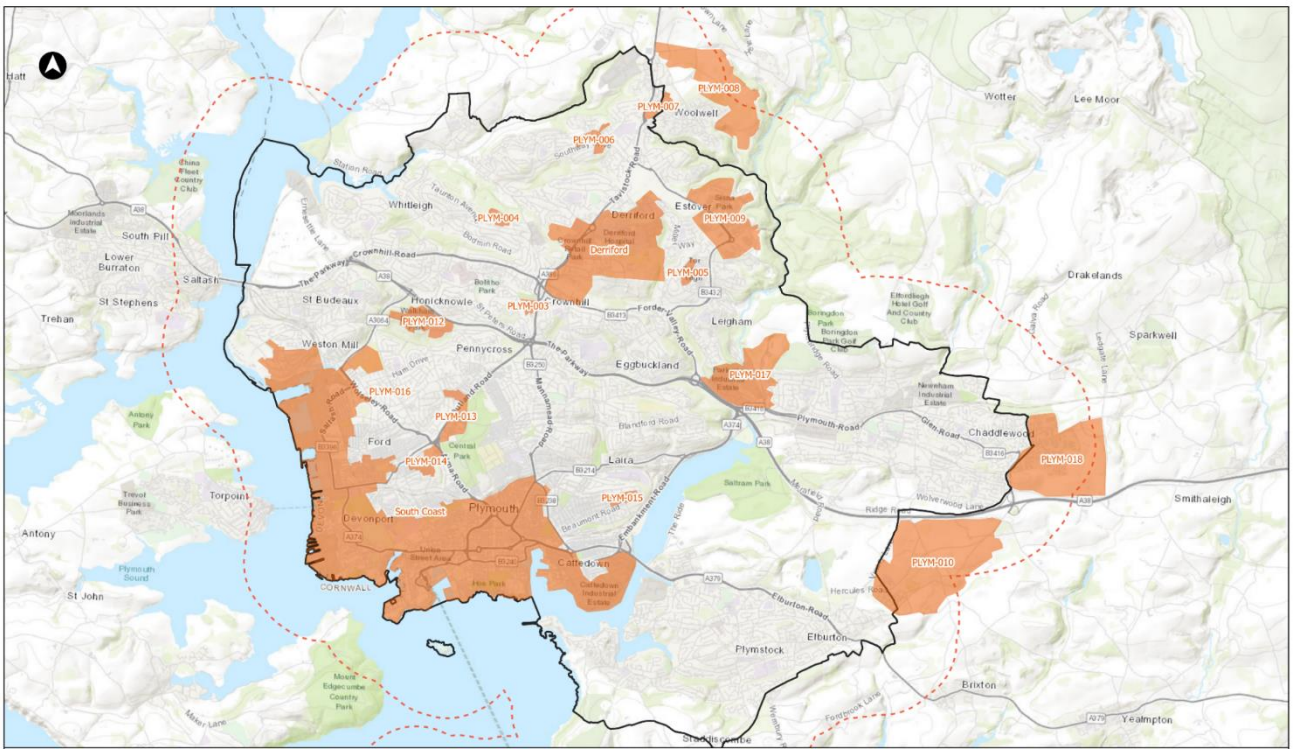
Department for Energy Security & Net Zero

Plymouth

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

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Contents

Executive Summary

About Plymouth: Plymouth is a coastal city in southwest England with a population of 264,695. It is the largest settlement in Devon and covers an area of nearly 80km².

Local Energy Policy: Plymouth City Council declared a Climate Emergency in 2019 and aims for carbon neutrality by 2030. The Net Zero Action Plan includes policies to support the development of heat networks.

Existing heat networks: Several existing networks operate at different temperatures. Planned networks cover the City Centre, Devonport and Derriford. Plymouth is a prioritised Advanced Zoning Programme (AZP) city.

Zones identified: Seventeen heat network zones were identified in Plymouth. The total annual heat demand for all buildings required to connect within these zones is around 300GWh/yr.

Strategic heat network zones: Two strategic zones, Plymouth South Coast and Plymouth Derriford, were identified. The overall heat demand for all buildings required to connect within these strategic zones is approximately 250GWh/yr.

Key heat demands: The initial zone opportunities identified would connect about 200GWh/yr of heat. Key buildings include the MoD estate, several redevelopments, Derriford Hospital and the University of Plymouth.

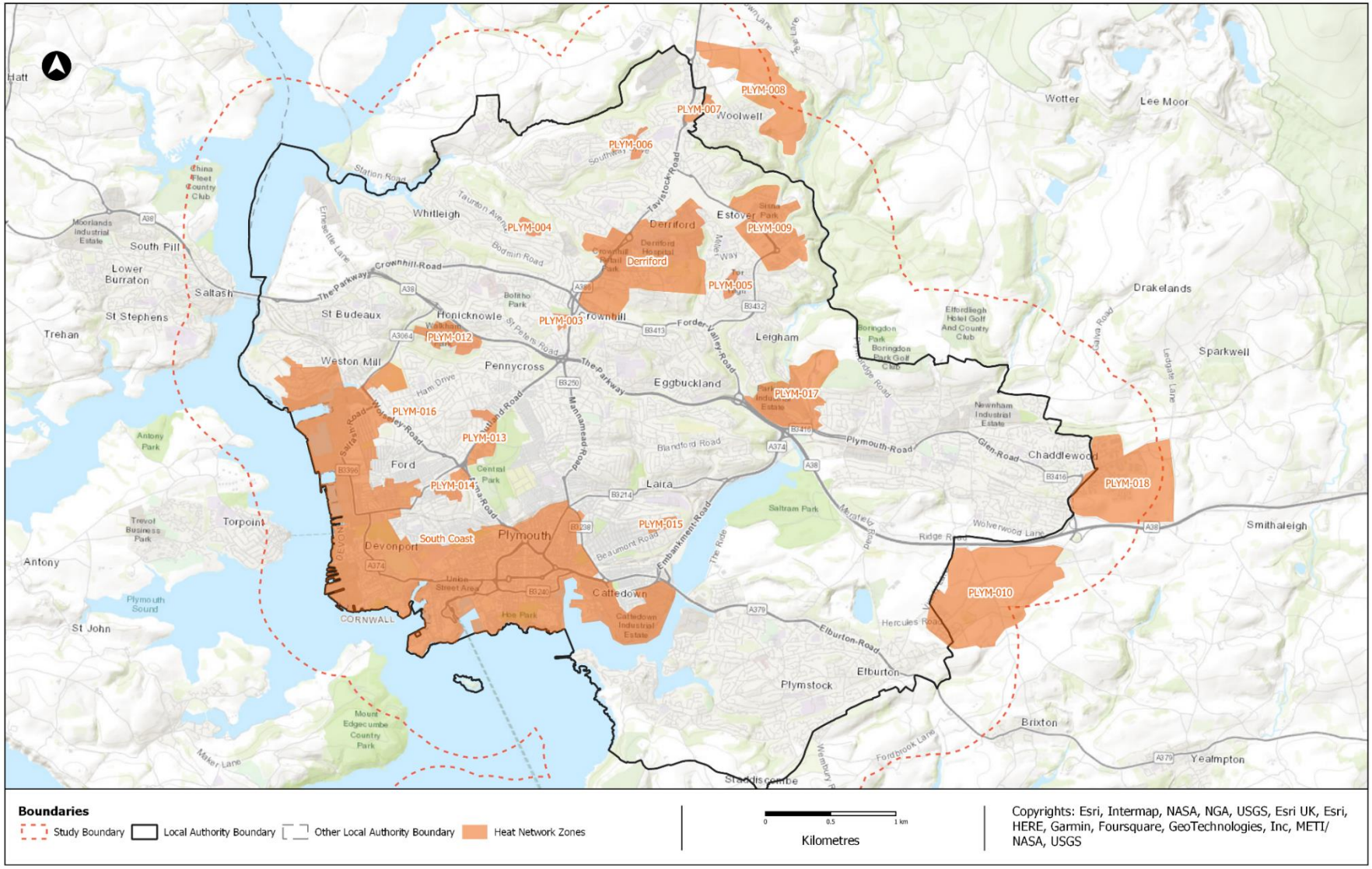
Key heat sources: Potential heat sources include energy from waste. Significant potential exists via marine, sewer, ground and air source heat pumps.

Estimated CapEx: The high-level estimate of capital expenditure to network all buildings required to connect in all zones is approximately £400m, of which the initial zone opportunities amount to approximately £250m.

Other heat network zones: Smaller and standalone heat network zones were identified in areas such as Langage, Sherford, and the China Claywork development.

Carbon savings: The initial zone opportunities identified could deliver carbon savings of about 35ktCO_{2e} annually.

Figure 1: Overview of Heat Network Zones in Plymouth



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 Plymouth 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.

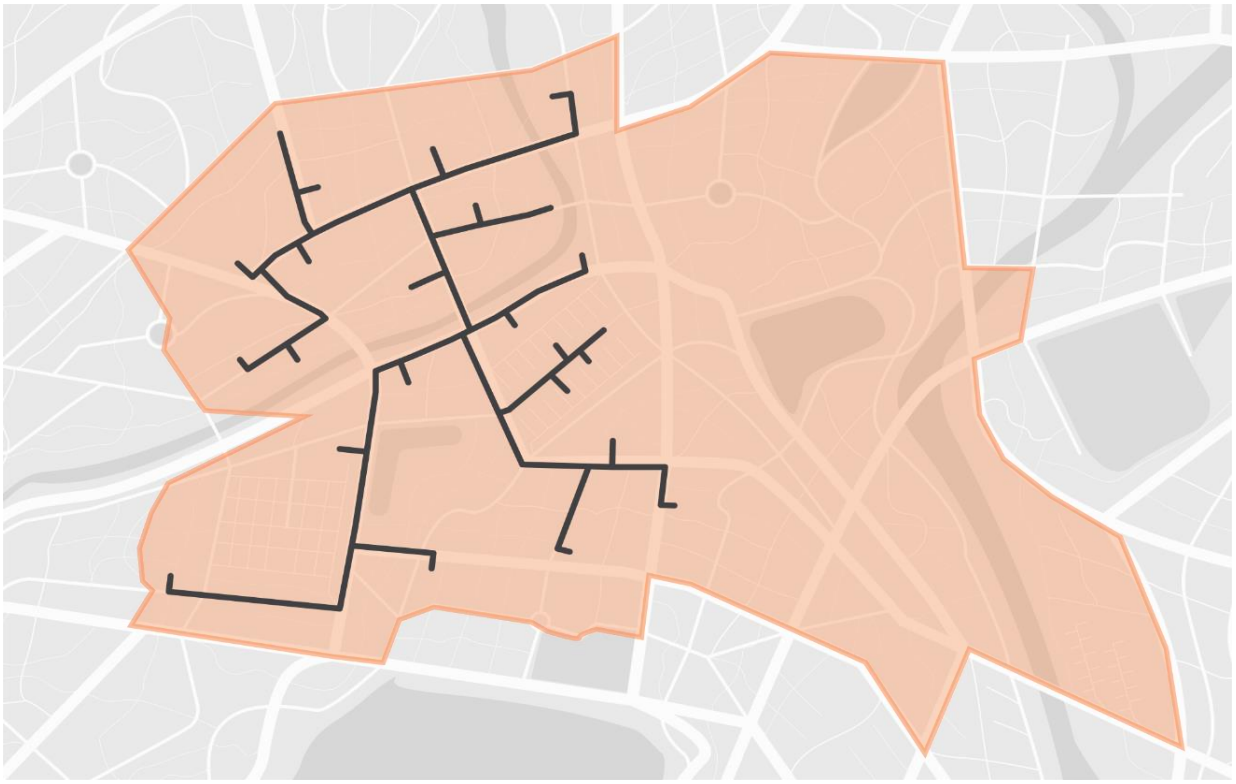
[1] More information can be found in the Heat Network Zoning Methodology Statements (Appendix 3, 4 & 5)

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.

Advanced Zoning Programme

The Advanced Zoning Programme (AZP) is working with 19 areas to support the construction of new zone scale heat networks as quickly as possible following the launch of heat network zoning in 2025. Amongst the programmes aims are to accelerate the delivery and construction of heat network zones; develop best practice guidance; provide project development support services; and promoting market transformation ready for the national rollout of Heat Network Zoning policy.

The programme builds upon lessons learnt from the Pilot programme and these outputs. In October 2024, DESNZ announced that ground-breaking heat network schemes in Leeds, Plymouth, Bristol, Stockport, Sheffield, and two more in London will receive prioritised support to advance to construction by the end of 2026.

AZP uses the latest zoning methodology (i.e. developed after the Pilot programme) and has undertaken further detailed development work with local stakeholders to further improve confidence and accuracy. The programme may also have applied local strategic and commercial considerations and therefore the opportunities may differ slightly from those presented here, using a national standardised approach. Where there is overlap, AZP studies should be considered more appropriate for use than the outputs from this Pilot programme.

2) Plymouth Heat Networks Context

2.1) Plymouth City Overview

The coastal city of Plymouth is in southwest England. The local authority, Plymouth City Council (PCC), is unitary and has city status in the ceremonial county of Devon. Defining geographic characteristics include the coastal harbour with historical maritime importance and undulating terrain to the north of the city which provides panoramic views of the surrounding area.

Plymouth is a mix of urban and suburban areas with a population of 264,695 according to the 2021 Census. It is the largest settlement in Devon and covers an area of nearly 80km^2. Social housing caters for around 18% of households in Plymouth, with leading providers including Plymouth Community Homes (PCH), Clarion and LiveWest. PCH is Plymouth's largest social housing provider with over 16,000 homes.

The local authority has been a driving force behind the decarbonisation of energy consumption within the city. In 2017[3] a city-wide strategy for district energy was produced and identified areas where heat networks should form a key part of new development proposals. The South-West Devon Joint Local Plan also requires that new developments make such provisions.

2.2) Plymouth Net Zero Targets and Commitments

PCC first declared a Climate Emergency in 2019 and are targeting carbon neutrality by 2030. To meet these targets, they have implemented several policies to accelerate development of heat networks, aligning with government net zero targets and forthcoming Heat Network Zoning policy.

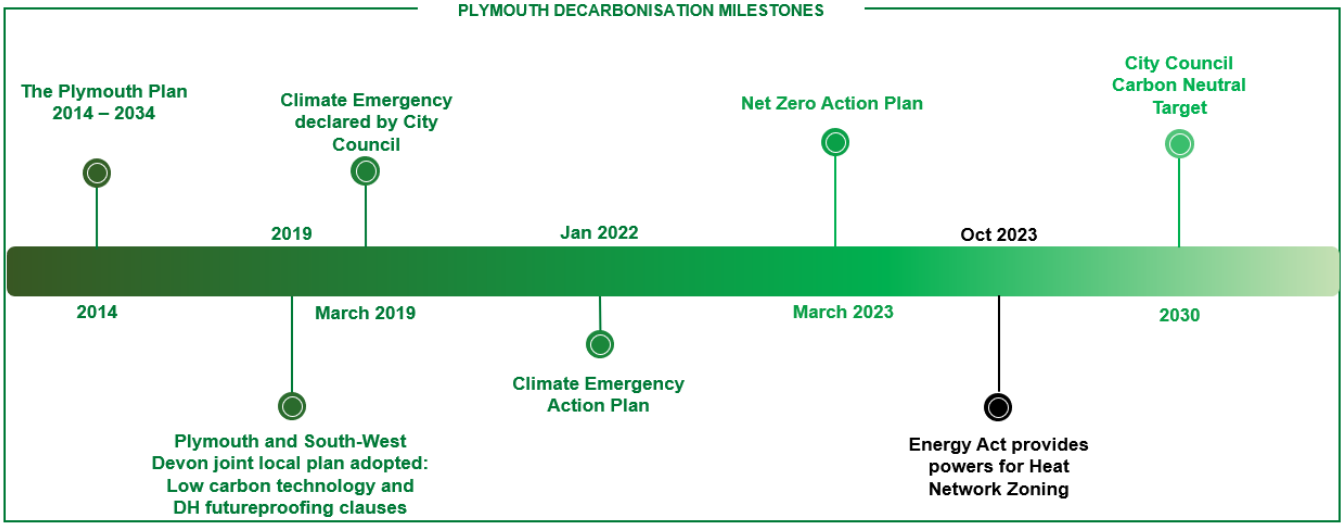
The Net Zero Action Plan, published in March 2023, is a three-year delivery plan, setting out PCC's proposals to reduce its greenhouse gas emissions. This includes a commitment to support the development of a low carbon energy generation and distribution infrastructure that will meet Plymouth's future energy needs. The plan sets a goal for 7,500MWh/yr of heat supplied by new low carbon heat networks in Plymouth by the end of 2025/26.

PCC has undertaken several feasibility studies supported by the Heat Networks Delivery Unit (HNDU) within DESNZ to assess heat networks across the city including at Barne Barton, Devonport, the South City Centre, Millbay and Derriford.

Figure 3 summarises key dates in PCC's plans for decarbonisation and demonstrates their progress towards decarbonisation targets announced in the Net Zero Action Plan.

[3] Plymouth City Council. (2023). Net Zero Action Plan | PLYMOUTH.GOV.UK. [online] Available at: https://www.plymouth.gov.uk/net-zero-action-plan

Figure 3: Plymouth Decarbonisation Milestones



2.3) Delivering Heat Networks in Plymouth

To date, PCC's ambitions for heat network development have focused on the south coast area, including the City Centre, and the area of Derriford in the north. An ultra-low-temperature network is currently under construction in the city centre where PCC have introduced a 'Low Temperature Building Zone' requiring that any new buildings in the area are designed around a low temperature heating system wherever possible. A large diameter DN300 pipework has been installed along Bath Street, which will be able to provide heating and cooling. There are also works underway to create a heat network in the Civic Cluster, in the City Centre, serving hard to treat listed buildings.

Existing and planned networks within Plymouth are located within the city centre and centred around the Ministry of Defence and Marjon University sites. The operational heat networks in Plymouth range from older 1st generation steam networks to more modern 5th generation, ambient loop networks. Please see Sections 3.1.2 and 3.2.2 for more detail.

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

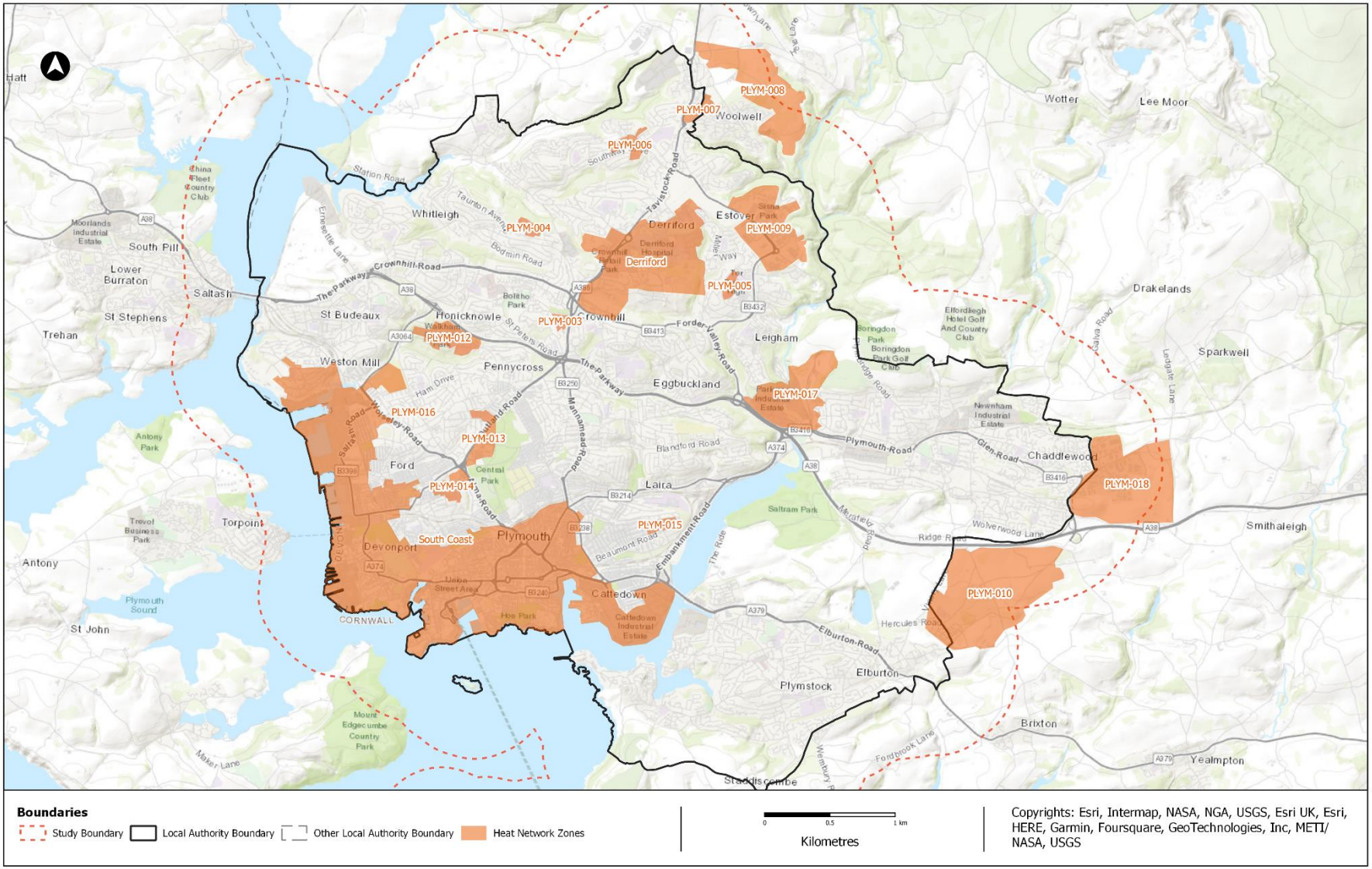
2.4) Plymouth Heat Network Zones

A total of 17 potential HNZs were identified in the study area, with two considered Strategic HNZs. Figure 4 shows the study area boundary as well as the boundaries of all HNZs identified within Plymouth. 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 Plymouth Study Area



3) Strategic Heat Network Zones

Strategic HNZs in Plymouth

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 presents a high-level estimate of the scale of opportunities across Plymouth. 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[4]	300
All buildings required to connect in strategic zones	250
All buildings connected to the IZOs	200

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.

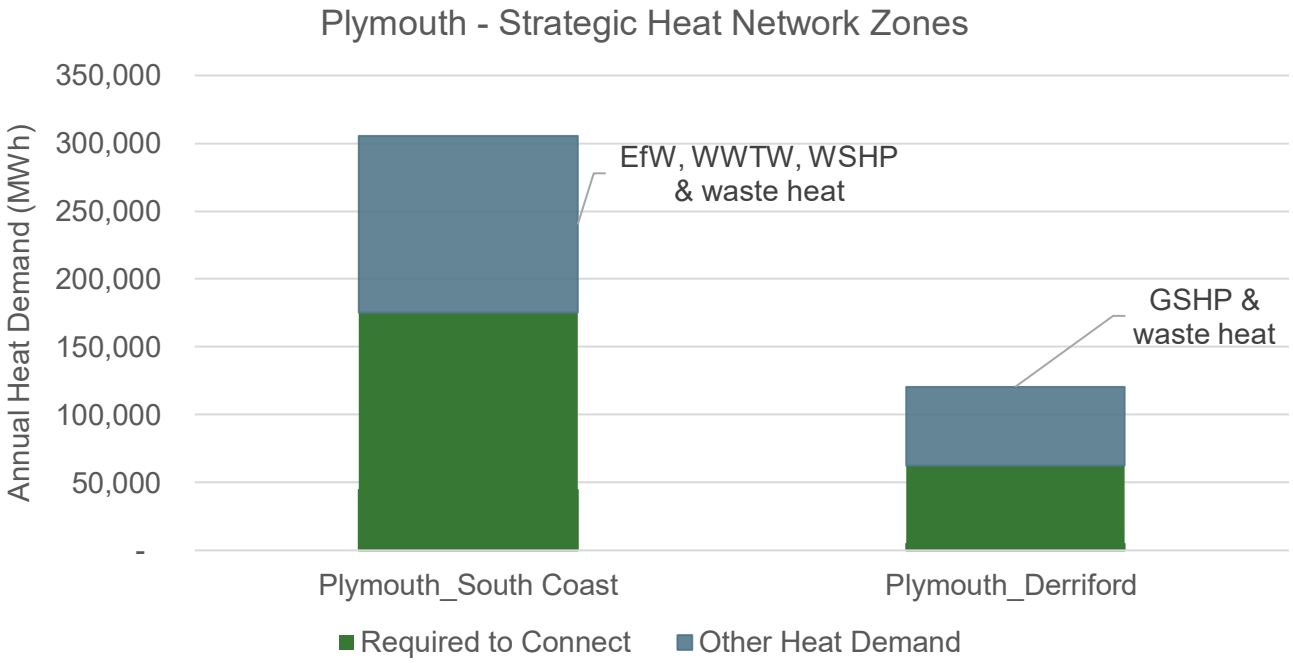
The two strategic zones are summarised below. Figure 5 illustrates the size of each, alongside the key potential heat source and the proportion of buildings that may be required to connect.

Plymouth South Coast is the largest of the potential zones identified by heat demand and area, with opportunities for water source heat pumps (WSHPs) and waste heat utilisation at South Yard Oceansgate, MVVs Energy from Waste (EfW) plant and the Plymouth Central Waste Water Treatment Works (WWTW). For more information, please see Section 3.1.

[4] [4] 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

Plymouth Derriford covers the Derriford area in the north of Plymouth, centred around the anchor load of the NHS Derriford Hospital. There is an opportunity for medical incinerator waste heat recovery at the NHS Derriford site, and ground source heat pumps (GSHPs), with existing GSHP in use at Plymouth Marjon University campus. For more information, please see Section 3.2.

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



3.1) Plymouth South Coast

3.1.1) Plymouth South Coast – HNZ Summary

Plymouth South Coast is a zone on the south-west coast, covering an area from Barne Barton to Cattedown, encompassing Devonport, Stonehouse, Millbay and the entire City Centre (see Figure 6).

There are 221 buildings potentially required to connect in the HNZ. The main building typologies are new developments, education campuses, city centre retail units and the Ministry of Defence (MOD) estate. Key anchor loads include:

- MoD HMNB Devonport is a large dockyard estate to the north of the zone, located south of the Barne Barton estate and the MVV EfW plant. The EfW plant provides steam and electricity for the MoD site, operated by Babcock. It has been confirmed that the MoD site no longer requires steam for their processes and consequently there are plans to de-steam the network. Currently, the steam network supplies a low temperature hot water network for provision of heat to residential units and industrial processes. Until recently, the MoD owned buildings in the South Yard site, these are now controlled by PCC and currently being redeveloped as part of the Oceansgate development.

- Oceansgate consists of a new marine research and industrial development within the Devonport South Yard area. Phase 1 has been constructed and spatial provision within buildings has been safeguarded for a future heat network connection. Ongoing studies are underway for the development of a heat network served by marine source heat pumps. The long-term ambition is to connect the MoD network to the Oceansgate and city centre areas, following the de-steaming and network modernisation, utilising the waste heat from the MVV EfW plant.
- Stonehouse barracks is a mixed use, new development in the early stages of development, within the Millbay Docks area.
- The city centre consists of several anchor loads including Drake Circus shopping centre, Cornwall Street mixed use development, the University of Plymouth, Guildhall, Theatre Royal and Pavilions entertainment venues.
- Fish Quay, also known as Sutton Harbour, is a commercial and residential new development located in Cattedown in the early stages of development, as an enhancement to the existing fish quay and market.

In addition to the MoD existing heat network mentioned above, there are three existing or in-construction networks. These are the Millbay network, the University of Plymouth network and Guildhall network. Key potential heat sources in the zone include the EfW plant, the opportunity for WSHPs recovering heat from the harbour and Plymouth Central WWTW. There are no major constraints within the proposed zone.

3.1.2) Plymouth South Coast - Existing Heat Networks

The existing and planned heat networks in the HNZ are described below and shown in Appendix 1: Map D. Proposed heat networks which are in early stages of development, may be described here, but not included in the map as firm plans for network routing is yet to be established. There are three operational heat networks, one planned heat network and one proposed heat network that is at an early feasibility stage within this zone.

Operational Heat Networks and Planned Expansions

The University of Plymouth

The University of Plymouth has a gas CHP-led heat network and is planning to transition to low carbon technology as part of its decarbonisation strategy. Either GSHPs or air source heat pumps (ASHP) will be installed in 2026, with the possibility of expanding to additional campus buildings. The network presently connects to six campus buildings. These are Davy, Main Hall, The House, Link, Smeaton and Marine. The existing energy centre has a capacity of 12.3MW and an annual demand of 9.5GWh/yr.

Civic Centre

The existing gas network, which serves the Council House and Guildhall, is undergoing decarbonisation. The project, nearing completion, has been facilitated by a grant from the Public Sector Decarbonisation Fund and involves the use of ASHPs. Phase 2 of the Civic Centre network includes expansion to additional buildings, following Green Heat Network Fund

(GHNF) award. The final energy centre capacity will be 2.1MW to initially serve 1.1GWh/yr. Connected buildings consist of the Civic Centre mixed-use redevelopment, Council House, Guildhall (both key PCC assets) as well as the Theatre Royal.

Advanced Zoning Programme:

The Plymouth City Centre District Energy Scheme is a £50m+ project in the City Centre and Civic Quarter areas of Plymouth. The network aims to expand a small-scale existing project which secured nearly £1.25m from the GHNF in early 2023. The existing heat network will be decarbonised with the support of the expanded scheme.

In May 2024, the City Council issued a Prior Information Notice in advance of an expected procurement for a new developer in early 2025. PCC will be looking to secure further GHNF funding to support the development of a wider scheme. The full scope could eventually extend across the Plymouth South Coast zone.

MoD North Yard and South Yard

The MoD North and South Yard networks are each steam driven networks. Reinforcement work has taken place in the North Yard network with steam supplied by the EfW plant at the north of the site. Additionally, part of Devonport's South Yard is now under re-development as part of the Oceansgate development, led by PCC. It is understood that the steam network supplying areas of the North and South Yard is nearing end of life, and modernisation needs to be investigated. The steam connection from the EfW to the North Yard has an MoD contractual agreement for up to 23.4MW.

Planned Heat Networks

Millbay

The Millbay network is planned to supply Pavilions, a major anchor load, as well as the Moxy Hotel, PCH social housing, Ballard House and Mayflower Court. The intention is to develop a 5th generation ambient loop network to serve projected annual heating and cooling demands of 3.54GWh/yr and 1.32GWh/yr respectively with peaks of around 2.2MW. The balancing plant for the network is still under investigation but is likely to use ASHPs, or GSHPs, around Millbay Park.

Proposed Heat Networks – Early stage

Devonport

Devonport's South Yard is now under re-development as part of the Oceansgate development. A feasibility study has been completed for a Devonport network which could replace the existing South Yard steam network and provide a connection to the new Oceansgate development. This would supply an estimated 18GWh/yr and supplied by 4MW of marine source heat pumps.

3.1.3) Plymouth South Coast - Initial Zone Opportunities

Two discrete IZOs were identified in the Plymouth South Coast zone. Potential routing[5] for the IZOs is shown in Figure 6 and summary statistics provided in Table 2.

Table 2: Plymouth South Coast - Summary Statistics for Initial Zone Opportunities[6]

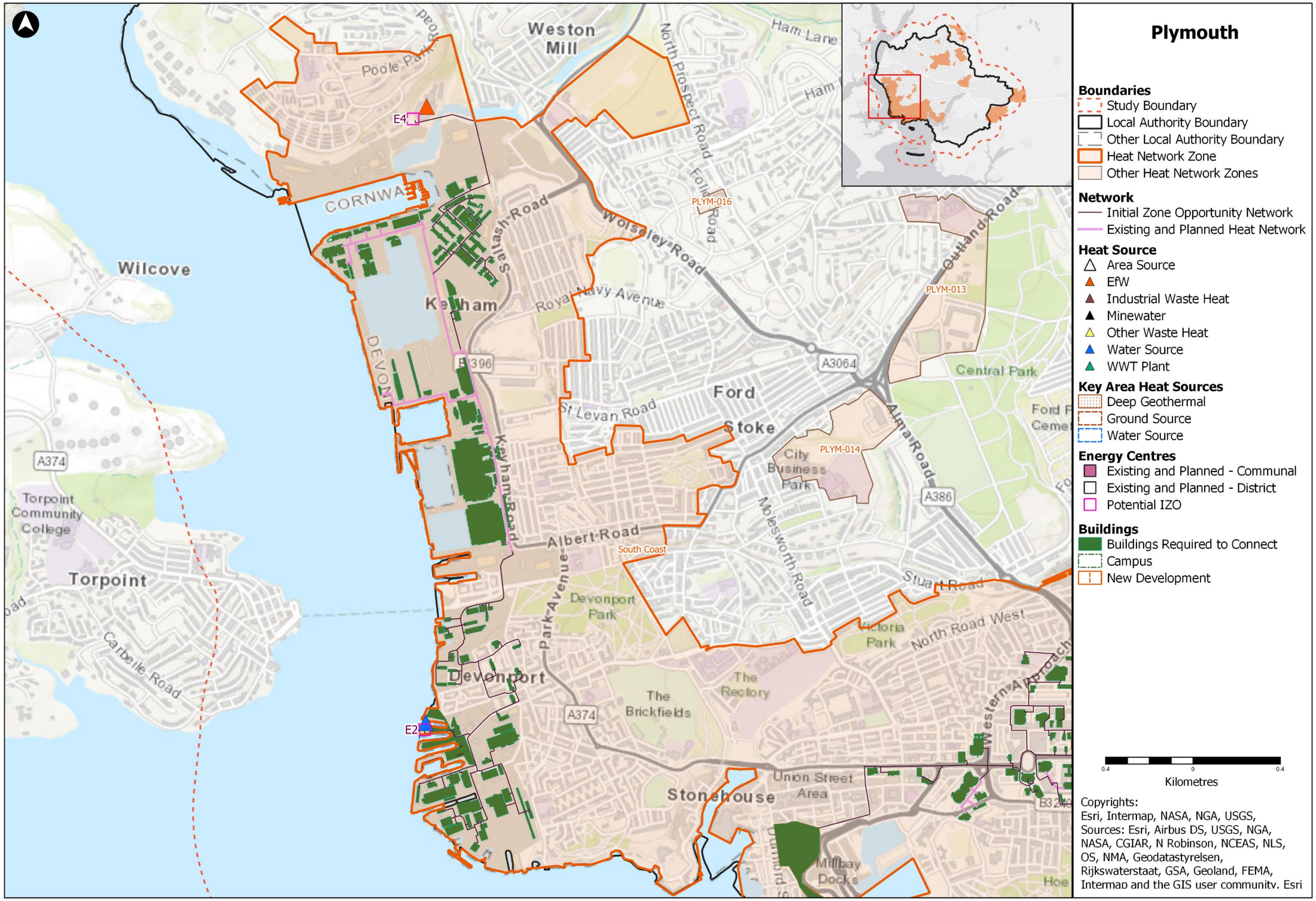
CapEx	Heat	Network	CO_{2e} savings	Linear Heat Density	Heat Sources
>£175m	~150GWh/yr	20km	>20ktCO_{2e}/yr	7.6MWh/m	EfW, WSHP & WWTW

The **Devonport IZO** includes a large scale, council owned new development directly adjacent to the harbour and therefore is a good opportunity for a WSHP. Pre-feasibility has been conducted for the South Yard / Oceansgate elements of the IZO, with the intention to investigate funding avenues such as GHNF. The Devonport IZO also connects to the existing MoD site and further sites of high heat density to the north. It is also near the MVV EfW plant to the North. The IZO is estimated to require a CapEx of £75m to connect to ~75 GWh/yr of heat demand.

The **City Centre IZO** corresponds to the work being delivered through the Advanced Zoning Programme which is currently investigating the potential capacity of a WSHP recovering heat from the WWTW in Cattedown. The vision is to interconnect the three existing and planned heat networks in the city centre to the WWTW. The IZO is estimated to require a CapEx of £100m to connect to ~75 GWh/yr of heat demand.

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

Figure 6: Initial Zone Opportunities in Plymouth South Coast HNZ



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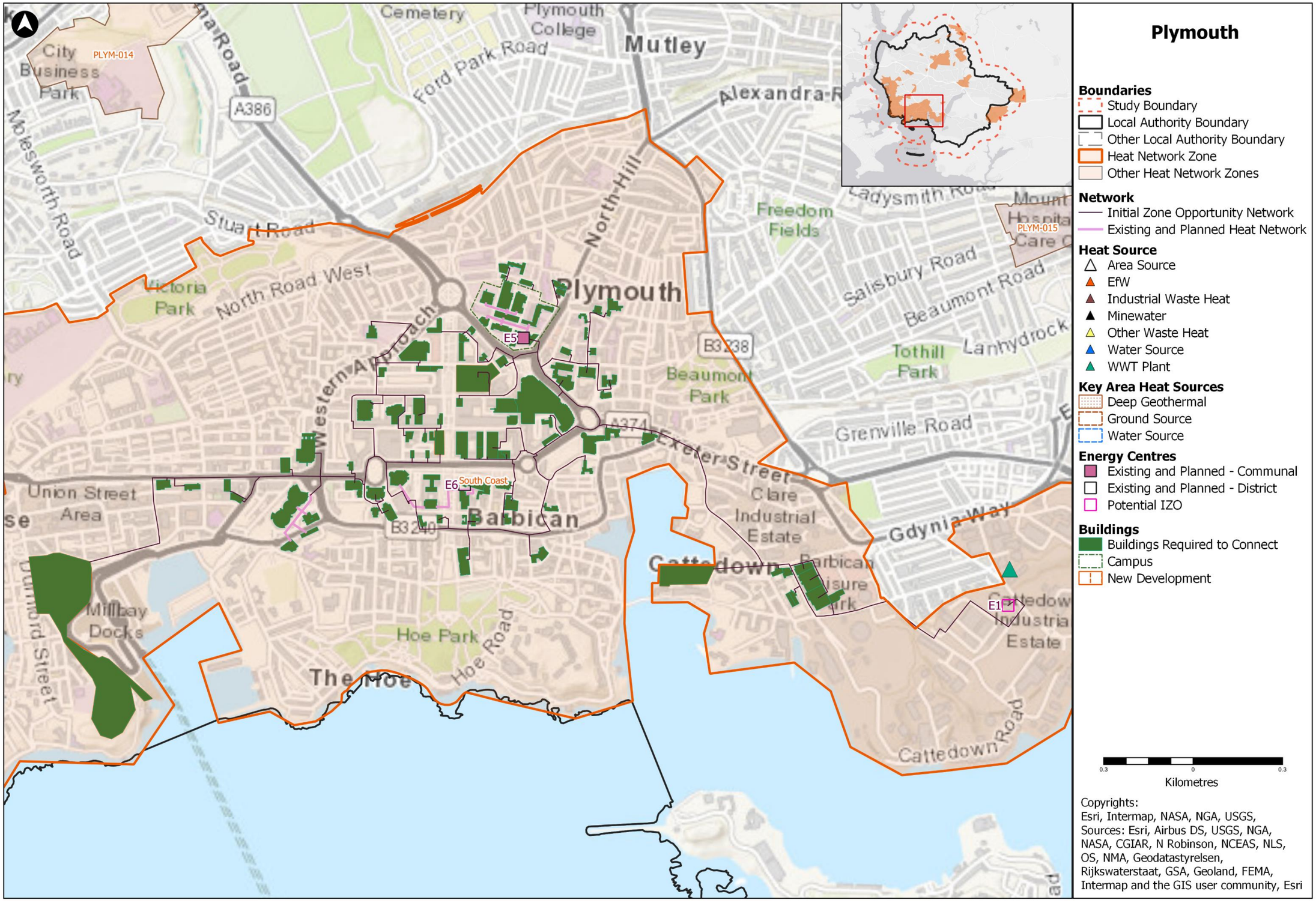


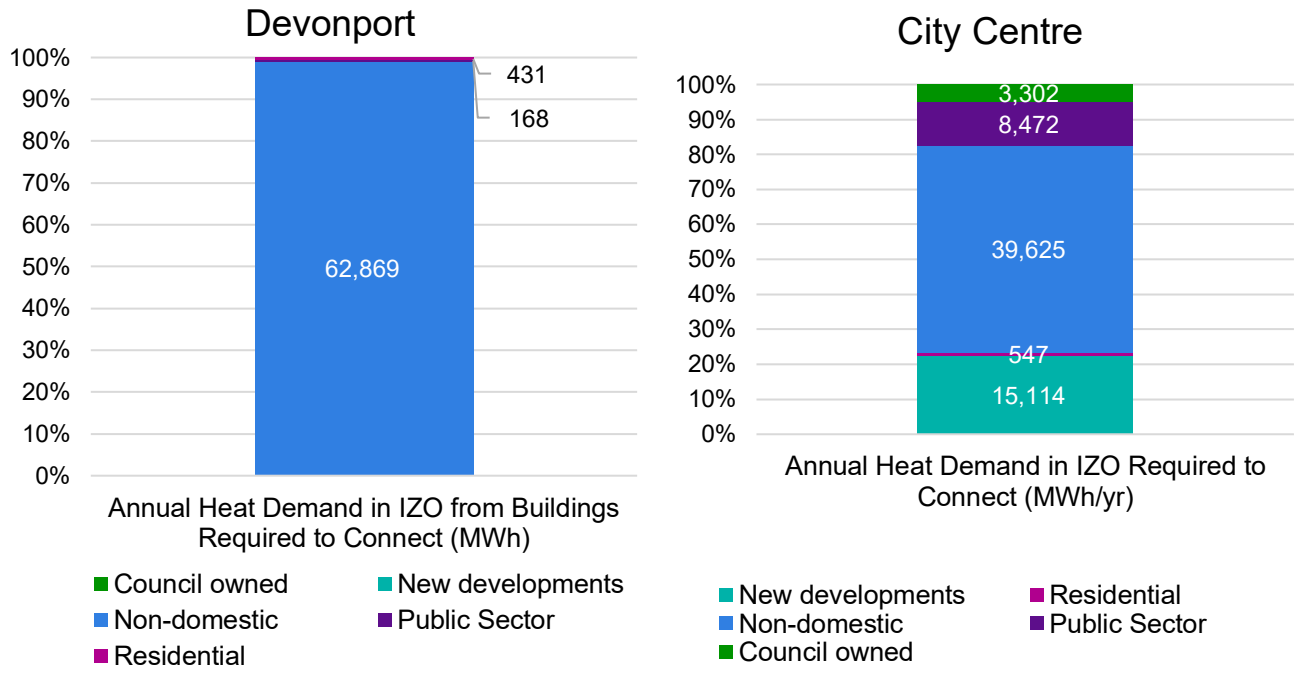
3.1.4) Plymouth South Coast – IZO Heat Demands

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.

Figure 7 presents the building typologies in each of the IZOs. The key typologies include educational, MoD, social housing and new developments. The scale of demand from all buildings potentially required to connect are estimated at ~150GWh/yr. The demands for the Devonport IZO are composed of the “non-domestic” buildings, of which a large proportion is attributed to the MoD estate. Within the city centre the demands are primarily composed of non-domestic and new developments, with large loads including retail at Drake Circus, education at the University of Plymouth and new developments such as the Stonehouse Barracks and Cornwall Street.

Figure 7: Plymouth South Coast - Categorisation of Heat Demand for Buildings Required to Connect in IZOs



Further details of the key heat demands for buildings that may be required to connect in the IZO are provided in Table 3. The zone has a high proportion of industrial buildings which would warrant further investigation. Half of the top 10 buildings noted within the IZO are located within the MoD estate. Also included are new developments at Cornwall Street West and the Stonehouse Barracks, and existing buildings at Drake Circus and City College Plymouth.

Table 3: Plymouth South Coast - Key Heat Demands Required to Connect in the IZOs[7]

Building name	Building category	Number of connections	Heat Demand (MWh/yr)	Data Source
MoD Building – #1	Industrial	1	15,500	Benchmark (NZM)
Stonehouse Barracks	New Development	400	8,750	Benchmark (NZM)
Industrial, MoD owned	Industrial	1	8,400	Benchmark (NZM)
Drake Circus	Existing Retail	1	7,300	Benchmark (NZM)
Cornwall Street West	Mixed use, New development	79	5,100	Benchmark (NZM)
Military Marine	Industrial building	1	1,900	Benchmark (NZM)
MoD Building – #2	Industrial	1	1,700	Benchmark (NZM)
MoD Building – #3	Industrial	1	1,600	Benchmark (NZM)
City College Plymouth	Education	1	1,550	Benchmark (NZM)
Western Approach	Existing Retail	-1	1,500	Benchmark (NZM)

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

3.1.5) Plymouth South Coast – IZO Heat Sources

There are three notable low carbon potential heat sources within the Plymouth South Coast HNZ, which are connected to the two IZOs. Table 4 and Table 5 in this section summarise the key heat sources and potential energy centre locations identified. These are also shown in the zone-level map in Figure 6 in Section 3.1.3 and Appendix 1: Map C.

The **Devenport IZO** is near to the surrounding coast and River Tamar, providing a good opportunity for a WSHP. Furthermore, it is near to the EfW plant in Barne Barton. The plant has a waste heat capacity of 26MW, 23.4MW of which is contracted to the MoD site while historically the MoD winter peak maximum is 19MW.

The primary low-carbon heat source identified for the **City Centre IZO** is a WSHP recovering heat from South West Water, Plymouth Central WWTW in Cattedown.

Table 4: Plymouth South Coast - Key Heat Source Opportunities for the IZOs

Heat source type	Capacity (kWp)	Temperature (ºC)	Potential Energy Centre [Ref number]
WSHP River Tamar	4,000	70	E2
WSHP Plymouth Central WWTW	12,000	70	E1
EfW MVV	26,000	180	E4

Table 5: Plymouth South Coast - Potential IZO Energy Centre Locations

EC Ref number	Site type	Name	Size (m^2)	Ownership	Heat Source
E1	Land	PCC Prince Rock Depot	Unknown	PCC	WSHP - WWTW
E2	Land	Oceansgate Jetty3 EC	400	PCC	WSHP - River
E4	Land	MVV EfW Land	Unknown	MVV	EfW
E5	Building	University of Plymouth EC	Unknown	University of Plymouth	ASHP
E6	Building	Guildhall EC	Unknown	Guildhall	ASHP

Other potential low-carbon sources in the area include waste heat recovery from private industrial buildings such as the Princess Yacht production factory, however, insufficient information is available for these to be considered as a preferred heat source for the IZOs. Aquifer water has also been investigated for the Millbay network, however the trial borehole and resulting flowrates from the test, deemed the source unviable. Furthermore, there are existing heat networks which could have potential for additional capacity within energy centres however this has not yet been confirmed by stakeholders.

There is sufficient land available for energy centre locations nearby to the IZO, however there are expected to be fewer options within the city centre itself.

3.1.6) Plymouth South Coast – 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.

The **Devonport IZO** network route runs parallel to the River Tamar, distributing heat from an energy centre proposed to be located to the south of the IZO at Oceansgate Jetty 3 (E2) and to the north of the IZO at the EfW plant (E4).

The **City Centre IZO** network route distributes heat from the east of the IZO where the energy centre is proposed to be located near to Plymouth Central WWTW, to the west of the IZO into Plymouth city centre and beyond to Millbay Docks. Table 6 shows the network statistics for the IZOs including the network length and associated cost. Please see Appendix 5 for related methodology statements and assumptions.

Table 6: Plymouth South Coast - Indicative Heat Network Statistics for IZOs

IZO Heat Network description	Network length (km)	Network cost (£m)
Plymouth South Coast	~20	~80

3.1.7) Plymouth South Coast – IZO Key Constraints and Mitigations

Plymouth South Coast:

[C1] Rail crossing: There is a national rail route that runs through the top edge of the zone. The railway does not interfere with proposed routing or key buildings that may be required to connect.

The Stonehouse Bridge separates the two IZOs within the zone. Whilst the Stonehouse Bridge does not prevent routing, it could be seen as a pinch point in connection between the IZOs. Routing around the bridge via Richmond Walk is possible. Engagement with PCC highways in the early stages of design will mitigate any issues which may arise.

Devonport:

Sensitivity of MoD site: The MoD site has an existing contractual agreement with the EfW and is a site of military importance. To de-risk this, alternative routing could be considered along Chapel Street, for example, which runs parallel to the MoD site. Secondly, it would be necessary to engage in commercial negotiations with the current network operator to access the unused contractual capacity of the EfW.

3.2) Plymouth Derriford

3.2.1) Plymouth Derriford – HNZ Summary

Plymouth Derriford is a zone which encompasses the Derriford area in the north of Plymouth. The HNZ has good land availability for potential energy centre locations and other low carbon related infrastructure (such as boreholes for GSHPs), as well as high heating and cooling annual demand density and a mix of building typologies (see Figure 8).

There are 60 buildings potentially required to connect in the zone. The demand of the area is dominated by the NHS Derriford Hospital, which has a medical waste incinerator which has been identified as a potential heat source. Other key anchor loads include two new developments and Majon University which has an operating 5th generation ambient loop network.

3.2.2) Plymouth Derriford - Existing Heat Networks

There is one operational heat network in the HNZ which is described below and shown in Appendix 1: Map D. There are a further two proposed heat networks in the HNZ which are in early stages of development. These are not included in the map as firm plans on network routing are not yet established.

Operational Heat Networks and Planned Expansions

Marjon ambient loop network

In 2022, Marjon University completed the installation of 55 building level heat pump units connected to an array of 120 boreholes, totalling a capacity of 650kW across their campus.

The network supplies 1.6GWh/yr to staff and student accommodation within the Student Village and several campus buildings. These include The Edge, The View and the East University buildings. The borehole arrays are close to St Marks Road.

Proposed Heat Networks – Early stage

Derriford area wide ambient loop

PCC commissioned a concept design study for the decarbonisation of the Derriford area. The study proposes an ambient loop network connecting the five key demand centres. The zone comprises of Nuffield; Plymouth Science Park; NHS Derriford & associated schools; NWQ; and the existing ambient loop network at Plymouth Marjon.

The proposed network would supply 35GWh/yr heating and 18GWh/yr cooling, decarbonising >50% of the of the total energy consumption within the Derriford area. Stakeholders have been actively engaged, and PCC is seeking to develop the scheme to an advanced stage.

North-West Quadrant (NWQ) development

As part of the NWQ development, which consists of medical related development, a communal geo-coupled ambient loop system is an option currently being investigated.

3.2.3) Plymouth Derriford – Initial Zone Opportunities

A single IZO was identified in the Plymouth Derriford zone. Potential routing[8] for the IZO is shown in Figure 8 and summary statistics provided in Table 7.

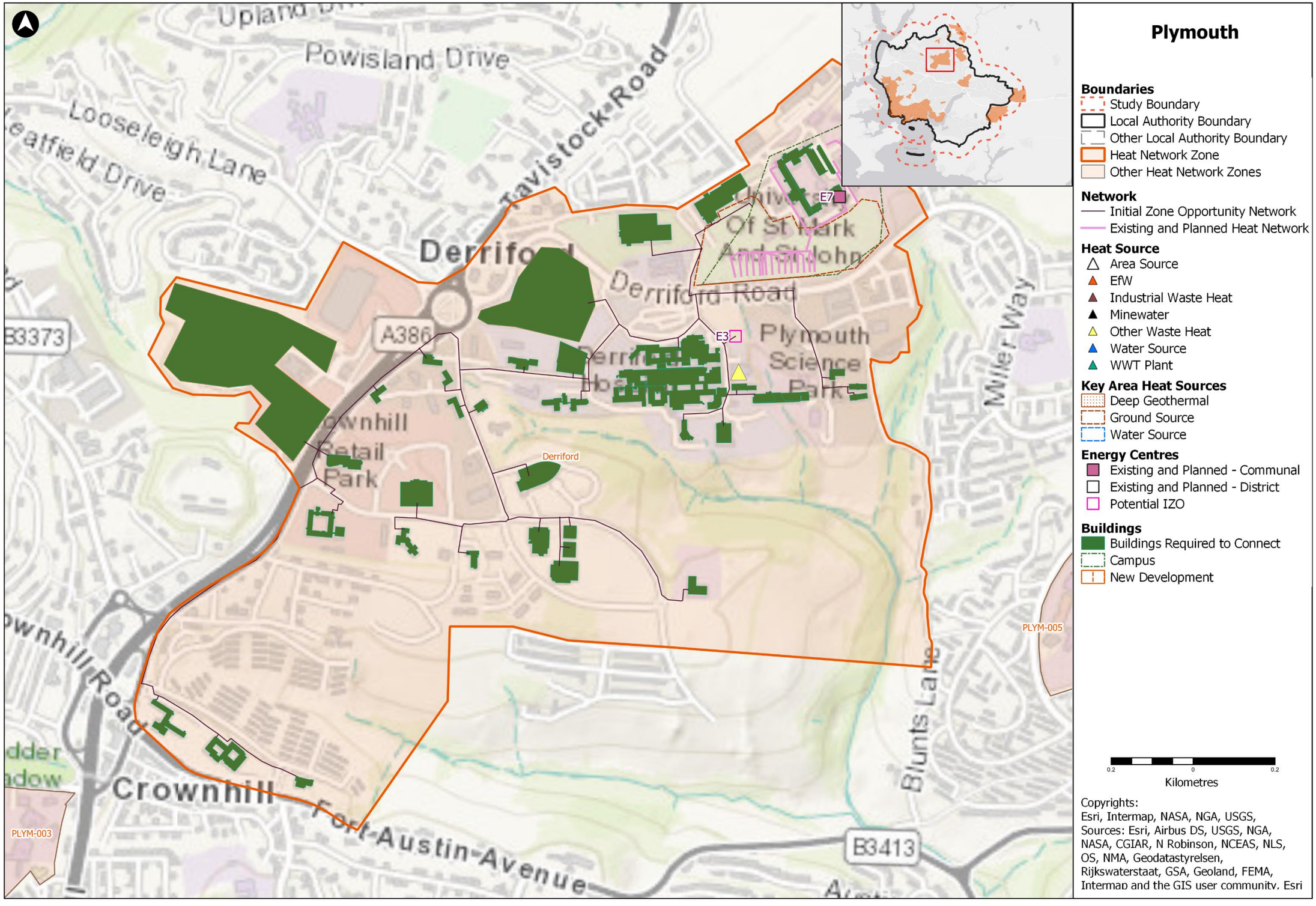
Table 7: Plymouth Derriford - Summary Statistics for Initial Zone Opportunities[9]

CapEx	Heat	Network	CO_{2e} savings	Linear Heat Density	Heat Sources
~£75m	>50GWh	~12km	10ktCO_{2e}/yr	6.4MWh/m	ASHP, Medical Incinerator, Ambient Loop

The identified IZO connects to 93% of the buildings potentially required to connect in the zone and includes all key anchor loads including NHS Derriford Hospital, and Glacis Park and Northwest Quadrant future developments. As the area has a balance of heating and cooling demands an ongoing HNDU study has proposed an ambient loop network.

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

Figure 8: Initial Zone Opportunity in Plymouth Derriford HNZ

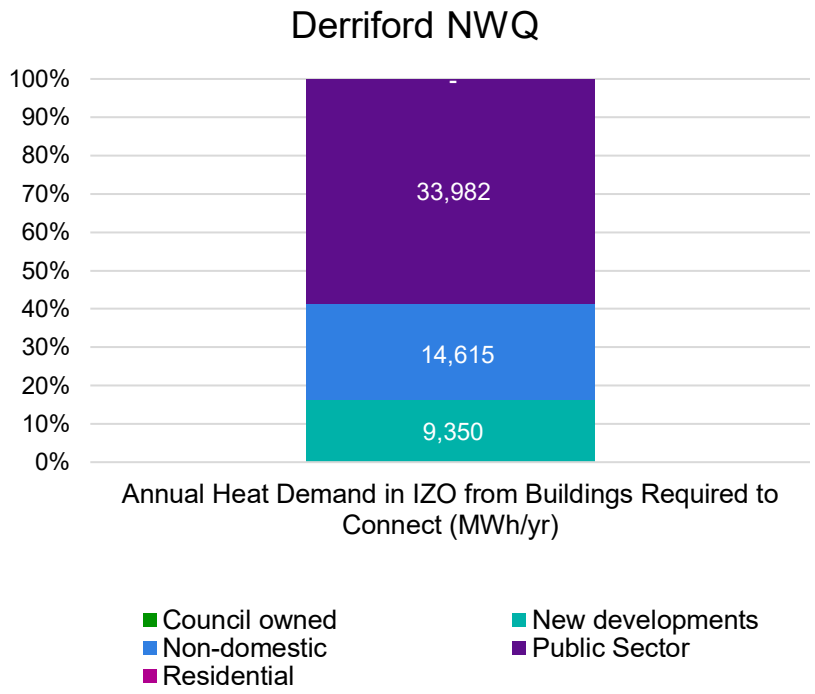


3.2.4) Plymouth Derriford – IZO Heat Demands

There are 60 buildings that may be required to connect in the zone, and 45 are connected to the IZO. Connections include five key neighbouring anchor loads (NHS Derriford Hospital, Nuffield Health Club, North West Quadrant, Marjon University and Plymouth Science Park), as well as the Glacis Park mixed use development to the west of the area. Major loads to the south including The Ship retail centre and PCH social housing. Figure 9 illustrates the split of demand per typology. The ~33 GWh/yr [10]for public sector buildings represents the NHS Derriford site and associated medical schools.

Further details of the key heat demands for buildings that may be required to connect in the IZO are provided in Table 8.

Figure 9: Plymouth Derriford - Categorisation of Heat Demand for Buildings Required to Connect in IZO



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

Table 8: Plymouth Derriford - Key Heat Demands Required to Connect in the IZO[11]

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
NHS Derriford Hospital	Public Sector	1	20,800	Benchmark (NZM)
Glacis Park	New development / Mixed use	1	9,350	Benchmark (NZM)
North-West Quadrant	New development	9	6,100	Benchmark (NZM)
NHS Derriford Retail	Commercial	1	5,700	Benchmark (NZM)
NHS Derriford Clinic	Public Sector	1	2,000	Benchmark (NZM)
Nuffield Health & Racquet Club	Leisure centre with pool	1	1,300	Benchmark (NZM)
The Ship	Leisure centre	1	1,250	Benchmark (NZM)
Marjon University	Education	1	1,000	Benchmark (NZM)
Plumer House	Social housing	1	750	Benchmark (NZM)
HM Land Registry	Council owned	1	700	Benchmark (NZM)

3.2.5) Plymouth Derriford – IZO Heat Sources

Plymouth Derriford does not have access to nearby water sources for the use of a WSHP. There is sufficient ground space available, i.e., the numerous carparks for the medical and leisure facilities, as well as sport fields. These spaces could facilitate low carbon energy generation from either GSHPs or ASHP plant. As an example, the ambient loop network at Marjon University relies on its 120 boreholes array under the grass sports pitch, which provides 650kW of heating.

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

The medical incinerator at Derriford Hospital could be a source of waste heat. It has been investigated in several previous HNDU studies. The energy centre location identified for the IZO is consistent with a HNDU study which previously identified an area of land owned by PCC next to the medical incinerator.

Table 9 and Table 10 summarise the key heat sources and potential energy centre locations. These are also shown in the map in Figure 8 in Section 3.2.3 and Appendix 1: Map C.

Table 9: Plymouth Derriford - Key Heat Source Opportunities for the IZO

Heat source type	Opportunity Capacity (kWp)	Temperature (ºC)	Potential Energy Centre (Ref number)
GSHP Marjon ambient loop	650	7-12 ºC	E7 Campus pitch
Medical Incinerator	1,800	90 ºC	E3 Derriford Road
GSHP Marjon grass sport pitch Hospital car park A Nuffield car park Science Park car park	163 300 300 190	7-12 ºC	E3 Derriford Road

Table 10: Plymouth Derriford - Potential IZO Energy Centre Locations

EC Ref number	Site type	Size (m^2)	Ownership	Heat Source
E3	Land	800	PCC	ASHP and potential waste heat recovery
E7	Land	Unknown	Plymouth Marjon University	WSHP and gas boiler

3.2.6) Plymouth Derriford – 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 related methodology statements and assumptions used.

The key heat network infrastructure proposed for the IZO is the pipework from the energy centre to the heat demands along three key sections, seen in Figure 8. The first section is along Derriford Road, serving the NHS Derriford Hospital and other anchor loads detailed in Section 3.2.4. The second section is along Brest Road supplying the retail hub around

Derriford District Centre. The third section is along Plumer Road to reach buildings required to connect in the south of the zone.

Table 11: Plymouth Derriford - Indicative Heat Network Statistics for the IZO

IZO Heat Network description	Network length (km)	Network cost (£m)
Plymouth Derriford	12	50

3.2.7) Plymouth Derriford – IZO Key Constraints and Mitigations

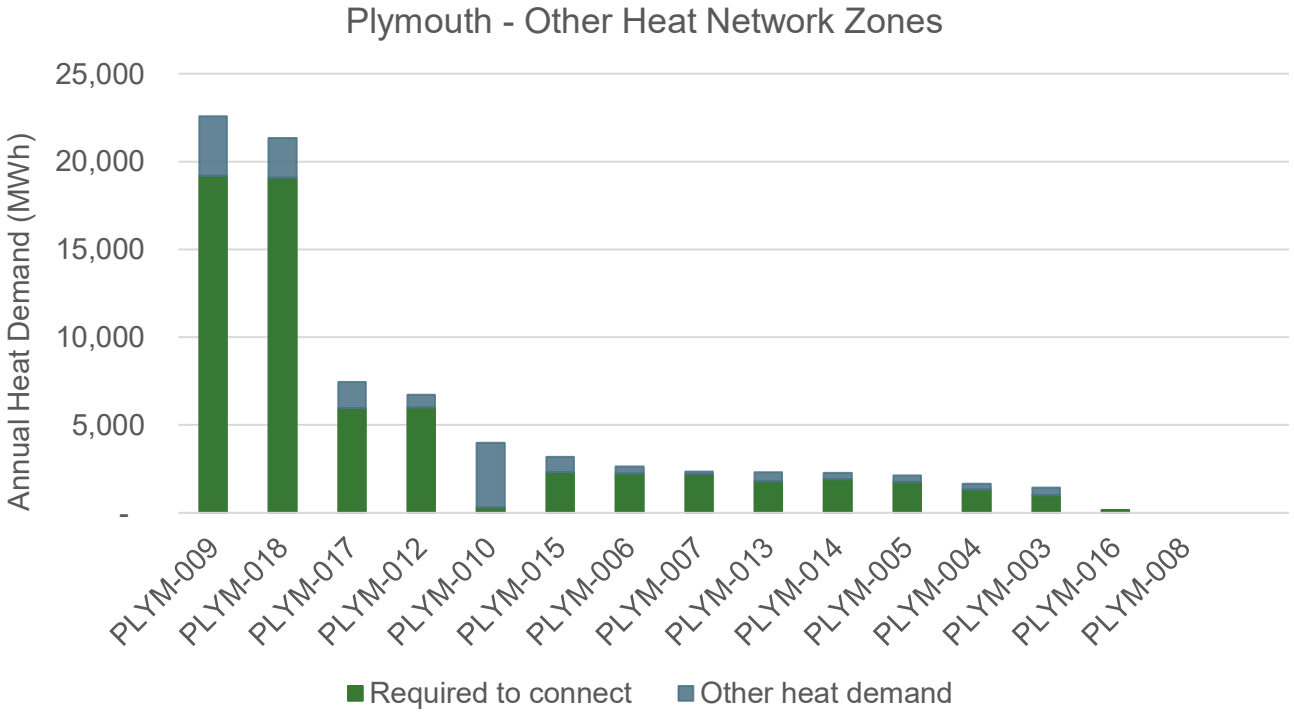
There are no major constraints identified for the proposed IZO.

4) Other Heat Network Zones

This section describes the 'Other' potential heat network zones that were identified in Plymouth. 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



PLYM-008: is situated to the north of the Plymouth boundary. This area is currently undeveloped with no existing buildings (hence 0MWh/yr). Timescales to develop are unknown, however there is an ambition to implement a residential and mixed-use large-scale development known as East Woolwell.

PLYM-009: is situated to the north of the city centre and Derriford area. The zone is dominated by industrial buildings and contains key anchor loads such as The Wrigley Co gum factory (~5GWh/yr) and the Fine Tubes factory (~2GWh/yr). Potential heat sources include recovered waste heat from the industrial processes, as well as GSHP due to the large amount of land availability including car parks.

PLYM-010: is east of the city centre and just outside the study boundary for Plymouth. The area is planned to be fully re-developed into a residential and mixed-use area. This new development plan is known as Sherford. The energy strategy has not yet been developed.

PLYM-017: is situated to the north-east of the city centre. The area is dominated by industrial buildings and the China Claywork new development. Potential heat sources include recovered waste heat from industrial processes taking place within the Princess Yacht factory as well as GSHP due to the large amount of land availability and car parks.

PLYM-018: is situated to the east of the city centre in the Langage area, bordering the Plymouth study area boundary. The area is dominated by buildings of an industrial nature such as the combined cycle gas turbine power station which has been announced as a new development site for a large-scale green hydrogen project.

PLYM-003, PLYM-004, PLYM-005, PLYM-006, PLYM-007, PLYM-012, PLYM-013, PLYM-014, PLYM-015, PLYM-016: are situated outside of the city centre. Each of these zones are relatively small representing a single network opportunity centred around existing multi-building estates.

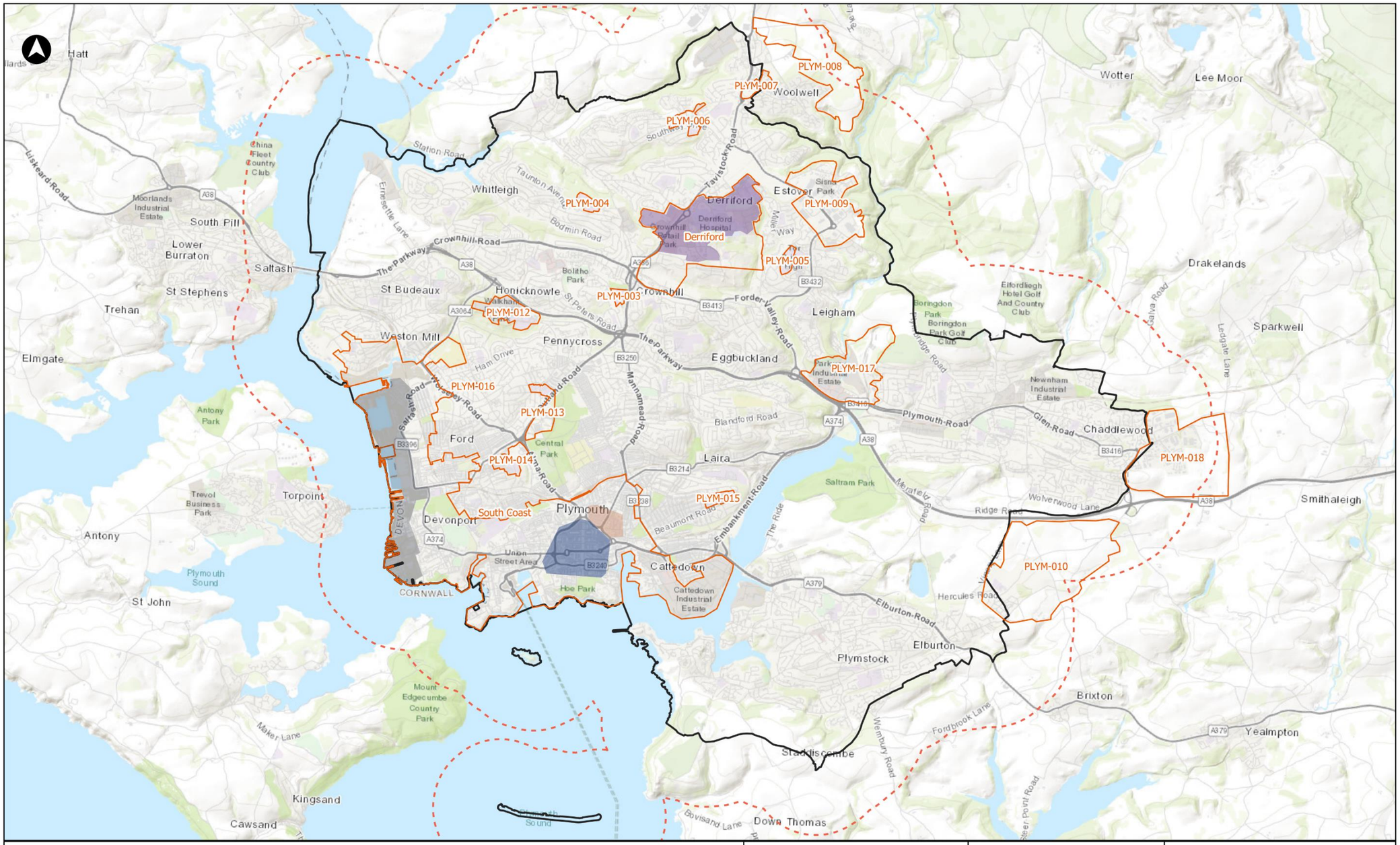
Appendix 1: Maps and Legends

This section provides guidance on interpreting the icons and legends used throughout this report and Maps A-G 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	‘Communal’ energy centres are those operated within a single building or across a campus
	Report maps	Existing/planned energy centre - District HNs	‘District’ 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 Mine 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. Plymouth Typology Map



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

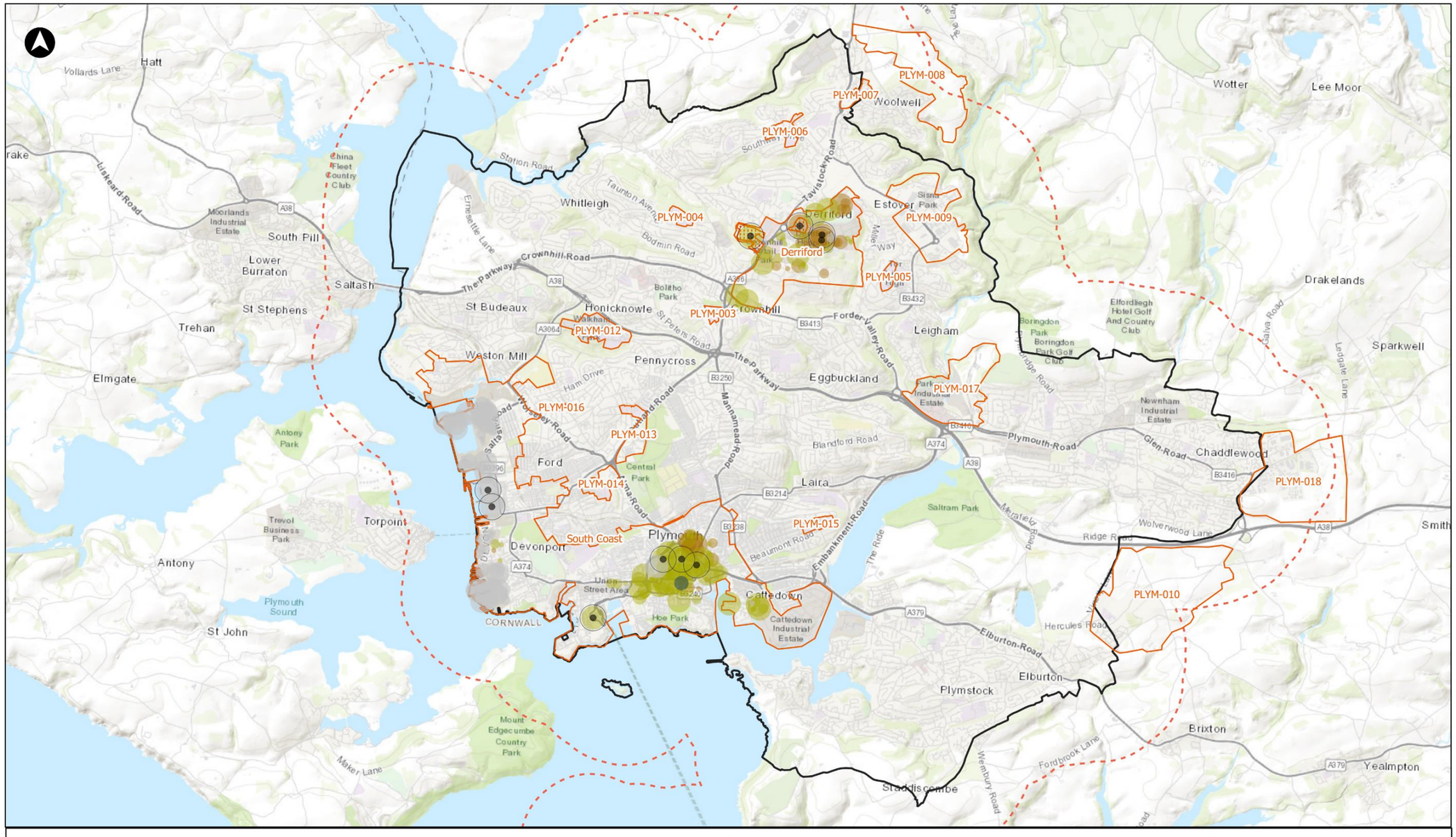
Key Typologies
- Dense city centre
- City centre fringe
- Mixed use district
- Social housing
- Campus (health/education)
- Commercial / business office district
- Industrial areas

Kilometres
Scale: 1:55,000
Coordinate System: OSGB36 / British National Grid

Department for Energy Security & Net Zero

Plymouth
Map A
City Typologies

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 - 200
- 200 - 400
- 400 - 600
- 600 - 1000

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

Department for Energy Security & Net Zero

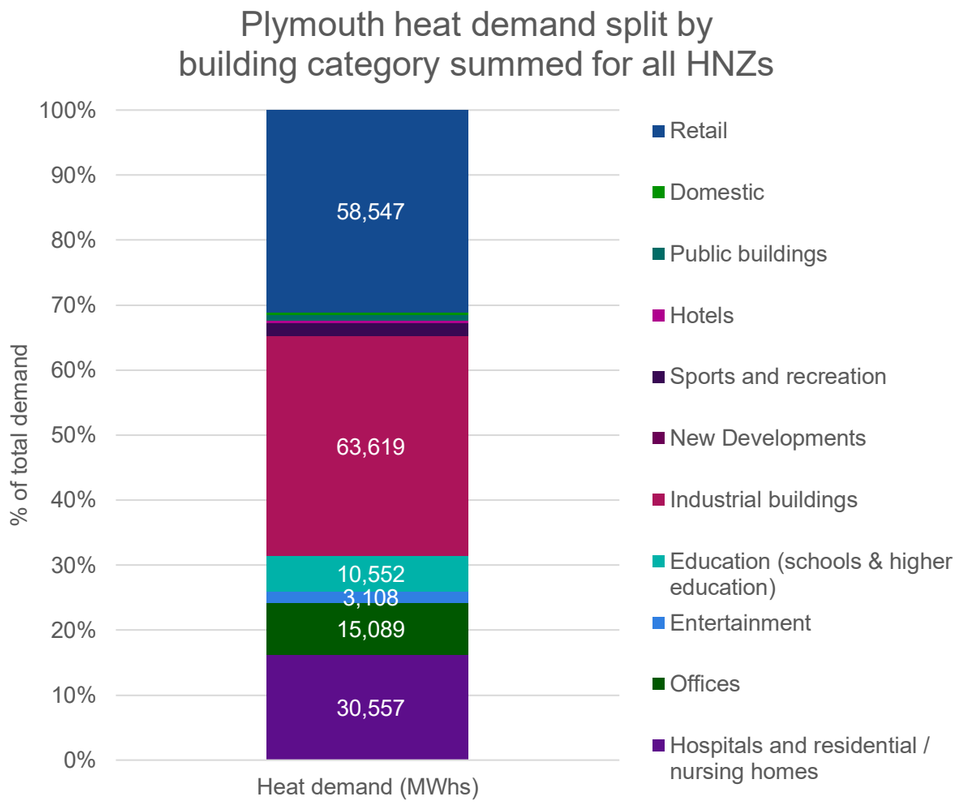
Plymouth

Map B

Key Heat Demand

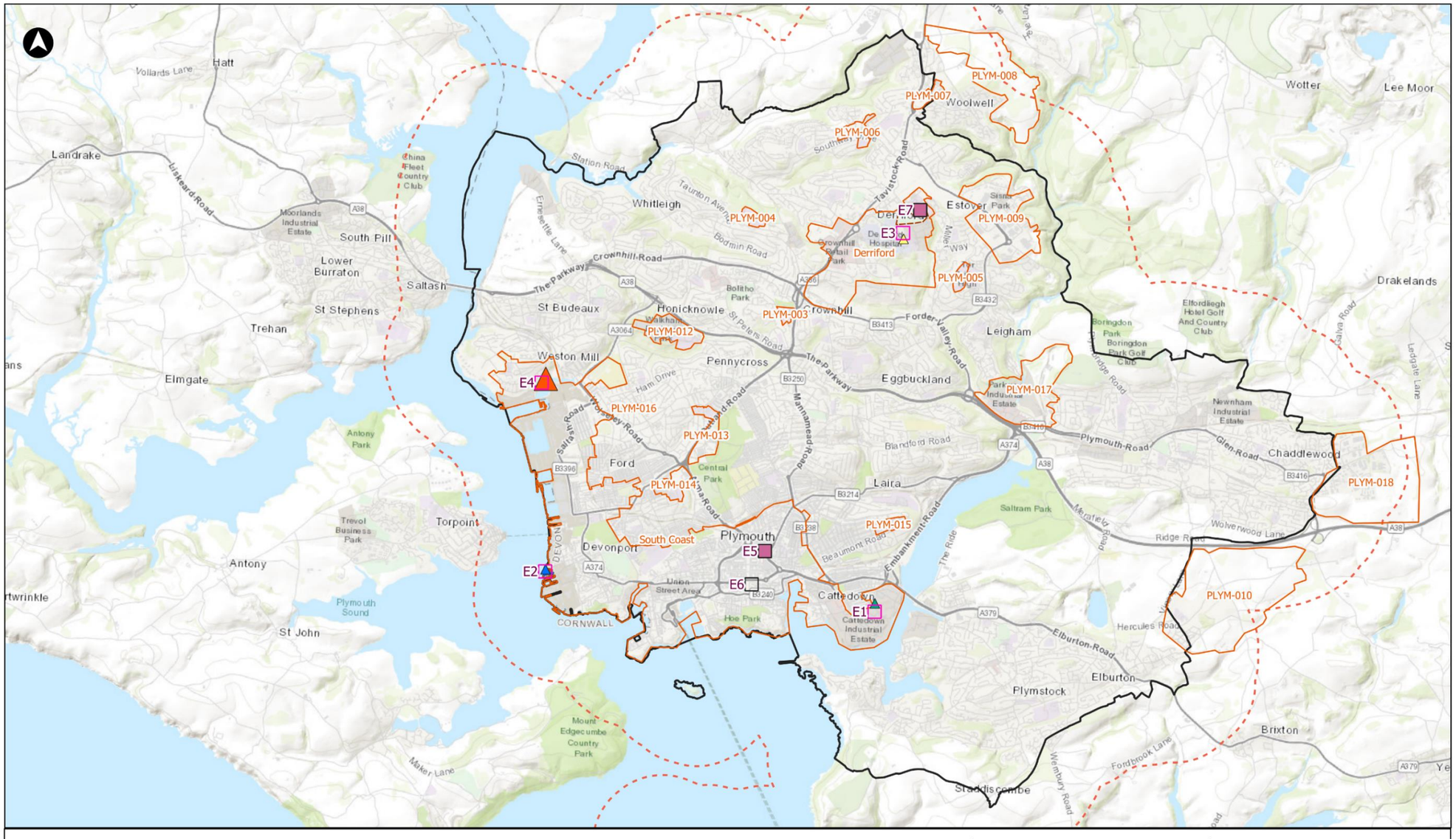
Table 12: Heat Demand split further by Building Categories across all Initial Zone Opportunities identified in Strategic HNZs in the Study Area

Building category	Number of buildings required to connect in this category	Annual Heat Demand of buildings required to connect across IZOs (MWh)
Domestic	3	977
Education (schools & higher education)	36	10,552
Entertainment	4	3,108
Hospitals and residential/nursing homes	8	30,557
Hotels	2	850
Industrial buildings	114	63,619
Offices	40	15,089
Public buildings	14	1,513
Retail	42	58,547
Sports and recreation	3	3,660
Totals	**266**	**188,473**



Note: In Plymouth there are 17 HNZs with a total of three IZOs identified across them. The table and graph above summarise and categorise 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 - 2
- 2 - 4
- 4 - 6
- 6 - 8

Energy Centres
- Potential IZO

Kilometres
Scale: 1:55,000
Coordinate System: OSGB36 / British National Grid

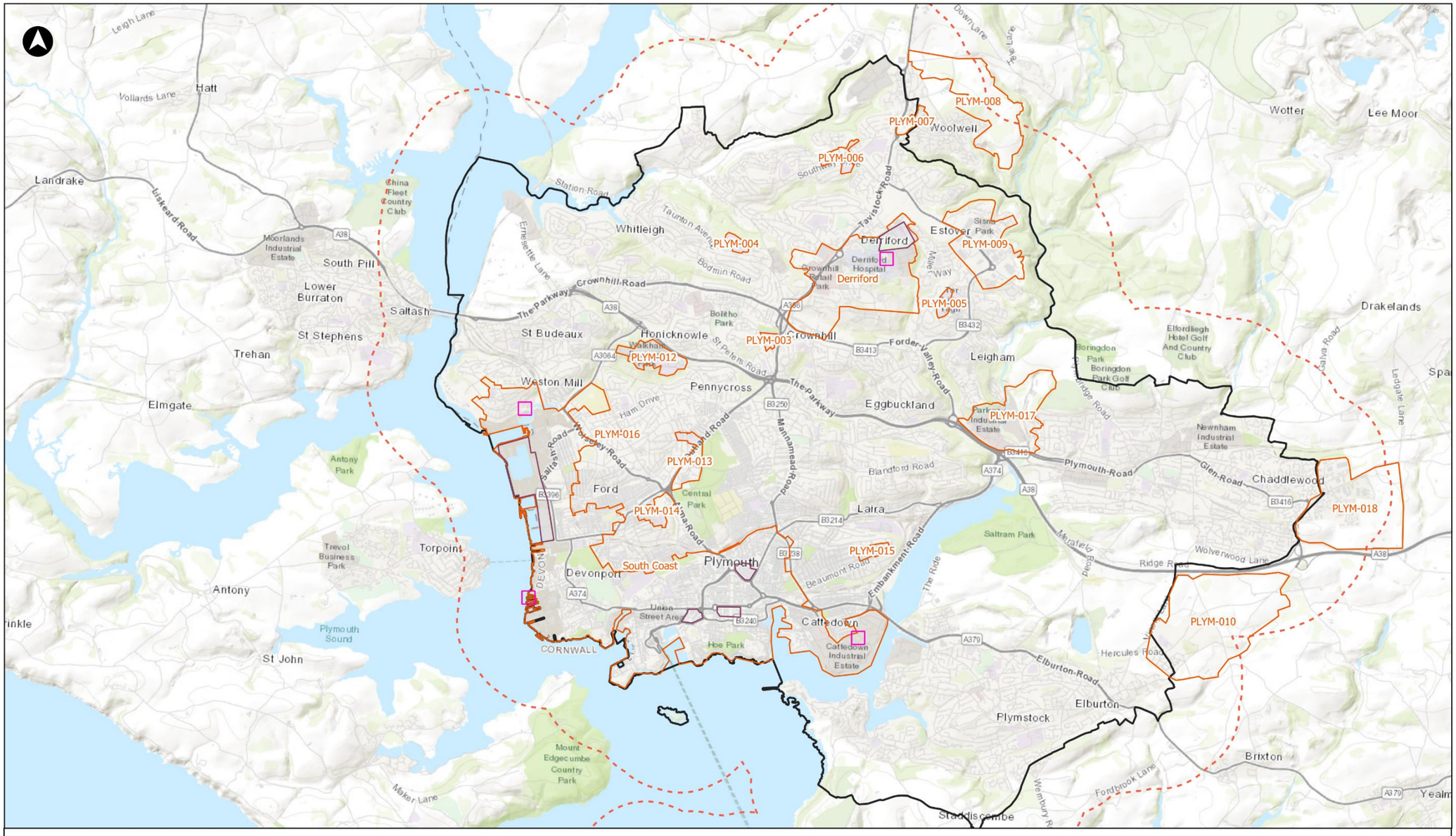
Department for Energy Security & Net Zero

Plymouth

Map C

Key Heat Sources and Energy Centres

D. Existing and Planned Heat Networks



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

Existing and Planned Heat Networks

Energy Centres
- Potential IZO site

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

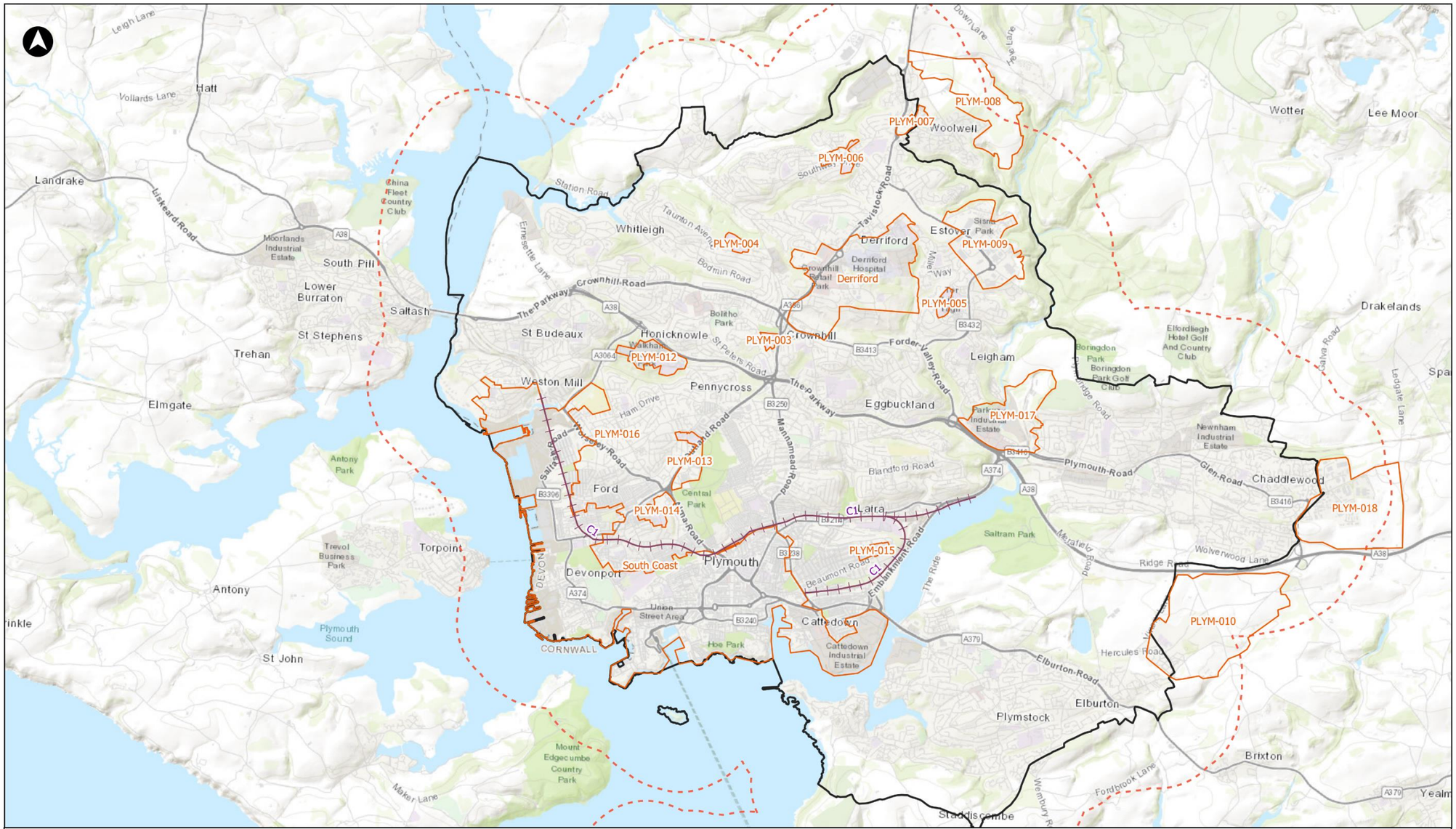
Department for Energy Security & Net Zero

Plymouth

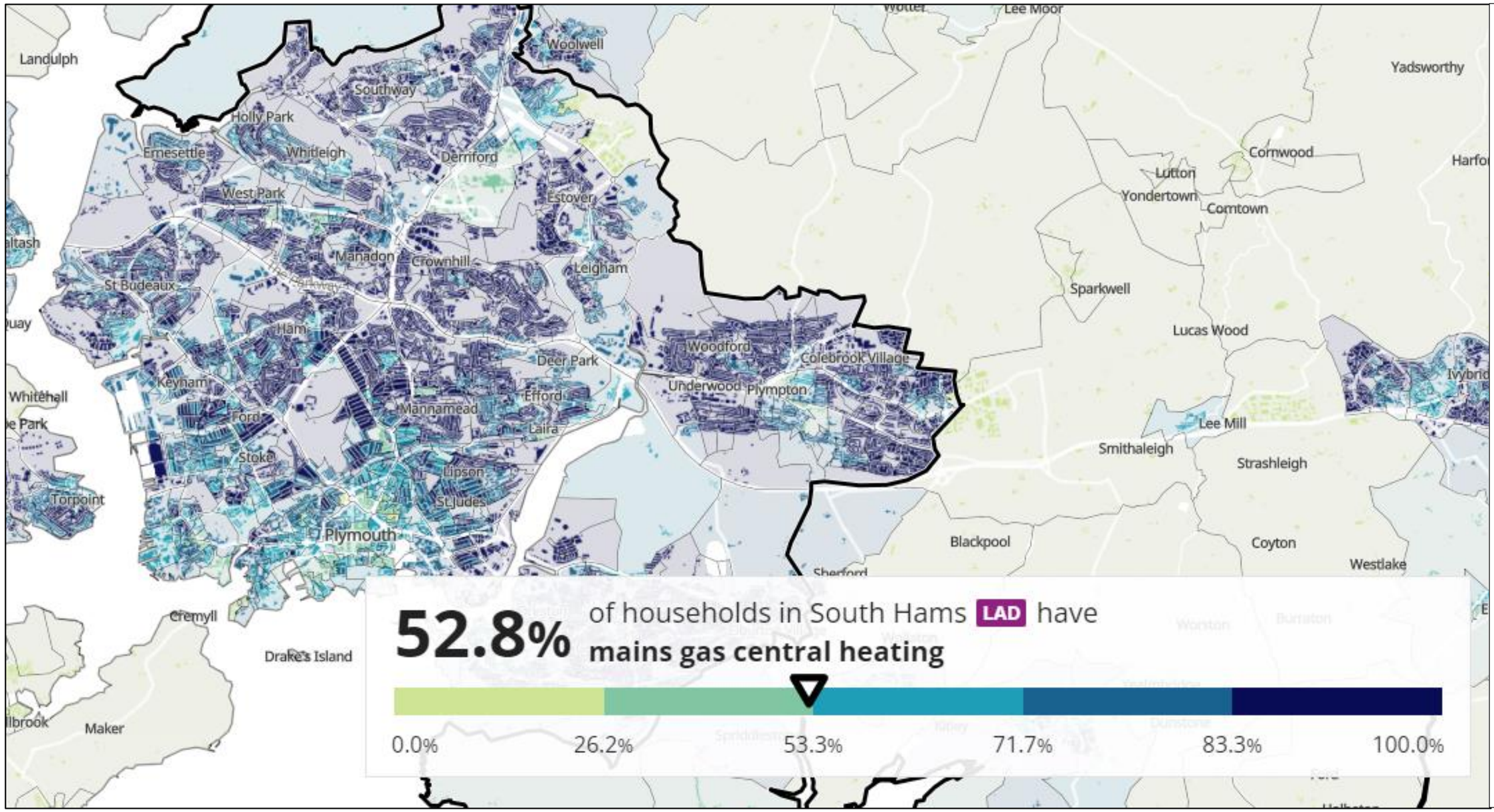
Map D

Existing and Planned Heat Networks

E. Physical Constraints



F. Off-Gas Grid Areas in Plymouth



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
Southern City Centre and Millbay Energy Feasibility Study, 2022	Buro Happold HNDU Study commissioned by PCC
Derriford Decarbonisation Opportunity, 2023	Buro Happold HNDU Study commissioned by PCC
Devonport Heat Network Pre-Feasibility Study	Buro Happold HNDU Study commissioned by PCC
Barne Barton Heat Network Feasibility Study	Buro Happold HNDU Study commissioned by PCC

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

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