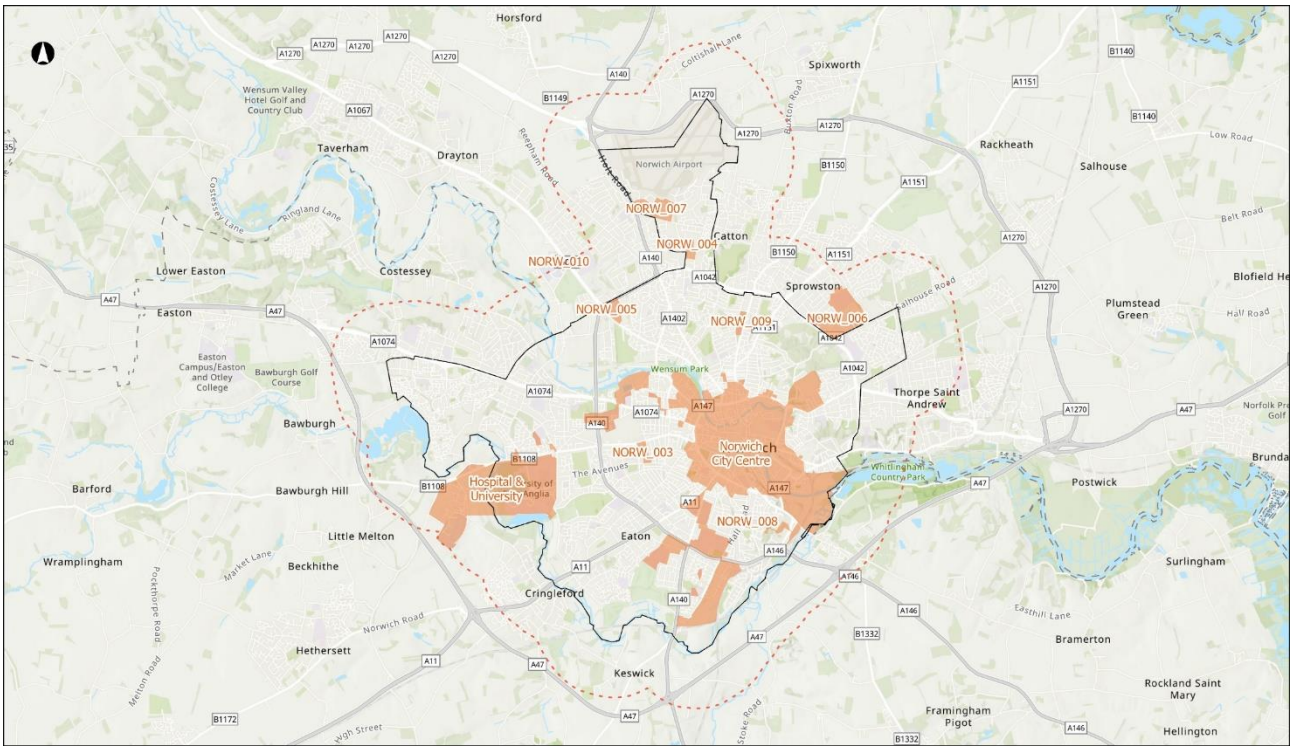
Department for Energy Security & Net Zero

Norwich

Heat Network Zoning

Zone Opportunity Report



February 2025

Disclaimer

Please read the following licence conditions thoroughly to understand your responsibility for use of this report and data presented within it.

This report contains outputs from the Heat Network Zoning Pilot Programme. The Pilot was undertaken prior to full details of the Heat Network Zoning policy being available. Therefore, the contents, including data shown in maps, technical and economic data within the report, are likely to change and potentially sensitive information is withheld. No part of this report shall be relied upon for any business decisions.

Acknowledgements

This document was produced by Greenfield Nordic with support from Norwich City Council. We are grateful to all stakeholders who participated in the Pilot programme for their time and assistance.

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Contents

Executive Summary

About Norwich: Norwich is a city in Norfolk, East of England, with a population of around 140,000. It has a rich history and is known for its service-oriented economy.

Local Energy Policy: Norwich City Council aims to be carbon neutral by 2030 and has set a target for the city to be net zero by 2045.

Existing heat networks: There are 45 communal heat networks in Norwich, primarily servicing social housing. Two large campus-level heat networks exist at The University of East Anglia and Norwich Community Hospital.

Zones identified: Ten heat network zones have been identified in Norwich, with a total annual heat demand for all buildings required to connect of 225GWh/yr.

Strategic heat network zones: Two strategic zones have been identified with a total annual heat demand for all buildings required to connect within these zones of approximately 200GWh/yr.

Key heat demands: The total annual heat demand for buildings connected to the initial zone opportunities is 100GWh/yr. Key buildings include the hospitals, universities and several new developments.

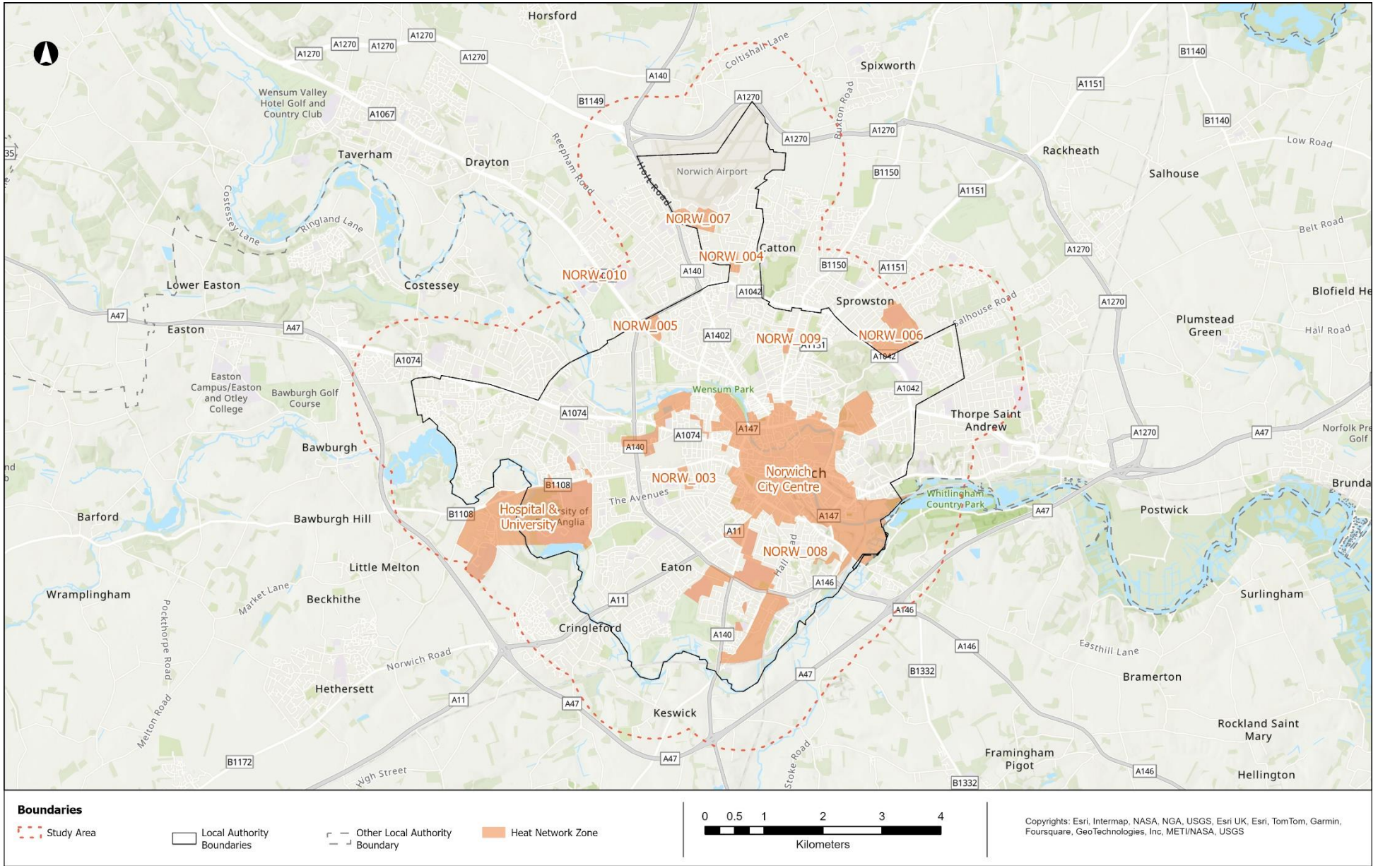
Key heat sources: Potential heat sources include water source heat pumps, recovering heat from rivers and reservoirs, and air source heat pumps.

Estimated CapEx: The high-level estimate of capital expenditure to network all buildings required to connect in all zones is approximately £300m, of which the initial zone opportunities amount to approximately £100m.

Other heat network zones: Smaller heat network zones identified around the city include areas like industrial estates and educational campuses.

Carbon savings: Initial zone opportunities identified could deliver carbon savings of more than 15 $ktCO_{2e}$ annually.

Figure 1: Overview of Heat Network Zones in Norwich



1) Introduction

Heat networks will play a crucial role in decarbonising heat in buildings. Heat networks take heating, cooling or hot water from a central source(s) and deliver it to a variety of premises such as public buildings, shops, offices, hospitals, universities, and homes. They are also an important part of securing the UK's energy independence through local, low carbon heat sources and reducing the cost of living through efficient, affordable heating in densely populated areas. Analysis shows that heat networks could provide about 20% of total heat by 2050. They currently provide about 3%.

The Department for Energy Security and Net Zero (DESNZ) is enabling the development of heat network infrastructure through a range of targeted funding, policy and legislative support to de-risk projects and attract investment. The Energy Act 2023 establishes the regulatory framework for heat networks in Great Britain and provides powers to introduce heat network zoning in England through secondary legislation. A heat network zone (HNZ) is a formally designated geographical area in England where heat networks are expected to provide the lowest-cost solution for decarbonising heating.

Under heat network zoning, central and local government will work with industry and local stakeholders to identify and designate areas of England where heat networks are expected to be the lowest-cost solution to decarbonising heat. Heat network zoning will be essential to speeding up the development of new heat networks and we hope to catalyse growth where it's most needed.

Heat network zoning will significantly increase private sector investment in the sector by removing the barriers which currently limit the pace of developing large scale heat networks. It will also give local communities the tools to accelerate the development of heat networks in their own areas and ensure that more homes and businesses can have access to greener, cheaper heat. It also has the potential to create tens of thousands of jobs across the country.

This report shows the Pilot programme outputs for Norwich and is intended to showcase potential heat network zones in the city. The report indicates the heat network investment opportunity at a city scale, the potential location of heat network zones, and key opportunities for initial heat network development within those potential zones

Please note that all information presented in this report, including the location of identified heat network zones, is subject to change. These are the findings of Pilot programme that were developed alongside the emerging Heat Network Zoning policy and therefore reflect our understanding at a moment in time. As the methodology improves, we will update these reports to improve our understanding of how heat network zoning may be rolled out in each area. Any potential zones that are identified fully, or partly, in an adjacent local authority area will need to be discussed further once local zone co-ordinators are established.

Heat Network Zoning Pilot Methodology

Heat network zones will be identified using a standardised national zoning methodology[1]. The Heat Network Zoning Pilot Programme (hereafter Pilot programme) set out to develop a process to identify potential zones in a consistent and standardised manner across a range of towns and cities in England. The programme was fully funded and led by DESNZ, working alongside 28 Local Authorities, and multiple consultancy firms, to develop and test this approach at a local level. As such the final outputs are supported by each Local Authority but do not reflect an approved, endorsed, or adopted position on how zones may be delivered.

Lessons from the Pilot have been used to inform the development of the Heat Network Zoning policy. This includes improvements to the identification approach itself, but also wider policy design relating to the number and size of potential zones; existing heat networks; and the impacts of the policy on a range of stakeholders. Once the response to the heat network zoning consultation is published, we will update the methodology to reflect the final policy position.

The key concepts, definitions and complementary workstreams relevant to this report are introduced below. For a fuller description of the Heat Network Zoning policy, and up to date information regarding its implementation, please visit https://www.gov.uk/government/collections/heat-network-zoning.

Heat Network Zone Identification

Heat network zones will be identified using a standardised national zoning methodology. The December 2023 consultation on Heat Network Zoning proposes that the methodology will consist of two stages:

1. a national mapping exercise (using a data-led spatial energy model – the National Zoning Model, (or NZM), to identify indicative heat network zones across England;
2. a refinement stage where relevant local stakeholders will input to the review and refinement of potential heat network zones prior to formal designation.

For the purposes of this study, indicative heat network zones have been identified using a prototype version of the NZM. These indicative zones were then refined by technical consultants with input from local stakeholders. The NZM outputs are already of considerably higher quality than those shared for this work and therefore these reports will improve over time.

This study split heat network zones into two different categories. These are **'strategic'** zones – the largest zones which are generally seen as strategically significant to developing heat networks in an area; and **'other'** zones – which are generally smaller and discrete. These are terms specific to the Pilot programme and the report focuses primarily on the strategic zones.

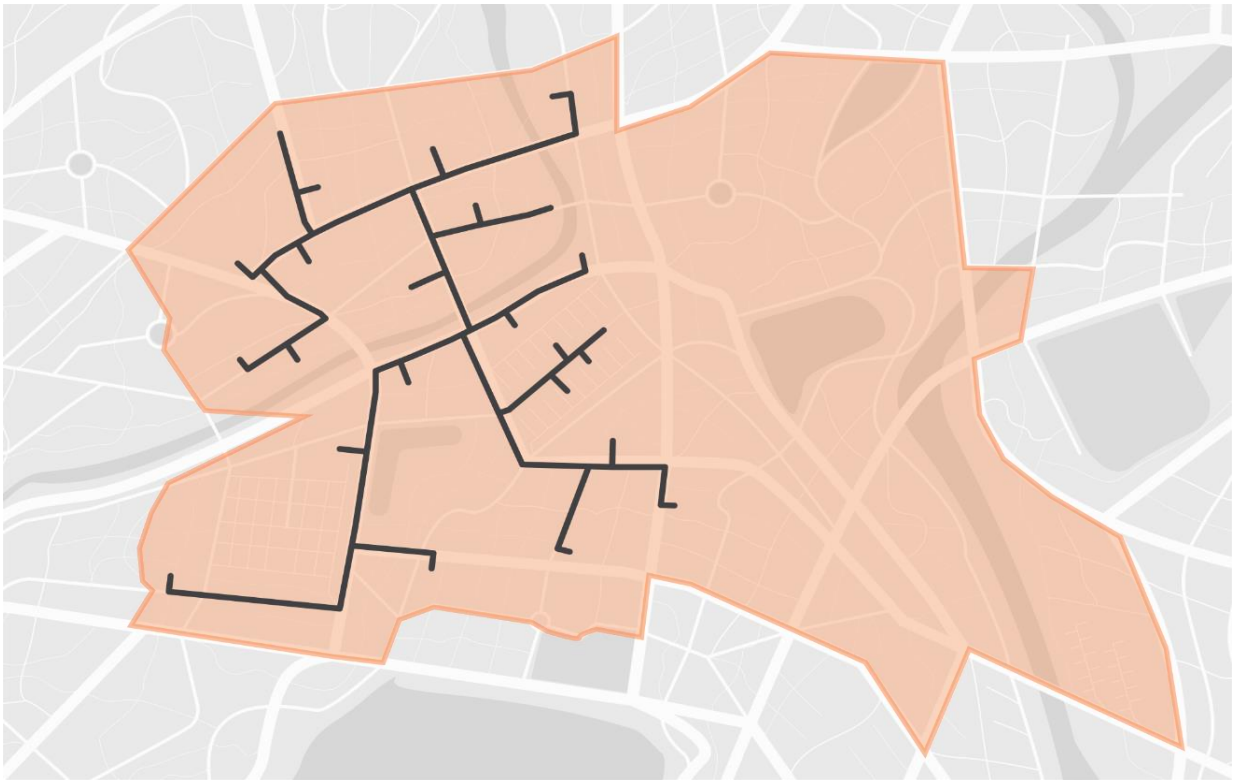
[1] More information can be found in the Heat Network Zoning Methodology Statements (Appendix 3, 4 & 5)

Initial Zone Opportunities

Alongside the identification of potential heat network zones, the Pilot programme has attempted to define areas within zones where the most attractive heat network development opportunities might exist. For the purposes of this programme *only* these are called an "initial zone opportunity" (or IZO). The approach considered economic viability, investment scale and returns, decarbonisation impact and deliverability. They were developed solely around buildings which could be required to connect[2] under the proposed Heat Network Zoning policy and did not consider potential voluntary connections.

Initial zone opportunity design targeted a linear heat density (LHD) of 4MWh/m/yr, for the existing built environment. This is considered a relatively low proxy for economic viability with the heat network sector in England. A more flexible approach was used for new development sites, where different economic success criteria are likely to be applied. To standardise the way opportunities were assessed, the IZOs presented in this report may differ from, or overlap with, existing or planned heat network infrastructure. Campus style heat networks (e.g. in hospitals or university campuses) were considered as potential heat loads with a single point connection. Figure 2 below shows an example of a heat network zone and an IZO.

Figure 2: Illustration of a Heat Network Zone (HNZ) and an Initial Zone Opportunity (IZO)



[2] The building categories being considered as required to connect include new developments, large non-domestic buildings, and communally heated residential blocks as described in Heat Network Zoning Consultation (2023)

Study Scope

This document is presented as a zone opportunity report as it was developed in advance of the final policy design. As such, the report does not include:

- references to the **central authority** or **zoning co-ordinator** roles;
- assumptions about rights of **existing heat networks,** or **zone delivery areas**;
- an options appraisal on which **routes to market** may be taken;
- calculations on the **cost of heat** (connection/tariffs) to specific buildings**;**
- any inferences as the suitability for **public/private sector delivery** unless it's matter of fact (existing network or Heat Network Investment Project/Green Heat Network Fund project);
- references to **local community benefit** or **consumer protection** (subject to a live consultation).

In the future, it is intended that a document, similar in style, will be produced to incorporate these policy design aspects and be used as a Zone Market Prospectus (ZMP) to market heat network zoning opportunities in an area. Further detail on the methodology and initial zone opportunity criteria is provided in Appendix 4 and Appendix 5.

2) Norwich Heat Networks Context

2.1) Norwich City Overview

Norwich is a city and district of the county of Norfolk in the East of England. It is located on the River Wensum which discharges into the River Yare. The city has a population of 140,000 and covers a land area of approximately 53km^2.

Norwich is administered under a two-tier arrangement with Norwich City Council (NCC) offering services at the district level, encompassing areas such as housing, town planning, leisure, and tourism. Norfolk County Council administers county-level services which include schools, social services, libraries, and transportation.

NCC's jurisdiction covers the centre of the Norwich urban area and an area around Norwich Airport. Adjoining urban areas sit within the jurisdictions of South Norfolk District Council and Broadland District Council and together they form the area known as Greater Norwich, which has a population in the region of 320,000.

NCC operates most of the social housing within the city with a stock of over 14,000 residences (including 8 tower blocks). Other social housing is owned by a range of national and local housing providers.

2.2) Norwich Net Zero Targets and Commitments

NCC's Environmental Strategy (2020-2025)[3], published in 2020, and the Climate Emergency Declaration 2019[4] set a target of NCC being carbon neutral by 2030. Furthermore, NCC has set a net zero target for the city of 2045, by means of its membership of UK100. With respect to heat networks, the action plan within the Environmental Strategy identifies several actions including: updating communal heating mapping, setting up an energy company to explore with partner organisations the potential for heat networks and, investigating decentralised energy including locally generated heat. NCC has also published a 2040 City Vision[5] which commits Norwich to "shifting to clean energy by 2040".

Figure 3 summarises key dates in NCC's plans for decarbonisation and demonstrates their progress towards decarbonisation targets set in NCC's Environmental Strategy.

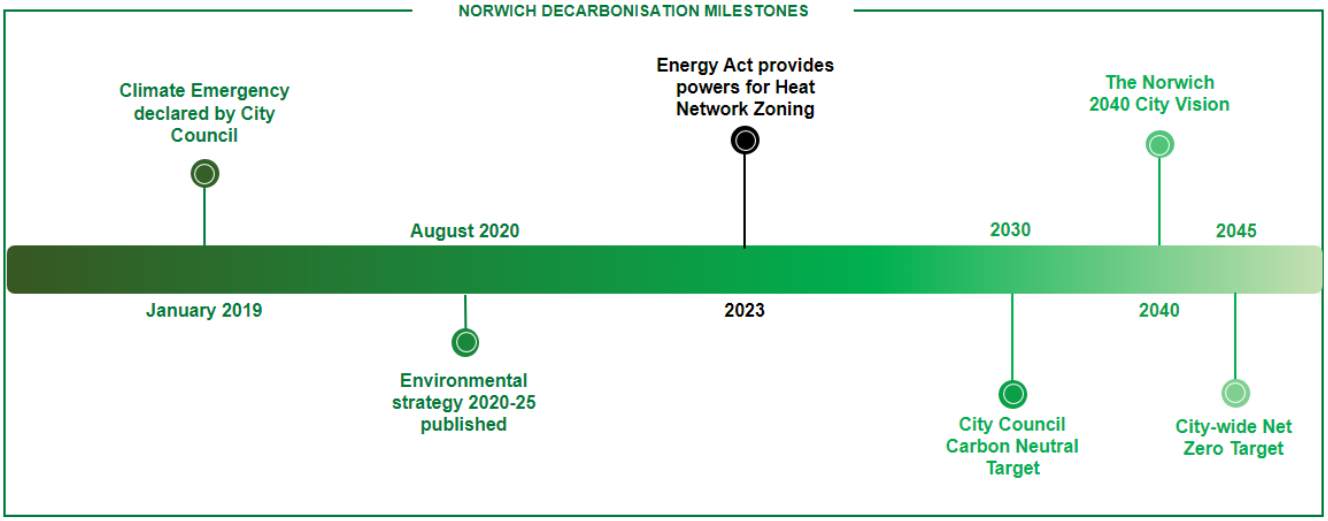
Delivery of city-scale heat network(s) could make a significant contribution to NCC's net zero ambitions, whilst providing economic and consumer benefits.

[3] Norwich City Council (2020) Environmental strategy 2020-25. Available at: https://www.norwich.gov.uk/info/20195/policies_plans_and_strategies/3606/environmental_strategy_2020-25

[4] Norwich City Council (2022) Climate Change and Sustainability. Available at: https://www.norwich.gov.uk/info/20504/climate_change_and_sustainability

[5] https://www.norwich.gov.uk/info/20324/norwich_2040_city_vision

Figure 3: Norwich Decarbonisation Milestones



2.3) Delivering Heat Networks in Norwich

Norwich does not currently have any operational district-scale heat networks. However, there are 45 communal heat networks known to be operating in the city, servicing social housing. 16 of these are registered under the Heat Network Metering and Billing Regulation while 29 (owned/operated by NCC) are not currently registered. There are a further two campus heat network schemes on the University of East Anglia (UEA) and Norwich Community Hospital estates. This demonstrates there is some existing knowledge and insight within the city to support heat network deployment.

NCC is planning to conduct heat network feasibility work across key parts of the city alongside a Local Area Energy Plan to ensure a coherent approach across energy issues.

Planning policies for the city are detailed in the Greater Norwich Local Plan (GNLP), which was adopted in early 2024. It covers the Greater Norwich area, replacing the existing Joint Core Strategy (2014-26) and relates to the period up to 2038. In relation to heat networks, the GNLP includes a Sustainable Communities policy with requirements around energy. This includes (clause 10ii) to: “Provide for the use of sustainable energy, local energy networks and battery storage where appropriate, giving the planning authority the opportunity to review delivery solutions and apply relevant conditions on development.”

It is understood that deployment of a heat network solution for the East Norwich regeneration scheme is under consideration. NCC is working with stakeholders to bring the scheme to market, which will facilitate deployment of low carbon solutions including heat networks.

Please refer to Appendix 2 for further information about the evidence compiled for heat network opportunities in Norwich. This includes a stakeholder directory and records of interactions with those stakeholders as well key studies and reports.

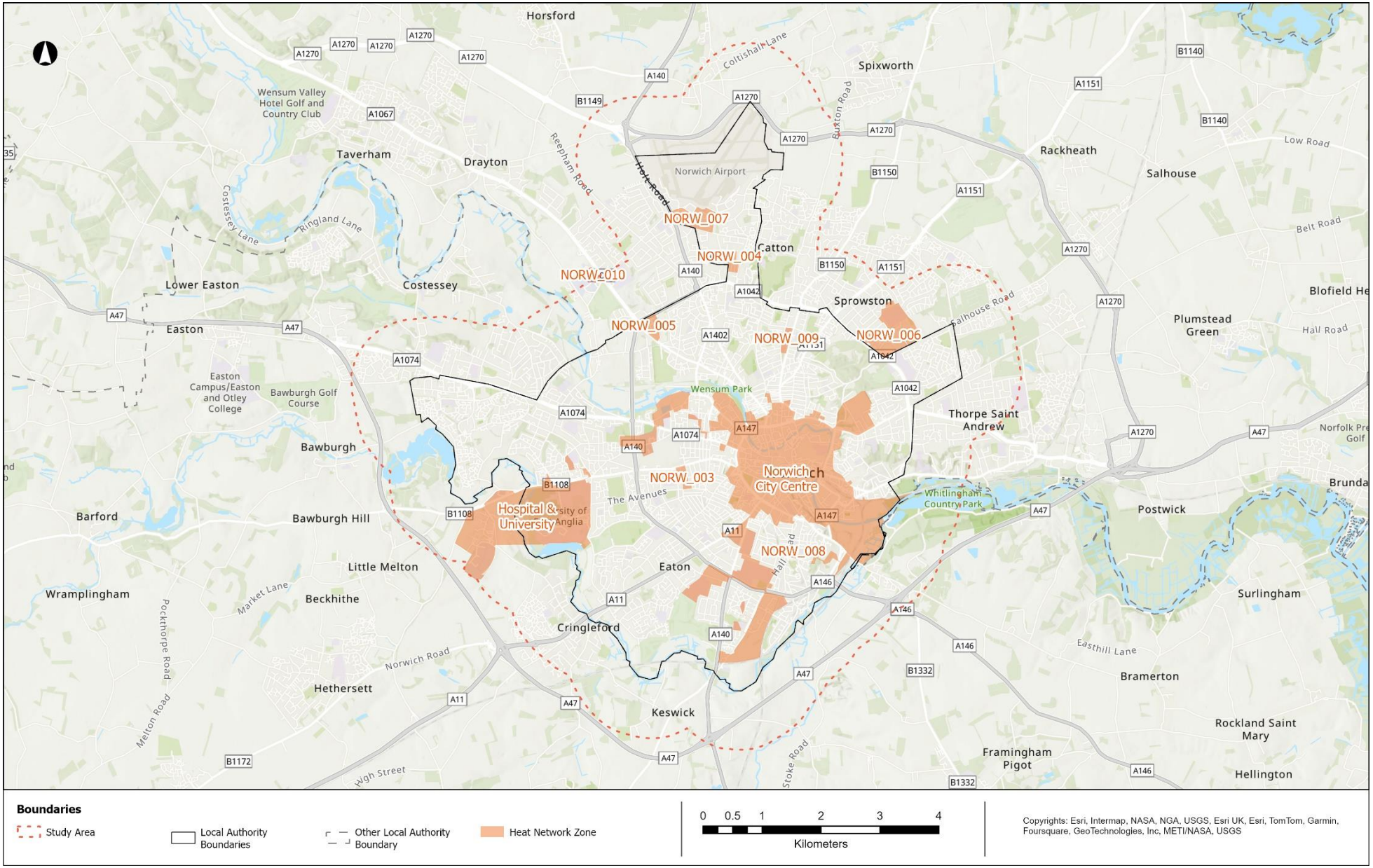
2.4) Norwich Heat Network Zones

A total of ten potential HNZs were identified in Norwich, with two considered Strategic HNZs. Figure 4, below, shows the study area boundary as well as the boundaries of all HNZs identified within Norwich. Strategic HNZs have been allocated a meaningful name agreed as relevant from a local perspective whilst Other HNZs have a reference number allocated instead. In both cases, these names are shown on the map.

Please see Appendix 1 for the following maps giving more detail:

- A: City Typology Map – shows building typologies which dominate by area.
- B: Key Heat Loads Map – highlights key buildings required to connect by heat demand.
- C: Key Heat Sources Map – highlights key heat sources by type and potential energy centre locations as well as any existing district heat network energy centres.
- D: Existing / Planned Heat Networks Map – shows existing heat networks, planned extensions, and planned networks at an advanced development stage.
- E: Key Constraints Map – shows key topographical constraints identified.
- F: Off-gas Grid Areas – presents areas with differing levels of properties off the gas grid within the study area.

Figure 4: Heat Network Zones Identified within the Norwich Study Area



3) Strategic Heat Network Zones

Strategic HNZs in Norwich

This section examines the two strategic HNZs and the IZOs identified within each. This covers the key heat demands, heat sources, energy centre locations and potential constraints for each IZO identified. Heat network distribution routes are conceptual and designed to illustrate the potential size and scale of the heat network opportunity that may be realised as part of the upcoming Heat Network Zoning policy. Other heat network zones are listed in Section 4.

Table 1 below presents a high-level estimate of the scale of opportunities across Norwich. Please refer to Appendix 4 for more detail.

Table 1: Annual Heat Demand for Buildings in All Zones, Strategic Zones and IZOs

Scope	Annual heat demand (GWh/yr)
All buildings required to connect in all zones[6]	225
All buildings required to connect in strategic zones	200
All buildings connected to the IZOs	100

Existing/planned heat networks that overlap with IZOs are described, though their locations may vary due to different approaches. The Pilot programme applied a standard set of technical and economic assumptions across each of the 28 areas that participated in the programme and uses a proxy for economic viability (see Section 1 and Appendix 4 for more detail). Existing and planned networks will often be based on more detailed design work and have taken account of strategic and commercial considerations that were relevant at the time of their development. Future iterations of this report will consider how to better align local studies whilst retaining a nationally consistent approach.

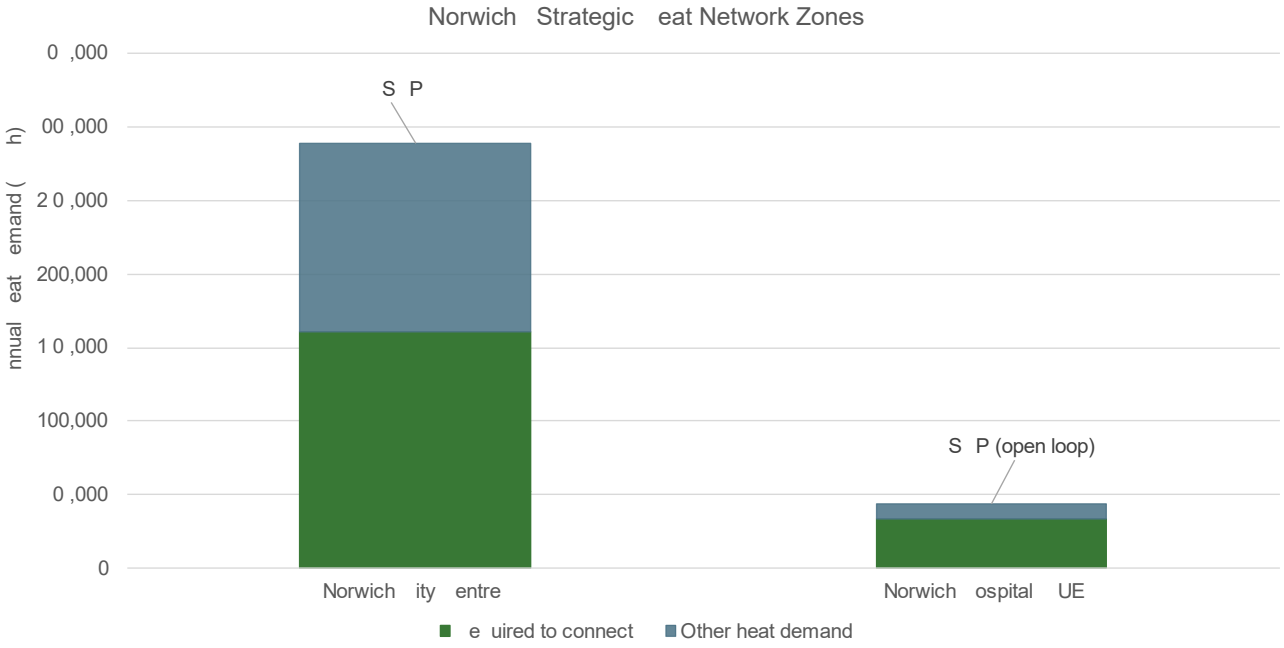
The two strategic zones are summarised below. Figure 5 illustrates the size of each, alongside the key potential heat source and the proportion of buildings that may be required to connect.

Norwich City Centre is a large strategic zone covering the denser parts of the city centre and the East Norwich regeneration area. In this zone, two IZOs were identified which are proposed to be supplied by water source heat pumps (WSHPs) and air source heat pumps (ASHPs). For more information see Section 3.1.

[6] Row 1 is an estimate of heat demand across buildings required to connect in all zones identified. Row 2 is as per row 1, but only within strategic zones. Row 3 includes buildings connected to the IZOs described and largely comprise of buildings potentially required to connect. Figures are generally rounded up to the nearest 25 or 50GWh/yr.

Norwich Hospital & UEA is a strategic zone located to the west of Norwich, and includes two large anchor loads, Norfolk and Norwich University Hospital and the University of East Anglia. In this zone, one IZO was identified which is proposed to be supply by ASHP(s). For more information see Section 3.2.

Figure 5: Summary of Heat Demands in all Strategic HNZs Identified



3.1) Norwich City Centre

3.1.1) Norwich City Centre – HNZ Summary

The Norwich City Centre HNZ, shown in Figure 6, covers a large area including the denser parts of the city centre and the East Norwich regeneration area. The zone extends out to the southern industrial/commercial area in Tuckswood and extends from the north-western edge of the city centre, connecting with the City Industrial Estate and continuing east to Norwich Community Hospital.

There are several potential low carbon heat sources identified within or close to the zone, including waste heat from Heigham Water Treatment Works, WSHPs recovering heat from the River Wensum or the River Yare as well as centralised ASHPs. Without further investigation into these options, heat recovery from the River Wensum is the preferred option, being close to the high-density heat demand and offering multiple heat offtake locations. As the capacity is estimated to be limited, a centralised ASHP is also proposed.

3.1.2) Norwich City Centre - Existing Heat Networks

No existing district-scale heat networks have been identified in this zone. It is understood that the developer of the East Norwich urban expansion is considering a heat network solution, but details of the plans are not currently available. For reference, there are circa. 45 existing social

housing communal heat systems in the city some of which are located within this proposed zone. There is also a campus heat network at the Norwich Community Hospital.

3.1.3) Norwich City Centre - Initial Zone Opportunities

Two discrete IZOs were identified in the Norwich City Centre zone. Potential routing[7] for the IZOs is shown in Figure 5 and summary statistics provided in Table 2.

Table 2: Norwich City Centre - Summary Statistics for Initial Zone Opportunities[8]

CapEx	Heat	Network	CO_{2e} savings	Linear Heat Density	Heat Sources
~£100m	>50GWh/yr	>30km	~10ktCO_{2e}/yr	3.9 MWh/m	WSHP (river) & ASHP

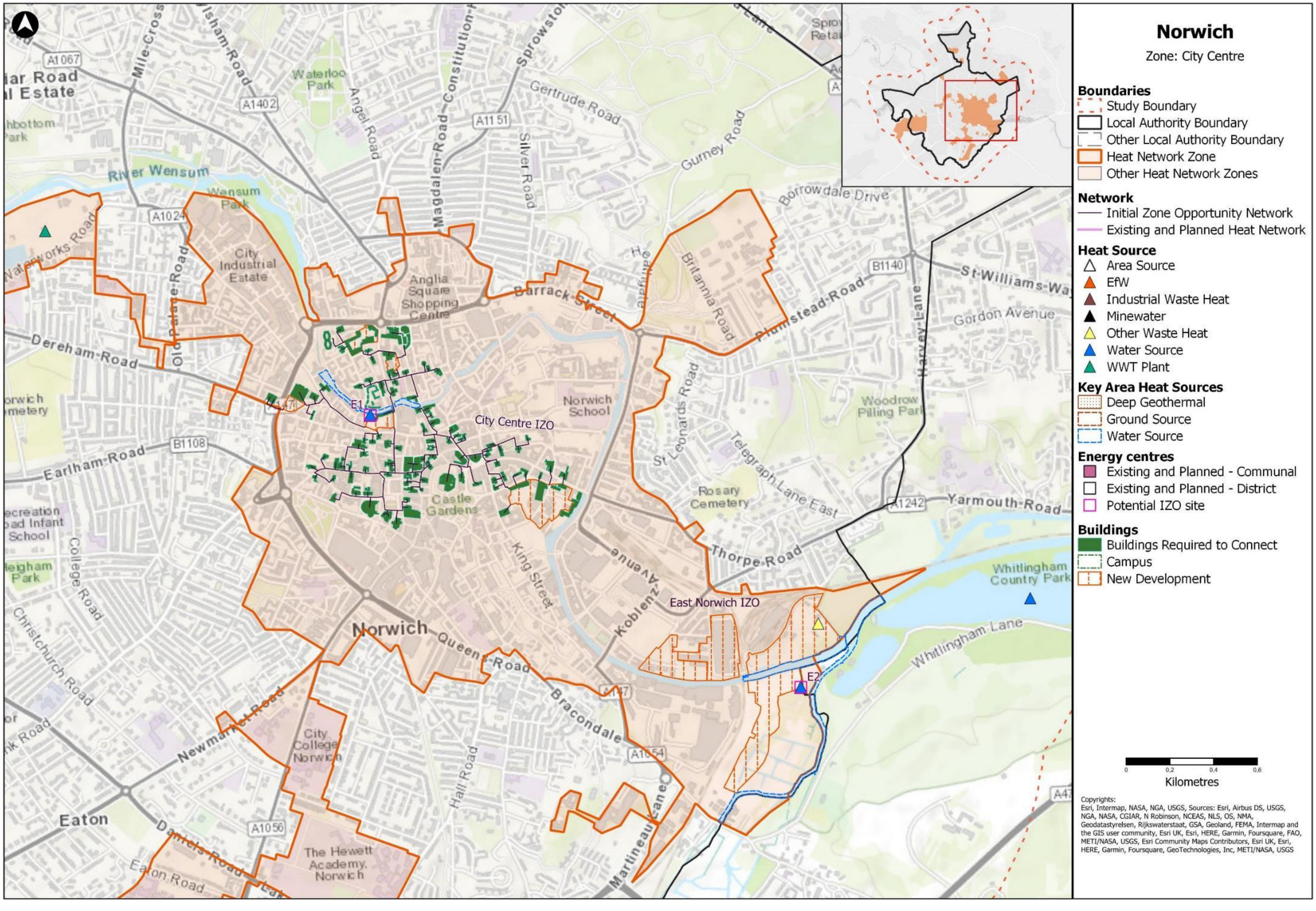
The **City Centre IZO** is a significant opportunity with over 30GWh/yr of heat demand. The relative proximity of larger anchor loads is a key driver for this IZO. Potential heat sources include waste heat from a water treatment works (WTW), heat recovery from the River Wensum, and grid power substations. At this point, a WSHP arrangement using heat from the Wensum, in combination with centralised ASHP plant, is the proposed option.

The **East Norwich IZO** is largely driven by a new development with plans for 3,500 homes and associated community/service properties to be constructed between 2024 and 2036, with an estimated heat demand of circa 20GWh/yr. This IZO is assumed to be supplied by a centralised WSHP arrangement, extracting heat from the River Yare and/or River Wensum, with an energy centre at their confluence. The Whitlingham Great Broad Reservoir and a large power substation (waste heat recovery), which are also in the close vicinity, offer additional or alternative heat supply opportunities.

Organic growth is envisaged for both IZOs and it is considered likely that the two could interconnect to form a single heat network in the future. This would involve navigating either the A1242 road and the main railway crossing, or through the dense urban area on the southern side of River Wensum.

[7] Routes can be expected to change as a better understanding of local constraints is developed through design.
[8] Please see Appendix 3 – lossary, “Specific definitions” of the main report for definitions related to Table 2.

Figure 6: Initial Zone Opportunities in Norwich City Centre



3.1.4) Norwich City Centre – IZO Heat Demands

The heat demands identified within the IZO are described below. The Pilot programme used several sources including local data collected from building owners; national energy demand datasets; benchmarks applied via the National Zoning Model (NZM); and a standardised approach to estimate the potential heat demands of new development sites. More information is provided in Appendix 4.

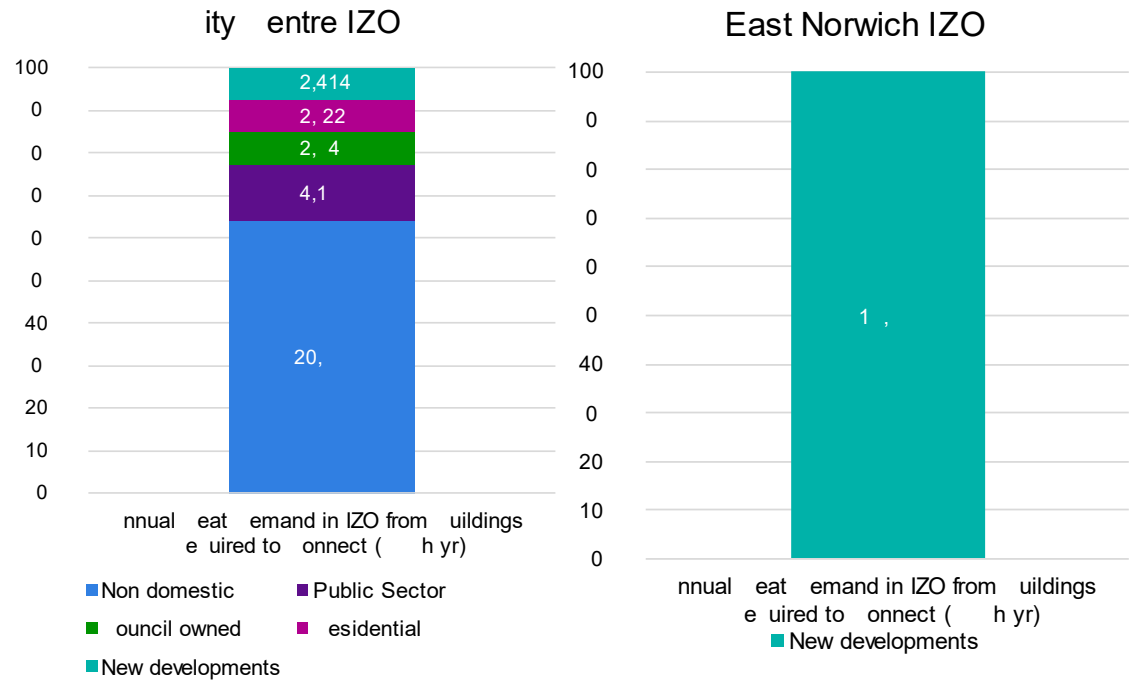
Where there are different values between datasets, the methodology prioritised the use of the early prototype version of the National Zoning Model, for consistency. This has led to an overestimation of some commercial and light industrial heat demands presented in this report. Large anchor loads that are already connected to existing district-scale heat networks are not listed.

The estimated total heat demand for buildings potentially required to connect in the HNZ is approximately 160GWh/yr. Over 50GWh/yr (32%) of this is connected to the two IZOs identified. The categorisation of heat demand in both IZOs is shown in Figure 7.

The **City Centre IZO** covers the most heat-dense part of Norwich. Key potential connections include Barnards Yard/Hoppers Yard (which has a communal heating system), The Forum, Castle Museum, St. Marys Works, St. r ispin's o use, and many retail, office and other commercial properties. Over 30GWh/yr is assumed to be connected in the City Centre IZO.

The **East Norwich IZO** covers a large area of new development, 'East Norwich' and has an estimated heat demand of 20GWh/yr. The regeneration scheme has plans for 3,500 homes and associated community/service properties to be constructed between 2024 and 2036. It focuses on four key sites: Carrow Works, Deal Ground, May Gurney and the Utilities sites.

Figure 7: Norwich City Centre - Categorisation of Heat Demand for Buildings Required to Connect in IZOs



The **City Centre IZO** heat demand is made up principally (65%) of private non-domestic properties with the remaining 35% from a largely even split of public, council, residential and new development buildings. The **East Norwich IZO** consists of new developments. Further details of key heat demand of buildings required to connect in the IZOs is provided in Table 3.

Table 3: Norwich City Centre - Key Heat Demands for Buildings Required to Connect in the IZOs[9]

Building name	Building category	Number of Connect-ions	Annual Heat Demand (MWh)	Data Source
City Centre IZO				
Barnards Yard/Hoppers Yard	Residential Communal Heating	1	1,550	Metered
The Forum	Non-domestic	1	1,300	Benchmark (NZM)
St. Crispin's House	Non-Domestic (Offices)	1	1,250	Benchmark (NZM)
The Castle Museum	Non-domestic	1	1,050	Benchmark (NZM)
Jarrolds	Non-Domestic (Retail)	1	800	Benchmark (NZM)
St. Marys Works	Non-Domestic (Offices)	1	800	Benchmark (NZM)
72-76 Mountergate	Non-Domestic (Sports & recreation)	1	750	Benchmark (NZM)
Offices, residential, retail and leisure (Land at Rose Lane and Mountergate)	New Developments (Mixed use)	1	750	Pilot Methodology (New Dev)
Silkfields	Residential Communal Heating	1	700	Metered
Premier Inn	Non-Domestic (Hotel)	1	650	Benchmark (NZM)

[9] Please refer to Appendix 3 for definitions related to building categories in this table.

Building name	Building category	Number of Connect-ions	Annual Heat Demand (MWh)	Data Source
East Norwich IZO				
Deal Ground development #1 (semis)	New Developments (Residential)	Unknown	3,900	Pilot Methodology
Carrow Works development #1 (flats)	New Developments (Residential)	Unknown	3,200	Pilot Methodology
Carrow Works development #2 (semis)	New Developments (Residential)	Unknown	3,050	Pilot Methodology
Deal Ground development #2 (flats)	New Developments (Residential)	Unknown	2,400	Pilot Methodology
Utilities Site development #1 (semis)	New Developments (Residential)	Unknown	2,200	Pilot Methodology
Utilities Site development #2 (flats)	New Developments (Residential)	Unknown	1,100	Pilot Methodology
Utilities Site development #3 (offices)	New Developments (Non-domestic)	6	850	Pilot Methodology
Carrow Works development #3 (offices)	New Developments (Non-domestic)	9	400	Pilot Methodology
Semi-Detached houses (May Gurney Site)	New Developments (Residential)	Unknown	400	Pilot Methodology
Carrow Works development #4 (industrial)	New Developments (Non-domestic)	6	300	Pilot Methodology

3.1.5) Norwich City Centre – IZO Heat Sources

Low carbon heat sources have been identified within or near to the Norwich City Centre HNZ. These are also shown in Figure 6 in Section 3.1.3 and in Appendix 1: Map C.

In the **City Centre IZO**, heat supply options identified are waste heat from the Heigham Water Treatment Works, a WSHP recovering heat from the River Wensum, a centralised ASHP and a ground source heat pump (GSHP), based on an open loop system extracting heat via multiple

boreholes from the underlying aquifer. The River Wensum WSHP is preferred due to its location but as the capacity is estimated to be limited, a centralised ASHP is also proposed to be included. Each option would need to be investigated further.

For the **East Norwich IZO**, a WSHP solution recovering heat from the River Yare and/or River Wensum is the preferred primary heat source. The Whitlingham Great Broad Reservoir and a large power substation (waste heat recovery) are also close by, offering additional or alternative heat supply opportunities using the same energy centre location. ASHP and GSHP solution are also considered. The energy centre's location within the East Norwich development site is flexible and may be included in future development stages, subject to detailed planning permission.

The opportunities are summarised in Table 4 and Table 5 below.

Table 4: Norwich City Centre - Key Heat Source Opportunities for the IZOs

Heat source type	Capacity (kWp)	Temperature (ºC)	Potential Energy Centre (Ref number)
City Centre IZO			
WSHP – River Wensum	4,000[10]	5-20 ºC	E1
ASHP	4,100[11]	5-20 ºC	E1
East Norwich IZO			
WSHP – River Yare	5,600	5-20 ºC	E2

Table 5: Norwich City Centre - Potential IZO Energy Centre Locations

EC Ref number	Site type	Size (m^2)[12]	Ownership	Heat Source
E1	Private development land (uke's harf)	810	uke's harf developer	WSHP or ASHP
E2	Private development land (East Norwich development site)	440	East Norwich developer	WSHP

[10] Full opportunity capacity available.
[11] Supplied capacity, i.e. capacity required by the proposed network
[12] Energy centre is sized assuming an assumption of 100m^2 per MW of installed capacity assuming each option provides the full supply capacity required by the IZO. This requires further review.

3.1.6) Norwich City Centre – IZO Heat Distribution

The approach to developing the heat network route considered economic viability, investment scale and returns, decarbonisation impact and deliverability. These criteria were applied in a standardised manner across all opportunities identified in the Pilot programme and therefore may not reflect detailed designs or proposed routes identified in more detailed feasibility work. Routing within the site boundary of a building or campus may not have been included if insufficient information was available. The IZO routing was developed solely around buildings which could be required to connect and did not consider potential voluntary connections.

The purpose of the concept heat network route is to define the scale, potential routing and identified associated constraints within the zone. Further work will be required to undertake a more detailed route assessment to take account of the buried utilities, building connections and other local strategic and local planning considerations. Table 6, shows the network statistics for the IZO including the network length and associated cost. Please see Appendix 5 for more detail.

Within the **City Centre IZO**, the principal energy centre is proposed to be situated in the development area at the intersection of Duke Street and Charing Cross. The network route follows a logical, least-distance route to connect to key heat demands including those in the city centre, while avoiding crowded shopping and pedestrian areas as much as possible.

The **East Norwich IZO**, heat network routing connects the planned new development, including 3,500 new homes. Routing this would need to be resolved with the property developer. Therefore, at this point in time, the length of the network required has been estimated based on a standardised methodology. As much of the planned network is within the new development area this will enable lower cost ‘soft-dig’ pipework construction.

Table 6: Norwich City Centre - Indicative Heat Network Statistics for IZOs

IZO Heat Network description	Network length (km)	Network cost (£m)
Norwich City Centre	30	50

3.1.7) Norwich City Centre – IZO Key Constraints and Mitigations

City Centre IZO:

[C1] River crossing: The River Wensum flows through the City Centre IZO, dividing the IZO into two separate elements. A single crossing is assumed. A feasibility assessment would be required to check suitability of the bridges to accommodate the heat network pipework (size and weight) and provide confirmation of the proposed route. Physical constraints described here, with reference numbers, are shown in Appendix 1: Map E.

East Norwich IZO:

[C1] River crossing: The River Wensum flows through the East Norwich IZO, dividing the IZO into two separate parts. One or two crossings will be required depending on how the rail line (C2) is navigated. It is assumed that other infrastructure required by the East Norwich development will also need to be routed over this constraint and therefore costs could be shared and approvals combined, which will mitigate these risks. A feasibility assessment is needed to confirm if the bridges can support the size and weight of the heat network pipework and validate the proposed route.

[C2] Rail crossing: The Great Eastern (principal) rail network from Norwich to London, along with regional and local networks, crosses through the strategic heat network zone. One or two crossings will be required depending on how the River Wensum (C1) is navigated. Like C1, it is assumed costs could be shared and approvals combined (with other infrastructure crossings), which will mitigate the associated risks.

3.2) Norwich Hospital & UEA

3.2.1) Norwich Hospital & UEA – HNZ Summary

The Norwich Hospital & UEA HNZ is the second largest zone identified in Norwich. It is located on the western edge of the city boundary but it crosses over into the South Norfolk District. There are two large anchor consumers within the zone: Norfolk and Norwich University Hospital (operated by the Norfolk and Norwich University Hospital NHS Foundation Trust), and the University of East Anglia (UEA). Other key consumers are the Norwich Research Park and West Earlham Junior School.

Various opportunities for heat supply exist, including the utilisation of a GSHP solution abstracting heat from the underlying aquifer. Other potential supply options include utilising waste heat from hospital/university processes, a solar thermal array or centralised ASHPs.

3.2.2) Norwich Hospital & UEA - Existing Heat Networks

There are no known operational or proposed district-scale heat network schemes in this HNZ. However, there is an extensive campus heat network scheme within the UEA estate, and it is assumed that most of the eneral osp ital's estate is supplied through a heat network. On both sites the heat is currently provided by gas CHP and gas boiler plant, but both stakeholders have firm decarbonisation targets.

3.2.3) Norwich Hospital & UEA – Initial Zone Opportunities

A single IZO was identified in the Norwich Hospital & UEA zone. Potential routing[13] for the IZO is shown in Figure 8 and summary statistics provided in Table 7.

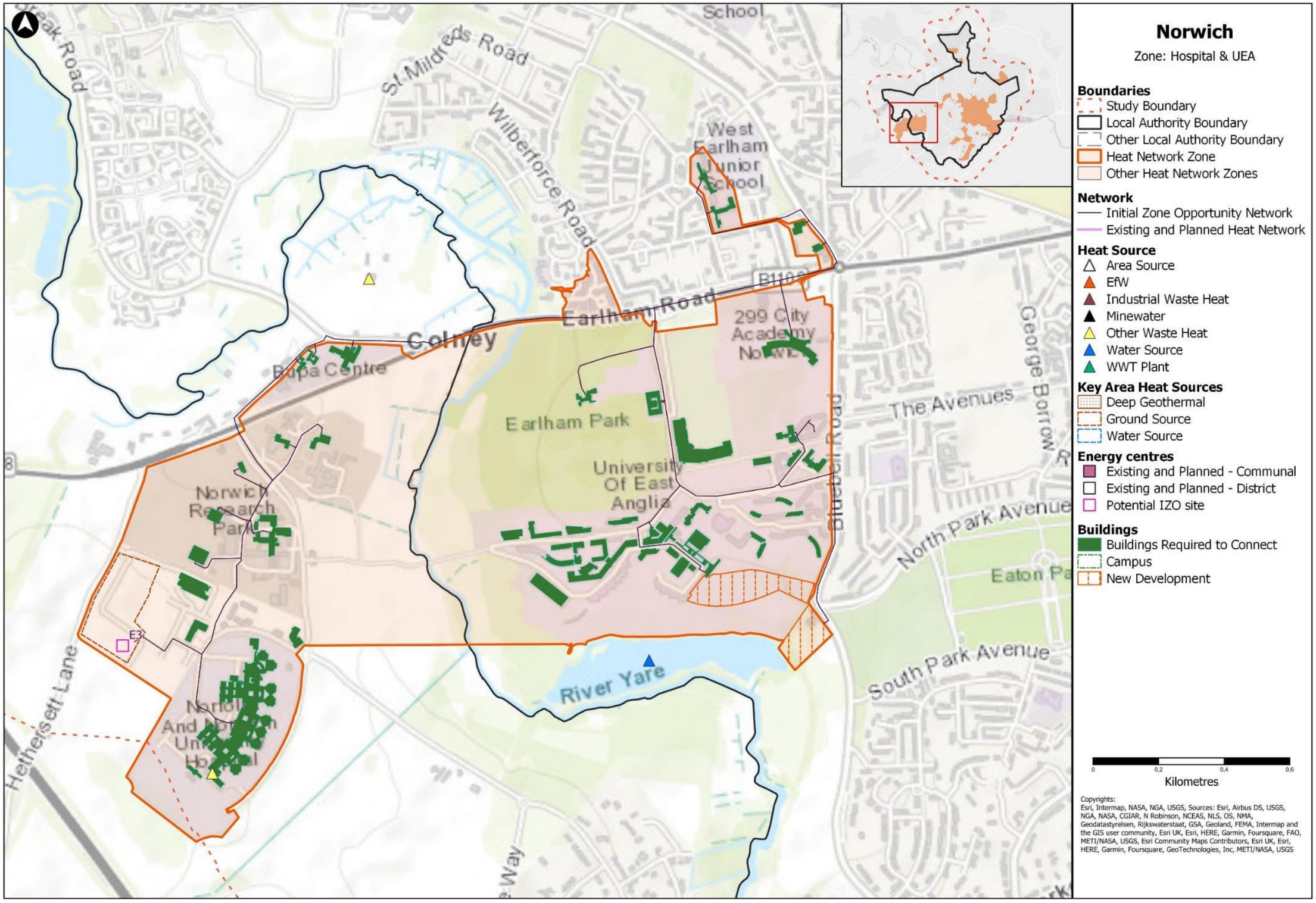
Table 7: Norwich Hospital & UEA - Summary Statistics for Initial Zone Opportunities[14]

CapEx	Heat	Network	CO_{2e} savings	Linear Heat Density	Heat Sources
~£30m	>30GWh/yr	>8km	>5ktCO_{2e}/yr	3.9MWh/m	ASHP

The identified IZO presents an opportunity to decarbonise the adjacent university and hospital estates and other neighbouring properties/sites, through one combined heat network. The IZO has an estimated heat demand of over 30GWh/yr. Presently, the IZO is assumed to be supplied by a centralised ASHP. It is possible that the IZO could expand over time to the north and/or east, to reach the Norwich City Centre HNZ. The scale of demand, proximity of consumers and low carbon heat source opportunities identified are the key drivers for this IZO.

[13] Routes can be expected to change as a better understanding of local constraints is developed through design.
[14] Please see Appendix 3 – lossary, "Specific definitions" of the main report for definitions related to Table .

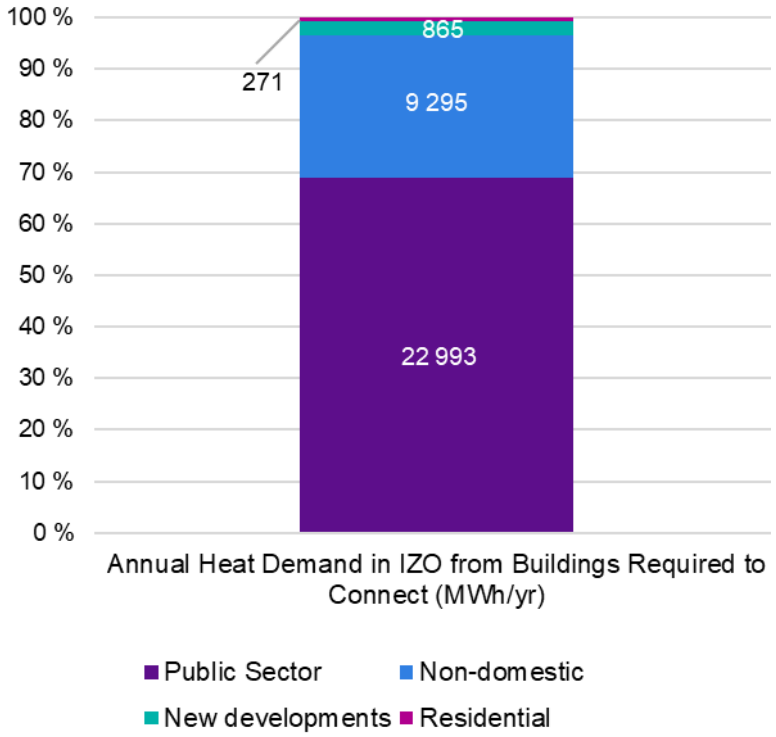
Figure 8: Initial Zone Opportunity in Norwich Hospital & UEA HNZ



3.2.4) Norwich Hospital & UEA – IZO Heat Demands

The IZO's heat demand is principally made up of public non-domestic properties (i.e. Norfolk and Norwich University Hospital) and private non-domestic properties (UEA and multiple properties on the Norwich Research Park). The IZO also includes several other smaller heat demands including health care, care home and educational, with some new development also planned for the UEA campus. Categorisation of this heat demand[15] is shown in Figure 9.

Figure 9: Norwich Hospital & UEA - Categorisation of Heat Demand for Buildings Required to Connect in IZO



The new developments were benchmarked as having a combined heat demand of 900MWh/yr and they were treated as individual consumers. Further details of the key heat demands for buildings required to connect in the IZO are provided in Table 8. It illustrates the significance of the Norfolk and Norwich University Hospital and UEA which each account for over 30% of the IZO heat demand.

[15] Please refer to section 3.1.4 for a description of IZO heat demands.

Table 8: Norwich Hospital & UEA - Key Heat Demands for Buildings Required to Connect in the IZO[16]

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
Norfolk and Norwich University Hospital	Public Sector (Hospital)	1	10,250	ERIC
University of East Anglia: East Anglian Sports Park	Public Sector (Leisure centre)	1	2,050	Benchmark (NZM)
University of East Anglia: Environmental Sciences	Public Sector (Education)	1	2,000	Benchmark (NZM)
The Sainsbury Laboratory	Public Sector (Research)	1	1,500	Benchmark (NZM)
City Academy Norwich	Public Sector (Education)	1	1,150	Benchmark (NZM)
University of East Anglia: Sainsbury Centre for Visual Arts	Public Sector (Education)	1	900	Benchmark (NZM)
Spire Norwich Hospital	Non-domestic (private Hospital)	1	700	Benchmark (NZM)
Earlham Institute	Public Sector (Research)	1	650	Benchmark (NZM)
University of East Anglia: The Central Library	Public Sector (Education)	1	600	Benchmark (NZM)
University of East Anglia: School of Medicine	Public Sector (Education)	1	550	Benchmark (NZM)

3.2.5) Norwich Hospital & UEA – IZO Heat Sources

A range of potential low carbon heat sources has been identified within or near the heat network zone. Table 9 and Table 10 summarise the proposed heat sources and potential

[16] Please refer to Appendix 3 for definitions related to building categories in this table.

energy centre locations for the identified IZO. These are also shown in the zone-level map in Figure 8 in Section 3.2.3 and Appendix 1: Map C.

The heat supply opportunities identified include the utilisation of a GSHP abstracting heat from the underlying aquifer, waste heat from hospital/university processes, waste heat from Norfolk East power substation or centralised ASHPs. Each option would need to be further investigated. The preferred solution, at this point, is a centralised ASHP with an energy centre located on the western side of the hospital estate. It is assumed that energy centres within the UEA and the hospital estates could be utilised to house peaking boilers and other equipment.

Table 9: Norwich Hospital & UEA - Key Heat Source Opportunities for the IZOs

Heat source type	Capacity (kWp)	Temperature (ºC)	Potential Energy Centre Location (Ref number)
ASHP	7,900[17]	5-20ºC	E3

Table 10: Norwich Hospital & UEA - Potential IZO Energy Centre Locations

EC Ref number	Site type	Size (m^2)[18]	Ownership	Heat Source
E3	Land to the west of the hospital state	790	Norfolk and Norwich University Hospital	ASHP

3.2.6) Norwich Hospital & UEA – IZO Heat Distribution

Table 11 shows the network statistics for the IZO including the network length and associated costs. Please refer to Section 3.1.6 and Appendix 5 for the assumptions used.

The proposed routing for the heat network is shown in Figure 8. It follows a logical, least-distance route north from the energy centre, picking up consumers in the Norwich Research Park before crossing the B1108 to cluster of consumers on Old Watton Road. Thereafter, it follows the B1108 to reach the UEA campus and remaining consumers.

Table 11: Norwich Hospital & UEA - Indicative Heat Network statistics for the IZO

IZO Heat Network description	Network length (km)	Network cost (£m)
Norwich Hospital & UEA	8	15

[17] Supplied capacity, i.e. capacity required by the proposed network
[18] Energy centre is sized assuming an assumption of 100m^2 per MW of installed capacity assuming each option provides the full supply capacity required by the IZO. This requires further review.

3.2.7) Norwich Hospital & UEA – IZO Key Constraints and Mitigations

Technical network constraints are not considered to be significant with much of the planned network within low density areas. The proposed route requires a single river crossing (over the River Yare) but as a small river with several bridges, this is not considered to be a significant constraint.

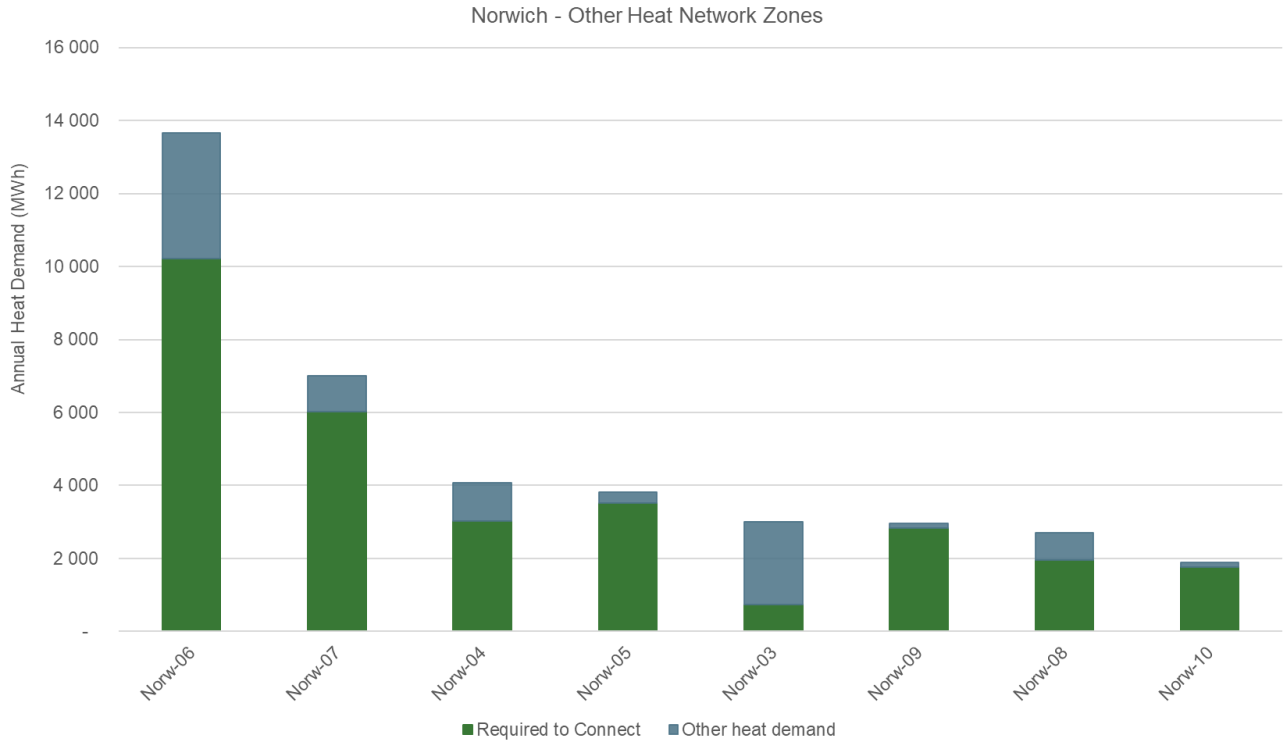
The proposed route also uses a section of the B1108, but it is possible that use of highway routes could be minimised if the network could be routed through UEA and the Norfolk and Norwich University Hospital NHS Foundation Trusts land. This could be along the route of the B1108 or a more direct route between the two campuses, using what appear to be private roads. Use of the private land would likely also increase ability to use soft-dig to significantly reduce construction costs.

4) Other Heat Network Zones

This section describes the 'Other' potential heat network zones that were identified in Norwich. These are areas where heat networks were deemed to offer the lowest carbon route to decarbonising heat, but are often much smaller or discrete in nature than the 'Strategic' heat network zones identified. The approach taken in the Pilot programme did not apply a minimum threshold for zone identification and therefore future work will need to consider factors such as size and aggregation to ensure efficient and effective delivery of heat networks in the area.

Figure 10 illustrates the total annual heat demand, and the proportion of which is associated with buildings that may be required to connect within each zone. A map of all zones can be found in Figure 4.

Figure 10: Total Heat Demand and Proportion Required to Connect in Other HNZs



Eight Other HNZs were identified in Norwich which are all smaller in terms of heat demand and are standalone in nature than the Strategic HNZs. The largest of these HNZs by heat demand is Norw-07. Norw-07 is described below followed by the Other HNZs which are grouped for discussion.

Norw-07: is a discrete zone to the north of the Norwich City Centre Strategic HNZ, next to Norwich Airport. The zone includes a mix of commercial and industrial buildings. Key anchor loads are Holiday Inn, Premier Inn, International Aviation Academy Norwich and Lotus Learning Academy. Buildings that may be required to connect have a total heat demand of over 5GWh/yr, which equates to circa 85% of the total heat demand of the zone.

Group 1: This group contains two distinct HNZs (Norw-06 and 10) that are located outside of the local authority boundary but still within the study area boundary. It is considered that these HNZs could support relatively small independent heat networks. Buildings required to connect present a total heat demand of over 15GWh/yr, which equates to around 80% of the total heat demand within the zones.

Group 2: This group contains three discrete zones (Norw-04, 05 and 07) to the north and west of the City Centre. It is considered that these zones could potentially support relatively small independent heat networks. These zones are centred around industrial areas. Buildings that may be required to connect present a total heat demand of approximately 15GWh/yr across the zones which equates to around 85% of the total heat demand within the zones.

Group 3: This group contains three discrete zones (Norw-03, 08 and 09) surrounding the City Centre. It is considered that these zones could potentially support relatively small independent heat networks. These zones are centred around clusters of education campuses. Buildings that may be required to connect present a total heat demand of over 5GWh/yr across the zones which equates to around 65% of the total heat demand within the zones.

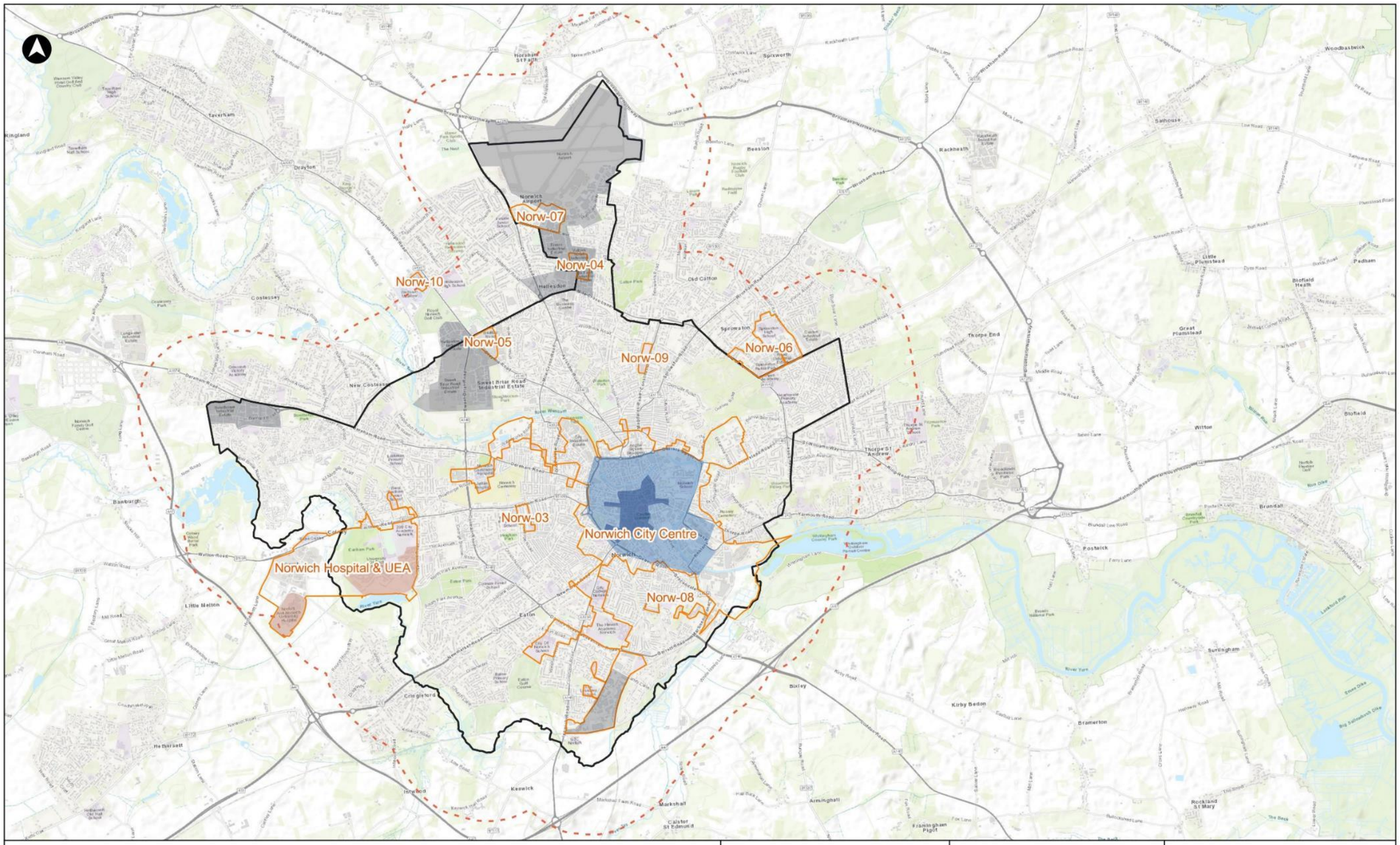
Appendix 1: Maps and Legends

This section provides guidance on interpreting the icons and legends used throughout this report and Maps A-F that follow:

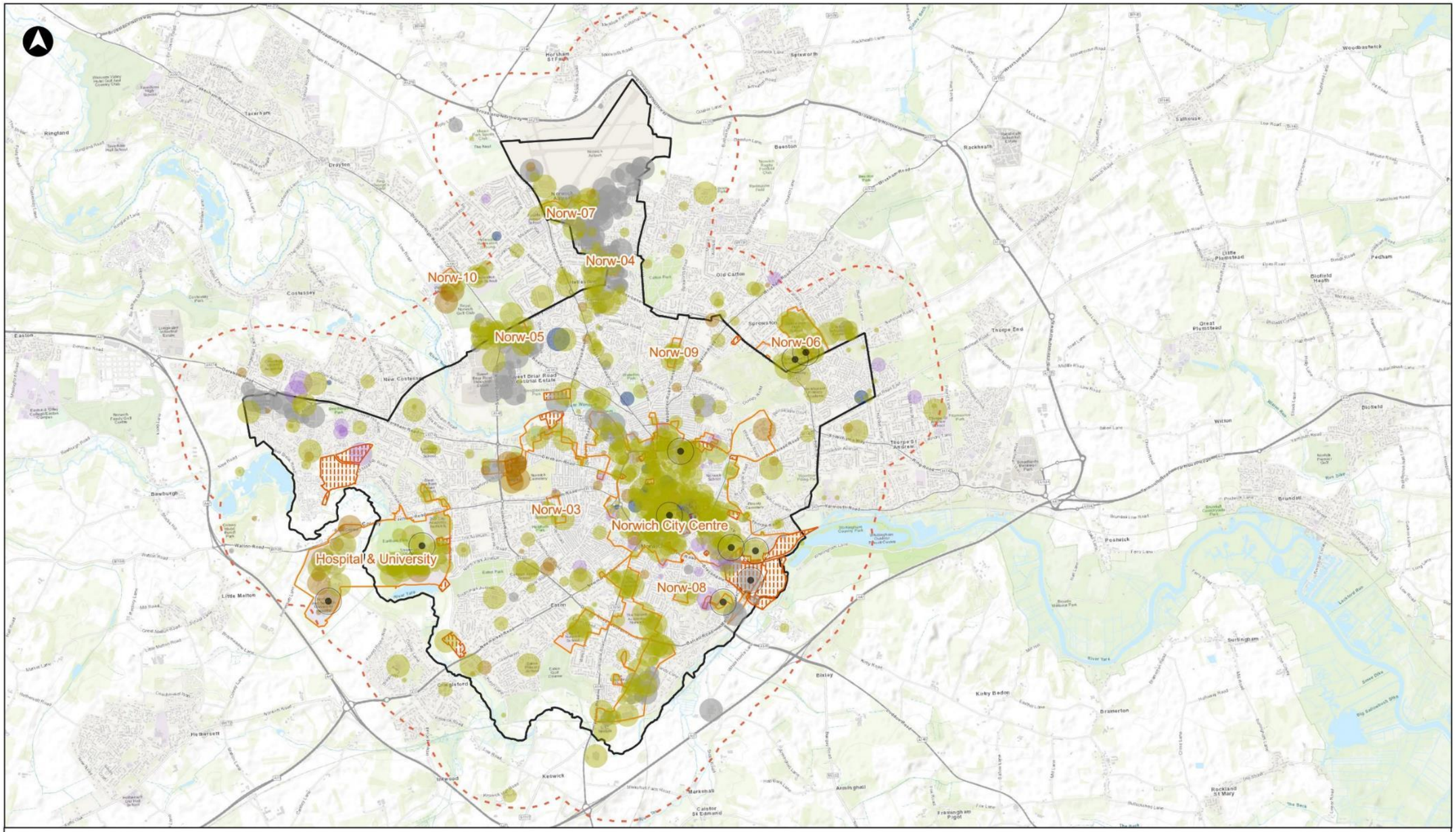
Legend / icon	Relevant map(s)	What this represents on the map	Comments on interpretation
	Report maps	Study boundary	Extends 1km beyond Local Authority boundary to include cross boundary opportunities
	Report maps	Local Authority boundary	
	Report maps	Other Local Authority boundary	
	Report maps	Heat network zones	This includes both Strategic HNZs and Other HNZs.
	Report maps	Other heat network zones	Smaller or discrete heat network zone opportunities
	Report maps	New developments	New development within heat network zones and IZOs that will still be in construction post-2025
Gates Hill	Report maps	Heat network zone name / reference number	‘Strategic’ zones are named; ‘Other’ zones are represented by a reference number
	Report maps	Buildings potentially required to connect	Buildings that could be required to connect (as described in the HNZ Consultation 2023)
	Report maps	Campuses	Multiple buildings owned and operated by the same organisation (e.g. Universities, Hospitals)
	Report maps	Initial Zone Opportunity concept network route	Conceptual heat network pipe routes between buildings that could be required to connect
	Report maps	Existing and Planned Heat Networks	Known existing or planned heat network pipe routes as provided by local stakeholders
	Report maps	Potential energy centre - IZO	Potential energy centre location for an IZO (see section 3)
	Report maps	Existing/planned energy centre - Communal HNs	‘ ommunal’ energy centres are those operated within a single building or across a campus
	Report maps	Existing/planned energy centre - District HNs	‘ istrict’ energy centres supply multiple buildings across multiple sites
Appendix 1: A – Typology map			
	Appendix 1: Map A	Dense City Centre	Locally recognised as the City or Town centre, where buildings development is most dense
	Appendix 1: Map A	City Centre Fringe	Around the City or Town Centre or at its outskirts, where both building density reduces
	Appendix 1: Map A	Mixed Use District	A variety of building typologies, with no single typology prevailing in the area
	Appendix 1: Map A	Social Housing	Public, private and third sector social housing
	Appendix 1: Map A	Campus (health / education)	Buildings that are owned and operated together (e.g. Universities, Hospitals)

	Appendix 1: Map A	Commercial / business office	Public & private office space
	Appendix 1: Map A	Industrial areas	Primarily used for manufacturing, engineering, and warehousing
Appendix 1: B – Key heat demands			
	Appendix 1: Map B	Top 10 Heat Demands	The largest (anchor) heat loads within the Pilot programme study area (see Section 3)
	Appendix 1: Map B	Local Authority	Buildings owned or operated by the Local Authority
	Appendix 1: Map B	Other public sector	Other buildings owned or operated by the public sector (e.g. hospital, universities, Govt. estates)
	Appendix 1: Map B	Residential with existing communal heating	Residential buildings with existing communal heating systems installed
	Appendix 1: Map B	Non-domestic private	Non-domestic private buildings (e.g. commercial, offices)
	Appendix 1: Map B	Industrial	Mixed industrial sites (e.g. light or heavy industry, manufacturing, warehouses and distribution)
400 - 600	Appendix 1: Map B	Building heat demand (MWh/yr)	Circle size increases with size of heat demand
Appendix 1: C – Key Heat Sources and Potential Energy Centres			
	Appendix 1: Map C	EfW plant	**Point heat sources** have known or likely points of heat offtake/abstraction ine water and water source ‘points’ indicate potential abstraction points. Other waste heat sources include sewers, electrical substations and other sources of heat. See section 3 for more detail on heat source capacities, where known. On the City-level Map C only, the heat waste symbol is sized according to its scale in GWh/yr
	Appendix 1: Map C	Industrial Waste Heat	
	Appendix 1: Map C	Mine water	
	Appendix 1: Map C	Other Waste Heat	
	Appendix 1: Map C	Water Source	
	Appendix 1: Map C	Waste Water Treatment	
	Appendix 1: Map C	Deep geothermal or mine water heat	**Area heat sources** differ from point-heat sources in that the exact location for extracting heat from the resource is not yet determined
	Appendix 1: Map C	Ground source	
	Appendix 1: Map C	Water source	
Appendix 1: D – Existing and planned heat networks			
	Appendix 1: Map D	Existing and planned heat networks	At this scale the route of an existing HN cannot be displayed, so an area outline is used instead
Appendix 1: E – Physical constraints			
	Appendix 1: Map E	Key constraints	Key heat network routing constraints as described in section 3

A. Norwich Typology Map



B. Key Heat Demands



Boundaries
- Study Boundary
- Local Authority Boundary
- Other Local Authority Boundary
- Heat Network Zones
- New development

Key Heat Demand
- Local authority loads
- Other public sector loads
- Residential with communal heating
- Non-domestic private buildings
- Industrial
- Top 10 heat demands

Heat Demand (MWh/Year)
- 100 - 130
- 130 - 190
- 190 - 350
- 350 - 10 000

2 0 2
Kilometres

Scale: 1:55 000

Coordinate System: OSGB36 / British National Grid

Department for Energy Security & Net Zero

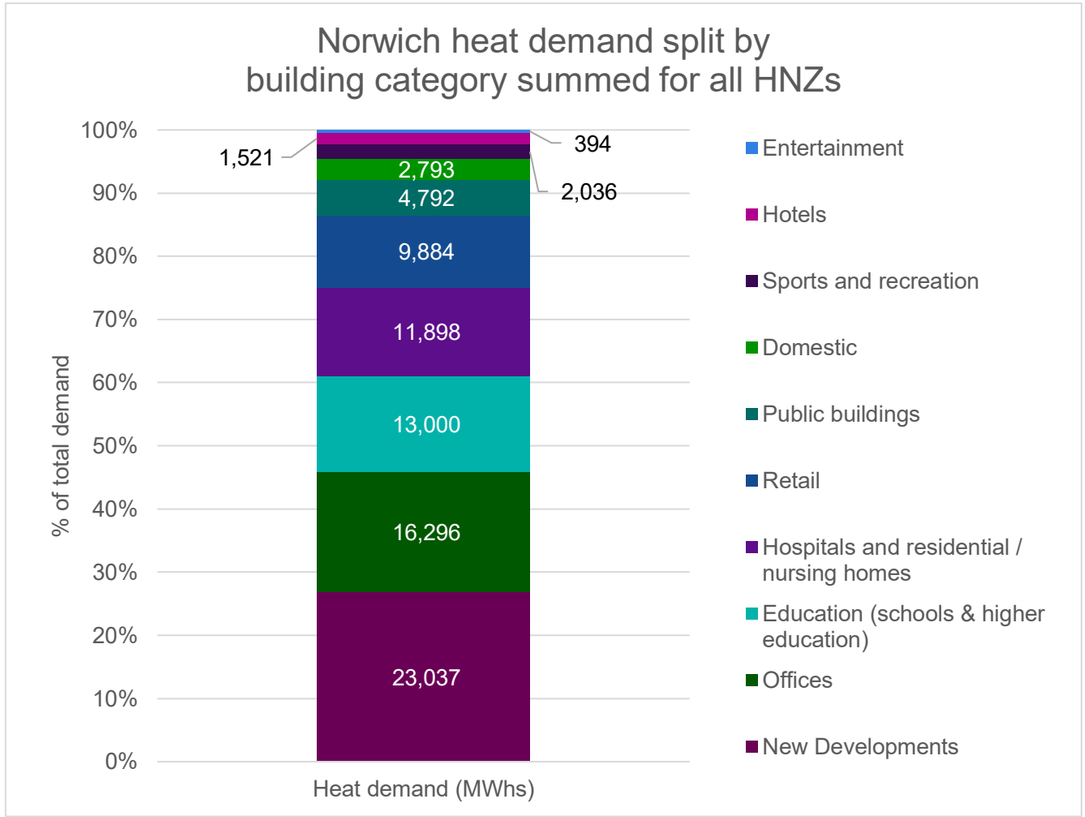
Norwich

Map B

Key Heat Demand

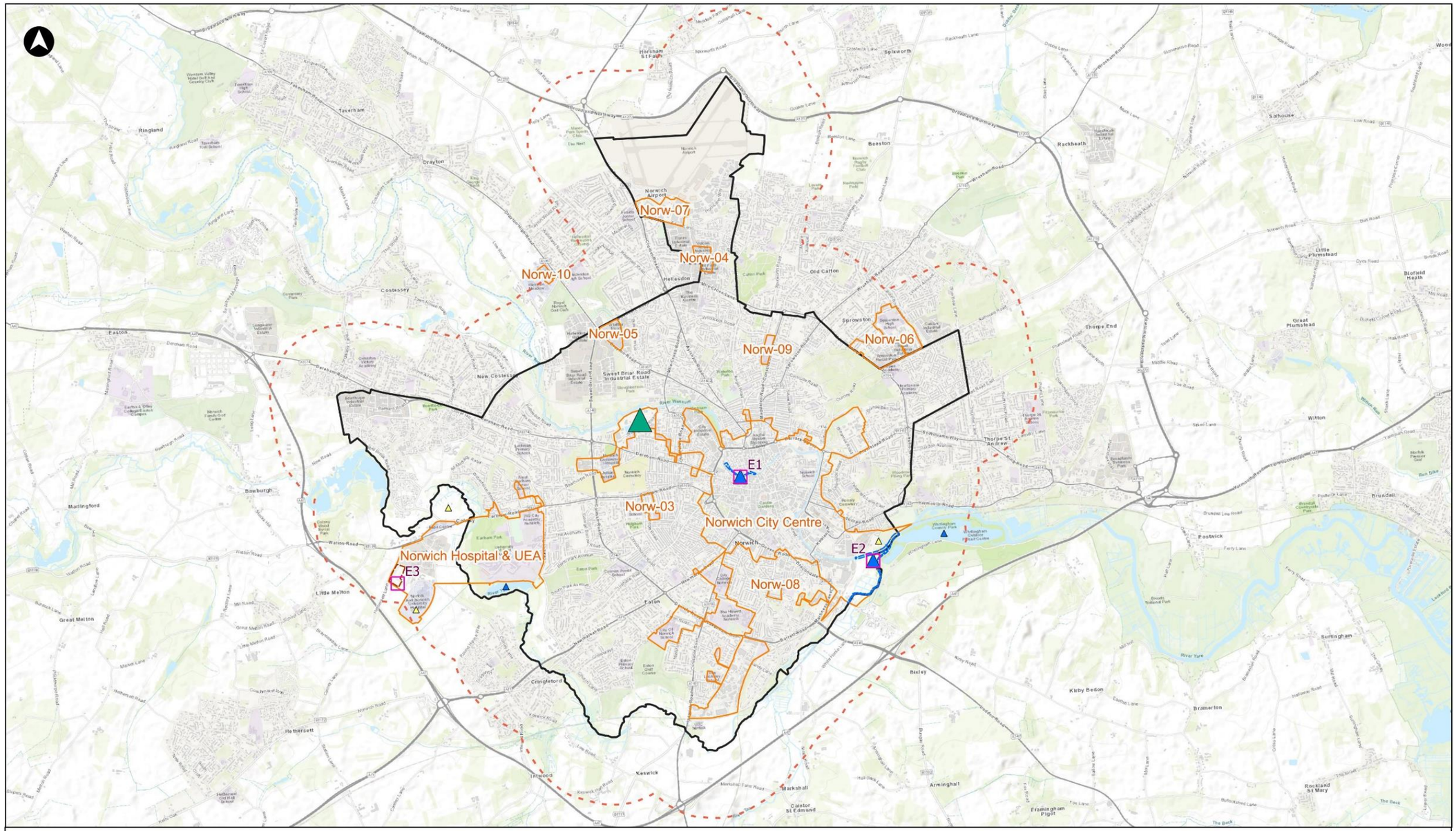
Table 12: Heat Demand split further by Building Categories across all Initial Zone Opportunities identified in Strategic HNZs in the Study Area

Building category	Number of buildings required to connect in this category	Annual Heat Demand of buildings required to connect across IZOs (MWh)
New developments	Unknown	23,037
Offices	59	16,296
Education (schools & higher education)	38	13,000
Hospitals and residential/nursing homes	9	11,898
Retail	35	9,884
Public buildings	18	4,792
Domestic	5	2,793
Sports and recreation	1	2,036
Hotels	5	1,521
Entertainment	3	394
Totals	**173**	**85,561**



Note: In Norwich there are 10 HNZs with a total of 3 IZOs identified across them. The table and graph above summarise the heat demand for buildings required to connect to these IZOs.

C. Key Heat Sources and Potential Energy Centres



Boundaries
- Study Boundary
- Local Authority Boundary
- Other Local Authority Boundary
- Heat Network Zones

Key Area Heat Sources
- Deep Geothermal
- Ground Source
- Water Source

Heat Source
- Area Source
- EfW
- Industrial Waste Heat
- Minewater
- Other Waste Heat
- Water Source
- WWT Plant

Capacity (GWh/year)
- 0 - 5
- 5 - 15
- 15 - 50
- 50 - 150

Energy Centres
- Potential IZO

0 1 2 3
Kilometres
Scale: 1:55 000
Coordinate System: OSGB36 / British National Grid

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Norwich

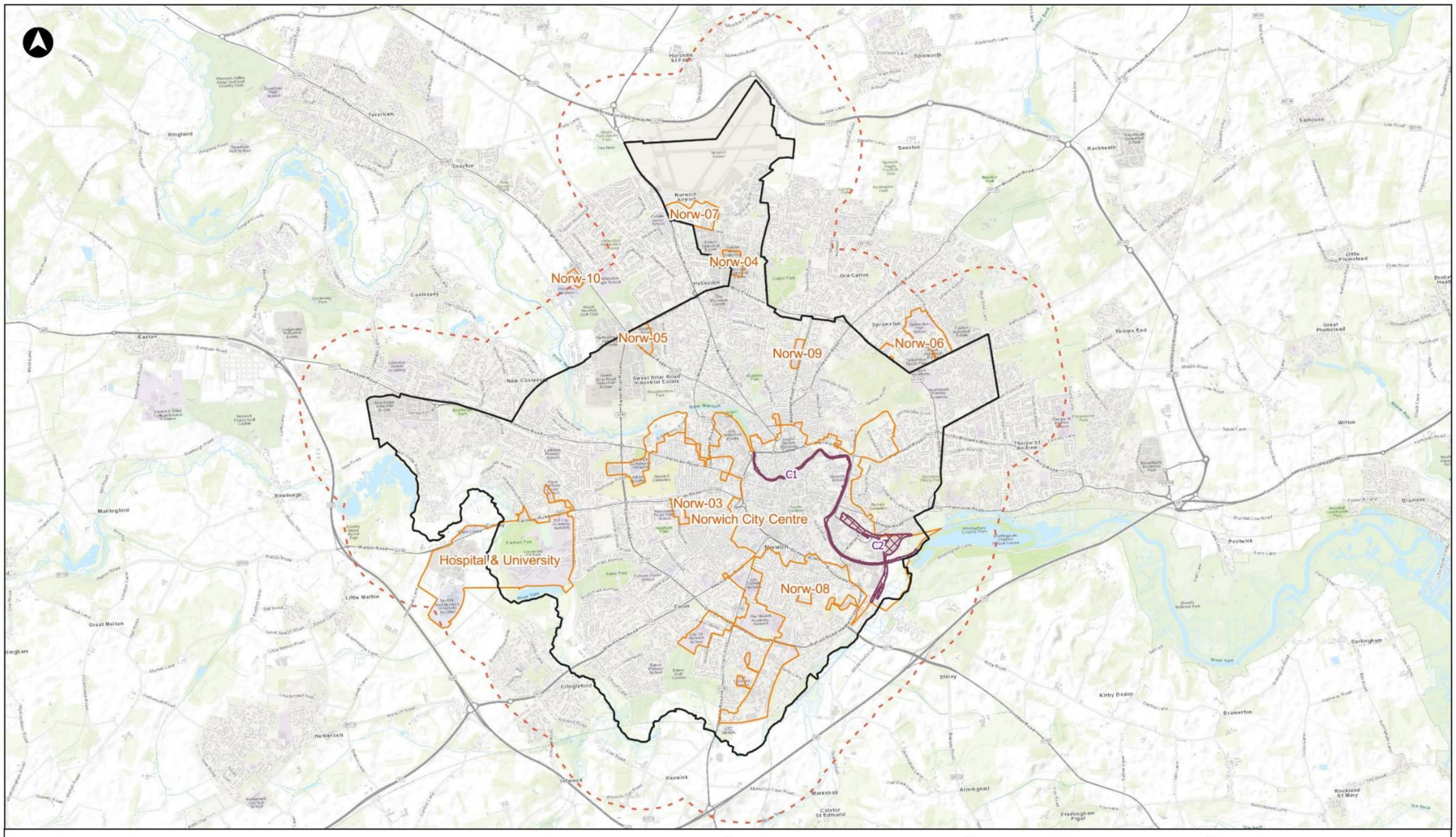
Map C

Key Heat Sources and Energy Centres

D. Existing and Planned Heat Networks

No relevant information available.

E. Physical Constraints



Boundaries

- Study Boundary
- Local Authority Boundary
- Other Local Authority Boundary
- Heat Network Zones
- Key constraints

2 0 2

Kilometres

Scale: 1:55 000

Coordinate System: OSGB36 / British National Grid

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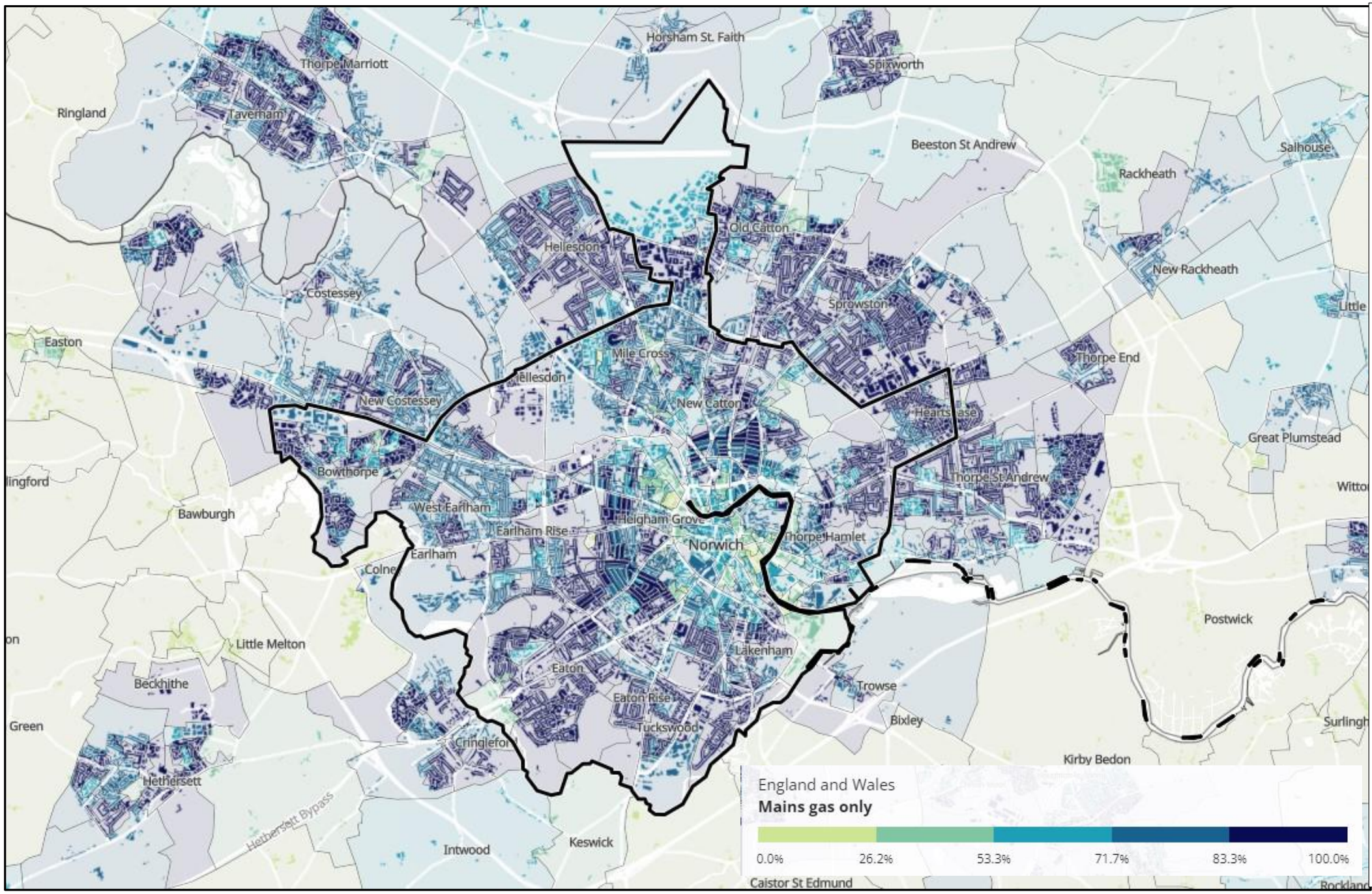
Map E

Physical Constraints

F. Off-Gas Grid areas in Norwich



Credit: This is an excerpt from the ONS Census Maps 2021 which is available to explore online. The data shown is subject to Crown copyright protection, is published under the Open Government Licence (OGL) and embeds map data which is copyright of Ordnance Survey and Street maps.

Appendix 2: Data Room Resources

Throughout the delivery of the Pilot programme, information resources have been compiled for future use in relation to the development of heat network zones.

These resources will remain restricted to DESNZ and the local authority. This is to ensure that the department remains within its Data Privacy Notice as shared with stakeholders providing the information. GIS outputs are not being published alongside the report as they are subject to change.

Table 13: Pilot Programme Standardised Information Resources

Information resource	Description of resource
Stakeholder Directory	A directory listing key stakeholders identified and approached during the Pilot programme, including organisation name, address, or website, contact names, work title and contact details.
Stakeholder meetings log and records	A log of key meetings held and related meeting records.
Datasets Directory	A list of datasets / reports shared by stakeholders cross-referencing who provided the item from the stakeholder directory and a description of the dataset.
Geospatial packages and related geo-coded datasets	Geo-coded datasets and descriptions related to maps produced in this report.

Table 14: Pilot Programme Study-Area-Specific Information Resources

Information resource	Description of resource
Norwich City Council communal heating systems	Limited information relating to council communal heating systems
Norwich City Council Estate	Limited information relating to council-owned properties
Schedule of East Norwich	Summary information of the planned development
Norfolk County Council estate information	Detail information relating to council-owned property
Norwich Powerhouse & Heat Mapping study (2011)	Heat Network mapping and feasibility work
WSHP study on Wensum	Technological and Ecological Feasibility Study on the Use of Water Source Heat Pumps on the River Wensum, by UEA

This publication is available from: https://www.gov.uk/government/collections/heat-networks

If you need a version of this document in a more accessible format, please email alt.formats@energysecurity.gov.uk. Please tell us what format you need. It will help us if you say what assistive technology you use.