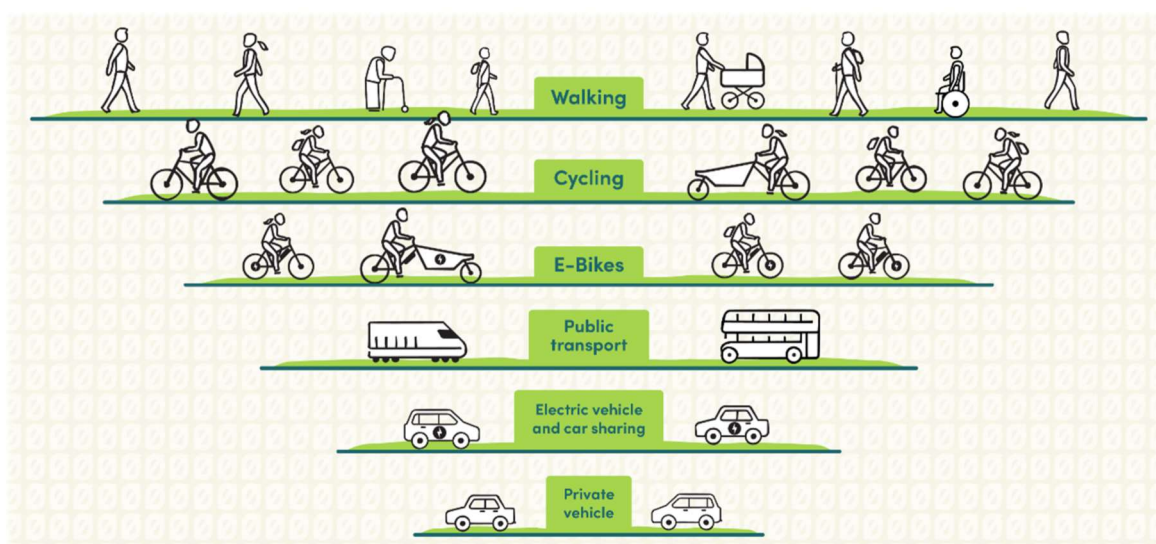
7.57 It is important to note that Figure 7.7 illustrates the number of *vehicles* entering the site each day. Those same vehicles would also leave the site, so the number of *vehicle trips* is twice the number of vehicles.

7.58 This dataset shows that in 2018 some 735 vehicles entered the site on an average day, equating to 1470 vehicle trips per day. This is a little below the average 1506 vehicle trips per day across the ten-year period for which data has been reviewed.

## IDENTIFICATION AND EVALUATION OF KEY EFFECTS

7.59 The Movement Strategy has been devised around the following hierarchy of movement as set out in national and local policy and guidance.

**Figure 7.8 – Movement strategy**



### Pedestrians and cyclists

7.60 The layout has been designed to be highly permeable for pedestrians and to provide safe routes for cyclists. The pedestrian/cycle routes radiate outwards from the Application Site to link to existing infrastructure as well as proposed or potential routes linking to the City Centre.

7.61 The landscape treatment of the Abbey Grounds is highly sensitive and is being designed by Bowles & Wyer. This is relevant to the Movement Strategy in that the design includes some private space, some semi-private space and some public space. The pedestrian routes through



those spaces will therefore have different levels of restriction, appropriate to the setting of the listed building.

7.62 A key element of the East Norwich Masterplan is the opening up of the riverside for public access. The illustrative masterplan shows a new riverside pedestrian/cycle route through the Railway Side, Waterside and Gateway areas, linking to Paper Mill Yard and King Street via a series of new public squares in the Gateway area.

7.63 A parallel east/west route known as Mustard Mill Way, will be a semi-pedestrianised 'balanced street' which provides a safe route for pedestrians and cyclists but also serves as vehicular access to the northern part of the Proposed Development.

7.64 A new pedestrian/cycle bridge over the River Wensum is referred to in the East Norwich Masterplan. The delivery of this bridge forms part of the development proposal but is subject to approval from a third-party landowner in respect of the bridge-landing on the northern side of the river; however, land has been safeguarded within the Application Site to ensure the southern bridge-landing is within the control of the Carrow Works site. The delivery of the bridge is expected to be secured by means of a Section 106 agreement.

7.65 A number of options are being explored with NCiC to upgrade the existing subway beneath the rail line to provide a pedestrian/cycle link between Carrow Works and Deal Ground. The upgrading of the subway forms part of the Proposed Development and is expected to be secured by means of a Section 106 agreement.

7.66 As earlier, NCoC identified three off-site road junctions which fall on the primary desire line between the Application Site and the city centre, and which they consider deter cycle usage in their current form.

#### Public transport

7.67 During scoping discussions, two options were considered to make the scheme highly accessible for bus passengers; Option 1 included a new Bus Hub within the Application Site, close to Bracondale (whole development within 400m of the Bus Hub); Option 2 allowed buses to circulate around the perimeter road with simple stops along the way, generally at 400m intervals. Option 2 has been progressed with buses entering the Proposed Development and circulating in an anti-clockwise direction. The provision of three bus stops within the Proposed Development will ensure the entire development is within 200m of a bus stop as shown below.

**Figure 7.9– Proposed bus stop locations**



7.68 The internal circular bus route is 1.2km long which equates to 2.5 minutes of driving time plus an average of 3 minutes of boarding/alighting time. The inclusion of bus stops within the Proposed Development therefore requires a 5½ minute extension to the existing bus routes that would divert into the Application Site. Border Bus and First (Norfolk & Suffolk) have been contacted with regards to extending routes 146 and X22 respectively. At the time of writing no formal agreement has been reached with the bus companies; however, the provision of high-quality bus infrastructure as part of the Proposed Development is a key element of the proposed movement strategy.

### Parking

7.69 Policy DM31 of the adopted Local Plan is entitled 'Car parking and servicing'. It states that car parking should be provided within the minimum and maximum levels set out in Appendix 3; that cycle parking should be provided to at least the levels prescribed; that the required provision should be made for disabled drivers and that provision should be made for electric



vehicle charging points (EVCP). It states that parking restraint should be provided in areas of high accessibility.

7.70 Policy DM32 is entitled 'Encouraging Car Free and Low Car Housing'. It states that residential development must be car-free on sites identified in the Application Site allocations plan for car-free housing, within the city centre primary retail area and on sites within a controlled parking zone, and where vehicle access cannot be provided under DM30. The Carrow Works site does not fall within these categories.

7.71 DM32 also states that car-free or low-car housing will be acceptable in the controlled parking zones and city centre; other sites within 200m of a bus stop offering a service to the city centre of at least 10 minutes, or other sites within or adjacent to district centres where low-car housing can contribute to the beneficial reuse and regeneration of vacant or underused buildings (subject to the provisions of policy (DM21).

7.72 DM32 also states that the provision of Car Club spaces will be taken into account in assessing any proposal.

7.73 In line with the requirements of the NPPF, the parking standards vary depending on the location and accessibility of the Proposed Development. The Carrow Works site is outside the city centre and not currently within a CPZ; however, as a core component of the East Norwich regeneration area it is appropriate for the parking provision to reflect the nature of the area once it has been redeveloped rather than the area as it currently is.

7.74 Taking full account of the above, the proposed parking provision is as follows:

**Table 7.4 – Proposed parking provision**

Use	GIA (m <sup>2</sup> )
<b>Flats</b>	0.2 spaces per dwelling
<b>Houses</b>	1 space per dwelling
<b>Commercial (E)</b>	1 space per 500m <sup>2</sup>
<b>Industrial (B2/B8)</b>	1 space per 750m <sup>2</sup>
<b>Foodstore</b>	1 space per 50m <sup>2</sup>



7.75 The Proposed Development will provide a new Car Club and will provide car club spaces in publicly accessible locations. The strategy is to provide one car club space for every 200 dwellings from the outset but make provision for one space per 100 dwellings subject to demand. This equates to an initial 9 car club spaces, potentially doubling to 18.

7.76 Research by the independent charity CoMoUK suggests that one car club vehicle removes up to 20 private cars from the streets. The proposed level of car club provision therefore equates to 180 to 360 private parking spaces.

7.77 All eligible new residents within the Carrow Works development will be provided with free Car Club membership but the Car Club vehicles will be available to the wider local community, thereby reducing parking demand beyond the boundaries of the Proposed Development.

7.78 Each planning Use Class has different parking standards for disabled drivers, EVCP and cycle parking provision.

7.79 Parking provision for disabled drivers will be provided in accordance with the standards. For Class E and B, 5% of total spaces will be allocated for disabled parking.

7.80 EVCP will be provided in accordance with the standards. For class E and B uses, one parking space will be provided with electric charging point plus one for every 5000m<sup>2</sup>. With regards to residential, a minimum of one space will be provided with an electric charging point in all communal unallocated parking areas and in all garages.

7.81 Cycle parking provision will be provided in accordance with the Local Plan standards. All long-stay cycle parking for flats will be provided in cycle stores within the building. Long stay cycle parking for houses will be provided in garages or storage areas. Short stay cycle parking will be in the form of Sheffield loop stands, incorporated into the landscaping.

7.82 For Class E, staff should be provided a secure cycle parking space per 100m<sup>2</sup>. Customers should be provided one cycle space per 50m<sup>2</sup> adjacent to principal entrances or nearby if on the highway. Class B, staff should be provided with one covered and secure cycle parking space per 75m<sup>2</sup>. Customers should be provided with one cycle space per 500m<sup>2</sup>. For residential, covered and secure cycle storage space must be provided. 1 bed units: 1 space, 2 and 3 bed units: 2 spaces: 4+ bed units: 3 spaces.



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### Means of access

7.83 The TA scoping note prepared by Entran in May 2022 suggested that the Proposed Development would retain the existing primary access from the Bracondale roundabout but remodelled in order to provide two separate carriageways. This would remove the need for a second vehicle access (other than emergency access via Paper Mill Yard). However, notwithstanding this explanation, NCoC rejected the concept of parallel carriageways as the sole vehicular access to the side and directed the developer to investigate options for providing a secondary access.

### Secondary Accesses

7.84 Four secondary access options were considered:

- Paper Mill Yard
- Carrow House
- Bracondale
- South-eastern access

7.85 **Paper Mill Yard** is a private road. It was formerly part of the public highway but was 'stopped up' some considerable time ago. The developer has a legal right to use Paper Mill Yard for emergency access and for pedestrians and cyclists; they have no general legal right of vehicle access across this third-party private land.

7.86 The existing emergency access is denoted on the ground by yellow box junction markings and is to be retained as a pedestrian/cycle access which also serves as access for emergency vehicles.

7.87 Carrow House is located to the west of the Application Site and has an internal access from the Carrow Works perimeter Road. That access is currently gated but could be re-opened. Carrow House has two gated accesses onto King Street; both are single-width and therefore operate as separate access and egress. The access is 27m from the stop line of the King Street / Bracondale signal controlled junction; the egress is approximately 90m further north.

7.88 The internal road between the access and egress passes in front of Carrow House's main entrance and all vehicles leave the Application Site via this route. The narrow egress has limited visibility to the back edge of footway and does not have the required 2.4m x 43m



intervisibility between drivers. This egress would therefore need significant remodelling if it were to form any part of the Carrow Works means of access.

7.89 Of greater significance is the fact that the link road between the Carrow Works perimeter Road and the Carrow House access/egress passes directly through the Carrow House car park. This would be unsuitable even as a secondary access into the Carrow Works development and would therefore require the Carrow House car park to also be remodelled in order for this route to be used as means of access to the Carrow Works development

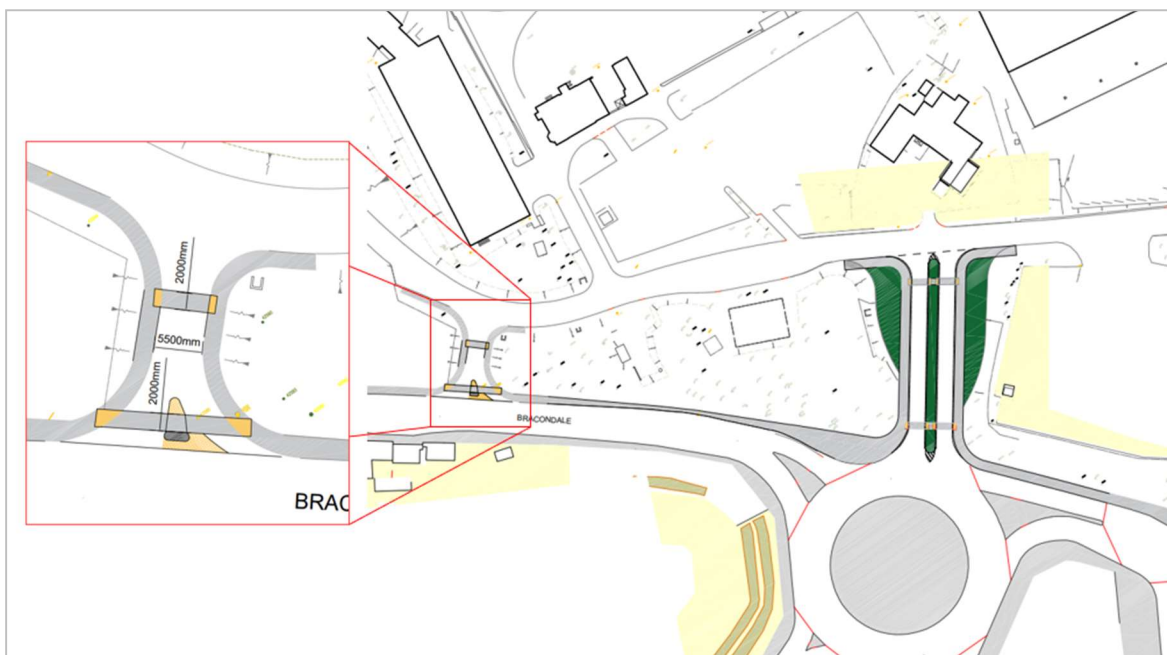
7.90 If general access were permitted into the Carrow Works site via Carrow House, this would be a more attractive route into (and potentially out of) the Application Site for those travelling to and from the city centre. This could therefore draw a significant level of additional daily vehicle movements through the Carrow House site.

7.91 It is important to note that the Carrow House land is also in private ownership (albeit public sector) and would therefore require that land to be incorporated within the planning boundary.

7.92 This is therefore feasible in principle but would be a very expensive option and unnecessarily complex if a suitable alternative were available.

7.93 A secondary access onto **Bracondale** could be delivered within land under the developer's control and public highway. It would not be desirable to provide an all-movements junction onto Bracondale, so a simple left-out design would restrict the general use of this secondary access. Vehicles turning left in would have no material effect on the operation of Bracondale; drivers are unlikely to turn left out as they would have to give way onto Bracondale and then give way at the roundabout. Drivers are also unlikely to turn right in, across opposing traffic when it would have been simpler to enter via the main access from the roundabout. Under normal conditions this would therefore be a lightly used access; however, if the main access were to be obstructed this would be a suitable temporary access to allow residents and businesses to gain access to the Application Site.

**Figure 7.10 – Secondary access from Bracondale**



7.94 This shows that a relatively modest secondary access could easily be accommodated onto Bracondale with no adverse effect on highway safety or operational capacity.

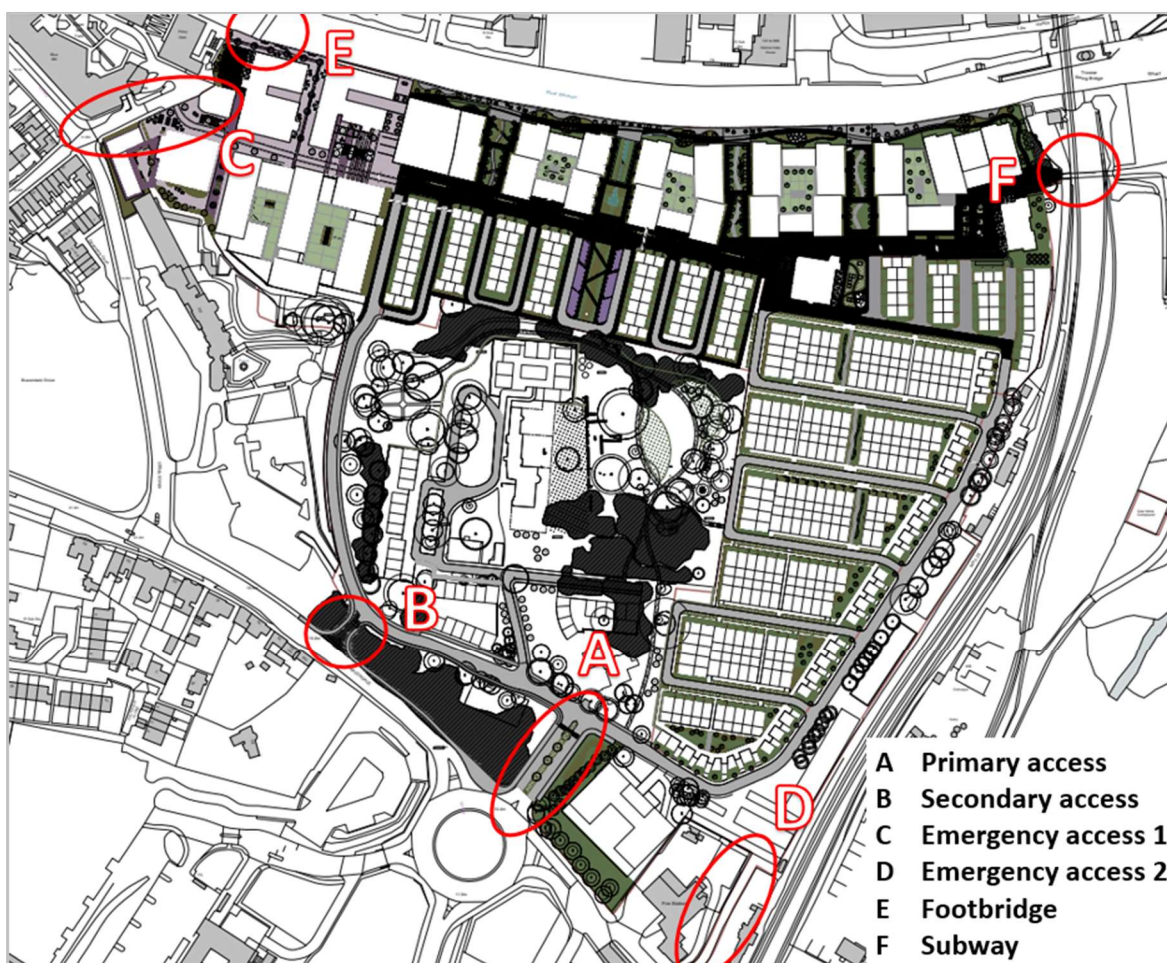
7.95 As the **south-eastern** extent of the Application Site, the Carrow Works land has an existing emergency access onto Bracondale, to the east of the fire station. This gated access has served the Application Site for many years but is now over-grown and unused. This access varies in width but is generally around 5.0m-5.5m wide. This is therefore adequate to accommodate two-way vehicular traffic, but not in conjunction with pedestrian access.

7.96 The limited width makes this unsuitable as a general secondary access but very suitable as a further pedestrian/cycle link which can be used by emergency vehicles.

7.97 The outcome of this option analysis is the conclusion that if the highway authority will not accept a parallel carriageway as the sole means of access, then a limited movements secondary access onto Bracondale would be the most suitable secondary access. These can work together to ensure access to all residents and businesses even if both carriageways of the main access were obstructed. Furthermore, the Proposed Development will benefit from two further accesses for emergency vehicles if both the primary and secondary accesses were obstructed. This creates a highly permeable layout for pedestrians and cyclists on a daily basis and a very safe, highly accessible site for the emergency services.



Figure 7.11 – Access strategy.



Transport effects (construction phase)

7.98 A Construction Logistic Plan (CLP) would be implemented before construction works commence to provide management control and minimise congestion to public highways. Further details are contained in the TA.

7.99 The Proposed Development will be delivered in phases. Each construction phase will have its own Demolition and Construction Management Plan, including control of access from the highway.

7.100 At construction phase, it is anticipated that the number of vehicular movements to and from the Application Site as a result of each phase of the construction will not be more than the number of trips generated by the completed development.

7.101 A detailed assessment of construction vehicle numbers was carried out. It is estimated that during the peak period of demolition and construction, up to 500 daily traffic movements



would occur to and from the Application Site. This includes HGV traffic associated with demolition and construction activities as well as traffic generation by construction workers travelling to and from the Application Site.

7.102 The existing daily traffic movements on Bracondale is 21,902. Traffic generated by the Proposed Development during peak demolition and construction period would be therefore equate to 2.3% of the existing traffic movements. The predicted peak demolition and construction traffic represents a negligible proportion of additional traffic movement of Bracondale. The proportional increase on all other road links would be less.

7.103 In addition, a percentage increase in traffic movements of less than 5% is not considered to have insignificant effect on the operation of the local network. As such, it is considered that any effect to driver delays, pedestrians and cyclists as a result of traffic during demolition and construction would be minimal and therefore the effect on the local highway network without an appropriate CLP would be **Minor adverse short term local**.

7.104 The HGV trips will be spread throughout the day, as they will be made up of materials deliveries, off-site disposal and other trips related to the management of the construction process.

7.105 The daily traffic flow associated with the Proposed Development construction traffic is considered to be relatively low and the change in magnitude for severance is considered to be negligible adverse for all links assessed.

7.106 In general, the construction vehicles would use the existing or proposed vehicle accesses from Bracondale. This is a main arterial route with footways and cycleways available either on one or both sides of the carriageway. On this basis, the change in magnitude for fear and intimidation is considered to be **Minor adverse short term local** for all links assessed.

#### Transport effects (operational phase)

7.107 The transport effects of the Proposed Development are determined by comparing the net increase in journeys between the existing and proposed uses. Accordingly, the DfT Guidance on Transport Assessment (March 2007) advises at paragraph 4.7 that baseline traffic data should be derived as follows.



7.108 Accordingly, the transport effects of the Proposed Development should be determined by comparing the predicted travel demand associated with the Proposed Development with the potential travel demand generated by the permitted use of the Application Site.

7.109 The data for Industrial uses indicates that 9% of vehicle trips occur during the morning peak hour (0800-0900) and 6% during the evening peak hour (1700-1800). When these proportions are applied to the observed daily flows for the former use of the Carrow Works site, the peak hour and daily vehicle flows are as shown below.

**Table 7.5 – Carrow Works previous industrial vehicle trips**

	Arrive	Depart	Total
0800-0900	80	59	139
1700-1800	40	54	94
Daily	703	703	1506

7.110 The TRICS database has been interrogated in order to derive predicted vehicle trips for the Proposed Development. In each case, the surveys selected were all in England, outside London, in areas with similar levels of accessibility and, where practicable, for sites of a similar size (\*/. 50%). Adjustments have been made where the proposed parking levels differ from the survey sites, and adjustments have been made to take account of internal and linked trips. Full details are contained in the TA.

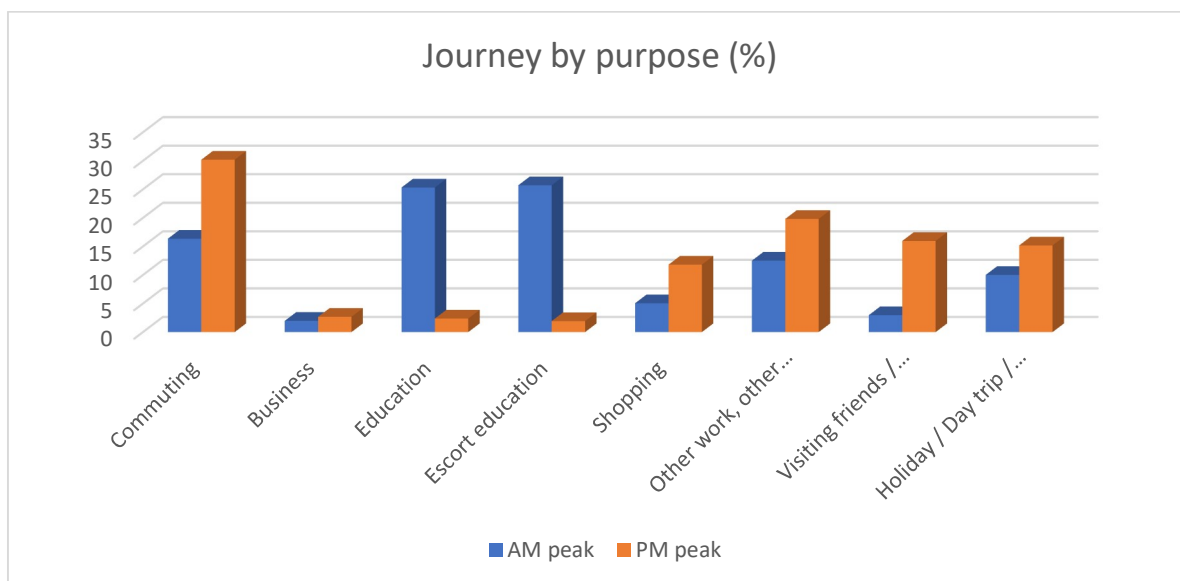
7.111 The net change in vehicle trips when compared to the lawful use of the site is shown below.

**Table 7.6 – External vehicle trips**

	Existing	Proposed	Net change
AM	139	396	261
PM	94	490	400
Daily	1506	4767	3264

7.112 During scoping discussions NCoC requested that peak hour vehicle trip distribution should be based on journeys to work derived from Census data. Needless to say, not all vehicle trips during the highway peak hours are journeys to work. For this reason, the first assessment of Census data should always be to establish the proportion of trips that are journeys to work. The Census data does not hold information on journey purpose for Norwich specifically but is does for the East of England and for Norfolk. The Norfolk data is shown in in the graphs below.

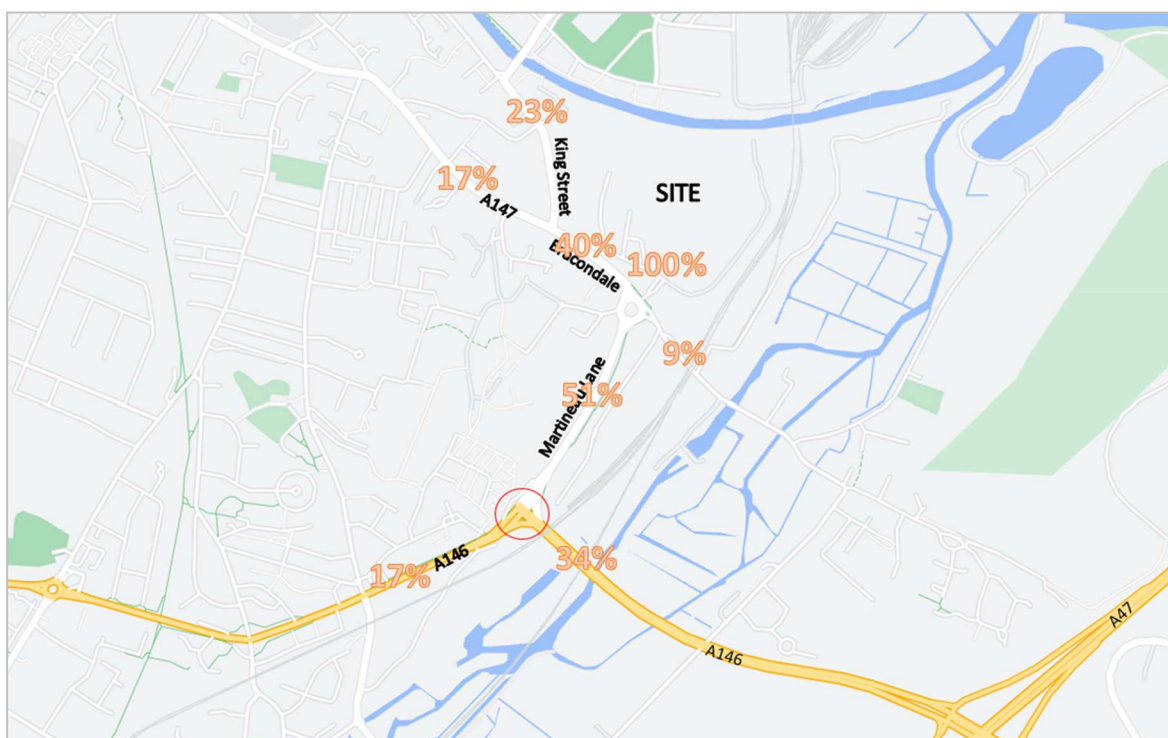
**Figure 7.12 – Peak hour journey by purpose**



7.113 This illustrates that during the morning peak (0800-0900) commuting only represents 16% of all journeys on the highway network with education being by far the primary purpose. During the evening peak (1700-1800) commuting is the dominant purpose; however, it still only represents 30% of all journey types.

7.114 Based on this information it would be inappropriate to distribute all peak hour vehicle trips onto the highway network in accordance with journey to work destination proportions. Alternatively, the observed baseline data on the local highway network includes all journeys for all purposes. In this instance it is therefore more accurate to apply a weighted distribution in proportion to the observed flows on each road link within the study area. For clarity, the proportions, radiating outwards from the Application Site are as shown below.

**Figure 7.13 – Weighted distribution**



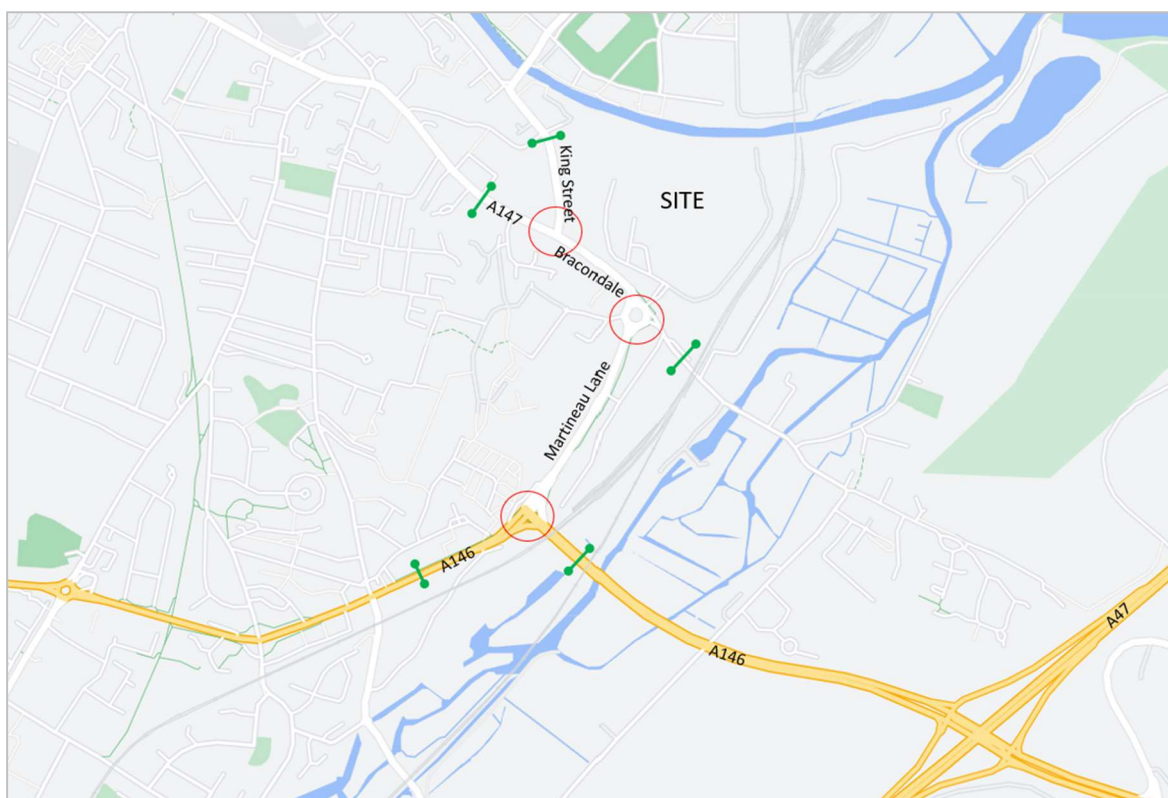
7.115 Based on the proportional distribution shown in Figure 7.4, a series of peak hour link flow diagrams and origin/destination tables have been prepared for the following scenarios:

- 2022 observed baseline
- 2028 baseline (TEMPro growth to year of completion)
- 2028 plus Colman's traffic
- 2028 plus Development

7.116 The diagrams and tables are included within the TA.

7.117 The net change in vehicle trips has been used to assess the transport effects on the local highway network. The junctions within the study area have been assessed using the proprietary software ARCADY and LinSig.

**Figure 7.14 – Study area**



7.118 Any proportional increase beyond the study area (green cordons in Figure 7.1) have been assessed against the criteria set out in Norfolk CC guidance; however, during scoping discussions NCoC advised that this guidance is not considered to be up to date. Accordingly, a uniform lower threshold of 3% has been set across the network.

7.119 The scoping note stated that the transport effects of development would be assessed by comparing the results of scenarios 2 and 3 and that mitigation requirements would be based on the following principles.

**Table 7.7 – Mitigation requirements**

2 – Colman’s traffic	3 – Development traffic	Net change
Junction within capacity	Junction remains within capacity	No mitigation required
Junction within capacity	Junction over capacity	Mitigation required to bring junction within capacity, but necessarily to scenario 2 levels
Junction over capacity	Junction further over capacity	Mitigation required to bring junction back to scenario 2 levels



7.120 However, during scoping discussions NCoC stated that adopted policy requires greater focus on promoting sustainable travel choices rather than carrying out highway capacity improvements on a 'predict and provide' basis. For this reason, mitigation may be in the form of additional measures or infrastructure to promote walking, cycling and public transport use rather than additional junction capacity.

7.121 The TA shows that all three junctions within the study area experience a level of stress during the AM and PM peak periods in 2028 (scenario 2). The introduction of additional traffic would increase queue lengths at all three junctions. In the absence of mitigation measures the Proposed Development would result in a **Moderate Adverse long-term local** effect on the operational capacity of the local highway network.

7.122 No baseline data is available for multi-modal journeys associated with the former Colman's factory. As a result, the transport effects of non-vehicular travel demand are based on the gross trips associated with the Proposed Development, not the net increase. This is a very robust form of development.

7.123 The TA demonstrates that a proportion of journeys on foot and by bike will be internal within the Proposed Development (i.e. a new resident visiting one of the cafés or shops); however, all bus and rail journeys will constitute external trips. The total predicted external multi-modal trips are shown below.

**Table 7.8 – External multi-modal trips**

	Walk	Cycle	Bus	Rail	Car	Passenger	Goods	Total
AM	116	33	129	54	311	572	51	1265
PM	119	19	117	38	369	372	30	1063
Daily	1695	186	1372	342	3709	4651	529	12484

7.124 In the absence of any mitigation measures the predicted travel demand would have a **Moderate Adverse long-term local** effect on the local pedestrian network. The predicted travel demand would have **Minor Adverse long-term local** effect on the local cycle network. The predicted travel demand would have **Moderate Adverse medium-term local** effect on local bus services. The predicted travel demand would have a **Neutral** effect on rail capacity.

7.125 The Proposed Development includes proposed off-site highway works at the County Hall Roundabout and at the King Street / Carrow Road junction (outside the original study area).



The redevelopment of the Carrow Works site also provides an opportunity for pedestrians and cyclists to bypass the Bracondale/King Street junction.

7.126 The Proposed Development will deliver a new footbridge over the River Wensum, reducing walking distances to key facilities, including Norwich station. It will also open up the subway beneath the rail line to extend walking routes to the east and increase walking and cycling opportunities for the Deal Ground development.

7.127 The Proposed Development would also introduce two bus services into the heart of the scheme ensuring that every resident would live within 200m of a bus stop.

7.128 The Travel Plan measures, including a new Car Club within the scheme and free Car Club membership for all eligible residents will further promote sustainable travel choices and reduce reliance on the private car.

7.129 On the basis of the above, adequate mitigation is delivered by the significant sustainable transport infrastructure improvements that will be delivered by the Proposed Development rather than seeking to increase operational capacity within the local highway network.

7.130 TN3 shows that the net change between scenario 2 and scenario 3 would not exceed 3% proportional increase on any part of the highway network beyond the study area. It should be noted that in terms of the A146 link road, this proportional increase is measured against the observed 2019 AADF rather than the suppressed 2022 data.

## **ASSESSMENT OF CUMULATIVE EFFECTS**

7.131 The Carrow Works development is the largest development to have any effect on the study area within the approved study period. Other committed and allocated developments will have the potential to add traffic onto the local highway network within the study area. For this reason, all future year traffic assessments have included for a level of growth in background traffic that takes account of the cumulative effects of committed developments.

## **INTER-RELATIONSHIP EFFECTS**

7.132 There are inter-relationships with the air quality and noise and vibration chapters as identified through the use of traffic data within these assessments. There are no identified inter-relationship effects with other topics.





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## ENHANCEMENT, MITIGATION AND RESIDUAL EFFECTS

7.133 The Proposed Development includes proposed off-site highway works at the County Hall Roundabout, the Bracondale/King Street signal-controlled junction and at the King Street / Carrow Road junction (outside the original study area). The redevelopment of the Carrow Works site also provides an opportunity for pedestrians and cyclists to bypass the Bracondale/King Street junction.

7.134 The Proposed Development will deliver a new footbridge over the River Wensum, reducing walking distances to key facilities, including Norwich station. It will also open up the subway beneath the rail line to extend walking routes to the east and increase walking and cycling opportunities for the Deal Ground development.

7.135 The Proposed Development would also introduce two bus services into the heart of the scheme ensuring that every resident would live within 200m of a bus stop.

7.136 The Travel Plan measures, including a new Car Club within the scheme and free Car Club membership for all eligible residents will further promote sustainable travel choices and reduce reliance on the private car.

7.137 The Proposed Development will be supported by a Construction Logistics Plan for each phase of development and a Delivery and Servicing Plan for the completed development.

7.138 The Construction Logistics Plans will ensure the residual effects on the local transport network during the construction phase will be **Minor Adverse short-term local**.

7.139 Following the mitigation measures listed above, the residual affects of the Proposed Development will be as follows:

7.140 Following highway improvements and mitigation measures listed above, the residual travel demand would have a **Minor Adverse long-term local** effect on highway capacity at two junctions. The residual effect on the local pedestrian network would be a **Moderate Beneficial long-term local** effect. The predicted travel demand would have **Moderate Beneficial long-term local** effect on the local cycle network. The residual travel demand would have **Neutral** effect on local bus services. The predicted travel demand would have a **Neutral** effect on rail capacity.



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7.141 On the basis of the above, adequate mitigation is delivered by the significant sustainable transport infrastructure improvements that will be delivered by the Proposed Development rather than seeking to increase operational capacity within the local highway network.

**SUMMARY**

7.142 A summary of potential effects, mitigation and resulting residual effects in relation to transport are summarised below in Table 7.9



**Table 7.9: Transport and Access Summary Table**

Potential Effect	Nature of Effect	Significance	Mitigation/ Enhancement Measures	Residual Effects
<b>Construction Phase</b>				
Highway capacity	Short term local	Minor adverse	CLP	Neutral
Disruption to pedestrians and cyclists	Short term local	Minor adverse	CLP	Minor Adverse
Disruption to public transport	Short term local	Minor adverse	CLP	Neutral
<b>Completed Development</b>				
Highway capacity	Long term local	Moderate adverse	Highway improvements	Minor adverse
Pedestrian network	Long term local	Moderate adverse	Highway improvements	Moderate beneficial
Cycle network	Long term local	Minor adverse	Highway improvements	Moderate beneficial
Disruption to bus services	Long term local	Moderate adverse	New routes and stops	Neutral
Disruption to rail services	-	Neutral	-	Neutral



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## REFERENCES

**Ref 7.1:** DfT (2007); 'Towards a Sustainable Transport System', DfT Publications, London

**Ref 7.2:** DfT (2008); 'Delivering a Sustainable Transport System', DfT Publications, London

**Ref 7.3:** DETR (2011); 'Creating Growth, Cutting Carbon – Making Sustainable Transport Happen', DfT Publications, London

**Ref 7.4:** DCLG (2012)(updated 2021); 'National Planning Policy Framework', HMSO

**Ref 7.6:** DfT (2007); 'Guidance on Transport Assessment', HMSO, Norwich.

**Ref 7.6:** DCLG (2014); 'Travel Plans, Transport Assessments and Statements in decision taking'.

**Ref 7.7:** Norfolk County Council "Safe, Sustainable Development : Aims and Guidance Notes for Local Highway Authority Requirements in Development Planning (2019)



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## 8 AIR QUALITY

### INTRODUCTION

8.1 This Chapter presents the findings of an assessment of local air quality effects associated with the Proposed Development.

8.2 The Proposed Development may introduce the following air quality effects;

- During the construction phase, suspended and re-suspended fugitive dust emissions from demolition / construction activities and vehicular emissions from construction traffic, including re-suspended dust from HGV movements.
- During the operational phase, vehicular emissions (primarily nitrogen dioxide (NO<sub>2</sub>) and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) from increased traffic movements associated with the Proposed Development.

8.3 The potential effects of the Proposed Development on local air quality during both construction and operational phases have been assessed. For both phases, the type, source and significance of potential effects are identified and the measures that should be employed to minimise these effects are described.

8.4 A glossary of common air quality terminology is provided in **Appendix 8.1**.

### ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

#### Scope of Assessment

8.5 The scope of the assessment has been determined in the following way:

- Review of air quality data for the area surrounding the Application Site and background pollutant maps; and
- Review of the traffic flow data, which has been used as an input to the air quality modelling assessment.

8.6 There is the potential for impacts on local air quality during both the construction and operational phases of the Proposed Development. During the construction phase, there is the potential for impacts to occur as a result of dust and PM<sub>10</sub> emissions. Guidance provided by the



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Institute of Air Quality Management (IAQM) (Ref. 8.1) includes the following criteria for assessing the effects of construction dust:

- A sensitive 'human receptor' within 350m of the site boundary or within 50m of the route used by construction vehicles on public highways up to 500m from the site entrance; and /or
- A sensitive 'ecological receptor' within 50m of the site boundary or within 50m of the route used by construction vehicles on the public highway, up to 500m from the site entrance.

8.7 There are residential properties situated within 350 m of the Application Site boundary. An assessment of construction phase impacts of dust and particulate matter in relation to human health and nuisance has therefore been included in this assessment. There are no sensitive ecological habitats within 50m of the Application Site boundary or within 50m of the route used by construction vehicles up to 500m from the Application Site entrance, therefore an assessment of construction phase impacts on sensitive ecological habitats has been scoped out of this assessment.

8.8 Construction traffic will contribute to existing traffic levels on the surrounding road network. The greatest potential for impacts on air quality from traffic associated with this phase of the Proposed Development will be in the areas immediately adjacent to the principal means of access for construction traffic.

8.9 Information provided by the transport consultants indicated that during the peak construction period, there would be less than 500 additional daily traffic movements to and from the Application Site. This includes HGV traffic associated with the demolition and construction activities as well as traffic generated by the construction workers travelling to and from the Application Site.

8.10 Guidance provided by Environmental Protection UK (EPUK) and the IAQM (Ref. 8.2) provides threshold criteria for establishing when significant impacts on local air quality may occur and when a detailed assessment of potential impacts is required. At locations outside an AQMA, a change in light duty vehicles (LDV) of more than 500 per day and / or a change in heavy duty vehicles (HDV) of more than 100 per day is considered to result in potentially significant impacts on air quality. At locations within or adjacent to an AQMA, a change in LDVs of more than 100 per day and / or a change in HDVs of more than 25 per day is considered potentially significant.



8.11 The Proposed Development is not located within an AQMA, the additional traffic generated by the construction works is therefore below the relevant threshold level. A detailed assessment of the impacts of emissions from construction traffic vehicles is therefore not included.

8.12 During the operation of the Proposed Development there is the potential for impacts on local air quality to occur as a result of emissions from road vehicle trips generated by the operation of the Development.

8.13 Data provided by the transport consultants indicates that the Proposed Development will result in an increase in LDVs in excess of the threshold values for locations outside and inside an AQMA. An assessment of impacts arising from vehicle emissions using the local roads during the operational phase has therefore been included in the assessment.

8.14 A tarmac plant is located to the east of the Application Site. The tarmac plant operates under an environmental permit, therefore emissions from the facility are controlled and regulated under this permit. Three site visits were undertaken during which time odour sniff tests and dust observations were made. No odour was detected during the site visits and no evidence of dust observed. Air quality impacts arising from the tarmac plant have therefore been scoped out of this assessment.

8.15 Details of the assessment methodology and the specific issues considered are provided below.

### **Construction Phase Methodology**

8.16 To assess the potential impacts associated with dust and PM<sub>10</sub> releases during the construction phase and to determine any necessary mitigation measures, an assessment based on the latest guidance from the IAQM (Ref. 8.1) has been undertaken.

8.17 This approach divides construction activities into the following dust emission sources:

- demolition;
- earthworks;
- construction; and
- trackout.



8.18 The risk of dust effects (low, medium or high) is determined by the scale (magnitude) and nature of the works and the proximity of sensitive human and ecological receptors.

8.19 The significance of the dust effects is based on professional judgement, taking into account the sensitivity of receptors and existing air quality.

Dust Emission Magnitude

8.20 The magnitude of the dust impacts for each source is classified as Small, Medium or Large depending on the scale of the proposed works. Table 8.1 summarises the IAQM criteria that may be used to determine the magnitude of the dust emission. These criteria are used in combination with site specific information and professional judgement.

**Table 8.1: Dust Emission Magnitude Criteria**

Source	Large	Medium	Small
<b>Demolition</b>	<ul style="list-style-type: none"> <li>Total building volume &gt;50,000m<sup>3</sup></li> <li>Potentially dusty material (e.g. concrete)</li> <li>Onsite crushing and screening</li> <li>Demolition activities &gt;20m above ground level.</li> </ul>	<ul style="list-style-type: none"> <li>Total building volume 20,000 - 50,000m<sup>3</sup></li> <li>Potentially dusty material</li> <li>Demolition activities 10 - 20m above ground level.</li> </ul>	<ul style="list-style-type: none"> <li>Total building volume &lt;20,000m<sup>3</sup></li> <li>Construction material with low potential for dust release</li> <li>Demolition activities &lt;10m above ground level</li> <li>Demolition during wetter months</li> </ul>
<b>Earthworks</b>	<ul style="list-style-type: none"> <li>Total site area &gt;10,000m<sup>2</sup></li> <li>Potentially dusty soil type (e.g. clay)</li> <li>&gt;10 heavy earth moving vehicles active at any one time</li> <li>Formation of bunds &gt;8m in height</li> <li>Total material moved &gt;100,000 tonnes</li> </ul>	<ul style="list-style-type: none"> <li>Total site area 2,500 -10,000m<sup>2</sup></li> <li>Moderately dusty soil type (e.g. silt)</li> <li>5 - 10 heavy earth moving vehicles active at any one time</li> <li>Formation of bunds 4 - 8m in height</li> <li>Total material moved 20,000 - 100,000 tonnes</li> </ul>	<ul style="list-style-type: none"> <li>Total site area &lt;2,500m<sup>2</sup></li> <li>Soil type with large grain size (e.g. sand)</li> <li>&lt;5 heavy earth moving vehicles active at any one time</li> <li>Formation of bunds &lt;4m in height</li> <li>Total material moved &lt;20,000 tonnes</li> <li>Earthworks during wetter months</li> </ul>
<b>Construction</b>	<ul style="list-style-type: none"> <li>Total building volume &gt;100,000m<sup>3</sup></li> <li>On site concrete batching</li> <li>Sandblasting</li> </ul>	<ul style="list-style-type: none"> <li>Total building volume 25,000 - 100,000m<sup>3</sup></li> <li>Potentially dusty construction</li> </ul>	<ul style="list-style-type: none"> <li>Total building volume &lt;25,000m<sup>3</sup></li> <li>Material with low potential for dust</li> </ul>





Source	Large	Medium	Small
		material (e.g. concrete) <ul style="list-style-type: none"> <li>On site concrete batching</li> </ul>	release (e.g. metal cladding or timber)
<b>Trackout</b>	<ul style="list-style-type: none"> <li>&gt;50 HGV movements in any one day (a)</li> <li>Potentially dusty surface material (e.g. high clay content)</li> <li>Unpaved road length &gt;100m</li> </ul>	<ul style="list-style-type: none"> <li>10 - 50 HGV movements in any one day (a)</li> <li>Moderately dusty surface material (e.g. silt)</li> <li>Unpaved road length 50 - 100m</li> </ul>	<ul style="list-style-type: none"> <li>&lt;10 HGV movements in any one day (a)</li> <li>Surface material with low potential for dust release</li> <li>Unpaved road length &lt;50m</li> </ul>

(a) HGV movements refer to outward trips (leaving the site) by vehicles of over 3.5 tonnes.

#### Receptor Sensitivity

8.21 Factors defining the sensitivity of a receptor are presented in Table 8.2.

**Table 8.2: Factors Defining the Sensitivity of a Receptor**

Sensitivity	Human (health)	Human (dust soiling)	Ecological
<b>High</b>	<ul style="list-style-type: none"> <li>Locations where members of the public are exposed over a time period relevant to the air quality objectives for PM<sub>10</sub> (a)</li> <li>Examples include residential dwellings, hospitals, schools and residential care homes.</li> </ul>	<ul style="list-style-type: none"> <li>Regular exposure</li> <li>High level of amenity expected.</li> <li>Appearance, aesthetics or value of the property would be affected by dust soiling.</li> <li>Examples include residential dwellings, museums, medium and long-term car parks and car showrooms.</li> </ul>	<ul style="list-style-type: none"> <li>Nationally or Internationally designated site with dust sensitive features (b)</li> <li>Locations with vascular species (c)</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>Locations where workers are exposed over a time period relevant to the air quality objectives for PM<sub>10</sub> (a)</li> <li>Examples include office and shop workers (d)</li> </ul>	<ul style="list-style-type: none"> <li>Short-term exposure</li> <li>Moderate level of amenity expected</li> <li>Possible diminished appearance or aesthetics of property due to dust soiling</li> <li>Examples include parks and places of work</li> </ul>	<ul style="list-style-type: none"> <li>Nationally designated site with dust sensitive features (b)</li> <li>Nationally designated site with a particularly important plant species where dust sensitivity is unknown</li> </ul>
<b>Low</b>	<ul style="list-style-type: none"> <li>Transient human exposure</li> <li>Examples include public footpaths, playing fields, parks and shopping streets</li> </ul>	<ul style="list-style-type: none"> <li>Transient exposure</li> <li>Enjoyment of amenity not expected.</li> </ul>	<ul style="list-style-type: none"> <li>Locally designated site with dust sensitive features (b)</li> </ul>



Sensitivity	Human (health)	Human (dust soiling)	Ecological
		<ul style="list-style-type: none"><li>• Appearance and aesthetics of property unaffected</li><li>• Examples include playing fields, farmland (e), footpaths, short-term car parks and roads</li></ul>	
<p>(a) In the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day.</p> <p>(b) Ecosystems that are particularly sensitive to dust deposition include lichens and acid heathland (for alkaline dust, such as concrete).</p> <p>(c) Cheffing C. M. &amp; Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.</p> <p>(d) Does not include workers exposure to PM<sub>10</sub> as protection is covered by Health and Safety at Work legislation.</p> <p>(e) Except commercially sensitive horticulture.</p>			

8.22 The sensitivity of a receptor will also depend on a number of additional factors including any history of dust generating activities in the area, likely cumulative dust impacts from nearby construction sites, any pre-existing screening such as trees or buildings and the likely duration of the impacts. In addition, the influence of the prevailing wind direction and local topography may be of relevance when determining the sensitivity of a receptor.

#### Area Sensitivity

8.23 The sensitivity of the *area* to dust soiling and health impacts is dependent on the number of receptors within each sensitivity class and their distance from the source. In addition, human health impacts are dependent on the existing PM<sub>10</sub> concentrations in the area. Tables 8.3 and 8.4 summarise the criteria for determining the overall sensitivity of the area to dust soiling and health impacts respectively.



**Table 8.3: Sensitivity of the Area to Dust Soiling Effects on People and Property**

Receptor Sensitivity	Number of Receptors	Distance from the source (a)			
		<20m	<50m	<100m	<350m
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

(a) For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.

**Table 8.4: Sensitivity of the Area to Human Health Impacts**

Receptor Sensitivity	Annual Mean PM <sub>10</sub> (µg/m <sup>3</sup> )	Number of Receptors	Distance from the source (a)				
			<20m	<50m	<100m	<200m	<350m
High	> 32	> 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32	> 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28	> 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	< 24	> 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	>32	> 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28-32	> 10	Medium	Low	Low	Low	Low



Receptor Sensitivity	Annual Mean PM <sub>10</sub> (µg/m <sup>3</sup> )	Number of Receptors	Distance from the source (a)				
			<20m	<50m	<100m	<200m	<350m
		1 - 10	Low	Low	Low	Low	Low
	<28	-	Low	Low	Low	Low	Low
<b>Low</b>	-	>1	Low	Low	Low	Low	Low

(a) For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.

8.24 For each dust emission source (demolition, construction, earthworks and trackout), the worst-case area sensitivity is used in combination with the dust emission magnitude to determine the risk of dust impacts.

#### Risk of Dust Impacts

8.25 The risk of dust impacts prior to mitigation for each emission source is presented in Tables 8.5, 8.6 and 8.7.

**Table 8.5: Risk of Dust Impacts – Demolition**

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
<b>High</b>	High Risk	Medium Risk	Medium Risk
<b>Medium</b>	High Risk	Medium Risk	Low Risk
<b>Low</b>	Medium Risk	Low Risk	Negligible

**Table 8.6: Risk of Dust Impacts – Earthworks and Construction**

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
<b>High</b>	High Risk	Medium Risk	Medium Risk
<b>Medium</b>	Medium Risk	Medium Risk	Low Risk
<b>Low</b>	Medium Risk	Low Risk	Negligible



**Table 8.7: Risk of Dust Impacts - Trackout**

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

### Operational Phase Methodology

#### Assessment of Air Quality

8.26 The prediction of local air quality has been undertaken using ADMS Roads dispersion model (Version 5.0.0.1, March 2020). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

8.27 The ADMS Roads model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from Norwich Meteorological Station for 2019 has been used for the assessment.

8.28 The model has been used to predict road specific concentrations of oxides of nitrogen (NO<sub>x</sub>) and Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>) at selected receptors in the vicinity of the surrounding road network and within the Application Site itself. The predicted concentrations of NO<sub>x</sub> have been converted to NO<sub>2</sub> using the NO<sub>x</sub> to NO<sub>2</sub> calculator available on the Defra air quality website (Ref. 8.3).

8.29 Traffic data for road links adjacent to the Application Site has been provided by the Transport Consultants.

8.30 A summary of the traffic data used in the assessment can be found in **Appendix 8.2**. The data includes details of annual average daily traffic flows (AADT), vehicle speeds and percentage Heavy Duty Vehicles (HDV) for the assessment years considered. Low traffic



speeds have been assigned to appropriate road links to account for congestion and queuing vehicles.

8.31 The following scenarios have been included in the assessment:

- 2019 – base scenario (for verification purposes);
- 2028 – future base scenario plus committed developments (hereafter referred to as ‘without development’ scenario); and
- 2028 – future base scenario plus committed developments plus Proposed Development (hereafter referred to as ‘with development’ scenario).

8.32 The emission factors released by Defra in November 2021, provided in the emissions factor toolkit EFT2021 v11.0 have been used to predict traffic related emissions in 2019 (for verification purposes) and 2028.

8.33 To predict local air quality, traffic emissions predicted by the model must be added to local background concentrations. Background concentrations of NO<sub>x</sub>, NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> have been taken from the 2018 Defra background maps (issued August 2020). The maps provide an estimate of background concentrations between 2018 and 2030. The data used for the modelling assessment are set out in Table 8.12.

8.34 Background concentrations for 2019 have been used to predict concentrations in 2028 assuming no change in future years. This is considered to represent a conservative approach to the prediction of future concentrations to take account of uncertainty in future background concentrations.

8.35 To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process aims to minimise modelling uncertainty and systematic error by correcting the modelled results by an adjustment factor to gain greater confidence in the final results. This process was undertaken using the methodology outlined in Chapter 7, Section 4 of LAQM.TG(16). Full details of the model verification process are presented in **Appendix 8.3**.

8.36 An overall verification factor of 4.52 was determined which indicates that the model is underpredicting compared to the monitored concentrations in this area. The modelled NO<sub>x</sub> concentrations were adjusted using this factor prior to conversion to NO<sub>2</sub> using the NO<sub>x</sub> to NO<sub>2</sub> calculation tool available on Defra’s website.



8.37 Local roadside monitoring data were not available for concentrations of PM<sub>10</sub> and PM<sub>2.5</sub>. Modelled PM<sub>10</sub> and PM<sub>2.5</sub> concentrations have therefore been adjusted by the verification factor obtained for NO<sub>x</sub>, which is consistent with the guidance provided in LAQM.TG(16).

8.38 LAQM.TG(16) does not provide a method for the conversion of annual mean NO<sub>2</sub> concentrations to 1-hour mean NO<sub>2</sub> concentrations. However, research (Ref. 8.4) has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m<sup>3</sup>. Care has been taken to ensure that locations where the 1-hour mean objective is relevant are included in the assessment.

8.39 A quantitative assessment of air quality in the vicinity of the Proposed Development has been completed against the Air Quality Strategy objectives set out in **Appendix 8.4** for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>.

## **Significance Criteria**

### Construction Phase

8.40 The IAQM assessment methodology recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from a construction activity following the application of appropriate mitigation measures. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effects will normally be negligible.

### Operational Phase

8.41 The EPUK & IAQM planning guidance provides criteria for determining the significance of a development. The EPUK & IAQM guidance recommends that the impact at individual receptors is described by expressing the magnitude of incremental change in pollution concentration as a proportion of the relevant assessment level and examining this change in the context of the new total concentration and its relationship with the assessment criterion as summarised in Table 8.8.



**Table 8.8: Impact Descriptors for Individual Receptors.**

Long Term Average Concentration at Receptor in Assessment Year	% Change in concentration relative to AQAL (a)			
	1	2-5	5-10	>10
75% or less of AQAL	Negligible	Negligible	Slight adverse	Moderate adverse
76-94% of AQAL	Negligible	Slight adverse	Moderate adverse	Moderate adverse
95-102% of AQAL	Slight adverse	Moderate adverse	Moderate adverse	Substantial adverse
103-109% of AQAL	Moderate adverse	Moderate adverse	Substantial adverse	Substantial adverse
110% or more of AQAL	Moderate adverse	Substantial adverse	Substantial adverse	Substantial adverse
(a) A change in concentration of less than 0.5% of the AQAL is considered insignificant, however changes between 0.5% and 1% are rounded up to 1%.				

8.42 The EPUK & IAQM guidance notes that the criteria in Table 8.8 should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for. The EPUK & IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:

- The existing and future air quality in the absence of the Proposed Development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

### **Sensitive Receptors**

8.43 LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations ‘where members of the public are regularly present’ should be considered. At such locations, members of the public will be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

8.44 For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standard (i.e. 15-minute mean or 1-hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term (such as 24-hour mean or annual mean) standards





may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

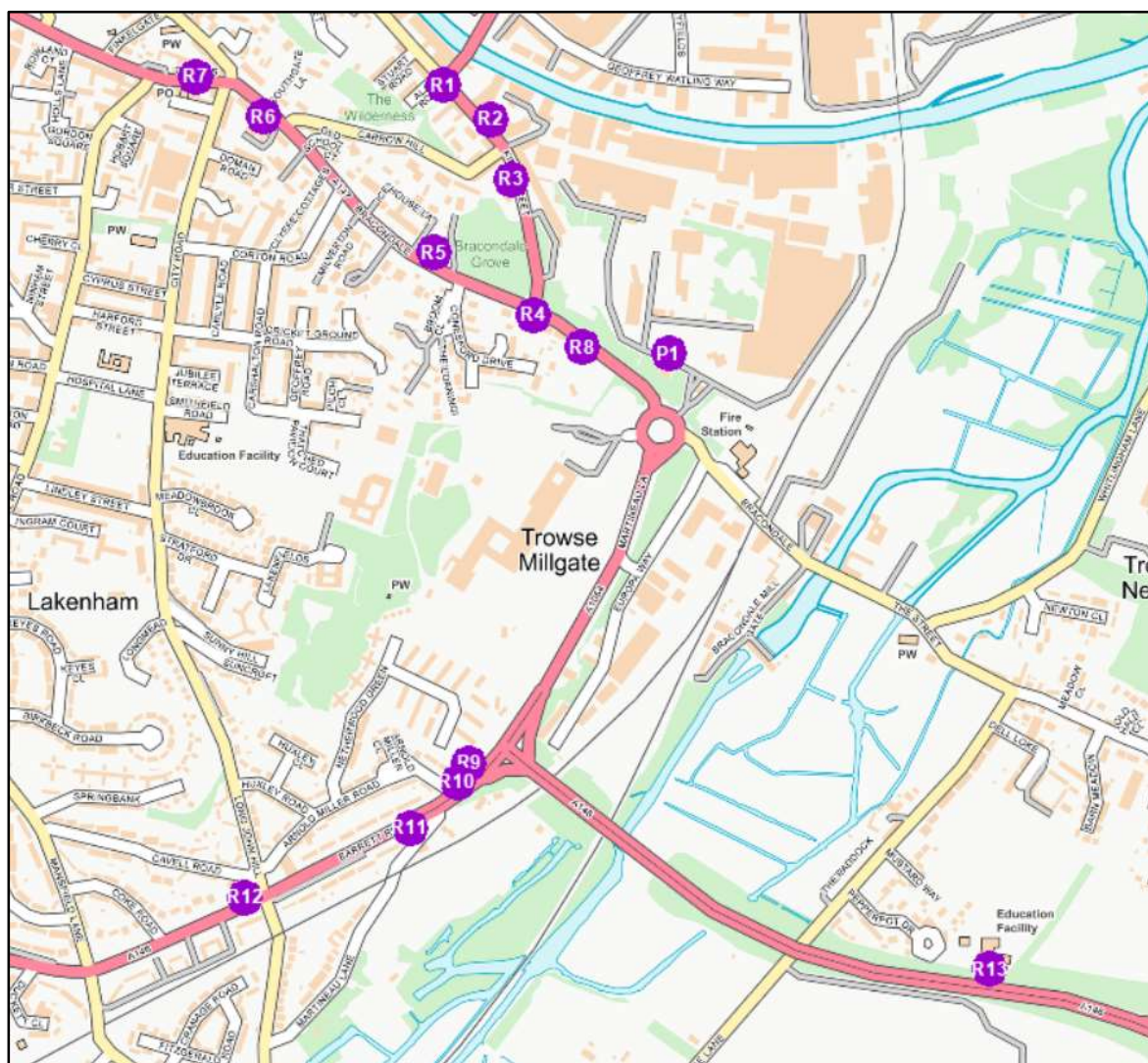
8.45 To assess the impact of emissions arising from the traffic generated by the Proposed Development, pollutant concentrations have been predicted at 13 existing sensitive receptors within the vicinity of the Application Site including nearby residential properties, a day care centre and a school. Details of these sensitive receptors are presented in Table 8.9 and the locations are illustrated in Figure 8.1.

8.46 The modelling assessment also predicted concentrations at one location within the Proposed Development itself to assess the suitability of the Application Site for the proposed end use.

**Table 8.9: Location of Sensitive Receptors**

ID	Receptor	Type	Easting	Northing
R1	256 King Street	Residential	623865.2	307680.1
R2	Old Mustard Mill Flat Complex	Residential	623935.4	307629.6
R3	14 Governors Court	Residential	623966.1	307542.4
R4	66 Bracondale	Residential	623998.4	307341.3
R5	53 Bracondale	Residential	623852.1	307433.6
R6	24 Bracondale Court	Residential	623601.1	307633.4
R7	232 Queens Road	Residential	623501.3	307693.4
R8	78 Bracondale	Residential	624070.9	307294.3
R9	Martineau Lane	Residential	623903.7	306680.7
R10	Lakenham Day Centre	Day Care	623885.3	306654.0
R11	27 Martineau Lane	Residential	623816.0	306585.5
R12	74 Long John Hill	Residential	623572.6	306484.4
R13	Trowse Primary School	School	624670.8	306377.7
P1	Façade of the Proposed Development	Proposed Residential	624196.9	307285.1

**Figure 8.1: Location of Receptors Considered within ADMS Model**



## LEGISLATION, PLANNING POLICY AND GUIDANCE

### The European Directive on Ambient Air and Cleaner Air for Europe

8.47 European Directive 2008/50/EC (Ref. 8.5) of the European Parliament and of the Council of 21st May 2008, sets legally-binding Europe-wide limit values for the protection of public health and sensitive habitats. The Directive streamlines the European Union's air quality legislation by replacing four of the five existing Air Quality Directives within a single, integrated instrument.

8.48 The pollutants included are sulphur dioxide (SO<sub>2</sub>), NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, lead (Pb), carbon monoxide (CO), benzene (C<sub>6</sub>H<sub>6</sub>), ozone (O<sub>3</sub>), polycyclic aromatic hydrocarbons (PAHs), cadmium (Cd), arsenic (As), nickel (Ni) and mercury (Hg).



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## Air Quality Strategy for England, Scotland, Wales & Northern Ireland

8.49 The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007 (Ref. 8.6), pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

8.50 The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C<sub>6</sub>H<sub>6</sub>), 1,3-butadiene (C<sub>4</sub>H<sub>6</sub>), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO<sub>2</sub>), particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>), sulphur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>) and polycyclic aromatic hydrocarbons (PAHs).

8.51 The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

8.52 The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

8.53 For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO<sub>2</sub>, the short-term standard is for a 1-hour averaging period, whereas for PM<sub>10</sub> it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

8.54 The AQS also contains a framework for considering the effects of a finer group of particles known as 'PM<sub>2.5</sub>'. Local Authorities are required to work towards reducing emissions / concentrations of PM<sub>2.5</sub>, but there is currently no statutory objective incorporated into UK law at this time.



8.55 Of the pollutants included in the AQS, NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> will be particularly relevant to this project as these are the primary pollutants associated with road traffic.

8.56 The AQS objective levels relevant to this assessment are set presented in **Appendix 8.4**.

### **Air Quality (England) Regulations**

8.57 Many of the objectives in the AQS were made statutory in England through the *Air Quality (England) Regulations 2000* (Ref. 8.7) and the *Air Quality (England) (Amendment) Regulations 2002* (the Regulations) (Ref. 8.8) for the purpose of Local Air Quality Management (LAQM).

8.58 The Air Quality Standards Regulations 2010 (Ref. 8.9) came into force on the 10<sup>th</sup> June 2010 and have adopted into UK law the limit values required by EU Directive 2008/50/EC. These regulations prescribe the 'relevant period' (referred to in Part I2V of the Environment Act 1995) that local authorities must consider in their review of the future quality of air within their area. The regulations also set out the air quality objectives to be achieved by the end of the 'relevant period'.

8.59 Ozone is not included in the Regulations as, due to its transboundary nature, mitigation measures must be implemented at a national level rather than at a local authority level.

### **Local Air Quality Management (LAQM)**

8.60 Part IV of the Environment Act 1995 also requires local authorities to periodically Review and Assess the quality of air within their administrative area. The Reviews have to consider the present and future air quality and whether any air quality objectives prescribed in Regulations are being achieved or are likely to be achieved in the future.

8.61 Where any of the prescribed air quality objectives are not likely to be achieved, the authority concerned must designate that part an Air Quality Management Area (AQMA).

8.62 For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.



8.63 The Department of Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their Review and Assessment work (Ref. 8.10). This guidance, referred to in this chapter as LAQM.TG(16), has been used where appropriate in the assessment.

### **National Planning Policy Framework**

8.64 The National Planning Policy Framework (NPPF) (Ref. 8.11) sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

8.65 The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to *'to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'*

8.66 Under Section 15: Conserving and Enhancing the Natural Environment, the NPPF (paragraph 174) requires that *'planning policies and decisions should contribute to and enhance the natural and local 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. Development should, wherever possible help to improve local environmental conditions such as air and water quality'*

8.67 In dealing specifically with air quality the NPPF (paragraph 186) states that *'planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.'*



8.68 Paragraph 188 states that *'the focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively.'*

### **Norwich Local Plan (Ref. 8.12)**

8.69 The Norwich Local Plan was adopted in November 2014 and is used to manage development in the area. Policy DM11 – Environmental hazards states:

#### *'Air and Water Quality*

*In areas where an Air Quality Management Area (AQMA) has been declared (under the Environment Act, 1995), development which is likely to have an impact on air quality will be required to take particular account of the air quality action plan for that area. Where the action plan identifies poor or deteriorating air quality as an issue in localised areas within the AQMA, development will be required to incorporate measures which will mitigate against the effects of existing or potential further deterioration in local air quality through design, density, disposition of uses or travel demand management as appropriate, on a case-by-case basis. [...]*

### **Control of Dust and Particulates associated with Construction**

8.70 Section 79 of the *Environmental Protection Act (1990)* provides the following definitions of statutory nuisance relevant to dust and particles:

- *'Any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance', and*
- *'any accumulation or deposit which is prejudicial to health or a nuisance'.*

8.71 Following this, Section 80 states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

8.72 In the context of the proposed development, the main potential for nuisance of this nature will arise during the construction phase – potential sources being the clearance, earthworks, construction and landscaping processes.



8.73 There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist – 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates.

### **EPUK & IAQM Land Use Planning and Development Control**

8.74 Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) published the Land Use Planning and Development Control Air Quality guidance in January 2017 (Ref. 8.2) to provide guidance on the assessment of air quality in relation to planning proposals and ensure that air quality is adequately considered within the planning control process.

8.75 The main focus of the guidance is to ensure all developments apply good practice principles to ensure emissions and exposure are kept to a minimum. It also sets out criteria for identifying when a more detailed assessment of operational impacts is required, guidance on undertaking detailed assessments and criteria for assigning the significance of any identified impacts.

8.76 This guidance has been used within this assessment.

### **Assessment of Dust from Demolition and Construction**

8.77 The IAQM published guidance in 2014 on the assessment of emissions from demolition and construction activities (Ref. 8.1). The guidance sets out an approach to identifying the risk of impacts occurring at nearby sensitive receptors from dust generated during the construction process and sets out recommended mitigation measures based on the identified risk. This guidance has been used within this assessment.

## **BASELINE CONDITIONS**

### **Norwich City Council Review and Assessment of Air Quality**

8.78 Norwich City Council (NCC) has carried out reviews of the air quality in the area and as a result has declared one AQMA in central Norwich due to exceedances of the NO<sub>2</sub> annual mean objective. The Application Site is located 100m to the east of this AQMA.



8.79 NCC currently monitor air quality within the borough using a network of diffusion tubes, and two automatic monitors.

#### Automatic Local Monitoring Data

8.80 NCC operate two automatic monitoring sites, the closest of which is the Lakenfields urban background monitor, located approximately 610m to the southwest of the Application Site. Data from this site is summarised in Table 8.10.

**Table 8.10: Pollutant Concentrations measured at the Lakenfields Urban Background Monitor ( $\mu\text{g}/\text{m}^3$ )**

Pollutant	Statistic	Year				
		2016	2017	2018	2019	2020
NO <sub>2</sub>	Annual Mean	14	13	12	13	10
	Number of 1-Hour means > 200 $\mu\text{g}/\text{m}^3$ (a)	0	0	0	0	0
PM <sub>10</sub>	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	16	16	16	14	13
	Number of 24-hour means > 50 $\mu\text{g}/\text{m}^3$	1	5	1	4	0
PM <sub>2.5</sub>	Annual Mean ( $\mu\text{g}/\text{m}^3$ )	11	12	10	10	8
Data obtained from NCC Air Quality Annual Status Report 2021						

8.81 Annual mean NO<sub>2</sub> and PM<sub>10</sub> concentrations recorded have been well below the 40  $\mu\text{g}/\text{m}^3$  objective levels since 2016. Annual mean PM<sub>2.5</sub> concentrations recorded have been well below the 25  $\mu\text{g}/\text{m}^3$  objective level since 2016.

8.82 No exceedances of the NO<sub>2</sub> hourly objective were recorded in the five years of monitoring presented, therefore the objective was met.

8.83 Exceedences of the 24-hour PM<sub>10</sub> objective have been recorded during the five years of the monitoring presented, however the objective allows for 35 exceedences of the 50  $\mu\text{g}/\text{m}^3$  limit in any given year. Therefore, the objective was met in all five monitoring years.

8.84 Based on the data recorded at this site, NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations are expected to meet the relevant objectives at the Application Site.





## Non-Automatic Monitoring

8.85 NO<sub>2</sub> diffusion tube monitoring is carried out at a number of locations within the area. Data from the closest monitoring sites to the Application Site are presented in Table 8.11.

**Table 8.11: Annual Mean NO<sub>2</sub> Concentrations Measured by Diffusion Tube (µg/m<sup>3</sup>)**

Site Name	Site Type	Distance to kerb (m)	Annual mean concentrations (µg/m <sup>3</sup> )				
			2016	2017	2018	2019	2020
DT1 – 256 King Street	Roadside	3.5	37.7	36.3	33.3	34.2	25.6
DT4 – Lakenfields AQS	Urban Background	1.5	12.9	13.9	11.8	12.0	10.0
DT21 – Rotary House	Roadside	2.0	32.9	32.5	29.1	30.9	24.9
DT22 – Carrow Bridge House	Roadside	5.0	23.3	25.3	31.1	29.4	21.7

Data obtained from NCC Air Quality Annual Status Report 2021

8.86 At the diffusion tube sites, NO<sub>2</sub> concentrations were below the annual mean objective in the years of monitoring presented.

8.87 Diffusion tubes are unable to record short-term concentrations of NO<sub>2</sub>. However, as detailed previously, where annual mean concentrations are less than 60 µg/m<sup>3</sup> it is unlikely there will be an exceedences of the 1-hour objective. Based on the annual mean concentrations recorded since 2016 it is expected that the 1-hour mean objective is being met at these locations and in the vicinity of the Application Site.

## Defra Background Maps

8.88 Additional information on background concentrations in the vicinity of the Application Site has been obtained from the Defra background pollutant maps. The Defra background maps provide estimated concentrations for the years 2018 to 2030. For the purposes of this assessment 2019 background concentrations have been obtained.

8.89 The pollutant concentrations from the grid squares representing the assessment area have been extracted from the maps which include the Application Site and road links included in the modelling assessment. The background concentration for each pollutant used in the assessment is presented in Table 8.12 below.



**Table 8.12: Estimated Annual Mean Background Concentrations from Defra Maps ( $\mu\text{g}/\text{m}^3$ )**

Grid Square	Receptor	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
623500, 307500	R1, R2, R3, R4, R5, R6, R7, DT1, DT21, DT22	15.3	15.5	10.3
624500, 307500	R8, P1	16.6	15.2	9.9
623500, 306500	R9, R10, R11, R12, R13	13.0	15.0	9.8

## IDENTIFICATION AND EVALUATION OF KEY EFFECTS

### Construction Phase Effects

#### Area Sensitivity

8.90 The assessment of dust impacts is dependent on the proximity of the most sensitive receptors to the Application Site boundary. Residential properties proposed as part of the Land north of Carrow Quay site and Deal Ground site have been included as sensitive receptors. A summary of the receptor and area sensitivity to health and dust soiling impacts is presented in Table 8.13.

**Table 8.13: Sensitivity of Receptors and the Local Area to Dust Impacts**

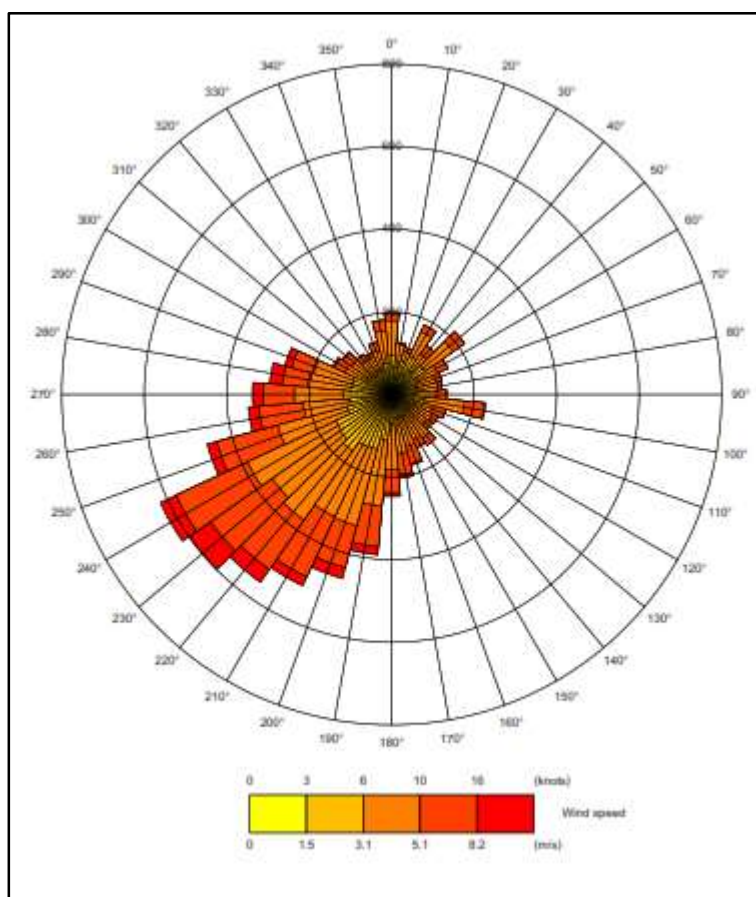
Receptor	Distance from Site Boundary (m)	Approx. Number of Receptors	Sensitivity to Health Impacts (a)		Sensitivity to Dust Soiling Impacts	
			Receptor	Area	Receptor	Area
Existing Residential Properties	<20 m	1-10	High	Low	High	Medium
	<50 m	10-100	High	Low	High	Medium
Proposed Residential Properties	<20 m	0	High	-	High	-
	<50 m	10-100	High	Low	High	Medium
<b>Overall Sensitivity of the Area</b>			<b>Low</b>		<b>Medium</b>	
(a) Estimated background PM <sub>10</sub> concentration is 15.2 $\mu\text{g}/\text{m}^3$ .						

8.91 There are more than 10 properties within 20m of the carriageway within 500m of the Application Site entrance, therefore the sensitivity of the area is considered to be high for dust soiling from trackout and low for human health impacts from particulate matter from trackout.

8.92 The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited will depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

8.93 A wind rose from Norwich is provided in Figure 8.2, which shows that the prevailing wind is from the southwest, therefore receptors to the northeast of the Application Site are the most likely to experience dust impacts from the Proposed Development. The area to the northeast of the Application Site is predominantly open fields with some residential receptors. The highest risk of impacts is expected to occur in this location.

**Figure 8.2: Wind Rose for Norwich Meteorological Station (2019)**



### Dust Emission Magnitude

8.94 Dust emissions during demolition will depend on the scale of the works, the methods used for demolition and the material of the building to be demolished. The existing buildings



and structures onsite have an overall volume greater than 50,000m<sup>3</sup>. The magnitude of the dust emission for the demolition phase is therefore considered to be '*large*'.

8.95 Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling of the site and landscaping. The area of the Application Site is greater than 10,000m<sup>2</sup> and therefore classed as '*large*' in terms of emissions magnitude based on the IAQM guidance.

8.96 Dust emissions during construction will depend on the scale of the works, method of construction, construction materials and duration of build. The main construction material would involve the use of brick and timber, which have a low to moderate potential for dust release. Due to the size of the Application Site and to ensure a worst-case assessment, the dust emission magnitude is considered to be '*large*'.

8.97 Factors influencing the degree of trackout and associated magnitude of effect include vehicle size, vehicle speed, vehicle numbers, geology and duration. Due to the size of the Application Site, the number of HGV movements (leaving the site) is likely to be in excess of 50 per day, therefore dust emission magnitude due to trackout is considered to be '*large*'.

#### Dust Risk Effects

8.98 A summary of the potential risk of dust impacts, based on the low overall sensitivity of the area to human health and medium overall sensitivity to dust soiling impacts, is presented in Table 8.14.

**Table 8.14: Risk of Dust Impacts Prior to Mitigation**

Source	Impact Magnitude	Human Health Risk	Dust Soiling Risk
Demolition	Large	Medium	High
Earthworks	Large	Low	Medium
Construction	Large	Low	Medium
Trackout	Large	Low	High



## Operational Phase Effects

### Predicted NO<sub>2</sub> Concentrations

8.99 Annual mean NO<sub>2</sub> concentrations, predicted at the identified receptor locations are presented in Table 8.15 below.

**Table 8.15: Predicted Annual Mean NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**

Receptor	2028 Without Development	2028 With Development	Concentration Change due to Development (% of Objective)	Magnitude of Impact
R1	23.7	24.0	0.7	Negligible
R2	24.0	24.3	0.7	Negligible
R3	23.8	24.1	0.7	Negligible
R4	25.5	25.9	1.1	Negligible
R5	21.0	21.2	0.5	Negligible
R6	20.3	20.4	0.4	Negligible
R7	24.8	25.1	0.8	Negligible
R8	24.8	25.2	1.1	Negligible
R9	18.4	18.5	0.5	Negligible
R10	19.3	19.5	0.5	Negligible
R11	20.3	20.6	0.6	Negligible
R12	20.4	20.6	0.6	Negligible
R13	18.9	19.1	0.5	Negligible
P1	-	20.6	-	-

8.100 The results of the modelling indicate that in the opening year of 2028, the predicted annual mean NO<sub>2</sub> concentrations will be well below (less than 75%) the objective level of 40 µg/m<sup>3</sup> at all the selected receptors both with and without the Proposed Development operational.

8.101 Based on the EPUK & IAQM significance criteria, the impact on annual mean NO<sub>2</sub> concentrations at all receptors as a result of traffic emissions from the Proposed Development is predicted to be *negligible*.



8.102 Within the Application Site itself, the annual mean NO<sub>2</sub> concentration is predicted to be well below (less than 75%) of the AQAL and therefore the impact with regards to new exposure is considered to be negligible.

8.103 Concentrations of annual mean NO<sub>2</sub> predicted within the study area are all well below 60µg/m<sup>3</sup> therefore it is considered likely that the AQS objective level for hourly mean NO<sub>2</sub> concentrations will also be met. Therefore, the impact of the Proposed Development on the surrounding existing receptors and with regards to new exposure for hourly mean NO<sub>2</sub> concentrations is also considered to be negligible.

#### Predicted PM<sub>10</sub> Concentrations

8.104 Predicted annual mean PM<sub>10</sub> concentrations at the selected receptor locations are presented below in Table 8.16.

**Table 8.16: Predicted Annual Mean PM<sub>10</sub> Concentrations (µg/m<sup>3</sup>)**

Receptor	2028 Without Development	2028 With Development	Concentration Change due to Development (% of Objective)	Magnitude of Impact
R1	19.7	19.8	0.3	Negligible
R2	19.8	20.0	0.4	Negligible
R3	19.6	19.8	0.3	Negligible
R4	20.0	20.2	0.5	Negligible
R5	18.3	18.4	0.2	Negligible
R6	17.7	17.7	0.2	Negligible
R7	20.2	20.3	0.4	Negligible
R8	19.3	19.5	0.6	Negligible
R9	17.4	17.5	0.2	Negligible
R10	18.1	18.2	0.3	Negligible
R11	18.6	18.7	0.3	Negligible
R12	18.3	18.4	0.3	Negligible
R13	18.1	18.2	0.3	Negligible
P1	-	17.1	-	-



8.105 The results of the modelling indicate that in the opening year of 2028, the predicted annual mean PM<sub>10</sub> concentrations will be well below (less than 75%) the objective level of 40 µg/m<sup>3</sup> at all the selected receptors both with and without the Proposed Development operational.

8.106 Based on the EPUK & IAQM significance criteria, the impact on annual mean PM<sub>10</sub> concentrations at all receptors as a result of traffic emissions from the Proposed Development is predicted to be *negligible*.

8.107 LAQM.TG(16) provides a relationship between predicted annual mean concentrations and the likely number of exceedances of the short-term (24-hour mean) PM<sub>10</sub> objective of 50 µg/m<sup>3</sup> (N), where:

$$N = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean}).$$

8.108 The objective allows 35 exceedances per year, which is equivalent to an annual mean of 32 µg/m<sup>3</sup>.

8.109 Based on the above approach, the maximum number of days where PM<sub>10</sub> concentrations are predicted to exceed 50µg/m<sup>3</sup> is between 1 and 4 days at the selected receptors with a change of less than one day as a result of the operation of the Proposed Development. The impact on 24-hour PM<sub>10</sub> concentrations is therefore also considered to be negligible.

8.110 Within the Application Site itself, annual mean and 24-hour mean PM<sub>10</sub> concentrations are predicted to be well below (less than 75%) of the relevant AQAL. The impact of the Proposed Development with regards new exposure is therefore considered to be negligible.

#### Predicted PM<sub>2.5</sub> Concentrations

Predicted annual mean PM<sub>2.5</sub> concentrations at the identified receptor locations are presented in Table 8.17 below.



**Table 8.17: Predicted Annual Mean PM<sub>2.5</sub> Concentrations (µg/m<sup>3</sup>)**

Receptor	2028 Without Development	2028 With Development	Concentration Change due to Development (% of Objective)	Magnitude of Impact
R1	12.6	12.7	0.3	Negligible
R2	12.7	12.8	0.3	Negligible
R3	12.6	12.7	0.3	Negligible
R4	12.8	12.9	0.4	Negligible
R5	11.8	11.9	0.2	Negligible
R6	11.5	11.5	0.2	Negligible
R7	12.9	13.0	0.4	Negligible
R8	12.1	12.2	0.5	Negligible
R9	11.2	11.2	0.2	Negligible
R10	11.5	11.6	0.2	Negligible
R11	11.8	11.9	0.3	Negligible
R12	11.7	11.7	0.2	Negligible
R13	11.5	11.6	0.2	Negligible
P1	-	10.9	-	-

8.111 The results of the modelling assessment indicate that in the opening year of 2028, predicted annual mean PM<sub>2.5</sub> concentrations will be well below (less than 75%) the 25 µg/m<sup>3</sup> objective limit at the selected receptor locations both with and without the Proposed Development in operation.

8.112 Based on the EPUK & IAQM significance criteria, the impact on annual mean PM<sub>2.5</sub> concentrations at all receptors as a result of traffic emissions from the Proposed Development is predicted to be *negligible*.

8.113 Within the Application Site itself, annual mean PM<sub>2.5</sub> concentrations are predicted to fall well below the relevant AQAL. The impact with regards to new exposure is therefore also considered to be negligible.

### **Uncertainty**

8.114 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data that have





been input which will have inherent uncertainties associated with them. There is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

8.115 Defra issued revised emission factors in November 2021 which better reflect the anticipated change in future year emissions. This assessment has used these emissions factors in conjunction with background concentrations obtained from background maps based on 2018 monitored concentrations to reduce the uncertainty in the prediction of future concentrations.

## **ASSESSMENT OF CUMULATIVE EFFECTS**

8.116 Cumulative effects can potentially be experienced during both the construction and operational phases. During the construction phase, cumulative effects of dust and particulate matter generated from on-site activities may be experienced in locations in close proximity to two or more development sites and when the timing of the construction phases overlap. There may also be an effect due to the increased construction traffic on local roads if construction vehicles are to use the same routes to access the sites. During the operational phase, cumulative effects may be experienced due to the additional road vehicles generated by one or more schemes if the traffic is likely to affect the same local roads.

8.117 Details of the committed developments considered cumulatively within this assessment are outlined in Chapter 3.

### **Construction Phase Effects**

8.118 Guidance provided by the IAQM suggests that effects of dust and particulate matter generated from a construction site may be experienced up to 350m from the site. There are two committed developments located adjacent to the Application Site: Deal Ground and Land north of Carrow Quay. It is unknown when construction will begin for both sites. The area that is within 350m of both the Application Site and the Church Farm site is primarily occupied by open fields, although some residential properties to the east and west are also within 350m of both sites. There are sensitive receptors located to the north within 100m of the Application Site, adjacent to the Land north of Carrow Quay.

8.119 All construction sites would be the subject of stringent mitigation measures similar to those that would be implemented during construction of the Proposed Development. The cumulative impact of the Proposed Development and the committed developments is therefore considered to remain negligible following the implementation of the relevant site specific Dust Management Plans.



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## Operational Phase Effects

8.120 The traffic flows used for the assessment include a contribution from the committed developments in the area. The assessment of the impact of the Proposed Development has therefore taken into account the cumulative effect of the Application Site and the committed development on predicted future pollutant concentrations.

## Inter-Relationship Effects

8.121 There are inter-relationships with the transport chapter as identified through the use of traffic data within the assessment. No other inter-relationships with other topics are identified.

## ENHANCEMENT, MITIGATION AND RESIDUAL EFFECTS

### Mitigation

#### Construction Phase

8.122 The control of dust emissions from construction site activities relies upon management provision and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

8.123 A high risk of dust soiling impacts and a medium risk of human health (PM<sub>10</sub>) effects is predicted at adjacent receptors during construction of the Proposed Development. Appropriate mitigation measures for the Application Site have been identified following the IAQM guidance and based on the risk effects presented in Table 8.18. It is recommended that the 'highly recommended' measures set out in **Appendix 8.5** are incorporated into a Dust Management Plan (DMP) and approved by NCC prior to commencement of any work on the Application Site.

8.124 Following implementation of the 'highly recommended' measures outlined in the IAQM guidance and reproduced in **Appendix 8.5**, the impact of emissions during construction of the Proposed Development would be negligible.

#### Operational Phase

8.125 The results of the detailed modelling assessment predicted a negligible impact on local NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations and that the concentrations of relevant pollutants (NO<sub>2</sub>,



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PM<sub>10</sub> and PM<sub>2.5</sub>) within the Proposed Development and at nearby sensitive receptors will meet the relevant air quality objectives. No mitigation measures during the operation of the Proposed Development are therefore considered necessary.

### **Residual Effects**

#### Construction Phase

8.126 Following implementation of the measures recommended for inclusion within the DMP the impact of emissions during construction of the Proposed Development would be *negligible*.

#### Operational Phase

8.127 Residual impacts on local air quality would be negligible.

### **SUMMARY**

8.128 An air quality impact assessment has been undertaken to assess both construction and operational effects associated with the Proposed Development.

8.129 An assessment of the potential impacts during the construction phase has been carried out in accordance with the latest Institute of Air Quality Management Guidance. This has shown that for the Proposed Development, limited releases of dust and particulate matter are likely to be generated from on-site activities. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and particulate matter releases may be effectively mitigated and the resultant impacts are considered to be negligible.

8.130 ADMS Roads dispersion modelling has been carried out to assess both the impact of the operation of the Proposed Development on local pollutant concentrations and the suitability of the Application Site for its proposed end use with regards to local air quality. The results indicate that predicted concentrations of relevant pollutants (NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>) concentrations are well below the relevant objectives within the Proposed Development and at nearby sensitive receptors. The predicted increase in NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations is of negligible significance at worst-case receptor locations along the local road network.

8.131 Future occupants of the Proposed Development would not be exposed to pollutant concentrations above the relevant objective levels, therefore the impact of the Proposed Development with regards new exposure to air quality is considered to be negligible.



8.132 It is concluded that air quality does not pose a constraint to the Proposed Development, either during construction or once operational.

**Table 8.30: Air Quality Summary Table**

Potential Effect	Nature of Effect (Permanent or Temporary)	Significance	Mitigation/ Enhancement Measures	Residual Effects
Dust and particulate matter generated during the construction phase	Temporary	-	The adoption of <i>best practice and measures outlined in the IAQM guidance</i>	Negligible
Effects on Local Air Quality from emissions from construction traffic	Temporary	Negligible	None	Negligible
Effects on Local Air Quality from emissions from road traffic generated by the operation of the Proposed Development	Permanent	Negligible	No mitigation required	Negligible



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## REFERENCES

- Ref. 8.1:** Institute of Air Quality Management (2014); 'Guidance on the assessment of dust from demolition and construction version 1.1'.
- Ref. 8.2:** Environmental Planning UK & Institute of Air Quality Management. Land-use Planning and Development Control: Planning for Air Quality, January 2017
- Ref. 8.3:** <http://uk-air.defra.gov.uk>
- Ref. 8.4:** D. Laxen and B Marner (2003) Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites.
- Ref. 8.5:** Air Quality Directive 2008/50/EC
- Ref. 8.6:** The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007)
- Ref. 8.7:** The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928
- Ref. 8.8:** The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043
- Ref. 8.9:** The Air Quality Standards Regulations 2010 – Statutory Instrument 2010 No. 1001
- Ref. 8.10:** Department for Environment, Food and Rural Affairs (Defra), (2016): Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16).
- Ref. 8.11:** Communities and Local Government: *National Planning Policy Framework* (July 2021)
- Ref. 8.12:** Norwich City Council. (2014). Norwich Local Plan: Development Management Policies Plan.



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## 9 NOISE AND VIBRATION

### INTRODUCTION

9.1 This Chapter of the ES assesses the likely environmental effects of the Proposed Development, with respect to noise and vibration. The existing and likely future ambient noise levels are considered in order to demonstrate site suitability and to allow consideration of potential effects at existing noise sensitive receptors in the surrounding area.

9.2 In the context of this assessment, noise is defined as unwanted or undesirable sound derived from sources such as road traffic, or construction works that interfere with normal activities, including conversation, sleep or recreation. Vibration is defined as the transmission of energy through the medium of ground or air resulting in small movements of the transmitting medium, such as a building, which can cause discomfort or even damage to structures if the movements are large enough.

9.3 Described within this Chapter is the relevant legislative and policy framework; the assessment methodology; the baseline conditions at the Application Site and surroundings; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been employed.

### ASSESSMENT METHODOLOGY

#### Construction Phase Methodology

9.4 The impact of noise and vibration during construction of the Proposed Development requires prediction and assessment in accordance with the guidance presented in BS 5228 1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Noise' (Ref 9.1).

9.5 The following elements are considered to have the potential to give rise to significant effects during the construction stage of the Proposed Development and have, therefore, been considered within this ES chapter:

- Noise from on-site construction activities affecting nearby existing sensitive receptors; and



- Vibration from on-site construction activities affecting nearby existing sensitive receptors.

### **Changes in Road Traffic Flows**

9.6 The impact at existing residential receptors due to changes in noise level resulting from changes in traffic flow as a result of the operational development has been assessed in accordance with the guidance presented in the Design Manual for Roads and Bridges (DMRB) (Ref 9.2). The future 'with development' scenario has been considered against the future 'without development' scenario based on the traffic flow data for the opening year 2028, as provided by the transport consultants, in order to identify the impact of the introduction of the Proposed Development.

### **Noise at Proposed Residential Properties**

9.7 Computer noise modelling has been used to calculate road traffic noise across the Proposed Development in accordance with the methodology contained within the Calculation of Road Traffic Noise (CRTN) (Ref 9.3).

9.8 The ambient noise at residential dwellings is assessed against the guidance provided by BS 8233:2014 (Ref 9.4) for both the day and night time period. Night time maximum noise levels are assessed against the guideline noise level for the onset of sleep disturbance provided by the WHO Guidelines for Community Noise (Ref 9.5). The ambient noise levels for the year 2028 have been calculated to ensure future noise levels are appropriately considered.

### **Fixed Plant**

9.9 Information pertaining to operational plant is not yet available and details of any likely building services plant are not known. Consequently, limits relating to the introduction of any commercial sources are derived based on the guidance presented by BS 4142:2014+A1:2019 (Ref 9.6). These limits will ensure that plant items can be appropriately selected to minimise the risk of adverse effects.

### **Assumptions and Limitations**

9.10 The adopted construction noise levels are representative of continuous activity and therefore are likely to provide a conservative assessment of the likely impacts. The calculated



noise levels are therefore likely to be higher than those observed in practice. Construction noise levels have been calculated based on typical noise levels for construction activities.

9.11 The road noise levels were calculated using the traffic data provided within this ES and measurements obtained during the noise survey. Rail movements were modelled based on train movement data and measurements obtained on site. The calculations used within this ES are considered representative of the ambient environment at the Proposed Development.

9.12 The assessment of the change in noise levels across existing road links is based on the provided traffic flow data. The data includes future committed development within the surrounding area. Any changes to the calculated traffic flows may provide a material change to this assessment. Any decrease in flows related to the Proposed Development may change the calculated effect significance due to road traffic flows.

## METHODOLOGY FOR DEFINING EFFECTS

### Sensitivity

9.13 The criteria set out in Table 9.1 below have been applied to identify noise/vibration sensitive receptors either on or adjacent to the Application Site.

**Table 9.1 Noise and Vibration Receptors**

Sensitivity	Description	Receptor
High	Receptors that are especially susceptible to noise/vibration	Residential dwellings, Schools, Hospitals, Care Homes
Moderate	Receptors where a reasonable degree of noise disturbance is acceptable	Offices
Low	Receptors where noise is tolerable	Retail shops, restaurants
Negligible	Receptors where noise is not likely to be a factor	Sports Grounds, commercial and industrial environments

### Construction Noise

9.14 Noise levels generated by construction activities have the potential to impact upon nearby noise-sensitive receptors. However, the magnitude of the potential impact will depend upon a number of variables, such as:

- the noise generated by plant or equipment used on site;





- the period of time that construction plant is operational;
- the distance between the noise source and the receptor; and
- the level of likely attenuation due to ground absorption and barrier effects.

9.15 BS 5228 gives several examples of acceptable limits for construction or demolition noise. The most simplistic being based upon the exceedance of fixed noise limits and states in paragraph E.2:

*“Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut.”.*

*“Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed: 70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise or 75 decibels (dBA) in urban areas near main roads in heavy industrial areas. These limits are for daytime working outside living rooms and offices.”*

9.16 The construction noise impact considers the noise magnitude and adverse effect levels as provided in the Noise Policy Statement for England (NPSE) (Ref 9.7) and the Planning Policy Guidance (PPG) (Ref 9.8) provided by the Department for Communities & Local Government in its on-line planning guidance to assist with interpretation of the NPPF (Ref 9.9) as shown in Table 9.2.

**Table 9.2 Construction Noise Magnitude**

Day	Time (hours)	Averaging Period T	LOAEL L <sub>Aeq,T</sub> (dB)	SOAEL L <sub>Aeq,T</sub> (dB)*
Mondays to Fridays	0700 - 0800	1 hour	60	70
	0800 - 1800	10 hours	65	75
	1800 - 1900	1 hour	60	70
	1900 - 2200	1 hour	55	65
Saturdays	0700 - 0800	1 hour	60	70
	0800 - 1300	5 hours	65	75
	1300 - 1400	1 hour	60	70
	1400 - 2200	1 hour	55	65
Sundays & Public Holidays	0700 - 2200	1 hour	55	65
Any night	2200 - 0700	1 hour	45	55

\* The measured levels should be monitored in order to ensure that the levels presented in the table are not exceeded for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.



9.17 Threshold values for the onset construction impacts are required to allow quantitative assessment of construction noise levels. The adopted values used to define the magnitude of change for construction noise impacts are based on the values presented in Table 9.3.

**Table 9.3 Weekday Threshold Ranges for Construction Levels**

Impact	Negligible	Low	Medium	High
Construction Noise Level, $L_{Aeq,T}$ dB	< 65	65 – 70	70 - 75	> 75

9.18 It is worth noting that the purpose of the target construction noise criteria is to control the impact of construction noise insofar as is reasonably practicable, whilst recognising that it is unrealistic for developments of this nature to be constructed without causing some degree of disturbance in the locality. Hence, even if the criteria adopted for this assessment is achieved, noise from construction activities is likely to be readily noticeable. It is further noted that the local authority may restrict the hours of construction and construction related traffic on the Application Site.

### Construction Vibration

9.19 Vibration may be impulsive, such as that due to hammer-driven piling; transient, such as that due to vehicle movements along a railway; or continuous, such as that due to vibratory driven piling. The primary cause of community concern generally relates to building damage from both construction and operational sources of vibration, although, the human body can perceive vibration at levels which are substantially lower than those required to cause building damage.

9.20 Damage to buildings associated solely with ground-borne vibration is not common and although vibration may be noticeable, there is little evidence to suggest that they produce cosmetic damage such as a crack in plaster unless the magnitude of the vibration is excessively high. The most likely impact, where elevated levels of vibration do occur during the construction phase, is associated with perceptibility.

9.21 BS 5228 indicates that the threshold of human perception to vibration is around 0.15mm/s, although it is generally accepted that for the majority of people vibration levels in excess of between 0.15 and 0.3 mm/s peak particle velocity (PPV) are just perceptible.

9.22 Accordingly 1 mm/s ppv has been selected as the target criteria to control the impact of construction vibration, with the criteria for assessing the magnitude of vibration impacts



according to the margin by which this target criterion is achieved or exceeded presented in Table 9.4.

9.23 This target criterion is based on the guidance contained within BS 5228, experience from previous sites and accepted vibration policy criteria across a range of enforcing authorities elsewhere in the UK. The limits are presented in terms of peak particle velocity (PPV) as it is the simplest indicator for both perceptibility and building damage.

**Table 9.4 Ground-vibration impact levels for permanent residential buildings**

Vibration		
Lowest Observed Adverse Effect Level	PPV mm/s	1
Significant Observed Adverse Effect Level	PPV mm/s	10

9.24 Again, it is worth noting that the purpose of the target construction vibration criteria is to control the impact of construction vibration insofar as is reasonably practicable and is entirely based on the likelihood of the vibration being perceptible, rather than causing damage to property. Hence, although vibration levels in excess of 1 mm/s ppv would be considered a Major Adverse impact in respect of the likelihood of perceptibility, they would not be considered significant in terms of the potential for building damage, which would require levels of at least 15 mm/s ppv to result in minor cosmetic damage in light / unreinforced buildings.

9.25 There are currently no British Standards that provide a methodology to predict levels of vibration from construction activities, other than that contained within BS 5228 which relates to percussive or vibratory piling only. Therefore, it is not possible to accurately predict levels of vibration during the site preparation and construction phases of the Proposed Development.

9.26 Notwithstanding the above, the empirical predictors for groundborne vibration arising from mechanized construction works provided within BS 85228 have been adapted to provide an indication of the distances where impacts may begin to occur. The adopted calculation is based on vibratory piling and is considered to constitute a cautious consideration when applied to all construction activity.

9.27 The resultant thresholds for identification of vibration impacts at residential dwellings, and calculated distances for the likely onset of these values, are presented in Table 9.5.



**Table 9.5 Thresholds for ground-vibration effects at permanent residential buildings**

Effect Significance	PPV Threshold	Indicative Distance, m
Negligible	< 1	> 73.3
Minor	1 – 5	21.3 – 73.3
Moderate	5 – 10	12.5 – 21.3
Major	> 10	< 12.5

**Effect Magnitude: Completed Development**

9.28 The aim of noise policy within the UK is to protect individuals from excessive noise levels both in the workplace and within their homes. It has been recognised that severe annoyance to individuals due to noise can lead to sleep disturbance and adverse health effects.

9.29 The NPPF does not give a set of criteria for external noise assessment and therefore guidance within contemporary British Standards and other internationally published documents has been considered.

9.30 For the purposes of this assessment, external noise levels for residential use have been applied to the residential accommodation and derived on the basis of internal noise criteria outlined in British Standard 8233 and World Health Organisation (WHO) guidance.

9.31 BS 8233 makes recommendations for the control of noise in and around buildings. It suggests appropriate criteria for different situations, and is primarily intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate. The guidance provides desirable indoor ambient noise levels for dwellings which are summarised in Table 9.6 below.

**Table 9.6 - Noise Criteria for Residential Use Buildings**

Activity	Location	0700 to 2300	2300 to 0700
Resting	Living room	35 dB L <sub>Aeq,16 hour</sub>	-
Dining	Dining room/area	40 dB L <sub>Aeq,16 hour</sub>	-
Sleeping (daytime resting)	Bedroom	35 dB L <sub>Aeq,16 hour</sub>	35 dB L <sub>Aeq,8 hour</sub>

9.32 To allow a quantitative assessment of significant effects, impacts have been assigned based on the excess of the BS 8233 criteria and the typical façade reductions, as provided within BS 8233. Reductions of 15 dB and 33 dB are typically afforded for partially open and closed windows, respectively.



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9.33 Accordingly, where a reduction of 15 dB is required to achieve the BS 8223 criteria this is an indication that no mitigation is required. The effect is therefore considered as Negligible.

9.34 A 3 dB increase in noise level is considered to constitute a perceptible change, with a 10 dB increase resulting in a perceived doubling in sound level. A Minor effect is considered to be present in instances up to 9 dB above the Negligible criteria, where a sound may be perceived as no more than twice as loud as noise levels at the Negligible threshold value. Where the criteria is exceeded by more than 15 dB and up to 24 dB a Minor significance of effect is identified.

9.35 Based on the 33 dB reduction provided within BS 8233 for closed windows, noise levels up to 33 dB above the BS 8233 criteria are controllable with typical insulated double glazing and adequate ventilation. An identified required façade reduction between 25 and 33 dB is therefore considered a Moderate Adverse effect.

9.36 Where the required façade reduction exceeds 33 dB, a Major Adverse effect is identified. Sufficient glazing and ventilation would be likely for habitable rooms that are subject to these effects in order to suitably reduce internal noise levels.

9.37 For all identified effects, the significance could be considered as Negligible with the installation of typical glazing and ventilation options. Where suitable glazing and ventilation options are required, windows may remain openable to allow for purge ventilation or to be used at the occupants' discretion.

9.38 BS8233:2014 states that for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB  $L_{Aeq,T}$ , with an upper guideline value of 55 dB  $L_{Aeq,T}$  which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.

9.39 In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.



9.40 The internal noise levels recommended in BS 8233 are almost identical to those presented in WHO guidelines for community noise (internal to buildings). Internally, the WHO guidance is that in order to avoid sleep disturbance the period noise level ( $L_{Aeq,T}$ ) should not exceed 30 dB and individual noise events should not exceed 45 dB  $L_{Amax}$ . Section 3.4 of the WHO Guidelines states that for good sleep, indoor noise levels should not exceed approximately 45 dB  $L_{Amax}$  more than 10-15 times a night. On the basis of the WHO's 15 dB façade insulation for windows partly open; this equates to external  $L_{Amax}$  of 60 dB that should not be exceeded more than 10-15 times per night.

### **Fixed Plant**

9.41 British Standard BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound is intended to be used for the assessment of whether sound of industrial and/or commercial nature is likely to give rise to complaints from people residing in nearby dwellings. The Standard, which was updated in 2014, states that such sound can include:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and,
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

9.42 The procedure contained in BS 4142 for assessing the likelihood of complaints is to compare the measured or predicted sound level from the source in question, the 'specific sound level', at the assessment position with the background sound level. Where sound contains acoustic features, such as tonality, impulsivity or other noticeable characteristics then a correction is added to the specific sound to obtain the 'rating level' that reflects the contextual setting of the site.

9.43 To assess the likelihood of complaints, the measured background sound level is subtracted from the rating level. BS 4142 states:

*'Typically, the greater this difference, the greater the magnitude of the impact;*



- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and,*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'*

9.44 BS 4142 also states that “*where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.*”

9.45 Accordingly, it is more appropriate to consider the BS 8233 methodology in order to assess the existing ambient environment, which includes the operation of the asphalt site. The existing noise levels at the Proposed Development site have therefore been assessed by comparing the results of the environmental noise survey with the guidance provided in BS 8233 and the WHO Guidelines.

### **Road Traffic Noise**

9.46 The impact of any changes in road traffic noise levels has been considered against the principles and guidance presented within the Design Manual for Roads and Bridges (DMRB) Part 7 HD213/11 Noise and Vibration, 2011. DMRB presents an impact significance matrix for assessing the magnitude of changes in noise level for the short and long term and can be used as criteria for assessing the impact of any changes in road traffic noise levels, as shown in Tables 9.7 and 9.8.

9.47 The DMRB states that:

*‘The impact of a Proposed Development at any location can be reported in terms of changes in absolute noise level. In the UK the standard index used for traffic noise is the LA10,18hr level, which is quoted in decibels’*



9.48 In order to determine whether changes in traffic noise levels are likely to occur as a result of the Proposed Development, noise levels have been predicted in accordance with the methodology contained within CRTN, based on traffic flow data for the local road network with and without the Proposed Development.

**Table 9.7 Semantic Descriptors for Traffic Noise in the Short Term**

Change in Noise Level $L_{A10,18hr}$ dB	Magnitude of Impact
0	No Change
0.1 to 0.9	Negligible
1 to 2.9	Minor
3 to 4.9	Moderate
5+	Major

**Table 9.8 Semantic Descriptors for Traffic Noise in the Long Term**

Change in Noise Level $L_{A10,18hr}$ dB	Magnitude of Impact
0	No Change
0.1 to 2.9	Negligible
3 to 4.9	Minor
5 to 9.9	Moderate
10+	Major

### Effect Significance Matrix

9.49 The significance matrix has been adopted to guide the quantitative identification of significant effects. The sensitivity of the receptor is used in conjunction with the calculated magnitude of impact to identify a likely significant effect. The matrix presented in Table 9.9 does not allow for consideration of additional context and is therefore used as a guide. Professional judgement will be applied where deemed necessary due to additional factors.

**Table 9.9 Quantitative Derivation of Effect Significance**

Derivation of Effect Significance		Magnitude of Impact			
		Negligible	Minor	Moderate	Major
Sensitivity	High	Negligible	Minor	Moderate	Major
	Moderate	Negligible	Negligible	Minor	Moderate
	Low	Negligible	Negligible	Negligible	Minor
	Negligible	Negligible	Negligible	Negligible	Negligible

9.50 Effects that are identified as being 'moderate' or 'major' adverse / beneficial are classified as significant effects.





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## **BASELINE CONDITIONS**

9.51 The baseline conditions across the Application Site have been determined by environmental noise measurements and subjective observations at the Application Site. The survey of baseline noise conditions at the Application Site was carried out between 19<sup>th</sup> and 24<sup>th</sup> May 2022.

9.52 The primary purpose of the noise survey was to gather acoustic information on the sound levels at the Application Site during daytime and night-time periods. The ambient noise data is used to validate the computer model of noise levels and to identify any façade mitigation requirements for the Proposed Development. The measured background sound levels are used for consideration of fixed plant noise levels.

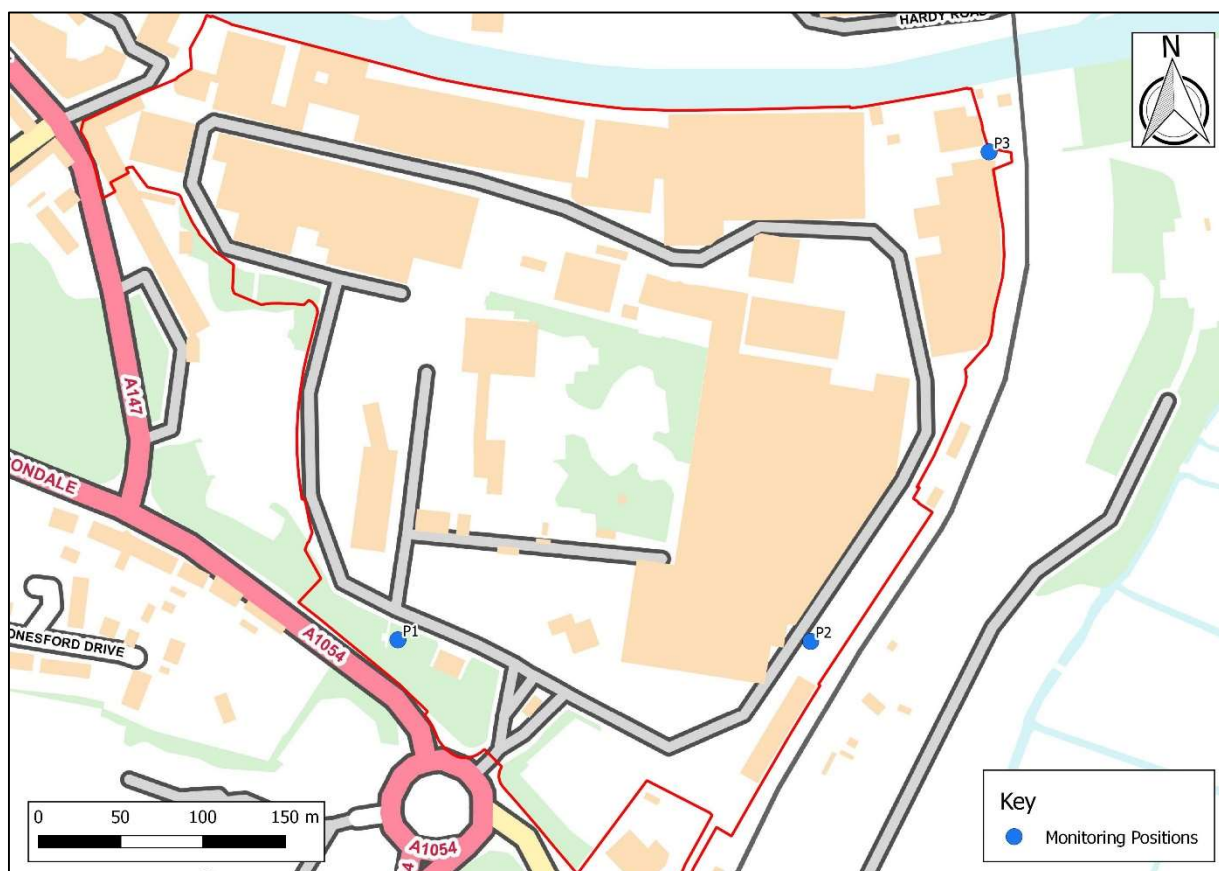
9.53 The main source of noise at the Application Site was noted to be road traffic on the surrounding road network and occasional rail movements on the Great Eastern Main Line. Ambient noise levels at the south east of the site are also influenced by the Tarmac Trowse Asphalt Plant site, which is situated approximately 50m east of the closest site boundary.

9.54 The monitors were situated at positions across the Application Site in order to allow consideration of road and rail movements for validation of the noise model. P1 was situated at the south of the Application Site overlooking the A1054, at approximately 1.8m above local ground level. P2 was situated in close to the asphalt plant site at the south east of the Application Site, at approximately 1.8m above local ground level.

9.55 Source measurements of a railway pass by were obtained at P3 in order to calculate the 16-hour and 8-hour noise levels pertaining to rail movements.

9.56 The microphones were fitted with protective windshields for the measurements. All measurement equipment used during the noise surveys conformed to relevant Type 1 specifications. Weather conditions during the survey period were stable and are not considered to have significantly affected the survey data. The noise measurement locations are shown in Figure 9.1.

**Figure 9.1 Survey Positions**



9.57 A summary of the unattended noise measurements is presented in Table 9.10. The full set of graphical results is shown in Appendix 9.3 and 9.4.

**Table 9.10 Summary of Unattended Noise Levels**

Monitoring Position	Measured Sound Pressure Level, dB re. 2x10 <sup>-5</sup> Pa.					
	Day Time (07:00 - 23:00)			Night-time (23:00 - 07:00)		
	L <sub>Amax,F</sub>	L <sub>Aeq,T</sub>	L <sub>A90,T</sub>	L <sub>Amax,F</sub>	L <sub>Aeq,T</sub>	L <sub>A90,T</sub>
P1	98.0	56.6	50.3	81.3	51.4	40.4
P2	86.2	61.2	47.7	81.7	56.0	38.0

9.58 Background sound levels have been obtained using statistical analysis of the unattended sound levels to identify the most frequently occurring L<sub>A90,15min</sub> values. The adopted background sound levels are presented in Table 9.11, statistical analysis of measurements is presented in Appendix 9.5 and 9.6.



**Table 9.11 Adopted Background Sound Levels**

Monitoring Position	Period	Noise Limit for Fixed Installations of Mechanical Plant, $L_{Ar,Tr}$ (dB)
P1	Daytime	51
	Night-Time	42
P2	Daytime	41
	Night-Time	35

9.59 All noise measurements were undertaken by consultants competent in environmental noise monitoring, and, in accordance with the principles of BS 7445:2003 (Ref 9.10). The broadband noise parameters of  $L_{Aeq,T}$ ,  $L_{A10,T}$ ,  $L_{A90,T}$ , and  $L_{Amax,F}$  were recorded at each location.

9.60 On-site vibration levels were qualitatively assessed during the noise survey and no vibration was observed to be perceptible. It is therefore considered that a vibration survey was not required for the purpose of this assessment.

9.61 Rail noise has been calculated based on source measurements of the railway, undertaken at P3, which have been factored over 16 hours and 8 hours based on the number of rail movements during typical operation. The measured rail pass by and calculated SEL are presented in Table 9.11.

**Table 9.11: Summary of Railway Source Measurement**

Source	Measurement Period	$L_{Aeq,T}$	SEL
Rail	45 Seconds	66.2	82.7

9.62 The railway schedule indicates that 11 trains run past the Application Site during the night-time period, and 118 trains run during the daytime. The calculated daytime and night-time noise levels are presented in Table 9.12.

**Table 9.12: Calculated Railway Noise Levels**

Source	Period	SEL	No Trains.	$L_{Aeq,T}$
Rail	Daytime (07:00 - 23:00)	82.7	118	55.8
	Night-Time (23:00 - 07:00)		11	48.5

## RECEPTORS AND RECEPTOR SENSITIVITY

9.63 The proposed residential receptors are high sensitivity. Receptors identified for the assessment of construction activities are presented in Figure 9.2.

**Figure 9.2 Construction Assessment Receptor Locations**



9.64 The change in road traffic flows due to the Proposed Development is considered for the residential receptors on surrounding road links, which are high sensitivity.

## IDENTIFICATION AND EVALUATION OF POTENTIALLY SIGNIFICANT EFFECTS

### Construction Noise

9.65 The operation of equipment associated with site preparation and construction of the Proposed Development has the potential to result in noise effects at existing noise sensitive receptors in the vicinity.

9.66 The construction noise calculations have been undertaken for the noisiest construction phases to provide assessment levels at the nearest high sensitivity receptors. The highest noise levels are from plant usually associated with earthworks, piling, concreting, road pavement and general construction site activities. Typical facade noise levels have been adopted based on measurements of similar activities and are presented below. These are representative of continuous activity and are considered a worse-case consideration.



- Enabling works - 84 dB(A) at 10m
- CFA Piling - 85 dB(A) at 10m
- Sub Structure - 80 dB(A) at 10m
- Road pavement - 81 dB(A) at 10m
- Super Structure - 85 dB(A) at 10m

9.67 With regard to barrier attenuation effects, acoustic screening would be provided by permanent structures on the intervening land between the proposed construction areas and receptor locations, in addition to the natural screening that may be afforded by the topography of the area. To provide a robust assessment however, the construction noise predictions assume no attenuation from site hoardings at receptor locations.

9.68 Construction noise levels have been predicted at the closest existing representative noise sensitive receptor locations. The calculations have been undertaken for both minimum and typical distances between the construction locations and the identified receptors. The construction noise levels are therefore calculated to provide both a worse case and indicative typical assessment.

9.69 Indicative noise levels have been calculated using the closest separation distances between the Application Site and receptors, as well as a typical distance to a more central position in order to identify the likely worse case temporary effects as well as the likely typical effects. These worse case and typical noise levels have been calculated at the closest façade of each receptor position during each phase of the works. The adopted distances are presented in Table 9.12.

**Table 9.12 Separation Distances Between Construction Activities and Receptors, m**

Receptor	Separation Distance	
	Closest Activity	Typical Distance
R1	75	330
R2	80	330
R3	80	310
R4	100	240
R5	65	215
R6	20	270
R7	60	310
R8	50	225
R9	45	225
R10	100	305

9.70 The calculated noise levels are shown in Table 9.13.



**Table 9.13 Calculated Façade Construction Noise Levels**

Receptor	Façade Noise Level at Nearest Receptors During Likely Phases of Construction, dB(A), $L_{Aeq,16hr}$				
	Enabling Works	Piling	Sub-structure	Roads	Super-structure
<b>Closest Activity</b>					
R1	66	67	<65	<65	67
R2	65	66	<65	<65	66
R3	65	66	<65	<65	66
R4	<65	<65	<65	<65	<65
R5	67	68	<65	<65	68
R6	>75	>75	73	74	>75
R7	67	68	<65	<65	68
R8	69	70	65	66	70
R9	70	71	66	67	71
R10	<65	<65	<65	<65	<65
<b>Typical Distance</b>					
R1	<65	<65	<65	<65	<65
R2	<65	<65	<65	<65	<65
R3	<65	<65	<65	<65	<65
R4	<65	<65	<65	<65	<65
R5	<65	<65	<65	<65	<65
R6	<65	<65	<65	<65	<65
R7	<65	<65	<65	<65	<65
R8	<65	<65	<65	<65	<65
R9	<65	<65	<65	<65	<65
R10	<65	<65	<65	<65	<65

9.71 The resultant noise impacts are shown in Table 9.14.

**Table 9.14 Calculated Construction Noise Impacts**

Receptor	Calculated Noise Impacts During Likely Phases of Construction				
	Enabling Works	Piling	Sub-structure	Roads	Super-structure
<b>Closest Activity</b>					
R1	Low	Low	Negligible	Negligible	Low
R2	Low	Low	Negligible	Negligible	Low
R3	Low	Low	Negligible	Negligible	Low
R4	Negligible	Negligible	Negligible	Negligible	Negligible
R5	Low	Low	Negligible	Negligible	Low
R6	High	High	Medium	Medium	High
R7	Low	Low	Negligible	Negligible	Low
R8	Low	Medium	Low	Low	Medium
R9	Medium	Medium	Low	Low	Medium
R10	Negligible	Negligible	Negligible	Negligible	Negligible
<b>Typical Distance</b>					



R1	Negligible	Negligible	Negligible	Negligible	Negligible
R2	Negligible	Negligible	Negligible	Negligible	Negligible
R3	Negligible	Negligible	Negligible	Negligible	Negligible
R4	Negligible	Negligible	Negligible	Negligible	Negligible
R5	Negligible	Negligible	Negligible	Negligible	Negligible
R6	Negligible	Negligible	Negligible	Negligible	Negligible
R7	Negligible	Negligible	Negligible	Negligible	Negligible
R8	Negligible	Negligible	Negligible	Negligible	Negligible
R9	Negligible	Negligible	Negligible	Negligible	Negligible
R10	Negligible	Negligible	Negligible	Negligible	Negligible

9.72 The resultant effect significance, with consideration to the sensitivity of the nearby receptors, is presented in Table 9.15.

**Table 9.15 Calculated Construction Noise Effects**

Receptor	Calculated Effects Impacts During Likely Phases of Construction				
	Enabling Works	Piling	Sub-structure	Roads	Super-structure
<b>Closest Activity</b>					
R1	Minor	Minor	Negligible	Negligible	Minor
R2	Minor	Minor	Negligible	Negligible	Minor
R3	Minor	Minor	Negligible	Negligible	Minor
R4	Negligible	Negligible	Negligible	Negligible	Negligible
R5	Minor	Minor	Negligible	Negligible	Minor
R6	Negligible	Negligible	Negligible	Negligible	Negligible
R7	Negligible	Negligible	Negligible	Negligible	Negligible
R8	Minor	Moderate	Minor	Minor	Moderate
R9	Moderate	Moderate	Minor	Minor	Moderate
R10	Negligible	Negligible	Negligible	Negligible	Negligible
<b>Typical Distance</b>					
R1	Negligible	Negligible	Negligible	Negligible	Negligible
R2	Negligible	Negligible	Negligible	Negligible	Negligible
R3	Negligible	Negligible	Negligible	Negligible	Negligible
R4	Negligible	Negligible	Negligible	Negligible	Negligible
R5	Negligible	Negligible	Negligible	Negligible	Negligible
R6	Negligible	Negligible	Negligible	Negligible	Negligible
R7	Negligible	Negligible	Negligible	Negligible	Negligible
R8	Negligible	Negligible	Negligible	Negligible	Negligible
R9	Negligible	Negligible	Negligible	Negligible	Negligible
R10	Negligible	Negligible	Negligible	Negligible	Negligible

9.73 Close proximity works are calculated to result in Minor (not significant) effects. During works at typical distances across the Application Site, the effect significance is classed as Negligible (not significant). Whilst the calculated impact is Negligible, it is still prudent to employ



mitigation measures to further minimise the likelihood of adverse impact. Such measures are discussed later in this Chapter.

### Construction Vibration

9.74 The likely worse case vibration effects at the identified separation distances have been calculated based on the methodology provided within BS 5228-2. The calculated effects are presented in Table 9.16.

**Table 9.16 Calculated Construction Vibration Effects**

Receptor	Calculated Vibration Effects During Likely Phases of Construction				
	Enabling Works	Piling	Sub-structure	Roads	Super-structure
<b>Closest Activity</b>					
R1	Negligible	Negligible	Negligible	Negligible	Negligible
R2	Negligible	Negligible	Negligible	Negligible	Negligible
R3	Negligible	Negligible	Negligible	Negligible	Negligible
R4	Negligible	Negligible	Negligible	Negligible	Negligible
R5	Minor	Minor	Minor	Minor	Minor
R6	Negligible	Negligible	Negligible	Negligible	Negligible
R7	Negligible	Negligible	Negligible	Negligible	Negligible
R8	Minor	Minor	Minor	Minor	Minor
R9	Minor	Minor	Minor	Minor	Minor
R10	Negligible	Negligible	Negligible	Negligible	Negligible
<b>Typical Distance</b>					
R1	Negligible	Negligible	Negligible	Negligible	Negligible
R2	Negligible	Negligible	Negligible	Negligible	Negligible
R3	Negligible	Negligible	Negligible	Negligible	Negligible
R4	Negligible	Negligible	Negligible	Negligible	Negligible
R5	Negligible	Negligible	Negligible	Negligible	Negligible
R6	Negligible	Negligible	Negligible	Negligible	Negligible
R7	Negligible	Negligible	Negligible	Negligible	Negligible
R8	Negligible	Negligible	Negligible	Negligible	Negligible
R9	Negligible	Negligible	Negligible	Negligible	Negligible
R10	Negligible	Negligible	Negligible	Negligible	Negligible

9.75 Considering the typical separation distances, nearby receptors are unlikely to be affected during construction works. The likely vibration impact from construction activities is therefore considered to be short term Minor (not significant) to Negligible (not significant).





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## Operational Phase

### Site Suitability – Ambient Noise Climate

9.76 The future suitability of the Application Site for residential accommodation has been confirmed by considering the calculated noise contours and the guidance adopted for this Chapter.

9.77 Noise emission levels affecting the Proposed Development have been calculated using predictive computer noise modelling. The noise modelling software (Cadna-A) uses algorithms based on ISO 9613 'Attenuation of sound during outdoor propagation' to predict noise levels generated at receiver locations by noise sources.

9.78 The noise levels have been predicted across the Application Site. Noise contours have been calculated at 4 m above ground level.

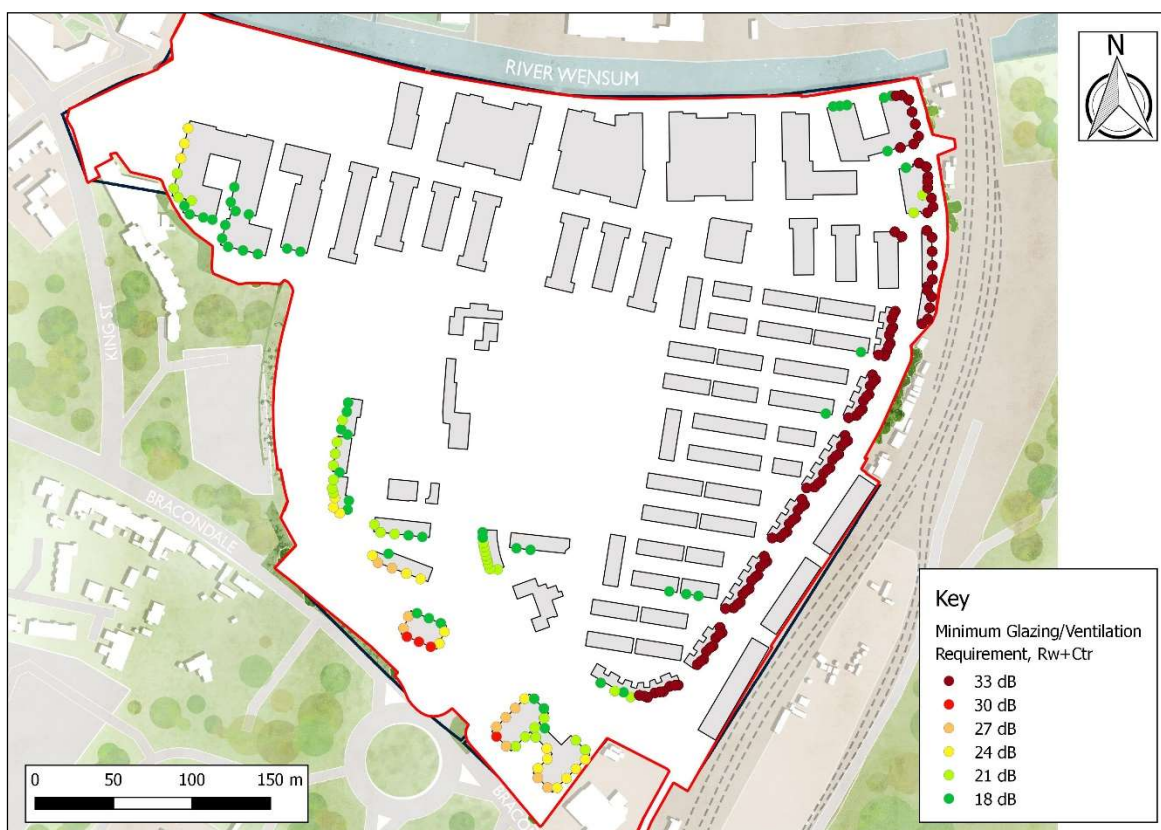
9.79 The primary noise sources affecting the Proposed Development are identified as road traffic on the local and surrounding road network and railway movements on the Great Eastern Main Line. Ambient noise levels to the south east of the site are also influenced by operation of the nearby asphalt plant.

9.80 The baseline scenario for the year 2022 was modelled and verified using the provided traffic data, obtained rail movement data and unattended measurement data as presented within this Chapter. Following verification of the existing scenario, the proposed road traffic flows for the year 2028 have been modelled. The with modelled scenario includes the likely increased traffic due to the Proposed Development. Traffic flows adopted for completion of the computer noise model are presented in Appendix 9.7.

9.81 The future noise levels at the Application Site have been assessed by considering the results of the calculations against the guidance provided in BS 8233 and the WHO Guidelines.

9.82 Calculated daytime and night-time contours across the Proposed Development are presented in Appendix 9.8 and 9.9, respectively. The calculated facade reductions required at facade locations across the Proposed Development are presented in Figure 9.3.

**Figure 9.3 Glazing and Ventilation Requirements**



9.83 The calculated noise contours indicate that ambient noise levels within properties within the majority of proposed residential areas will fall below the BS 8233 guideline value with windows partially open.

9.84 The guideline values will be calculated to be achieved across the entirety of the Proposed Development with closed windows.

9.85 Roof and façade constructions typically achieve an attenuation of at least 55 dB  $R_w$ , with the windows and trickle ventilators being the weakest part of any façade. Suitable glazing and ventilation options at such properties should be incorporated as required to allow windows to remain closed.

9.86 Proposed dwellings are identified as requiring typical insulated double glazing and sufficient attenuated double glazing. No further requirement for façade design is identified.

9.87 Based on the adopted assessment methodology and prior to mitigation, effects up to Moderate significance are identified as likely. It is likely that this would be experienced at



positions overlooking road and rail sources. All other effects are likely to be Minor to Negligible (not significant).

9.88 Typical glazing and ventilation options would achieve the BS 8233 criteria without specific consideration of mitigation options. All effects are considered Negligible (not significant) with the incorporation of appropriate façade glazing and ventilation, provided it does not compromise the façade with regards to noise reduction.

9.89 Daytime ambient noise levels across the majority of the Application Site are calculated to be below 55 dB.

9.90 The calculation undertaken for this assessment does not take into consideration any proposed fencing or further barriers that may be present in the final design. Typical close boarded solid timber fencing would be likely to further reduce noise levels at amenity areas.

9.91 The WHO Guidelines states that indoor noise levels should not exceed approximately 45 dB  $L_{Amax}$  more than 10-15 times a night to ensure there are no negative health effects related to sleep disturbance.

9.92 Considering the façade sound reduction from typical design as used in the BS 8233 assessment and the maximum night time noise levels at both monitoring locations, the WHO criterion is likely to be achieved, provided sufficient glazing and ventilation options are employed.

9.93 The mitigation options identified following consideration of ambient noise levels are likely to be adequate for the control of both ambient  $L_{Aeq,T}$  and night time maximum noise levels.

9.94 To ensure suitable internal noise levels are attained at facades overlooking the railway, the required façade reduction has been specified as 33 dB  $R_w$ , regardless of the calculated noise level. Typical double glazing and insulated double glazing are likely to achieve this value. However, to ensure the likelihood of effects remain low it would be prudent to ensure selected units are specified to achieve this value.

9.95 The  $R_w$  values take account of possible low frequency noise, the sound reduction index of each element will include a correction for the Ctr urban traffic noise spectrum. The ventilation will achieve this value when open, to allow ventilation to the dwelling. Additionally, the glazing and ventilation installation must maintain the integrity of the façade with regard to noise insulation.



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### Fixed Plant Operation

9.96 Any proposed plant and activities will be specified to ensure compliance with the relevant design standards contained within BS 4142.

9.97 The proposed plant has not yet been specified, and detailed data is not yet available. Limits have therefore been identified in order to inform the design of the proposed plant items/activities during the detailed design stage.

9.98 The proposed plant would be specified and sufficiently mitigated as required, such that suitable conditions are maintained at the nearby residential dwellings. In accordance with BS 4142, the Rating level of any plant (inclusive of penalties accounting for acoustic features) should remain below the background sound level during all periods of operation.

9.99 BS 4142 provides assessment periods of:

- Daytime, 07:00 – 23:00; and
- Night-time, 23:00 – 07:00.

9.100 The background sound levels identified for the purpose of the assessment are identified within Table 9.11. Any fixed plant would be specified such that the calculated combined Rating level at the nearest residential receptors does not exceed these limits.

### Changes in Road Traffic Noise – Existing Residential Receptors

9.101 The traffic flow data provided within the Transport Assessment has been used as the basis for the road traffic noise assessment. The 18-hour Annual Average Weekday Total (AAWT) flows were provided for the year 2028 both with and without the Proposed Development.

9.102 Traffic noise predictions have been made using the CRTN prediction methodology. The methodology has been used to predict the magnitude of any change in noise level resulting from the Proposed Development at the roadside of the local network.

9.103 The predicted changes in noise level on existing road links, identified with respect to the road traffic noise impact assessment criteria, are presented in Table 9.17.



**Table 9.17 Change in Noise Level on Local Road Network in, 2028**

Road Link	Calculated BNL, 2028		BNL Change
	Without Dev	With Dev	
A147 King Street	69.9	70.7	0.7
A147 Bracondale	69.7	69.8	0.1
A147 Bracondale	69.9	70.1	0.2
Bracondale	63.5	63.8	0.2
A1054	71.0	71.3	0.2
A146	68.7	69.0	0.2
A146	71.6	71.7	0.0

9.104 Changes in road traffic noise levels are calculated to result in Negligible (not significant) short term and long term impacts at existing noise-sensitive receptors adjacent to the road network.

## MITIGATION AND RESIDUAL EFFECTS

### Construction Mitigation

9.105 To control the impact of noise during construction of the Proposed Development, contractors will ensure that works are carried out in accordance with best practicable means (BPM) as described in BS 5228 comprising of the following:

- Where possible, 'silenced' plant and equipment will be used;
- Where vehicles are standing for a significant period of time, engines will be switched off;
- Acoustic enclosures will be fitted where possible to suppress noisy equipment;
- Plant will operate at low speeds, where possible, and incorporate automatic low speed idling;
- Where possible, electrically driven equipment will be selected in preference to internal combustion powered, hydraulic power in preference to pneumatic and wheeled in lieu of tracked plant;
- All plant will be properly maintained (greased, blown silencers replaced, saws kept sharpened. Teeth set and blades flat, worn bearings replaced etc);
- Consideration will be given to temporary screening or enclosures for static noisy plant to reduce noise emissions and plant should be certified to meet any relevant EC Directives;
- All contractors will be made familiar with the guidance in BS 5228 (Parts 1 & 2) which will form a pre-requisite of their appointment; and



- Early and good public relations with the adjacent tenants and occupants of buildings will also reduce the likelihood of complaints.

9.106 These general measures to control construction noise should be incorporated within the Construction Environmental Management Plan (CEMP) and/or detailed in construction method statements. By adopting the recommended best practicable means, construction noise levels can typically be reduced by 10 dB(A).

### **Residential Dwellings**

9.107 Typical insulated double glazing and attenuated ventilation is likely to suitably reduce noise levels. Suitable glazing and ventilation options will be adopted in conjunction with typical façade in order to achieve the BS 8233 and WHO criteria.

9.108 Any ventilation will allow for sufficient airflow whilst maintaining the integrity of the façade with regard to noise insulation.

9.109 Examples of façade mitigation include acoustic air bricks, trickle ventilation and mechanical ventilation. Passive or mechanical systems allow for sufficient airflow whilst maintaining the integrity of the façade with regard to noise insulation.

9.110 Assessment of the Proposed Development site indicates that ambient  $L_{Aeq,T}$  noise levels in external amenity areas are likely to achieve the BS 8233 upper guidelines with the introduction of the block plan.

9.111 It should be noted that the sound reduction performances detailed above apply to habitable rooms, such as living rooms and bedrooms, only. For non-habitable rooms, such as kitchens, bathrooms, stairways, halls, landings etc, lower acoustic performance glazing configurations maybe considered permissible.

### **Fixed Plant**

9.112 The sound from fixed plant and activities will be specified such that sound levels remain below the limits specified in this chapter.



9.113 Mitigation options will be specified during the detailed design stage, as appropriate. Effects from fixed plant would be negligible following specification and assessment of proposed items.

## **RESIDUAL EFFECTS**

### **Construction Phase**

9.114 Construction noise levels are calculated to remain below the 75 dB  $L_{Aeq,T}$  criterion noise level for the majority of the construction and are calculated to fall below LOAEL.

9.115 Construction noise and vibration effects are likely to be Negligible (not significant) during the majority of activities. Minor short term effects are likely during close proximity works and BPM measures will be adopted to ensure the likelihood of effects is reduced as far as practicable.

### **Operational Phase - Site Suitability**

9.116 Ambient levels within the residential areas are calculated to fall below the BS 8233 and WHO criteria with typical insulated double glazing and attenuated trickle ventilation.

9.117 The residual noise effect is considered to be Negligible following incorporation of suitable mitigation.

### **Fixed Plant**

9.118 Fixed plant items will be specified during the detailed design stage. All plant will be specified such that rating levels at the nearest residential receptors fall below the specified background sound levels.

9.119 Whilst the effect cannot be quantitatively assessed, any proposed plant will be specified such that the resulting effect is Negligible.

### **Operational Phase - Road Traffic Noise**

9.120 The provided data indicates a minimal change on the local road network. The assessment of the change in traffic flows indicates that the Proposed Development will have a Negligible effect (not significant) in the long term on surrounding road links.



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## **CUMULATIVE EFFECTS**

9.121 Nearby developments that may potentially give rise to cumulative effects are identified in ES Chapter 3. Consideration of potential cumulative effects are presented below.

### **Construction**

9.122 The construction activity at each of the future committed development sites has the potential to cause localised noise disturbance around each development site. However, it is not known whether the construction activities from each development will occur at the same time as those on the Application Site.

9.123 Construction activities may give rise to cumulative effects in instances where construction activity takes place in close proximity to an identified receptor at both the Application Site and the following sites:

- Deal Ground
- Land North of Carrow Quay

9.124 Cumulative effects are unlikely between the sites and typical distances for construction is calculated to give rise to Negligible impacts. However, impacts at nearby high sensitivity receptors are calculated to be temporary Minor Adverse in the short term at local residential receptors.

9.125 Minor Adverse short-term effects may therefore be identified as a possible worst case where construction activities pertaining to two separate sites take place in close proximity to a residential receptor.

9.126 There are unlikely to be any cumulative effects from construction noise at other development sites due to the intervening distance between the Application Site and the other development sites.

### **Completed Development**

9.127 The noise and vibration assessment has considered the combined road traffic movements from these future committed developments as part of the predicted future baseline conditions. Accordingly, there are no identified additional cumulative effects.





9.128 With consideration to the calculated residual effects and intervening distance between the Application Site and the other development sites there are no expected significant cumulative effects. The potential cumulative effects from the completed development and identified nearby developments are unlikely to affect those identified within this chapter.

## **SUMMARY**

9.129 This chapter has considered the likely effects of the Proposed Development with respect to noise and vibration. These include the effects of existing conditions on the Application Site and the effects of noise and vibration generated from construction activities pertaining to the Proposed Development on surrounding properties. Limits have been specified for the operational phases. The detailed design of the Proposed Development will ensure that noise emissions from the Application Site would remain below the specified background sound levels.

9.130 The impact of noise and vibration during construction of the Proposed Development has been predicted and assessed in accordance with BS 5228. Generic mitigation measures have been recommended, which when implemented are capable of ensuring that the impact of noise and vibration during the construction of the Proposed Development is adequately controlled.

9.131 Construction noise and vibration effects are likely to be Minor (not significant) in the short term with the majority of activities being Negligible (not significant).

9.132 An assessment has been carried out in accordance with the adopted criteria to determine the suitability of the Application Site for residential accommodation. The assessment has been based on a computer noise model, informed and validated using environmental noise measurements and traffic data provided for the adjacent road links.

9.133 Noise levels at the residential dwellings associated with the Proposed Development are likely to be sufficiently mitigated with the implementation of typical insulated double glazing and attenuated ventilation. The residual noise effect is considered to be Negligible (not significant) with the incorporation of these measures.

9.134 The impact of the increase in road traffic associated with the Proposed Development has been calculated as Negligible (not significant).



**Table 9.18 Noise Summary Table**

Potential Effect	Nature of Effect (Permanent or Temporary)	Significance	Mitigation/ Enhancement Measures	Residual Effects
<b>Construction</b>				
Noise at surrounding receptors	Direct, Temporary Short-Term Local	Minor Temporary to Negligible	Implementation of Best Practicable Means to control noise emissions	Moderate Temporary to Negligible
Vibration at surrounding receptors	Direct, Temporary Short-Term Local	Minor Temporary to Negligible	Implementation of Best Practicable Means to control vibration	Minor Temporary to Negligible
<b>Completed Development</b>				
Ambient noise at proposed residential receptors	Direct, Permanent Long-Term Local	Negligible	Incorporation of typical glazing and attenuated ventilation	Negligible
Noise from fixed plant at surrounding receptors	Direct, Permanent Long-Term Local	Negligible	Appropriate mitigation, to be determined during detailed design	Negligible
Noise from changes in road traffic noise at existing residential receptors	Direct, Permanent Long-Term Local	Negligible	None	Negligible



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## REFERENCES

**Ref 9.1:** British Standard 5228:-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise

**Ref 9.2:** Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 7 – HD 213/11 Noise and Vibration, 2011

**Ref 9.3:** The Department for Transport, 1988, 'Calculation of Road Traffic Noise (CRTN)', The Stationary Office

**Ref 9.4:** British Standard 8233: 2014 Sound Insulation and Noise Reduction for Buildings

**Ref 9.5:** World Health Organisation (WHO): 1999, 'Guidelines for Community Noise', WHO, Geneva

**Ref 9.6:** BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound

**Ref 9.7:** Noise Policy Statement for England, 2010 (NPSE)

**Ref 9.8:** Planning Policy Guidance PPG24 'Planning and Noise'. 1994 The Stationary Office, 1994

**Ref 9.9:** The National Planning Policy Framework, February 2019, The Stationary Office, 2012

**Ref 9.10:** British Standard 7445: 2003: Description and measurement of environmental noise. BSI, 2003



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## 10 BIODIVERSITY AND NATURE CONSERVATION

### INTRODUCTION

10.1 This Chapter assesses the likely significant effects of the construction (including demolition) and operational phases of the Proposed Development in terms of ecology.

10.2 This Chapter describes the legislative and policy framework; the assessment methodology; the baseline conditions at the Application Site and surroundings; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been employed. It should be read in conjunction with the following reports and assessments:

- Preliminary Ecological Appraisal (PEA) Report (Appendix 10.1);

### LEGISLATION AND PLANNING POLICY CONTEXT

#### International

#### The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019

10.3 The Conservation of Habitats and Species Regulations replace The Conservation (Natural Habitats, etc.) Regulations 1994 (as amended), and transpose Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora ('EU Habitats Directive'), and Council Directive 79/409/EEC on the Conservation of Wild Birds ('Birds Directive') into UK law (in conjunction with the Wildlife and Countryside Act).

10.4 Regulations 43 and 47 respectively of the Conservation of Habitats and Species Regulations makes it an offence (subject to exceptions) to deliberately capture, kill, disturb or trade in the animals listed in Schedule 2 (European protected species of animals) or pick, collect, cut, uproot, destroy or trade in the Plants listed in Schedule 5 (European protected species of plant). Development that would contravene the protection afforded to European protected species requires a derogation (in the form of a licence) from the provisions of the Habitats Directive.

10.5 Regulation 63 (1) states: 'A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which – (a) Is likely to have



a significant effect on a European site or a European offshore marine site (either alone or in combination with the other plans or projects); and (b) Is not directly connected with or necessary to the management of that site, must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.'

## **National**

10.6 Current key legislation relating to ecology includes the Wildlife and Countryside Act 1981 (as amended); The Countryside and Rights of Way Act 2000 (CRoW Act), The Natural Environment and Rural Communities Act (2006) and The Environment Act (2021). A description of each of these pieces of legislation are provided below. The specific protection afforded to individual species/group of species e.g. bats and birds under these pieces of legislation is detailed below under the specific species/group of species headings. This approach has been taken as species/group of species can receive protection under more than one piece of legislation.

### Wildlife and Countryside Act 1981 (as amended)

10.7 The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the Birds Directive and EU Habitats Directive are implemented in Great Britain.

### The Countryside and Rights of Way Act 2000

10.8 The Wildlife and Countryside Act has been updated by the CRoW Act. The CRoW Act amends the law relating to nature conservation and protection of wildlife. In relation to threatened species it strengthens the legal protection and adds the word 'reckless' to the offences of damaging, disturbing, or obstructing access to any structure or place a protected species uses for shelter or protection and disturbing any protected species whilst it is occupying a structure or place it uses for shelter or protection.

### The Natural Environment and Rural Communities Act 2006

10.9 The Natural Environment and Rural Communities Act 2006 states that every public authority must, in exercising its functions, have regard, so far as is consistent with the proper



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exercise of those functions, to the purpose of conserving biodiversity. Biodiversity Action Plans provide a framework for prioritising conservation actions for biodiversity.

10.10 Section 41 of the Natural Environment and Rural Communities Act requires the Secretary of State to publish a list of species of flora and fauna and habitats considered to be of principal importance for the purpose of conserving biodiversity. The list, a result of the most comprehensive analysis ever undertaken in the UK, currently contains 1,149 species, including for example hedgehog (*Erinaceus europaeus*), and 65 habitats that were listed as priorities for conservation action under the now defunct UK Biodiversity Action Plan (UK BAP). Despite the devolution of the UK BAP and succession of the UK Post-2010 Biodiversity Framework (and Biodiversity 2020 strategy in England), as a response to the Convention on Biological Diversity's (CBD's) Strategic Plan for Biodiversity 2011-2020 and EU Biodiversity Strategy (EUBS), this list (now referred to as the list of Species and Habitats of Principal Importance in England) will be used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under section 41 of the Natural Environment and Rural Communities Act 2006 'to have regard' to the conservation of biodiversity in England, when carrying out their normal functions.

#### The Environment Act, 2021

10.11 The Environment Act, 2021 will mandate the requirement for new development in England to deliver a minimum 10% biodiversity net gain (BNG), as measured by the agreed metric (the current relevant version being the Natural England metric 3.1), secured through planning condition as standard (as per schedule 14 of the Act). Approach to the delivery of BNG must follow the mitigation hierarchy, with avoidance of impact and on-site compensation/gains prioritised, ahead of the use of offsite biodiversity unit offsets, or the purchase of biodiversity credits.

10.12 The Act introduces the condition that no development may begin unless a biodiversity net gain plan has been submitted and approved by the local planning authority (LPA).

10.13 The Act also amends requirements of the NERC Act, 2006, adding the need to not just conserve, but enhance biodiversity through planning projects. Furthermore, it introduces the need for the LPA to have regard to relevant local nature recovery strategies and relevant species/protected site conservation strategies, when making their decision. Under the Act, the enhancements must be maintained for at least 30 years.



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### Legislation relating to Bats

10.14 All UK bats and their roosts are protected by law. Since the first legislation was introduced in 1981, which gave strong legal protection to all bat species and their roosts in England, Scotland and Wales, additional legislation and amendments have been implemented throughout the UK.

10.15 Six of the 18 British species of bat have Biodiversity Action Plans (BAPs) assigned to them, which highlights the importance of specific habitats to species, details of the threats they face and proposes measures to aid in the reduction of population declines.

10.16 Although habitats that are important for bats are not legally protected, care should be taken when dealing with the modification or development of an area if aspects of it are deemed important to bats such as flight corridors and foraging areas.

10.17 The Wildlife and Countryside Act 1981 (as amended) was the first legislation to provide protection for all bats and their roosts in England, Scotland and Wales (earlier legislation gave protection to horseshoe bats only).

10.18 All eighteen British bat species are listed in Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and under Annex IV of the Habitats Directive, 1992 as a European Protected species. They are therefore fully protected under Section 9 of the 1981 Act and under Regulation 43 of the Conservation of Habitats and Species Regulations 2017 It is an offence to:

- Deliberately capture, injure or kill a bat;
- Intentionally or recklessly disturb a bat in its roost or deliberately disturb a group of bats;
- Damage or destroy a bat roosting place (even if bats are not occupying the roost at the time);
- Possess or advertise/sell/exchange a bat (dead or alive) or any part of a bat; and
- Intentionally or recklessly obstruct access to a bat roost.

10.19 The legislation applies to all bat life stages.

10.20 The implications of the above in relation to the proposals are that where it is necessary during construction to remove trees, buildings or structures in which bats could roost, it must be



determined whether the tree or structure does support a roost and if so that the work is compulsory and whether an appropriate licence must be obtained from Natural England.

#### Legislation relating to nesting birds

10.21 Nesting birds, with certain exceptions, are protected from disturbance under the Wildlife and Countryside Act 1981 (as amended) and the CRoW Act. Any clearance of suitable habitat should therefore be undertaken outside of the nesting bird season, taken to run conservatively from March to August inclusive, unless an ecologist confirms the absence of active nests prior to clearance. Under the legislation it is an offence to:

- Kill, injure or take any wild bird;
- Take, damage or destroy the nest of any wild bird while it is in use or being built; and
- Take or destroy the egg of any wild bird.

10.22 Some birds, known as ‘Schedule 1 birds’, (e.g. peregrine falcon), have extra legal protection. For these bird species it’s also an offence to do the following, either intentionally or by not taking enough care:

- disturb them while they’re nesting, building a nest, in or near a nest that contains their young
- disturb their dependent young

#### Legislation relating to reptiles

10.23 All species of reptile native to the UK are protected to some degree under national and/or international legislation, which provides mechanisms to protect the species, their habitats and sites occupied by the species.

10.24 Sand lizards and smooth snakes are European protected species and are afforded full protection under Section 9 of the Wildlife and Countryside Act 1981 and Regulation 43 of the Conservation of Habitats and Species Regulations 2019. However, these species are rare and highly localised. Their occurrence is not considered as relevant in this instance, as the ranges and specialist habitats of these species do not occur at the Application Site.

10.25 The remaining widespread species of native reptiles (adder, grass snake, slow worm and viviparous lizard) are protected under part of Section 9(1) and all of Section 9(5) of the





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Wildlife and Countryside Act 1981. They are protected against intentional killing and injury and against sale, transporting for sale etc. The habitat of these species is not protected. However, in terms of development, disturbing or destroying reptile habitat during the course of development activities while reptiles are present is likely to lead to an offence under the Wildlife and Countryside Act 1981. It is therefore important to identify the presence of these species within a potential development site. If any of these species are confirmed, all reasonable measures must then be taken to ensure the species are removed to avoid the threat of injury or death associated with development activities.

10.26 Each species of native reptile has specific habitat requirements but general shared features include a structurally diverse habitat that provides for shelter, basking, foraging and hibernating.

10.27 All reptiles are BAP species and as such are also of material consideration in the planning process due to the NPPF.

## **Policy**

### National Planning Policy Framework, 2021

10.28 The National Planning Policy Framework (NPPF) 2021 sets out the Government's planning policies for England, including how plans and decisions are expected to apply a presumption in favour of sustainable development. Chapter 15 of the NPPF focuses on conservation and enhancement of the natural environment, stating plans should 'identify and pursue opportunities for securing measurable net gains for biodiversity'.

10.29 It goes on to state: 'if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused'. Alongside this, it acknowledges that planning should be refused where irreplaceable habitats such as ancient woodland are lost.



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Regional - Norwich development management policies local plan 2014

*Protecting and enhancing the natural environment Policy DM6*

Natural environmental assets

10.30 Development will be expected to take all reasonable opportunities to avoid harm to and protect and enhance the natural environment of Norwich and its setting, including both sites and species, taking particular account of the need to avoid harm to the adjoining Broads Authority area and other identified areas of natural environmental value immediately adjoining the City. Appropriate proposals which deliver significant benefits or enhancements to local biodiversity or geodiversity will be strongly supported and encouraged. Opportunities should be taken to incorporate and integrate biodiversity, green infrastructure and wildlife friendly features in the design of individual schemes.

10.31 Where, in exceptional circumstances, development is accepted which is likely to result in substantial and unavoidable harm to or loss of priority habitats and species populations identified through local biodiversity action plans, developers will be required to provide for the re-creation and recovery of such populations through biodiversity offsetting.

Nationally protected sites of special scientific interest (SSSI)

10.32 Development having a significant adverse impact on SSSIs not subject to an international designation will only be permitted in exceptional circumstances where the benefits of the development clearly and substantially outweigh the impacts that it is likely to have. Such proposals must be accompanied by an environmental statement, showing clearly how the development would mitigate any effects on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs.

Regional and local sites

10.33 Development affecting sites of regional and local importance for nature conservation, biodiversity, geodiversity or geological interest will only be permitted where it would not result in significant and demonstrable harm to the particular interest and value of the site, taking account of:



- The effectiveness of any proposals to mitigate the environmental impact of the development,
- any overriding benefits arising from that development in achieving the wider objectives of the JCS and
- any opportunities for local enhancements to biodiversity, geodiversity or green infrastructure associated with the proposal.

10.34 The sites to which this part of the policy applies include local nature reserves, County Wildlife Sites, County Geodiversity Sites, Roadside Nature Reserves (RNRs), and significant areas of woodland identified on the Policies map which are not covered by the above designations. Where development results in some impact the proposal must be accompanied an assessment of that impact and specify the appropriate mitigating measures that will be undertaken.

## **ASSESSMENT METHODOLOGY**

### **Desktop Study**

10.35 Records were obtained from Norfolk Biodiversity Information Service (NBIS) on details of statutory and non-statutory designated sites of nature conservation importance, and records of protected and other notable species for the site within 2km. In addition, the Multi-Agency Geographic Information for the Countryside (MAGIC) website was used to derive information relating to the location of statutory designated sites and priority habitats within a larger radius. A historical Preliminary Ecological Appraisal (PEA) (The Ecology Consultancy, 2018) was also reviewed.

### **Surveys**

10.36 A PEA was undertaken by Greengage Environmental Ltd in April 2022. The PEA (which included an Extended Ecological Phase 1 Survey) was undertaken in accordance with guidance in the UK Habitat Classification System (UKHab) and the Chartered Institute of Ecological and Environmental Management (CIEEM) (2017) Guidelines for Preliminary Ecological Appraisal, in accordance with BS42020:2013: Biodiversity. The overall assessment consisted of:

- Site specific biological information gained from the desk study; and
- A site walkover, protected species scoping assessment and phase 1 habitat survey.



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## Assessment of Importance of Receptors

10.37 Following the completion of the desktop and site surveys the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment (Ref. 10.1) have been used to establish the importance, or sensitivity, of terrestrial habitats and species impacted by development.

### *Key Terms*

10.38 An impact is defined as 'actions resulting in changes to an ecological feature' with an effect being the 'outcome to an ecological feature from an impact.'

10.39 The ecological feature which is being affected by the impact is termed the receptor. Key ecological receptors are features that have been assessed as being of value within the context of the proposals and the EIA.

### *Criteria for Assessing Importance of Terrestrial Ecology Receptors*

10.40 The approach to ecological evaluation advocated by the CIEEM guidelines involves professional judgement, based on available guidance and information, together with advice from experts who know the locality of the project and / or the distribution and status of the species or features that are being considered. The analysis aims to assign value to an ecological feature with reference to a defined geographical scale, i.e.

- International;
- National;
- Regional;
- Borough;
- Local.

10.41 Sites which are subject to statutory and/or non-statutory designation may be readily assigned a level of importance on this scale, for example:

- Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar Sites are internationally important sites;
- SSSIs are nationally important sites;
- Local Nature Reserves (LNR) are of borough importance; and



- Non-statutory County Wildlife Sites (CWS) are of borough importance.

10.42 Where an area has more than one designation, the highest of these has been used to assign value. Features of a site that are not the reasons for its designation(s) are assessed and valued according to their intrinsic value.

10.43 In assigning importance to on-site habitats and to species, reference to a species' geographical distribution, and its population status (e.g. widespread, common, rare) and trends (e.g. declining, stable) has been made. A species that is rare and declining may be assigned a higher level of importance than one that is rare but known to be stable. Species which have a significant proportion of their European population in the UK may also be highly valued.

### **Methods for Assessing Nature and Significance of Ecological Impacts**

#### *Impact Identification*

10.44 The sensitivity (and recoverability) of receptors to an impact was identified, as far as current knowledge allows, during the EIA process. Generally, this was, by necessity, a qualitative assessment based on published literature and best available scientific information.

#### *Impact Characterisation*

10.45 Impacts were characterised by reference to the following terms and definitions:

- **Positive** (a change that improves the quality of the environment);
- **Negative** (a change which reduces the quality of the environment);
- **Extent** (the spatial or geographical area over which the impact/effect may occur);
- **Magnitude** (size, amount, intensity and volume);
- **Duration** (should be defined in relation to ecological characteristics (such as a species' lifecycle) as well as human timeframes);
- **Timing** (timing of an activity or change may result in an impact if it coincides with critical life-stages or seasons e.g. bird nesting season.);
- **Frequency** (the number of times an activity occurs will influence the resulting effect.); and
- **Reversibility.**



10.46 Consideration was given to the potential for impacts to interact with other impacts (either arising from the Proposed Development or a different (external) source), thus producing a cumulative effect (often of greater magnitude).

#### *Significance*

10.47 For the purpose of EIA, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general.

#### *Residual Impacts*

10.48 During the EIA process the available means to avoid, minimise or mitigate for negative impacts were identified. Then, subject to their acceptability, these means were incorporated in the design of the proposal, so that the final assessment was of identified impacts that would be left. The consequences for development control, policy guidance and legislative compliance were then identified from the predicted residual impacts.

#### *Assessment of Potential Impacts*

10.49 The following table provides definitions for the terms used to describe impacts in each of the sections below covering impacts on terrestrial ecology.

**Table 10.1 – Definition of Terms Used in Assessment of Ecological Impacts**

Severity	Periodicity	Extent
Positive	Temporary	Within the Site Boundary
Negative	Short-term	Local
	Medium-term	Borough
Neutral	Long-term	Regional
	Permanent - no recovery to previous state within lifespan of project	National – national population context
		International– international context

10.50 'Neutral' has been used for severity 'where no discernible improvement or deterioration to the existing environment is anticipated'.



## Assumptions and Limitations

10.51 The PEA has identified potential for a range of protected species, for which further surveys will be required to establish presence or likely absence. Assumptions have therefore been made on potential value of these ecological receptors, based on suitability and size of habitat, and records from the desk study search, however levels of importance are estimates only at this stage and will need to be confirmed by the additional surveys.

10.52 It is recommended that this Ecological Impact Assessment is updated upon completion of the additional surveys.

## BASELINE CONDITIONS

### Nature Conservation Designations

#### Statutory Designated Sites

10.53 Consultations with the local biological record centres (NBIS) and the MAGIC dataset have confirmed that there are no statutory designations of national or international importance within the boundary of the Application Site.

10.54 There is however one Ramsar & Special Protection Area (SPA), and two Special Areas of Conservation (SAC) within a 6km radius of Application Site. There are also three Local Nature Reserves (LNR) within a 2km radius.

10.55 Records from NBIS also identified eight non-statutory County Wildlife Sites (CWS) within 2km of the site boundary.

10.56 Table 10.2 below gives the locations and descriptions of the statutory designations.

**Table 10.2 – Table 10.2 Statutory Designated Sites within Search Radius**

Site Name	Approximate Location	Description
Broadland (Ramsar & SPA) (Overlapping SSSI designation)	5.8km east	Broadland is a low-lying wetland complex straddling the boundaries between east Norfolk and northern Suffolk. The area includes the river valley systems of the Bure, Yare and Waveney and their major



Site Name	Approximate Location	Description
		<p>tributaries. The open distinctive landscape comprises a complex and interlinked mosaic of wetland habitats including open water, reedbeds, carr woodland, grazing marsh and fen meadow. The region is important for recreation, tourism, agriculture and wildlife. The Ramsar's designated features include wintering Bewick's swan, floodplain alder woodland, floodplain fen, wintering gadwall, shoveler and wigeon, wetland invertebrate assemblage and wetland plant assemblage. SPA designated features include bewick's swan, bittern, gadwall, hen harrier, marsh harrier, ruff, shoveler, whooper swan and wigeon.</p>
<p>River Wensum (SAC) (Overlapping SSSI designation)</p>	<p>4.9km north-west</p>	<p>The Wensum is a naturally enriched, calcareous lowland river. The upper reaches are fed by springs that rise from the chalk and by run-off from calcareous soils rich in plant nutrients. This gives rise to beds of submerged and emergent vegetation characteristic of a chalk stream. Lower down, the chalk is overlain with boulder clay and river gravels, resulting in aquatic plant communities more typical of a slow-flowing river on mixed substrate. Much of the adjacent land is managed for hay crops and by grazing, and the resulting mosaic of meadow and marsh habitats, provides niches for a wide variety of specialised plants and animals. Buttercup vegetation occurs throughout much of the river's length. Stream water-crowfoot (<i>Ranunculus aquatilis</i>) is the dominant buttercup species but thread-leaved water-crowfoot (<i>R. trichophyllus</i>) and fan-leaved water-crowfoot (<i>R. circinatus</i>) also occur in association with the wide range of aquatic and emergent species that contribute to this vegetation type. The river supports an abundant and rich invertebrate fauna including the native freshwater</p>





Site Name	Approximate Location	Description
		<p>white-clawed crayfish as well as a diverse fish community, including bullhead and brook lamprey. The site has an abundant and diverse mollusc fauna which includes Desmoulin's whorl-snail, which is associated with aquatic vegetation at the river edge and adjacent fens.</p>
<p>The Broads (SAC) (Overlapping SSSI designation)</p>	<p>5.8km east</p>	<p>The Broads in East Anglia contain several examples of naturally nutrient-rich lakes. Although artificial, having been created by peat digging in medieval times, these lakes and the ditches in areas of fen and drained marshlands support relict vegetation of the original Fenland flora, and collectively this site contains one of the richest assemblages of rare and local aquatic species in the UK. The stonewort (<i>Nitellopsis obtusa</i>) – pondweed (<i>Potamogeton sp.</i>)– water-milfoil (<i>Myriophyllum sp.</i>) – water-lily (<i>Nymphaeaceae</i>) associations are well-represented, as are club-rush (<i>Ficinia nodosa</i>) – common reed (<i>Phragmites australis</i>) associations. The dyke (ditch) systems support vegetation characterised by water-soldier (<i>Stratiotes sp.</i>), whorled water-milfoil (<i>Myriophyllum verticillatum</i>) and broad-leaved pondweed (<i>Potamogeton natans</i>) as well as being a stronghold of little whirlpool ram's-horn snail and Desmoulin's whorl snail in East Anglia. The range of wetlands and associated habitats also provides suitable conditions for otters. The Broads is the richest area for stoneworts in Britain. The core of this interest is the Thurne Broads and particularly Hickling Broad, a large shallow brackish lake. Within the Broads examples of Chara vegetation are also found within fen pools (turf ponds) and fen and marsh ditch systems. The complex of sites contains the largest blocks of alder wood in England.</p>



Site Name	Approximate Location	Description
		<p>Within the complex complete successional sequences occur from open water through reedswamp to alder woodland, which has developed on fen peat. There is a correspondingly wide range of flora, including uncommon species such as marsh fern. This site contains the largest example of calcareous fens in the UK. The great fen-sedge habitat occurs in a diverse set of conditions that maintain its species richness, including small sedge mires, and areas where great fen-sedge (<i>Cladium mariscus</i>) occurs at the limits of its ecological range. The habitat type forms large-scale mosaics with other fen types, fen meadows (with purple moor-grass), open water and woodland, and contains important associated plants such as fen orchid (<i>Liparis loeselii</i>), marsh helleborine (<i>Epipactis palustris</i>), lesser tussock-sedge (<i>Carex diandra</i>), slender sedge (<i>C. lasiocarpa</i>) and fibrous tussock-sedge (<i>C. appropinquata</i>). There are also areas of short sedge fen (both black bog-rush (<i>Schoenus nigricans</i>)– blunt-flowered rush (<i>Juncus subnodulosus</i>) mire and bottle sedge (<i>C. laevigata</i>) – moss mire), which in places form a mosaic with common reed – milk-parsley (<i>Peucedanum palustre</i>) fen. The Broads also contain examples of transition mire, that are relatively small, having developed in re-vegetated peat-cuttings as part of the complex habitat mosaic of fen, carr and open water.</p>



Site Name	Approximate Location	Description
Whitlingham (LNR)	0.4km east	Whitlingham covers an area of 15.48 hectares. The reed beds present on site form the bulk of the reserve. Chinese Water Deer are sometimes visible within the reed beds. Dragonflies are common.
Lion Wood (LNR)	1.0km north	Lion Wood covers an area of 8.87 hectares. It consists mainly of Oak-Sycamore woodland with some very large trees. About a third of the wood is thought to be ancient. Sweet chestnut, beech, hornbeam, wild cherry, silver birch and holly. Plant species present include bluebells ( <i>Hyacinthoides non-scripta</i> ). A range of woodland birds are present including jay, blackcap, greater-spotted and green woodpeckers and sparrowhawk.
Mousehold Heath (LNR)	1.7km north	Mousehold Heath covers an area of 73.99 hectares. It is a remnant of a once more extensive heathland. The site has a mixture of oak/birch woodland, scrub, acid grassland, remnant heath and a large seasonal pond. Bell heather ( <i>Erica cinerea</i> ), ling ( <i>Molva molva</i> ), broom ( <i>Cytisus scoparius</i> ) and common gorse ( <i>Ulex europaeus</i> ), western gorse ( <i>U. gallii</i> ) and dwarf gorse ( <i>U. minor</i> ) are present within the heathland. The site has a good variety of insect life and common lizards. Wooded areas have a variety of birds including greater-spotted woodpecker, sparrowhawk and song thrush.

10.57 The 8 CWS within 2km are:

- Carrow Abbey Marsh (0.2km east)
- Trowse Meadows (0.3km south-east)
- County Hall Woods (0.3km south-west)
- Trowse Wood (0.5km south-east)
- Carey's Meadow (0.9km north-east)
- Lion Wood, Telegraph Plant'n & Rosary Cemetery (1.1km north)
- Pinebanks (1.6km north-east)



- Mousehold Heath & Valley Drive (1.6km north)

10.58 The appended PEA provides further detail in these CWSs.

### **On-site habitats**

10.59 The habitats presented across the assessment site consist of the following UKHab categories, as mapped at Figure A.1:

- Buildings;
- Developed Land Sealed surface in the form of hardstanding;
- Unsealed surface;
- Introduced shrub;
- Sub-urban mosaic of developed/natural surface;
- Built linear features;
- Ruderal/ephemeral;
- Modified grassland in the form of amenity grassland and improved grassland;
- Other woodland; broadleaved;
- Line of trees;
- Other woodland; mixed;
- Other hedgerows; and
- Scattered trees.

10.60 The majority of the habitats above are limited in terms of ecological value, comprising common and widespread urban habitats. Where habitats offer potential to support protected and notable species, these are discussed separately in the sections below, with an appropriate valuation in terms of the species concerned. Of note within the on-site habitats are areas of woodland, which meet the definition of BAP priority woodland habitat, and are mapped as such on MAGIC. No ancient woodland is present on the Application Site or within 1km.

10.61 The woodland and grassland habitats on-site are considered to be of **local** importance, with the remaining habitats being of **negligible** importance.



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## Species and Species Groups

### Bats

10.62 Bat species recorded in the desk study comprised western barbastelle (*Barbastella barbastellus*), serotine (*Eptesicus serotinus*), whiskered/brandt's (*Myotis mystacinus/brandtii*), daubenton's (*M. daubentonii*), natterer's (*M. nattereri*), lesser noctule (*Nyctalus leisleri*), noctule (*N. noctula*), common pipistrelle (*Pipistrellus pipistrellus*), Nathusius's pipistrelle (*P. nathusii*), soprano pipistrelle (*P. pygmaeus*) and brown long-eared (*Plecotus auritus*).

### Foraging Bats

10.63 The majority of the Application Site comprises building/hardstanding which has negligible potential to support foraging bats. The woodland, improved grassland, tall ruderal habitat, scattered trees and introduced shrub is likely to provides habitat for invertebrates which in turn provides a food source for foraging bats. The Application Site is connected to other areas of greenspace through off-site linear features such as the River Wensum which abuts the northern boundary (although value is limited by the built-up nature of the river at this point) and the railway along the eastern boundary.

10.64 Further activity surveys have been recommended for bats to determine the Application Site's level of use – the results of these surveys will confirm the Application Site's level of importance for foraging and roosting bats, but given the size, nature and location of the suitable habitat, connectivity to the wider landscape, and the species recorded in the desk study, the Application Site is considered to be up to **borough** level in terms of importance for foraging and commuting bats.

### Roosting bats

10.65 Ten buildings have been assessed as having bat roosting potential ranging from low suitability to high, with a further two buildings having confirmed presence, indicated by low / single numbers of bat droppings recorded in the 2018 and 2022 surveys. Five buildings were identified as offering potential to support hibernating bats. Trees with roosting potential are also present.

10.66 Further tree roost assessment and emergence / return surveys have been recommended for the above buildings to determine presence / likely absence of roosting bats,



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and assess the importance of the roosts. The results of these surveys will confirm the Application Site's level of importance for roosting bats, but given the number of buildings with potential, availability of foraging habitat, and the species recorded in the desk study, the Application Site is considered to be up to **regional** level importance for roosting bats.

### Reptiles

10.67 Suitable reptile habitat is present on the Application Site in the form of areas of improved grassland, therefore further reptile surveys have been recommended to determine reptile presence / likely absence. The desk study returned six reptile records, comprising grass snake (*Natrix helvetica*) and common lizard (*Zootoca vivipara*). To be confirmed on completion of the further surveys, given the limited extent of suitable habitat and limited local reptile records, the site is likely to be of up to **local** importance for reptiles.

### Birds

10.68 There is suitable nesting habitat for passerine bird species associated with the trees and dilapidated buildings on the Application Site. Evidence of hirundine (swallow family) nesting was observed on B8, pigeons were recorded nesting in several of the buildings including B9, B10 and B14 and a gull was recorded nesting on B13.

10.69 There was anecdotal evidence of peregrine falcons (*Falco peregrinus*) foraging on the Application Site with some tall structures that would be suitable heights for nesting. Further survey has been recommended for peregrine falcon. Dependent on the results of the further surveys, the Application Site offers up to **regional** level importance for birds.

### Other BAP mammals (hedgehog and polecat)

10.70 A single record of polecat (*Mustela putorius*) was returned from within the Application Site in the desk study, and further survey has been recommended for the species. The PEA identified areas of suitable habitat for West European hedgehog (*Erinaceus europaeus*). To be confirmed on completion of the polecat monitoring, the Application Site is likely to be up to **borough** level importance for other BAP priority mammal species (if polecat is recorded).



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### Other species

10.71 Based on the PEA and desk study findings, the Application Site is considered to be of **negligible** importance for other species.

## **IDENTIFICATION AND EVALUATION OF KEY EFFECTS**

### **During Construction**

#### Statutory Designated Sites

10.72 The international designated sites are of sufficient distance away that the majority of potential construction impacts will be negligible. However, the Application Site is adjacent to the River Wensum which is hydrologically linked to the international sites, therefore any run-off or pollution incidents during construction could, in the absence of mitigation, cause **significant, temporary, negative** impacts on an **international** scale.

10.73 Of the LNRs, only the Whitlingham LNR is within sufficient proximity to be affected by potential construction impacts, and is again linked to the site by the adjacent river. Any run-off or pollution incidents during construction could, in the absence of mitigation, cause **significant, temporary, negative** impacts on a **regional** scale.

#### Non-statutory Designated Sites

10.74 Of the CWSs, Carrow Abbey Marsh (0.2km east), Trowse Meadows (0.3km south-east), and County Hall Woods (0.3km south-west) are close enough to be potentially affected by construction impacts, including dust, pollution and run-off. In the absence of mitigation, this could cause **significant, temporary, negative** impacts on a **borough** scale.

#### On-site Habitats

10.75 Key on-site habitats, including the grassland areas and BAP priority woodland habitat, are to be retained and enhanced, with the aim of providing net gains for biodiversity. This will be evidenced by a Biodiversity Net Gain calculation using the Natural England 3.1 Metric methodology. Therefore, the proposals stand to cause a **significant, permanent, positive** impact on a **local** scale.



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10.76 However, on-site habitats could, in the absence of mitigation, be subject to construction impacts in the form of accidental damage to woodland and grassland habitats, dust, pollution and run-off. In the absence of mitigation, this could cause **significant, temporary, negative** impacts on a **local** scale.

#### Species and Species Groups

##### Foraging and Commuting Bats

10.77 The majority of suitable habitat is to be retained. However, construction activities could cause potential impacts to foraging and commuting bats through light and noise disturbance. In the absence of mitigation, this could cause **significant, temporary, negative** impacts on a **borough** scale.

##### Roosting Bats

10.78 Demolition or alterations to buildings could result in the loss of bat roosts and direct mortality of bats (to be determined by further survey). Trees are predominantly to be retained, however tree removal could result in the loss of tree roosts (to be determined by further survey). In the absence of mitigation, this could cause **significant, permanent, negative** impacts on a **regional** scale.

##### Reptiles

10.79 Although the majority of suitable habitat is to be retained, construction activities could result in small-scale loss of reptile habitat and reptile mortality. In the absence of mitigation, this could cause **significant, permanent, negative** impacts on a **local** scale.

##### Birds

10.80 Demolition and construction activities could cause the destruction of active nests and potential loss of nesting sites for peregrine falcon (to be determined by further survey). In the absence of mitigation, this could cause **significant, permanent, negative** impacts on a **regional** scale.





Other BAP mammals (hedgehog and polecat)

10.81 Although the majority of suitable habitat is to be retained, construction activities could result in accidental habitat damage or direct mortality of these species. In the absence of mitigation, this could cause **significant, temporary, negative** impacts on a **borough** scale.

### **During Operation**

#### Statutory Designated Sites

10.82 The Application Site is within the River Wensum and Broads designated sites catchment areas. The operational phase will lead to a net increase in dwellings, which will result in potential increased nutrient pressure on the internationally designated sites caused by additional wastewater from the development. In the absence of mitigation, this could cause **significant, permanent, negative** impacts on an **international** scale.

10.83 An increase in dwellings also has the potential to create additional recreational impacts on the internationally designated sites. In the absence of mitigation, this could cause **significant, permanent, negative** impacts on an **international** scale.

10.84 LNRs, in comparison to the international sites, are considered to be less sensitive to recreational pressure, and those with public access are managed with recreation in mind. Furthermore, green and recreational spaces form a fundamental element of the proposals. Therefore, impacts on the LNRs during the operational phase of the proposed development are considered to be **Neutral**.

#### Non-statutory Designated Sites

10.85 As above, the CWSs are considered to be less sensitive to recreational pressure, and those with public access are managed with recreation in mind. Furthermore, green and recreational spaces form a fundamental element of the proposals. No direct impacts are predicted. Therefore, impacts on the CWSs during the operational phase of the proposed development are considered to be **neutral**.



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### On-site Habitats

10.86 No further impacts on on-site habitats are predicted in the operational phase, therefore impacts are considered to be **neutral**.

### Species and Species Groups

#### Foraging and Commuting Bats

10.87 Key foraging and commuting habitats are to be retained, however the development proposals are likely to include lighting on-site and in the absence of mitigation, could lead to an increased level of external lighting. In the absence of mitigation, this could cause **significant, temporary, permanent, negative** impacts on a **borough** scale.

#### Roosting Bats

10.88 Any impacts on roosting bats would be anticipated at the construction phase – no further impacts would result from operation.

#### Reptiles

10.89 The majority of impacts on reptiles would be anticipated at the construction phase. However, operational phase impacts could occur through poor management of retained habitats, leading to **significant, temporary, negative** impacts on a **local** scale.

#### Birds

10.90 The introduction of additional pets to the Application Site once operational could result in increased predation on nesting birds, from domestic cats in particular. The study by Woods et al (2003) (Ref. 10.2) found that birds comprised nearly 25 % of all prey items returned. However, the RSPB (Ref. 10.3) note that 'Despite the large numbers of birds killed by cats in gardens, there is no clear scientific evidence that such mortality is causing bird populations to decline. Many millions of birds die naturally every year, mainly through starvation, disease or other forms of predation. There is evidence that cats tend to take weak or sickly birds.'

10.91 Assessing the effect of cat predation on prey populations is complex, and difficult to determine with any certainty. Given this uncertainty, and based on the evidence available, it is



considered that increased predation by cats during the operational phase of the Proposed Development may have some limited influence on the distribution of local bird populations. Cat predation is not considered likely to affect peregrine falcons (should they be present), therefore the potential effects of cat predation would be **permanent, non-significant and negative**, at the **local** level.

Other BAP mammals (hedgehog and polecat)

10.92 Any impacts would be anticipated at the construction phase – no further impacts would result from operation.

## **MITIGATION AND ENHANCEMENT**

### **During Construction**

10.93 The mitigation measures discussed in the following section will be incorporated into a Construction Environment Management Plan (CEMP) produced for the scheme.

#### Designated Sites

10.94 To protect the designated sites and on-site habitats, the CEMP will include the following:

- Pollution and run-off control measures, paying particular consideration to the adjacent river, noting the potential connectivity to designated sites;
- Dust control measures;
- Noise and light control measures;
- Materials storage and waste management.

#### On-site Habitats

10.95 The CEMP will also include habitat protection measures such as Heras fencing, informed by the arboricultural survey where appropriate, to ensure protection of retained habitats during construction.

10.96 Landscaping designs will include numerous proposals to enhance the biodiversity value of the site, including retention and enhancement of trees, woodland and other habitats.



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## Species and Species Groups

### Foraging and Commuting Bats

10.97 Full mitigation for foraging and commuting bats will be informed by the proposed bat activity surveys, and will be formalised within the CEMP, but will include as a minimum:

- Lighting controls: limiting construction works to daylight hours only wherever possible. Where lighting is required, this will be directional, pointing away from sensitive areas such as retained woodlands, and controlled by sensors and timers.
- Protection of woodland habitat through the measures defined in the associated arboricultural report.

### Roosting Bats

10.98 In order to determine the mitigation required for roosting bats, further emergence/return and hibernation surveys are required. Full mitigation cannot be determined until completion of these surveys, however mitigation will include:

- Provision of bat boxes in nearby trees and/or specially placed poles prior to commencement of any demolition works;
- Supervised soft strip of the building(s) prior to full demolition and/or timing of works to avoid the time when bats are in site; and
- Provision of bat boxes and any other roosting spaces deemed appropriate by the results of the surveys, integrated within the fabric of the new buildings.

10.99 Roosting bat mitigation will be secured by carrying out the works under an appropriate licence from Natural England.

### Reptiles

10.100 Proposed reptile surveys will determine the need or not for reptile mitigation. Should reptiles be encountered, mitigation will likely include:

- Retention of key reptile habitat on-site;



- Should low numbers be recorded, use of phased habitat manipulation or a trapping and translocation effort to move reptiles, either to retained on-site habitats or a dedicated off-site receptor.

## Birds

10.101 The clearance/demolition of the vegetation and buildings with nesting bird potential/confirmed nesting activity will be undertaken outside of bird nesting season (taken to run from March to August inclusive) or after a suitably qualified ecologist has confirmed absence. Any nests recorded by the ecologist would be protected until they are no longer active. Alternative nesting opportunities will be created through installation of bird boxes and planting of suitable habitat.

10.102 Should peregrine falcon nesting sites be recorded, nesting sites will be retained, or alternatives be provided.

10.103 Further mitigation and enhancement will be introduced in the form of integrating a variety of bird boxes into the new buildings, targeting a range of species. Through incorporation of additional nesting features, the site will be enhanced in terms of its value to nesting birds.

## Other BAP mammals (hedgehog and polecat)

10.104 The above-mentioned habitat protection measures within the CEMP will also serve to protect other BAP mammals, further informed by the proposed polecat survey.

## **During Operation**

### Designated Sites

10.105 At this stage it is known that there are various options available for the mitigation of the nutrient load impacts, however, currently no specific mitigation measure has been opted for.

10.106 The detailed aspect of this application does not include any new buildings, therefore it is proposed that nutrient neutrality is considered and conditioned at the reserved matters application stage, where the new housing developments will be brought forward for assessment.

10.107 To mitigate for potential recreational impacts, financial contributions are likely to be required in line with the Norfolk Green Infrastructure and Recreational Impact Avoidance and



Mitigation (GIRAM) Strategy. Pursuant to the GIRAM Strategy, the Norfolk LPAs have identified the nature of visitor pressures and put together an interim action plan of mitigation measures, to be funded by a county-wide tariff, calculated on the number of new dwellings (yet to be finalised).

#### On-site habitats

10.108 To secure the long-term viability of the landscape enhancements, an Ecological Management Plan (EMP) will be produced, which will include:

- Required management actions ranging from general maintenance to more specific requirements for specialist enhancements such as green roofs;
- Details of timing of required management actions;
- Detail of any required monitoring requirements; and
- Allocation of management and maintenance responsibility.

#### Species and Species Groups

##### Foraging and Commuting Bats

10.109 Any required mitigation measures will be confirmed following further bat activity surveys. High level recommendations at this stage include the provision of compensatory wildlife friendly landscaping utilising native plant species to attract invertebrate prey and the design of lighting in line with guidance provided by the Institute of Lighting Professionals (ILP) and Bat Conservation Trust (BCT) (Ref. 10.4), specifically:

- Avoidance of metal halide and fluorescent light sources;
- Warmth' of luminaires. Any external areas should incorporate light at a <2700K where possible, with peak wavelengths higher than 550nm;
- Use of screens/hoods to make any external lighting as directional as possible, avoiding light spill on any natural features;
- Height of lighting column. Where possible, external lights should be as low to the ground as possible; and
- Lighting controls. Appropriate controls to minimise the duration lights are illuminated should be instated.
- Light levels over the woodland, river Wensum and railway line should remain the same as current light levels or be reduced where possible.



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10.110 By providing compensatory and enhanced foraging habitat through landscaping proposals, and minimising the impacts of external lighting, impacts upon foraging and commuting bats can be effectively mitigated, and enhancements can be delivered.

#### Reptiles

10.111 To ensure the long-term viability of retained reptile habitat (if required, to be determined by reptile surveys), the EMP will include details of appropriate habitat management to provide areas of taller grassland, and scrub. Log piles and hibernacula will be installed and maintained, through inclusion in the EMP.

#### Birds

10.112 Although the negative effects of cat predation are considered non-significant, the enhancements proposed for birds through the installation of a variety of bird boxes throughout the development will also serve to further offset this non-significant effect, through effective placement of boxes beyond the reach of any domestic cats. Box positions and numbers will be detailed within the EMP.

### **RESIDUAL EFFECTS**

#### **During Construction**

##### Designated Sites

10.113 The effective implementation of the CEMP to manage construction impacts will result in **neutral** residual effects on designated sites.

##### On-site Habitats

10.114 The effective implementation of the CEMP to manage construction impacts will mitigate any possible negative impacts, and the proposed landscape enhancements will result in **significant, permanent, positive** effects on a **local** scale.



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## Species and Species Groups

### Foraging and Commuting Bats

10.115 Mitigation will need to be confirmed by the proposed activity surveys, however through implementation of the proposed lighting controls and other measures within the CEMP, **neutral** residual effects on foraging and commuting bats are predicted.

### Roosting Bats

10.116 Mitigation for roosting bats is proposed, which may require updating following completion of the recommended bat surveys, however final mitigation will require approval from Natural England through the licencing procedure. Natural England will not approve mitigation that does not ensure favourable conservation status of the bats recorded, therefore a minimum of **neutral** residual effects on roosting bats is predicted.

### Reptiles

10.117 Although exact details may require confirmation on completion of the reptile surveys, effective mitigation is considered possible to achieve, therefore **neutral** residual effects are predicted.

### Birds

10.118 Following the implementation of the mitigation relating to the timing of clearance works and ecological supervision where required, in addition to mitigation informed by the proposed peregrine falcon survey, the residual impact on birds on the Application Site would be considered neutral during the construction phase of the Proposed Development.

10.119 However incorporation of the proposed enhancements through provision of additional nesting opportunities will result in **significant, permanent, positive** effects on a **local** scale.

### Other BAP mammals (hedgehog and polecat)

10.120 Following the implementation of the CEMP, the residual impact on other BAP mammals is considered **neutral** during the construction phase of the Proposed Development.





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## During Operation

### International Designated Sites

10.121 It is proposed that mitigation around nutrient neutrality is finalised at the reserved matters application stage. This will require consultation with the LPA and Natural England, and it is anticipated that the proposals will only be approved at that stage if nutrient neutrality is demonstrated. Therefore, it is anticipated that any final approved scheme will require a **neutral** residual effect in terms of nutrient neutrality and the internationally designated sites.

10.122 Mitigation of potential recreational effects, through contributions to the GIRAM strategy, are considered to result in likely **neutral** residual effects.

### On-site habitats

10.123 Delivery of proposed landscape biodiversity enhancements, and management through the EMP, stand to result in **significant, permanent, positive residual** effects on a **local** scale.

### Species and Species Groups

#### Foraging and Commuting Bats

10.124 To be confirmed by bat activity surveys, residual effects from operation on foraging and commuting bats, after lighting mitigation and proposed habitat enhancements, stand to result in **significant, permanent, positive residual** effects on a **local** scale.

#### Reptiles

10.125 To be confirmed by further reptile surveys, the residual effects after implementation of habitat management prescriptions in the EMP, are anticipated to be **neutral**.

#### Birds

10.126 Residual operational effects on birds, after installation of the proposed enhancements, are considered **neutral**.



## SUMMARY TABLE

10.127 Table 10.3 below provides a summary of the above assessment.

**Table 10.3 – Summary Table**

Ecological Receptor	Potential Impact	Mitigation and enhancements	Residual Effect
<b>During Construction</b>			
International Designated Sites (Broadland Ramsar and SPA, River Wensum SAC and The Broads SAC)	Pollution and run-off impacts through connectivity via adjacent river	Construction best practice to be secured through a CEMP, including pollution and run-off controls, noise and light control measures, habitat protection measures such as Heras fencing, materials storage and waste management.	Neutral
Whitlingham LNR	Pollution and run-off impacts through connectivity via adjacent river	Construction best practice to be secured through a CEMP, including pollution and run-off controls, noise and light control measures, habitat protection measures such as Heras fencing, materials storage and waste management.	Neutral
Carrow Abbey Marsh CWS, Trowse Meadows CWS, and County Hall Woods CWS	Dust, pollution and run-off impacts	Construction best practice to be secured through a CEMP, including pollution and run-off controls, noise and light control measures, habitat protection measures such as Heras fencing, materials storage and waste management.	Neutral
On-site habitats	Dust, pollution and run-off impacts	Construction best practice to be secured through a CEMP, including pollution and run-off controls, noise and light control measures, habitat protection	Significant, permanent, positive residual effects on a local scale.



Ecological Receptor	Potential Impact	Mitigation and enhancements	Residual Effect
		<p>measures such as Heras fencing, materials storage and waste management.</p> <p>Implementation of landscape enhancements to provide net gains in biodiversity.</p>	
Foraging and Commuting Bats*	Light and noise disturbance*	Lighting controls included within the CEMP, and protection of woodland habitat through the measures defined in the associated arboricultural report.*	Neutral*
Roosting bats*	Loss of bat roosts and direct mortality of bats*	<p>Provision of bat boxes in nearby trees and/or specially placed poles prior to commencement of any demolition works,</p> <p>Supervised soft strip of the building(s) prior to full demolition and/or timing of works to avoid the time when bats are in site;</p> <p>and Provision of bat boxes and any other roosting spaces deemed appropriate by the results of the surveys, integrated within the fabric of the new buildings.</p> <p>Roosting bat mitigation will be secured by carrying out the works under an appropriate licence from Natural England.*</p>	Neutral*
Reptiles*	Small-scale loss of reptile habitat and reptile mortality*	<p>Retention of key reptile habitat on site;</p> <p>Should low numbers be recorded, use of phased habitat manipulation or a trapping and translocation effort to move</p>	Neutral*



Ecological Receptor	Potential Impact	Mitigation and enhancements	Residual Effect
		reptiles, either to retained on-site habitats or a dedicated off-site receptor.*	
Birds*	Destruction of active nests and potential loss of nesting sites for peregrine falcon.*	Clearance/demolition of vegetation and buildings will be undertaken outside of bird nesting season or after a suitably qualified ecologist has confirmed absence. Any nests recorded by the ecologist would be protected until they are no longer active. Alternative nesting opportunities will be created through installation of bird boxes and planting of suitable habitat. Should peregrine falcon nesting sites be recorded, nesting sites will be retained, or alternatives be provided, under licence from Natural England if necessary.*	Significant, permanent, positive residual effects on a local scale.*
Other BAP mammals (hedgehog and polecat)*	Accidental habitat damage or direct mortality of these species*	Habitat protection measures within the CEMP, further informed by the polecat survey.*	Neutral*
<b>During Operation</b>			
International Designated Sites (Broadland Ramsar and SPA, River Wensum SAC)	Increased nutrient load from increased number of dwellings, and increased recreational impacts.	At this stage it is known that there are various options available for the mitigation of the nutrient load impacts, however, currently no specific mitigation measure has been opted for.	Neutral**



Ecological Receptor	Potential Impact	Mitigation and enhancements	Residual Effect
and The Broads SAC)		<p>The detailed aspect of this application does not include any new buildings, therefore it is proposed that nutrient neutrality is considered and conditioned at the reserved matters application stage, where the new housing developments will be brought forward for assessment.</p> <p>To mitigate for potential recreational impacts, financial contributions are likely to be required in line with the Norfolk Green Infrastructure and Recreational Impact Avoidance and Mitigation (GIRAM) Strategy. Pursuant to the GIRAM Strategy, the Norfolk LPAs have identified the nature of visitor pressures and put together an interim action plan of mitigation measures, to be funded by a county-wide tariff, calculated on the number of new dwellings (yet to be finalised).</p>	
On-site habitats	Retention and enhancement of on-site habitats aiming for net gains in biodiversity.	Mitigation not required, but long term viability of enhancements to be secured through an EMP.	Significant, permanent, positive residual effects on a local scale.
Foraging and commuting bats*	Disturbance through increased lighting.*	Lighting controls in line with BCT and ILP guidance. Provision of compensatory and enhanced foraging habitat.*	Significant, permanent, positive residual



Ecological Receptor	Potential Impact	Mitigation and enhancements	Residual Effect
			effects on a local scale.*
Reptiles*	Habitat loss through poor management.*	Appropriate habitat management prescriptions within the EMP.	Neutral*
Birds	Potential cat predation (non-significant impact)	Inclusion of the proposed bird enhancements (integrated bird boxes) within the EMP	Neutral

\* Level of importance, impacts, mitigation and residual effects are predicted only at this stage, in the absence of further species-specific surveys. Final assessment will need to be undertaken after the surveys to confirm or modify the above.

\*\* Residual impacts relating to nutrient neutrality will require further assessment once the final strategy has been confirmed.

## **CUMULATIVE IMPACTS**

### During Construction

10.128 The residual effects of the construction phase of the Proposed Development on all the ecological receptors are neutral to permanent positive at a local scale (subject to confirmation following further survey). Any surrounding schemes considered under the cumulative assessment will also have to provide suitable mitigation for any impact on designated sites, loss of habitat and protected species impacts, as part of their submission in order to comply with relevant legislation and planning policy with regards to biodiversity and nature conservation. As such, no negative cumulative effects are predicted.

### During Operation

10.129 The impact of the operational phase of the Proposed Development on all the ecological receptors is neutral to permanent positive at a local level (subject to confirmation following further survey and agreement of nutrient neutrality mitigation). Any surrounding schemes



considered under the cumulative assessment will also have to provide suitable mitigation for any impact on designated sites, loss of habitat and protected species impacts, as part of their submission in order to comply with relevant legislation and planning policy with regards to biodiversity and nature conservation. As such, no cumulative negative effects are predicted.

## **INTER-RELATIONSHIP EFFECTS**

10.130 There are no significant inter-relationships with other topics identified.

## **CONCLUSION**

10.131 The assessment concludes that all potential impacts on on-site and off-site ecological receptors can be effectively mitigated, with neutral or local-level positive residual effects. In the absence of species-specific survey data and a final nutrient neutrality mitigation strategy, some assumptions have been made, however assessments of importance and impacts can be reasonably predicted through assessment of on-site habitats and existing biological records data. However final valuations and impact predictions cannot be made until the surveys are complete, at which point this report should be revised, updated and amended where necessary, to ensure that neutral or positive residual effects remain.

## **REFERENCES**

**Ref 10.1:** CIEEM (2018, updated 2022) Guidelines for Ecological Impact Assessment in the UK and Ireland

**Ref 10.2:** Woods, M., R. A. McDonald, and S. Harris. 2003. Predation of wildlife by domestic cats *Felis catus* in Great Britain. *Mamm. Rev.* 33:174–188.

**Ref 10.3:** How Many Birds do Cats Kill. Available at: <https://www.rspb.org.uk/birds-and-wildlife/advice/gardening-for-wildlife/animal-deterrents/cats-and-garden-birds/are-cats-causing-bird-declines/>

**Ref 10.4:** BCT and ILP (2018) Bats and artificial lighting in the UK. Bats and the Built Environment Series. Bat Conservation Trust and Institution of Lighting Professionals.



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## 11 WATER QUALITY, HYDROLOGY AND FLOOD RISK

### INTRODUCTION

11.1 This Chapter assesses the likely significant effects of the Proposed Development on the environment with regard to water quality, hydrology and flood risk. It describes the methods used to assess the effects; the baseline conditions currently existing at the Application Site and the surrounding area; the mitigation measures required to prevent, reduce or offset any significant negative effects; and the likely residual effects after these measures have been adopted. This Chapter assesses the impact of the construction and operational phases of the Proposed Development on surface and groundwater quality. It also considers the impacts with regards to the risk of flooding, drainage and infrastructure capacity.

### ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

#### Baseline Data

11.2 The study area is generally defined as the area within a 2 km radius of the Application Site, although a number of issues are considered at a greater distance or at the river catchment level, where necessary. The assessment of effects encompasses surface water and groundwater quality, surface water and groundwater resources (in terms of water quantity), drainage and flood risk.

11.3 The assessment has been undertaken in accordance with the National Planning Practice Guidance (PPG) (Ref. 11.1) and has involved review of the following sources of baseline data:

- review of Phase 1 Desk Study report by Leap Environmental July 2018 (refer to Chapter 12 - Soils, Geology and Contaminated Land) providing information on surface water and groundwater discharged and abstractions, river quality, baseline hydrology, groundwater vulnerability and pollution incidents;
- review of Phase 2 Site Investigation Report by Leap Environmental September 2018 (refer to Chapter 12 - Soils, Geology and Contaminated Land)
- review of Environment Agency (EA) data records on groundwater Source Protection Zones (SPZs), chemical and biological river quality, ecological status, groundwater quantity and quality and the location of indicative floodplain;





- review of the planning policy framework to identify specific plans and policies relating to the protection of the aquatic environment;
- review of the Norfolk County Council (NCC) Strategic Flood Risk Assessment (SFRA) and accompanying reports; and
- review of the accompanying FRA and Drainage Strategy relating to the Proposed Development (refer to Appendix 11.1 & 11.2).

11.4 The assessment methodology has been entirely desk-based. Recent data on local river quality has been acquired from the EA, therefore, water sampling was not considered necessary.

### Assessment and Evaluation of Effects

11.5 The assessment of effects has involved the following general approach:

- the sensitivity or importance of aquatic receptors has been established on the basis of their use, proximity to the Application Site, existing quality or resource value and consideration of potential pollutant pathways (refer to Table 11.1);
- evaluation of the magnitude of the potential changes in water quantity and quality and assessment of the sensitivity of the aquatic environment to the predicted changes (refer to Table 11.2);
- the potential effects have been given a significance of Negligible or Minor, Moderate or Major Adverse or Beneficial based on the matrix in Table 11.3; and
- where any predicted effects are Minor, Moderate or Major Adverse, these are considered significant and, therefore, mitigation measures have been incorporated to eliminate or reduce the effects to an acceptable level. The residual effects (post-mitigation) are discussed in the final subsection of this chapter.

**Table 11.1: Definition of Receptor Sensitivity**

Receptor Sensitivity	Receptor Type	Sensitivity Details
High	Surface Water	<ul style="list-style-type: none"><li>• WFD catchment classification of 'High' or 'Good'</li><li>• No pathway constraints to this receptor</li></ul>



Receptor Sensitivity	Receptor Type	Sensitivity Details
	Groundwater	<ul style="list-style-type: none"> <li>Principal Aquifer</li> <li>Groundwater Source Protection Zone (SPZ) Zone I</li> </ul>
	Flood Risk and Drainage	<ul style="list-style-type: none"> <li>Flood Zone 3a or 3b (high flood risk)</li> <li>Critical drainage or flood storage areas</li> </ul>
	Water Resources and Infrastructure	<ul style="list-style-type: none"> <li>Area of major known water stress/foul sewerage capacity issues</li> </ul>
Medium	Surface Water	<ul style="list-style-type: none"> <li>WFD catchment classification of 'Moderate'</li> </ul>
	Groundwater	<ul style="list-style-type: none"> <li>Secondary A or B Aquifer</li> <li>Groundwater SPZs Zone II or III</li> <li>Areas of potential historic contamination</li> </ul>
	Flood Risk and Drainage	<ul style="list-style-type: none"> <li>Flood Zone 2 (medium flood risk)</li> <li>Problem (but not critical) drainage area</li> </ul>
	Water Resources and Infrastructure	<ul style="list-style-type: none"> <li>Area of known water stress/foul sewerage capacity issues</li> </ul>
Low	Surface Water	<ul style="list-style-type: none"> <li>WFD catchment classification of 'Poor' or 'Bad'</li> </ul>
	Groundwater	<ul style="list-style-type: none"> <li>Unproductive Strata, i.e. Non-Aquifer</li> <li>Not located on groundwater SPZ</li> </ul>
	Flood Risk and Drainage	<ul style="list-style-type: none"> <li>Flood Zone 1 (low flood risk)</li> <li>No known drainage or flooding problems</li> </ul>
	Water Resources and Infrastructure	<ul style="list-style-type: none"> <li>Area of no known water stress/foul sewerage capacity issues</li> </ul>

**Table 11.2: Methodology for Assessing Magnitude**

Magnitude of Effect	Criteria for Assessing Effect
Major	Total loss or major/substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post-development character/composition/attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post-development character/composition/attributes of the baseline will be materially changed.



Magnitude of Effect	Criteria for Assessing Effect
Minor	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

**Table 11.3: Effect-Significance Matrix**

Magnitude	Sensitivity*		
	High	Medium	Low
Major	Major	Moderate to Major	Minor to Moderate
Moderate	Moderate to Major	Minor to Moderate	Minor
Minor	Minor to Moderate	Minor	Negligible to Minor
Negligible	Negligible	Negligible	Negligible

11.6 In EIA terms, those effects that are not classified as negligible are considered to be significant. Any effect that is classified as negligible is considered to have no effect on the receptor and therefore is not significant.

### **Limitations and Assumptions**

11.7 The residential element of the Proposed Development is assumed to have an operational lifetime of 100 years, with commercial elements assumed to have an operational lifetime of 60 years. The assessment of construction phase effects is based on the indicative construction methodology and phasing for the Proposed Development.

11.8 The assessment of operational phase effects is based on the maximum parameters of the detailed elements of the Proposed Development as described in Chapter 5 (The Proposed Development).

### **LEGISLATION, PLANNING POLICY AND GUIDANCE**

11.9 The following subsection provides a summary of relevant planning policy at a National, Regional and Local level as well as key environmental legislation. These planning policies and



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legislation form the basis of planning decision-making in relation to water quality, hydrology and flood risk.

### **National Planning Policy**

#### National Planning Policy Framework (NPPF) 2021

11.10 The NPPF (Ref. 11.2) sets out the Government's planning policies for England and how these are expected to be applied. The principles of policy relevant to water resources and flood risk are provided in Section 14 'Meeting the challenge of climate change, flooding and coastal change' and Section 15 'Conserving and enhancing the natural environment' and, combined with the associated Planning Practice Guidance (PPG), form the current policy at the national level.

### **Norwich Local Planning Policy**

11.11 The Norwich Local Plan (Ref. 11.3) was formally adopted in November 2014 and is due to be replaced shortly. The Local Plan sets out a vision for the area and, from this, a number of objectives have been identified. Strategic and non-strategic policies, including development allocation policies, have been designed in order to achieve the objectives and the following policies are considered relevant to this technical chapter and the Proposed Development:

- DM1 – Sustainable development principals for Norwich
- DM6 – Protecting and enhancing the natural environment
- DM8 – Planning effectively for open spaces and recreation
- DM9 – Safeguarding Norwich's heritage
- DM11 – Protecting against environmental hazards
- DM12 – Ensuring well-planned housing developments

### **Legislative Context**

11.12 A summary of key relevant UK water legislation is provided below:

- Environmental Protection Act (1990) (Ref. 11.4): sets out a range of provisions for environmental protection, including integrated pollution control for dangerous substances;



- Water Resources Act (1991) (Ref. 11.5): consolidated previous water legislation with regard to both the quality and quantity of water resources;
- Environment Act (1995) (Ref. 11.6): established a new body (the Environment Agency (EA) with responsibility for environmental protection and enforcement of legislation. This Act introduced measures to enhance protection of the environment including further powers for the prevention of water pollution;
- Water Industry Act (1999) (Ref. 11.7): consolidated previous legislation relating to water supply and the provision of sewerage services;
- Anti-Pollution Works Regulations (1999) (Ref. 11.8): provides powers to the EA to stop any activity (e.g. construction) that is giving or is likely to give rise to environmental pollution or to adequately enforce pollution control measures;
- Control of Pollution (Oil Storage) (England) Regulations (2001) (Ref. 11.9): Imposes general requirements for preventing pollution of controlled waters from oil storage, particularly fixed tanks or mobile bowsers. Makes contravention a criminal offence;
- Water Act (2003) (Ref. 11.10): extends the provisions of the Water Resources Act (1991) and the Environment Act (1995) with regard to abstractions and discharges, water conservation and pollution control;
- Water Environment (Water Framework Directive) (WFD) (England and Wales) Regulations (2003) (Ref. 11.11): requires the development and implementation of a new strategic framework for the management of the water environment and establishes a common approach to protecting and settling environmental objectives for groundwater and surface waters; and
- Flood and Water Management Act (2010) (Ref. 11.12): makes provisions about the management of risks in connection with flooding and coastal erosion.

## **BASELINE CONDITIONS**

### **Surface Water Quality**

#### Hydrological Features

11.13 From a review of EA and Ordnance Survey mapping, the closest 'main river' is the Wensum River that borders the Application Site to the North. The River Yare is located approximately 500m to the East of the Application Site. There are no other 'main rivers' or open-channel ordinary watercourses that have been identified within a 2 km radius of the Application Site.



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### Water Quality

11.14 Since the introduction of the WFD, the EA assigns a classification for water bodies on the basis of their 'ecological status', which encompasses chemical, biological and ecological assessment parameters. For catchment purposes, the Application Site lies within the 'Wensum DS Norwich Water Body' which was classified as having a 'Moderate' ecological status in 2022 with the objective of 'Good' by 2027.

### Designations, Abstractions and Discharges

11.15 According to the EA, the Application Site lies within a Nitrate Vulnerable Zone (NVZ). The Application Site does not lie within a surface water safeguard zone for drinking water, but does lie within a Drinking Water Protected Area.

### Pollution Incidents

11.16 The Phase 1 Desk Study by Leap Environmental identifies one recorded national pollution incident within 500 m of the Application Site. This incident occurred in October 2002 approximately 184 m east of the Application Site and involved heavy metal pollution. The incident was classified as Category 4 (no impact) on hydrology.

### Sensitivity

11.17 In accordance with Table 11.1, the hydrology of the Application Site is considered to be of **Medium Sensitivity**.

## **Hydrogeology and Groundwater Quality**

### Groundwater Quality

11.18 As reported on the British Geological Survey (BGS) online Geology of Britain Viewer, the majority of the Application Site is underlain by the superficial geology of River Terrace Deposits comprising sand and gravel. Areas in the north-western part of the Application Site are underlain by superficial deposits of Alluvium. The bedrock across the Application Site comprises of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation



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11.19 According to Defra, the Chalk Formations are classified as a Primary Aquifer. Primary Aquifers are defined 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.”*

11.20 The superficial geology is classified as Secondary A Aquifer by the EA. Secondary A Aquifers are *“aquifers comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers”*

#### Designations, Abstractions and Discharges

11.21 The Application Site does not lie within a groundwater safeguard zone for drinking water, however does sit within a Nitrate Vulnerability Zone.

11.22 Groundwater Source Protection Zones (SPZs) are provided by the EA which *“show the risk of contamination from any activities that might cause pollution in the area”*. EA data identifies that the Application Site is located within a Total Catchment (Zone 1) groundwater SPZ.

11.23 According to the Phase 1 Desk Study, there are 148 water abstraction points in the vicinity of the Application Site, 7 within 250m and 12 between 250m & 500m. The Application Site was previously part owned by Britvic, the on-site water abstractions are to be retired.

#### Pollution Incidents

11.24 The Phase 1 Desk Study report identifies incidents of Pollution to Controlled Waters. It identifies 3 on site, 26 within 250m and 15 between 250m & 500m. There have been zero on-site since May 1993 and none off site within 500m since 1997.

11.25 The Application Site has a long historic use in manufacturing, with production on-site beginning in 1865.

11.26 A Phase 1 Desk Study was undertaken by Leap Environmental at the Application Site (refer to Chapter 12 – Soils, Geology and Contaminated Land).

11.27 The Phase 1 investigation identified *“Known PCE contamination present onsite and likely other contaminants present due to industrial history”*.



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### Sensitivity

11.28 The Application Site is located on a Principal Aquifer and is within an SPZ Zone 1; therefore, the hydrogeology is considered to be of **High Sensitivity**.

### **Flood Risk and Drainage**

#### Flood Risk

11.29 The EA's flood map for planning shows that the Application Site lies largely within Flood Zone 1 (low risk). A small area of the Application Site to the Northeast is located in Flood Zone 2 (medium risk) and Flood Zone 3 (high risk), these areas are proposed to be raised as part of the Proposed Development. It is therefore concluded that the Application Site would remain in Flood Zone 1 for its operational lifetime (assumed to be 100 years).

11.30 According to the EA's surface water flood map, there is a very low risk of surface flooding to the majority of the Application Site, defined by the EA as having an annual chance of flooding of less than 0.1%. An area near the north eastern boundary has a medium risk of surface water flooding. The medium surface water flood risk extents are comparably limited and are not considered to pose a significant risk to the Application Site.

11.31 A review of the NCC Strategic Flood Risk Assessment (SFRA; JBA, 2018) has identified that the Application Site is potentially at risk from groundwater flooding (<75%). The Leap Environmental Phase 2 Investigation Report recorded groundwater between 0.5mbgl and 4.2mbgl.

11.32 According to the FRA (refer to Appendix 11.1), the risk of flooding from reservoirs is considered to be low.

#### Existing Drainage

11.33 The Application Site is a brownfield site comprising industrial and manufacturing uses and rail infrastructure. Currently, any surface water runoff generated within the Application Site is dealt with via the existing drainage infrastructure associated with the Application Site which discharges to the River Wensum at an unrestricted rate.





11.34 A reduction to greenfield runoff rates for the 100 year return period was agreed with the LLFA in a pre-application meeting. The proposed surface water drainage strategy has been designed to accommodate the 1 in 100 year rainfall event including a 40% allowance for climate change.

#### Sensitivity

11.35 The Application Site is located mostly within Flood Zone 1 (low risk) and the Application Site is potentially at risk from surface water. Areas of Flood Zone 2&3 are to be raised as part of the Proposed Development with compensation being provided in the Deal Ground site. There is an elevated risk of groundwater flooding, however the Proposed Development proposes no basements. There are no other significant sources of flooding within the Application Site or surrounding area according to the SFRA or EA maps.

11.36 The Application Site itself has no known drainage problems and due to its location in Flood Zone 1 is considered to be of **Low Sensitivity**.

### **IDENTIFICATION AND EVALUATION OF KEY EFFECTS**

11.37 There are three potentially significant effects on water quality and hydrology during the construction phase of the Proposed Development, these are as follows:

- potential remobilisation of contamination that may already be present at the Application Site;
- potential contamination from general construction related activities; and
- potential interruption of groundwater flows, giving rise to an elevated risk of groundwater flooding and/or effects on baseflow to local water bodies.

11.38 For the purpose of this assessment, the potential effects identified during the construction phase are considered to be temporary in nature and of relevance at the local level only.

#### Potential Remobilisation of Contamination that may already be Present at the Application Site

11.39 As established within the baseline section of this chapter, the Application Site has a number of potentially contaminative historical land uses. The Phase 2 Investigation report concluded that:



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*“Fairly limited exceedances have been recorded for metals (arsenic, cadmium, copper, lead and zinc), PAHs (naphthalene, phenanthrene and BaP), heavier fraction aromatic petroleum hydrocarbons and asbestos in made ground. No exceedances of any determinants were recorded in any natural soil sample.*

*As there are currently no redevelopment plans available it is not possible to make an assessment of any remedial actions which may be required at this stage. However, should impacted made ground soils not be removed as part of the construction / redevelopment process then clean cover systems would likely be required in private gardens and areas of soft landscaping.*

*An assessment of the risk posed by land gas will need to be undertaken once development proposals have been produced. The results of this study indicate that the risk of vapour intrusion into buildings (outside of the known PCE plume area) is low.”*

11.40 Construction works would disturb the ground at the Application Site which could cause the remobilisation of any existing contaminants present in the shallow soils. The main construction works that could disturb the underlying strata are localised site levelling, excavations for foundations, services and construction of drainage routes and associated features.

11.41 Therefore, the effect magnitude of remobilising contamination during construction is considered to be Minor. Prior to mitigation, the effect significance of the remobilising of contaminants arising during construction-related activities is considered to be **Minor to Moderate Adverse** for groundwater and **Minor Adverse** for surface water.

#### Potential Contamination from General Construction Related Activities

11.42 The operation of construction vehicles and general construction activities could give rise to the potential for groundwater to become contaminated with hydrocarbons, silt and other construction materials. This may in turn lead to a contamination event should the Application Site drainage be allowed to enter the River Wensum or the ground untreated.

11.43 The Proposed Development will be constructed in a number of phases. Referring to Table 11.2, the effect magnitude of contamination arising from general construction activities is considered to be Minor. Prior to mitigation, the effect significance of contamination arising from



general construction activities is considered to be **Minor to Moderate Adverse** for groundwater and **Minor Adverse** for surface water.

#### Potential Interruption of Groundwater Flows

11.44 Records from the Geotechnical Reports and the Phase 1 Environmental Assessment report undertaken by Leap Environmental indicate that groundwater depths lie between 0.5mbgl and 4.2mbgl.

11.45 The foundation strategy for the proposed buildings is not known as these fall in the outline planning application, however there is likely to be the use of piled foundations adjacent to the River Wensum.

11.46 However, there is already a dense concentration of buildings on the Application Site. Whilst the foundations for the existing buildings are not known, the use of piles is not anticipated to have a significant effect on groundwater flood risk. The impact on groundwater interruption is therefore considered to be **Negligible** and no mitigation is considered necessary.

#### **Operational Phase**

11.47 There are four potential significant effects on water quality and hydrology during operational phase of the Proposed Development;

- the control of surface water runoff taking climate change predictions into account;
- potential contamination of local surface waters and/or groundwater from the routine site drainage or accidental spills;
- water demand and the effect on the availability of local water resources; and
- foul drainage and the effect on local surface waters and/or groundwaters.

11.48 For the purpose of this assessment, the potential effects identified during the operational phase are considered to be long-term in nature (i.e. for the duration of the operational phase of the Proposed Development) and of relevance at a local level, unless stated otherwise.

#### Control of Surface Water Runoff



11.49 As indicated within the FRA (refer to Appendix 11.1), the risk of surface water flooding within the Application Site ranges from very low to medium, therefore the drainage strategy is required to reduce the risk of surface water flooding. The Application Site is currently brownfield and therefore the surface water runoff rates from the Application Site are required to be improved. The existing drainage strategy discharges to the River Wensum via a number of lateral drains at an unrestricted rate. The Proposed Development would result in a similar percentage of hardstanding compared to the former use and therefore runoff rates (prior to mitigation) would be largely unchanged. The proposals include a reduction in the discharge rate to the 1 in 100 year greenfield rate and discharge to the tidal River Wensum.

11.50 The effect magnitude of the control of surface water runoff taking climate change into account during the operational phase is considered to be Negligible prior to mitigation and the effect significance is **Negligible**.

#### Contamination of Surface Water and/or Groundwater from the Routine Site Drainage

11.51 The proposed drainage strategy could have the potential to contaminate surface water and/or groundwater from a number of sources. The majority of the Application Site will be utilised for residential development and, as such, the typical range of potential contaminants will be limited to hydrocarbons and vehicle-related oils and lubricants, as well as small quantities of general household chemicals. Employment areas, commercial areas, significant road infrastructure and other associated development have a wider range of potential contaminants which would also likely be stored and transported in higher volumes.

11.52 The effect magnitude is considered to be Minor. Prior to mitigation, the risk of contamination from the routine site drainage is considered to be **Moderate Adverse** for surface water and **Minor Adverse** for groundwater.

#### Foul Drainage Demand

11.53 The foul drainage demand is expected to significantly increase as a result of the Proposed Development. Anglian Water have not confirmed that the foul sewerage system does not have the capacity to accommodate the needs of the Proposed Development.

11.54 Appropriate mitigation will need to be implemented by Anglian Water should a capacity concern exist. This will be confirmed following planning approval.



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11.55 The effect magnitude of increased foul drainage demand from the Proposed Development is therefore considered to be Moderate. Prior to mitigation, the effect significance is considered to be **Minor to Moderate Adverse**.

### **ASSESSMENT OF CUMULATIVE EFFECTS**

11.56 All committed major developments in the area surrounding the Proposed Development will have to satisfy the requirements for the control of surface runoff within the NPPF PPG, i.e. discharge at the current greenfield runoff rate or the provision of a betterment in runoff rates post-development. Therefore, the cumulative effect of other local developments should result in a net positive effect through reducing overall flood risk in the area.

11.57 In terms of water quality, new or committed developments will also have to incorporate appropriate pollution control measures to protect the underlying groundwater and/or local surface waters through planning conditions enforced by the Local Authority and/or discharge consents enforced by the EA.

11.58 The cumulative effects of new development on water resources and foul drainage provision are managed at the regional level by the appropriate water companies in consultation with statutory bodies such as the Local Planning Authorities and the EA. The cumulative effect of increases in mains water and foul drainage demand have to be offset by sustainable design and water efficiency measures and infrastructure contributions for sewage treatment works, where necessary. These measures should collectively ensure that the cumulative effects on regional water resources and treatment performance are controlled to an acceptable level.

### **INTER-RELATIONSHIP EFFECTS**

11.59 There are inter-relationships identified between this topic and Chapter 12: Soils, Geology and Contaminated Land. The effects of potential soil contamination have the potential to cause significant surface water and groundwater effects, this has been considered in the assessment presented.

11.60 An inter-relationship has also been identified between flood risk and climate change with regard to future flood extents and predicted impacts of increased rainfall intensity on sustainable drainage design. This has been considered within the assessment and within the Flood Risk and Drainage Strategy.



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## ENHANCEMENT, MITIGATION AND RESIDUAL EFFECTS

11.61 The following subsections set out the mitigation measures that would be implemented to eliminate potential environmental effects and reduce these to an acceptable level.

### Construction Phase

#### Potential Remobilisation of Contamination that may already be Present at the Application Site

11.62 It is recommended that further assessment is undertaken at the Application Site to provide coverage of previously un-investigated areas. This further investigation can be completed at the detailed design stage.

11.63 Should this further contamination assessment identify that contaminated soils are present elsewhere on the Application Site, it is recommended that a remediation/removal strategy is prepared and agreed with the Council before construction works begin to ensure that garden and public open space areas have suitably clean subsoil/topsoil. This will ensure that any significant pollution linkages are eliminated or minimised to an acceptable level with appropriate remediation and control measures in place.

11.64 With these mitigation measures in place, it is considered that the residual effect would be **Negligible**.

#### Potential Contamination from General Construction Related Activities

11.65 Construction vehicles will be properly maintained to reduce the risk of hydrocarbon contamination and will only be active when required. Construction materials will be stored, handled and managed with regard to the sensitivity of the local aquatic environment and thus the risk of accidental spillage or release will be minimised.

11.66 The construction drainage system will be designed and managed to comply with BS6031:2009 'The British Standard Code of Practice for Earthworks' (Ref 11.13) which details methods that should be considered for the general control of drainage on construction sites. Further advice is contained within the British Standard Code of Practice for Foundations (BS8004: 2015) (Ref. 11.14)

11.67 These mitigation measures will need to be incorporated into a Construction Environmental Management Plan (CEMP), which sets out measures for the control of the



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Application Site drainage, reducing the risk of accidental spillages and the storage and handling of materials.

11.68 With these mitigation measures in place, it is considered that the residual effects would be **Negligible**.

## **Operational Phase**

### Control of Surface Water Runoff

11.69 The drainage strategy (Appendix 11.2) proposes to control surface water runoff via a range of SuDS features, reducing site discharge to the 1 in 100 year greenfield rate for all events up to and including the 1 in 100 year +40% CC.

11.70 The strategy involves discharging runoff from the Proposed Development into a range of SuDS features such as attenuation tanks, permeable paving, bio-retention areas, tree pits and other surface level attenuation features. The Application Site has been divided into sub-catchment areas and where the rate of discharge is managed on a catchment-by-catchment basis. There are a number of outfalls to the River Wensum. To ensure contaminants are not discharged, SuDS and Interceptors are proposed to protect the River. The strategy ensures that all designs are for the 1 in 100-year flood event with a 40% allowance for climate change.

11.71 The implementation of the drainage strategy for the Application Site would ensure that the surface water runoff rates would be reduced significantly compared to the existing rates, for the operational lifetime of the Proposed Development. It will also ensure that any discharge from the Application Site has met the requirements of the SuDS Manuals (Ref. 11.15) Simple Index Approach to pollution.

11.72 With these mitigation measures in place, it is considered that the residual effects would be **Minor Beneficial**.

### Contamination of Surface Water and/or Groundwater from the Routine Application Site Drainage

11.73 The proposed drainage strategy is included within the FRA (Appendix 11.1) and will ensure that all runoff from the Application Site will receive an appropriate level of treatment in accordance with the SuDS Manual.



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11.74 Table 26.2 of the SuDS Manual sets out pollution hazard indices for different land use classifications including residential roofs, commercial roofs, commercial areas and sites with heavy pollution. For each land use, a pollution hazard index is outlined for Total Suspended Solids (TSS), metals and hydrocarbons. Mitigation indices are given to SuDS components for discharges to surface water and groundwater, which in total should exceed the pollution hazard indices.

11.75 The use of the SuDS techniques for pollution control will ensure that the surface water discharge from the Proposed Development will be of a sufficient quality in accordance with latest guidance.

11.76 With these mitigation measures in place, it is considered that the residual effect would be **Negligible**.

#### Foul Drainage Demand

11.77 Consultation with Anglian Water will confirm if the foul sewerage system has the capacity to accommodate the needs of the Proposed Development. Appropriate mitigation will need to be implemented by Anglian Water should the capacity not exist. This will be confirmed following planning approval.

11.78 With these mitigation measures in place, it is considered that the residual effect would be **Minor Adverse**.

#### Nutrient Neutrality

11.79 Guidance has also been provided by Natural England with regards to the potential to affect water quality by treated foul effluent resulting in adverse nutrient impacts on habitat sites. The Proposed Development will result in a net increase in population served by the Anglian Water wastewater system. At this stage it is known that there are various options available for the mitigation of this impact, however, currently no specific mitigation measure has been opted for.

11.80 The detailed aspect of this application does not include any new buildings, therefore it is proposed that nutrient neutrality is considered and conditioned at the reserved matters application stage, where the new housing developments will be brought forward for assessment.





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## SUMMARY

11.81 From reviewing the baseline conditions within and surrounding the Application Site, groundwater and foul drainage are considered to be the key receptors in terms of the Proposed Development. For groundwater, this is due to the Application Site being situated on a Principal Aquifer and within an SPZ Zone 1. For foul drainage, the high sensitivity classification is due to the local drainage infrastructure potentially not having the capacity for the Proposed Development without mitigation and consultation with Anglian Water is ongoing. Surface water is considered to be medium sensitivity as the Application Site is located within the 'Wensum' catchment which has a 'Moderate' ecological status. Flood risk and drainage are considered to be low sensitivity receptors as the Application Site is located largely in Flood Zone 1 and is not in a critical drainage area.

11.82 The key effect during the construction phase is the potential for the remobilisation of contaminants at the Application Site. However, with suitable mitigation measures, the residual effect is considered to be **Negligible**.

11.83 Water demand and foul demand are considered to be the key potential effects during the operational phase of the Proposed Development. However, with suitable mitigation measures put in place, the residual effects are considered to be **Minor Adverse** for water demand and foul demand.

11.84 The Proposed Development will include Sustainable Drainage Systems (SuDS), as detailed within the Flood Risk Assessment and Drainage Strategy reports. The system seeks to reduce the rate of surface water runoff in accordance with local policy. This runoff rate would be lower than the current natural rate of surface water runoff during extreme events.

11.85 In conclusion, given the location and nature of the receptors, the overall environmental effect of the Proposed Development in relation to water resources and flood risk following mitigation measures is considered to be **Negligible to Minor Adverse**. All residual effects are Negligible with the exception of surface water drainage (Minor Beneficial) and water/foul demand (Minor Adverse).



**Table 11.4: Water Quality and Hydrology Summary Table**

Phase	Potential Effect	Nature of Effect (Permanent or Temporary)	Significance	Mitigation/ Enhancement Measures	Residual Effects
Construction	Potential remobilisation of contamination	Temporary	Groundwater- Minor to Moderate Adverse  Surface water- Minor adverse	<ul style="list-style-type: none"> <li>Further ground investigation works</li> </ul> Potential for remediation/removal of topsoil as required	Negligible
	Potential groundwater contamination from general construction-related activities	Temporary	Minor to Moderate Adverse	Construction materials and vehicle properly maintained in compliance with BS6031:2009  Preparation of a CEMP	Negligible
	Potential interruption of groundwater flows	Permanent	Negligible	Piling construction is not considered to increase the risk of groundwater flooding so mitigation is not required	Negligible
Operational	Control of surface water runoff	Permanent	Negligible	Compliance with the SuDS drainage strategy within the FRA to provide a reduction in runoff rates	Minor Beneficial
	Potential contamination of surface water or groundwater from the routine Site drainage	Permanent	Groundwater- Moderate Adverse  Surface Water- MinorAdverse	Compliance with drainage strategy  Infiltration features located in areas where there is no risk to controlled waters with suitable interceptors prior to discharge.	Negligible
	Water demand	Permanent	Minor to Moderate Adverse	Incorporation of water-saving devices, where possible	Minor Adverse
	Foul demand	Permanent	Minor to Moderate Adverse	Further consultation with Anglian Water and mitigation measures put in place	Minor Adverse



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## REFERENCES

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**Ref 11.2:** Department for Communities and Local Government. (2021). National Planning Policy Framework

**Ref 11.3:** Norwich Local Plan – November 2015 [Online]. [Accessed on: 27th May 2022]. Available from: [https://www.norwich.gov.uk/info/20199/adopted\\_local\\_plan](https://www.norwich.gov.uk/info/20199/adopted_local_plan)

**Ref 11.4:** Environmental Protection Act 1990 (c. 43). London: Her Majesty's Stationery Office.

**Ref 11.5:** Water Resources Act 1991 (c. 57). London: Her Majesty's Stationery Office.

**Ref 11.6:** Environment Act 1995 (c. 25). London: Her Majesty's Stationery Office.

**Ref 11.7:** Water Industry Act 1999 (c. 9). London: Her Majesty's Stationery Office.

**Ref 11.8:** Anti-Pollution Works Regulations S.I. 1999 No. 1006. London: Her Majesty's Stationery Office.

**Ref 11.9:** Control of Pollution (Oil Storage) (England) Regulations S.I. 2001 No. 2954. London: Her Majesty's Stationery Office.

**Ref 11.10:** Water Act 2003 (c. 37). London: Her Majesty's Stationery Office.

**Ref 11.11:** Water Environment (Water Framework Directive) (England and Wales) Regulations S.I. 2003 No. 3242. London: Her Majesty's Stationery Office.

**Ref 11.12:** Flood and Water Management Act 2010 (c. 29). London: Her Majesty's Stationery Office.

**Ref 11.13:** BS6031:2009, The British Standard Code of Practice for Earthworks, (2009). British Standards Institute.

**Ref 11.14:** BS8004:2015, The British Standard Code of Practice for Foundations, (2015) British Standard Institute.

**Ref 11.15:** The SuDS Manual (C753), (2015), CIRIA



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## 12 SOILS, GEOLOGY AND CONTAMINATED LAND

### INTRODUCTION

12.1 This Chapter considers the potential significant effects from ground conditions and disturbance of potentially contaminated ground during the demolition, construction, and operation of the Proposed Development. It considers potential effects from contamination and ground conditions on human health and the environment including controlled waters, as well as the effects of potentially contaminated ground or groundwater on the Proposed Development. It also details the objectives, methodology and findings of both a desk-based environmental review combined with the results of an intrusive site investigation.

### ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

#### Assessment Methodology

12.2 The assessment of contaminated soils in the UK follows a risk-based approach and is structured in a tiered manner. As well as having a systematic approach to collecting the data it is also necessary to adopt recognised techniques and standards in assessing them and particularly regarding environmental risk assessment.

12.3 The assessment of ground conditions at the Application Site has been undertaken following the current industry guidance i.e. Land contamination risk management (LCRM) (Ref. 12.1) as outlined below:

- Tier 1 – Preliminary risk assessment – first tier of risk assessment that develops the initial conceptual site model to establish whether there are any potentially unacceptable risks;
- Tier 2 – Generic quantitative risk assessment – uses generic assessment criteria and assumptions to estimate risk; and
- Tier 3 – Detailed quantitative risk assessment – uses detailed site-specific information to estimate risk.

12.4 An assessment of baseline conditions has been undertaken based on the findings of a desk-based study. The methodology employed in completing the desk-based review of the Application Site and surroundings involved the following:



- a site walkover by an experienced environmental consultant to provide an assessment of current activities on the Application Site and the environmental setting;
- a review of available historic maps to determine the land-use history in the context of potentially contaminative activities;
- a review of environmental data relating to the Application Site and its surroundings using a proprietary third-party environmental database;
- a detailed review of previous environmental data relating to the Application Site (i.e. earlier phases of environmental assessment both desk-study and field-based);
- desk-based assessment of the geology, hydrogeology and hydrology at the Application Site from published mapping and web-based sources to determine the Application Site's environmental setting and sensitivity;
- a web-based search of the Environment Agency (EA) website and other freely available sources of information to identify any potential issues relating to the Application Site;
- review of the internet-based MAGIC environmental mapping service, a web-based interactive service which maps governmental environmental information; and
- provision of a qualitative contaminated land risk assessment based on Source-Pathway-Receptor as per current guidance outlined within LCRM (Ref. 12.1).

### **Development of a Conceptual Site Model**

12.5 Information from the data sources identified above enable the identification of potential pollution sources and pathways for pollutants to migrate from the source areas to potential receptors (*i.e.* humans, ecosystems, buildings, *etc.*). Based on this information a Conceptual Site Model (CSM) has been formed for the Application Site and its proposed end use. The CSM is based on the risk assessment principles of source, pathway and receptor connecting to form a pollutant linkage.

### **Assessment of Significant Effects**

12.6 There are no published qualitative criteria for assessing the likely significant effects from ground conditions and contamination although CIRIA C552 (Ref. 12.2) has been utilised as a basis for the assessment process. Significance criteria have therefore been developed using the criteria outlined, published guidance on contaminated land and professional judgement.



12.7 An adverse effect (with respect of ground contamination) relies on the presence of a source, pathway, and receptor pollutant linkage. The significance of the effect depends on the value of the resource, the sensitivity of the receptor and the ways in which the Proposed Development can provide a pathway to the receptor. The significance of an effect also partly depends on the timescales involved, *i.e.* short, medium or long term and the extent of the area affected.

12.8 Environmental receptors can demonstrate different sensitivities to changes in their environment. It is also recognised that environmental impacts can operate over a range of geographical areas and therefore a geographical scale should be considered in the scale/magnitude of the effect, as well as the receptor. The sensitivity of the receptor also considers the long or short-term exposure of the receptor. For this assessment sensitivity is determined (via professional judgement) as outlined within Table 12.1.

**Table 12.1 – Criteria for assessing the sensitivity of a receptor**

Sensitivity	Description
High	<p>Land to be in use for residential purposes with plant uptake (<i>i.e.</i> private gardens).</p> <p>Construction workers (not defined in Part IIA; however relevant in the context of a human receptor during the development process). On-site maintenance works with increased potential for direct contact with areas of contamination (if present) / working in confined spaces; <i>e.g.</i> to install / repair underground services.</p> <p>Principal aquifer, which may be used for public water supply. Source Protection Zone I – Inner Protection Zone and Zone II – Outer Protection Zone.</p> <p>Surface watercourse located on or adjacent to land under assessment. Watercourse with a high-water quality classification.</p> <p>Land located in or directly within the immediate catchment area of an ecologically sensitive area, <i>e.g.</i> Special Protection Area (SPA)/Site of Scientific Interest (SSSI)/Ramsar Site, etc.</p> <p>Buildings: World Heritage Site or Conservation Area</p>



Sensitivity	Description
Medium	<p>Land to be in use for residential purposes (without plant uptake).</p> <p>Off-site land in current residential usage and with potential for consumption of home grown produce.</p> <p>Land to be used for agricultural arable usage or livestock.</p> <p>Third party utilities.</p> <p>Secondary aquifer, which is not used for public water supply. Source Protection Zone III – Total Catchment Area.</p> <p>Surface watercourse located less than 250 m from the Site (however not located on or adjacent to the Site). Watercourse with a medium water quality classification.</p> <p>Not located in an ecologically sensitive area however located within its wider catchment.</p> <p>Buildings: Area of Historic Character</p>
Low	<p>Land to be in use for commercial/industrial purposes.</p> <p>Off-site commercial land usage.</p> <p>Members of the public accessing the Site for relatively short periods (e.g. dog walkers, bird watchers).</p> <p>Unproductive strata. Groundwater not used for public water supply.</p> <p>Surface watercourse located more than 250 m from the Site. Watercourse with a poor water quality classification.</p> <p>Not located in an ecologically sensitive area or its wider catchment.</p> <p>Buildings of replaceable or local value only.</p>

12.9 The magnitude of potential impacts during both construction and operation of the Proposed Development has been assessed using professional judgement. The magnitude (scale of change) is determined by considering the degree of deviation from the baseline conditions and whether this is likely to result in any exceedances of statutory objectives or changes in suitable uses of the receptor. For this assessment magnitude is outlined within Table 12.2.



**Table 12.2 – Criteria for assessing magnitude of an impact**

Impact	Adverse	Beneficial
High	Substantial environmental risk to sensitive receptors requiring extensive remedial works.	Substantial reduction in environmental risk to sensitive receptors. Substantial improvement in ground conditions.
Medium	Moderate environmental risk to sensitive environmental receptors requiring monitoring and localised remedial works.	Moderate reduction in environmental risk to sensitive environmental receptors. Moderate improvements in ground conditions.
Low	Minor environmental risk to sensitive environmental receptors requiring no remedial work (or no additional remedial work if remedial works are ongoing).	Minor reduction in environmental risk to sensitive environmental receptors. Minor improvements in ground conditions.
Negligible	Residual risk considered to be so minor to sensitive receptors that it would not be detectable. No appreciable change in environmental risk to sensitive environmental receptors.	

12.10 Where a potential impact is identified, the significance of the impact and level of contamination risk is determined by considering the sensitivity and type of receptor, the temporal nature of the impact and the geographic scope of the impact upon receptors. Some suggested descriptive criteria are outlined within Table 12.3.

**Table 12.3 – Descriptive criteria for assessing environmental impacts**

Impact	Nature	Geographical	Timescale	Frequency
Beneficial	Temporary	Localised	Short-term	Frequent
Negligible/Neutral	Reversible	Site-wide	Medium-term	Infrequent
Adverse	Permanent	District	Long-term	Rare
		Regional		
		National		
		Trans-national		

12.11 The potential effects have been classified, prior to mitigation, as Minor, Moderate or Major (either “Adverse”, “Neutral/Negligible” or “Beneficial”). Where the predicted effects are significant (substantial), mitigation measures have been incorporated to eliminate or reduce the effects to an acceptable level. The significance matrix is outlined in Table 12.4.





**Table 12.4 – Significance Criteria for Contamination Assessment**

Sensitivity	Magnitude			
	High	Medium	Low	Negligible
High	Major	Moderate/Major	Moderate	Minor
Medium	Moderate/Major	Moderate	Minor/Moderate	Negligible/Minor
Low	Moderate	Minor/Moderate	Negligible/Minor	Negligible

12.12 A description of the significance assessment is outlined below:

- **Major Adverse** – Significant environmental risk to a sensitive environmental receptor, and/or humans (construction workers and end users) requiring extensive mitigation works. For example, substantial widespread permanent reduction in quality of potable groundwater and/or surface water resource, substantial and permanent impact on ecosystems (plant and animal numbers) and/or substantial long-term effect on human health.
- **Moderate Adverse** – Local environmental risk to a sensitive environmental receptor, and/or humans (construction workers and/or end users) requiring monitoring and local mitigation work. For example, substantial short-term/moderate long-term reduction in quality of groundwater and/or surface water resource, substantial short-term/moderate long-term effect on ecosystems and/or human health.
- **Minor Adverse** – Temporary, minor environmental risk to a sensitive environmental receptor, for example minor local reduction in groundwater and/or surface water quality, minor local impact on ecosystems. Effects are reversible. Minor effect on human health.
- **Negligible** – No appreciable environmental risk to a sensitive environmental receptor and/or human health. Any minor adverse effects are reversible.
- **Minor Beneficial** – Minor reduction in environmental risk to humans or a sensitive environmental receptor. For example, minor local improvement in groundwater and/or surface water quality, minor local improvement in impact on ecosystems and minor improvement in human health effects.
- **Moderate Beneficial** – Moderate reduction in environmental risk to humans or a sensitive environmental receptor. Moderate improvement in groundwater and/or surface water quality, moderate improvement in ecosystems effects and moderate improvement in human health effects.



- **Major Beneficial** – Substantial reduction in environmental risk to humans or a sensitive environmental receptor. Substantial widespread improvement in quality of potable groundwater and/or surface water resource, major improvement in impact on ecosystems and major improvement on human health effects.

12.13 As previously detailed EIA is a process that identifies the likely significant environmental effects (both beneficial and adverse) of a Proposed Development. The process aims to prevent, reduce, and mitigate any adverse significant environmental effects, where these are identified. Significant effects are considered material to the decision process.

12.14 Any impacts of minor significance or lower are not considered to be significant and as such it will not be necessary to always propose mitigation methods. Impacts of moderate or higher significance will be deemed to be potentially significant and will require, where possible, mitigation methods to be adopted.

## **LEGISLATION, PLANNING POLICY AND GUIDANCE**

### **National Planning Policy and Legislation**

12.15 The National Planning Policy Framework (July 2021) (Ref. 12.3) sets out the Government's planning policies for England and how these are expected to be applied. The National Planning Policy Framework (NPPF) constitutes guidance for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications. Fundamental to the NPPF is a presumption in favour of sustainable development.

12.16 The NPPF states (Section 183) that planning policies and decisions should ensure that:

- the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;
- after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the *Environmental Protection Act 1990*; and
- adequate site investigation information, prepared by a competent person, is presented.



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12.17 Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner. In addition, planning policies and decisions should also ensure that new development is appropriate for its location considering 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.

12.18 The NPPF includes standalone Planning Practice Guidance for Land affected by contamination (July 2019) (Ref. 12.4). This provides guiding principles on how planning can deal with land affected by contamination.

12.19 The planning process can influence how contaminated sites are managed through planning policy and development control. In terms of the latter, planning conditions often require detailed site assessment or, in some cases, the remediation of a site to render it suitable for its proposed new use.

12.20 Part 2A of the *Environmental Protection Act 1990* (EPA 1990) provides the legislative framework for the Contaminated Land regime in England, Wales, and Scotland. It provides for Contaminated Land to be identified and dealt with in a risk-based manner. *The Contaminated Land (England) Regulations 2006* (SI 2006/1380) set out provisions for procedural matters under Part IIA. The 2006 regulations were modified with the introduction of *The Contaminated Land (England) (Amendment) Regulations 2012*, (SI 2012/263) which came into force on 6<sup>th</sup> April 2012. This includes an amendment to Regulation 3(c) to take account of the updated definition of “controlled waters” in Section 78A(9) of the *Environmental Protection Act 1990*.

12.21 Section 78A(2) of Part IIA of the EPA 1990 defines contaminated land as “land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- pollution of controlled waters is being or is likely to be caused”.

12.22 The implementation of Section 86 of *The Water Act 2003* on 6<sup>th</sup> April 2012 by *The Water Act 2003 (Commencement No. 11) Order 2012* (SI 2012/264) modifies the definition of contaminated land to also include land where there is “significant possibility of significant pollution of controlled waters”.



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## **Regional Policy**

12.23 The Joint Core Strategy for Broadland, Norwich and South Norfolk is the key planning policy document for the Greater Norwich area (Ref. 12.5). It forms part of the Local Plans for the districts of Broadland, Norwich and South Norfolk setting out the broad vision for the growth of the area and containing strategic policies for the period 2008 – 2026. This document does not outline any specific requirements with respect to contaminated land development.

## **Local Policy**

12.24 The Proposed Development area is identified within the Norwich City Council Brownfield Register (2021) (Ref. 12.6). The Application Site is referred to as 'Proposed Greater Norwich Local Plan (GNLP) allocation for residential led mixed use development including housing, community, education and leisure facilities, local employment and retail, local greenspace, biodiversity areas and recreational open space' (Ref. 12.7).

12.25 Norwich City Council undertook a Contaminated Land Strategy Review in 2009/2010 (Ref. 12.8). The Contaminated Land Inspection Strategy was first adopted in 2001 as part of the authority's duties under Part IIA of the Environmental Protection Act 1990 (Part IIA).

## **Guidance and Standards**

12.26 Defra Contaminated Land Statutory Guidance published in April 2012 (Ref. 12.9) provides for a four-category test which is intended to clarify when land does or does not need to be remediated, where Category 1 is deemed as being high risk and Category 4 as being low risk. Significant harm is defined in the Guidance on risk-based criteria and must be the result of a significant pollutant linkage. The presence of a pollutant linkage relies on the Source-Pathway-Receptor concept, where all three factors must be present and potentially present or linked for a potential risk to exist. An initial assessment of pollutant linkage can be made qualitatively (*i.e.* through identifying these factors) and may be assessed using qualitative risk assessment models.

12.27 The UK Government (Environment Agency) has issued Land Contamination: Risk Management (LCRM) Guidance (Ref. 12.1) which it expects a developer to follow when managing the risks from land contamination. There is various guidance and best practice standards relevant to this Chapter, they include:



- BS 5930:2015+A1:2020 Code of practice for ground investigations, ISBN 978 0 539 05986 1 (Ref. 12.10).
- BS 10175:2011+A2:2017 Investigation of potentially contaminated sites – code of practice, ISBN 978 0 580 98996 4 (Ref. 12.11).
- BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. British Standards Institute (Ref. 12.12)
- Guidance Managing and reducing land contamination: guiding principles (GPLC), GPLC2 - FAQ's, technical information, detailed advice, and references (last updated April 2016) (Ref. 12.13)

12.28 Further guidance documents relevant to the assessment of contaminated land are provided by various statutory and non-statutory bodies and are referenced where applicable throughout this Chapter.

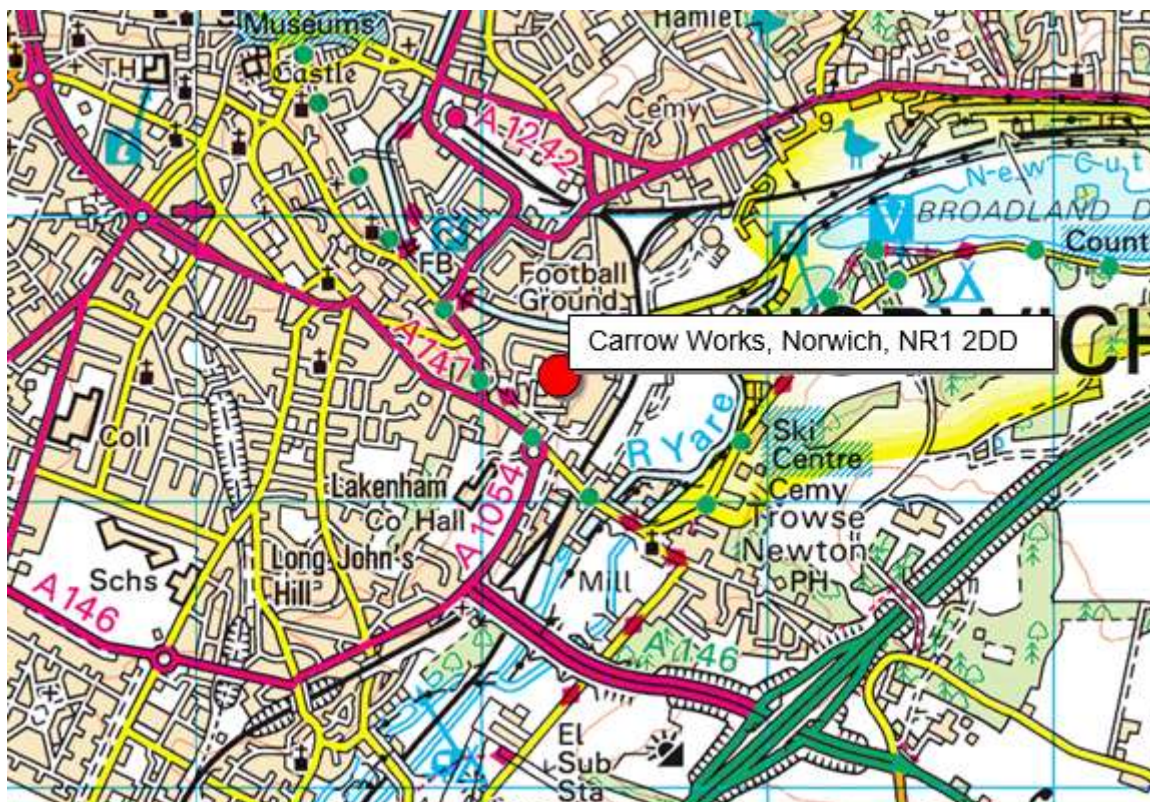
#### **BASELINE CONDITIONS**

12.29 The Proposed Development area is located at the Carrow Works, Bracondale, Norwich, Norfolk, NR1 2DD (Figure 12.1). The Application Site's approximate central National Grid Reference (NGR) is TG 24252 07465. The Application Site lies at between an elevation of 5-8 metres Above Ordnance Datum (AOD) in the main area and 10- 17 metres AOD near the central part of the Application Site.

12.30 The Carrow Works, the former Colman Mustard manufacturing site, comprises a 16.9 Ha site in the centre of Norwich. The Application Site features 1.5 million sq. ft of existing buildings including the Grade I listed Carrow Abbey and Grade II listed Victorian warehouses with 500 metres of waterfrontage along the River Wensum.

**Figure 12.1: Site location (Scale 1:50,000)**

Based upon the Ordnance Survey 1: 50,000 scale map with the permission of The Controller of Her Majesty's Stationery Office, Crown Copyright, Earth and Marine Environmental Consultants Ltd, Licence No. 100050755

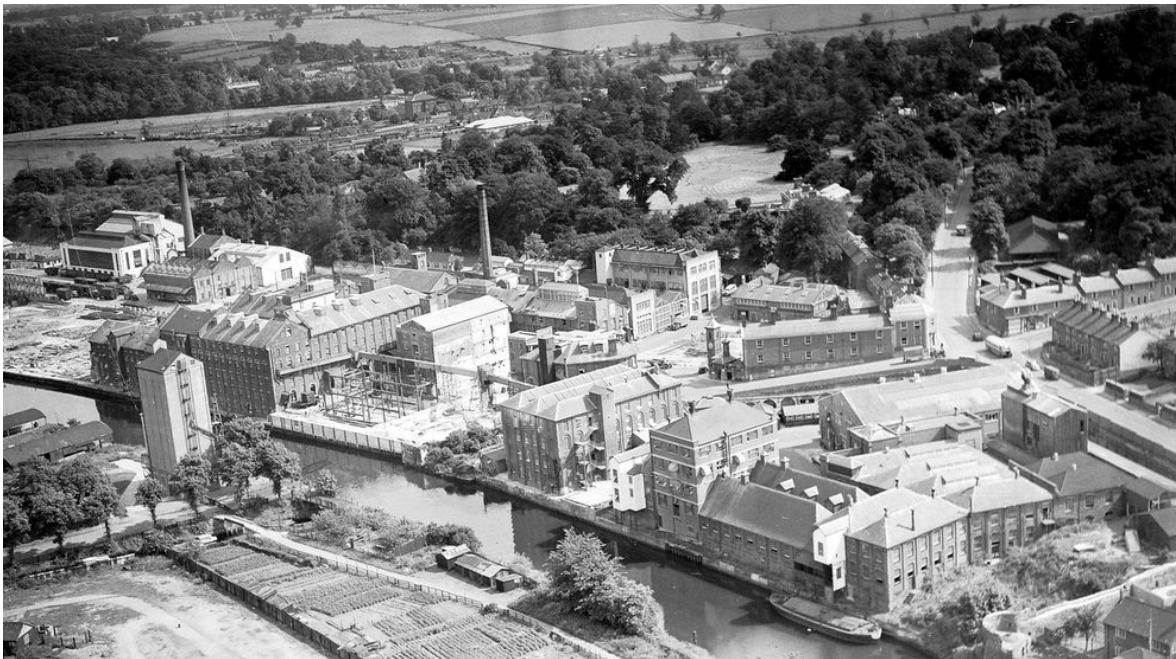


### Site History

12.31 The Application Site was acquired by J. Colman in the mid-1850s from the Norfolk Railway for the development and expansion of his mustard business. This land encompassed a large area to the east of the railway line with the sites connected via a below ground tunnel. In 1903 the company bought rival mustard maker Keen Robinson & Company which also owned a barley water business. Robinson's production was moved to The Carrow Works site in 1925. In 1938, Colman's merged with Reckitt and Sons to become conglomerate Reckitt and Colman. In 1995 the mustard and condiment side of the business was sold to Unilever. Britvic acquired Robinson's also in 1995. Today the disused works occupies the northern, some central and the eastern regions of the Application Site. The land to the east of the railway was not sold to Unilever and Britvic. A conservation area (located centrally on the Application Site) contains the residential dwelling known as Carrow Abbey which now forms part of the conference centre. The factory canteen, conference centre car parking and groundmen's facilities are also within this area.

## Photograph 12.1: Carrow Works (1950s)

Source: <https://www.edp24.co.uk/lifestyle/heritage/spring-at-carrow-works-in-1950s-norwich-7808016>



### Site Description and Layout

12.32 The Application Site can be split into two primary areas, based on historic use, these are Zone 1 (Historic production areas) and Zone 2 (Conservation area) (Figure 12.2).

Figure 12.2: Site zones





12.33 The main production area comprises numerous large warehouse, manufacturing and office buildings of varying age and construction. External to the main buildings, there are smaller structures housing water supply boreholes, water treatment plant, process chemicals and electrical infrastructure. In 2019 the factory rolled its last jar of mustard off the production line. Colman's continued making other condiments at the Carrow works site until full closure in early 2020. The Application Site is currently disused apart for some localised small-scale third-party activities:

- Stage 1 warehouse occupied by Beattie Passivehaus.
- Stage 2 warehouse 1/3 occupied by Polonia (Ukrainian Relief Charity)
- Stage 3 warehouse occupied by Norfolk County council/Norse COVID support Hub and (Afghanistan Relief Charity). Tenancy due to expire end of June 2022.

12.34 The conservation area encompasses the ruins of a 12th Century priory and Carrow Abbey. Abbey Conference Centre is in the northern part of the conservation area and encompasses the original house. Car parking facilities, the former technical (R&D) centre, a canteen, gardens and groundmen's facilities are also present.

12.35 A full discussion of the Application Site history and associated contamination sources is outlined within the Leap Environmental Ltd (2018) Phase I Contaminated Land Assessment (Ref. 12.14) (Appendix 12.1) and Leap Environmental Ltd (2018) Phase II Site Investigation report (Ref. 12.15) (Appendix 12.2).

## **Geology**

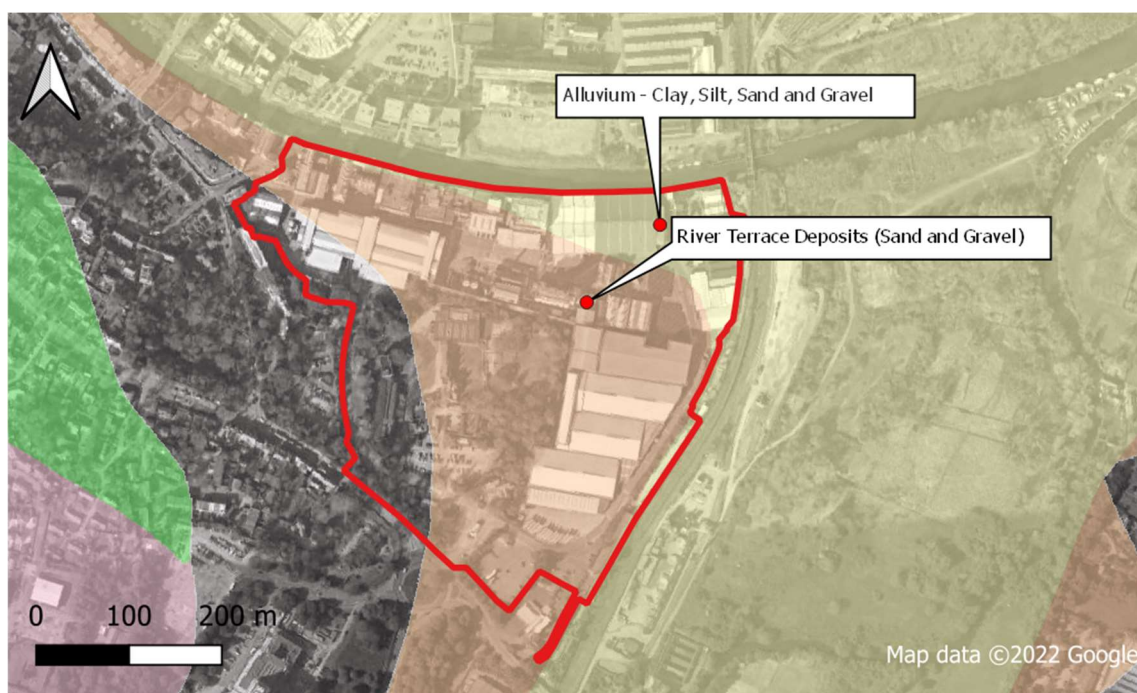
12.36 The geology of the Application Site has been established from British Geological Survey (BGS) mapping and from the historic site investigations that have been undertaken across the Application Site.

12.37 The relevant British Geological Survey (BGS) 1:50,000 map of the area (Sheet 161, Norwich, solid and drift, 1:50,000, 1975) shows the Application Site is directly underlain by superficial deposits of alluvium (clay, silt, sand and gravel) and River Terrace deposits (sand and gravel) (Figure 12.3). These are underlain by Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (undifferentiated) (Figure 12.4).



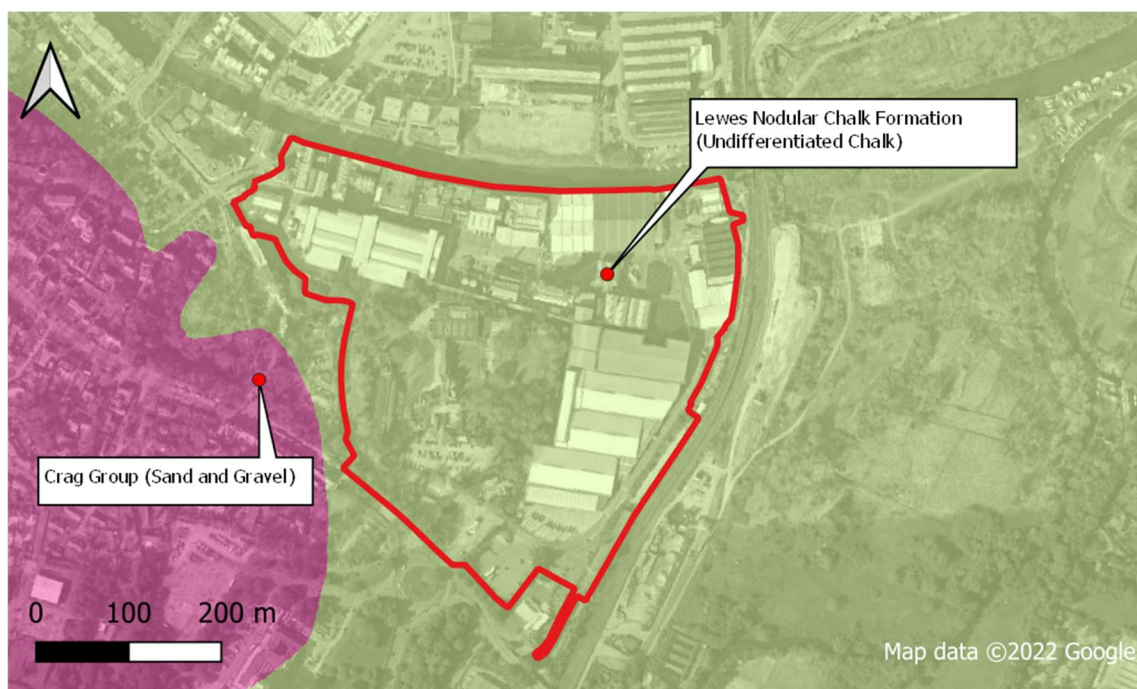
### Figure 12.3: Superficial geology

BGS 1:50,000 (Sheet 161, Norwich, solid and drift, 1:50,000, 1975)



### Figure 12.4: Solid geology

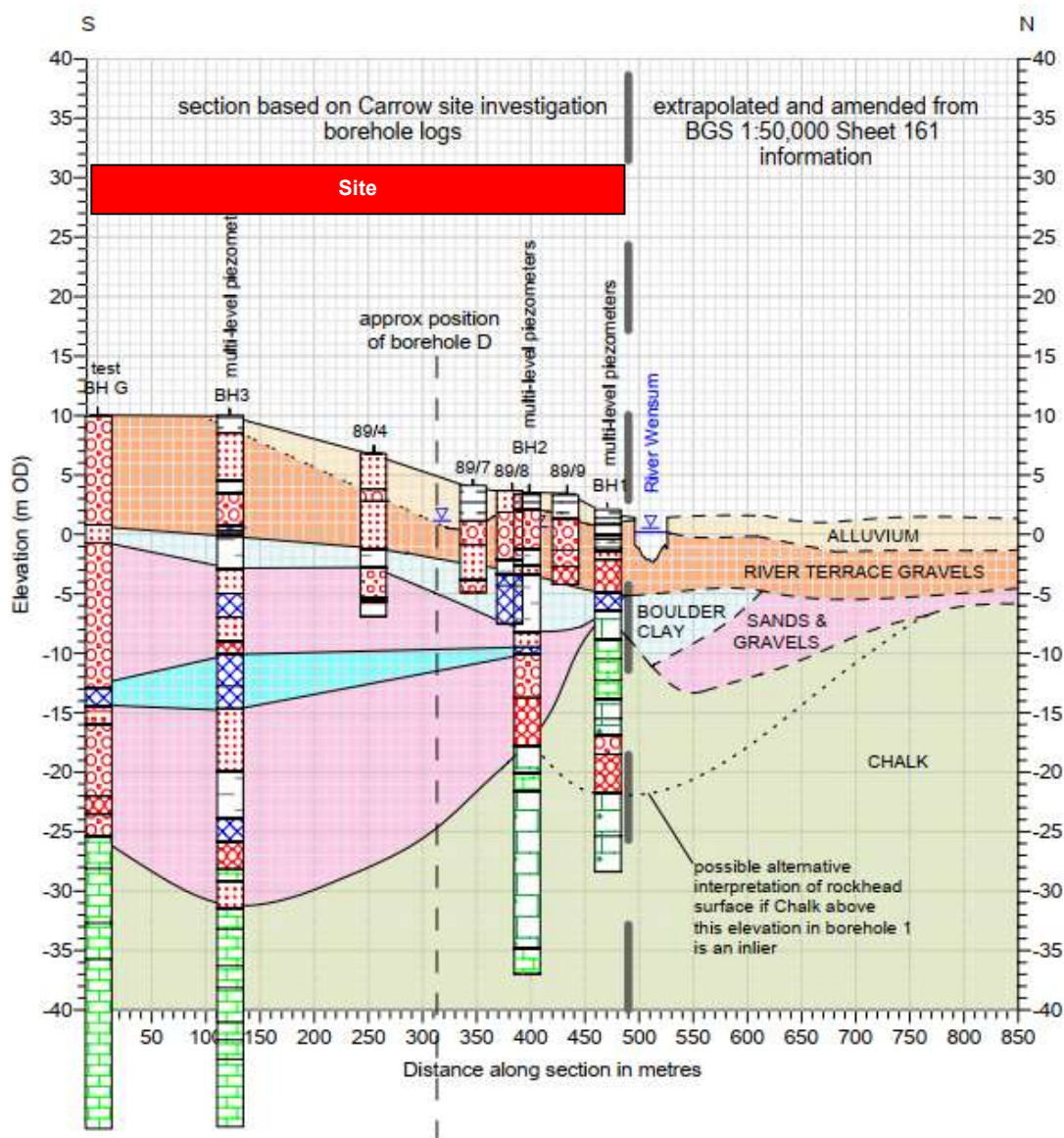
BGS 1:50,000 (Sheet 161, Norwich, solid and drift, 1:50,000, 1975)



12.38 A geological cross section is outlined within Figure 12.5 as a result of the work carried out by Vatnaskil Land and Water Resource Consultants (VLWRC) in 2012 (Ref. 12.16).

**Figure 12.5: Geological cross section (north-south)**

Vatnaskil LWRC (June 2012), Hydrogeological and Hydrochemical Modelling of Eastern Norwich



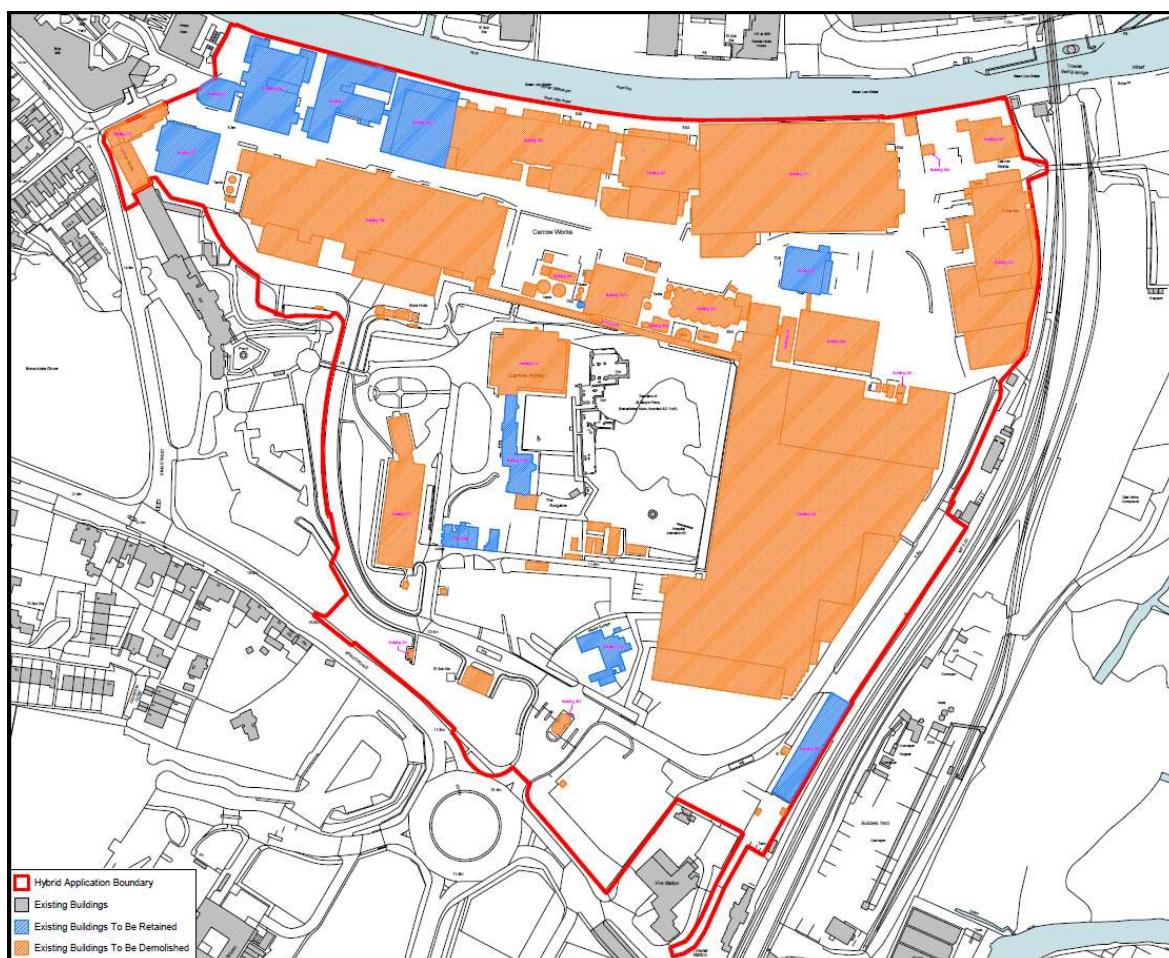
Chalk Dissolution Features

12.39 The Leap Phase I report (Ref. 12.14) indicates the Application Site is not situated within an area affected by coal mining and there are no historical on-site ground workings reported in the Envirocheck report. The Envirocheck report does include a record of a former underground chalk mine located circa 36m to the south of the Application Site. There are further records of 3 shafts associated with chalk mining 4m south of the Application Site and additional man-made cavities 146m southwest of the Application Site (chalk-related) and 162m west of the Site (sand

and gravel and chalk-related). There is a record of 4 solution pipe features (a natural cavity) being located 40m to the southwest of the Site.

12.40 There has been no reported geotechnical site investigation undertaken on the Application Site. Site investigation will be required to determine the engineering properties of soil and rock and how they will interact with the Proposed Development especially with regards to foundation and substructure design including potential Chalk dissolution features. It is important to note that, as the previous environmental ground investigation was undertaken in 2018, the current redevelopment plans, and layouts weren't available, and the Application Site was still operational. These limitations need to be addressed and, as a result, further ground investigation and assessments will be undertaken post demolition as this will allow access into areas that could not be accessed during the 2018 investigation. The extent of the proposed demolition programme is outlined (in red) within Figure 12.6.

**Figure 12.6: Demolition Plan**



## Radon

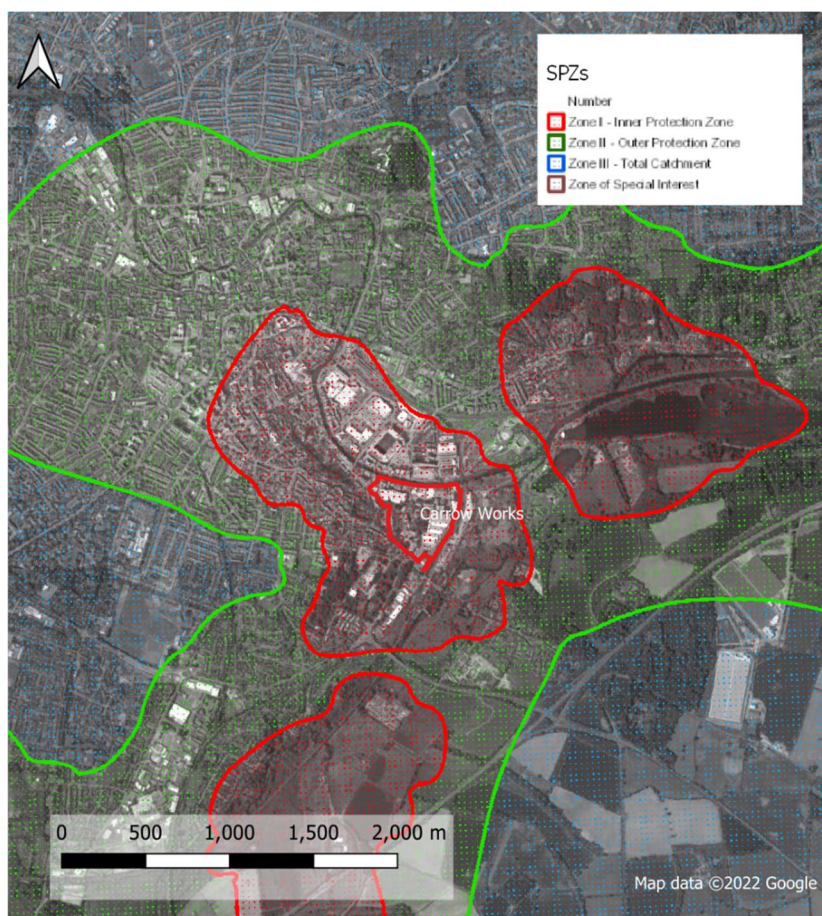
12.41 According to the Envirocheck database search, the Application Site is not within a radon affected area (less than 1% of homes are above the action level for radon). Therefore, no special protective measures are required in the construction of buildings on the Application Site, in respect of radon gas.

## **Hydrogeology**

12.42 The superficial deposits (alluvium and river terrace deposits) are recorded as Secondary (A) Aquifers whilst the underlying Chalk is designated as a principal aquifer with high groundwater vulnerability.

12.43 The Application Site is located wholly within a Source Protection Zone (SPZ) Zone I (Figure 12.7). The Environment Agency (EA) classify this zone as a 50-day travel time of pollutant to source with a 50 metres default minimum radius.

**Figure 12.7: Groundwater Source Protection Zones**



12.44 There were, upon closure of the Application Site, eight groundwater abstraction boreholes located on-site that were utilised as part of the processing and production operations (Figure 12.8). There is one further active (off-site) groundwater abstraction within 250 metres of the Application Site held by Norwich City Football Club (182m northwest) for spray irrigation.

12.45 The on-site boreholes will need to be formally decommissioned in-line with current Environment Agency (Ref. 12.28).

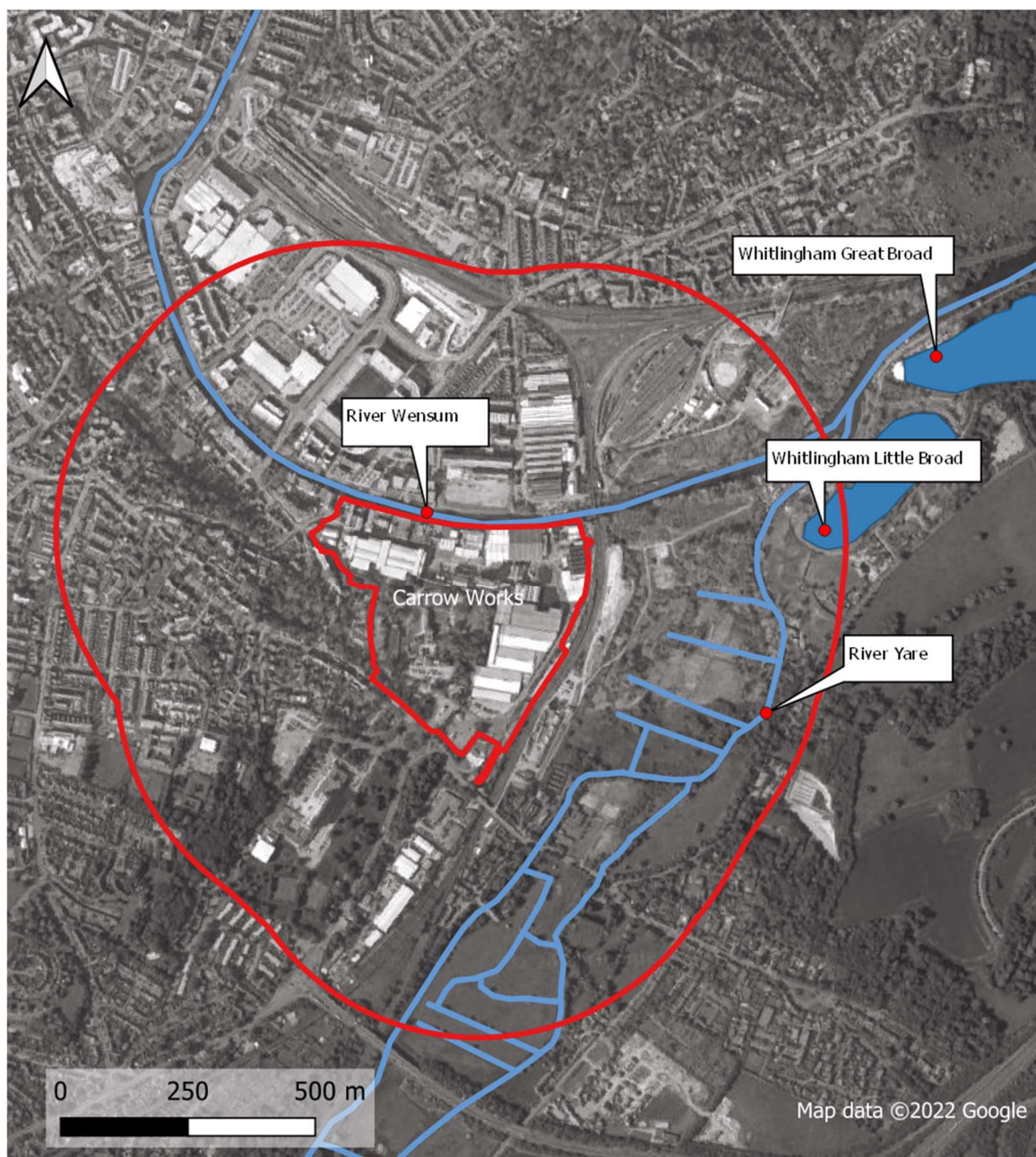
**Figure 12.8: Permitted on-site groundwater abstractions**



## Hydrology

12.46 There are no surface water features within the Application Site boundary. The River Wensum runs adjacent to the entire northern boundary of the Application Site (Figure 12.9). An on-site surface water abstraction (from the river) is listed within the Leap Environmental Phase I report (Ref. 12.14). There are 4 additional surface water abstractions (1 from the River Wensum and 3 from the River Yare) within 250m of the Application Site. The water is reportedly used for cooling, general/process washing and industrial processing).

**Figure 12.9: Hydrological Features (within 500 metres)**



12.47 According to the EA Catchment Explorer the Application Site is located within the Anglian River Basin District, Broadland Rivers Management Catchment, Yare Operational Catchment and Wensum DS Norwich water body. The water body (cycle 2) was, in 2019, classified as moderate ecological quality, good physico-chemical quality elements (e.g. BOD, DO, phosphate, temperature and pH) and fail for chemical quality in relation to Polybrominated diphenyl ethers (PBDE) only. PBDEs are a group of organobromine compounds. They have been used as flame retardants in polyurethane foams in upholstery and in polymer resins and plastics used as components in electrical equipment.



12.48 The Leap Environmental Phase I report indicates that there is 1 active discharge consent on-site (with 2 revoked licences relating to the same location). The license relates to the discharge of process water to the River Wensum. There are a further 22 records of discharge consents within 250m of the Application Site. Circa 4 or 5 appear active and all relate to emergency discharge of storm or sewage water into the local watercourses (Ref. 12.14).

### Flood Risk

12.49 According to the UK government flood mapping service the Application Site is in the following flood zone areas:

- **Planning** – Flood Zone 3. The location has a high probability of flooding and will need a flood risk assessment. A flood risk assessment (as part of a planning application) is required where a development is bigger than 1 ha, in an area with critical drainage problems (as notified by the Environment Agency) or there is a change of use in development type to a more vulnerable category (for example from commercial to residential) and in an area that could be affected by sources of flooding other than rivers and the sea (such as surface water or reservoirs).
- **Rivers and Seas** – The majority of the Application Site is classified as not at risk but some areas near the north-eastern corner are classified as at very low risk of flooding which means that each year this area has a chance of flooding of less than 0.1%. This considers the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.
- **Surface water** – The majority of the Application Site is not at risk from surface water flooding, however, some of the roadways between the existing buildings are classified as between medium to high risk (means that each year this area has a chance of flooding of greater than 3.3%). Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- **Reservoirs** – The majority of the Application Site is not at risk of flooding from reservoirs. The northern edge of the Application Site with the River Wensum is classified in an area that could be affected (when there is also flooding from rivers).

## Sensitive Land Uses and Receptors

### Ecological and land use designation

12.50 The MAGIC website which is managed by the Department for Environment, Food and Rural Affairs (Defra), was queried to locate Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites, National Nature Reserves (NNR), Areas of Outstanding Natural Beauty (AONB), National Parks and Local Nature Reserves (LNR), ancient woodlands, green belt within 1-km of the Application Site (Figure 12.10).

**Figure 12.10: Statutory land use designations (within 500 metres)**







12.51 No ancient woodland, greenbelt, NNRs, Ramsar, SACs, SPAs or SSSIs were identified within 500 metres of the Application Site.

12.52 The closest designated areas are the River Wensum which is part of The Broads National Park (Britain's largest protected wetland) and Whitlingham LNR. The LNR encompasses the Great and Little Broads up to the banks of the River Yare, Whitlingham Woods at the eastern end of the Park, the Picnic Meadow to the south of Whitlingham Lane, Trowse Meadow and Trowse Woods. The Park has an important role in conservation and biodiversity of the Yare Valley overall, providing connectivity to other habitats such as Whitlingham Marshes. The overall management aim is two-fold: to provide a mosaic of habitats which support Broadland wildlife of varying levels whilst also offering green space to local people, visitors from farther afield and schools for education and recreation. Certain parts of the Park are promoted for use by the public; other, more sensitive areas are restricted so that wildlife can remain undisturbed.

#### Protected buildings and sites

12.53 The MAGIC, English Heritage and Historic England websites were queried to locate Scheduled Monuments, World Heritage sites, battlefield sites park and gardens and Listed Buildings and conservation areas within 500 metres of the Application Site (Figure 12.11).

12.54 The following Grade I and Grade II listed structures are present on-site:

- Carrow Abbey (I)
- Carrow works – Blocks 7, 7A, 8A and 8 including metal canopy attached to block 7 and block 92 (II)
- Air raid shelter (II)
- K6 Telephone Kiosk (II)
- Steps and paved surface (associated with Carrow Abbey) (II)
- Flint wall and pet tombs (II)
- Lodge, gardener's cottage and former cart shed to Carrow Abbey (II)
- Former mustard drying shed (II)

12.55 Carrow Abbey is also listed as a scheduled monument. Although the former residential dwelling that stands on this site is known as Carrow Abbey, it in fact stands on the site of Carrow Priory – a Benedictine nunnery which was founded in 1146.

**Figure 12.11: Historic statutory designations (within 500 metres)**



### Residential Receptors

12.56 Residential receptors are located to the north of the Application Site across the River Wensum (within 40 metres) to the south across the A147 Bracondale (within 50 metres) and west across Carrow Hill (within 20 metres) of the site boundary.

### Recreational Land Use

12.57 There is no public access on to or through the Application Site via footpaths or bridleways.



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## Significance of Environmental Setting

12.58 The significance of the environmental setting is as follows:

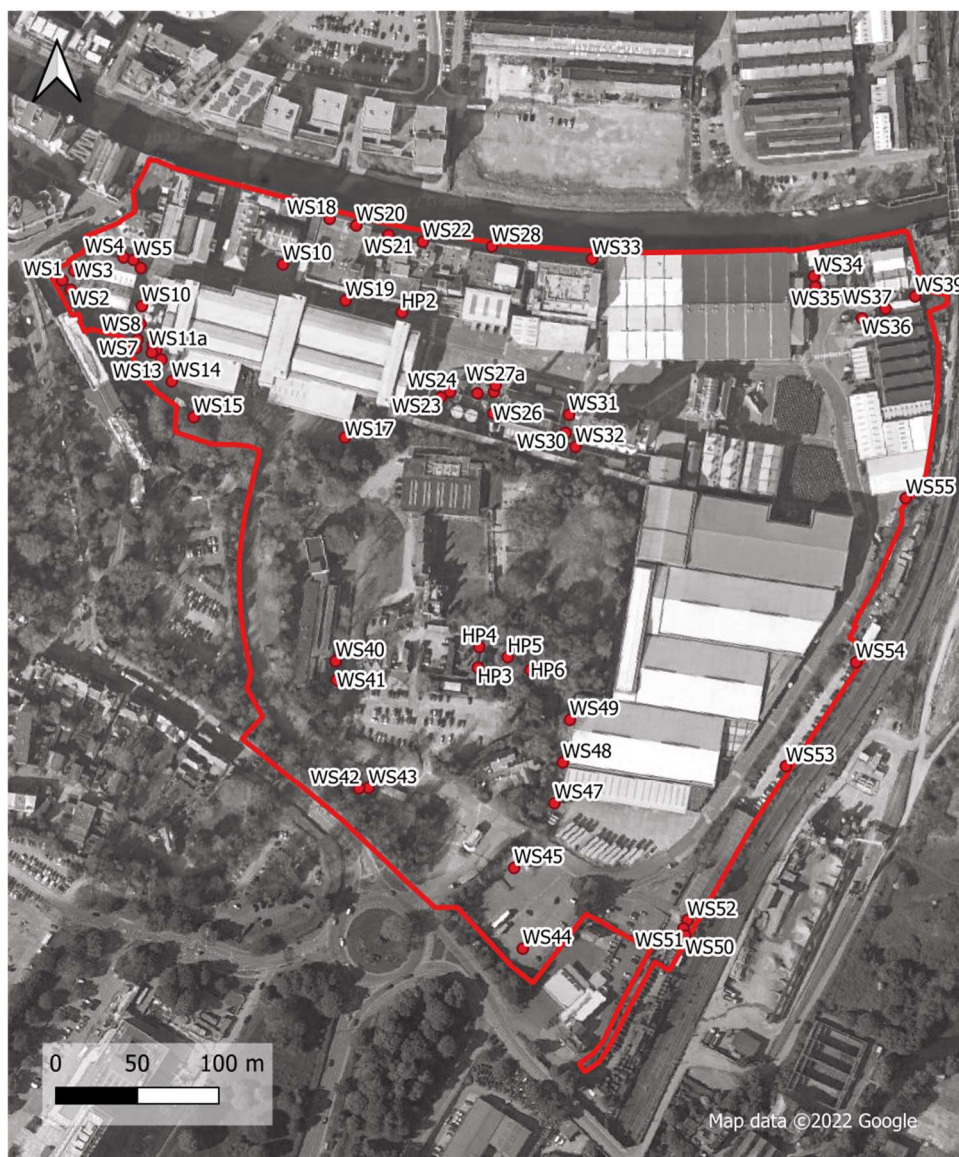
- **Groundwater [HIGH SENSITIVITY]** – The Application Site is located on superficial deposits classified as a Secondary A aquifer and the Chalk bedrock deposits are classified as a Principal Aquifer. The Application Site is located within a SPZ Zone I.
- **Surface Water [HIGH SENSITIVITY]** – The nearest surface watercourse is the River Wensum (at the northern site boundary).
- **Ecological Sensitive Areas [HIGH SENSITIVITY]** – The closest designation is the Broads National Park which is located at the northern edge of the Application Site (i.e. the River Wensum).
- **Protected Buildings and Structures [HIGH SENSITIVITY]** – There are multiple Grade II listed buildings on-site and Carrow Abbey is listed as a scheduled monument, and Grade I listed structure.
- **Residential Areas [HIGH SENSITIVITY]** – There residential properties surrounding the Application Site to the north, south and west.
- **Recreational Areas [LOW SENSITIVITY]** – There are no public rights of way on to or around the Application Site.

## Baseline Ground Conditions

12.59 The Application Site has been subject to various phases of investigation and assessment between 1994 and 2022 with the most significant site-wide investigation taking place in 2018 (Ref. 12.15).

12.60 The 2018 intrusive investigation was designed by Leap Environmental Ltd (Ref. 12.15) to provide representative site wide coverage whilst targeting fuel, ingredient, product, and waste storage areas. A total of 61 locations were excavated across 17 process areas comprising 53 windowless sampler boreholes and 8 hand excavated pits (Figure 12.12).

Figure 12.12: Leap (2018) Site Investigation



12.61 Given the long industrial history of the Application Site the contamination found during this investigation is relatively minor. Leap Environmental Ltd concluded that there were limited exceedances for metals (arsenic, cadmium, copper, lead and zinc), Polycyclic Aromatic Hydrocarbons (PAHs) e.g. naphthalene, phenanthrene and Benzo(a)pyrene (BaP), heavier fraction aromatic petroleum hydrocarbons and asbestos in the Made Ground. No exceedances of any determinants were recorded in any natural soil sample. Most of the exceedances relate to the most sensitive end-use of residential (with home grown produce) assessment criteria which would only be applicable to houses with private gardens. As Leap Environmental Ltd were not provided a redevelopment plan no formal assessment of ground gases was undertaken.



12.62 Although the investigation was sufficiently detailed it is important to note that the works were undertaken when the Application Site was operational. In addition, due to the density of the buildings, large areas of the Application Site could not be targeted. It is anticipated that further intrusive investigations will be required (post-demolition) to assess those areas not accessed during the earlier assessments and aligned to the development proposals.

### **Groundwater Contamination and Remediation**

12.63 It was reported that in 1988/1989 Groundwater Technology (GWT) undertook a site investigation in the northeast corner of the Application Site during which Tetrachloroethylene, also known as tetrachloroethene or perchloroethylene (PCE) was found within the groundwater. PCE is a volatile chlorinated solvent that is denser than water i.e. a Dense Nonaqueous Phase Liquid (DNAPL) (Figure 12.13).

12.64 The LEAP Phase I (2018) (Ref. 12.14) references a Land & Water Resource Consultants (LWRC) Hydrogeological Investigation from 1998 (Ref. 12.17) that outlines the presence of a contaminant plume of PCE and its breakdown products within the soils and groundwater in the north-eastern region of the Application Site. The source was reportedly, an historic 8m<sup>3</sup> below ground storage tank located close to the (now disused) mint processing plant.

12.65 The report states that an attempt to address the contamination was made in 1989-1994 via soil venting and air stripping. In 2007 the regulatory authorities contacted the owners of the Application Site as part of their responsibilities to compile a list of all contaminated sites under the *Environmental Protection Act 1990*. The concern arose from historical data obtained from Anglian Water. This resulted in further site investigation works which identified that contamination remained. Remediation of the shallow soils was undertaken in order that the Application Site would not be registered as contaminated under the EPA 1990. However, the Environment Agency (EA) remained concerned that the contamination in groundwater presented a risk to the Anglian Water drinking water abstraction borehole at nearby Thorpe.

**Figure 12.13: PCE Plume and Remediation Area**



12.66 The Application Site owners agreed to undertake further investigation work and sunk 3 ‘piezometer’ boreholes (BH1 – 30m, BH2 – 40m and BH3 – undisclosed depth) followed by soil and groundwater sampling which identified chlorinated solvent contamination to at least 30m bgl.

12.67 Reports and meetings with the EA followed and groundwater modelling was undertaken. The resultant conclusion was that the best short-term approach would be to continue day-to-day abstraction as the resulting groundwater cone of depression was effectively containing the contamination and preventing migration offsite. Regular sampling was undertaken with the results provided to the EA. This data (now dating back 5 years) has demonstrated that the onsite abstraction is containing the contaminant plume and potentially reducing the main solvent source (via abstraction well, BHD) (Figure 12.7).

#### Current On-going Groundwater Investigation and Remediation

12.68 A series of ground investigations has been carried out over the years since the loss to ground. These have revealed that below a variable cover of made ground, the Application Site is underlain by a thin cover of Alluvium that extends to a depth of around 3m and which is



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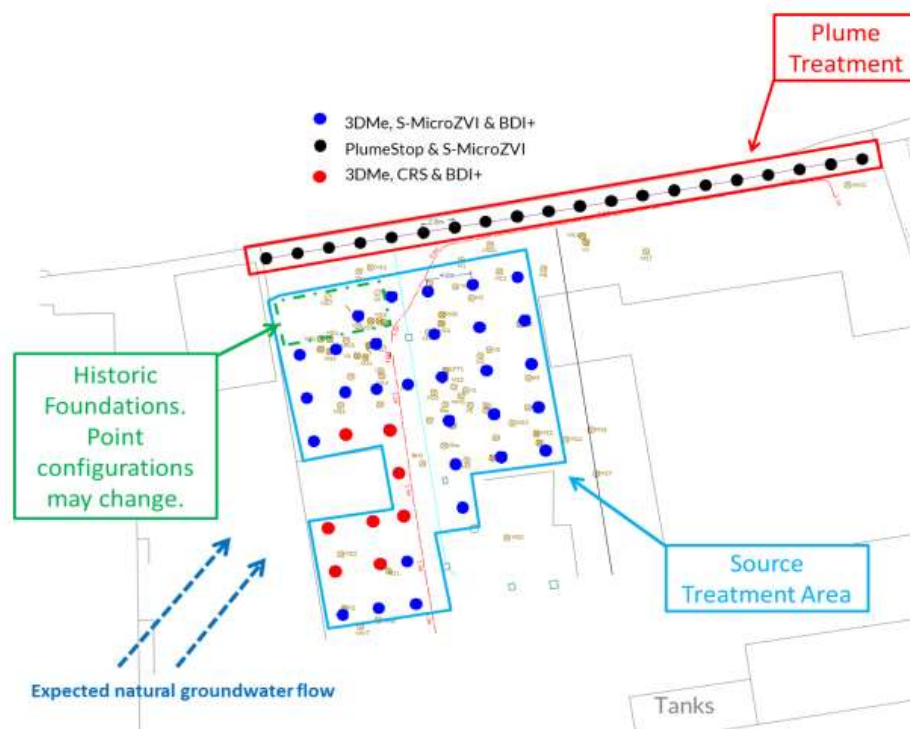
underlain by River Terrace Sand and Gravel that extends to depths of around 7m, whereupon the Upper Chalk is present. Groundwater is present at depths of around 0.7m to 2.0m and lies at a similar level to that of the adjacent River Wensum.

12.69 Geotechnical and Environmental Associates (GEA) carried out an investigation (2020-2021) of the contaminated area using a Membrane Interface Probe (MIP) to provide a continuous profile of the contaminant concentration with depth on an approximately 5m triangular grid. This investigation has revealed the presence of extremely high concentrations of chlorinated solvent, which is thought to represent small droplets of pure liquid PCE, within the basal layers of the River Terrace Sand and Gravel just above the surface of the Chalk.

12.70 The upper surface of the chalk has weathered to a putty consistency with a low permeability and is thought to have largely contained the solvent within a natural trough in the surface of the chalk that has produced a plume of 'free product' solvent droplets that measures approximately 25m southeast to northwest by 4m increasing to 7m southwest to northeast. This plume is at its widest in the northwest.

12.71 In the area where the spillage is thought to have occurred it has also been confirmed that some of the solvent has penetrated the chalk and is presently at relatively high concentrations to depths of at least 15m. Significant dissolved solvent concentrations have also been measured within the groundwater in the adjacent monitoring well at 30m depth. Whilst the removal of the dissolved solvent from the abstracted groundwater is mitigating the contamination to some extent and the pumping is helping to contain the plume within the Application Site, it is probable that with pure liquid solvent droplets being present in the ground, such pumping would need to continue for many decades before the contamination would be fully addressed (this would restrict development in this area). GEA, in collaboration remediation professionals Regeneration, therefore proposed that a phased remediation programme be implemented, firstly to tackle the central plume area where the highest concentrations of free product droplets are present and where contaminants are thought to be adsorbed in the chalk, with a view to removing the contaminant source, and then to tackling the wider plume of contamination dissolved in the groundwater.

**Figure 12.14: Remediation Second Phase: Source Reduction and Plume Migration**



12.72 The works within this area are currently on-going as per the agreed remediation programme. The EA has been fully consulted by GEA/Regenesis during the investigation and remediation process. As the works are currently on-going no formal reports are currently available although regular updates and information is being provided to the EA

**IDENTIFICATION AND EVALUATION OF KEY EFFECTS**

12.73 This section considers the potential effects of the Proposed Development, both during the construction and operational phases.

12.74 Based on the above information, a qualitative assessment of the presence of potential pollutant linkages can be undertaken. The results of the Qualitative Risk Assessment are outlined within the Leap Environmental Phase I report (Appendix 12.1) and are in-line with CIRIA C552 (Ref. 12.14).

**During Construction**

12.75 The potential effects (during the construction phase) are outlined within Table 12.5. The impacts outlined within Table 12.5 are ‘in the absence of mitigation’.





**Table 12.5 – Summary of Potential Construction Phase Effects**

<b>Pathway and Receptor</b>	<b>Description</b>	<b>Impact</b>
<b>Human Health</b> Construction workers <i>via Ingestion, Inhalation and/or Dermal contact</i>	There is the potential for effects on human health during the construction phase as previous investigations have established the potential presence of land affected by contamination.  In addition, where ground gas risks are present (not yet assessed or determined), these may pose risks to construction workers in confined or semi-confined spaces.	Direct Temporary Moderate adverse Local Significant
<b>Human Health</b> Off-site human receptors <i>via Ingestion, Inhalation and/or Dermal contact</i>	There residential properties surrounding the Site to the north, south and west.  Construction activities may lead to mobilisation of contaminants from within soils leading to potential off-site impacts on adjacent sites, e.g. via soil excavation, material transportation, odour release or from windblown dusts (stockpiles).	Direct Temporary Moderate adverse Local Significant



Pathway and Receptor	Description	Impact
<p><b>Controlled Waters</b> Surface Water and Groundwater <i>via migration from impacted soils and/or direct discharge</i></p>	<p>The Site is located on superficial deposits classified as a Secondary A aquifer and the Chalk bedrock deposits are classified as a Principal Aquifer. The Site is located within a SPZ Zone I.</p> <p>The nearest surface watercourse is the River Wensum (at the northern Site boundary). This is also designated as part of the Broads National Park.</p> <p>During ground works, it is possible that pathways could be created that would enable migration of contaminants. Elevated concentrations of substances have been identified in soils and groundwaters at the Site, and as such, existing pollutants could be mobilised during construction phase activities. Pathways may occur because of the leaching of contaminants from stockpiles, creation of pathways via piling or ground improvement works, creation of pathways for migration of dissolved or free phase contaminants via groundwater flow through buried services and infrastructure or increased infiltration through soils during the construction period.</p> <p>The presence of a contaminant plume of PCE and its breakdown products within the soils and groundwater in the north-eastern region of the Site is currently being addressed via active remediation. These works are currently on-going.</p> <p>During the construction phase, it is likely that substances and waste materials will need to be stored on site. There is potential for leakages and spillages of such chemicals and/or waste liquids to occur which would adversely affect ground and water quality. Given the sensitive nature of controlled water bodies at and adjacent the Site, the receptors are of high sensitivity. The magnitude of the effect could be high if a significant incident was to occur.</p>	<p>Direct Temporary Moderate/Major adverse Local Significant</p>



## During Operation

12.76 The potential effects (during the operational phase) are outlined within Table 12.6. The impacts outlined within Table 12.6 are 'in the absence of mitigation'.

**Table 12.6 – Summary of Potential Operational Phase Effects**

Pathway and Receptor	Description	Impact
<b>Human Health</b> Site occupants and maintenance workers <i>via Ingestion, Inhalation and/or Dermal contact</i>	There is the potential for effects on human health during the operational phase as previous investigations have established the potential presence of land affected by contamination.  In addition, where ground gas risks are present (not yet assessed or determined), these may pose risks to construction workers in confined or semi-confined spaces.	Direct Permanent Moderate adverse Local Significant
<b>Controlled Waters</b> Surface Water or Groundwater <i>via migration from impacted soils and/or direct discharge/release</i>	The sensitivity of controlled water receptors at the Site (surface water and groundwater) is high. There is potential for pollution of controlled waters to occur during the operational phase via migration of existing contaminants through pre-existing routes such as existing monitoring wells, buried infrastructure (e.g. drains or soakaways), or direct routes through the shallow geology. Migration could also be introduced through new routes such as via piles or new service ducts.	Direct Permanent Moderate/Major adverse Local Significant
<b>Built Environment</b> On-site buildings, services, and structures <i>via direct contact and/or migration of land gas through soils</i>	Made Ground has been observed across most of the Site. This and the presence of the underlying Chalk can produce elevated ground gases such as Methane and, with respect to Chalk, Carbon dioxide.	Direct Permanent Moderate adverse Local Significant

## ASSESSMENT OF CUMULATIVE EFFECTS

12.77 In line with the EIA Regulations, an EIA must consider the cumulative effects or impact interactions of a Proposed Development. Cumulative impacts may result from incremental changes caused by other past, present or reasonably foreseeable activities or projects in the local area, in combination with the Proposed Development.

12.78 The committed developments, considered within the assessment, are outlined within the EIA Scoping Opinion Request for mixed use re-development at Carrow Works (Ref. 12.18). All



the identified schemes will include construction phases activities hence could involve disturbance and associated management of contaminated land.

12.79 Effects relating to ground conditions and contamination are typically site-specific. As such, it is considered highly unlikely that any nearby committed developments have the potential to give rise to effects that could interact with those arising from the Proposed Development.

12.80 Furthermore, as with the Proposed Development, the potential for contamination and associated risks and effects would be identified by the applicants to ensure that each development would be 'suitable for use' in accordance with the requirements of Part IIA of the *Environmental Protection Act, 1990* and associated planning conditions. All demolition and construction activities would also be controlled and managed via the implementation of both relevant legislative requirements and best practice guidance to minimise contamination risks and effects to the environment to acceptable levels. The likely demolition and construction related cumulative ground conditions and contamination effects would therefore be negligible.

12.81 None of the identified schemes currently provide sufficient information to be able to assess the cumulative effects in combination with the Proposed Development. It is important to note that the construction phases are relatively short-term and are development programme related hence may not coincide with the Proposed Development schedule.

## **INTER-RELATIONSHIP EFFECTS**

12.82 There are inter-relationships with Chapter 11: Water Quality, Hydrology and Flood Risk and Chapter 17: Waste Management. The effects of soils contamination have the potential to cause surface water and groundwater quality effects, this has been taken into account in the assessments.

## **ENHANCEMENT, MITIGATION AND RESIDUAL EFFECTS**

### **During Construction**

12.83 The following mitigation measures will be employed during the initial demolition, site clearance and construction phase activities. It is important to note that the initial assessment and construction phases activities are designed to identify and remove (remediate) contamination that creates unacceptable potential pollutant linkages once the Application Site transitions to its operational state.



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### Pre-demolition Survey

12.84 A detailed pre-demolition audit will be undertaken by an appointed contractor before any demolition activities take place, to quantify the types of demolition waste materials that might arise. The Institution of Civil Engineers (ICE) has produced guidance on pre-demolition audits, including 'The Demolition Protocol' (Ref. 12.19) this would be considered current best practice.

12.85 Materials will be segregated into separate waste streams (where possible). The separated materials will be removed for off-site recycling or disposal. The demolition contractor will work closely with the developer to ensure full compliance and deliverability of recycling targets.

### Hazardous Material Surveys

12.86 Given the age of the buildings and associated structures the (localised) presence of asbestos-containing materials (ACMs) is considered highly likely. A refurbishment/demolition survey asbestos-containing materials (ACMs) will be undertaken (post planning submission).

12.87 If the any structures containing ACMs are to be refurbished or demolished a Health and Safety Executive (HSE) licensed asbestos contractor shall be employed to safely remove the materials for off-site disposal. All works would be undertaken in conformance with HSE requirements and the *Control of Asbestos Regulations 2012*. Any ACM containing waste will be transported by a registered waste carrier and disposed of at permitted landfill site. All necessary consignment notes will be maintained.

12.88 Any other hazardous materials will be removed ahead of demolition works. Hazardous wastes will be transported by registered waste carriers and disposed of at appropriately permitted off-site facilities.

### Land Contamination and Geotechnical Surveys

12.89 In general, demolition and construction phase activities will involve disturbance and interaction with soils and (potentially) groundwater and thus could generate 'contaminated' waste materials that need to be appropriately and effectively managed.

12.90 A site-wide Phase I Contaminated Land Assessment has been undertaken by Leap Environmental Ltd (Ref. 12.14) in 2018. The desk study provides an initial Conceptual Site



Model (CSM) and qualitative Preliminary Risk Assessment (PRA) for the Application Site in accordance with the principals set out in Land Contamination Risk Management (LCRM) guidance (Ref. 12.1) previously referred to as CLR11, published by the Environment Agency. The desk study has also been prepared in consideration of the National Planning Policy Framework (NPPF) and The Building Regulations 2010, Approved Document C - Site preparation and resistance to contaminants and moisture (Ref. 12.20).

12.91 There is currently an on-going assessment and remedial activities around the PCE plume in the north-eastern corner of the Application Site. All works are being co-ordinated by Unilever (UK) Ltd & Britvic Soft Drinks Ltd in consultation with the Environment Agency.

12.92 A site-wide Phase II intrusive investigation was undertaken by Leap Environmental Ltd (Ref. 12.15) in 2018. The intrusive investigation was designed to provide representative site wide coverage whilst targeting fuel, ingredient, product, and waste storage. A total of 61 locations were excavated across 17 'Areas' comprising 53 windowless sampler boreholes and 8 hand excavated pits. The exploratory techniques were selected to minimise disruption to the ongoing site operations.

12.93 It is important to note that, as the investigation was undertaken in 2018, the current redevelopment plans, and layouts weren't available, and the Application Site was still operational. These limitations need to be addressed and, as a result, further ground investigation and assessments will be undertaken post demolition as this will allow access into areas that could not be accessed during the 2018 investigation. The results would be presented in a 'Phase II' geo-environmental interpretive report in accordance with BS10175:2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice (Ref. 12.11) and LCRM guidance (Ref. 12.1).

12.94 The dissolution of soluble rocks such as Chalk, can result in subsurface voids, which might affect foundations and other infrastructure associated with the Proposed Development. A desk-based soluble rock risk assessment aligned with CIRIA C574 (Ref. 12.27) shall be carried out which would be supplemented with geophysics, trial trenches and/or rotary boreholes. The findings of the investigations would help design the foundations, roads and/or drainage, together with any remedial/ground improvement works that may be required to mitigate any identified risks.



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### Remediation and Verification

12.95 The potential for remedial activities needs to be split between the wider Application Site area (where possible remediation might be required) and the known area of groundwater contamination that is currently undergoing active remediation (i.e. the PCE plume area).

12.96 Where required the proposed site-wide Phase II site investigation would be followed by a Remediation Options Appraisal, Remediation Strategy and (post-remediation) preparation of a Verification Report. All works will be undertaken in compliance with LCRM Guidance (Ref. 12.1). Where required a long-term monitoring programme would be proposed and incorporated into the final Proposed Development design. This currently applies specifically to the PCE plume area where long-term monitoring of the groundwater would be required during the Monitored Natural Attenuation (MNA) phase of the works.

### Foundation Works Risk Assessment

12.97 Due to the type and nature of the Proposed Development, it is envisaged that the foundation loads are likely to be significant. Considering this and the weak and variable nature of the shallow soils found across the Application Site, it is proposed that the main built structures are founded upon piles. The potentially contaminated nature of the near surface deposits and the potential for creating pathways to the underlying soils and aquifer because of the piling operation is recognised and understood, thus, piling methods will be chosen based on risk assessment as well as structural performance.

12.98 A Foundation Works Risk Assessment (FWRA) would be produced in-line with current guidance (Ref. 12.23 and Ref. 12.24).

### Site Preparation and Earthworks

12.99 Waste arising from site clearance, primary infrastructure and earthworks is expected to comprise rubble, tarmac from former areas of hard standing, gravel, clay material and possibly localised contaminated materials.

12.100 Demolition rubble (if present) will be screened and crushed for re-use on the Application Site (where possible). The mobile plant and equipment will be permitted, as required under the *Environmental Permitting (England and Wales) Regulations 2016*. Techniques to minimise



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emissions are outlined within Process Guidance Note 3/16 (12) Secretary of State's Guidance for Mobile Crushing and Screening (Ref. 12.21).

12.101 Any clean excavated material that cannot be reused on-site would be removed by registered waste carriers and sent for reuse at another development site or sent for disposal at appropriately permitted facilities. If excavated soils are to be reused on-site this would be undertaken in compliance with the CL:AIRE Definition of Waste: Code of Practice (Ref. 12.22).

12.102 The CL:AIRE Definition of Waste: Development Industry Code of Practice (DoWCoP) will be used to assess whether excavated materials are classified as waste or not. If excavated materials are dealt with in accordance with the DoWCoP, the Environment Agency (EA) should consider that these materials are unlikely to be waste if they are used for the purpose of land development. An integral part of the CoP is the production of a Materials Management Plan (MMP) which documents how all the material to be excavated are to be dealt with.

12.103 All excavations/soils in higher risk areas will be monitored and analysed by qualified and experienced field scientists to ensure the chemical characteristics of the materials are understood and that they are handled and segregated appropriately (e.g. contaminated soils will not be mixed with uncontaminated soils).

12.104 Detailed records (and where appropriate a photographic log) will be kept of all construction phase waste arisings and their management and fate. This will be available to the Local Authority and EA on completion of the construction phase.

12.105 Where wastes are to be removed from the Application Site and disposed of to landfill Waste Acceptance Criteria (WAC) testing will be undertaken to determine the type of landfill that can accept the waste i.e. hazardous, stable non-reactive hazardous and inert waste.

12.106 All works will be undertaken within-line with current statutory guidance. A Materials Management Plan (MMP) would be produced so that the Principal Contractor can comply with Environment Agency requirements with regards to excavated materials i.e. the DoWCoP.

#### Construction Environmental Management Plans

12.107 A Construction Environmental Management Plan (CEMP) identifies the project management structure roles and responsibilities, regarding managing and reporting on the environmental impact of the construction phase including waste management.





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12.108 A CEMP helps to ensure that construction work considers aspects of environmental protection within the context of compliance with local legislation and minimisation of the impacts on humans and the environment. A CEMP allows a proactive approach in controlling potentially polluting activities to prevent adverse public health impacts, nuisance and hazards to the natural and human environment including the management of contaminated land.

#### Health and Safety Controls

12.109 All construction phase activities would be covered under the *Health and Safety at Work etc Act 1974* and associated legislation including the *Construction (Design and Management) Regulations 2015*. The principal contractor would ensure that suitable and sufficient systems are established and maintained to ensure compliance with prevailing EHS legislative requirements including the appropriate guidance (Ref. 12.25).

#### Water Supply Pipework

12.110 In January 2011, UK Water Industry Research (UKWIR) published "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21). Its aim is to ensure that the correct materials are selected for water pipes and components to be used below ground in brownfield sites to protect the quality of drinking water whilst considering the service life of the water distribution system. All pipework shall be installed in compliance with the required guidelines (Ref. 12.26) based on the findings and recommendations of the Phase II site investigation.

### **During Operation**

12.111 The following mitigation measures will be employed during the operational phase.

#### Long-term Monitoring Programme

12.112 A long-term monitoring programme describes the collection of key performance data over a prolonged time. It is an important component of contaminated land management because the data can be used to estimate trends in contaminant concentrations, evaluate remediation performance and determine if clean-up objectives are being achieved. All works would be undertaken in compliance with LCRM (Ref. 12.1).



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## RESIDUAL IMPACTS

### During Construction

12.113 Following implementation of the proposed mitigation measures, the Proposed Development (construction and demolition phase) has potential for **Temporary, Minor Adverse** impact at a **Local** scale (**Not Significant**).

### During Operation

12.114 Following implementation of the proposed mitigation measures, the Proposed Development (operational phase) has potential for **Permanent, Beneficial** impact at a **Local** scale (**Not Significant**).

## SUMMARY

12.115 The presence of the PCE contaminated groundwater plume represents a significant ongoing source of contamination that is currently being addressed through active remediation prior to redevelopment of the Application Site. The Environment Agency has been fully consulted during the investigation and remediation process. This active programme combined with the proposed mitigation measures should have an overall **Permanent Positive** impact on the local environment, especially through the reduction of the risks to surface water and groundwater.

12.116 Subject to the mitigation measures detailed within this Chapter, the Proposed Development is likely to comply with all legislation and planning policy requirements with regards to contaminated land.



**Table 12.7: Contaminated Land Summary Table**

Potential Effect	Nature of Effect (Permanent or Temporary)	Significance	Mitigation/ Enhancement Measures	Residual Effects
<b>During Construction</b>				
<p>Effects on human health (ground contamination, ground gases).</p> <p>Effects on controlled waters (surface water and groundwater)</p> <p>Effects on human health and property (ground dissolution and instability)</p>	<p>Temporary</p> <p>Short term</p> <p>Local</p>	<p>Significant</p>	<p>Pre-demolition Survey</p> <p>Hazardous Material Surveys</p> <p>Construction Environmental Management Plan</p> <p>Construction Health and Safety Controls</p> <p>Geoenvironmental Surveys</p> <p>Remediation Options Appraisal and Remediation Strategy (including land gas protection measures)</p> <p>Remediation programme</p> <p>Verification Assessment and Reporting</p> <p>Foundation Works Risk Assessment</p> <p>Selection and installation of appropriate construction materials (WRAS approved).</p>	<p>Temporary</p> <p>Minor Adverse impact</p> <p>Local scale</p> <p>Not Significant</p>



Potential Effect	Nature of Effect (Permanent or Temporary)	Significance	Mitigation/ Enhancement Measures	Residual Effects
<b>During Operation</b>				
Effects on human health (ground contamination, ground gases). Effects on controlled waters (surface water and groundwater) Effects on human health and property (ground dissolution and instability)	Permanent Long-term Local	Not Significant	Long Term Monitoring Programme	Permanent Neutral impact Local scale Not Significant



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## REFERENCES

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## 13 ARCHAEOLOGY

### INTRODUCTION

13.1 This chapter of the Environmental Statement deals with the assessment of the potential effects of the Proposed Development on archaeology. It sets out the assessment methodology and significance criteria, describes the planning policy context and baseline conditions, identifies and evaluates the key effects, the magnitude of possible impacts on archaeological assets at the Application Site and describes the mitigation measures and residual effects.

13.2 Historic structures and setting are not specifically considered within this chapter except where they are relevant to the archaeological interpretation of the Application Site.

### ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

13.3 This section presents the methodology used to assess the potential effects of the Proposed Development in relation to below ground archaeological remains.

### Consultation

13.4 **Table 13.1** presents a summary of the comments raised in the Scoping Opinion relevant to Archaeology.





**Table 13.1 Summary of Comments Raised in the Scoping Opinion**

Consultee	Comment	Response
<p>Norfolk Historic Environment Service REF: CNF40839</p>	<p>The potential of development to impact on archaeological remains of medieval date relating to Carrow Priory is identified in the scoping documents. Potential impact on remains of Palaeolithic, Mesolithic and Roman date remains to be defined.</p> <p>We echo the comments of Historic England. Any updated archaeological desk-based assessment should include consideration of existing sources of palaeoenvironmental and geoarchaeological information and present this information in the form of a deposit model.</p> <p>At this stage the applicants should consider bolstering the base line information relating to Carrow Priory with information from non-intrusive investigations such as ground-penetrating radar survey.</p>	<p>All points agreed and incorporated for assessment.</p>



Consultee	Comment	Response
Historic England REF: PL00772902	<p>We note that the EIA Cultural Heritage chapter will include an updated Archaeological Desk-Based Assessment to consider the potential impacts of the proposed development on both designated and non-designated archaeological remains and deposits with palaeoenvironmental and geoarchaeological significance. We recommend that, in addition to the sources stated in the Scoping Report, the assessment includes a review of existing borehole and geoarchaeological datasets.</p> <p>In addition to the range of potential historic environment impacts identified in the Scoping report, the assessment should also consider the potential for changes in burial-environment and hydrology to adversely impact the preservation of buried archaeological and palaeoenvironmental remains or the foundations of existing historic structures at the site. We recommend that appropriate reference is made in the assessment to the Historic England document 'Preserving Archaeological Remains &lt;<a href="https://historicengland.org.uk/images-books/publications/preserving-archaeologicalremains/">https://historicengland.org.uk/images-books/publications/preserving-archaeologicalremains/</a>&gt;' (2016).</p> <p>The assessment should consider using historic maps and aerial photographs to model the extents and, where possible, the depths of previous known ground-disturbance within the site to identify areas where the potential for the survival of buried archaeological remains is particularly high or low.</p> <p>Given the designated heritage assets on the site and beyond which fall within the remit of Historic England and the anticipated development, we consider there is likely to be a significant impact from the development on them. We are therefore likely to have substantive comments to make and would welcome the chance to comment on any assessment carried out and further details of the proposals.</p>	All points agreed and incorporated for assessment.

## Assessment Methodology

### Receptor Sensitivity

13.5 Receptors comprise known and unknown archaeological assets, such as such as World Heritage Sites, Scheduled monuments, designated and non-designated heritage assets etc.



Their potential presence is given in the baseline and further detailed in the Desk0based Assessment (Appendix 13.1).

13.6 The criteria used to determine the value of heritage assets is based on the guidelines set out in Historic England's *Conservation Principles: Policy and Guidance for the Sustainable Management of the Historic Environment (Ref 13.1)*, along with statutory designation and professional judgement.

13.7 In line with the NPPF, for the purposes of this ES Chapter, archaeological 'receptors' are referred to as 'buried heritage assets', and heritage 'significance' is used in place of 'sensitivity'. The use of heritage 'significance' and 'significance of (environmental) effect' are clearly differentiated throughout.

13.8 The value and level of interest for statutory designated assets and non-designated heritage assets are set out in **Table 13.2** below.

**Table 13.2 Value and Significance of Receptors**

Value	Significance	Type
Very High	International / national	World Heritage Sites (WHS), Scheduled Ancient Monuments (SAMs), Grade I* Listed Buildings (LBs), Registered Parks and Gardens (RPGs), Protected Wrecks, Heritage assets of national importance
High	National/regional	Conservation Areas (CAs), Designated historic battlefields, Grade II LBs, Burial grounds, Protected heritage landscapes such as ancient woodland, Heritage assets of regional or county importance
Medium	Sub-regional/district	Heritage assets with district level cultural or education value, Local Authority's Locally Listed Buildings (LLBs).
Low	Local Area	Heritage assets with a local level cultural or education value only
Negligible	Negligible	Historic environment item with no known significant value.

13.9 The magnitude of likely effects is set out in **Table 13.3**



**Table 13.3 Magnitude of Impact**

Magnitude of Impact	Criteria for Assessing Impact Magnitude
Major	Total loss or major / substantial alteration to key elements / features of the baseline (pre-development) conditions such that the post development character/ composition / attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements / features of the baseline conditions such that post development character / composition / attributes of baseline will be materially changed.
Minor	A minor shift away from baseline conditions. Change arising from loss / alteration will be discernible / detectable but not material. The underlying character / composition / attributes of the baseline condition will be similar to the pre- development circumstances / situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a “no change” situation.
Neutral	No impact.

#### Defining the Effect

13.10 Following the identification of baseline conditions, the effect of the Proposed Development on each of the identified receptors is then considered.

13.11 Each effect has also been considered by the nature of the effect likely to occur, made up of judgements considering:

- The size and scale of the effect;
- The susceptibility of the receptor to the proposed change including the setting of the asset;
- The geographical extent of the area of the effect; and
- The duration of the effect and its reversibility.

13.12 Direct impacts on buried heritage assets and their value are likely to result from changes to the physical fabric of the asset. The magnitude of impacts is set out in **Table 13.4**.



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### Nature of Effects

13.13 Depending on the magnitude of impact, effects can be beneficial or adverse. Beneficial and adverse effects would either positively or negatively contribute to the understanding of the asset. Effects to heritage assets of unknown value are based on professional judgement and consideration of the likely loss of such an asset, for example, if this would likely be a partial loss or total loss of an asset.

### Geographic Extent

13.14 The following geographical scales are relevant to this assessment:

- Site wide effects – associated with the area within The Application Site;
- Local effects – associated with local area and nearby receptors;
- District effects – beyond the immediate area;
- Regional effects – within the wider area (e.g. outside of the Core Study Area);  
and
- National effects – affecting the United Kingdom.

### Duration

13.15 Generally, effects on buried archaeology assets are considered to be permanent, whether these are associated with the construction works or the completed Proposed Development, as archaeological assets are irreplaceable.

### Scale of effects

13.16 The scale of effects are determined through combining judgements of value and magnitude using the matrix in **Table 13.4**. The professional judgement of the significance of an effect are made with reference to the assessment matrix.



**Table 13.4 Significance of Effects**

Heritage Value (Significance of Asset)	Magnitude of Impact (Degree of Change)				
	Major	Moderate	Minor	Negligible	Neutral
Very High	Major	Major	Moderate	Minor	No Impact
High	Major	Moderate	Moderate	Negligible	No Impact
Moderate	Moderate	Moderate	Minor	Negligible	No Impact
Low	Minor	Minor	Negligible	Negligible	No Impact
Negligible	Negligible	Negligible	Negligible	Negligible	No Impact

Categorising Likely Significance of Effect

13.17 Effects that are identified as being moderate to major adverse and moderate to major beneficial would be considered to be significant. Effects that are identified as being negligible, minor adverse or beneficial or 'no impact' are considered to be not significant. Major and moderate adverse effects will require mitigation.

Limitation and Assumptions

13.18 The presence of and significance of below ground archaeological remains is often uncertain, until their nature and extent has been sufficiently determined through archaeological fieldwork such as evaluation trenching. Previous archaeological investigations have been carried out across the Application Site

**LEGISLATION, PLANNING POLICY AND GUIDANCE**

Legislation Context

13.19 The statutory framework for heritage in England is as follows:



- The Planning (Listed Buildings and Conservation Areas) Act 1990 provides specific protection for buildings and areas of special architectural or historic interest
- The Ancient Monuments and Archaeological Areas Act 1979 provides specific protection for monuments of national interest

#### National Planning Policy

13.20 The following national planning policies are relevant to the Proposed Development:

- Ministry of Housing, Communities and Local Government, 2021 National Planning Policy Framework

#### Regional and Local Planning Policy

13.21 The following regional and local planning policies are relevant to the Proposed Development:

- Norwich Local Plan Development Management Policies Plan (adopted December 2014) Policy DM9 Safeguarding Norwich's heritage
- Joint Core Strategy for Broadland, Norwich and South Norfolk (adopted January 2014) Policy 1: Addressing climate change and protecting environmental assets

### **BASELINE CONDITIONS**

#### Establishing Baseline Conditions

13.22 The archaeological baseline has been assessed using the Norfolk Historic Environment Record (NHER) data and other available sources including grey literature reports and historic mapping. The intention of the search is to locate known heritage assets which may be affected by the Proposed Development, and to predict and extrapolate the likely effect of the Proposed Development on known and unknown assets.

13.23 In June 2022, Icen Projects prepared an Archaeological DBA and Geoarchaeological Deposit Model (Appendix 13.1) which assessed the potential presence of archaeological assets on the Application Site and within a 500m Study Area (as agreed with NHER). This was supported by drawing on a range of available sources including:



- Historic Environment Record (HER) data obtained from the Norfolk Historic Environment Record (NHER) within a 500m Study Area of the Application Site., for records of designated and non-designated heritage assets (archaeological sites, monuments and find spots, as well as the locations of listed buildings and previous environmental and archaeological investigations).
- NHER) data detailing the results of previous archaeological investigations on the Application Site and in the surrounding 500m Study Area. The NHER data was obtained on 20/05/2022 (ENF152381) and is the copyright of Norfolk County Council 2021.
- Historic England Datasets - Information on statutory Designated Assets data including World Heritage Sites, Scheduled Ancient Monuments and Listed buildings, and any identified Heritage at Risk.
- Reports on past archaeological investigations within the 500m Study Area.
- British Geological Survey (BGS) - Solid and Drift geology digital mapping and geological borehole data.
- Ordnance Survey (OS) maps from their historic first edition through to modern OS mapping. Digital versions of the earlier historic maps, were identified online and examined.
- Historic and modern aerial photography was examined at <https://historicengland.org.uk/images-books/archive/collections/aerial-photos/>
- Reports and borehole logs from previous geotechnical investigations within the Application Site.

13.24 The DBA was undertaken pursuant to professional guidance, issued by the Chartered Institute for Archaeologists and with regard to legislation and policy considerations, and assessed the likely effects resulting from the Proposed Development on potential buried assets using the above sources.

#### Baseline Conditions

13.25 The archaeological baseline of The Application Site is summarised below. For further detail and for maps, plans and images, refer to the Desk-based assessment located in Appendix 13.1. All references to archaeological interventions, findspots and monuments will be contained within parenthesis throughout the document.





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## Geology

13.26 The BGS identifies the underlying geology of the Application Site to be undifferentiated chalk formations of White Chalk Subgroup, with superficial River Terrace Deposits across the majority of the Application Site. In the northeastern corner of the Application Site, the superficial geology is indicated to comprise Alluvium. No superficial geology is indicated to be present on the western boundary region of the Application Site.

13.27 Extensive archaeological and geoarchaeological investigations in the Study Area have confirmed the underlying geology as comprising alluvial silts, with relatively deep deposits of made ground overlying Peat, River Terrace Deposits (sand and gravel) and Chalk bedrock.

13.28 The Application Site is fairly flat with a low point in the northeast and a highpoint in the southwest. The southwestern area of the Application Site is located at a height of c.15m OD which would naturally slope down to the north and east. The natural slope towards the river Wensum has been drastically altered as the northern third of the Application Site has been levelled to create the Carrow Works area. The northern boundary of the Application Site is located at a height of c.1m OD.

13.29 The extensive landscaping associated with the Proposed Development and expansion of Carrow Works, along with river defences and water management, particularly during the post-medieval period, would have resulted in significant landscape modification and redesign and impact on archaeological deposits which predate this expansion.

## Archaeological Baseline

### Designated Heritage Assets

13.30 The Application Site lies partially within the eastern extent of the Bracondale Conservation Area which incorporates the SAM Carrow Priory (SAM 1004031), Grade 1 Listed Carrow Abbey complex, the Grade II Listed Carrow House and parts of the industrial Carrow Works site, including two further Grade II Listed Buildings associated with the works. A small portion of the southeastern extent of Carrow Works also lies within the Trowse Millgate Conservation Area, incorporating two locally listed structures.



13.31 The Norwich City Walls and Towers SAM (SMA1004023) covers a large area, extending around the limits of the later Medieval city. The nearest element of this SAM is located c.120m northwest of the Application Site.

#### Non-designated Heritage Assets

##### Prehistoric

13.32 Material indicative of human activity for the prehistoric period within the Study Area tends to be characterised by individual spot finds.

13.33 Palaeolithic flint objects, including at least five handaxes and a number of flakes, were recovered from gravel terrace deposits exposed during construction work at Carrow Works in 1927-8 (MNF473). The flints were identified as being of the Acheulian-Clactonian culture, although a more recent re-examination of this assemblage suggested that material of more than one industry/age is present. Mammoth remains including a tooth and a tusk fragment were also recovered from these gravel deposits.

13.34 Two Upper Palaeolithic flint blades were also recovered during construction work at the Application Site in 1965. These were found at a depth of approximately 1.2mbgl, although no further information is recorded (MNF74).

13.35 The Study Area also records further evidence of Palaeolithic material outside the Application Site Outline, including the survival of in-situ Upper Palaeolithic flint artefacts at Norwich City Football Club, immediately northwest of the Application Site over the River Wensum (MNF 41766).

13.36 The geoarchaeological deposit model indicates that the untruncated surface of the River Terrace Deposits sealed by peat and alluvium – similar to the setting of the in-situ Upper Palaeolithic remains at Norwich City Football Club - may exist in the north of the Application Site.

13.37 Other evidence recorded in the NHER data includes one blade component, retrieved from a flint assemblage at 191-213 King Street (MNF 766) and some evidence of Palaeolithic flint artefacts at the Read's Flour Mill complex (MNF 26467).



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13.38 Mesolithic flint scatterings were also recorded during the above-mentioned excavations at Norwich City Football Club. Further Mesolithic evidence was present at the King Street site, with a large crested blade, a neat thin blade and several regular tertiary flakes potentially being Mesolithic in date (MNF 766).

13.39 Further early prehistoric material is recorded in the NHER as chance finds. In 1887 a Mesolithic flint tranchet axehead was found at the Application Site (MNF465). This was found within peat at a considerable depth below the surface, although no measurements are recorded. A chance find of three long Mesolithic flint blades were also recovered at the top of Carrow Hill in the early 20th century (MNF467).

13.40 The peat identified in the northeastern corner of the Application Site is likely to have formed from the Mesolithic period onward in a well-vegetated low-energy riparian wetland environment under temperate climatic conditions, reflecting a mosaic of grass/sedge fen and reedswamp environments, perhaps locally fringed by areas of wet woodland (e.g. carr) that existed adjacent to the Rivers Wensum and Yare. The resources available in these environments are likely to have been attractive to local Mesolithic hunter-gatherer communities.

13.41 By the Neolithic period, the Application Site likely had given way to a more open environment, probably as a result of increased agricultural development in the area.

13.42 Early Neolithic worked flints were recorded at the Norwich Riverside development site (MNF 26476).

13.43 Neolithic and Bronze Age worked flints, along with occupational activity in the form of prehistoric pits and post holes were also recorded during the excavations at Norwich City Football Club (MNF 41766).

13.44 During the Bronze Age, the environment became progressively more open and there are indications that cultivated soils were present in the locality, although it is unlikely that the landscape became completely treeless. The evidence of Neolithic and Bronze Age occupation in the vicinity indicates the potential for this to extend into the Application Site, though in areas which have been extensively landscaped and / or subject to bomb damage, it is likely to have been disturbed or completely removed.



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13.45 A pot containing cremated human remains, speculatively dated to the Bronze Age, was recovered c.350m from the Application Site and may be associated with the nearby possible prehistoric settlement on Gas Hill (MNF 344).

13.46 A Bronze Age copper alloy socketed spearhead was recovered from the River Wensum near Carrow Bridge during dredging, c.170m northwest of the Application Site (MNF 503).

13.47 There is scant information for Iron Age activity within the Study Area. A single Iron Age coin was identified during works at Norwich City Football Club (MNF 41766).

13.48 It is likely that the recovery of prehistoric material in the Study Area is primarily the result of deposition from ongoing fluvial erosion of archaeological deposits, including fills of pits cut into in situ prehistoric soil horizons, which may extend southwards across the Application Site.

13.49 The surrounding riverine environment would have provided an attractive occupation setting throughout the prehistoric period, providing important natural resources which were probably utilised for a broad range of activities including grazing, fishing and fowling.

13.50 Surviving areas of river terrace deposits present on the Application Site have the potential to contain significant archaeological material from the prehistoric period, including highly significant Palaeolithic material.

### Roman

13.51 The Application Site is situated away from major known Roman settlements, although some limited evidence for Roman settlement is present in the broader Study Area.

13.52 A dispersed group of finds, including pottery and coins, cremations, burials and archaeological features of Roman date, have been recorded in c.550m northeast, possibly indicating a settlement of this period (MNF63912). The area is located around the point where the projected line of the Roman road leading south from Brampton Roman town would meet the River Yare and includes the Application Site of a possible wharf.

13.53 Roman pottery sherds were identified at the Norwich Riverside development site (MNF26476). A further small amount of pottery sherds have been identified at Norwich City Football Club site (MNF41766).



13.54 The Application Site itself lay some distance from a Roman arterial road network and was not located in the vicinity of any known settlements. The marginal location of the Application Site during this period suggests the Application Site has limited potential for Roman remains or evidence of occupation being present.

### Medieval

13.55 The Application Site likely comprised agricultural or pastoral land until the construction of Carrow Priory in the 12<sup>th</sup> century.

13.56 During this period, increased land reclamation and redevelopment in the north of the Application Site along the River Wensum is thought to have been undertaken to create an area in which to carry out agricultural and maritime industry. Riverside or channel edge structures such as drains, revetments, boats or fishtraps relating to the period may occur within the alluvial clays and channel fills which built up in the earlier palaeochannels.

13.57 Carrow Priory (MNF296) represents the surviving foundations of a Benedictine nunnery that was founded in the 12<sup>th</sup> century. The monument survives as upstanding and buried remains, including the Priory church, and the claustral ranges of the inner precinct. The area encompasses the prioresses house, which survives as the Grade I listed building called Carrow Abbey.

13.58 Previous archaeological work within the Application Site had uncovered substantial archaeological remains. Further information relating to previous archaeological excavations within the Application Site are listed below in the Past Archaeological Investigations within the Application Site section.

13.59 Carrow Priory is of national significance having very high historical, evidential, and architectural heritage values. It represents the remains of an important religious house in England's second largest city during the medieval period. Outside of the known areas of material associated with the upstanding remains of the Priory, there is potential for further significant archaeological material from the medieval period, including highly significant below ground remains associated with the Scheduled Area of the Priory.



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## Post-Medieval

13.60 After the dissolution in the 16<sup>th</sup> century, Carrow Priory gradually fell into ruin, with the only exception being the upstanding early 16th century Grade I Listed Prioress' house, which was maintained as a secular residence (MNF64583). The house and its grounds were eventually acquired by the Colman firm in 1878.

13.61 In 1850, the land north of Carrow Abbey along the river Wensum, which was initially owned by the Norfolk Railway Company, was purchased by Jeremiah James Colman as the new location for the industrial and manufacturing works of the Colman's business which produced mustard. This area became known as Carrow Works, and progressively expanded around the Abbey.

13.62 The industrial buildings at Carrow Works are north of the Abbey, and date from the 1850s onward. The earliest buildings were constructed along the river, in the western part of the Application Site.

13.63 An undated map of Carrow Works, likely from the 1870s, shows the early layout of the factory buildings. The majority of the buildings were to the east, and included counting rooms, paper, starch, and laundry blue factories, mills for flour and mustard, and warehouses for new pickings, mustard, and starch. The fact that the Application Site also contained kilns, cooperage, saw mills, and a carpenter's shop demonstrates that production ranged from the processing of the raw goods to the creation of packaging for the finished products. The plan also shows the network of railway tracks extending throughout the factory complex, which joined up with to the Norfolk Railway Company's line to the west, enabling the efficient transportation of goods off site.

13.64 The surviving foundations of the Priory Church and east range of the monastic buildings were subject to extensive excavation in the 1880-1. A plan of Carrow Abbey based on the excavation is illustrated in Figure 5 of the desk-based assessment. The Prioress's Lodging is the standalone building to the west of the Cloister. The 1885 OS Map shows the central portion of the Application Site containing the Priory.

13.65 The 1887 OS Map shows that Carrow Works expanded eastwards, with the extent of the railway network also visible. Much of the area to the east and south of the works remained open, with cattle and sheep pens adjacent to the railway line.



13.66 Between 1899 and 1909, the Prioress's House was significantly extended and remodelled as seen in the 1914 OS Map. A wing on the southeastern side of the building was also demolished. Stables Cottage, a group of outbuildings south of the Prioress's House, was also built during this period. Glasshouses have been erected to the south-southwest of the Priory buildings and the field to the east side has been landscaped with trees, shrubs and perimeter pathways. The outbuildings to the orchard / kitchen garden to the north of the Prioress's lodging have been redeveloped as a new factory building.

13.67 The expansion of the factory site to include the mustard seed drier (constructed in 1890) and storage complex is also shown. This encroached onto the Priory grounds. Stable and Cottages are constructed to the south of the Priory. To the south of Carrow House a sunken garden has been created with a fountain at the centre

13.68 The 1956 OS Map records a number of new buildings and alterations. Significant bomb damage occurred during the Second World War, with Blocks 201 and 204 being demolished and rebuilt. A new storage silo is present to the northeast of the Priory.

13.69 The 1976 OS Map no longer depicts the network of railway sidings within the factory works. A new access road for articulated lorries is present to the east of the Application Site. This also includes a new car park south of the Priory. Blocks 213 & 213a (Technical Centre) have been constructed to the west of Carrow Abbey. A canteen adjoining to the north of Carrow Abbey is present. The glasshouses and outbuildings associated with the large kitchen garden have been demolished to accommodate a very large distribution shed (Block 224). Block 218 has been erected to the south of the Mustard Seed Drier.

13.70 The 1983 OS Map illustrates the car park to the west of the Stable cottages has been enlarged and a new roadway has been laid out along the western boundary of the Application Site. The large distribution shed on the site of the former kitchen garden (Block 224) has been considerably enlarged on the site of the playing field.

13.71 No significant changes are evident on the OS Maps after this period.

13.72 Since the mid-19<sup>th</sup> century, the Application Site has formed part of a large industrial and manufacturing complex initially owned by the Norfolk Railway Company, before passing into the ownership of the Coleman family who used the works for the production of Coleman's Mustard.



13.73 Post-medieval deposits potentially present within the Application Site will demonstrate a variety of industrial debris assemblages, most notably 19th and 20th century structures and footings associated with increased industrialisation and infrastructure development on the Application Site.

#### Past Archaeological Investigations within the Application Site

13.74 In 1880, J.J. Colman also undertook a major excavation of the Priory, which revealed the surviving elements of the foundations (MNF385/ENF86509).

13.75 The surviving portions of the church, the chapter house and the eastern range were recorded during this excavation. Fragments of a number of other buildings were also identified, along with a boundary wall to the north of the church, that enclosed an area containing several features that were probably cesspits and/or wells.

13.76 Several graves were also identified, these indicating the presence of graveyards both to the north of the church nave and to the east of the chapter house. The presence of a cemetery to the north of the nave had been suggested by earlier discoveries and further burials were encountered in this area on several occasions during the 20th century.

13.77 The Application Site of a possible gatehouse associated with Carrow Priory were also recorded during this excavation, in the northwest corner of the grounds of Carrow Abbey (MNF64579/ENF130619). Steps that led down to a small basement and a least one 'vault' were also recorded, although no remains were identified above ground. A single flint and brick was subsequently recorded here in 1954. It is possible that this building is associated with the post-medieval secular residence at Carrow Abbey.

13.78 Further human remains were found during monitoring of ground works associated with the construction of a works canteen on the Application Site of the Priory church nave (ENF130531). This discovery lies relatively close to the grave identified to the north of the nave during the 19<sup>th</sup> century excavations.

13.79 In the southeast corner of the grounds of Carrow Abbey, the excavation of a gas pipe trench in 1976 revealed medieval floor surfaces and flint rubble walls (MNF64578/ENF130585). The evidence recovered during this work supports the suggestion that this building was associated with Carrow Priory, rather than the earlier, 12th century nunnery.





13.80 A single cesspit was excavated at the possible site of the Priory reredorter in 1978 (ENF6246).

13.81 A programme of consolidation work was undertaken at Carrow Priory in 1981 (ENF95218). Several areas of intact late medieval tiled floor and a series of burials were recorded. Eleven burials of late 12<sup>th</sup> to late 15<sup>th</sup> century date were discovered within the choir and side chapels of the Priory church. Two further burials of possible 13<sup>th</sup> century date were found in what would have been the graveyard to the north of the 12<sup>th</sup> century Priory church, cut by an extension to the north aisle.

13.82 A geophysical survey was also undertaken in 1981, revealing evidence for buried walls on the site of the cloister and the remains of several buildings beyond the east range (ENF130596). The area to the east of Carrow Abbey was investigated with several walls associated with the cloister identified. A large area was also surveyed to the east of the dorter range, revealing a number of additional buildings. Several walls were also identified between the main Priory complex and the eastern boundary of the Priory.

13.83 A watching brief in the northwest area of the Application Site in 2009, in proximity to the large scale industrial units revealed only modern rubble and demolition from landscaping of the area, likely as a result of a post Second World War demolition and clearance (MNF57921/ENF122835).

13.84 A watching brief in the northeast of the Application Site in 2010, close to the culinary unit, revealed an early 20<sup>th</sup> century retaining wall and revetment that had been inserted against the river frontage to stabilise the bank (MNF59870/ENF124305).

## **IDENTIFICATION AND EVALUATION OF KEY EFFECTS**

13.85 The Proposed Development will include will involve the Applicant submitting a hybrid planning application for mixed reuse redevelopment at Carrow Works.

13.86 Full details of the Proposed Development can be found in Chapter 5.

### Effects During Construction

13.87 Demolition of the existing structures on the Application Site will likely include the demolition of below ground structural elements such as basements, foundations and piles/pile



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caps. Below ground demolition and obstruction clearance prior to construction has the potential to impact buried remains.

13.88 The new structures associated with the Proposed Development are likely to have lower ground floor elements, along with foundations extending below ground level. The foundations for elements of the Proposed Development are yet to be determined. The installation of buried services, landscaping and resurfacing will also have a below ground impact. Scheme drawings have been provided with this ES at Appendix 5.

#### Paleoenvironmental

13.89 The Application Site has high potential for palaeoenvironmental archaeological remains. Previous geotechnical site investigations have demonstrated the presence of Holocene peat and alluvial sediments in the northeast corner and Pleistocene River Terrace Deposits across the whole of the Application Site. The peat has a high potential for palaeoenvironmental remains, and the alluvium and River Terrace Deposits have a medium potential for palaeoenvironmental remains. If present, these remains would likely be of sub-regional/district (Medium) significance.

13.90 The magnitude of below ground impacts during construction is considered to be major.

13.91 The Proposed Development would therefore have a direct permanent moderate to major adverse effect (significant) on paleoenvironmental archaeological receptors during the construction phase prior to the implementation of mitigation measures.

#### Prehistoric

13.92 The Application Site has moderate potential for prehistoric archaeological remains. Remains dating to this period would likely be of regional/district (Medium) significance.

13.93 The magnitude of below ground impacts during construction is considered to be major.

13.94 The Proposed Development would therefore have a direct permanent moderate to major adverse effect (significant) on prehistoric archaeological receptors during the construction phase prior to the implementation of mitigation measures.

#### Roman



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13.95 The Application Site has a low potential for Roman archaeological remains. Remains dating to this period would likely be of local area (low) significance.

13.96 The magnitude of below ground impacts during construction is considered to be major.

13.97 The Proposed Development would therefore have a direct permanent minor adverse effect (not significant) on Roman archaeological receptors during the construction phase.

#### Medieval

13.98 The Application Site has high potential for medieval archaeological remains. Remains dating to this period would likely be of national (High) significance.

13.99 The magnitude of below ground impacts during construction is considered to be major.

13.100 The Proposed Development would have a direct permanent major adverse effect (significant) on medieval archaeological receptors during the construction phase.

#### Post-medieval

13.101 The Application Site has a high potential for post-medieval remains. Such remains would be considered as having a negligible/local area (low) significance or sub-regional/district (Medium) significance.

13.102 The magnitude of below ground impacts during construction is considered to be major.

13.103 The Proposed Development would have a direct permanent neutral to moderate adverse effect (not significant) on post-medieval archaeological receptors during the construction phase.

#### Summary

13.104 Based on the evidence presented in the Archaeological desk-based assessment (Appendix 13.1), during construction, the magnitude of impact of the Proposed Development will be major adverse on any surviving archaeological remains. As any archaeology present is likely to range between negligible/local area (low) and national (high) significance, the Proposed Development would have a permanent effect ranging from a neutral to minor adverse (not significant) to major adverse (significant) on the archaeology present, during the construction phase prior to the implementation of mitigation measures.



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## **ASSESSMENT OF CUMULATIVE EFFECTS**

13.105 Below ground demolition and construction on other schemes as listed in Chapter 3 have the potential to negatively impact any below ground archaeological remains that may be present on these sites. Those situated within the Study Area of the archaeology assessment have the potential to contain similar remains to those that may survive on the Application Site. It is assumed that the effects of the other developments do not affect any below ground archaeological remains that may survive on the Application Site.

## **INTER-RELATIONSHIP EFFECTS**

13.106 There are some inter-relationships between this chapter and Chapter 14 Heritage, Townscape and Visual Assessment, although historic structures are not specifically considered within this Chapter, except where they are relevant to the archaeological interpretation of the Application Site.

## **ENHANCEMENT, MITIGATION AND RESIDUAL EFFECTS**

### Mitigation During Construction

13.107 The presence or absence of archaeological assets cannot be determined with certainty unless investigative site works are undertaken.

13.108 Impacts to archaeological assets that may survive on the Application Site are limited to construction phase works. Resulting effects will be permanent and range from negligible/minor adverse to major adverse and would extend across areas of the Application Site where below ground impact occurs.

13.109 The LPA, in consultation with the Senior Historic Environment Advisor, and in accordance with the NPPF, may attach an archaeological condition of planning to permission for the Proposed Development. This may require an initial archaeological site investigation (evaluation) in order to further assess the potential for the survival of significant below ground archaeological remains at the Application Site. The evaluation may also be required to take place pre-determination of the application. If significant remains are seen to be present during the evaluation, a programme of archaeological mitigation may be necessary prior to construction.



13.110 All archaeological site based work would need to take place before below ground impacts relating to construction commence.

13.111 Potential adverse impacts to sub-surface archaeological remains during the construction phase could be successfully mitigated by a programme of archaeological excavation and recording where remains of higher significance are present, or by an archaeological watching brief where remains of lesser significance are present, or a combination of both where necessary. This is typically secured via an appropriately worded pre-commencement condition.

13.112 The method statements, or Written Schemes of Investigation (WSI), detailing the archaeological site investigation, and any subsequent mitigation, would be developed in consultation with the Senior Historic Environment Advisor and submitted against the relevant condition followed by the results of the work. If significant archaeological remains are encountered during mitigation, assessment and publication of the results may also be required.

13.113 Preservation in situ may be required for archaeological remains of appropriately high significance.

13.114 The knowledge gained by performing archaeological mitigation and the making public of the results, is often seen as sufficient to offset the adverse effects of development on surviving archaeological remains on a site.

#### Mitigation Once the Proposed Development is Operational

13.115 It is not anticipated that there would be any effects to archaeological remains once the Proposed Development is operational and therefore no mitigation measures would be required.

#### Residual Effects and Monitoring

13.116 Residual Effects are those which would remain once any proposed mitigation measures are implemented.

13.117 Where the effect on the relationship of a feature to its significance is classified as major or moderate, this is considered to be equivalent to likely significant effects referred to in The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Major and moderate adverse direct effects will require mitigation.



13.118 Effects to archaeological assets that may survive on the Application Site are limited to construction phase activity. All construction activity that has a below ground impact has the potential to adversely impact archaeological remains by causing disturbance or total or partial removal. Such activity may include, but is not limited to, below ground demolition, pile probing, piling, foundation and service excavation, ground reduction, enabling works, ground compaction etc. Where significant effects are anticipated, mitigation measures will be implemented to reduce the potential for likely significant effects to occur as far as possible but in some instances the significant effects cannot be removed in their entirety.

## **SUMMARY**

13.119 With consideration to the archaeology recorded within the 500m Study Area and the nature of the Application Site's topography, geology, and archaeological and historical background, the archaeological potential is:

13.120 Paleoenvironmental remains which can provide information on past environmental conditions and indirect evidence for human activity (e.g., evidence for agriculture and/or industrial activities) (high potential of sub-regional/regional significance).

13.121 Prehistoric remains including cut features and artefacts (medium potential of regional significance).

13.122 Roman remains likely to constitute remains of a residual nature or sparse rural occupational activity (low potential of neutral/local area significance).

13.123 Medieval ecclesiastical features or deposits including inhumations. (High potential of national significance).

13.124 Post-medieval building footings, levelling deposits and 19<sup>th</sup> century infrastructure associated with the former Carrow Works (high potential of neutral/local area to sub-regional significance).

13.125 The Proposed Development will include below ground elements and intrusions, (basements, foundations, piling etc.) with the potential to have an adverse impact on surviving archaeological remains prior to the implementation of mitigation measures.

13.126 The presence or absence of archaeology on the Application Site, along with its significance, can only be confirmed by conducting an on-site investigation prior to construction



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of the Proposed Development. The results of such an investigation would inform any necessary archaeological mitigation measures.

13.127 The assessment has found that there is potential for the survival of unrecorded sub-surface archaeological remains within the Application Site. The adverse direct effect on any such remains will be mitigated by implementing a programme of archaeological works within those undisturbed parts of the Proposed Development to be subject to ground-breaking works. The Proposed Development would have a Minor to Moderate adverse direct impact upon any unrecorded sub-surface archaeological remains, which will be mitigated for by appropriate evaluation and further mitigation if required, in consultation with the Senior Historic Advisor to the LPA.

13.128 Appropriate archaeological mitigation (e.g., trial trench evaluation/Watching Brief) would seek to reduce the residual effects of the Proposed Development.

13.129 It is assumed that the effects of the other developments in conjunction with the Proposed Development would not form an additional cumulative effect on any below ground archaeological remains that may survive on the Application Site.

13.130 Effects on the archaeological assets are confined to the construction phase only.



**Table 13.5: Archaeology Summary Table**

Description of Receptor	Receptor (Sensitivity)	Nature of Effect and Geographic Scale	Magnitude of Impact*	Classification of Effect (Statement of Significance)	Mitigation and Monitoring	Residual Impact** (Statement of Significance)
<b>Construction Effects</b>						
Damage/loss of paleoenvironmental remains	Paleoenvironmental (High)	Permanent adverse, Site-wide	Major	Moderate to Major Adverse (Significant)	Archaeological evaluation followed by preservation in-situ / excavation / watching brief as appropriate	Minor (Not Significant) to Moderate Adverse (Significant)
Damage/loss of prehistoric remains	Prehistoric (Medium)	Permanent adverse, Site-wide	Major	Moderate to Major Adverse (Significant)	Archaeological evaluation followed by preservation in-situ / excavation / watching brief as appropriate	Minor (Not Significant) to Moderate Adverse (Significant)
Damage/loss of Roman remains	Roman (Low)	Permanent adverse, Site-wide	Major	Minor Adverse (Not Significant)	Archaeological evaluation followed by preservation in-situ / excavation / watching brief as appropriate	Neutral (Not Significant)





Damage/loss of medieval remains	Medieval (High)	Permanent adverse, Site-wide	Major	Major Adverse (Significant)	Archaeological evaluation followed by preservation in-situ / excavation / watching brief as appropriate	Moderate Adverse (Significant) to Major Adverse (Significant)
Damage/loss of post-medieval remains	Post-medieval (Low/Medium)	Permanent adverse, Site-wide	Major	Negligible to Minor Adverse / Moderate Adverse (Significant)	Archaeological evaluation followed by preservation in-situ / excavation / watching brief as appropriate	Minor (Not Significant)
Operational Effects						
No impacts on archaeological remains are anticipated once the Proposed Development is operational.						

## REFERENCES

**Ref 13.1** Historic England (2008) Conservation Principles, Policies and Guidance: Policy and Guidance for the Sustainable Management



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## 14 HERITAGE, TOWNSCAPE AND VISUAL IMPACTS

### INTRODUCTION

14.1 This Chapter has been prepared by Icen Projects to provide an assessment of the Built Heritage, Townscape and Visual Effects of the Proposed Development upon the Application Site and its surroundings. It is supported by a detailed Technical Appendix, the Heritage, Townscape and Visual Impact Assessment (Technical Appendix 14.1), which should be referred to when reading this Chapter.

14.2 This assessment has been developed based on a number of full surveys of the Application Site and its surroundings between 2021 and 2022, desk-based research and local archives accessed and informed by the relevant conservation legislation, planning policy and guidance. The initial analysis of the Application Site and baseline material has been collated to aid and inform the design development of the Proposed Development, produced by JTP ('the Architects').

14.3 The heritage, townscape and visual receptors have been identified through the ES Scoping exercise and discussed and agreed with Norwich City Council ("NCC") and Historic England ("HE") as part of the full ES submission. In addition to the ES Scoping exercise, meetings held with NCC and HE have served to generate agreement on a more detailed scope and approach to identifying and assessing views, and to the inclusion and exclusion of heritage assets for assessment. This HTVIA has been developed to be proportionate to the Application Site and the sensitivity of its surroundings in line with the National Planning Policy Framework (NPPF, 2021) paragraph 194.

14.4 In addition to the designated and non-designated heritage assets within the Application Site, portions of Application Site are within the Bracondale Conservation Area, which also covers land beyond the Application Site. There are also a large number of listed buildings, scheduled monuments and non-designated heritage assets ("NDHAs") within the site boundary. A 250m radius around the Application Site has been agreed, the assessment of effects has, where appropriate, grouped heritage assets together, primarily based on location and shared historical and or architectural values. The assessment of effects of the Proposed Development has considered buildings within the site boundary individually. Assets beyond the site boundary potentially affected through a change within their setting described on the basis of the groupings.

14.5 This Chapter will:



- Outline the methodology used for the heritage, townscape and visual assessments;
- Summarise the relevant legislative and policy framework within which to assess the Application Site's townscape and heritage impact;
- Provide a summary of the analysis of the Application Site and surrounding area's historic development, including its heritage assets and townscape receptors;
- Summarise the assessment undertaken of the likely heritage, townscape and visual effects of the Proposed Development during construction and operation with the support of a concise and comprehensive visual impact assessment; and
- Identify both embedded mitigation measures (already incorporated within the Proposed Development) and/or additional mitigation measures where appropriate to avoid, reduce or offset any adverse effects identified. Taking account of mitigation measures, the nature and significance of the likely residual effects are described.

## **ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA**

14.6 The methodology used by Icen Projects to assess the likely effects of the Proposed Development on heritage assets, townscape character and visual amenity is based on best practice guidance set out in Landscape Institute's 'Guidelines for Landscape and Visual Impact Assessment' (GLVIA, Third Edition, 2013) and Townscape Character Assessment Technical Information Note 05/2017 (TIN 05/17, 2018). TIN 05/17 notes that GLVIA3 is 'industry standard guidance' which applies to the scope and approach, however that 'the various physical and cultural aspects which contribute to character may differ' (para.1.4) which highlights the fundamental differences in assessing landscape and townscape.

14.7 Therefore, as recommended in TIN 05/17 and using this guidance, the methodology adapts GLVIA to an urban context where relevant. The purpose of the Heritage, Townscape and Visual Impact Assessment (HTVIA) is to determine whether effects arising from the Proposed Development on built heritage, the townscape and visual amenity are likely to be significant and the extent to which it is likely to enhance environmental resources or detract from them, taking into account any mitigation measures incorporated into its design.

14.8 In urban environments, built heritage, townscape and visual effects tend to be interrelated and it is often appropriate to assess them alongside each other for the benefit of the overall assessment. This HTVIA takes that approach, while recognising that built heritage assessment, and townscape and visual assessment are treated as separate topics in EIA, under the following headings:



- Built Heritage: assessment of the effects of new development on the heritage significance and setting of heritage assets (heritage receptor), including designated and non-designated heritage assets;
- Townscape: assessment of the intrinsic character and components that are distinctive to an urban area (townscape receptor); and
- Visual: assessment of effects on specific views and on the general visual amenity experienced by people at these viewpoints (visual receptors).

### Scoping and Assessment Approach

14.9 In accordance with Regulation 13 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, a scoping exercise has been carried out with the Local Planning Authority ('LPA'), Norwich City Council, identifying the potentially significant environmental issues relating to the Application Site and the Proposed Development. This report outlines the basis of which the Scoping was undertaken to ensure that this exercise ensures the appropriate level of assessment is carried throughout the ES submission.

#### *Heritage Receptors*

14.10 Accordingly, the following Heritage Assets are scoped into this Assessment:

**Table 14.1 – Heritage Assets included within Assessment**

Asset Name	Asset Type	Grade	NHLE Number
Carrow Priory	Scheduled Monument		1004031



Asset Name	Asset Type	Grade	NHLE Number
Norwich City Wall	Scheduled Monument		1004023
Carrow Abbey	Listed Building	Grade I	1205742
Carrow House	Listed Building	Grade II	1292106
Conservatory at Carrow House	Listed Building	Grade II*	1479038
Carrow Works Blocks 7, 7a, 8, 8a including metal canopy attached to block 7	Listed Building	Grade II	1372826
Carrow Works Block 92	Listed Building	Grade II	1116888
Carrow Works Block 60	Listed Building	Grade II	1116887
Walls Steps and paved surfaces of the sunken garden near Carrow Abbey	Listed Building	Grade II	1478318
Former Mustard Seed Drying Shed	Listed Building	Grade II	1478122
K6 Telephone Kiosk outside the entrance to Former Mustard Seed Drying Shed	Listed Building	Grade II	1478657
Lodge, Gardener's Cottage and former cart shed to Carrow Abbey	Listed Building	Grade II	1478591
Flint Wall and 19 attached pet tombs	Listed Building	Grade II	1478166
Eastern Air Raid Shelter at Carrow Works	Listed Building	Grade II	1478214
Late C19 engine house at Trowse Sewage Pumping Station Designation Type: Listing	Listed Building	Grade II	1478264



Asset Name	Asset Type	Grade	NHLE Number
Early C20 engine house, boiler house and coal store at Trowse Sewage Pumping Station Designation Type: Listing	Listed Building	Grade II	1478662
Mill House	Listed Building	Grade II	1372532
Trowse Railway Station	Listed Building	Grade II	1478346
Trowse House	Listed Building	Grade II	1051767
Bracondale Cottage	Listed Building	Grade II	1051346
72, 72a And 72b, Bracondale,	Listed Building	Grade II	1372766
70, Bracondale	Listed Building	Grade II	1051345
Forecourt Wall, Gate And Railings To Number 68,	Listed Building	Grade II	1051344
66, Bracondale	Listed Building	Grade II	1372764
66a, Bracondale	Listed Building	Grade II	1051342
62 And 64, Bracondale	Listed Building	Grade II	1051381
60, Bracondale	Listed Building	Grade II	1372744
Tower And Adjoining Retaining Wall To Rear Of Number 58	Listed Building	Grade II*,	1280541
Manor House	Listed Building	Grade II*,	1051379
51-57, Bracondale	Listed Building	Grade II	1051378
45 And 47, Bracondale	Listed Building	Grade II	1205738
37-43, Bracondale	Listed Building	Grade II	1372742
Numbers 33 And 35 And Attached Garden Wall To East Of Number 35	Listed Building	Grade II	1205728



Asset Name	Asset Type	Grade	NHLE Number
31, Bracondale	Listed Building	Grade II	1051377
29 And 29a, Bracondale	Listed Building	Grade II	1051376
25 And 27, Bracondale	Listed Building	Grade II	1205691
17 And 19, Bracondale	Listed Building	Grade II	1051375
Peppers	Listed Building	Grade II	1051351
1, 1a, 8a, 1b, Ice House Lane	Listed Building	Grade II	1051229
9-12, Ice House Lane	Listed Building	Grade II	1210141
Tower House	Listed Building	Grade II	1051380
South East And South West Boundary To Wall To Number 54 Bracondale	Listed Building	Grade II	1280578
48-52, Bracondale	Listed Building	Grade II	1205750
40-46, Bracondale	Listed Building	Grade II	1372743
Crown Point	Registered Park and Garden	Grade II	1001480
Stables Cottage	Locally Listed Building		
Norwich City Conservation Area	Conservation Area		
Bracondale Conservation Area	Conservation Area		
Trowse Millgate Conservation Area	Conservation Area		

### *Townscape Receptors*

14.11 The following Townscape Character Areas have been identified for assessment (see 5.10 of Technical Appendix HTVIA for an overview of these areas):



**Table 14.2 – Townscape Character areas included within Assessment**

Character Area Name	Character Area Number
Character Area 1 - Carrow Abbey	1
Character Area 2 - 20th Century Offices and Landscape	2
Character Area 3 - Large-scale Industrial units and Utilities	3
Character Area 4 - Large-scale Modern Industrial	4
Character Area 5 – Carrow House and Landscape	5
Character Area 6 – Bracondale Residential	6
Character Area 7 – Industrial Riverside	7
Character Area 8 – Civic and Landscape	8
Character Area 9 – Railway Industrial Character	9

14.12 Finally, the following Townscape Views have been identified for assessment:

**Table 1.3 – Viewpoints included within Assessment**

Viewpoint Number	Viewpoint Name	Description of Location	AVR Typology
1	Carrow Priory	East side of Carrow Abbey orientated North East.	Wireline (as scheme in Outline)
2	Carrow Abbey	West side of Carrow Abbey looking North West.	Wireline
3	Industrial East – West Route	North West of the site and is orientated East along the main route through the Industrial Character Area	Wireline
4	Industrial East – West Route 2	Within the industrial Character Area, orientated Eastwards.	Wireline
5	Industrial East – West Route 3	Within the industrial Character Area, North Carrow Abbey, along the main East-West route through the site.	Wireline
6	Carrow Priory 2	South East side of Carrow Abbey and is orientated East towards the rustic summer house	Wireline





Viewpoint Number	Viewpoint Name	Description of Location	AVR Typology
7	Carrow House Triptych	Gardens of Carrow House, Carrow House Conservatory Steps	Wireline
7a	Carrow House	Access Terrace	Wireline
8	Sunken Garden Triptych	Within the Sunken Garden, orientated Eastwards towards Carrow Abbey.	Wireline
9	Carrow Bridge, River Wensum	Carrow Bridge, it is orientated East along the River Wensum	Wireline
10	Carrow Road Stadium	North of the River Wensum to the North East side of the Carrow Road Stadium close to the intersection between Carrow Road and the A1242	Wireline
11	Whitlingham Broad/Whitlingham Adventure	Whitlingham Adventure, where the Rivers Wensum and Yare meet, Orientated South West	Wireline
12	Wensum North Bank	River Wensum, adjacent to Riverside Heights, orientated East	Wireline
13	Novi Sad Friendship Bridge	River Wensum from the Carrow Bridge, orientated East	Wireline
14	Bracondale	within the Bracondale Conservation Area, along Bracondale	Wireline
15	King Street, junction with Carrow Bridge	King Street, Orientated South	Wireline
16	Carrow Hill	Carrow Hill, Orientated East	Wireline
17	Bracondale Railway Bridge	Bracondale Bridge crossing the Railway Line Orientated North	Wireline



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## Methodology

### Built Heritage

#### Approach to Heritage Assessment

14.13 In assessing the likely effects of the Proposed Development on heritage receptors, the intention is to identify how and to what degree it would affect the setting, heritage significance and special interest of identified heritage assets (built heritage only).

14.14 The methodology for the assessment of potential effects on designated and non-designated heritage assets takes into account national, regional and local planning policy and guidance.

14.15 Heritage assets are defined in the National Planning Policy Framework (NPPF, 2021) as being “a building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest”.

14.16 The term ‘heritage asset’ includes both designated and non-designated heritage assets. Designated heritage assets include World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Park and Gardens, and Conservation Areas. Non-designated heritage assets include locally listed building or structures as identified by the LPA.

14.17 Legislative and policy requirements for the assessment of effects on heritage assets require the assessor to establish whether the heritage significance or value is preserved, better revealed/enhanced or harmed as a result of new development.

14.18 There are two ways in which new development can affect the significance of heritage assets:

- by changes to the fabric of heritage assets, i.e. if the project includes the demolition or alteration of listed buildings, demolition within or changes to the character and appearance of conservation areas, development within registered parks and gardens or demolition or alterations to locally listed buildings of merit (known as direct effects); and
- by changes to the setting of designated or non-designated heritage assets located in the vicinity of the project (known as indirect effects).



- Effects of new development on the significance of heritage assets can range between enhancement and harm and are rated according to the following criteria, where the Proposed Development can:
- 'Better reveal its significance' or 'enhance its significance'. Cause no harm to the significance of the heritage asset, hence 'no effect on its significance';
- In the case of designated heritage assets: cause 'less than substantial harm' to the significance of the heritage asset; or 'substantial harm or loss' to the significance of the heritage asset;
- In the case of non-designated heritage assets: cause 'harm' or 'loss' to the significance of the heritage asset, to be taken into account in making a balanced judgement.

14.19 Paragraphs 199-202 of the NPPF set out the approach to assessing the effects to designated heritage assets, identifying that 'great weight should be given to the asset's conservation' irrespective of the level of harm and that any harm requires 'clear and convincing justification' and should be weighed against the public benefits of the Proposed Development.

14.20 The assessment of effects on non-designated heritage assets follows paragraph 203 of the NPPF. This requires a balanced judgement to be made when weighing applications that affect non-designated heritage assets, having regard to the scale of any harm or loss and the significance of the heritage asset.

14.21 Historic England's Historic Environment Good Practice Advice in Planning, Note 3: The Setting of Heritage Assets (Second Edition, 2017), provides a series of steps to determine the effects of development on the significance of heritage assets through a change in their setting:

Step 1: Identify which heritage assets and their settings are potentially affected by the Proposed Development;

Step 2: Assess the degree to which settings make a contribution to the significance of the heritage asset(s) or allow significance to be appreciated;

Step 3: Assess the effects of the Proposed Development, whether beneficial or harmful, on that significance or on the ability to appreciate it;

Step 4: Consider the ways in which the Proposed Development has sought to maximise enhancement and avoid or minimise harm to the heritage asset.



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Step 5: Rate the overall effect in terms utilised in the NPPF.

14.22 Use is made of Accurate Visual Representations (AVRs) in the assessment of effects on the setting of heritage assets. AVRs illustrate potential change in views, and while views of or from an asset usually play an important part in the setting of an asset, setting is a wider concept which might also depend on other environmental factors or historical relationships between places that are not perceived visually.

14.23 In accordance with Paragraph 194 of the NPPF, the level of detail in the assessments in this HTVIA is proportionate to the importance of the asset.

14.24 Potential effects on the identified built heritage receptors may arise as a result of both the construction and operation of the Proposed Development.

#### *Townscape and Visual Effects*

14.25 The methodology for the assessment of effects on townscape and visual receptors is distinct from that used to assess the effects on built heritage receptors. It considers effects on the townscape resource as a whole and on visual receptors, i.e. people experiencing views. The approach taken is in accordance with the GLVIA (2013), and considers how the Proposed Development will affect the key components of the townscape character and visual amenity. Potential effects on the identified townscape and visual receptors may arise as a result of both the construction and operation of the Proposed Development.

#### *Townscape Receptors*

14.26 In assessing the likely effects of the Proposed Development on Townscape Receptors, the intention is to identify how and to what degree it would affect the elements that make up an area of townscape, including its distinctive character. These elements may include urban grain, building heights, scale, permeability, legibility, sense of place, role of water or planting, or other characteristics. Townscape Character Areas have been identified as townscape receptors and assessed in line with TIN 05/17.

14.27 To undertake the townscape assessment in this HTVIA, the baseline conditions were first established. This included identifying areas of distinct townscape character in proximity to the Application Site, with the potential to be significantly affected by the Proposed Development. These townscape character areas were mapped as appropriate and key characteristics were described, using photography in some cases.



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14.28 Key characteristics may include:

- the context or setting of the urban area or Site;
- the topography;
- the grain of built form and its relationship to historic patterns of development;
- the layout and scale of buildings, including architectural qualities, period and materials;
- patterns of land use, past and present;
- contributions made by vegetation, green space and water bodies;
- contributions made by open space and the public realm; and
- access and connectivity through and across the area.

14.29 Townscape character areas and their key characteristics have been identified in part through the analysis of the area. Where conservation areas are designated in proximity to the Application Site, their appraisals may also be relevant to understanding the key characteristics of the townscape.

14.30 The key qualities or characteristics of the townscape within character areas that are likely to be affected by the Proposed Development are identified within the assessment. Examples of these might be:

- A particular scale or height of development that is characteristic and of value;
- Particular spatial layouts, patterns of development or urban grain;
- Particular relationships between open or green spaces, water bodies or topography;
- Particular features, such as skylines or permeability through the area, that are of importance;
- The overall character or quality/condition of a particular street or series of spaces; and
- Notable aesthetic, perceptual or experiential qualities.

#### *Visual Receptors*

14.31 Assessments of visual effects are focused on the likely effects to visual receptors, i.e. people experiencing townscape views. It identifies representative views and considers changes in visual amenity as a result of Proposed Development using AVRs to accurately model the changes to identified views and visual amenity.



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14.32 Site visits, supported by map analysis and the use of computer models, allow for the identification of publicly accessible viewpoint positions from which the Proposed Development would potentially be visible. Considerations for selecting views include, amongst other factors: the likely maximum visibility of the Proposed Development; tree cover; traffic sign positions; hierarchy of viewpoint (e.g. public or semi-public access); the significance of the place; and ability for surveyors to safely place equipment without obstructing the public realm.

14.33 Views are generally restricted to street level (i.e. 1.6m above ground), as this is from where townscapes are mostly appreciated. The most appropriate of these positions are chosen for formal assessment in consultation with the local planning authority.

14.34 The viewpoints assessed in the HTVIA represent a spread of close, medium and long distance views, and the intention has been to show the Proposed Development at its most visible within those representative views and in its maximum conjunction with sensitive townscape and heritage receptors.

14.35 Views from all directions are included, illustrating the urban relationships likely to arise between the Proposed Development and its surroundings, including heritage assets and other important elements of townscape. In accordance with good practice, the viewpoints are from the public realm.

14.36 The methodology recognises that the AVRs included in the HTVIA have a role to play in illustrating visual effects and the visual amenity of people, but also effects on the characteristics of urban townscapes and landscapes and, where relevant, on the setting of heritage assets

#### *Significance Assessment*

14.37 The assessment of heritage, townscape and visual effects adheres to the following process: i. A description of the receptor and its qualities; ii. Identifying the sensitivity of the receptor; iii. Predicting the magnitude of change to the receptor; iv. Combining the judgements on sensitivity and magnitude of change to identify the resultant effect, including classification of the significance of the effect; and v. Cumulative effect, where applicable.



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## LEGISLATION, PLANNING POLICY AND GUIDANCE

### Legislation

14.38 The relevant legislation for this assessment arises from the **Planning (Listed Buildings and Conservation Areas) Act 1990**. Sections 16, 66 and 72 are of particular relevance to this application, insofar as they put in place a need for local authorities to “pay special regard” or “special attention” to the need to preserve the special interest of listed buildings and their settings, and the character and appearance of Conservation Areas.

14.39 The **Ancient Monuments and Archaeological Areas Act 1979** is also of relevance, insofar as it controls works to Scheduled Monuments under Section 2, permitting works to take place where written permission is provided by the Secretary of State (via Historic England). An application has been accordingly made for Scheduled Monument Consent for works to Carrow Priory.

### National Planning Policy Framework (July 2021)

14.40 Section 16 of the National Planning Policy Framework sets out the government’s advice as to how applications effecting heritage assets should be assessed. It considers designated heritage assets (including listed buildings and conservation areas) and non-designated heritage assets (such as locally listed buildings). Full details are provided in Technical Appendix 14.1, Section 3.0, the key points are outlined below:

- That paragraph 197 Paragraph 197 emphasises that local planning authorities should take account of: the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation; the positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and the desirability of new development making a positive contribution to local character and distinctiveness.
- That Paragraph 199 states that when considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset’s conservation. It emphasises that the weight given to an asset’s conservation should be proportionate to its significance, and notes that this great weight should be given irrespective of whether any potential harm amounts to substantial harm, total loss or less than substantial harm to its



significance. Paragraph 200 subsequently notes that any harm or loss to designated heritage assets requires clear and convincing justification.

- Paragraphs 201 and 202 lay out the “weighing exercise” to be undertaken where harm does arise, in relation, in turn to ‘substantial harm’ and ‘less than substantial harm’ respectively, identifying the need to weigh harms against public benefits (with a greater requirement to do so, and more stringent associated tests for cases where substantial harm arises).
- Paragraph 203 lays out the balancing exercise for non-designated heritage assets, identifying the need to consider the significance of the NDHA, the scale of any harm to significance, and the scale of any public benefits.
- Paragraphs 206 and 207 respectively make clear that opportunities to enhance sites within Conservation Areas and their settings should be encouraged and looked favourably upon, and that not all parts of a Conservation Area may make a positive contribution towards its character and appearance.

### **Statutory Development Plan**

14.41 Norwich City Council’s Local Plan consists of a series of documents, including the Joint Core Strategy, which sets out the Council’s spatial vision and its guiding principles for planning, the Development Management Policies Document, and the Site Allocations and Site Specific Policies Plan, both of which support the strategic objectives set out in the Core Strategy. The relevant policies, in regards to heritage and townscape and visual assessment, are summarised below.

14.42 Norwich City Council is currently working with Broadland District Council, South Norfolk District Council, and Norfolk County Council to prepare a new Local Plan, the Greater Norwich Local Plan (GNLP), which will plan for development until 2036. The GNLP is currently in examination stage.

14.43 The core relevant **Joint Core Strategy (2014)** policy is as follows:

- Policy 2: Promoting Good Design

14.44 The relevant **Norwich Local Plan (2014)** policies are as follows:

- Policy DM1 - Achieving and Delivering Sustainable Development;
- Policy DM3 – Delivering High Quality Design;
- Policy DM9 – Safeguarding Norwich’s Heritage.





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14.45 This assessment has also had regard to Supplementary Planning Documents produced by NCC, including:

- Conservation Area Appraisals for the Bracondale and Norwich City Centre Conservation Areas.

### **Other Material Considerations**

14.46 Additionally, regard has been had to two advice documents produced by Historic England, from its “Historic Environment Good Practice in Planning” series:

- GPA2: Managing Significance in Decision-Taking;
- GPA3: The Setting of Heritage Assets

14.47 Additionally, the Landscape Institute’s Guidelines for Landscape and Visual Impact Assessment III (GLVIA3) has also been used as best practice guidance for undertaking TVI assessments, and is referred to within the Technical Appendix as such.

## **BASELINE CONDITIONS**

### **Historic Development Summary**

14.48 The Application Site sits outside the historic City Walls of Norwich, next to the river Wensum, and within sight of the remaining walls and towers that show where Norwich’s walled medieval city ended. Although there had been an earlier hospital on the site, the Application Site’s history begins in earnest in 1148, with the foundation of Carrow Priory, a Benedictine foundation. Over its life, it became a substantial institution, its Priory Church’s nave being second only in length to the Cathedral in Norwich.

14.49 Dissolved in 1538 with the rest of England’s monasteries and nunneries, the Priory’s buildings were predominantly demolished, plundered for building stone, with the sole exception of the Prioress’s Lodging, the building that would, over time, come to be known as Carrow Abbey. Originally gifted by Henry VIII to Anne Boleyn’s uncle, Sir John Shelton, the house passed through various ownerships until it came into the ownership of J.J. Colman and his family in 1878. By this point, the Colman family already owned the land north of the Abbey, along the river, having moved his factory to this location from Stoke Mill, four miles south of Norwich, between 1856 and 1862.



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14.50 Colman's factory was dedicated to the production of mustard, laundry starch and blue, which was to become known as Carrow Works. Colman's, at this point already famous for producing a mustard flour with the brown husk removed, to create its bright yellow colour, developed the Application Site quickly, and a few buildings, including the Counting House and Blocks 7 and 8, remain from the latter part of the nineteenth century. Aerial views and prints used as part of Colman's advertising show the Application Site's northern, riverside portion as densely packed with factory buildings and warehouses.

14.51 When the Colman family took ownership of the Abbey in 1878, they initially used the Prioress's Lodging as a Library, but from 1880 onwards, with the assistance of the Norwich architect Edward Boardman, they began to turn it into a family home, with stables, lodges, and other associated buildings. Colman also, at the same time, initiated a major excavation of the Priory; elsewhere in the City, JJ Colman was also a major funder of works to bring the Castle and Blackfriars' Hall into the City's ownership (with Boardman being the architect of the Castle Keep's fanciful reconstruction).

14.52 Between 1899 and 1909, Boardman and his son heavily extended Carrow Abbey for the Colmans, and the factory continued to grow along the Wensum; by this point Colman's was one of the biggest companies in the United Kingdom. Having acquired Keen Robinson, producer of Keen's Mustard, but also, crucially, Robinson's Barley Waters, the company diversified its production within the Application Site. Development began to spread within the eastern part of the Application Site, formally a walled garden, up to the railway line.

14.53 During the Second World War, air raid shelters were constructed within the Works, to allow the Application Site to continue production in support of the war effort (the ability of mustard to flavour bland food being seen as a means of maintaining morale throughout rationing). The Application Site was heavily bomb-damaged, necessitating repair, and this precipitated a further period of rapid advancement in automation and technical innovation, creating the Works site that we see today, combining Victorian factory buildings with functional, efficient, large-scale production buildings of the post-war period.

14.54 Unilever acquired Colman's in 1995 (whilst Britvic bought the Robinson's side of the business), ultimately deciding to close the Works in 2018-2019. Mustard production remains active under the Colman's brand close to Norwich, in Easton.



## Summary of Significance of Heritage Assets

14.55 Those heritage receptors which have the highest significance are located within the central core of the Application Site, around the site of the original Carrow Priory. These are the earliest buildings on the Application Site and depict how the Application Site would have functioned when it was used as a nunnery between the 12th and 16th centuries. These buildings have an enclosed setting, which is surrounded by a mix of formal gardens and heavy mature tree coverage. Buildings with slightly less significance were constructed in the late 19th century, during the initial occupation of the Application Site by the Colman Family. These include a mix of residential and factory buildings.

14.56 The most significant factory buildings sit to the north west of the Application Site. The late 19th century residential buildings of high significance are located to the south of the Abbey have an Arts and Crafts style, typical of the late Edwardian era. These buildings adds to the eclectic character of outbuildings added to the Carrow Abbey estate. There are buildings of low significance on the Carrow Abbey estate, typically these were constructed after the Second World War and reflect the changing needs of industrial sites at the time. These low significance buildings are of poor quality and aesthetic value; they are of a common typology found across the UK. In summary, the significance of heritage assets varies across the Application Site, depending on their relationship with one another, and the Application Site's functioning and contrasting uses from the 12th century.

14.57 Outside the site boundary are a number of assets, largely of a Medium Sensitivity (being Grade II listed, or a Conservation Area), with the occasional higher sensitivity, Grade II\* listed building or Scheduled Monument.

**Table 14.3 – Heritage Assets: Sensitivity Summary**

Asset Name	Asset Type	Asset Grade	Sensitivity
Carrow Priory	Scheduled Monument		High



Asset Name	Asset Type	Asset Grade	Sensitivity
Norwich City Wall	Scheduled Monument		High
Carrow Abbey	Listed Building	Grade I	High
Carrow House	Listed Building	Grade II	Medium
Conservatory at Carrow House	Listed Building	Grade II*	High
Carrow Works Blocks 7, 7a, 8, 8a including metal canopy attached to block 7	Listed Building	Grade II	Medium
Carrow Works Block 92	Listed Building	Grade II	Medium
Carrow Works Block 60	Listed Building	Grade II	Medium
Walls Steps and paved surfaces of the sunken garden near Carrow Abbey	Listed Building	Grade II	Medium
Former Mustard Seed Drying Shed	Listed Building	Grade II	Medium
K6 Telephone Kiosk outside the entrance to Former Mustard Seed Drying Shed	Listed Building	Grade II	Medium
Lodge, Gardener's Cottage and former cart shed to Carrow Abbey	Listed Building	Grade II	Medium
Flint Wall and 19 attached pet tombs	Listed Building	Grade II	Medium
Eastern Air Raid Shelter at Carrow Works	Listed Building	Grade II	Medium
Late C19 engine house at Trowse Sewage Pumping Station Designation Type: Listing	Listed Building	Grade II	Medium
Early C20 engine house, boiler house and coal store at Trowse Sewage Pumping Station Designation Type: Listing	Listed Building	Grade II	Medium



Asset Name	Asset Type	Asset Grade	Sensitivity
Mill House	Listed Building	Grade II	Medium
Trowse Railway Station	Listed Building	Grade II	Medium
Trowse House	Listed Building	Grade II	Medium
Bracondale Cottage	Listed Building	Grade II	Medium
72, 72a And 72b, Bracondale,	Listed Building	Grade II	Medium
70, Bracondale	Listed Building	Grade II	Medium
Forecourt Wall, Gate And Railings To Number 68,	Listed Building	Grade II	Medium
66, Bracondale	Listed Building	Grade II	Medium
66a, Bracondale	Listed Building	Grade II	Medium
62 And 64, Bracondale	Listed Building	Grade II	Medium
60, Bracondale	Listed Building	Grade II	Medium
Tower And Adjoining Retaining Wall To Rear Of Number 58	Listed Building	Grade II*	High
Manor House	Listed Building	Grade II*	High
51-57, Bracondale	Listed Building	Grade II	Medium
45 And 47, Bracondale	Listed Building	Grade II	Medium
37-43, Bracondale	Listed Building	Grade II	Medium
Numbers 33 And 35 And Attached Garden Wall To East Of Number 35	Listed Building	Grade II	Medium
31, Bracondale	Listed Building	Grade II	Medium
29 And 29a, Bracondale	Listed Building	Grade II	Medium
25 And 27, Bracondale	Listed Building	Grade II	Medium
17 And 19, Bracondale	Listed Building	Grade II	Medium
Peppers	Listed Building	Grade II	Medium
1, 1a, 8a, 1b, Ice House Lane	Listed Building	Grade II	Medium
9-12, Ice House Lane	Listed Building	Grade II	Medium
Tower House	Listed Building	Grade II	Medium



Asset Name	Asset Type	Asset Grade	Sensitivity
South East And South West Boundary To Wall To Number 54 Bracondale	Listed Building	Grade II	Medium
48-52, Bracondale	Listed Building	Grade II	Medium
40-46, Bracondale	Listed Building	Grade II	Medium
Crown Point	Registered Park and Garden	Grade II	Medium
Stables Cottage	Locally Listed Building		Low
Norwich City Conservation Area	Conservation Area		Medium
Bracondale Conservation Area	Conservation Area		Medium
Trowse Millgate Conservation Area	Conservation Area		Medium

### Summary of Townscape Sensitivity

14.58 The most distinctive areas of townscape character areas are found in the more historical parts of the city, mostly the more densely built-up areas of Norwich, which are located within the medieval city boundary and along the River Wensum. Those character areas identified within this assessment are comparably not of such a high quality and are less sensitive than those within city core. The Application Site sits within an urban fringe area, is a relatively enclosed and self-contained area which comprises of a wide variety of building types within distinctive character areas. This includes the distinctive Industrial buildings of large footprint and scale and the open and historic setting of the Priory. The townscape has been subdivided into nine distinct character areas ranging from medium to low sensitivity, a summary of their individual sensitivity is presented in table 1.5 below.

**Table 14.4 – Townscape Areas: Sensitivity Summary**

Character Area Name	Character Area Number	Sensitivity
Carrow Abbey	1	Medium



Character Area Name	Character Area Number	Sensitivity
20th Century Offices and Landscape	2	Medium
Large-scale Industrial units and Utilities	3	Medium
Large-scale Modern Industrial	4	Low
Carrow House and Landscape	5	Medium
Bracondale Residential	6	Low
Industrial Riverside	7	Medium
Civic and Landscape	8	Low
Railway Industrial Character	9	Medium

**Table 14.5 – Townscape Views: Sensitivity / Susceptibility Summary**

Viewpoint Number	Viewpoint Name	Sensitivity	Susceptibility
1	Carrow Priory	High	High
2	Carrow Abbey	High	High
3	Industrial East – West Route	Medium	Medium
4	Industrial East – West Route 2	Low	Low
5	Industrial East – West Route 3	Low	Low
6	Carrow Priory 2	High	High
7	Carrow House Triptych	High	Medium
7a	Carrow House	Medium	Medium
8	Sunken Garden Triptych	High	Medium
9	Carrow Bridge, River Wensum	Medium	Low
10	Carrow Road Stadium	Low	Low
11	Whitlingham Broad/Whitlingham Adventure	High	Low
12	Wensum North Bank	Medium	Medium
13	Novi Sad Friendship Bridge	Low	Low



Viewpoint Number	Viewpoint Name	Sensitivity	Susceptibility
14	Bracondale	High	High
15	King Street, junction with Carrow Bridge	Low	Low
16	Carrow Hill	Medium	Medium
17	Bracondale Railway Bridge	Low	Low

## IDENTIFICATION AND EVALUATION OF KEY EFFECTS

### Demolition and Construction Effects

#### Built Heritage

14.59 Construction effects will vary for heritage receptors subject to proximity to the site. Those assets within the Application Site itself will experience more direct effects during the Construction process, as construction will take place around them. Further afield, assets are increasingly well-screened and distanced from the Application Site, preventing harmful effects in terms of noise, vibration, dust generation and visual impact

14.60 Heritage Assets within the site boundary assessed include: Carrow Abbey (LE: 1205742), Carrow Works Block 7, 7a, 8a, 8 and canopy (LE:1372862), Carrow Works Block 92 (LE: 1116888), Carrow Works Block 60 (LE: 1116887), Carrow Priory (LE: 1004031), Walls steps and paved surfaces of the sunken garden near Carrow Abbey (LE: 1478318), Former Mustard Seed Drying Shed (LE: 1478122), K6 Telephone Kiosk outside the entrance of the former mustard seed drying shed (LE: 1478657), Lodge, gardener's cottage and former cart shed to Carrow Abbey (LE: 1478591), Flint wall and 19 attached pet tombs (LE: 1478166) Eastern air raid shelter at Carrow Works (LE: 1478214) Bracondale Conservation Area.

14.61 All assets above are included in the Proposed Development and will therefore be directly affected by the demolition and construction. The Proposed Development will be phased, given its scale, and therefore the impacts on these assets will not be consistent across the entirety of the Construction period. Instead, different assets and areas are often insular, and screened from surrounding areas. As an example, Carrow Abbey, Carrow Priory, and the other associated assets within this part of the Application Site would be well-screened from the development zone to the east, and the effect of construction in this area would be considerably





reduced, when compared to the effect of construction within the immediate vicinity of these assets.

14.62 For the remaining built heritage receptors further away with great screening effects by intervening development, there would be either a temporary minor adverse effect or negligible effect on their settings from visible machinery and construction infrastructure. This effect would be temporary and reversible.

14.63 Construction activities such as removal of fabric demolition and construction activity in close proximity, use of hoardings and visible machinery infrastructure may have a temporary major to moderate adverse effect on the significance of built heritage receptors in the closest proximity, but this effect would be temporary and reversible.

14.64 For the remaining built heritage receptors further away, there are great screening effects by intervening development, resulting in either a temporary minor adverse effect or negligible effect on their settings from visible machinery and construction infrastructure. This effect would be temporary and reversible.

### **Mitigation Measures**

14.65 As part of this hybrid planning submission a mitigation strategy has been outlined in order to minimise any adversity identified. The mitigation of potential construction effects would follow industry best practice construction standards. The phasing of the Proposed Development would reduce the intensity of the construction effects in the setting of receptors. This would generally mitigate the construction effects for those receptors in close proximity to a temporary moderate to minor adverse effect. For those receptors further away, the temporary minor adverse to negligible effect would remain.

### Townscape and Visual Effects

### **Operational Effects**

#### Built Heritage

14.66 The operational effects on built heritage receptors generally range from minor neutral to moderate beneficial. It is found that the scale, nature and siting of the proposals would overall preserve the special interest and significance of the majority of assets, although in the case of



Carrow Abbey and Priory a Major Adverse Effect has been identified. It should be noted, however, that the nature of the works to convert the Abbey are such that the degree of intervention into the fabric is minimal, and the change of use to residential is considered the least harmful option to restore a function to the building and achieve a sustainable and Optimum Viable Use. Mitigations also exist, as will be seen to reduce this harm in residual terms.

14.67 It is also of note that, in our assessment, the Bracondale Conservation Area, while experiencing a largescale change, would not experience harm to its significance or sensitivity, and would therefore experience a neutral effect on balance. The area's special architectural and historic character would be preserved. In the other instances where significant resultant effects have been identified, these are neutral or beneficial and heritage significance and setting is preserved. When considered alongside cumulative schemes, there would be little change to the assessed operational effects. This is due to the self-contained nature of the Application Site, and the Proposed Development of the emerging context of the surroundings.

**Table 14.6 – Heritage Assets: Summary of Operational Effects**

Asset Name	Sensitivity	Magnitude of Change	Residual Effect
Carrow Priory	High	Medium	Moderate Adverse
Norwich City Wall	High	Low	Minor Neutral
Carrow Abbey	High	Medium	Moderate Adverse
Carrow House	Medium	Medium	Moderate Neutral
Conservatory at Carrow House	High	Medium	Major Neutral
Carrow Works Blocks 7, 7a, 8, 8a including metal canopy attached to block 7	Medium	Medium	Moderate Beneficial
Carrow Works Block 92	Medium	Medium	Moderate Beneficial
Carrow Works Block 60	Medium	Medium	Moderate Beneficial
Walls Steps and paved surfaces of the sunken garden near Carrow Abbey	Medium	Medium	Moderate Beneficial
Former Mustard Seed Drying Shed	Medium	Medium	Moderate Beneficial
K6 Telephone Kiosk outside the entrance to Former Mustard Seed Drying Shed	Medium	Medium	Moderate Beneficial



Asset Name	Sensitivity	Magnitude of Change	Residual Effect
Lodge, Gardener's Cottage and former cart shed to Carrow Abbey	Medium	Medium	Moderate Beneficial
Flint Wall and 19 attached pet tombs	Medium	Medium	Moderate Beneficial
Eastern Air Raid Shelter at Carrow Works	Medium	Low	Minor Beneficial
Late C19 engine house at Trowse Sewage Pumping Station Designation Type: Listing	Medium	Low	Minor Neutral
Early C20 engine house, boiler house and coal store at Trowse Sewage Pumping Station Designation Type: Listing	Medium	Low	Minor Neutral
Mill House	Medium	Low	Minor Neutral
Trowse Railway Station	Medium	Low	Minor Neutral
Trowse House	Medium	Low	Minor Neutral
Bracondale Cottage	Medium	Low	Minor Neutral
72, 72a And 72b, Bracondale,	Medium	Low	Minor Neutral
70, Bracondale	Medium	Low	Minor Neutral
Forecourt Wall, Gate And Railings To Number 68,	Medium	Low	Minor Neutral
66, Bracondale	Medium	Low	Minor Neutral
66a, Bracondale	Medium	Low	Minor Neutral
62 And 64, Bracondale	Medium	Low	Minor Neutral
60, Bracondale	Medium	Low	Minor Neutral
Tower And Adjoining Retaining Wall To Rear Of Number 58	High	Low	Major Neutral
Manor House	High	Low	Major Neutral
51-57, Bracondale	Medium	Low	Minor Neutral



Asset Name	Sensitivity	Magnitude of Change	Residual Effect
45 And 47, Bracondale	Medium	Low	Minor Neutral
37-43, Bracondale	Medium	Low	Minor Neutral
Numbers 33 And 35 And Attached Garden Wall To East Of Number 35	Medium	Low	Minor Neutral
31, Bracondale	Medium	Low	Minor Neutral
29 And 29a, Bracondale	Medium	Low	Minor Neutral
25 And 27, Bracondale	Medium	Low	Minor Neutral
17 And 19, Bracondale	Medium	Low	Minor Neutral
Peppers	Medium	Low	Minor Neutral
1, 1a, 8a, 1b, Ice House Lane	Medium	Low	Minor Neutral
9-12, Ice House Lane	Medium	Low	Minor Neutral
Tower House	Medium	Low	Minor Neutral
South East And South West Boundary To Wall To Number 54 Bracondale	Medium	Low	Minor Neutral
48-52, Bracondale	Medium	Low	Minor Neutral
40-46, Bracondale	Medium	Low	Minor Neutral
Crown Point	Medium	Low	Minor Neutral
Stables Cottage	Low	Medium	Minor Neutral
Norwich City Conservation Area	Medium	Low	Minor Neutral
Bracondale Conservation Area	Medium	High	Major Neutral
Trowse Millgate Conservation Area	Medium	Low	Minor Neutral

### Townscape and Visual Effects

14.68 The Proposed Development would have either a moderate beneficial, minor beneficial, negligible neutral, or no effect on the townscape character areas. When considered alongside cumulative schemes, there would be little change to the assessed operational effects due to the Proposed Development being characteristic of the emerging context of the surroundings. From the ground surrounding Carrow Abbey there is the potential for the upper parts of new residential



buildings to appear in the background in some view positions. However, this would not detract from the townscape and would in fact be consistent with existing largescale built form on the Application Site and of the emerging townscape. In the local views within northern portion of the Application Site, the architecture, scale, bulk and mass of the Proposed Development will become more apparent. Where visible, the Proposed Development will be experienced as a high-quality addition to the townscape, offering significant improvement over the current arrangement. This is achieved through considered architecture for both the commercial and residential elements, with appropriate use of brick, varied fenestration, and enforcing the unique heritage interest of character areas through distinctive and interpretive design. Overall, the Proposed Development would have either beneficial, neutral, negligible, or no visual effect (no effect has been identified where the Proposed Development is completely occluded by intervening townscape, and therefore not visible). Therefore, visual amenity would be maintained or enhanced by the Proposed Development.

**Table 14.7 – Townscape Areas: Summary of Operational Effects**

Character Area Name	Character Area Number	Sensitivity	Magnitude of Change	Residual Effect
Carrow Abbey	1	Medium	High	Major Neutral
20th Century Offices and Landscape	2	Medium	Medium	Moderate Beneficial
Large-scale Industrial units and Utilities	3	Medium	Medium	Moderate Beneficial
Large-scale Modern Industrial	4	Low	High	Moderate Beneficial
Carrow House and Landscape	5	Medium	Low	Minor Beneficial
Bracondale Residential	6	Low	Low	Negligible
Industrial Riverside	7	Medium	Low	Minor Beneficial
Civic and Landscape	8	Low	Low	Negligible
Railway Industrial Character	9	Medium	Medium	Moderate Beneficial



**Table 14.8 – Townscape Views: Summary of Operational Effects**

View point Number	Viewpoint Name	Sensitivity	Susceptibility	Magnitude of Change	Residual Effect
1	Carrow Priory	High	High	Medium	Major-Neutral
2	Carrow Abbey	High	High	Medium	Major-Beneficial
3	Industrial East – West Route	Medium	Medium	Medium	Moderate Beneficial
4	Industrial East – West Route 2	Low	Low	Medium	Moderate Beneficial
5	Industrial East – West Route 3	Low	Low	Medium	Moderate Beneficial
6	Carrow Priory 2	High	High	Low	Moderate Neutral
7	Carrow House Triptych	High	Medium	Low	Negligible
7a	Carrow House	Medium	Medium	Medium	Moderate Beneficial
8	Sunken Garden Triptych	High	Low	Low	Minor Beneficial
9	Carrow Bridge, River Wensum	Medium	Low	Low	Minor Beneficial
10	Carrow Road Stadium	Low	Low	Low	Minor Beneficial
11	Whitlingham Broad/Whitlingham Adventure	High	Low	Low	Negligible
12	Wensum North Bank	Medium	Medium	Medium	Moderate Beneficial
13	Novi Sad Friendship Bridge	Low	Low	Low	Minor Neutral
14	Bracondale	High	High	Low	Negligible
15	King Street, junction with Carrow Bridge	Low	Low	Medium	Minor Beneficial



View point Number	Viewpoint Name	Sensitivity	Susceptibility	Magnitude of Change	Residual Effect
16	Carrow Hill	Medium	Medium	Medium	Moderate Neutral
17	Bracondale Railway Bridge	Low	Low	Medium	Minor Beneficial
18	Carrow House Access Terrace	Low	Low	Medium	Minor Beneficial

### **ASSESSMENT OF CUMULATIVE EFFECTS**

14.69 When considered alongside cumulative schemes, there would be little change to the assessed operational effects due to the Proposed Development being characteristic of the emerging context of the surroundings. Cumulative effects would remain unchanged.

### **INTER-RELATIONSHIP EFFECTS**

14.70 There are some inter-relationships between this assessment and the Chapter related to Archaeology, insofar as that chapter assesses buried, rather than built heritage assets. The single asset with a particular overlap is Carrow Priory Scheduled Monument. This chapter assesses the asset in terms of its setting as a heritage asset with an above-ground manifestation, whilst the Archaeology chapter assesses the potential effect on its buried form.

### **ENHANCEMENT, MITIGATION AND RESIDUAL EFFECTS**

14.71 The significance and sensitivity of the Application Site have been considered throughout the application process and an approach agreed with NCC which is sensitive to the historic environment.

14.72 The EIA and the design evolution of the Proposed Development have adopted a considered design process, in order to avoid, reduce or offset negative changes. These measures are considered 'embedded mitigation' and are presented in full in the Design and Access Statement.

14.73 The residual effects of the Proposed Development have been assessed as part of this chapter of the EIA, each heritage receptor and townscape character area have been identified



within tables 14.6-14.7. It is expected that various further mitigation measures will be secured through planning conditions.

## **SUMMARY**

14.74 Overall, the proposal offers a high standard of design that has considered the urban context. The Proposed Development would largely give rise to predominantly beneficial, neutral or negligible effects and would enhance the visual amenity and townscape character of the Application Site. The only adverse effect identified, concern works to convert the Abbey to a sustainable use. The clear benefits of bringing this building back into active use have been carefully considered to ensure minimal intervention into historic fabric. This assessment has recognised that a residential use is likely to be the Optimum Viable Use.

14.75 Though the Proposed Development would offer some enhancement to the setting of Carrow Abbey through the replacement of negative contributors, reinstating the historic detachment of the building, there is nevertheless considered to be some residual harm to the Priory and setting of the Abbey through the subdivision of the grounds. This will disrupt one's appreciation of Scheduled Monument and the Grade I listed Abbey. Paragraph 202 of the NPPF states that 'where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal including, where appropriate, securing its optimum viable use'. It is our conclusion that the benefits of being able to deliver a viable scheme that will facilitate the regeneration of the area outweighs the less than substantial harm identified to Carrow Priory and its setting.

14.76 The functions of the Application Site are currently redundant with numerous heritage assets currently at risk of dissociation through dereliction and disuse. While still adjacent to industrial built form and large scale redevelopment to the north of the river, due to topography, riverside location, and mature screening the Application Site has a degree of isolation from the surrounding townscape. Additionally, considering its former use, the Application Site is considered capable of sustaining considerable change. The proposed massing, siting, bulk, scale and architecture has been carefully considered so that the submitted Proposed Development is deemed appropriate in views and townscape. The assessment concludes that while some harm has been identified, this would be balanced against a number of clear heritage benefits across the Application Site as a whole, including regeneration of the area and preservation of key heritage assets. Overall, the character of the surrounding townscape would be enhanced due to the carefully considered and high-quality design which has drawn on the historic context of the Application Site.





**Table 14.9: Effects during Demolition and Construction Summary Table**

Receptor	Residual Effect	With Mitigation	List of Affected Receptors
Heritage Receptors - during demolition and construction	Temporary major to moderate adverse for receptors in close proximity to the Site	Temporary moderate to minor adverse for receptors in close proximity to the Site	Carrow Priory, Carrow Abbey, Carrow Works Blocks 7, 7a, 8, 8a including metal canopy attached to block 7, Carrow Works Block 92, Carrow Works Block 60, Walls Steps and paved surfaces of the sunken garden near Carrow Abbey, Former Mustard Seed Drying Shed, K6 Telephone Kiosk outside the entrance to Former Mustard Seed Drying Shed, Lodge, Gardener's Cottage and former cart shed to Carrow Abbey, Flint Wall and 19 attached pet tombs
	Temporary minor adverse or negligible effects for the remaining built heritage receptors	Temporary minor adverse or negligible	Norwich City Wall, Carrow House, Conservatory at Carrow House, Eastern Air Raid Shelter at Carrow Works, Grouping 1 – Trowse, Grouping 2 – Bracondale South, Grouping 3 – Bracondale West Crown Point
Townscape Receptors	Close-range townscape receptors:	Temporary moderate adverse	Character Area 1 - Carrow Abbey,



Receptor	Residual Effect	With Mitigation	List of Affected Receptors
– during demolition and construction	temporary moderate to major adverse		Character Area 2 - 20th Century Offices and Landscape, Character Area 3 - Large-scale Industrial units and Utilities, Character Area 4 - Large-scale Modern Industrial Character
	Medium-distance townscape receptors: temporary minor to moderate adverse	Temporary minor adverse	Area 5 – Carrow House and Landscape, Character Area 6 – Bracondale Residential, Character Area 7 – Industrial Riverside, Character Area 8 – Civic and Landscape, Character Area 9 – Railway Industrial Character
	Long-distance townscape receptors: temporary negligible to minor adverse	Temporary minor adverse or negligible	Area 7 – Industrial Riverside Character
Visual Receptors – during demolition and construction	Close-range visual receptors: temporary moderate to major adverse	Temporary moderate adverse	Views - 1, 2, 3, 4, 5, 6, 8, 19,
	Medium-distance visual receptors: temporary minor to moderate adverse	Temporary minor adverse	Views 7, 9, 12, 13, 14, 15, 16, 17,



Receptor	Residual Effect	With Mitigation	List of Affected Receptors
	Long-distance visual receptors: temporary negligible to minor adverse	Temporary minor adverse or negligible	Views 10, 11,

## REFERENCES

**Ref 14.1:** Carrow Abbey Visitors Information

**Ref 14.2:** Britain from Above <https://www.britainfromabove.org.uk/>

**Ref 14.3** George Plunkett's Photographs of Old Norwich

<http://www.georgeplunkett.co.uk/Website/index.htm>

**Ref 14.4** Grace's Guide to British Industrial History

[https://www.gracesguide.co.uk/J.\\_and\\_J.\\_Colman](https://www.gracesguide.co.uk/J._and_J._Colman)

[https://www.gracesguide.co.uk/1914\\_Who's\\_Who\\_in\\_Business:\\_Company\\_C](https://www.gracesguide.co.uk/1914_Who's_Who_in_Business:_Company_C)

[https://www.gracesguide.co.uk/1926\\_Institution\\_of\\_Mechanical\\_Engineers:\\_Visits\\_to\\_Works](https://www.gracesguide.co.uk/1926_Institution_of_Mechanical_Engineers:_Visits_to_Works)

**Ref 14.5** Historic England Archive, Architectural Red Box Collection

<https://historicengland.org.uk/images-books/photos/englands-places/>

**Ref 14.6** Norfolk Historic Environment Record

Carrow Bridge: <https://www.heritage.norfolk.gov.uk/record-details?MNF843-Carrow-Bridge&Index=11&RecordCount=29&SessionID=fa3ada7a-dc04-46f1-b4b6-051697f6e8c8>

**Ref 14.7** Carrow House: <https://www.heritage.norfolk.gov.uk/record-details?MNF26478-Carrow-House&Index=14&RecordCount=29&SessionID=fa3ada7a-dc04-46f1-b4b6-051697f6e8c8>

Carrow Works: <https://www.heritage.norfolk.gov.uk/record-details?MNF26409-Carrow-Works>

**Ref 14.8** Priory of St Mary of Carrow (Carrow Priory) and Carrow Abbey house and grounds:

[https://www.heritage.norfolk.gov.uk/record-details?MNF296-The-Priory-of-St-Mary-of-Carrow-\(Carrow-Priory\)-and-Carrow-Abbey-house-and-grounds&Index=2&RecordCount=29&SessionID=fa3ada7a-dc04-46f1-b4b6-051697f6e8c8](https://www.heritage.norfolk.gov.uk/record-details?MNF296-The-Priory-of-St-Mary-of-Carrow-(Carrow-Priory)-and-Carrow-Abbey-house-and-grounds&Index=2&RecordCount=29&SessionID=fa3ada7a-dc04-46f1-b4b6-051697f6e8c8)

**Ref 14.9** Old Carrow Bridge: <https://www.heritage.norfolk.gov.uk/record-details?MNF842-Old-Carrow-Bridge&Index=10&RecordCount=29&SessionID=fa3ada7a-dc04-46f1-b4b6-051697f6e8c8>



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Ruins of Carrow Priory: <https://www.heritage.norfolk.gov.uk/record-details?MNF385-The-ruins-of-Carrow-Priory&Index=3&RecordCount=29&SessionID=fa3ada7a-dc04-46f1-b4b6-051697f6e8c8>

**Ref 14.10** Norwich estate map: Carrow Works, undated, ca. 1870, DS 228

**Ref 14.11** Plan of Carrow Works, 1880, MC 3245/3

**Ref 14.12** Plan of Carrow Works, 1889, MC 3245/4

**Ref 14.13**

**Ref 14.14** Church, Roy. 'The Colman Family', Oxford Dictionary of National Biography, <https://doi.org/10.1093/ref:odnb/50409>.

**Ref 14.15** Norwich City Council, Bracondale Conservation Area Appraisal, 2011.



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## 15 SOCIO-ECONOMICS, POPULATION AND HUMAN HEALTH



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## 16 CLIMATE CHANGE



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## 17 WASTE MANAGEMENT

### INTRODUCTION

17.1 This Chapter addresses the waste management aspects associated with the Proposed Development. The potential for the generation of waste is an aspect of any activity. In relation to the Proposed Development, there are three main activities that have the potential to generate waste, during the demolition and clearance phase, the construction phase and during the operational phase.

17.2 There is a great deal of regulatory and financial pressure to manage wastes effectively and to avoid landfill disposal (where possible). This Chapter considers this in the context of the Proposed Development and assesses the waste characteristics of the current use and the Proposed Development to try and evaluate potential effects and identify options for sustainable waste management.

### ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

#### Scope of the Assessment

17.3 The aim of the waste assessment has been to determine the likely waste generation rates and how waste should be managed during site clearance, construction and during operation of the Proposed Development. The desk-based waste assessment has involved the following:

- an assessment of waste collection systems operated and co-ordinated by the Norwich City Council/Norfolk County Council (Waste Collection Authority);
- an assessment of current baseline conditions in relation to waste generation rates and disposal facilities within the local area;
- a review of the typical waste arisings, management practices and recycling rates within the local area from publicly available statistics *e.g.* Department of Environment, Food and Rural Affairs (DEFRA) Waste Statistics (where available) and information on the Norwich City Council and Norfolk County Council websites;
- estimates of the amount of waste generated, by type, throughout the refurbishment and construction phase of the Proposed Development with



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reference to data on similar large scale construction projects published by the Building Research Establishment (BRE) SMARTWaste project; and

- an estimate of waste generation and storage requirements for the completed, occupied development using British Standard BS5906:2005 Waste Management in Buildings (Ref. 17.1). This document provides guidance on the likely waste arisings and consequently storage provision.

17.4 For the construction phase, consideration has been made of the potential wastes that will be produced (based on similar construction projects). The methodology for looking at operational wastes has involved examining current waste management practices and, as far as possible, predicting waste generation activities associated with the redeveloped site.

### **Assessment Criteria**

17.5 Significant effects relating to waste will be determined within the context of identified potentially sensitive receptors. There is limited published or formalised technical guidance available for the assessment of potential waste related effects and, as such, professional judgement and experience has been relied upon in assessing potential waste effects due to the Proposed Development. In March 2020, the Institute of Environmental Management and Assessment (IEMA) published the Guide to Materials and Waste in Environmental Impact Assessment (Ref. 17.2). This is the first industry publication to offer guidance and recommendations for EIA practitioners and stakeholders concerned with the impacts and effects of materials and waste on the environment. Where relevant this current guidance and has been considered throughout this Chapter.

17.6 The IEMA guide states that whilst waste processing and recovery facilities may not be able to divert all received resources from landfill, these operations are a beneficiary of incoming feedstock, and are (ultimately) being used to drive arisings up the Waste Hierarchy. They, hence, create conditions that support the national and wider drive to a circular economy.

17.7 Accordingly, the IEMA guidance does not consider waste processing and recovery facilities as sensitive receptors, rather: they are part of a system that has the potential to reduce the magnitude of adverse impacts associated with waste generation and disposal. Waste processing and recovery facilities are, hence, different to landfills, in that the latter are finite resources.

17.8 Therefore, for waste, the sensitive receptor is landfill capacity. Landfill is a finite resource, and hence, through the ongoing disposal of waste, there is a continued need to





expand existing and develop new facilities. This requires the depletion of natural and other resources which, in turn, adversely impacts the environment.

17.9 To assess potential effects pertaining to waste, the magnitude of change (from the baseline) due to the Proposed Development has been estimated using a qualitative approach. Once determined, the magnitude of change is applied to each potentially sensitive receptor to determine the significance of any potential effects. The magnitude of change has been based on two factors (i) the volume of waste arisings and (ii) waste composition and likely waste management options which will/can be applied.

17.10 The choice of criteria has been derived from the requirement to ensure the application of the waste hierarchy (as defined by the Waste Framework Directive 2008/98/EC) *i.e.* ensuring disposal of waste is minimised. All local planning authorities, to the extent appropriate to their responsibilities, are aiming to drive up recycling and composting rates. The UK Government agreed on the July 30, 2020, to transpose aspects of the European Union's Circular Economy Package into UK law, agreeing on targets to recycle 65% of household waste by 2035 and to allow a maximum of 10% municipal waste going to landfill in the same timeframe.

17.11 Each factor is separately defined as having a 'high', 'medium', 'low' or 'negligible' magnitude of change. However, it is possible that the same magnitude of change may not be applied for both factors. In this instance, an average magnitude of change will be determined. For example, if the volume of waste is considered to have a high magnitude of change, but waste composition is considered to have a low magnitude of change, the overall magnitude of change will be medium. Where required a worst-case scenario will be applied to the assessment.

**Table 17.1 – Magnitude of change**

Magnitude of Change	Waste Volume	Waste Composition & Management Options
High	Proposed Development results in an increase in waste generation on a national scale from the baseline.	Largely hazardous waste streams that require specialised handling, storage, and treatment.  Disposal most likely option.



Magnitude of Change	Waste Volume	Waste Composition & Management Options
Medium	Proposed Development results in an increase in waste generation on a regional scale from the baseline.	Some hazardous waste streams that require some specialised handling, storage, and treatment.  Mixture of waste management options.
Low	Proposed Development results in an increase in waste generation on a local scale from the baseline.	Largely inert and/or non-hazardous waste streams typically generated by household and commercial activities such as office and retail ( <i>i.e.</i> mixed dry recyclables, packaging waste, residual waste).  Re-use, recycling and/or energy recovery most likely options.
Negligible	Insignificant increase in the volume of waste from the baseline.	Largely inert and/or non-hazardous waste streams typically generated by household and commercial activities such as office and retail ( <i>i.e.</i> mixed dry recyclables, packaging waste, residual waste).  Re-use, recycling most likely options.

17.12 Receptors that are potentially sensitive to changes in waste because of the Proposed Development have been identified following the assessment of baseline conditions. Using professional judgement, each has been assigned a level of sensitivity (*i.e.* high, medium and low) (Table 17.2).

**Table 17.2 – Waste management receptor sensitivity**

Sensitivity	Waste Management Systems and Infrastructure
High	Minimal range of facilities (higher up the waste hierarchy) within the region. Small amount of remaining capacity for addressing waste arisings from the Proposed Development.  The baseline/future baseline ( <i>i.e.</i> without development) of regional/national landfill void capacity is expected to reduce considerably.



Sensitivity	Waste Management Systems and Infrastructure
Medium	<p>Moderate range of facilities available within the region providing a waste management system with more than one management route disposal (<i>i.e.</i> recycling and composting) in addition to final disposal.</p> <p>Facilities that are available but have only a moderate amount of remaining capacity for addressing waste arisings from the Proposed Development.</p> <p>The baseline/future baseline (<i>i.e.</i> without development) of regional/national landfill void capacity is expected to reduce noticeably.</p>
Low	<p>Wide range of facilities available in the region providing a waste management system with several management routes (<i>i.e.</i> recycling, composting, energy recovery, <i>etc.</i>) in addition to final disposal.</p> <p>Facilities have a large amount of remaining capacity for addressing waste arisings from the Proposed Development.</p> <p>The baseline/future baseline (<i>i.e.</i> without development) of regional/national landfill void capacity is expected to reduce minimally.</p>

17.13 To determine the significant effects, the magnitude of change due to the Proposed Development and receptor sensitivity are assessed qualitatively as a function of each other. It is important to note that whilst recommended mitigation measures do have the potential to alter the magnitude of change due to the Proposed Development, they do not alter the sensitivity of any potential receptors. Table 17.3 outlines the matrix used in determining the significance of effects.

**Table 17.3 – Significance criteria for waste assessment**

Sensitivity	Magnitude of Change			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Neutral
Medium	Major	Moderate	Minor	Neutral
Low	Moderate	Minor	Neutral	Neutral

17.14 The potential effects have been classified, prior to mitigation, as Minor, Moderate, Major or Neutral (either “Adverse”, “Beneficial” or “Neutral”). Where the predicted effects are significant, mitigation measures have been incorporated to eliminate or reduce the effects to an acceptable level. It is important to note that although effects can be beneficial none have been



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identified associated with increased waste production so have been omitted from the significance criteria and associated definitions. Accordingly, the following terms have been used to describe the significance of effects associated with the Proposed Development with regards to waste:

- Major Adverse – A substantial negative effect upon potentially sensitive receptors due to waste generation volumes, waste stream composition and the availability of waste management systems and infrastructure.
- Moderate Adverse – A noticeable negative effect upon potentially sensitive receptors due to waste generation volumes, waste stream composition and the availability of waste management systems and infrastructure.
- Minor Adverse – A barely perceptible negative effect upon sensitive receptors due to waste generation volumes, waste stream composition and the availability of waste management systems and infrastructure.
- Neutral – No discernible effect upon potentially sensitive receptors due to waste generation and waste stream composition.

17.15 Other descriptive criteria include the extent (local, district, regional, national or International), duration (short, medium, long term) and nature (direct, indirect, reversible or irreversible).

17.16 In the context of the Proposed Development, temporary effects would be generally those associated with the demolition and construction works, and long-term effects would be those associated with the completed and operational development. Local effects would be those affecting receptors neighbouring the Application Site, whilst effects upon receptors within the wider Norwich area are assessed at a district level. Sub-regional effects would be those affecting adjacent Boroughs, whilst effects upon Norfolk are assessed at a regional level. Effects upon different parts of the country, or England as a whole, are at a national level. Finally, effects across national boundaries would be considered at an international level.

17.17 For the purposes of EIA, effects of moderate and above are considered to be 'significant'.



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## LEGISLATION, PLANNING POLICY AND GUIDANCE

### International

17.18 The UK was a participant at the 1992 Earth Summit in Rio de Janeiro hosted by the United Nations Conference on Environment and Development (UNCED) and at the Global Climate Change conference at Kyoto in 1997. The UK government has ratified and agreed to implement many of the objectives agreed at these international meetings. In particular, the UK signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992.

17.19 The commitments included reducing waste generation, increasing the amount of recycling and re-use, reducing dependence on techniques such as landfill and reducing carbon dioxide emissions resulting from combustion of fossil fuels.

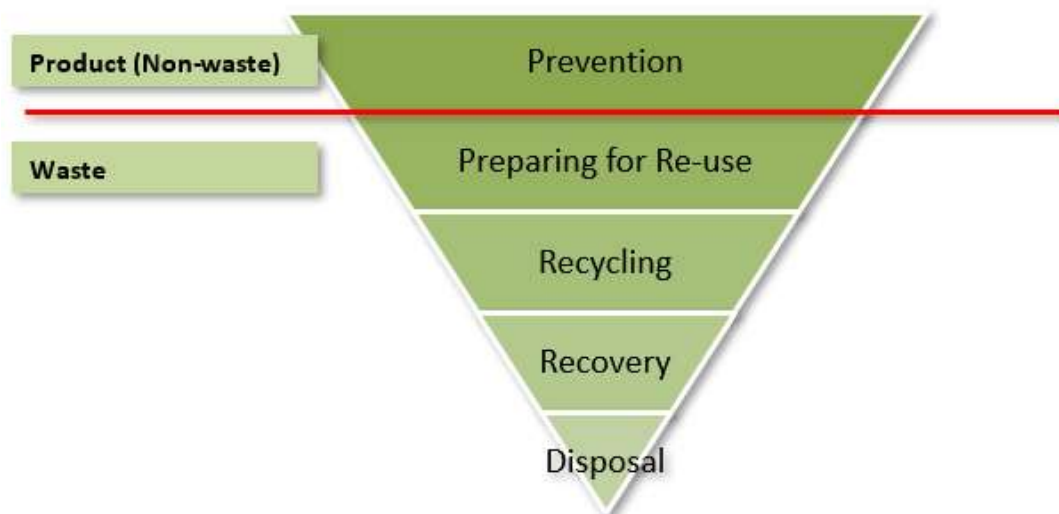
### Waste Framework Directive (2008/98/EC)

17.20 The European Commission's Waste Framework Directive (WFD) (2008/98/EC) sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery. It explains when waste ceases to be waste and becomes a secondary raw material (so called end-of-waste criteria), and how to distinguish between waste and by-products. The Directive lays down some basic waste management principles: it requires that waste be managed without endangering human health and harming the environment, and without risk to water, air, soil, plants, or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest. It also requires the development of national waste management plans as the cornerstone of any national, regional, or local policy on waste management.

17.21 The Directive introduces the "polluter pays principle" and the "extended producer responsibility". It incorporates provisions on hazardous waste and waste oils and includes two new recycling and recovery targets to be achieved by 2020: 50% preparing for re-use and recycling of certain waste materials from households and other origins similar to households, and 70% preparing for re-use, recycling and other recovery of construction and demolition waste. The Directive requires that Member States adopt waste management plans and waste prevention programmes.

17.22 Waste legislation and policy of the EU Member States shall apply as a priority order the waste management hierarchy outlined in Figure 17.1.

Figure 17.1: Waste hierarchy as outlined within Directive 2008/98/EC on waste (WFD)



17.23 The main principles of the Waste Hierarchy are:

- waste should be prevented or reduced at source as far as possible;
- where waste cannot be prevented, waste materials or products should be reused directly or refurbished and then reused;
- waste materials should be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material;
- where useful secondary materials cannot be reclaimed, the energy content of the waste should be recovered and used as a substitute for non-renewable energy resources; and
- only if waste cannot be prevented, reclaimed or recovered, should it be disposed of into the environment and this should only be undertaken in a controlled manner.

17.24 The waste hierarchy has been implemented in the UK through the Waste (England and Wales) Regulations 2011.

#### Withdrawal from EU

17.25 Parliament finally ratified the withdrawal agreement with the *European Union (Withdrawal Agreement) Act 2020*. The UK left the EU on the 31st of January 2020. The EU requirements are largely enshrined within current UK law, but the longer-term impact of Brexit on UK environmental policy and law is unclear.



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## National Policy and Legislation

### National Planning Policy Framework

17.26 The National Planning Policy Framework (NPPF) (July 2021) (Ref. 17.3) does not contain specific waste policies since National Waste Planning Policy is published as part of the Waste Management Plan for England (WMPE) (Ref. 17.4). The NPPF aims to replace many Planning Policy Statements (PPS), Planning Policy Guidance (PPG) and Mineral Planning Guidance (MPG) documents.

17.27 The NPPF includes standalone Planning practice guidance for Waste (October 2015) (Ref. 17.5). This provides further information in support of the implementation of waste planning policy.

17.28 Paragraph 8(c) of the NPPF outlines a specific environmental objective which aims to protect and enhance our natural, built and historic environment, including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

### Waste Management Plan for England (WMPE)

17.29 The Waste Management Plan for England is a high-level document which is non-site specific (Ref. 17.4). It provides an overview of waste management in England. The plan includes changes to waste management plan requirements which have been made by the *Waste (Circular Economy) (Amendment) Regulations 2020* where these could be incorporated in the Plan. The *Waste (England and Wales) Regulations 2011* specify that the Plan for England must contain specific information.

17.30 Planning Policy Statement 10: Planning for sustainable waste management was superseded by the national planning policy for waste published on 16th October 2014.

### National Planning Policy for Waste

17.31 This National Planning Policy for Waste (NPPW) sets out detailed waste planning policies (Ref. 17.6). All local planning authorities should have regard to the National Planning



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Policy for Waste policies when discharging their responsibilities to the extent that they are appropriate to waste management.

17.32 The policy document aims to streamline previous waste planning policy, making it more accessible to local authorities, waste developers and local communities alike. It aims to provide a clear framework to enable waste planning authorities to work collaboratively with their communities and consider, through their Local Plans, what sort of waste facilities are needed and where they should go, while also protecting the local environment and local amenity by preventing waste facilities being placed in inappropriate locations.

17.33 The policy replaces previous policy in Planning Policy Statement 10 (PPS10): Planning for Sustainable Waste Management as the national planning policy for waste in England and it sites alongside other national planning policy for England set out in the NPPF.

17.34 The NPPW includes the waste hierarchy, a framework for sustainable waste management setting out the preferential treatment of waste.

#### Circular Economy

17.35 The Circular Economy Package (CEP) policy statement was published in July 2020 (Ref. 17.7). The EU Circular Economy Package was approved in April 2018 but no longer applies in the UK following Brexit.

17.36 The UK government says the CEP confirms that future national waste plans for England will set out the measures the UK will take to recycle 65% of municipal waste by 2035 and to have no more than 10% municipal waste going to landfill by 2035. Both are targets committed to in the Resources and Waste Strategy.

#### Resource and Waste Strategy

17.37 The Resource and Waste Strategy (Ref. 17.8) sets out how the UK will preserve our stock of material resources by minimising waste, promoting resource efficiency, and moving towards a circular economy. At the same time, the aim is to minimise the damage caused to our natural environment by reducing and managing waste safely and carefully, and by tackling waste crime.





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## Environmental Legislation

17.38 The *Environmental Protection Act 1990* (EPA 1990) Part II sets out waste management and disposal requirements that affect all companies or individuals producing or handling 'controlled waste' as defined in Section 75 (4) of the Act. Section 33 of the act makes it an offence to treat, keep or dispose of controlled waste without a waste management licence, unless specifically exempted. Section 34 introduces a statutory duty of care for all those producing or dealing with waste.

17.39 The *Environmental Protection Act 1990* also requires local authorities to contract out waste disposal. Their responsibility for waste management is exercised through control of these contracts and through their duties as waste collection authorities. Regulation of waste disposal became the responsibility of the Environment Agency in April 1996 and is undertaken chiefly through Environmental Permitting systems.

17.40 The *Controlled Waste (England and Wales) Regulations 2012* define controlled waste for the purposes of the EPA 1990 Part II, which introduced three categories of controlled wastes: household, industrial and commercial. Most wastes from households, industry, commerce, and construction activities are controlled wastes, including wastes destined for recycling.

17.41 The 2008 revisions to the Waste Framework Directive have been implemented in England and Wales through the *Waste (England and Wales) Regulations 2011*. The revision places greater emphasis on the waste hierarchy to ensure that waste is dealt with in the priority order of prevention, preparing for re-use, recycling, other recovery (for example, energy recovery) and finally disposal.

17.42 The *Environmental Permitting (England and Wales) (Amendment) Regulations 2013* implement the European Landfill Directive (Directive 1999/31/EC on the landfilling of waste) and Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills and the requirements of the Industrial Emissions Directive (IED) (2010/75/EU). The Landfill Directive aims to reduce the negative effects of landfilling on the environment and human health. Furthermore, it is an instrument for driving waste up the hierarchy through waste minimisation and increased levels of recycling and recovery.

17.43 Since the 1st of January 2015 the *Waste (England and Wales) Regulations 2011* has required waste collection authorities to collect wastepaper, metal, plastic, and glass separately.



It also imposes a duty on waste collection authorities, from that date, when planning for the collection of such waste, to ensure that those arrangements are by way of separate collection.

17.44 The *Environment Act 2021* received Royal Assent on 9th November 2021. The Act allows for further new legislation by allowing the relevant national authorities to make regulations about producer responsibility obligations, including requiring payment towards the costs of disposing of products and materials, the provision of resource efficiency information and resource efficiency requirements, new deposit schemes and charges for single use items, processes for managing waste including greater consistency in recycling collections and changes to waste enforcement and regulation. These recent developments have yet to feed across into statutory regulations, regional or local policies.

### Building Regulations

17.45 As a minimum the development will need to meet the requirements outlined within Schedule 1 of Approved Document H - Drainage and Waste Disposal of the *Building Regulations 2010* (as amended) (Ref. 17.9), to provide:

- H6. (1) Adequate provision shall be made for storage of solid waste.
- H6. (2) Adequate means of access shall be provided: (a) for people in the buildings to the place of storage; and (b) from the place of storage to a collection point (where one has been specified by the waste collection authority under Section 46 (household waste) or Section 47 (commercial waste) of the Environmental Protection Act 1990 (as amended) or to a street (where no collection point has been specified).

### **Regional Policy**

17.46 In general, *The Localism Act 2011* set out a series of measures with the potential to achieve a substantial and lasting shift in power away from central government and towards local people. They include new freedoms and flexibilities for local government; new rights and powers for communities and individuals; reform to make the planning system more democratic and more effective, and reform to ensure that decisions about housing are taken locally.

17.47 The Norfolk Core Strategy and Minerals and Waste Development Management Policies Development Plan Document (DPD) (Ref. 17.10), runs for a 17-year period from 1 January 2010 to 31 December 2026. The Core Strategy, along with the Proposals Map, sets out the spatial vision for future mineral extraction and associated development and waste management



facilities in Norfolk. It also contains strategic objectives and policies that make clear where, in broad terms, mineral extraction and associated development and waste management facilities should be in Norfolk, and conversely where they should not be located. It also sets out Development Management policies that will be used to ensure that the development of mineral extraction and associated development and waste management facilities can happen in a sustainable way at those locations assessed as being appropriate for development. When it is adopted, it will become part of the Local Development Framework (LDF) for Norfolk.

## **Local Policy**

### Development Management Policies Local Plan

17.48 The Development Management Policies Local Plan 2014 (DM policies plan) (Ref. 17.11) sets out detailed planning policies to help guide and manage change and development in Norwich until 2026. The DM policies plan builds on and supports the sustainable growth strategy for the wider area set out in the adopted Joint Core Strategy. It also closely follows national planning requirements for sustainable development and positive, community-based planning.

17.49 The DMP sets out specific requirements within Appendix 3 – Standards for transportation requirements within new developments for servicing and refuse collection (A3.24 - A3.32).

17.50 Norwich City Council have undertaken a review of the Development Management Policies Local Plan 2014 and the Site Allocations and Site-Specific Policies Local Plan 2014, taking account of relevant government guidance. The review concludes that the policies and plans are fit for purpose at the present time however, it is recommended that a full review of the Development Management Policies Local Plan should commence following the Regulation 19 consultation of the Greater Norwich Local Plan.

### Supplementary planning documents

17.51 There are no relevant Supplementary planning documents (SPDs) are produced by the city council in relation to waste management.



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### Local Development Scheme for Norwich

17.52 A Local development scheme (LDS) (Ref. 17.12) must be prepared under Section 15 of the Planning and Compulsory Purchase Act 2004 (as amended by the Localism Act 2011). It identifies the documents that will be prepared to set out the strategy for the development and use of land in the local planning authority's area – collectively called development plan documents. An LDS is a project plan which identifies the documents which, when prepared, will make up the Local Plan for the area. The current plan for Norwich was issued in December 2021.

### Joint Core Strategy for Broadland, Norwich, and South Norfolk

17.53 The Joint Core Strategy (JCS) for Broadland, Norwich, and South Norfolk (Ref. 17.13) is the key planning policy document for the Greater Norwich area. It forms part of the Local Plans for the districts of Broadland, Norwich and South Norfolk setting out the broad vision for the growth of the area and containing strategic policies for the period 2008 – 2026. When adopted, the GNLP will supersede the current JCS and the various site allocations plans.

### Greater Norwich Local Plan

17.54 The Greater Norwich Local Plan (GNLP) is in two parts - the Strategy and Sites Plan (Ref. 17.14). The Strategy outlines the broad approach to housing and jobs growth, along with policies to ensure sustainability, protect our environment and provide infrastructure. The Sites Plan identifies the sites which we propose to allocate to meet housing and employment needs to 2038, as well as the allocations we propose to carry forward from the current Broadland, Norwich and South Norfolk local plans. The plan is for adoption of the GNLP in Q4-2022. The strategy includes 7 key policy areas:

- Policy 1 - The Sustainable Growth Strategy
- Policy 2 - Sustainable Communities
- Policy 3 - Environmental Protection and Enhancement
- Policy 4 - Strategic Infrastructure
- Policy 5 - Homes
- Policy 6 - The Economy (Including Retail)
- Policy 7 - Strategy for the areas of growth



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## Norwich City Council Environmental Strategy 2020-25

17.55 This document is the fourth environmental strategy that the city council has produced and details the council's environmental vision and priorities until 2025 (Ref. 17.15). One of the priorities identified in the strategy is Priority 3: increase reuse and recycling in the city and reduce the amount of residual waste.

### **Development Design Schemes**

17.56 At the time of this Chapters preparation no information was made available regarding the proposed design standards that would be applied to the development beyond compliance with the local design standards and requirements. Even if the final development does not formally apply the schemes identified below the concepts and requirements are considered best practice and could be used to help demonstrate a sustainable approach to waste management.

17.57 First launched in 1990, the Building Research Establishment Environmental Assessment Methodology (BREEAM) was the world's first environmental assessment method for new building designs. It uses a balanced scorecard approach with tradable credits to enable the market to decide how to achieve optimum environmental performance for the project.

17.58 One of the overall BREEAM aims is to promote resource efficiency by reducing waste during construction and throughout the life cycle of the development. Typical waste related assessment criteria include:

- Pre-demolition audit – A pre-demolition audit should be carried out using an appropriate methodology. The Institute of Civil Engineers (ICE) has produced guidance on pre-demolition audits including the Demolition Protocol (Ref. 17.6).
- WRAP Principles of Designing out Waste – The five Designing out Waste principles, developed by WRAP, focus on Reuse and Recovery, Off Site Construction, Materials Optimisation, Waste Efficient Procurement and Deconstruction and Flexibility.
- Waste management strategy or plan – A waste management strategy is one that defines a target benchmark for resource efficiency e.g. m<sup>3</sup> or tonnes of non-hazardous construction waste per 100m<sup>2</sup>, procedures and commitments for minimising construction waste in line with the benchmark procedures, an estimate of amounts and types of refurbishment/demolition, excavation waste



and construction waste, procedures for sorting, reusing and recycling construction and demolition waste, where applicable, into defined waste groups.

- Diversion from landfill – Diversion from landfill includes reusing the material on site (in-situ or for new applications), reusing the material on other sites, salvaging or reclaiming the material for reuse, returning material to the supplier via a 'take-back' scheme and recovery of the material from site by an approved waste management contractor to be recycled or sent for energy recovery.

17.59 It is important to note that BREEAM is only relevant to the non-residential elements of the scheme.

17.60 The Home Quality Mark (HQM) is an independently assessed certification scheme for new homes. It awards certificates with a simple star rating for the standard of a home's design, construction, and sustainability and is in line with other BREEAM schemes.

## **Guidance**

### British Standards

17.61 British Standard BS 5906:2005 Waste management in buildings (Ref. 17.1) is a code of practice for methods of storage, collection, segregation for recycling and recovery, and on-site treatment of waste from residential and non-residential buildings and healthcare establishments. This British Standard is applicable to new buildings, refurbishments, and conversions of residential and non-residential buildings, including but not limited to retail and offices.

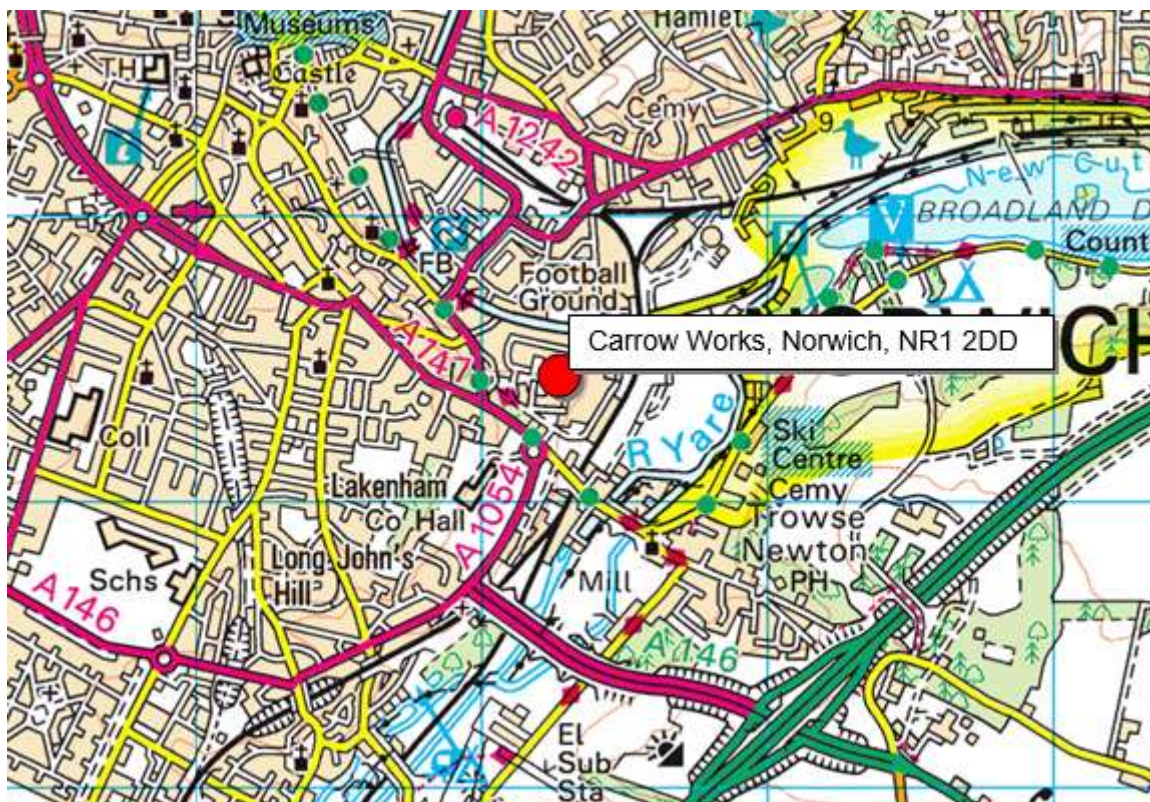
## **BASELINE CONDITIONS**

17.62 The Application Site is located at the Carrow Works, Bracondale, Norwich, Norfolk, NR1 2DD. The approximate central National Grid Reference (NGR) is TG 24252 07465. The Application Site lies at between an elevation of 5-8 metres Above Ordnance Datum (AOD) in the main site area and 10-17 metres AOD near the central part.

17.63 The Carrow Works, the former Colman Mustard manufacturing site, comprises a 16.9 Ha site in the centre of Norwich. The Application Site features 1.5 million sq. ft of existing buildings including the Grade I listed Carrow Abbey and Grade II listed Victorian warehouses with 500 metres of waterfrontage along the River Wensum.

**Figure 17.2: Site location (Scale 1:50,000)**

Based upon the Ordnance Survey 1: 50,000 scale map with the permission of The Controller of Her Majesty's Stationery Office, Crown Copyright, Earth and Marine Environmental Consultants Ltd, Licence No. 100050755



17.64 The Application Site was acquired by J. Colman in the mid-1850s from the Norfolk Railway for the development and expansion of his mustard business. This land encompassed a large area to the east of the railway line with the sites connected via a below ground tunnel. In 1903 the company bought rival mustard maker Keen Robinson & Company which also owned a barley water business. Robinson's production was moved to The Carrow Works site in 1925. In 1938, Colman's merged with Reckitt and Sons to become conglomerate Reckitt and Colman. In 1995 the mustard and condiment side of the business was sold to Unilever. Britvic acquired Robinson's also in 1995. Today the disused works occupies the northern, some central and the eastern regions of the Application Site. The land to the east of the railway was not sold to Unilever and Britvic. A conservation area (located centrally on the Application Site) contains the residential dwelling known as Carrow Abbey which now forms part of the conference centre. The factory canteen, conference centre car parking and groundmen's facilities are also within this area.

17.65 The main production area comprises numerous large warehouse, manufacturing and office buildings of varying age and construction. External to the main buildings, there are smaller



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structures housing water supply boreholes, water treatment plant, process chemicals and electrical infrastructure. In 2019 the factory rolled its last jar of mustard off the production line. Colman's continued making other condiments at the Carrow site until full closure in early 2020. Most of the Application Site is currently disused apart from:

- Stage 1 warehouse occupied by Beattie Passivehaus.
- Stage 2 warehouse 1/3 occupied by Polonia (Ukrainian Relief Charity)
- Stage 3 warehouse occupied by Norfolk County council/Norse COVID support Hub and (Afghanistan Relief Charity). Tenancy due to expire end of June 2022.

17.66 The conservation area encompasses the ruins of a 12th Century priory and Carrow Abbey. Abbey Conference Centre is in the northern part of the conservation area and encompasses the original house. Car parking facilities, the former technical (R&D) centre, a canteen, gardens and groundmen's facilities are also present, although not currently used.

17.67 The current baseline waste generation rates are considered negligible. There are no residential derived waste streams associated with the current baseline.

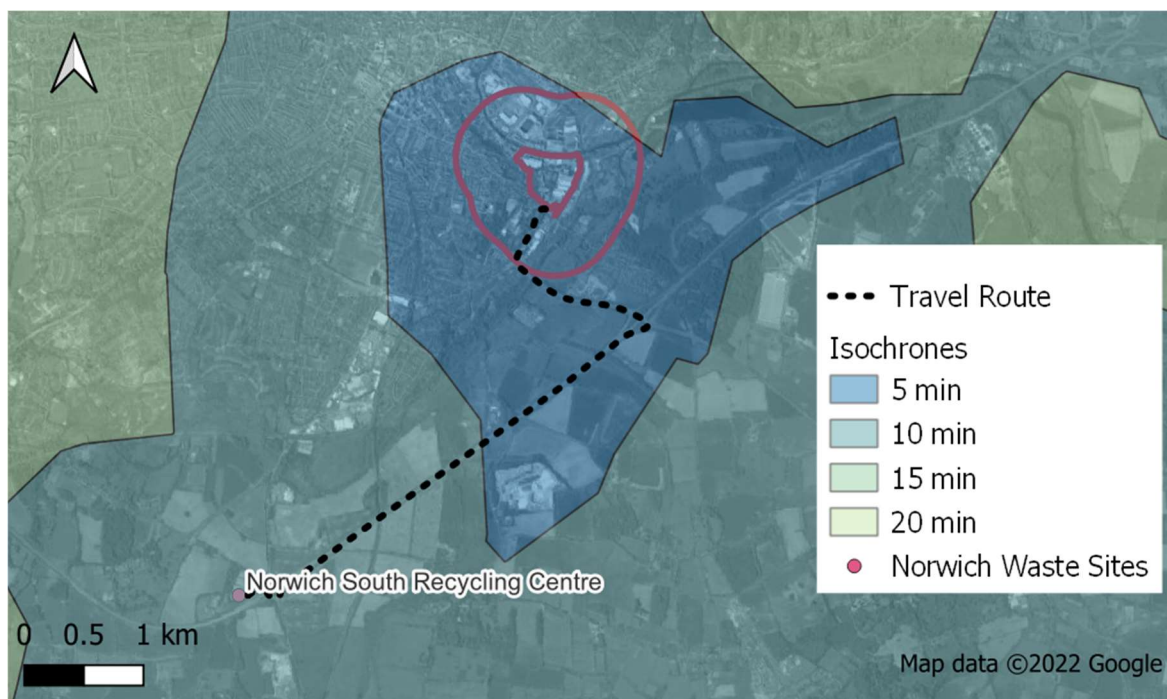
### **Household waste recycling centres**

17.68 There are currently two Household waste recycling centres (HWRCs) within the wider Norwich City area, Norwich South Recycling Centre (Ipswich Road, NR4 6US) and Norwich North Recycling Centre (Morse Road, Horsham St Faith, Norwich NR10 3JX). Based on the travel distance it is expected that the Norwich South Recycling Centre would be utilised by the residential occupants of the Proposed Development. The full list of accepted waste is outlined on the Norfolk County Council website (Ref. 17.17).

17.69 The closest HWRC is the Norwich South Recycling Centre located 6.17 km or 12 minutes travel time (using a car on the fastest route) from the Application Site (Figure 17.3).



**Figure 17.3: Travel distance to local HWRC**



17.70 Norfolk County Council last published an Annual Monitoring Report Waste Data (financial year 2018-19) in March 2020 (Ref. 17.18). The proportion of local authority collected municipal waste (LACMW) sent to landfill came to 3.8% which is higher than in 2017/18 but significantly lower than any previous year up to 2016/17. This reduction in LACW disposed of to landfill over recent years is due to a significant increase in the quantity and percentage of waste recovered as either Refuse Derived Fuel or by incineration with energy recovery.

17.71 It is estimated that in 2018/19 over 494,000 tonnes of the inert and construction & demolition waste, received at transfer stations and recycling centres, was recovered. This includes waste recovered at quarries as well as waste management facilities. The increase in inert waste recovery was due to an increase in material being used for quarry restoration.

17.72 The quantity of non-hazardous waste recycled/composted in 2018/19 was over 990,000 tonnes. This compares with over 768,000 tonnes in 2017/18 and 820,000 tonnes in 2016/17. The increase in non-hazardous waste recycling is mainly due to significant increases in the quantities of waste received at six sites. In particular, there was a large increase in the quantities of metal received for recycling.



## IDENTIFICATION AND EVALUATION OF KEY EFFECTS

17.73 The Proposed Development will have two distinct phases of waste generation, the first being one-off construction related wastes (which will be short lived and transient), the second being the long-term waste generation activities associated with the tenants and Application Site users.

### During Construction

17.74 For the Proposed Development, the anticipated waste types that are predicted for the construction phase include:

- Building demolition rubble comprising brick, glass, timber and concrete.
- Excavated soil (potentially contaminated) associated with foundation excavation and trenching for services.
- Spoil from piling operations.
- Vegetation from site stripping.
- Wastepaper, plastic, cardboard, and wood from delivery of construction material and site activities during the works.
- Redundant unused construction materials (e.g. wood, glass, plastic, concrete, bricks, tiles, ceramics, insulation materials, gypsum-based materials etc.).
- Collected groundwater and rainwater.

17.75 The volume of the wastes that will be generated cannot be specified at this time. It is possible, however, to give a relative (qualitative) assessment of the potential waste quantities and their intended fate (Table 17.4).

**Table 17.4 – Volume and Fate of Construction Wastes**

Waste Type	Relative Volume	Likely Fate
Building demolition rubble comprising brick, glass, timber, and concrete.	Moderate	Mixture of on-site re-use of materials and off-site recycling or disposal of unsuitable materials. Most of the demolition works have already been undertaken.
Redundant construction materials.	Small to moderate	Return to supplier, recycling, sale or disposal.
Wastepaper, plastic, cardboard, and wood.	Small to moderate	Off-site recycling and disposal via contracted waste management firm.

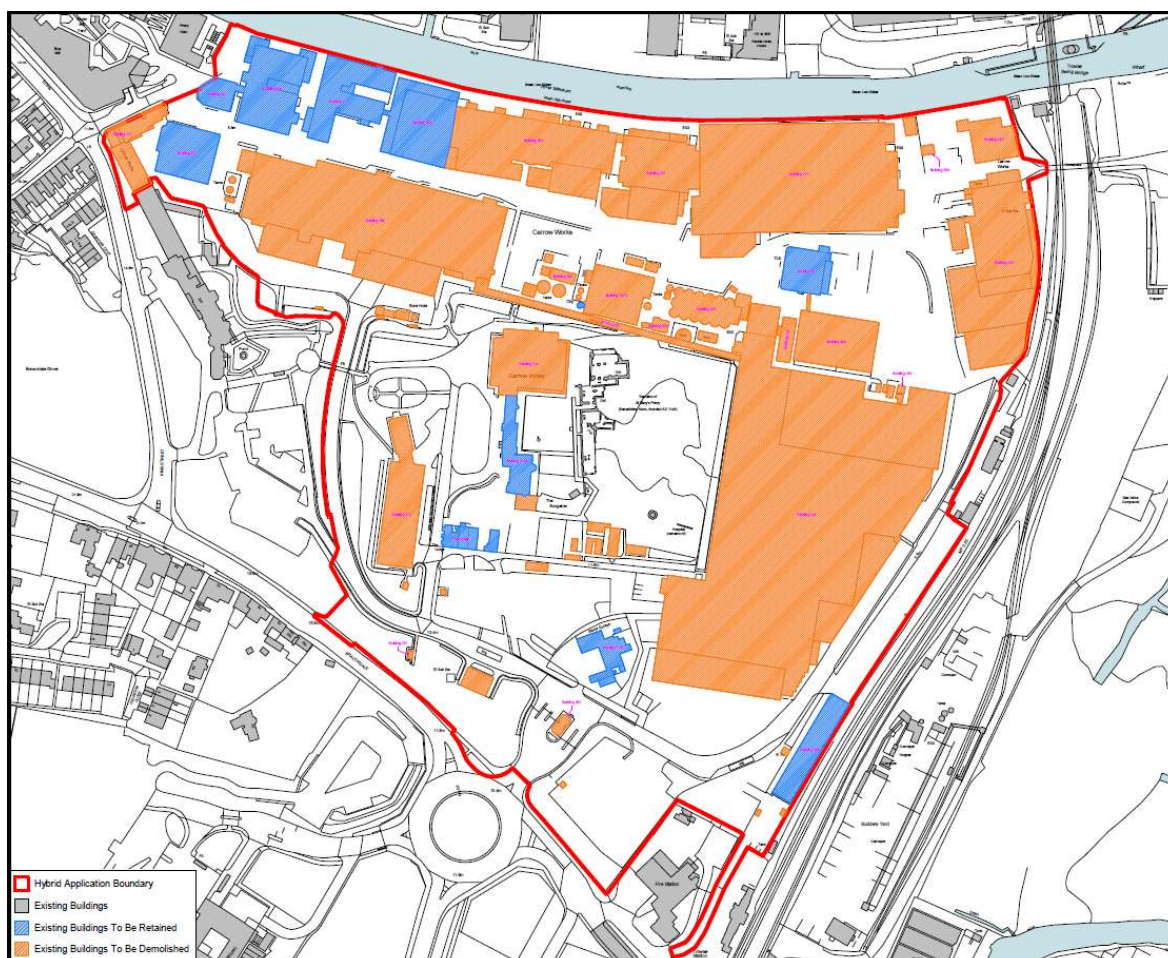


Waste Type	Relative Volume	Likely Fate
Excavated soil (potentially contaminated).	Small	On-site reuse and re-profiling. Off-site disposal or reuse for materials that cannot be managed on-site effectively. Preference will be given to materials reclamation and reuse rather than direct landfill disposal.
Collected perched groundwater and rainwater.	Small	Discharge to site surface or drainage system under controlled (consented) conditions if suitable or treatment and off-site disposal.
Trade effluent from vehicle wheel washing.	Small	Discharge to foul sewer under controlled conditions to be agreed with sewerage undertaker.
Waste oils, chemicals, and potentially hazardous materials.	Small	Removal to licensed treatment and disposal facilities via contracted waste management firms.
Scrap metal and redundant plant and equipment.	Small	Off-site recycling.
Vegetation from site stripping and landscape maintenance.	Small	Off-site composting.
Sanitary wastewater.	Small	Discharge to foul sewer under controlled conditions to be agreed with sewerage undertaker.
Spoiled and damaged goods from businesses.	Small	Return to supplier or recycling/disposal where return is not possible.
Asbestos-containing material (potential for cement sheet roofing and other material to be present in the older buildings).	Very Small	Specialist removal by licensed contractor and taken to hazardous waste disposal site.
<p>Key:</p> <p>Small = tens of tonnes, Moderate = hundreds of tonnes, Large = thousands of tonnes</p>		

### Demolition Waste

17.76 Demolition waste is often the largest tonnage of waste on site, because the amount of waste produced is site-dependant. Furthermore, it is not necessarily possible to reduce the amount of demolition waste (unless a decision is taken not to demolish in the first place). The current proposed demolition targets are outlined in red within Figure 17.4.

**Figure 17.4: Demolition Plan**



17.77 In accordance with the Proposed Development Phases demolition will be undertaken in a phased approach. A demolition plan for the entire Application Site will be created that outlines the proposed demolition and clearance strategy.

17.78 A Pre-demolition audit will be undertaken to estimate the types and amounts of materials likely to arise during the demolition process.

17.79 There is the potential for recycling the concrete and brick into new materials by following the requirements of the WRAP Quality Protocol for aggregates from inert waste (Ref. 17.19). Where possible, these materials should be reused within the new development to minimise the carbon impacts from transport. The other main material groups of metal, glass and timber all have the potential to be recycled.

17.80 The potential for reuse is limited to the smaller volume demolition products. Where reuse is not possible there is potential for recycling most of the material.



17.81 It is recommended, that an overall target of 97% diversion of non-hazardous waste from landfill should be set for the demolition phase of this redevelopment project.

#### Refurbishment Benchmarks

17.82 The Construction Resources and Waste Platform (CRWP) (Ref. 17.20) has developed indicators to aid in the calculation of waste arisings from conversions and refurbishment. The environmental benchmarks are based on tonnes of waste or cubic metres of waste per 100m<sup>2</sup> or per £100k. The benchmarks outlined within Table 17.5 are for information purposes only but could be applied (as a guide) to the proposed refurbishment parts of the project.

**Table 17.5 – CRWP Refurbishment benchmarks**

Type	m <sup>3</sup> of waste per 100m <sup>2</sup>	m <sup>3</sup> of waste per £100k	tonnes of waste per 100m <sup>2</sup>	tonnes of waste per £100k
Commercial (retail)	13.5	9.0	10.3	4.6
Commercial (offices)	14.1	12.9	6.4	6.2
Education	-	27.9	-	18.9
Leisure	-	13.9	-	5.0
Residential	17.8	26.4	10.9	16.2

17.83 The CRWP benchmark figures stated above relate to waste generation rates where no minimisation, reuse or recycling of materials has taken place.

#### New Build Benchmarks

17.84 The Building Research Establishment (BRE) SmartWaste project has developed indicators to aid in the calculation of construction waste arisings at the design stage of a new development (Ref. 17.21). The benchmarks are m<sup>3</sup> of waste per 100 m<sup>2</sup> and m<sup>3</sup> of waste per £100k. The new build residential benchmarks are outlined in Table 17.6.

**Table 17.6 – BRE Waste Benchmark Data by Project Type (New Build)**

Type	m <sup>3</sup> of waste per 100m <sup>2</sup>	m <sup>3</sup> of waste per £100k
Residential	18.1	12.3
Public Buildings	20.9	10.7



Type	m <sup>3</sup> of waste per 100m <sup>2</sup>	m <sup>3</sup> of waste per £100k
Leisure	14.4	9.2
Industrial Buildings	13.0	10.8
Healthcare	19.1	9.1
Education	20.7	10.0
Commercial (Other)	17.4	9.7
Commercial (Offices)	19.8	9.3
Commercial (Retail)	20.9	15.0

17.85 The benchmark figures stated above (Table 17.6) relate to waste generation rates where no minimisation, reuse or recycling of materials has taken place.

17.86 The CRWP has estimated the composition of construction waste arisings associated with UK construction projects (Table 17.7).

**Table 17.7 – CRWP waste arisings, new build, by waste type (2009)**

Type	Classification	% of total arising
Inert	Inert	26.3 %
Concrete	Inert	22.4 %
Bricks	Inert	19.9 %
Tiles and ceramics	Inert	1.3 %
<b>Total Inert</b>		<b>69.9 %</b>
Timber	Non-inert	8.5 %
Packaging	Non-inert	5.6 %
Gypsum	Non-inert	5.2 %
Insulation	Non-inert	2.3 %
Plastics	Non-inert	2.0 %
Canteen/office/ad hoc	Non-inert	1.9 %
Metals	Non-inert	1.9 %



Type	Classification	% of total arising
Binders	Non-inert	0.5 %
Asphalt and tar	Non-inert	1.8 %
Electrical and electronic equipment	Non-inert	0.2 %
Floor coverings (soft)	Non-inert	0.1 %
Furniture	Non-inert	0.1 %
Hazardous	Non-inert	0.1 %
Liquids	Non-inert	0.1 %
<b>Total Non-inert</b>		<b>30.3 %</b>
Notes: Oils and other less than 0.0 %. Figures do not total 100% due to rounding		

17.87 The figures above are based on standard construction operations in the UK and the estimated volumes identified above can be lowered through on-site good waste management practice.

17.88 An estimate of potential waste arisings from the construction of buildings (excluding general infrastructure) has been estimated using BRE SmartWaste benchmarks data (Ref. 17.22). By quantifying the waste predicted to be generated, it is possible to estimate quantities of waste that can be reused and recycled and set benchmarks to reduce or eliminate volumes of waste entering landfill. An estimate of construction and refurbishment waste volumes is outlined within Appendix 17.1, Table 17.1.

#### Environmental Impact – Construction and Demolition Waste

17.89 It is commonly recognised within the UK that construction and demolition (C&D) waste is one of the largest waste streams, with relatively stable amounts produced over time and high recovery rates. Although this may suggest that the construction sector is highly circular, reviews of waste management practices reveal that C&D waste recovery is largely based on backfilling operations and low-grade recovery. Circular economy-inspired approaches can help achieve waste policy objectives, namely waste prevention, and increase both the quantity and the quality of recycling for C&D waste while reducing hazardous materials in the waste.



17.90 The potential impacts associated with traffic, dust and noise and associated with the transportation of construction materials to the Application Site and construction waste materials from the Application Site to waste treatment and disposal facilities have been considered within Chapter 7.0 Transport, Chapter 8.0 Air Quality and Chapter 9.0 Noise and Vibration.

17.91 In the absence of mitigation, the Proposed Development (construction and demolition phase) has potential for **Temporary, Moderate Adverse** impact at a **District/Regional** scale (**Significant**).

## **During Operation**

### Waste Generation Metrics

17.92 The waste generation metrics within this ES Chapter are based on BS5906:2005 (Ref. 17.1). This states that a residential dwelling with communal refuse facilities will generate a total based on the following formula [Total weekly refuse (litres) = 30 litres per unit +70 litres per bedroom].

17.93 Refuse (or residual waste) provision is required for 75% of the total weekly refuse arising, based on the following formula [Residual waste provision (litres) = Total weekly refuse (litres) x 0.75]. This figure isn't stated within BS5906:2005 but is utilised by other Local Authorities e.g. Southwark London Borough Council (Ref. 17.23) and has been previously utilised within preparation of ES Waste Management Chapters.

17.94 The BS5906:2005 guidance requires that space be provided for recycling bins to accommodate 50% of this total weekly volume, based on the following formula [Recycling provision (litres) = Total weekly refuse (litres) x 0.5].

17.95 With respect to food generation volumes the available guidance is less clear. WRAP research (Ref. 17.24) has found that, on average, larger households generate less waste per person than single-occupancy households – this difference stems from single-occupancy households generating more waste from not using food before it goes off or past a date label. WRAP conducted a study on household food waste (Ref. 17.25) and found that the amount of wasted food for the average person in 2015 was 1.5 kg/week. Assuming a bulk density of 290 kg/m<sup>3</sup> (Ref. 17.26) this equates to 0.4 litres/person/week. This is considered an estimate only.





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17.96 Typically, where planned waste capacity is over 660 litres communal bins will be required.

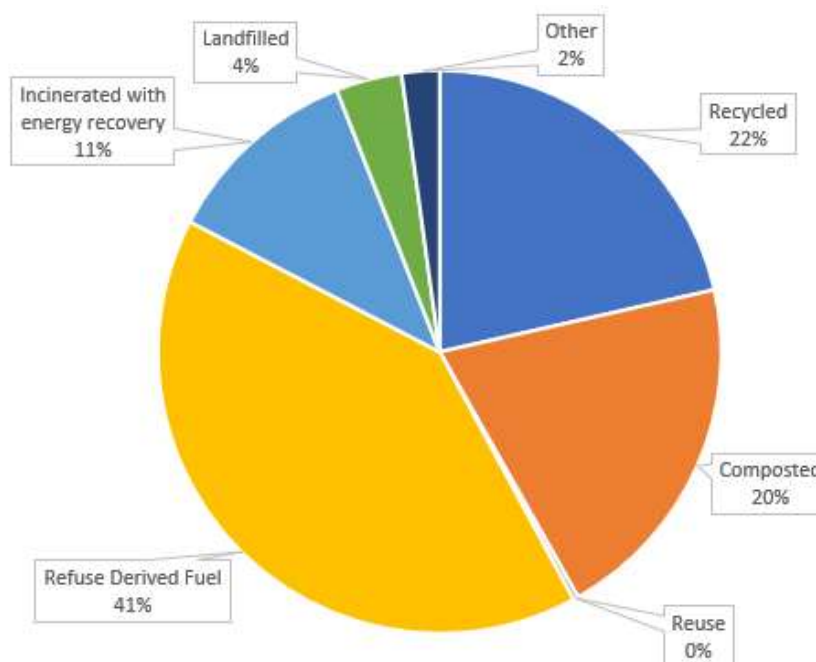
17.97 Where commercial space is allocated within the Proposed Development, the waste generation assessments shall be based on the waste BS5906 metrics (Ref. 17.1).

17.98 The potential operational waste generation rates (*i.e.* total refuse, residual waste, recycling waste and food waste) and the predicted number of required waste receptacles for the new build and refurbishment Phases are outlined within Appendix 17.1, Table 17.2 and Appendix 17.1, Table 17.3.

#### Environmental Impact – Operational Waste

17.99 The waste produced during the operational phases will be treated in the same manner as the current baseline waste streams. The Norfolk Minerals and Waste Development Framework (Ref. 17.18) outlines the current waste treatment and disposal mechanisms utilised within the County (Figure 17.5). It is expected that the same treatment/disposal options will be applied.

**Figure 17.5: Norfolk County Council Waste Treatment (2018-19)**



17.100 The collection, treatment and disposal of commercial derived waste streams will remain the responsibility of the individual business.

17.101 In the absence of mitigation, the Proposed Development (operational phase) has potential for **Permanent, Minor Adverse** impact at a **District** scale (**Not Significant**).

### **ASSESSMENT OF CUMULATIVE EFFECTS**

17.102 In line with the EIA Regulations, an EIA must consider the cumulative effects or impact interactions of a Proposed Development. Cumulative impacts may result from incremental changes caused by other past, present or reasonably foreseeable activities or projects in the local area, in combination with the Proposed Development. Cumulative effects can be split into:

- Type 1 - Combination effects i.e. combined effects of individual impacts resultant from the development upon a set of defined sensitive receptors e.g. noise, dust and visual impacts; or
- Type 2 - Cumulative effects i.e. combined effects arising from another development site or sites, which individually might be insignificant, but when considered together, could create a significant cumulative impact.



17.103 The committed developments, considered within the assessment, are outlined within Chapter 3 of this ES. All the identified schemes include demolition and subsequent construction phases activities hence will generate waste streams equivalent to the Proposed Development.

17.104 None of the identified schemes provide sufficient waste information to be able to assess the cumulative effects in combination with the Proposed Development. It is important to note that demolition and construction phase wastes are short-term and are development programme related hence may not coincide with the Proposed Development schedule.

### **INTER-RELATIONSHIP EFFECTS**

17.105 Cross topic effects associated with both the construction and operational waste could potentially include:

- air quality impacts (i.e. derived from waste handling activities, waste transportation and off-site waste treatment / disposal);
- transportation impacts (i.e. derived from the handling and movement of waste from site to the final treatment / disposal destinations);
- water resource impacts (i.e. derived from waste handling activities and off site waste treatment / disposal activities); and
- land impacts (i.e. derived from waste handling activities and off-site waste treatment / disposal activities).

17.106 These potential impacts have been addressed within the relevant topics in this ES.

### **ENHANCEMENT, MITIGATION AND RESIDUAL EFFECTS**

#### **During Construction**

17.107 The following mitigation measures will be employed during the initial demolition, site clearance and construction phase activities.

#### Pre-demolition Survey

17.108 A detailed pre-demolition audit will be undertaken by an appointed contractor before any demolition activities take place, to quantify the types of demolition waste materials that might arise. The Institution of Civil Engineers (ICE) has produced guidance on pre-demolition audits, including 'The Demolition Protocol' (Ref. 17.16) this would be considered current best practice.



17.109 Materials will be segregated into separate waste streams (where possible). The separated materials will be removed for off-site recycling or disposal. The demolition contractor will work closely with the developer to ensure full compliance and deliverability of recycling targets.

#### Hazardous Material Surveys

17.110 Given the age of the buildings and associated structures the (localised) presence of asbestos-containing materials (ACMs) is considered highly likely. A refurbishment/demolition survey asbestos-containing materials (ACMs) will be undertaken (post planning submission).

17.111 If any structures containing ACMs are to be refurbished or demolished a Health and Safety Executive (HSE) licensed asbestos contractor shall be employed to safely remove the materials for off-site disposal. All works would be undertaken in conformance with HSE requirements and the *Control of Asbestos Regulations 2012*. Any ACM containing waste will be transported by a registered waste carrier and disposed of at permitted landfill site. All necessary consignment notes will be maintained.

17.112 Any other hazardous materials will be removed ahead of demolition works. Hazardous wastes will be transported by registered waste carriers and disposed of at appropriately permitted off-site facilities.

#### Land Contamination Surveys

17.113 In general, demolition and construction phase activities will involve disturbance and interaction with soils and (potentially) groundwater and thus could generate 'contaminated' waste materials that need to be appropriately and effectively managed.

17.114 A site-wide Phase I Contaminated Land Assessment has been undertaken by Leap Environmental Ltd (Ref. 17.28) in 2018. The desk study provides an initial Conceptual Site Model (CSM) and qualitative Preliminary Risk Assessment (PRA) for the Application Site in accordance with the principals set out in Land Contamination Risk Management (LCRM) guidance (Ref. 17.29) previously referred to as CLR11, published by the Environment Agency. The desk study has also been prepared in consideration of the National Planning Policy Framework (NPPF) and The Building Regulations 2010, Approved Document C - Site preparation and resistance to contaminants and moisture (Ref. 17.30).



17.115 The Phase I states that the desk study has identified several potential sources of contamination associated primarily with (limited) fuel storage and chemical storage (which comprises primarily cleaning products, acids and alkalis). The resulting risk assessment has been heavily influenced by the known presence of a Tetrachloroethylene (also known as perchloroethylene or PCE) plume in the groundwater in the northeast of the Application Site since the early 1980's (the usage of which was historically associated with the processing of mustard seed by-products). Several moderate and high risks have been identified, some of which are likely to be reduced by the implementation of straightforward remedial measures during construction (such as placement of clean cover systems in residential gardens).

17.116 There is currently an on-going assessment and remedial activities around the PCE plume in the north-eastern corner of the Application Site. All works are being co-ordinated by Unilever (UK) Ltd & Britvic Soft Drinks Ltd in consultation with the Environment Agency.

17.117 A site-wide Phase II intrusive investigation was undertaken by Leap Environmental Ltd (Ref. 17.31) in 2018. The intrusive investigation was designed to provide representative site wide coverage whilst targeting fuel, ingredient, product, and waste storage. A total of 61 locations were excavated across 17 'Areas' comprising 53 windowless sampler boreholes and 8 hand excavated pits. The exploratory techniques were selected to minimise disruption to the ongoing site operations.

17.118 A geo-environmental risk assessment has been carried out by Leap Environmental Ltd. Concentrations of determinants were compared to 3 different sets of generic assessment criteria assuming a residential led mixed use redevelopment. Contamination testing of the soils identified fairly limited exceedances for metals (arsenic, cadmium, copper, lead and zinc), PAHs (naphthalene, phenanthrene and BaP), heavier fraction aromatic petroleum hydrocarbons and asbestos in made ground. No exceedances of any determinants were recorded in any natural soil sample. Two 'grab' samples of shallow perched water identified some minor exceedances of the environmental quality standards but no exceedances of the drinking water standards.

17.119 It is important to note that, as the investigation was undertaken in 2018, the current redevelopment plans, and layouts weren't available, and the Application Site was still operational. These limitations need to be addressed and, as a result, further ground investigation and assessments will be undertaken post demolition as this will allow access into areas that could not be accessed during the 2018 investigation. The results would be presented in a 'Phase II' geo-environmental interpretive report in accordance with BS10175:2011+A2:2017



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Investigation of Potentially Contaminated Sites – Code of Practice (Ref. 17.32) and LCRM guidance (Ref. 17.29).

17.120 Where required the Phase II would be followed by a Remediation Options Appraisal, Remediation Strategy and (post-remediation) preparation of a Verification Report. All works will be undertaken in compliance with LCRM Guidance (Ref. 17.29). Where required a long-term monitoring programme would be proposed and incorporated into the final Proposed Development design. This currently applies specifically to the PCE plume area where long-term monitoring of the groundwater would be required during the Monitored Natural Attenuation (MNA) phase.

#### Site Preparation and Earthworks

17.121 Waste arising from site clearance, primary infrastructure and earthworks is expected to comprise rubble, tarmac from former areas of hard standing, gravel, clay material and possibly localised contaminated materials.

17.122 Demolition rubble (if present) will be screened and crushed for re-use on-site (where possible). The mobile plant and equipment will be permitted, as required under the *Environmental Permitting (England and Wales) Regulations 2016*. Techniques to minimise emissions are outlined within Process Guidance Note 3/16 (12) Secretary of State's Guidance for Mobile Crushing and Screening (Ref. 17.33).

17.123 Any clean excavated material that cannot be reused on-site would be removed by registered waste carriers and sent for reuse at another development site or sent for disposal at appropriately permitted facilities. If excavated soils are to be reused on-site this would be undertaken in compliance with the CL:AIRE Definition of Waste: Code of Practice (Ref. 17.34).

17.124 The CL:AIRE Definition of Waste: Development Industry Code of Practice (DoWCoP) will be used to assess whether excavated materials are classified as waste or not. If excavated materials are dealt with in accordance with the DoWCoP, the Environment Agency (EA) should consider that these materials are unlikely to be waste if they are used for the purpose of land development. An integral part of the CoP is the production of a Materials Management Plan (MMP) which documents how all the material to be excavated are to be dealt with.

17.125 All excavations/soils in higher risk areas will be monitored and analysed by qualified and experienced field scientists to ensure the chemical characteristics of the materials are



understood and that they are handled and segregated appropriately (e.g. contaminated soils will not be mixed with uncontaminated soils).

17.126 Detailed records (and where appropriate a photographic log) will be kept of all construction phase waste arisings and their management and fate. This will be available to the Local Authority and EA on completion of the construction phase.

17.127 Where wastes are to be removed from the Application Site and disposed of to landfill Waste Acceptance Criteria (WAC) testing will be undertaken to determine the type of landfill that can accept the waste *i.e.* hazardous, stable non-reactive hazardous and inert waste.

17.128 All works will be undertaken within-line with current statutory guidance. A Materials Management Plan (MMP) would be produced so that the Principal Contractor can comply with Environment Agency requirements with regards to excavated materials *i.e.* the DoWCoP.

#### Considerate Constructors Scheme

17.129 It is anticipated that the Principal Contractor would register the Application Site with the 'Considerate Constructors Scheme' (CCS) a national initiative set up by the construction industry. Sites that register with the CCS sign up and are monitored against a Code of Considerate Practice, designed to encourage best practice beyond statutory requirements.

17.130 The Scheme is concerned about any area of construction activity that may have a direct or indirect impact on the image of the industry. The main areas of concern fall into three main categories: respect for the community, care for the environment and value their workforce. Waste management is a key area of focus and on-site considerations as outlined within the Considerate Constructors Scheme Checklist (Ref. 17.35).

17.131 It is expected that registered construction sites work in an environmentally conscious, sustainable manner.

#### Resource Management Plan

17.132 Site Waste Management Plans (SWMPs) were a statutory requirement until December 2013. SWMP still provide a structure for systematic waste management at all stages of a project's delivery and are still best practice for managing construction waste. They are sometimes also referred to as a Resource Management Plan (RMP).



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17.133 The Principal Contractor would develop a plan that defines (as a minimum) the following:

- a target benchmark for resource efficiency i.e. m<sup>3</sup> of waste per 100m<sup>2</sup> or tonnes of waste per 100m<sup>2</sup>;
- procedures and commitments for minimising non-hazardous waste in line with the benchmark;
- procedures for minimising hazardous waste;
- procedures for monitoring, measuring and reporting hazardous and non-hazardous site waste; and
- procedures for sorting, reusing and recycling construction waste into defined waste groups (see additional guidance section), either on site or through a licensed external contractor.

17.134 The plan will ensure (where practicable) that materials are diverted from landfill through consideration of waste hierarchy, *i.e.*

- reusing the material on site (in-situ or for new applications);
- reusing the material on other sites;
- salvaging or reclaiming the material for reuse;
- returning material to the supplier via a 'take-back' scheme; and
- recovery of the material from site by an approved waste management contractor and recycled or sent for energy recovery.

17.135 The roles and responsibilities for establishing, maintaining and implementing the waste management plan shall be clearly stated.

#### Construction Environmental Management Plans

17.136 A Construction Environmental Management Plan (CEMP) identifies the project management structure roles and responsibilities, regarding managing and reporting on the environmental impact of the construction phase including waste management.

17.137 Wastewaters likely to be generated on-site during the construction phase could include temporary portable toilets (utilised by the construction workers), wastewater from dewatering of excavations (groundwater and surface water runoff) and dirty water from the temporary on-site wheel wash.





17.138 Temporary portable toilet units will be emptied frequently under a maintenance contract. The waste from the units will be taken off-site for treatment and disposal at a local municipal wastewater treatment works.

17.139 Any water arising from the dewatering of excavations will either be discharged back over the ground surface and allowed to infiltrate or discharged to sewer or surface water (subject to statutory controls). Contaminated groundwater will be removed from the Application Site for off-site treatment and disposal.

17.140 Wastewater generated from the on-site wheel wash will be either collected in a sealed system for reuse, or collected in a sealed system for authorised disposal, following the guidance set out in the current UK Government Guidance (Ref. 17.36).

### **During Operation**

17.141 The following mitigation measures will be employed during the operational phase.

#### Waste Management Strategy

17.142 An operational waste management strategy will be prepared that:

- provides an estimate of the anticipated waste generation for the Proposed Development during operation;
- provides guidance on waste management to ensure that adequate spatial provision for clean, and efficient storage and collection of waste is incorporated into the design in-line with current British Standards (Ref. 17.1);
- allow waste and recycling to be appropriately stored, managed, collected and disposed in a safe and efficient manner;
- provide a strategy for the management of the anticipated waste generation within the Proposed Development, from the point where waste is generated to the point where it is collected;
- ensures that national and local policies are met; and
- investigate initiatives aimed at reducing the quantity of waste produced and maximising recycling rates (in-line with local opportunities).

17.143 All residential dwellings, regardless of type, will be provided with suitable bin(s) of a suitable size. It is suggested that where there is a lack of guidelines within BS5906 that (where



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required) the criteria within the HQM One England (Ref. 17.37) are utilised. Therefore, the proposed internal storage arrangements are outlined below:

- Recyclable waste – Norwich operates a commingled recycling service. Paper, cardboard, cans, food tins, aerosols, foil, glass bottles, jars, plastic bottles, food trays, pots, food cartons, drink cartons (including Tetra Pak) can all be recycled together in one container. Proposed minimum container size of 30 litres for 1–2 bedrooms and 40 litres for 3 or more bedrooms (Ref. 17.37).
- Food waste – All kitchen derived organic wastes, this can include meat fish and bones (cooked or raw), fruit and vegetables, bread, rice and pasta, eggs and dairy products, tea bags & coffee grounds and plate scrapings. As a minimum storage space inside kitchens of 10 litres in volume.
- Non-recyclable waste – All waste considered non-recyclable. No specific guidance available, but it is suggested that 15-30 litres (smaller household with limited space for 1-2 people), 30-40 litres (mid-range size) and 40-50 litres (most suited to families of 2-4 people).

17.144 Residents will be required to manage their own waste within their dwelling and will transport their own waste to the street-level internal waste storage area as necessary.

17.145 The distance residents must walk to a bin store will be under 30 metres (horizontal distance), where possible as per the *Building Regulations 2010* (Ref. 17.38). Where compliance is not possible, assessments will be undertaken to reduce these distances, but due to the dimensions of the buildings and the need to locate the communal waste stores within 10 metres of the refuse collection vehicle point (Ref. 17.1), there are limited opportunities to improve on the distances.

#### Communal Waste Storage Areas

17.146 All residential plots phases will be provided with a suitable internal communal waste storage area that residents will use to store their waste prior to collection by Norwich City Council's waste collection service provider.

17.147 The communal waste storage areas will be large enough to store (as a minimum) the equivalent of one week of waste and recyclables based on the estimated waste metrics for each of the plots.

17.148 External/central waste storage areas will be configured in one or two formats:



- Dedicated Facilities – Where a dwelling has direct access to the street and has sufficient space to store bins, it will be provided with a 360-litre wheeled bin which will be stored in a suitable secure location.
- Communal Facilities – For dwellings with multiple occupancies a communal waste facility will be provided for use by all tenants. The communal waste facility will have sufficient storage capacity to store the waste generated by the tenants for one week based on the waste generation metrics.

17.149 Every communal storage area will meet (as a minimum) the following standard:

- Accessibility – All bins shall be accessible within the bin store (i.e. the stores will be adequately sized). The stores shall be designed to allow the full opening of waste containers (2 metres minimum height).
- Secure – All communal bin stores shall be secured to prevent unauthorised access.
- Storage of other items – The communal bin stores will only be used to store waste materials. No other materials will be permitted.
- Signage – Communal storage areas shall include appropriate signage detailing correct use of the facilities.
- Lighting and ventilation – Appropriate lighting and ventilation shall be provided and maintained.
- Surfacing – Internal areas shall be constructed of good quality hardstanding to allow for cleaning and washing down. A source of water supply should be sufficiently close to the waste store.

17.150 There shall be no external storage of bins or other waste containers.

17.151 Food waste external bin are small (23-litre) containers, specific to those properties with a food waste collection service that are not using a 240-litre bin for organic waste, for food to be placed in prior to collection. The placement of communal stores has assumed the presence and use of 240-litre food waste bins.

17.152 No commercial wastes will be permitted within the communal residential waste stores.

17.153 Accessible positions shall be provided for the storage of large and bulky waste (e.g. furniture, fridges, etc.) or recyclable materials (e.g. cardboard packaging) or both, so that the local authority collection agent can make collection arrangements. All residential users will be informed that items should only be put out on the collection day.



17.154 Dog waste bins will be incorporated into the final design.

#### Waste Collection

17.155 To achieve the waste collection contractors maximum walking distance of 10 m from each of the dedicated waste storage areas a protected access routes through adjacent parking areas shall be provided at strategic locations. The protected access routes should be designed to prevent parked vehicles from blocking it at any time.

17.156 The standalone Transport Assessment includes a Delivery and Servicing Plan (DSP). This document outlines the roads and approaches to buildings and the relationships with respect to waste management collection. All systems have been designed to comply with BS5906 (Ref. 17.1).

#### Commercial Wastes

17.157 The tenant of each commercial unit will be required to provide a suitable waste storage area as part of their fit-out which is appropriated sized to accommodate the waste that they will generate based on a reasonable waste collection frequency that has been agreed with a commercial waste contractor. To ensure that the tenant provides an appropriate waste storage area within their unit, the requirements for waste management will be included in the tenant's specification.

17.158 The tenant's specification will, as a minimum, include the following requirements:

- All tenants should maximise the amount of waste that they recycle.
- Sufficient space will be allocated to the storage of waste and recyclables within the tenant's demise.
- Waste stores should be designed in compliance with BS5906:2005 (Ref. 17.1).
- No waste or recyclables should be stored outside of the tenants' premises.
- All waste and recyclables should be stored in sealed waste containers (i.e. wheeled bins or Eurobins).
- Waste and recyclables should be stored within a defined area (i.e. separate from other commercial activities).
- Waste and recyclables should be collected frequently enough to avoid odour generation.



- The tenants must arrange a suitable waste and recycling contract through a commercial waste contractor.

17.159 The proposed plans relating to the tenanted area will have to be submitted to and approved by the developer prior to fit out work commencing.

#### Landscaping

17.160 As part of the Estate Management plan for the communal gardens, composting bins (size to be determined) will be provided within the communal gardens for organic wastes resulting from the landscape management.

17.161 The composting bins will be used only for leaf litter, trimmings and other vegetative matter resulting from the maintenance of the communal gardens and will not be used by residents at the Proposed Development.

17.162 The landscaping team will be responsible for the composting bins and will ensure that they are correctly managed to ensure that they provide high quality compost that can be reused on-site.

17.163 Prior to the installation of the composting bins the site management team will have to liaise with the Environment Agency to assess whether they will need an Environmental Permit or an Exemption (e.g. T23 waste exemption: aerobic composting and associated prior treatment) to operate the composting facilities.

## **RESIDUAL IMPACTS**

### **During Construction**

17.164 Following implementation of the proposed mitigation measures, the Proposed Development (construction and demolition phase) has potential for **Temporary, Minor Adverse** impact at a **District/Regional** scale (**Not Significant**).

### **During Operation**

17.165 Following implementation of the proposed mitigation measures, the Proposed Development (operational phase) has potential for **Permanent, Neutral** impact at a **District** scale (**Not Significant**).



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## SUMMARY

17.166 The provision of sufficient, well-designed storage and collection arrangements should have an overall **Permanent Positive** impact on local waste management activities across the Application Site.

17.167 Subject to the mitigation detailed within this Chapter, the Proposed Development is likely to comply with all legislation and planning policy requirements with regards to waste management. The proposals are in line with the Norwich City Council Policy with regards to the management of waste and residential developments.



**Table 17.8: Waste Management Summary Table**

Potential Effect	Nature of Effect (Permanent or Temporary)	Significance	Mitigation/Enhancement Measures	Residual Effects
<b>During Construction</b>				
Increase in waste generation and increase in demand for local waste treatment and disposal facilities  District/regional waste treatment and disposal facilities	Temporary increase in demolition and construction waste volumes	Significant	Pre-demolition Survey Hazardous Material Surveys Land Contamination Surveys Considerate Constructors Scheme Resource Management Plan Construction Environmental Management Plans	Temporary Minor Adverse impact District/Regional scale Not Significant
<b>During Operation</b>				
Increase in waste generation and increase in demand for local waste treatment and disposal facilities  District waste treatment and disposal facilities	Permanent increase in domestic waste	Not Significant	Waste Management Strategy	Permanent Neutral impact District scale Not Significant



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## 18 CONCLUSIONS

18.1 This chapter contains the conclusions of the Environmental Statement (ES). The ES has examined the potential impacts associated with the Proposed Development during both the construction and operational phases.

18.2 The conclusions from each topic assessed in the ES are provided below.

### **Development Programme, Demolition and Construction**

18.3 This chapter identifies that the construction effects of the Proposed Development would be managed through the development of a project and site-specific Construction Environmental Management Plan (CEMP). The CEMP would outline methods for contractor and general public liaison, hours of work, methods to deal with complaints, and outline management practices to control dust, traffic and access, waste, water resources, ecological and archaeological effects, ensuring a high level of control throughout the construction works.

18.4 The procedures within the CEMP would ensure the delivery of a high level of environmental control throughout the construction phase, thereby minimising the potential for adverse effects.

18.5 The Proposed Development will be constructed in two Phases. It is anticipated that the duration of the construction works for Phase 1 will be to be approximately 5 years commencing in 2024 and completed by end 2028 and Phase 2 will be approximately 13 years commencing in 2028 and completed by end 2040.

### **Transport and Access**

18.6 The Movement Strategy has been designed around a hierarchy of users which priorities walking and cycling as a preferred mode of travel followed by public transport and car-sharing and then private car use. The internal network has been designed to reduce the dominance of vehicles and make the environment pleasant and convenient for pedestrians and cyclists so that people will choose to walk and cycle as their preferred mode of travel. The Proposed Development will deliver a new footbridge over the River Wensum and open up the subway beneath the rail line. This will reduce travel distances to key facilities. The Proposed Development will also deliver off site transport improvements at key junctions so that they are easier and safer for pedestrians and cyclists. The redevelopment of the Carrow Works site



provides an opportunity for pedestrians and cyclists to avoid certain busy roads and junctions as well as bypassing the steep hill on Bracondale and King Street.

18.7 The Proposed Development will be supported by a Transport Implementation Strategy (TIS) which provides the opportunity to further reduce dependence on travel by private car and seeks to influence travel to and from the site rather than merely assessing its impact.

18.8 The Proposed Development will be a 'low car' scheme, and a new Car Club will be introduced on-site so that every resident will be able to use a car for essential journeys even if they do not own one. Secure cycle parking will be provided in accordance with NCiC standards.

18.9 Three new bus stops will be provided within the Application Site, ensuring that every resident will live within 200m of a bus stop with frequent buses to a wide range of destinations. The new footbridge will reduce the walking or cycling time to Norwich Station which provides a direct and frequent services to a wide catchment including London and Stansted airport.

18.10 Junction capacity analyses have been carried out for a number of junctions within a defined study area. These demonstrate that the net increase in travel will result in some additional queues on pre-stressed junctions during the highway peak periods; however, the proposed mitigation measures comprise off-site infrastructure improvements to promote sustainable travel choices rather than adopting a 'predict and provide' strategy to increase capacity for private car journeys.

18.11 During the construction period there would be minimal traffic flows associated with construction during the peak hours so the effects on the highway network would be Neutral. The very presence of HGVs on the local network may contribute towards fear and intimidation of vulnerable road users so the residual effects on pedestrians and cyclists would be Minor Adverse short-term local.

18.12 The residual impact of the Proposed Development following the proposed range of on- and off-site highway improvements and the TIS would be a Minor Adverse long-term local effect on highway capacity, however, the residual effect of the Proposed Development would be a Moderate beneficial long term local effect on pedestrian and cycle infrastructure. The residual effect on bus and rail capacity would be Neutral.

## **Air Quality**



18.13 An air quality impact assessment has been undertaken to assess both construction and operational effects associated with the Proposed Development.

18.14 An assessment of the potential impacts during the construction phase has been carried out in accordance with the latest Institute of Air Quality Management Guidance. This has shown that for the Proposed Development, limited releases of dust and particulate matter are likely to be generated from on-site activities. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and particulate matter releases may be effectively mitigated and the resultant impacts are considered to be negligible.

18.15 ADMS Roads dispersion modelling has been carried out to assess both the impact of the operation of the Proposed Development on local pollutant concentrations and the suitability of the Application Site for its proposed end use with regards to local air quality. The results indicate that predicted concentrations of relevant pollutants (NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>) concentrations are well below the relevant objectives within the Proposed Development and at nearby sensitive receptors. The predicted increase in NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations is of negligible significance at worst-case receptor locations along the local road network.

18.16 Future occupants of the Proposed Development would not be exposed to pollutant concentrations above the relevant objective levels, therefore the impact of the Proposed Development with regards new exposure to air quality is considered to be negligible.

18.17 It is concluded that air quality does not pose a constraint to the Proposed Development, either during construction or once operational.

### **Noise and Vibration**

18.18 An assessment considering the likely effects of the Proposed Development with respect to noise and vibration has been undertaken. This included the effects of existing conditions on the Application Site and the effects of noise and vibration generated from construction activities pertaining to the Proposed Development on surrounding properties. Limits have been specified for the operational phases. The detailed design of the Proposed Development will ensure that noise emissions from the Application Site would remain below the specified background sound levels.

18.19 The impact of noise and vibration during construction of the Proposed Development has been predicted and assessed in accordance with BS 5228. Generic mitigation measures have



been recommended, which when implemented are capable of ensuring that the impact of noise and vibration during the construction of the Proposed Development is adequately controlled.

18.20 Construction noise and vibration effects are likely to be Minor (not significant) in the short term with the majority of activities being Negligible (not significant).

18.21 An assessment has been carried out in accordance with the adopted criteria to determine the suitability of the Application Site for residential accommodation. The assessment has been based on a computer noise model, informed and validated using environmental noise measurements and traffic data provided for the adjacent road links.

18.22 Noise levels at the residential dwellings associated with the Proposed Development are likely to be sufficiently mitigated with the implementation of typical insulated double glazing and attenuated ventilation. The residual noise effect is considered to be Negligible (not significant) with the incorporation of these measures.

18.23 The impact of the increase in road traffic associated with the Proposed Development has been calculated as Negligible (not significant).

### **Biodiversity and Nature Conservation**

18.24 Ecological surveys of the Application Site have been undertaken, including a desk study, and Preliminary Ecological Appraisal.

18.25 A number of ecological designations within the surrounds of the Application Site have been identified by the desk study. Potentially significant effects have been identified on Broadland (Ramsar and SPA), River Wensum (SAC), The Broads (SAC), Whittingham Local Nature Reserve, and three County Wildlife Sites.

18.26 The Application Site itself is dominated by buildings and hardstanding, which are considered to be of low ecological value, however impacts on woodland and grassland within the Application Site, although largely retained by proposals, have been assessed.

18.27 Surveys of protected species have yet to be completed, however the PEA noted potential suitability for bats, reptiles, birds (including peregrine falcon) and polecat. Further surveys for these species groups will be required to inform the assessment, at which point this assessment will require updating, however indications of importance, potential impacts, and



possible mitigation measures have been proposed based on the condition of habitats and desk study data.

18.28 A range of potential effects have been identified on off-site receptors (designated sites), on-site habitats and fauna. Mitigation measures are therefore proposed, including mitigation for the internationally designated sites, construction safeguards, formalised via CEMP, new habitat retention and enhancement, and mitigation methods for protected species (to be confirmed on completion of phase 2 surveys) to ensure compliance with relevant legislation and planning policy.

18.29 Following mitigation, compensation and enhancement measures, it is considered that the residual effects of the Proposed Development are likely to be neutral to net positive at local level, however this will require confirmation after completion of phase 2 species surveys and a finalisation of the nutrient neutrality strategy.

### **Water Quality, Hydrology and Flood Risk**

18.30 Groundwater and foul drainage are considered to be the key receptors in terms of the Proposed Development. For groundwater, this is due to the Application Site being situated on a Principal Aquifer and within an SPZ Zone. For foul drainage, the high sensitivity classification is due to the local drainage infrastructure potentially not having the capacity for the Proposed Development without mitigation and consultation with Anglian Water is ongoing. Surface water is considered to be medium sensitivity as the Application Site is located within the 'Wensum' catchment which has a 'Moderate' ecological status. Flood risk and drainage are considered to be low sensitivity receptors as the Application Site is located largely in Flood Zone 1 and is not in a critical drainage area.

18.31 Guidance has also been provided by Natural England with regards to the potential to affect water quality by treated foul effluent resulting in adverse nutrient impacts on habitat sites. The Proposed Development will result in a net increase in population served by the Anglian Water wastewater system. At this stage it is known that there are various options available for the mitigation of this impact, however, currently no specific mitigation measure has been opted for. The detailed aspect of this application does not include any new buildings, therefore it is proposed that nutrient neutrality is considered and conditioned at the reserved matters application stage, where the new housing developments will be brought forward for assessment.





18.32 The key effect during the construction phase is the potential for the remobilisation of contaminants at the Application Site and discharge of polluted effluent into the River Wensum, the mitigation for this is to be outlines in the CEMP.

18.33 The Proposed Development will include Sustainable Drainage Systems (SuDS), as detailed within the Flood Risk Assessment and Drainage Strategy reports. The system seeks to reduce the rate of surface water runoff in accordance with local policy. This runoff rate would be lower than the current rate of surface water runoff during extreme events. The integration of SuDS and petrol interceptors will also improve the quality of surface water discharged from the site to the River Wensum.

### **Soils, Geology and Contaminated Land**

18.34 This chapter reports on the effects of the Proposed Development on the soils and geology, with regards to land contamination.

18.35 An assessment of ground conditions and contamination has been undertaken using the findings of a desk-based study and intrusive site investigation undertaken at the Application Site in 2018 and updated using 2022 baseline data.

18.36 An assessment of the potential impacts during the construction phase has been carried out. This has shown that during this phase of the Proposed Development land contamination is unlikely to worsen during site activities. Through good site practice and the implementation of suitable mitigation measures such as Pre-demolition Survey, Hazardous Material Surveys, Construction Environmental Management Plan (CEMPs), Construction Health and Safety Controls, Geoenvironmental Surveys, Remediation Options Appraisal and Remediation Strategy (including land gas protection measures), Remediation programme implementation, Verification Assessment and Reporting and Foundation Works Risk Assessment any potential temporary impacts may be effectively mitigated, and the resultant impacts would not be significant.

18.37 The presence of the PCE contaminated groundwater plume represents a significant on-going source of contamination that is currently being addressed through active remediation prior to redevelopment of the Application Site. The Environment Agency has been fully consulted during the investigation and remediation process.



18.38 The residual impact of the Proposed Development on land contamination during both the construction and operational phases is not considered significant. The active remediation programme combined with the proposed mitigation measures should have an overall Permanent Positive impact on the local environment, especially through the reduction of the risks to surface water and groundwater.

### **Archaeology**

18.39 Carrow Priory Scheduled Ancient Monument (SAM) is located within the centre of the Application Site. Given the national significance of the SAM and the potential archaeology on the Application Site, consideration should be given to the potential constraints in the earliest stages of the Proposed Development.

18.40 The Application Site has the potential to contain archaeological remains, likely to constitute prehistoric, Roman, medieval or post-medieval features.

18.41 A number of previous archaeological excavations have been undertaken on the Application Site.

18.42 Archaeological survival on the Application Site is likely to be variable. Within the location of existing buildings and areas of identifiable intrusive landscaping, archaeology is likely to be truncated or completely disturbed. Outside of these locations, as demonstrated in the archaeological survival plan, the potential for archaeological remains is higher.

18.43 Due to the range of periods that remains may date to and the proximity of Carrow Priory surviving archaeological remains on the Application Site are likely to range between negligible/local area significance and national significance.

18.44 The Proposed Development will include below ground intrusions (piling, foundations, service runs etc.) with potential to impact on below ground archaeological remains.

### **Heritage, Townscape and Visual Impacts**

18.45 Overall, the proposal offers a high standard of design that has considered the urban context. The Proposed Development would largely give rise to predominantly beneficial, neutral or negligible effects and would enhance the visual amenity and townscape character of the Application Site. The only adverse effect identified, concern works to convert the Abbey to a



sustainable use. The clear benefits of bringing this building back into active use have been carefully considered to ensure minimal intervention into historic fabric. This assessment has recognised that a residential use is likely to be the Optimum Viable Use.

18.46 Though the Proposed Development would offer some enhancement to the setting of Carrow Abbey through the replacement of negative contributors, reinstating the historic detachment of the building, there is nevertheless considered to be some residual harm to the Priory and setting of the Abbey through the subdivision of the grounds. This will disrupt one's appreciation of Scheduled Monument and the Grade I listed Abbey. Paragraph 202 of the NPPF states that 'where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal including, where appropriate, securing its optimum viable use'. It is our conclusion that the benefits of being able to deliver a viable scheme that will facilitate the regeneration of the area outweighs the less than substantial harm identified to Carrow Priory and its setting.

18.47 The functions of the Application Site are currently redundant with numerous heritage assets currently at risk of dissociation through dereliction and disuse. While still adjacent to industrial built form and large scale redevelopment to the north of the river, due to topography, riverside location, and mature screening the Application Site has a degree of isolation from the surrounding townscape. Additionally, considering its former use, the Application Site is considered capable of sustaining considerable change. The proposed massing, siting, bulk, scale and architecture has been carefully considered so that the submitted Proposed Development is deemed appropriate in views and townscape. The assessment concludes that while some harm has been identified, this would be balanced against a number of clear heritage benefits across the Application Site as a whole, including regeneration of the area and preservation of key heritage assets. Overall, the character of the surrounding townscape would be enhanced due to the carefully considered and high-quality design which has drawn on the historic context of the Application Site.

## **Socio-Economics, Population and Human Health**

### **Climate Change**

### **Waste Management**



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18.48 The potential for the generation of waste is an aspect of any activity. In relation to the Proposed Development waste will be generated during the demolition and clearance phase, during the construction phase and during the operational phase.

18.49 An assessment of the potential impacts during the demolition and construction phase has been carried out using available guidance. Through good site practice and the implementation of suitable mitigation measures (applied via Planning Condition) such as a pre-demolition surveys, hazardous material surveys, land contamination surveys, Resource Management Plans (RMPs) and Construction Environmental Management Plans (CEMPs) any potential temporary impacts may be effectively mitigated.

18.50 Following implementation of the proposed mitigation measures, the Proposed Development (construction and demolition phase) has potential for Temporary, Minor Adverse impact at a District/Regional scale (Not Significant).

18.51 An assessment of potential impacts during the operational phase has been made using current guidance i.e. BS 5906:2005 - Waste management in Buildings - Code of Practice. Through the development of an appropriate waste strategy (aligned to the current guidelines) the provision of sufficient, well-designed storage and collection arrangements should have an overall permanent positive impact on local waste management activities across the estate.

18.52 Following implementation of the proposed mitigation measures, the Proposed Development (construction and demolition phase) has potential for Permanent, Neutral impact at a District scale (Not Significant).