Department for Energy Security & Net Zero

Plymouth

Draft Heat Network Zoning Pilot Programme Findings

Confidential

January 2024

Disclaimer

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

Due to the sensitive nature of HNZ Pilot Programme outputs, ahead of national policy being written as law, please be aware that DESNZ is managing access to this report, and recording people and organisations with whom it has been shared, for audit purposes.

This report contains outputs which are from a pilot phase of HNZ policy and process development. As such, the contents, including data shown in maps, technical and economic data within the report, are likely to change. **No part of this report shall be relied upon for any business decisions.**

Acknowledgements

This document was produced by Buro Happold in partnership with Plymouth City Council in a template format provided by DESNZ. The views expressed in this document are those of the Authors, and do not necessarily reflect those of the Department for Energy Security and Net Zero (DESNZ). This work was commissioned by DESNZ to inform their evidence base for future Heat Network Zoning Policy development.

We are grateful to all stakeholders who participated in the Pilot for their time and assistance.

Foreword

Plymouth City Council is committed to reducing carbon emissions and addressing fuel poverty, having first declared a Climate Emergency in 2019.

A key part of the decarbonisation challenge is heating in buildings, which constitute approximately 25 per cent of the overall carbon emissions in Plymouth. Heat networks already form a key part of the strategy to drive down these emissions within Plymouth's Net Zero Action Plan, while at the same time improving energy security and air quality.

Plymouth has been engaging in the Government's Heat Network Zoning Pilot and subsequently the Advanced Zoning Programme, highlighting the significant opportunities for heat networks incorporating sources of renewable and waste heat in Plymouth.

The proposals for Heat Network Zoning are complementary to our Plymouth and Southwest Devon Joint Local Plan policies, which have already secured new developments and are 'future-proofed' for connection to heat networks. Planning has also helped to ensure large new waste heat sources, such as the energy from waste plant, can supply heat to a network.

The Heat Network Zoning proposals will build on this track record, helping to create greater certainty and the conditions to accelerate the roll out of heat networks, to decarbonise heat in the city, drawing in the significant investment required.

Councillor Tom Briars-Delve
Cabinet Member for the Environment and Climate Change
Plymouth City Council

17/01/2024

Executive Summary

Pilot city overview

The coastal city of Plymouth is located within the South-West of England. The local authority, Plymouth City Council (PCC), is unitary and has city status in the ceremonial county of Devon.

The city authority area covers the urban centre of Plymouth as well as smaller suburban settlements of Plymstock and Plympton, with a population of 264,695 according to the 2021 Census. It is the largest settlement in Devon and covers an area of 79.85km^2.

Defining geographic characteristics include the harbour with historical maritime importance and undulating terrain to the north of the city which provides panoramic views of the surrounding area.

Plymouth City Council (PCC) has a net zero target year of 2030 and has several policies, as part of the Plymouth and South-West Devon Joint Local plan, supporting the development of district energy networks.

City-level opportunities

Thirteen heat network zones (HNZs) were identified in Plymouth. Two of these are considered strategic zones, key to enabling the development of heat networks within this city. Further information about the zones in Plymouth is provided below and within the full report.

These HNZs are shown in the Plymouth overview map contained in Figure 2. Further maps providing information about building typology, heat demands, existing heat networks, heat sources and potential energy centre locations are included in Appendix 1

Table 2a, below, summarises key statistics across all HNZs within the Plymouth study boundary. The total heat demand within heat network zones identified was 509 GWh, of which 432 GWh (84.9%) was in strategic heat network zones. Around 238 GWh (79.1%) of this was heat demand from buildings required to connect, of which, the initial zone opportunities identified in the pilot connected around 188GWh (79.3%).

An estimated CAPEX of over £240m would be required for the full rollout of heat networks within strategic and other heat network zones. This could deliver >300GWh of decarbonised heat and carbon savings in the region of 37 $MtCO_{2e}$, annually.

Table 1a: Summary metrics for delivery of all Heat Network Zones in Plymouth[1]

Capex	Heat	Heat Sources
> £382 m	>300 GWh p.a.	EfW, MSHP, SSHP, GSHP, ASHP

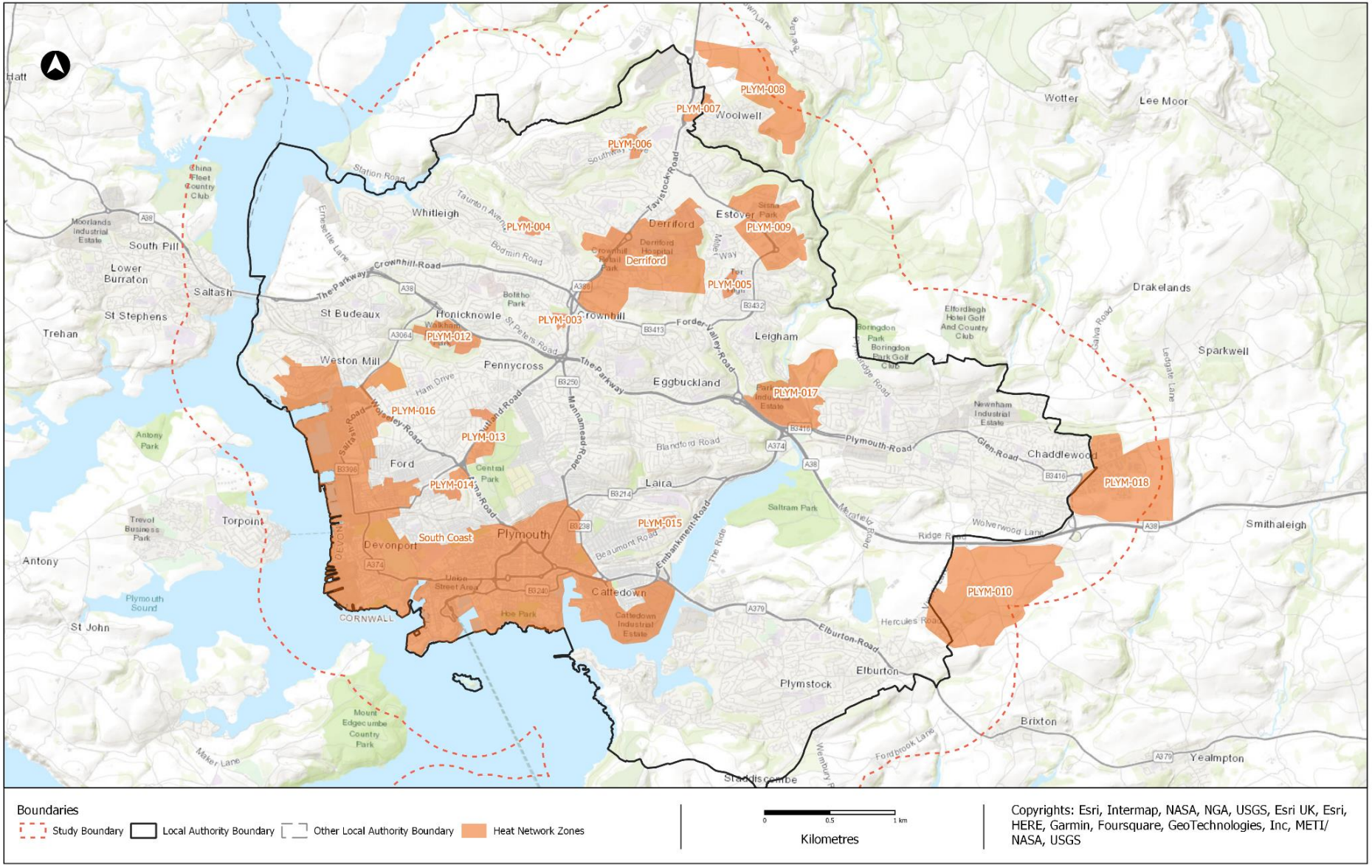
Table 2b: Summary statistics for delivery of all Initial Zone Opportunities in Plymouth

Capex	Heat	CO_2 savings	Network	Heat Sources
> £240m	>188GWh p.a.	37MtCO_{2e} p.a.	33km	EfW, MSHP, SSHP, GSHP, ASHP

Further information about individual zones in Plymouth is provided below and within the full report.

[1] Please see Appendix 3 – Glossary, “Specific definitions” of the main report for definitions related to Table 1.

Figure 2: Overview of Heat Network Zones in Plymouth



A map of Plymouth showing the Plymouth City Council boundary and wider study boundary, key topographical features, city districts and highlighting heat network zones identified.

Heat Network Zones – Initial Opportunities

The HNZs identified during the HNZ Pilot in Plymouth are summarised below. A detailed description of each, including related Initial Zone Opportunities (IZOs), is provided in the Plymouth main report.

Plymouth South Coast is the strategic zone on the Southwest coast, covering a large area stretching from the Barne Barton residential district, to Cattedown, an inner-city suburban area. The zone is the largest by area and heat demand and encompasses Devonport, Stonehouse, Millbay and the entire City Centre. In this zone, two IZOs were identified.

The first IZO is the City Centre. The City Centre aligns with the network proposed under the Advanced Zoning Programme (AZP), connecting various existing city centre networks to a sewage source heat pump. It connects 67GWh/p.a of heat demand, has a carbon intensity of 90gCO_{2e}/kWh, and an estimated CAPEX of £89m.

The second IZO is Devonport. The Devonport IZO is centred around the new Oceansgate development. The proposed network is interconnected with the existing campus heat networks at the MoD Devonport site and would be supplied by marine source heat pumps. It connects 63GWh/p.a of heat demand, has a carbon intensity of 70gCO_{2e}/kWh, and an estimated CAPEX of £73m. For more information, please see section 3.1 .

Plymouth Derriford is the strategic zone covering the Derriford area in the north of Plymouth. In this zone, one IZO was identified. The IZO is the North-West Quadrant (NWQ) and is centred around the NHS Derriford Hospital anchor load and the North-West Quadrant new development area. It connects 58GWh/p.a of heat demand, has a carbon intensity of 75gCO_{2e}/kWh, and an estimated CAPEX of £77m. For more information, please see section 3.2.

Other HNZs, smaller and standalone in nature, have been identified. These include, among others, the Estover Industrial Estate, Marsh Mill Retail Park and China Claywork development, Language Business Park, Sherford development and East Woolwell development. Please see Section 4 for further details on these HNZs, which are otherwise not the focus of this report.

Contents

1) Introduction

Heat networks are a vital part of the net-zero transition in the UK. They are one of the most cost-effective ways of providing secure, reliable, and affordable heat to consumers and help us end our reliance on fossil fuels while cutting customer bills. The Department for Energy Security and Net Zero (DESNZ) are enabling the development of heat network infrastructure through a range of targeted funding, policy and legislative support to de-risk projects and attract investment.

A key market enabling action is the Government's Heat Network Zoning policy in England, in which central and local government work together with industry and local stakeholders to identify and designate areas where heat networks are expected to be the lowest cost solution for decarbonising heat. DESNZ are aiming to introduce heat network zoning from 2025 and have instigated a Heat Network Zoning Pilot Programme to define a consistent and cost-effective approach to identifying potential heat network zones.

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 zones.

Please note, all information presented here, including the location of potential heat network zones, is subject to change until the zoning methodology has been fully developed.

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 Zones

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.

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 potential 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 pilot study, indicative heat network zones have been identified using a prototype version of the National Zoning Model. These indicative zones were then refined by technical consultants with input from key local stakeholders.

This document focuses primarily on those which are most likely to be seen as a priority for heat network development, referred to here as "**Strategic HNZs**". All other heat network zones identified by the model, and refined by consultants, are described briefly in this report and referred to as **"Other HNZs"**.

Initial Zoning 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 exist, referred to in this report as an "Initial Zone Opportunity" (or IZO). The approach taken to define Initial Zone Opportunities considered economic viability, investment scale and returns, decarbonisation impact and deliverability. They were developed 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. However, a more flexible approach was used when considering the inclusion of new development sites, where different economic success criteria are likely to be considered by project developers.

In order to standardise the way opportunities were assessed, the IZOs presented in this report may differ from, or overlap with, existing heat network infrastructure within an area. Campus style heat networks (e.g., in hospitals or university campuses) were considered as potential heat loads with a single point connection.

Zone Delivery Areas

A Heat Network Delivery Area is a proposed term for a grouping of Heat Network Zones (or a sub-partitioning of a large HNZ) within which an appointed Zone Developer will have exclusivity to develop and operate heat networks.

Neither the indicative Heat Network Zones, nor the Initial Zone Opportunities in this report are intended to represent the extent of Zone Delivery Areas as described in the HNZ consultation.

Further detail on the pilot methodology and Initial Zone Opportunity criteria is provided in Appendix 5 - Methodology.

[2] The building categories being considered as required to connect to a heat network within a Heat Network zones are discussed on page 27 of the consultation. In summary, these include new developments, existing communally heated buildings, some multi-unit residential buildings, existing non-domestic buildings over a threshold annual demand value. This latter category includes many public sector and academic buildings.

Advanced Zoning Programme

Alongside the pilot programme presented here, the DESNZ Advanced Zoning Programme is being delivered in fifteen cities across England, including Plymouth.

It was developed with the aim of accelerating heat network zoning; developing best practice guidance; providing project development support services; and promoting market transformation ready for the national rollout of heat network zoning policy.

The programme builds upon the zoning pilot learnings and outputs completed in these cities by developing initial heat network designs and delivery plans that broadly align with one or more of the strategic zones and associated Initial Zone Opportunities identified in the Heat Network Zoning pilot programme.

2) Plymouth Heat Networks Context

2.1) Plymouth city overview

The coastal city of Plymouth is located within the South-West of 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 79.85km^2. Social housing providers such as Plymouth Community Homes (PCH), Clarion or LiveWest own numerous properties within Plymouth. In comparison, the council owns relatively little social housing. PCH is Plymouths largest social housing provider with over 16,000 homes. Social housing providers in Plymouth are looking to decarbonise assets in line with government targets and have been seeking funding from the Social Housing Decarbonisation Fund.

The local authority has been a driving force behind the decarbonisation of energy consumption within the city. The Plymouth and South-West Devon joint local plan requires new development to make provision for future connection to heat networks.

In the South Coast strategic zone, heat sources include the MVV owned and operated Energy from Waste (EfW) plant, and the South West Water (SWW) sewage treatment works at Cattedown. Initial investigation suggests an opportunity to recover 7.5 MW of heat at Cattedown and 2.6MW heat at MVV. Unused jetties at PCC owned land in Devonport present an opportunity to develop marine source heat pumps along the city coastline.

Long terms plans to decarbonise heat along the coast include development of heat networks and a central strategic heat main. Proposed networks will utilise recovered waste heat from both Cattedown and the MVV plant for distribution to clusters along the South Coast (including Devonport and the city centre).

As part of this vision, PCC has been promoting energy network innovation with the construction of a 5th generation network in the central Millbay area. The total network length of this proposed scheme is 1.4km with 1.5MW of heat pumps providing heating and cooling. 5 developments are planned for connection in the core scheme (Plymouth Pavilions, Moxy Hotel, Ballard House, Abbeyfield, and PCH Bath Street), with a further 6 planned for connection in the extended scheme. Large diameter DN300 pipework has been installed along Bath Street, with plans for use in the core scheme. It is proposed that this network will be connected into the future city centre scheme.

Additionally, significant construction projects in the northern area of Derriford are underway. This includes expansion of medical, education and innovation facilities at the NHS owned NWQ site. There is also the potential to either expand or deliver new ambient loop networks to new buildings.

2.2) Plymouth Net zero targets and commitments

PCC first declared a Climate Emergency in 2019 and are targeting carbon neutrality by 2030 and have subsequently implemented several policies to accelerate development of heat networks, aligning with government net zero targets and heat network zoning legislation.

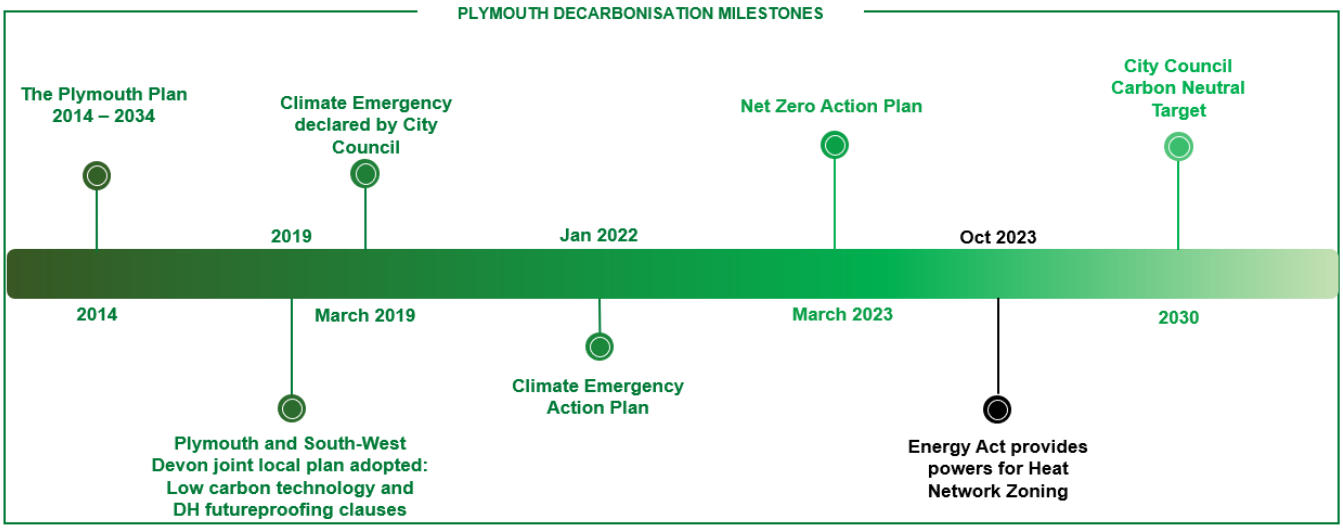
The 2014 – 2034 Plymouth and Southwest Devon Plan includes an outline of decarbonisation targets for Plymouth City Council. To aid in decarbonisation of heat, new developments should be designed with capability to connect to a future energy network. The proposals for Heat Network Zoning are aligned with the Plymouth and Southwest Devon Joint Local Plan policies. Planning policy PLY38 requires new development to make provision for future connection to heat network. This policy has been particularly effective in engaging developers.

Plymouth has a Low Temperature Building Zone in the city centre where any new buildings will need to be designed around a low temperature heating system wherever possible and in line with their 5th generation network connections pack.

The 2022 Plymouth Climate Emergency Action Plan furthered decarbonisation efforts with actions to assess feasibility of heat networks in identified zones across Plymouth. PCC has undertaken several HNDU feasibility studies to assess heat networks across the city, including at Barne Barton, Devonport, the South City Centre, Millbay and Derriford.

Figure 3, below, summarises key dates in the Council's plans for decarbonisation and demonstrates their progress towards decarbonisation targets announced in the Low Carbon Action Plan.

Figure 3: Plymouth Decarbonisation Milestones



2.3) Delivering Heat Networks in Plymouth

There are several operational heat networks in Plymouth, ranging from older 1st generation steam networks to more modern 5th generation, ambient loop networks.

Existing and near term future networks within Plymouth are located within the city centre, Ministry of Defence (MoD) and Marjons University areas.

For further detail, please refer to section 3.1.2 and 3.2.2, however a summary is provided below:

City Centre: Within Plymouth city centre, there are two operational existing networks:

1) The University of Plymouth and;

2) Guildhall (also known as the Civic Centre).

There is a third network planned; the 5th generation Millbay network.

Each of these networks are under consideration for future expansion and possible interconnection through the Advanced Zoning Programme (AZP).

MoD site: His Majesty Naval Base (HMNB) Devonport site has several existing heat networks, including:

1) A steam network connection from the EfW plant at Barne Barton
2) An Low Temperature Hot Water (LTHW) network which interfaces with the steam network noted above, and;
3) A further LTHW network known as “South Yard” which is currently under re-development due to infrastructure reaching end of life.

Marjons University: The University of St. Mark and St. John, also known as “Marjons” is located in the Derriford area of Plymouth. The university operates a Ground Source Heat Pump (GSHP) ambient loop network to serve building on campus.

The local authority has fostered relationships with major stakeholders involved in energy networks across Plymouth, notably:

- MVV Energy from Waste plant.
- Babcock, HMNB networks operators.
- Social housing providers, such as LiveWest, Clarion Housing or PCH. PCC is promoting energy reduction measures and integration of DHN connections as part of ongoing retrofit works.
- NHS Trust and NHS Future Hospital Programme. NHS Derriford hospital is a major anchor load and is in proximity to new development, also owned by the NHS Trust.

- Education & research: Marjons and University of Plymouth campuses existing networks and Plymouth Science Park which can be considered an anchor load and innovation hub in the Derriford area.
- Guildhall and Civic Centre existing network stakeholders.
- Millbay development stakeholders.

PCC has the intention to become procurement a delivery partner for the network being developed through AZP in Plymouth City Centre and potentially extend it to the Derriford strategic heat network zone.

Please refer to Appendix 2 for further information about the evidence compiled during the HNZ Pilot and held by DESNZ for Plymouth. This includes a fully populated stakeholder directory and records of interactions with those stakeholders as well key studies and reports shared with DESNZ.

2.4) Plymouth Heat Network Zones

Heat Network Zones identified: Within the city of Plymouth, thirteen potential HNZs have been identified. As shown in Table 1 within the Executive Summary, it is estimated that heat networks could be delivered within these HNZs at an estimated total capital cost of over £382m, delivering CO_2 savings of more than 37 $MtCO_{2e}$ annually.

Figure 4, below, 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.

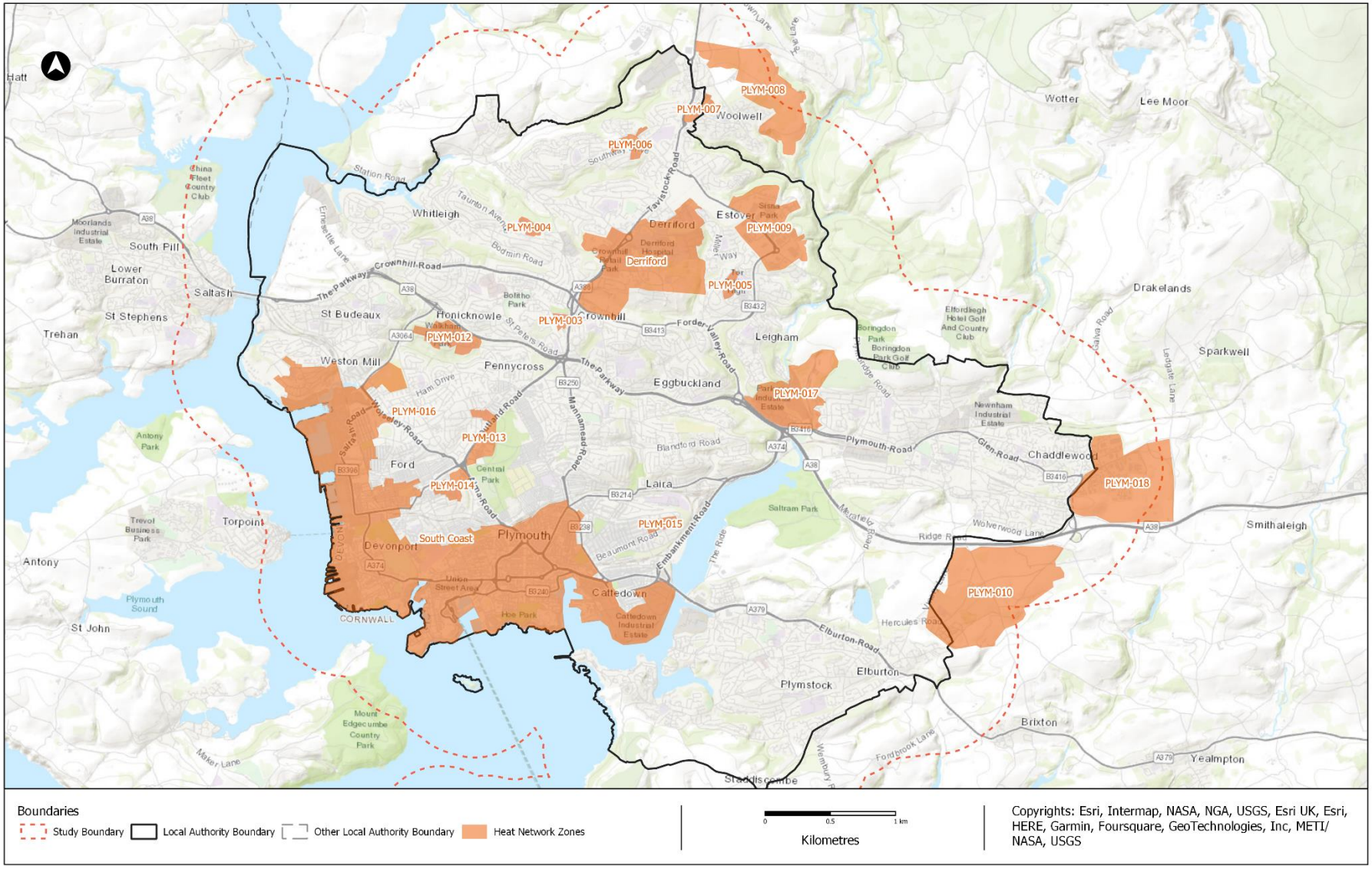
The HNZs identified match previously identified heat network opportunity areas which the council intends to develop. Therefore, the Heat Network Zoning policy will enable the Council to continue building on previous heat network feasibility, design studies to better exploit low carbon heat sources available across the study area.

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: Key Constraints Map – Shows key topographical constraints identified
- E: Existing / Planned Heat Networks Map – Shows existing HNs and planned extensions to them as well as any planned HNs in advanced stages of development

F: Off Gas Grid – 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

In this section we examine each Strategic HNZs identified in turn, outlining the Initial Zone Opportunities (IZOs) that should be taken forward from 2025, once HNZ legislation is fully in place to provide supporting powers and regulation.

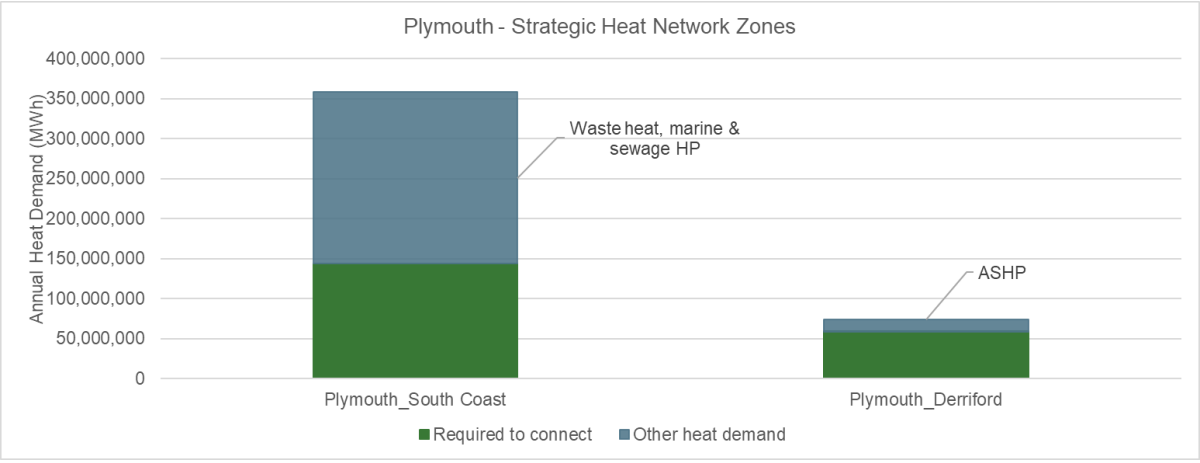
As shown on the city-level map in Figure 4, the following thirteen HNZs were identified in Plymouth. Two of these are considered Strategic HNZs, key to enabling the development of HNs within this city. These cover both the largest and/or most deliverable HNZs that are of strategic priority to the area over the coming years and are the focus of most of this report.

Plymouth South Coast is a strategic zone on the west coast areas, stretching from Barne Barton residential district, to Cattedown, encompassing the entire MoD estate and City Centre. For more information, please see section 3.1 from page 19.It is the largest of all identified zones by heat demand and area, with opportunities for waste heat utilisation at the MVV EfW plant and SWW central sewage treatment works.

Plymouth Derriford is the strategic zone covering the Derriford area in the north of Plymouth, centred around the anchor load of the NHS Derriford hospital. For more information, please see section 3.2 from page 35.There is opportunity for medical incinerator waste heat at the NHS Derriford site, and GSHP provision across land in Derriford with precedence for GSHP systems at Plymouth Marjon's campus.

Figure , below, shows the total annual heat demand, the proportion of annual heat demand attributable to Buildings Required to Connect and all Other Buildings for each Strategic HNZ in Plymouth. The low carbon heat source expected to supply that HNZ is indicated in the label, where known.

Figure 5: Summary of heat demands in all Strategic HNZs identified



Other HNZs have been identified and are discussed in section 4) Other Heat Network Zones.

3.1) Plymouth South Coast

3.1.1) Plymouth South Coast – Summary

Plymouth South Coast is the strategic zone on the west coast, covering an area from Barne Barton residential district, to Cattedown, encompassing Devonport, Stonehouse, Millbay and the entire City Centre, as it can be seen in Figure 3a and maps within the Appendix.

There are 221 buildings required to connect in the South Coast strategic zones. The main typologies required to connect are new developments, education campuses, city centre retail units and Ministry of Defence estate. Refer to Table 2a for an overview of the main metrics of this strategic zone.

The key anchor loads are:

- **MoD HMNB Devonport**. This is a large dockyard estate in the north of the strategic zone, located south of the Barne Barton neighbourhood and the MVV EfW plant. The EfW plant provides steam and electricity for the MoD sites, operated by Babcock. It has been confirmed that the MoD site no longer requires steam for their processes and there are consequently plans to de-steam the network. Currently, the steam network supplies a LTHW 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 city council controlled and currently being redeveloped as part of the Oceangate development.
- **Oceangate** consists of new marine research and industrial development within the Devonport South Yard area. The project is a PCC development. Phase 1 buildings have been constructed and spatial provision within these buildings has been safeguarded for 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 of the Local Authority (LA) is to connect the Ministry of Defence (MoD) energy network to Oceangate and city centre areas, following the de-steaming & network modernisation, utilising the waste heat from the MVV EfW plant.
- **Stonehouse barracks** is a mixed used, new development in the early stages of development, within the Millbay Docks area.
- The **city centre** consists of several anchor loads including Drake Circus existing shopping centre, Cornwall Street mixed use development, University of Plymouth campus, 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 EfW plant (a key heat source) and the opportunity for marine source technology, Plymouth South Coast extends to the Cattedown water treatment plant.
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.

There are no major constraints within the strategic Plymouth South Coast zone.

Table 3a: Plymouth South Coast - Summary statistics for Initial Zone Opportunities[5]

Capex	Heat	Network	CO_2e savings	LHD	Heat Sources
£210m	131GWh	30km	34MtCO_{2e}	7MWh/m	EfW & MSHP & SSHP

There are two IZOs within the strategic zone of Plymouth South Coast, see Figure 5:

- **Devonport**: this IZO primarily covers the MoD site and Oceangate. A phased approach to development of networks is needed as the Oceangate development is more "d than the MoD site, which is undergoing de-steaming, as well as the development of marine source heat pump scheme. The integration of the EfW within the modernisation of the MoD site network is not considered due to unknowns around capacities and status of energy centres. The marine source heat pump scheme only has been considered.
- **City centre**: this IZO corresponds to the work being delivered through the Advanced Zoning Programme currently investigating the potential capacity of a sewage source heat pump for the scheme. The vision is to interconnect the three existing heat networks in the city centre.

3.1.2) Plymouth South Coast - Existing Heat Networks

There are three operational HNs, one planned HN in late-stage development and one early stage proposed HN development in Plymouth South Coast, all described below. Please refer to Appendix 1, Map D – Existing and Planned Heat Networks, to understand where the operational HNs and planned expansions are, as well as planned, late development stage heat networks. Early stage proposed HNs are described below but not shown on associated maps as network routing is yet to be established.

Operational Heat Networks and Planned Expansions

The following operational heat networks and planned expansions have been identified within this HNZ and are visually represented in Figure 6a.

[5] Please see Appendix 3 – Glossary, “Specific definitions” of the main report for definitions related to Table 2.

The University of Plymouth network

The University of Plymouth has a CHP led network and is considering transition to low carbon plant as part of decarbonisation plans with either GSHP or ASHP in 2026 and expanding to further 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 but the annual demand on the network is circa 9,500MWh/p.a.

Civic Centre network

This network, historically called Guildhall, is an existing gas network with plans to decarbonise after securing £1.2million of GHNF. There are plans to transition the network to ASHP in Q3 of 2023 and expand to additional buildings in 2025. The final energy centre capacity will be 2.1MW to serve 1,113MWh/p.a of annual heat demand. Connected buildings consist of the Civic Centre office and Guildhall (both key Plymouth City Council assets) as well as the Theatre Royal.

MoD North and South Yard networks

The MoD North and South Yard networks are each steam driven networks. The South Yard network is being fully replaced due to pipework having reached end-of-life. Additionally, South Yard is now under re-development, led by PCC as part of the Oceangate development. It is understood that the steam network is nearing end of life, and modernisation needs to be investigated. The steam connection and MoD contractual agreement is for 23.4MW from the EfW.

Planned Heat Networks – Late stage

The following planned heat networks have been identified within this zone. These are in late Detailed Project Developed, Commercialisation or an early Construction phases.

Millbay network

The Millbay network is planned to supply Pavilions, a major anchor load, as well as the Moxy hotel, Plymouth Community Homes (PCH) social housing, Ballard House and Mayflower Court. The intention is to develop a 5th generation or “ambient loop” network to serve projected annual heating and cooling demands of 3,540MWh/p.a and 1,320MWh/p.a respectively with peaks of around 2.2MW. The balancing plant for the network is still under investigation, however ASHP’s are considered the most likely technology to be implemented, following investigations of GSHP technologies and subsequent borehole trials for utilising aquifer water, which proved unsuccessful.

Table 4a: Millbay Key Metrics

Annual Demand	Heat Sources	Estimated Capex	Construction Start Date

3.5GWh/p.a	Likely ASHP	Not known	2023

Proposed Heat Networks – Early stage

The following heat network development schemes are in early HN development stages of master-planning and feasibility and are not shown on Map D maps as firm plans on network routing are not yet established.

Devonport network

The Devonport network is the PCC network replacing the South Yard existing steam network and connection to the Oceangate new development. An estimated 18,000MWh/p.a of heat demand has been calculated, with an energy centre capacity of circa 4MW, driven by marine source heat pumps.

3.1.3) Plymouth South Coast - Initial Zone Opportunities

In Plymouth South Coast, two Initial Zone Opportunities (IZOs) were identified. The IZOs identified are Devonport and City Centre and key features of each are described below and shown in the HNZ-level map in Figure 6a below.

Devonport has been identified as an IZO. There is large scale, council owned new development directly adjacent to the harbour, and therefore good proximity to the proposed low-carbon marine source heat pumps. Pre-feasibility has been conducted for the South Yard / Oceangate 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 at the North. The key IZO characteristics are:

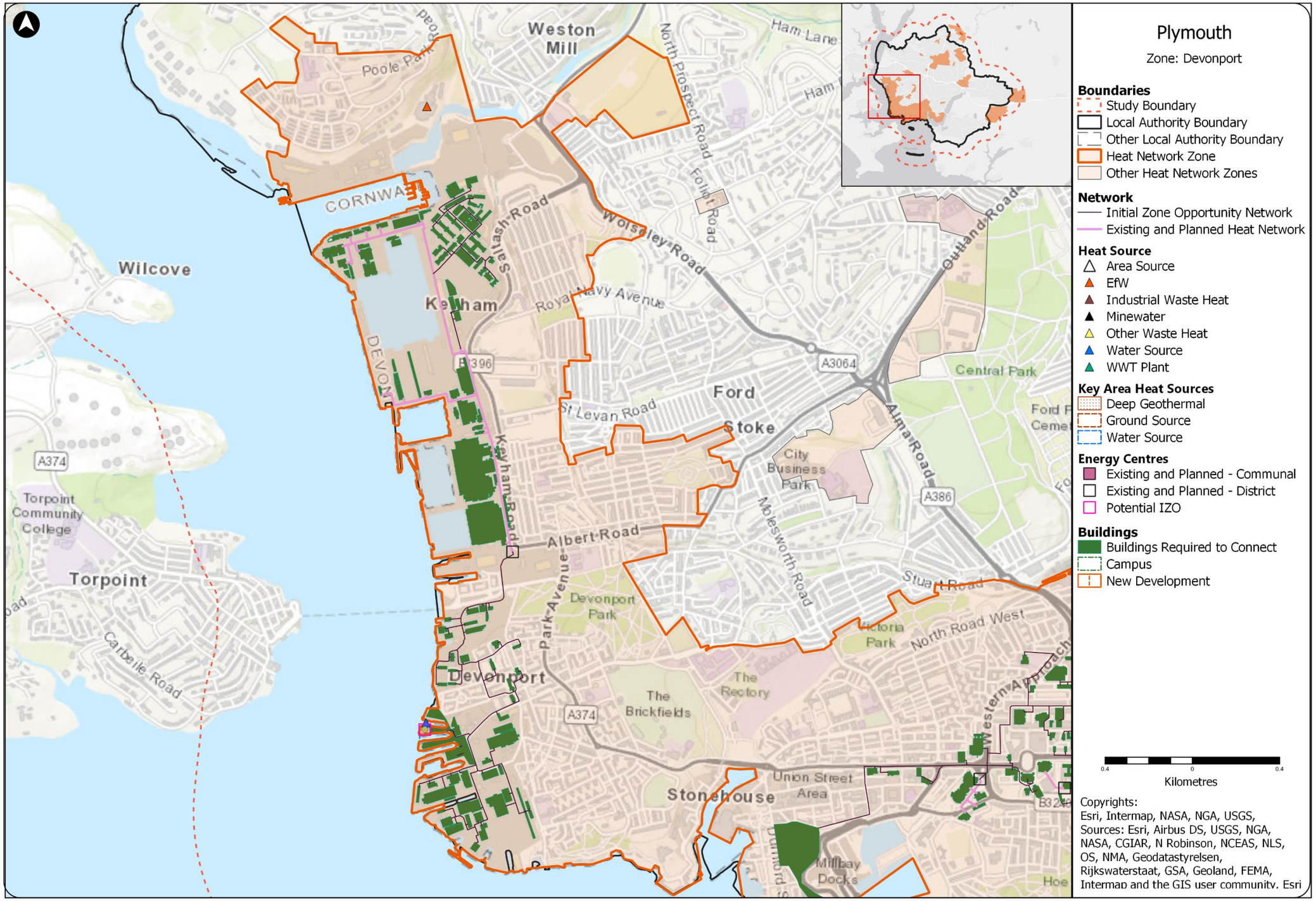
- 63.4GWh/p.a of connected heat demand and an estimated 17.5MW of capacity required at the energy centre
- Linear heat density of 9.9 MWh/m and carbon intensity of 74gCO_{2e}/kWh
- £63m of CAPEX

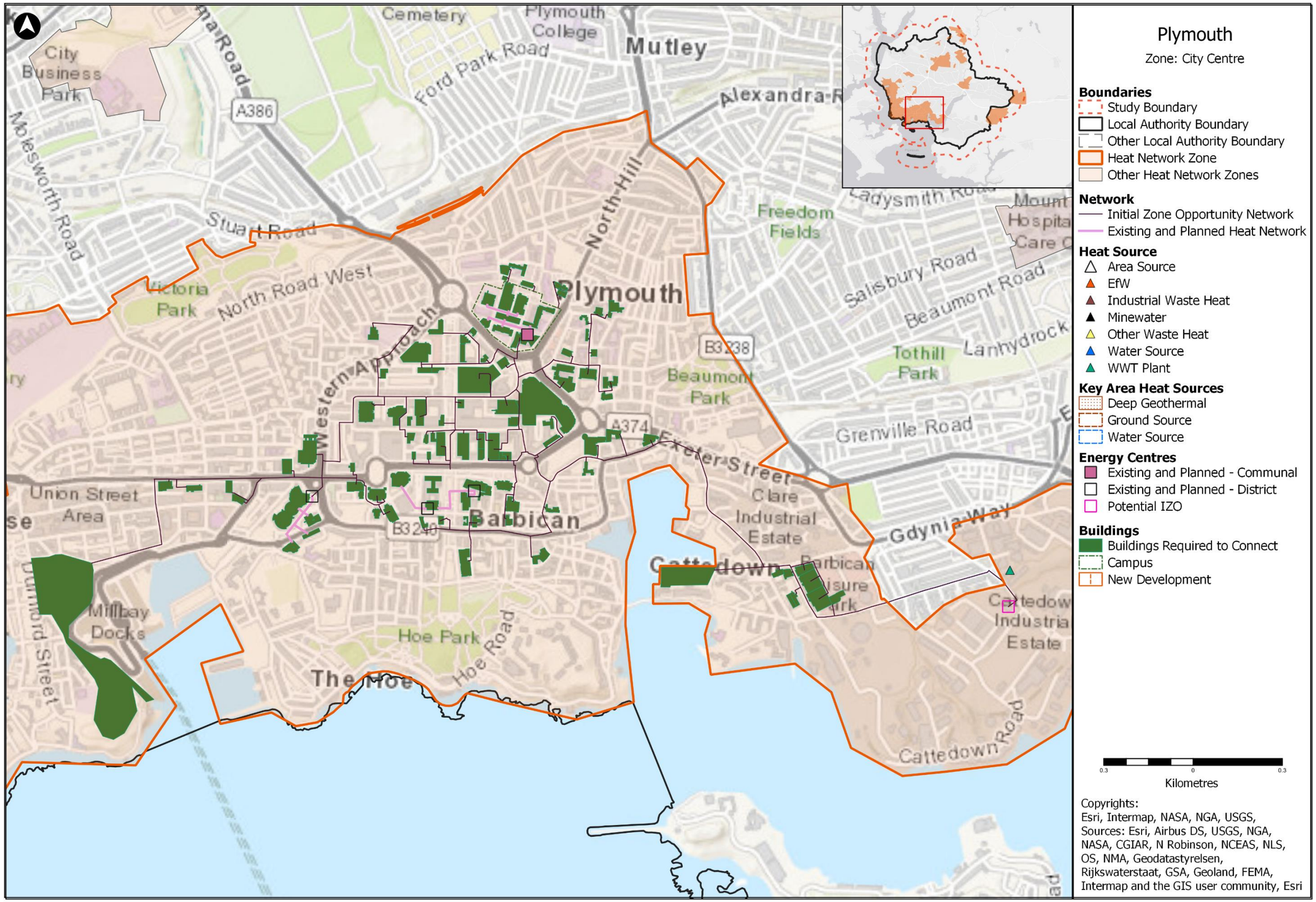
City Centre has been identified as an IZO following the AZP routing. It connects Millbay, Civic Centre and University of Plymouth existing and planned networks to a sewage source energy centre in Cattedown. The key IZO characteristics are:

- 67GWh/p.a of connected heat demand
- 1.3MW of sewer source heat pump and 16.6MW of existing or expanding energy centre capacity at Millbay, University of Plymouth and Civic Centre.

- Linear heat density of 5 MWh/m and carbon intensity of 89gCO_{2e}/kWh
- £89m of CAPEX

Figure 6a: Initial Zoning Opportunities in Plymouth South Coast

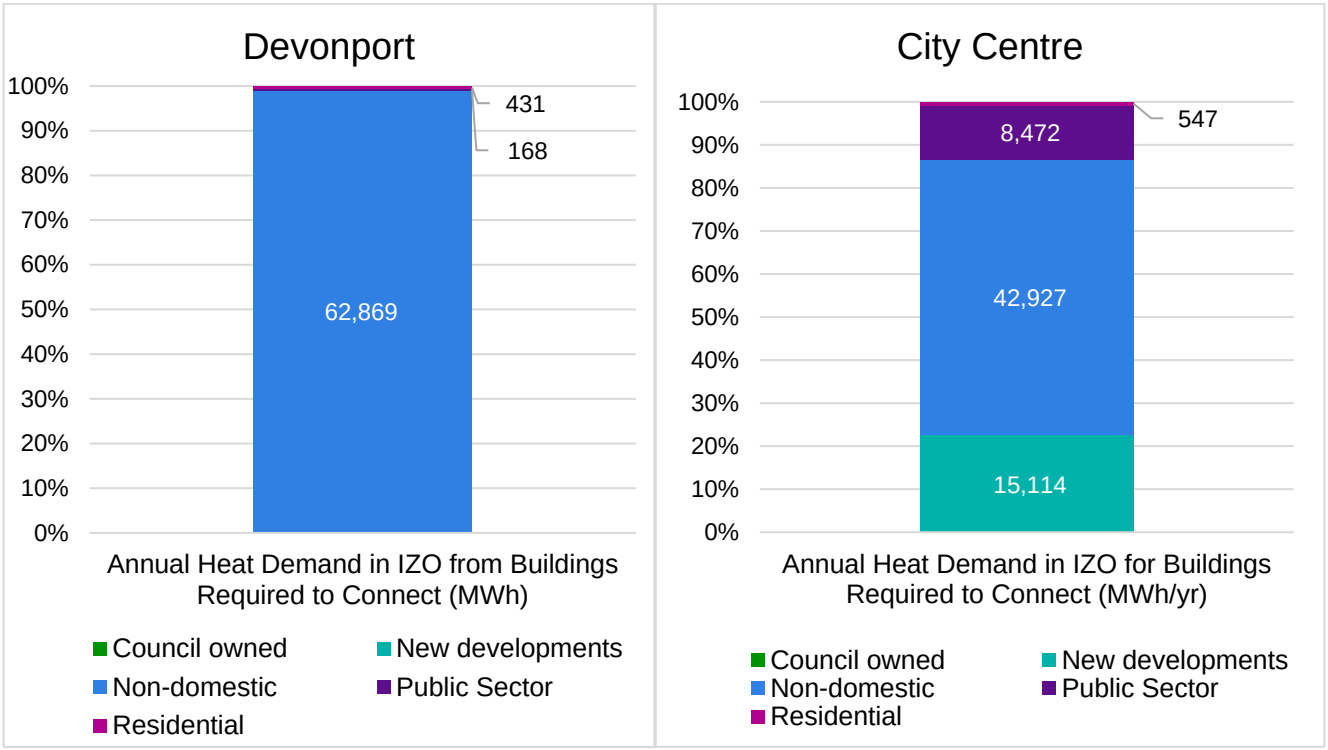



Plymouth
Zone: City Centre
Boundaries
Study Boundary
Local Authority Boundary
Other Local Authority Boundary
Heat Network Zone
Other Heat Network Zones
Network
Initial Zone Opportunity Network
Existing and Planned Heat Network
Heat Source
Area Source
EfW
Industrial Waste Heat
Minewater
Other Waste Heat
Water Source
WWT Plant
Key Area Heat Sources
Deep Geothermal
Ground Source
Water Source
Energy Centres
Existing and Planned - Communal
Existing and Planned - District
Potential IZO
Buildings
Buildings Required to Connect
Campus
New Development
0.3
0
0.3
Kilometres
Copyrights:
Esri, Intermap, NASA, NGA, USGS,
Sources: Esri, Airbus DS, USGS, NGA,
NASA, CGIAR, N Robinson, NCEAS, NLS,
OS, NMA, Geodatastyrelsen,
Rijkswaterstaat, GSA, Geoland, FEMA,
Intermap and the GIS user community, Esri
Plymouth
Mutley
Cemetery
Plymouth College
Ford Park Road
City Business Park
A386
Mobilesworth Road
Stuart Road
North Road West
Victoria Park
North Hill
Freedom Fields
Salisbury Road
Beaumont Road
Tothill Park
Lanhydrock
B3238
Beaumont Park
A374
Exeter Street
Grenville Road
Western Approach
Union Street Area
B3240
Barbican
Clare Industrial Estate
Gdynia Way
Cattedown
Barbican Leisure Park
Cattedown Industrial Estate
Cattedown Road
Millbay Docks
Hoe Park
Hoe Road
The Hoe
Richmond Street

3.1.4) Plymouth South Coast – IZO Heat demands

Figure 7a below presents the typologies in each of the two IZOs within the Plymouth South Coast strategic zone per percentage of annual demand of buildings required to connect. For Plymouth South Coast, it includes educational, MoD, social housing and new developments as key anchor loads and typologies. The scale of demand from all buildings required to connect in the Plymouth South Coast strategic zone is significant and estimated at circa 130GWh/p.a.

Figure 7a: Plymouth South Coast - Categorisation of heat demand for Buildings Required to Connect in IZOs



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.

Further details of the key heat demands for Buildings Required to Connect in the IZO are provided in Table 5a, below.

Table 5a: Plymouth South Coast - Key heat demands for Buildings Required to Connect in the IZO

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
MoD Building – no known name	Industrial	1	15,499	Benchmark
Stonehouse Barracks	New Development	400	8,723	Benchmark
Industrial, MoD owned	Industrial	1	8,386	Benchmark
Drake Circus	Existing Retail	1	7,306	Benchmark
Cornwall Street West	Mixed use, New development	79	5,115	Benchmark
Greenergy Plymouth Terminal	Fuel terminal / holders	1	1,903	Low or Benchmark
Military Marine	Industrial	1	1,877	Low or Benchmark
MoD Building – no known name	Industrial	1	1,697	Low or Benchmark
MoD Building – no known name	Industrial	1	1,608	Low or Benchmark
City College Plymouth	Education	1	1,532	Low or Benchmark

Please refer to Appendix 3 for definitions related to Building categories in this table.

This zone has a high proportion of industrial (or other) category buildings which would warrant further investigation. Half of the top 10 buildings noted within the cluster are located within the MoD estate. Further developments include new developments at Cornwall Street West and the Stone House Barracks, part of the city centre IZO, existing retail at Drake Circus and City College Plymouth.

3.1.5) Plymouth South Coast – Heat sources

Tables 5a and 6a in this section summarise the key heat sources and potential energy centre locations identified for this HNZ. These are also shown in the zone-level map in Figure 6 in section 3.1.3 above and on the city-level Map C in Appendix 1.

There are three notable low carbon potential heat sources within the Plymouth South Coast strategy zone, which are connected to the two proposed IZOs. These are:

- Energy from Waste plant (Devonport IZO) in Barne Barton. The plant has a waste heat capacity of 26MW, 23.4MW of which are contracted to the MoD site while historically the MoD winter peak maximum is 19MW.
- Natural water surrounding the coast (in Devonport IZO, specifically the River Tamar). Marine source heat pump sized to 4MW for the Oceangate development.
- Southwest Water Central treatment plant in Cattedown (City Centre IZO).

There are additional, other potential low-carbon sources in the area such as heat recovery from private industrial buildings i.e., the Princess Yacht production factory. However, there is not sufficient information available for them to be considered as a heat source for the IZOs.

Aquifer water has been investigated for the Millbay network, however the trial borehole and resulting flowrates from the test, deemed the source unviable. There are existing heat networks which could have potential for additional capacity within energy centres however this has not yet been confirmed by stakeholders. The existing networks are cited and expanded upon in Section 3.1.2. There is sufficient land available for agnostic technology sites around the Plymouth South Coast, however, within the city centre, which is urban and densely developed, there are fewer options with respect to land availability.

There are several parks in this strategic zone. While their ownership is unknown at this stage, they could be suitable sites for agnostic technology energy centres. This includes Mount Wise or Millbay Park.

Table 6a: Plymouth South Coast - Key heat source opportunities for the IZOs

Heat source type	Capacity (kWp)	Temperature (Degrees Centigrade)	Potential Energy Centre [Ref number]
Water source HP River Tamar Southwest Water Central treatment plant	 4,000 kWp 12,000 kWp	 70 ºC 70 °C	 E2 E1
Waste Heat MVV EfW	 26,000 kWp Unknown kWp	 180 ºC	 E4

Heat source type	Capacity (kWp)	Temperature (Degrees Centigrade)	Potential Energy Centre [Ref number]
Princess Yacht Industrial site			
Existing heat networks MoD North Yard (EfW Steam) University of Plymouth Civic Centre	 9,800 kWp 12,300 kWp 2,100 kWp	 180 ºC 75 °C 75 °C	 Unknown E5 E6

Table 7a: Potential IZO Energy Centre Locations in Plymouth South Coast

Ref #	Site type	EC Ref number	Name	Size (m2)	Ownership	Heat Source
1	Constructed Land	E1	Plymouth City Council Prince Rock Depot	Unknown at this stage	Council	Sewage
2	Constructed Land	E2	Oceangate Jetty3 EC	400	Council	Marine/River
3	Land	E4	MVV EfW Land	Unknown at this stage	MVV EfW	EfW
4	Building	E5	University of Plymouth EC	Unknown	University of Plymouth	ASHP/ WSHP
5	Building	E6	Guildhall EC	Unknown	Guildhall	ASHP

Table 7a lists potential energy centre locations for heat source in the Plymouth South Coast. These are shown on the HNZ-level map in Figure 6, matching by reference number.

3.1.6) Plymouth South Coast - Heat Distribution

The Devonport IZO is supplied by both EC2 (a marine source heat pump at Oceansgate Jetty 3) and waste heat from the MVV EfW.

Key connections include MOD sites in the North of Devonport (currently on an existing MOD run steam network), MOD sites by Pottery Road, and areas around Vivid Approach. This includes the planned commercial Oceansgate connections on the Oceansgate freeport site, Princess Yachts, and Babcock run MOD sites.

PCC has a long-term vision for development of a heat main transmission line from the MVV EfW plant, through Devonport into Plymouth City Centre, eventually connecting the SWW Cattedown Sewage Treatment site and MVV EfW.

The City Centre IZO connects existing network infrastructure at the University of Plymouth and Plymouth Civic Centre with main local heat demands. Planned connections include University of Plymouth sites, The Theatre Royal, Drake Circus Shopping Centre, Cornwall Street West and the Stonehouse Barracks development. Connection to the proposed Millbay ambient network is also included.

Heat is to be supplied from waste heat offtake at the SWW Cattedown site.

Please see Appendix 5 for related methodology statements and assumptions.

Table 8a: Plymouth South Coast - Indicative Heat Network statistics for Initial Zone Opportunities

IZO Heat Network description	Network length (km)	Network cost (£m)
Indicative IZO networks which connect all buildings required to connect to a heat distribution network and all IZO heat sources to the relevant energy centre(s))	29.5	211

3.1.7) Plymouth South Coast – Key constraints and mitigations

Plymouth South Coast:

C1 - There is a national rail route that runs through the top edge of the South Coast strategic zone. The railway does not interfere with proposed routing or key mandatable loads.

The Stonehouse Bridge separates the two IZOs within the South Coast strategic zone (City Centre and Devonport). 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 early stages of design will mitigate any issues which may arise in the connection of IZOs.

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, an alternative routing could be considered; Chapel Street for example runs parallel to the MoD site. Secondly, commercial negotiations with the existing network operator to unlock the contractual but unused capacity of the EfW would be necessary.

3.2) Plymouth Derriford

3.2.1) Plymouth Derriford – Summary

Plymouth Derriford strategic heat network zone encompasses the Derriford area in the North of Plymouth. The cluster possesses good spatial availability for potential energy centre locations and other low carbon related infrastructure (i.e., boreholes), as well as high heating and cooling annual demand density and a mix of building typologies.

Figure 6b provides an overview of the Plymouth Derriford strategic zone with summary statistics includes with Table 2b.

There are 60 buildings required to connect in Plymouth Derriford. The demand of the area is dominated by the NHS Derriford Hospital, which includes a medical waste incinerator as a potential heat source. Other key anchor loads include:

- North-West Quadrant new development (PCC & NHS owned)
- Marjons University which has an operating 5th generation ambient loop network
- Glacis Park new development
- Nuffield hospital and leisure centre
- The Ship, which is the Derriford District Centre new development and;
- The Range retail centre.

Table 2b9: Plymouth Derriford - Summary statistics for Initial Zone Opportunities[7]

Capex	Heat	Network	CO_2e savings	LHD	Heat Sources
£82m	63GWh	13km	10 $MtCO_{2e}$	6MWh/m	ASHP, Medical Incinerator, Ambient Loop

There is one IZO identified in this strategic zone. The IZO connects 93% of the required to connect buildings in the area, including all key anchor loads. Considering the area has a balance of heating and cooling, the ongoing current HNDU study has proposed an ambient loop network to connect buildings.

[7] Please see Appendix 3 – Glossary, “Specific definitions” of the main report for definitions related to Table 2.

3.2.2) Plymouth Derriford - Existing Heat Networks

There is one operational HN, and two early stage proposed HN developments in Plymouth Derriford, all described below. Please refer to Appendix 1, Map D – Existing and Planned Heat Networks, to see where all the operational HNs and planned expansions are. Early stage proposed HNs are described below, but not shown on this map as firm plans on network routing are not yet established.

Operational Heat Networks and Planned Expansions

The following operational heat networks and planned expansions to them have been identified within this HNZ.

Marjons' ambient loop network

In 2022 Marjons 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 1,600 MWh/p.a. of heat to staff and student accommodation within the Student Village and several campus buildings. These include: The Edge, The View and the KCB. The borehole arrays are located in the Grass Port Peach and the St Marks Road. A further key anchor load not yet connected to the network includes the Marjons' Sport and Health Centre.

There is no planned heat network in the area in late development stage.

Proposed Heat Networks – Early stage

The following heat network development schemes are in early HN development stages of master-planning and feasibility and are not shown on Map D as firm plans on network routing are not yet established.

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. These include;

- Nuffield;
- Plymouth Science Park;
- NHS Derriford & associated schools;
- NWQ; and
- Marjons existing ambient loop network.

The proposed network would supply 35GWh/p.a. of heat and 18GWh/p.a. of 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 detailed project development.

North-West Quadrant (NWQ) development

As part of the NWQ development, which consists of medical and council owned facilities, a communal geo-coupled ambient loop system is currently being investigated.

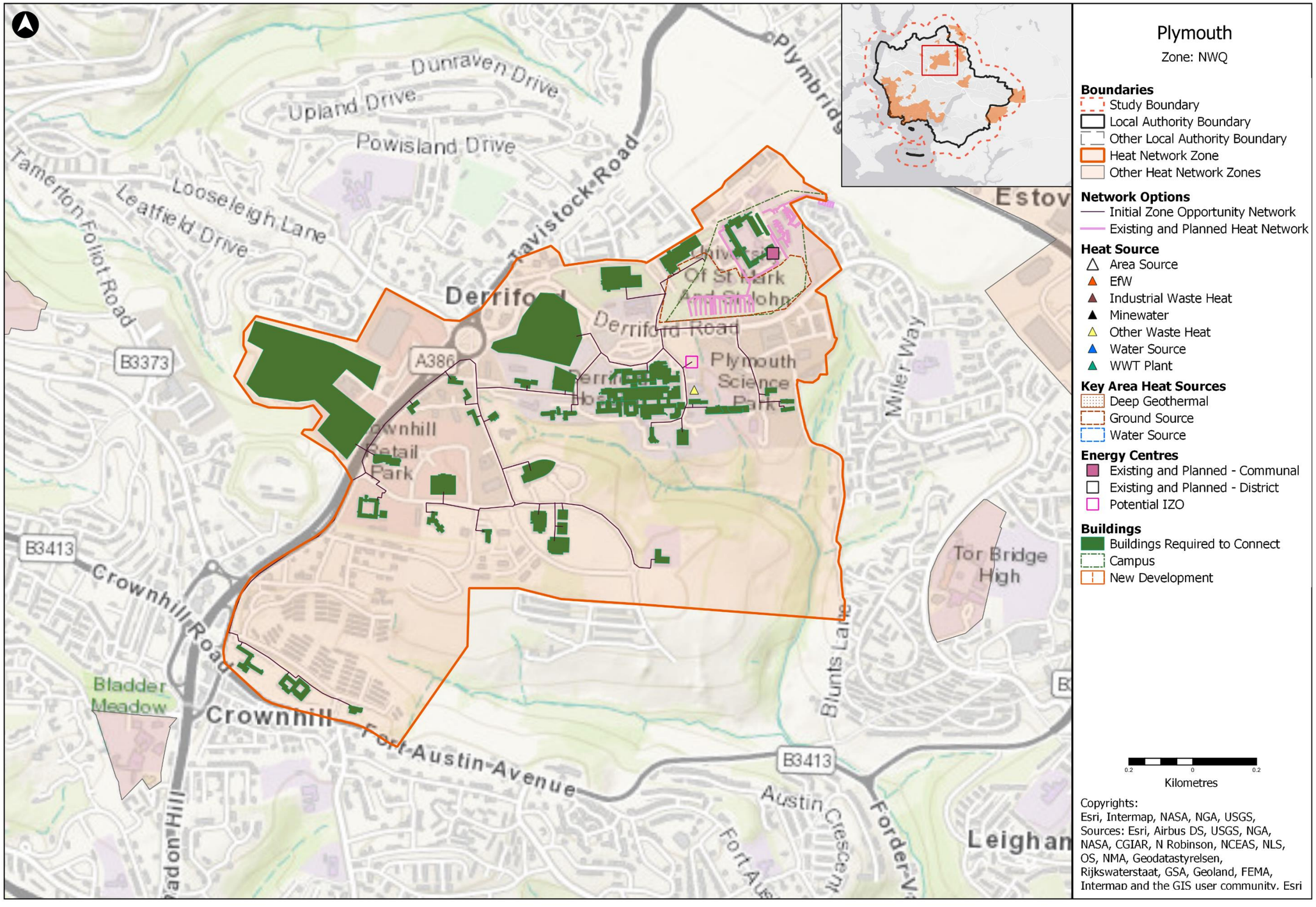
3.2.3) Plymouth Derriford – Initial Zone Opportunities

In Plymouth Derriford, a single Initial Zone Opportunity (IZO) has been identified. Key features are described below and shown in the HNZ-level map in Figure 6b below.

NWQ is the single IZO identified due to being centred around the high heat demand at the NWQ new development, as well as proximity land available and existing anchor loads. The key characteristics are:

- 58GWh/p.a of connected heat demand and 12.1MW of estimated required capacity at energy centre (ASHP)
- Linear heat density of 4.9 MWh/m and carbon intensity of 72gCO_{2e}/kWh
- £76m of CAPEX

Figure 6b1: Initial Zoning Opportunity in Plymouth Derriford HNZ



3.2.4) Plymouth Derriford – Heat demand

There are 60 buildings required to connect in the strategic zone and 45 are connected to the IZO. Connections include the five key neighbouring anchor loads (Nuffield, NWQ, Marjons, NHS Derriford, Plymouth Science Park), as well as the Glacis Park mixed use development into the west of the area and other major loads to the south including The Ship retail centre and PCH social housing. Refer to Table 4b below for the top 10 anchor load connected to the IZO.

Figure 7b: Plymouth Derriford - Categorisation of heat demand for Buildings Required to Connect in IZO

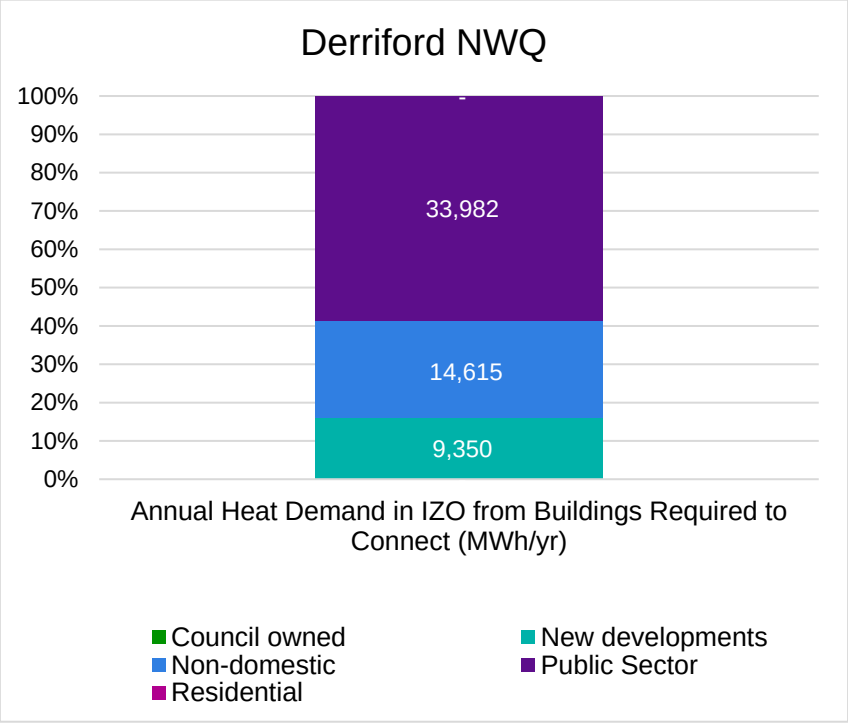


Figure 7b illustrates the split of demand per typologies of buildings Required to Connect in the Plymouth Derriford strategic zone. The 33.9GWh/p.a. for public sector buildings is the NHS Derriford site and associated medical schools.

Further details of the key heat demands for Buildings Required to Connect in the IZO are provided in Table 5b, below.

Table 4b: Plymouth Derriford - Key heat demands for Buildings Required to Connect in the IZO

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Quality Assessment
NHS Derriford Hospital	NHS / Public Sector	1	20,819	Benchmark
Glacis Park	New development / Mixed use	1	9,350	Benchmark
North-West Quadrant	New development	9	6,114	Benchmark
NHS Derriford Retail	Commercial	1	5,688	Benchmark
NHS Derriford Clinic	NHS / Public Sector	1	1,973	Benchmark
Nuffield Health & Racquet Club	Leisure centre with pool	1	1,315	Benchmark
The Ship	Leisure centre	1	1,249	Benchmark
Marjons	Education	1	967	Benchmark
Plumer House	Social housing	1	753	Benchmark
HM Land Registry	Council owned	1	705	Benchmark

Please refer to Appendix 3 for definitions related to Table Building categories in this table.

Existing NHS Healthcare related buildings including Derriford Hospital make up a significant proportion of the top 10 heat demands within the IZO. Future developments including Glacis Park and Northwest Quadrant also represent significant heat demands.

3.2.5) Plymouth Derriford – Heat sources

Plymouth Derriford does not have known water bodies to source low-carbon energy. There is however 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 ground arrays or location agnostic technologies such as ASHP plant. As

a precedent, Marjons ambient loop network relies on its 120 boreholes array under the grass sports pitch, which provides 650kW of heating.

The medical incinerator at NHS Derriford Hospital could be a source of waste heat. It has been investigated in several previous HNDU studies.

The energy centre location for the IZO is a HNDU study previously identified council owned area next to the medical incinerator.

Tables 5b and 6b in this section summarise the key heat sources and potential energy centre locations identified for this HNZ. These are also shown in the zone-level map in Figure 6b in section 3.1.3 above and on the city-level Map C in Appendix 1.

Table 5b: Plymouth Derriford - Key heat source opportunities for the IZOs

Heat source type	Capacity (kWp)	Temperature (Degrees Centigrade)	Potential Energy Centre (Ref number)
Waste Heat Medical Incinerator	1,800 kWp	90 ºC	E3 Derriford Road, PL6 8DH
GSHP – location agnostic Marjons grass sport pitch Hospital car park A Nuffield car park Science Park car park	 650 kWp 163 kWp 300 kWp 300 kWp 190 kWp	7-12 ºC	E7 Campus pitch
Existing heat networks Marjons ambient loop (GSHP)	900 kWp	Unknown	(See section 3.2.2)

Table 6b: Potential IZO Energy Centre Locations in Plymouth Derriford

Ref #	Site type	EC Ref number	Size (m2)	Ownership	Heat Source
1	Land	E3	800	Council	ASHP and potential waste heat recovery
2	Land	E7	Unknown	Plymouth Marjon University	WSHP and gas boiler

Table 7b**Error! Reference source not found.** lists potential energy centre locations for heat sources in Plymouth Derriford. These are shown on the HNZ-level map in Figure , matching by reference number.

3.2.6) Plymouth Derriford - Heat Distribution

The key heat network infrastructure within the IZO is the pipework from the proposed energy centre to the heat demand loads. There is no existing strategic main in Plymouth Derriford and therefore three sections of the IZO piping, seen in Figure 6b, could be considered strategic:

- Derriford Road, serving the NHS Derriford hospital, NWQ, Nuffield and Marjons leisure centre.
- Travistock and Brest Road semi-ring supplying the retail hub around Derriford District Centre.
- Plumer Road main to reach required to connect buildings in the south of the zone.

Please see Appendix 5 for related methodology statements and assumptions.

Table 7b: Plymouth Derriford - Indicative Heat Network statistics for Initial Zone Opportunities

IZO Heat Network description	Network length (km)	Network cost (£)
Indicative IZO networks which connect all buildings required to connect to a heat distribution network and all IZO heat sources to the relevant energy centre(s))	12	£76m

3.2.8) Plymouth Derriford – Key constraints and mitigations

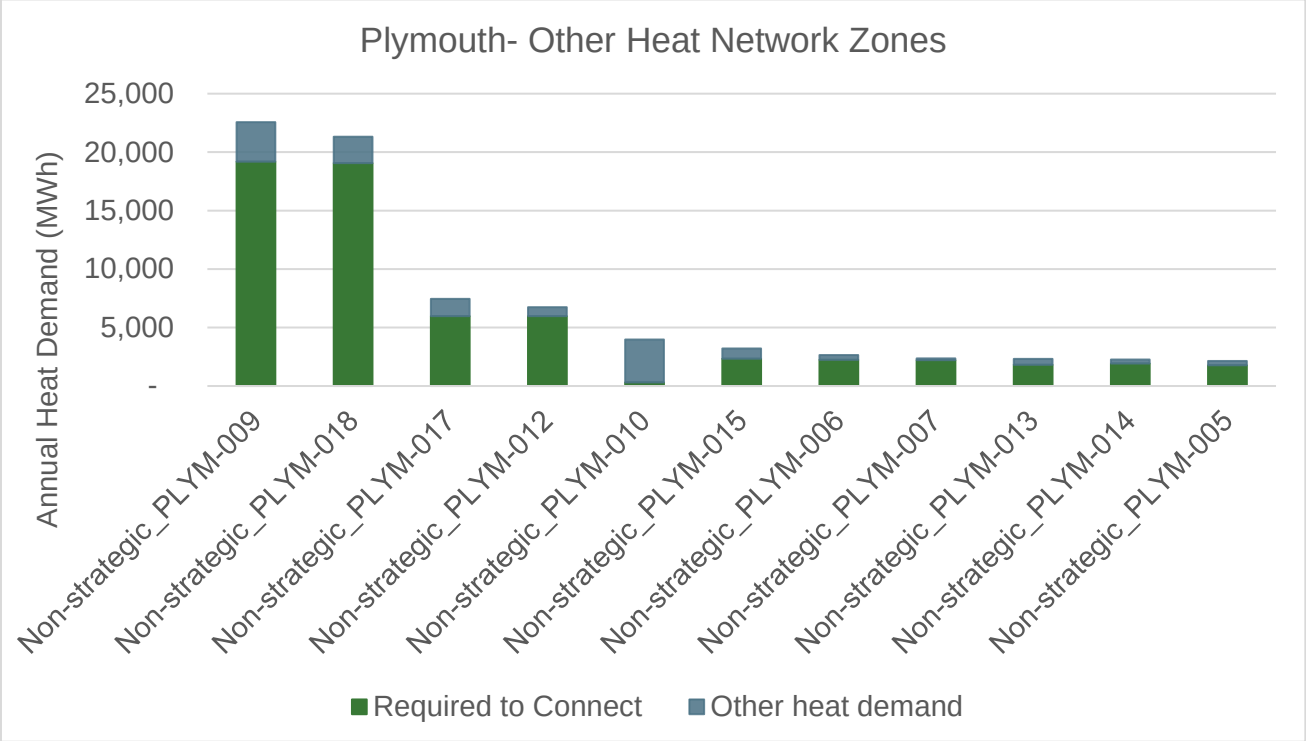
NWQ:

There are no major constraints for this IZO.

4) Other Heat Network Zones

Other HNZs were also identified in Plymouth, and these are summarised in Figure , below. This shows for each of these HNZs, the total annual heat demand and the proportion of this which is associated with buildings required to connect to a heat network. If a candidate heat source has been identified for the HNZ, this is shown in a label associated with the corresponding bar in this chart. Please note that these heat sources have not been investigated fully.

Figure 8: Total heat demand, proportion Required to Connect in Other HNZs in Plymouth



PLYM-008 This HNZ is situated to the North of Plymouth near the LA boundary. This area is currently undeveloped with no existing buildings. 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 This HNZ 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/p.a.) and the Fine Tubes factory (~2.4GWh/p.a.). Potential heat sources to supply this IZO 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 This HNZ is East of the city centre and just outside the study boundary for Plymouth. The area is planned to be fully re-developed to a residential and mixed-use area. This new development plan is known as Sherford. The energy strategy has not yet been developed.

PLYM-017 This HNZ is situated North-East of the city centre. The area is dominated by industrial buildings and the China Claywork new development. Known key anchor loads include the Princess Yacht factory (~800MWh/p.a.). Potential heat supply sources within this IZO 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 / car parks.

PLYM-018 This HNZ is situated 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 (CCGT) power station which has been announced as a new development site for a large-scale green hydrogen project.

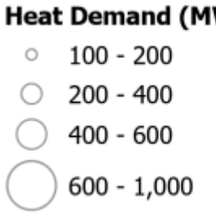
PLYM-003, PLYM-004, PLYM-005, PLYM-006, PLYM-007, PLYM-012, PLYM-013, PLYM-014, PLYM-015, PLYM-016 These HNZs are situated outside of the city centre and out with any high heat demand cluster. Each of these zones are relatively small representing a single network opportunity centred around exiting multi-building estates.

Appendix 1 – Standard City-level Maps

Please find below some guidance on interpreting key the icons (legends) used on the city-level maps that follow this page.

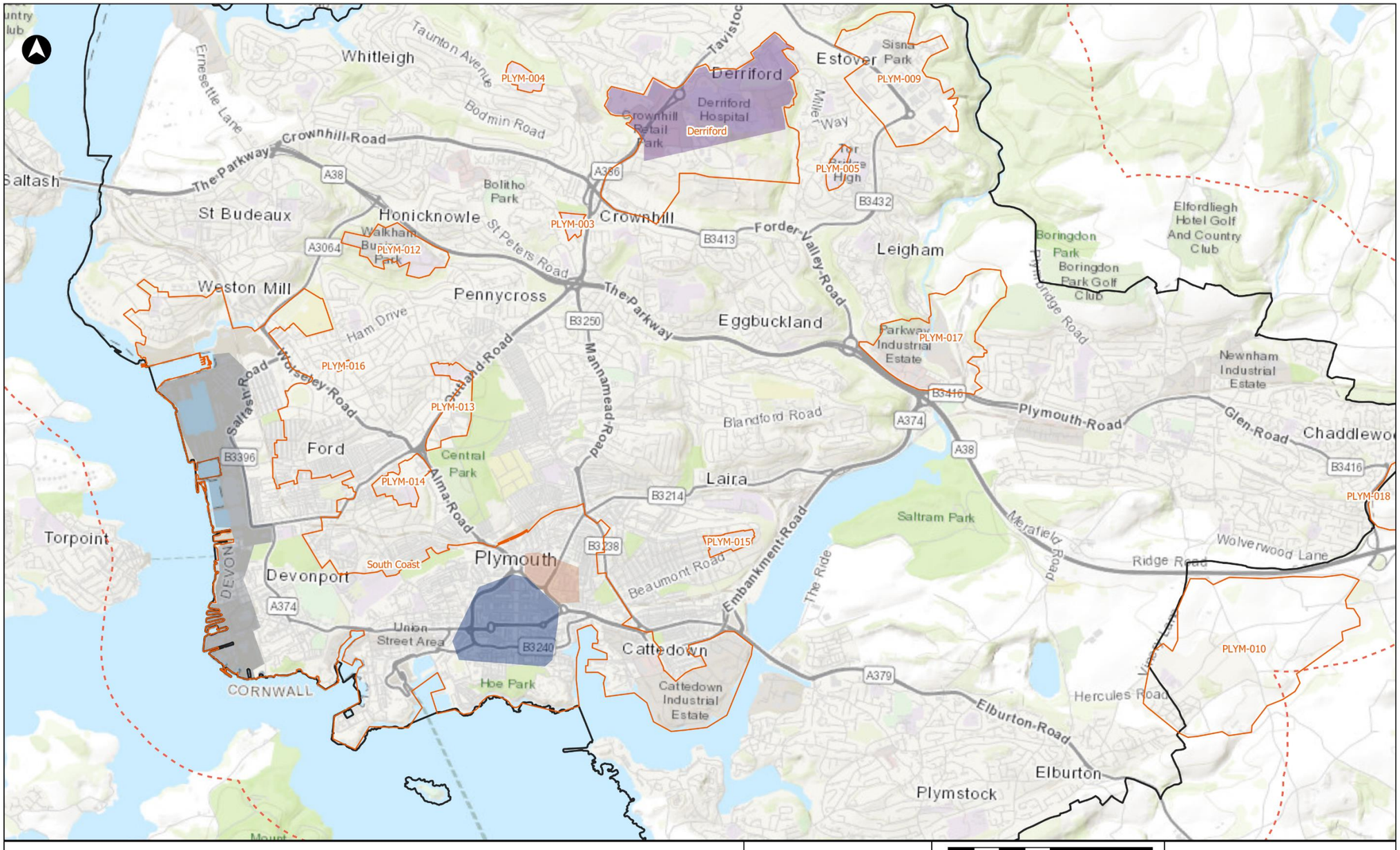
Many readers will be familiar with the Ordnance Survey maps and their legends. These maps use the Ordnance Survey background layers as provided by GIS data providers specified in the Copyright information on each one. This background map is then overlaid this with information about the HNZs identified. The HNZ iconography (legends) used in these city-level maps are described below:

Legend / icon	Relevant map(s)	What this represents on the map	Comments on interpretation
	All maps	Study Boundary	In all cases the study boundary expands one kilometre beyond the Local Authority boundary to capture cross-boundary urban expansion / new developments and especially suburban industrial developments which often contain key sources of waste heat, e.g., from Energy from Waste plants. By exception, some study boundaries were extended to include new developments beyond the one-kilometre standard, where this captured pre-existing heat networks, expansions of existing heat networks and planned heat networks close to construction.
	All maps	Local Authority Boundary	
	All maps	Other Local Authority Boundary	
 and 	City-level maps in Figures 1 and 2 All Appendix 1 City-level maps and 'Fig 6' HNZ-level pma	Heat Network Zones	This includes both Strategic HNZs and Other HNZs.
 OR 	City-level maps in Figures 1 and 2 All Appendix 1 City-level maps.	The name of a Strategic Heat Network Zone either within a HNZ boundary, or next to it, for smaller HNZs that will not contain the whole name.	These names are referenced in the main report as part of section headings, figure, and table captions, etc., throughout Section 3.
 OR 	City-level maps in Figures 1 and 2 All Appendix 1 City-level maps.	The reference number of an Other Heat Network Zone	These names are referenced in the main report in Section 4.
Key Typologies			
	Appendix 1 City-level Map A	Dense City Centre	An area locally recognised as the City or Town centre, where buildings are most densely packed and typically where buildings have the most storeys.
	Appendix 1 City-level Map A	City Centre Fringe	An area around the City or Town Centre or at its outskirts, where both building density and height of buildings starts to reduce. There is no strict definition for this, and it is optional to show this.
	Appendix 1 City-level Map A	Mixed Use District	A mixture of different building owner / occupier typologies, without any one typology dominating the area.

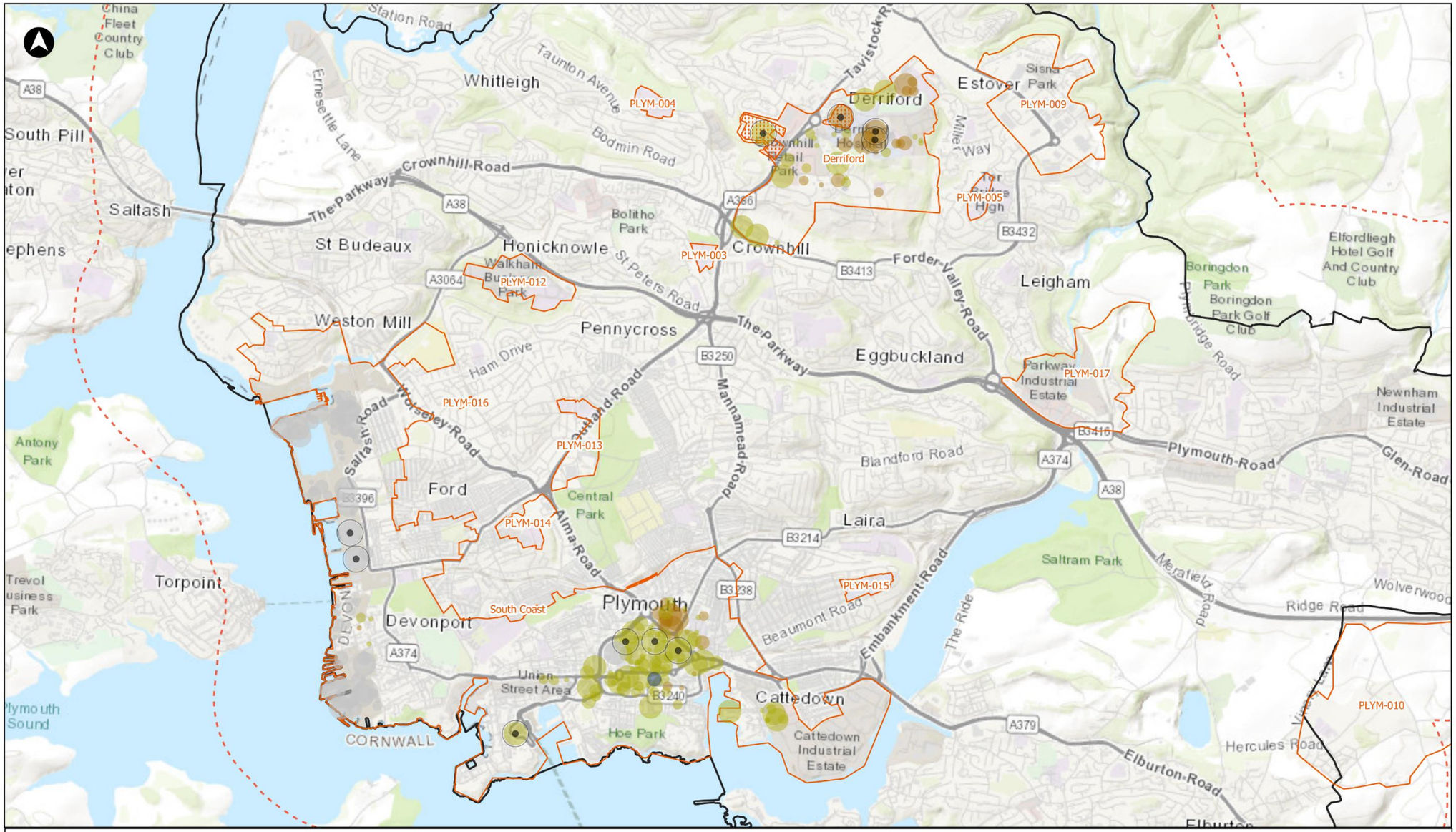
	Appendix 1 City-level Map A	Social Housing	Public, private and third sector social housing.
	Appendix 1 City-level Map A	Campus (health / education)	Buildings which are owned and operated together as a campus, such as Universities, Colleges of Further Education, Science / Research Parks, and health facilities such as Hospitals and associated ancillary services.
	Appendix 1 City-level Map A	Commercial / business office	Public & private office space
	Appendix 1 City-level Map A	Industrial areas	Industrial areas, including those operated by Municipal Utility Operators, e.g., Waste Management, Water Treatment, etc
Heat Demand types			
	Appendix 1 City-level Map B, HNZ-level “Fig 6” maps	New Developments	This includes all types of property development but for areas of new development within Heat Network Zones and Initial Zone Opportunities identified, the relevant chapter of section 3 gives more detail on what type and density of development is present. Note this only includes new developments which stakeholder-provided evidence suggests will not yet be constructed by the start of 2025.
	Appendix 1 City-level Map B	Local Authority Other public sector Residential with existing communal heating Non-domestic private Industrial	Local Authority – owned buildings / heat loads Other public sector heat loads (e.g., hospitals, universities) Residential buildings with existing communal heating systems Nondomestic private buildings, e.g., commercial office space Industrial sites e.g., industrial plant, manufacturing sites, warehousing, and distribution centres
	Appendix 1 City-level Map B	Top 10 Heat Demands	The largest (anchor) heat loads within the Pilot study area. (Note more detail is provided on top heat demands in each IZO identified within section 3 of the report.)
	Appendix 1 City-level Map B	These, or alternatively scaled circles as appropriate to each pilot study area and the scale of heat demand present (expressed in Mega-watt hours per year)	The heat demands are shown as per the colour chart to indicate the type of building owner / current usage of the building as shown above, however the circle sized according to the scale shown here. Top 10 heat demand have the black outline and central dot overlaid on them.
Heat sources and energy centres			
	Appendix 1 City-level Map C and HNZ-level ‘Fig 6’ Map	**Area Heat Sources:** Deep geothermal heat or Coalmine water sources Ground Source Water Sources	As distinct from point-heat sources, area heat sources are those for which a precise location where heat will be extracted from the heat resource not yet known.
	Appendix 1 City-level Map C and HNZ-level ‘Fig 6’ Map	**Point Heat Sources:** EfW plant Industrial Waste Heat Minewater Other Waste Heat Water Source WWT	These point heat sources are colour coded to show the type of heat source: Energy from Waste plant Waste heat emitted to air by industry (other than EfW or WWT plant) Minewater heat, where the specific coal or other mine shaft extract point is known Other waste heat sources include, for example, sewerage pipes heat and heat extracted from large electricity sub-stations, where assessed based on a prototype approach used in the pilot Water sources include marine water, rivers, and canals as well as large lakes and reservoirs. Waste Water Treatment plants

			On the City-level Map C only, the heat waste symbol is sized according to a scale (in giga-watt hours per year) indicated to the right on these icons. In the HNZ-level 'Fig 6' map, the symbols are all the same size to simplify the map. Text in the main report, Section 3, provides details on heat source capacity.
and 	Appendix 1 City-level Map C and HNZ-level 'Fig 6' Map	Energy Centre - IZO	Potential site for an Energy Centre serving and IZO As above but showing the point heat source which the potential IZO Energy Centre would serve, and with a reference label linking to text in the Main Report, Section 3.
	Appendix 1 City-level Map D (and HNZ-level 'Fig 6' Map)	Energy Centres - Existing & Planned Communal HNs Energy Centres - Existing & Planned District HNs	Energy Centres in use by existing or planned Communal-scale and Campus-scale HNs. Note Communal-scale supplies heat to properties in a single building, where Campus-scale supplies heat to properties within a campus environment and operated as a single system. Energy Centres in use by existing or planned District-level HNs, i.e., a HN supplying two or more buildings owned / operated by separate organisations
	Appendix 1 City-level Map D	Existing and Planned Heat Networks	At this scale the route of an existing HN is too small to show, so this area outline is substituted.
and 	Appendix 1 City-level Map E	Key constraints	Key Constraints As above but shown in map context with a reference label linking to text in the Main Report, Section 3.
	'Fig 6' – HNZ-level Map	Other Heat Network Zones	Heat Network Zones which are not the focus of the map whether or not they are Strategic HNZs
	'Fig 6' – HNZ-level Map	Initial Zoning Opportunity Network Existing and Planned Heat Networks	
Buildings			
	'Fig 6' – HNZ-level Map	Buildings required to connect Campuses New developments	

A. City_Name 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 - 200
- 200 - 400
- 400 - 600
- 600 - 1000

2 0 2
Kilometres
Scale: 1:35,000
Coordinate System: OSGB36 / British National Grid

Department for Energy Security & Net Zero

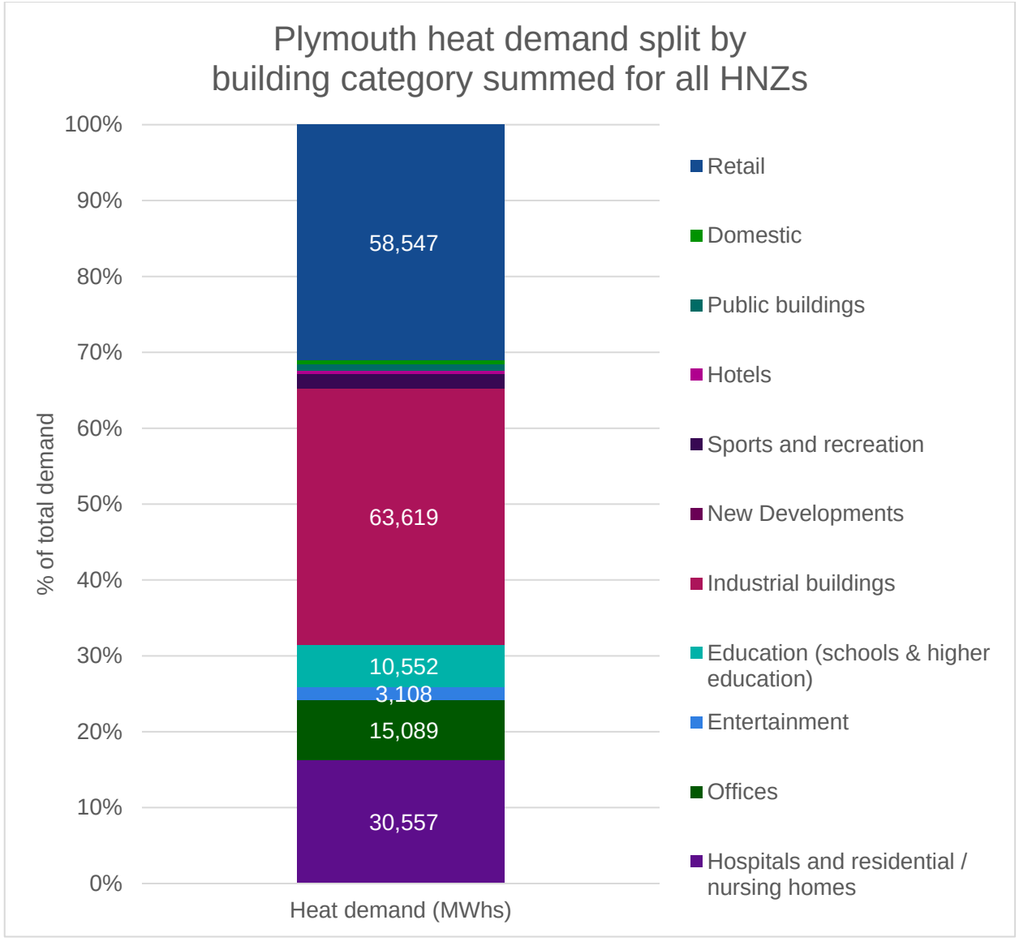
Plymouth

Map B

Key Heat Demand

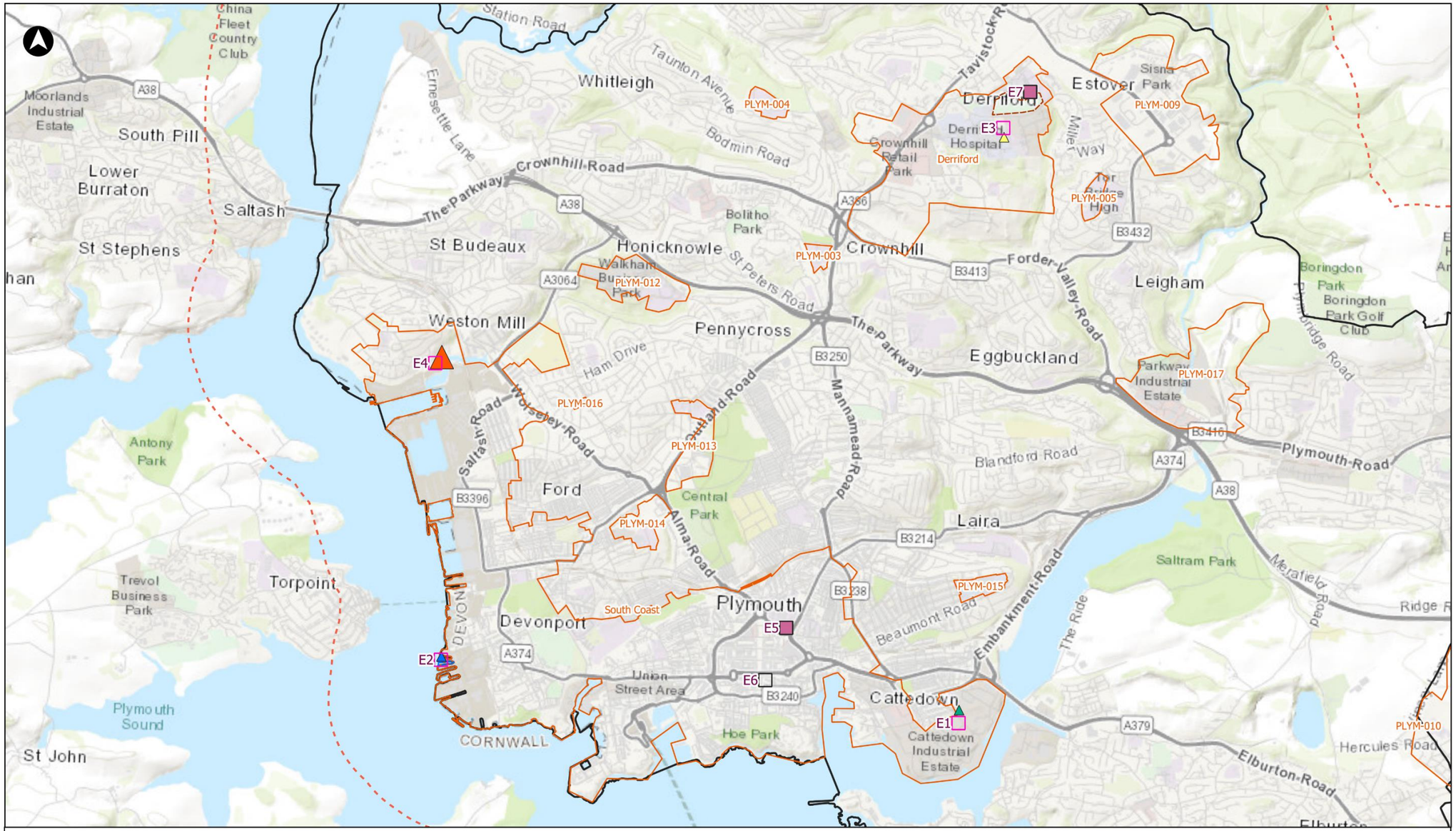
Table8: Heat source split further by building categories across all Initial Zoning Opportunities identified in Strategic HNZs in the study area

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

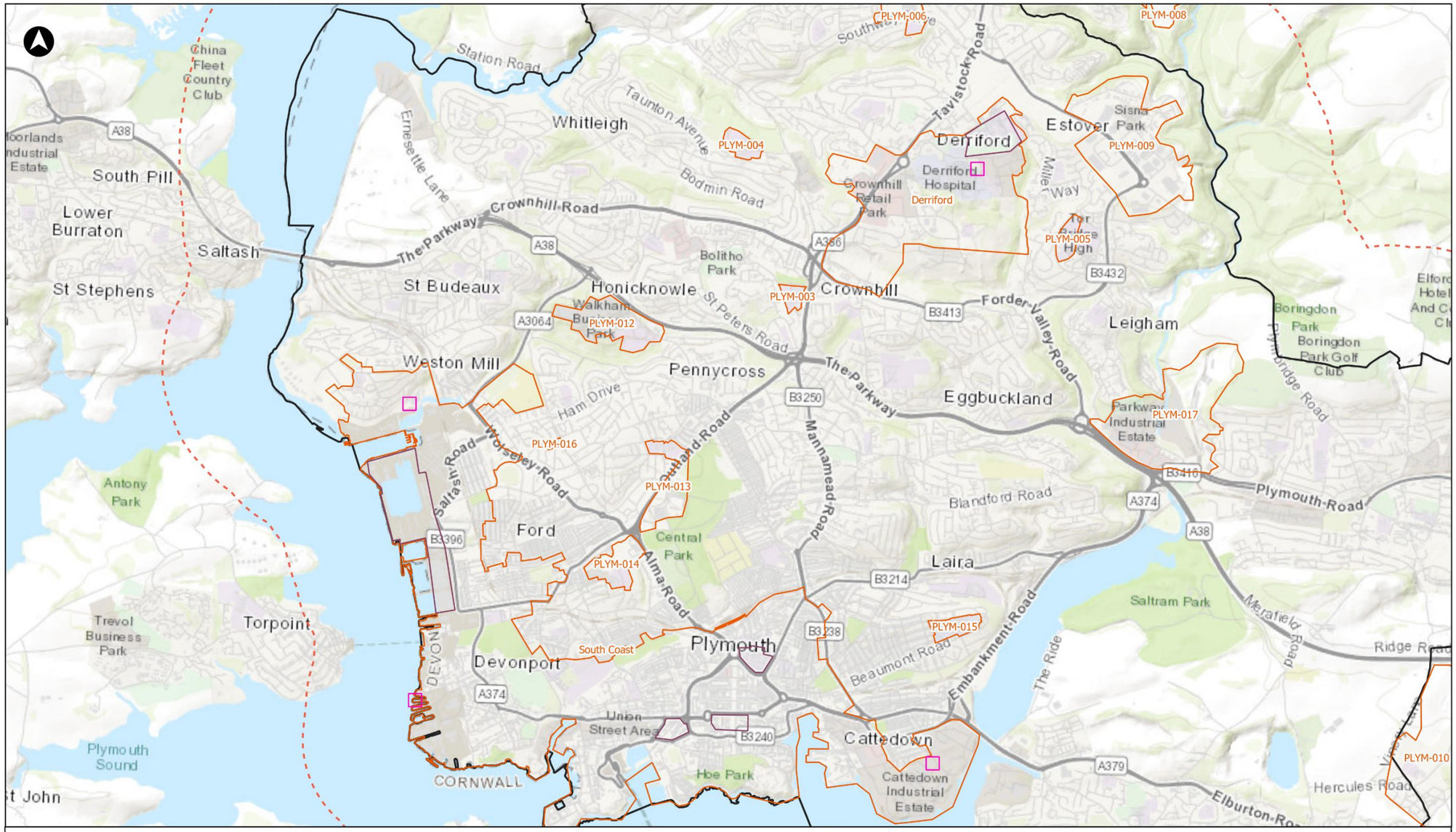


Note: In Plymouth there are 13 HNZs with a total of 3 IZOs identified across them. The table and graph above summarises and categorises the heat demand for all of these.

C. Key Heat Sources and Potential 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

Kilometres
Scale: 1:35,000
Coordinate System: OSGB36 / British National Grid

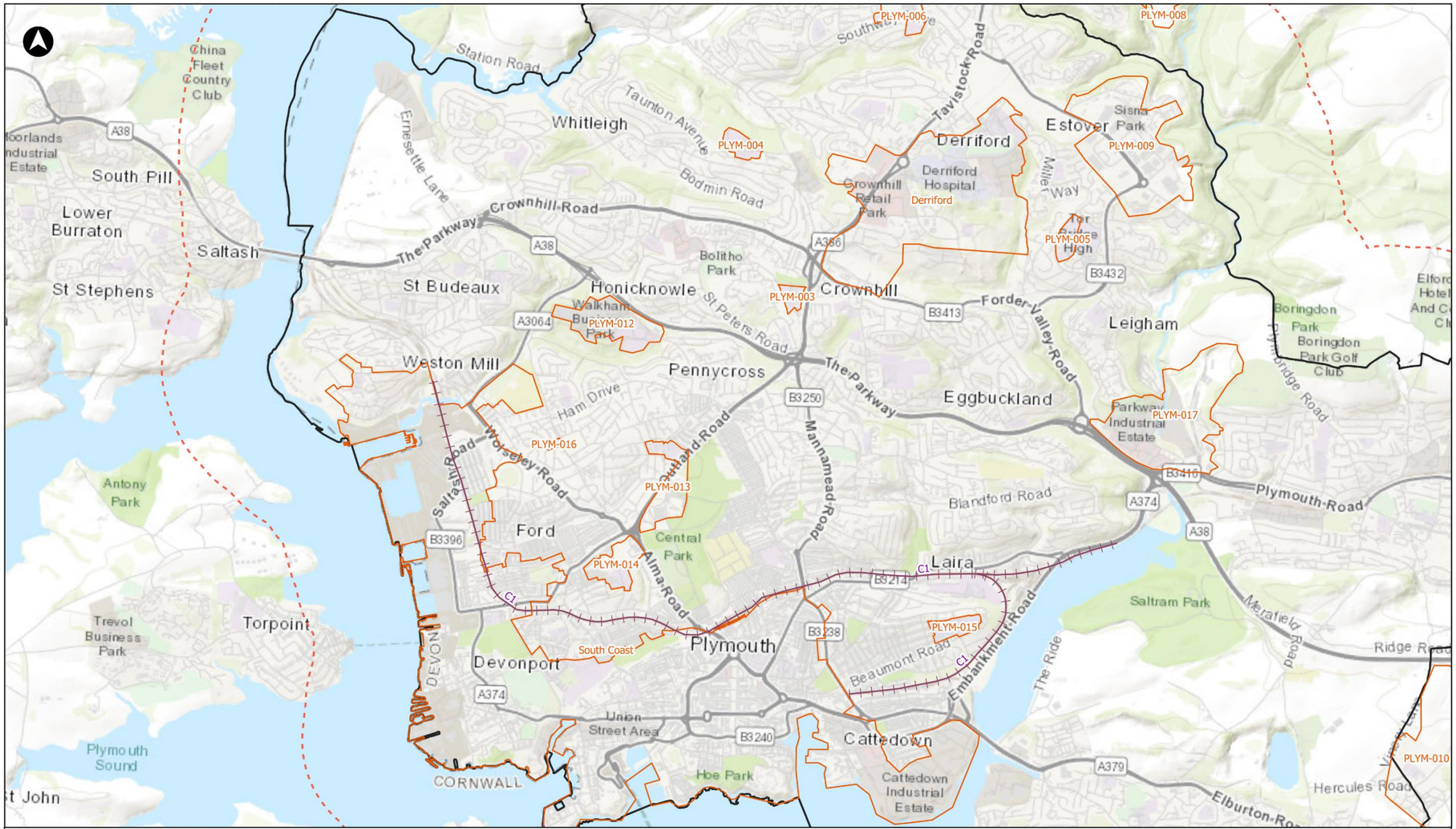
Department for Energy Security & Net Zero

Plymouth

Map D

Existing and Planned Heat Networks

E. Physical constraints



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

Key Constraints

2 0 2
Kilometres
Scale: 1:35,000
Coordinate System: OSGB36 / British National Grid

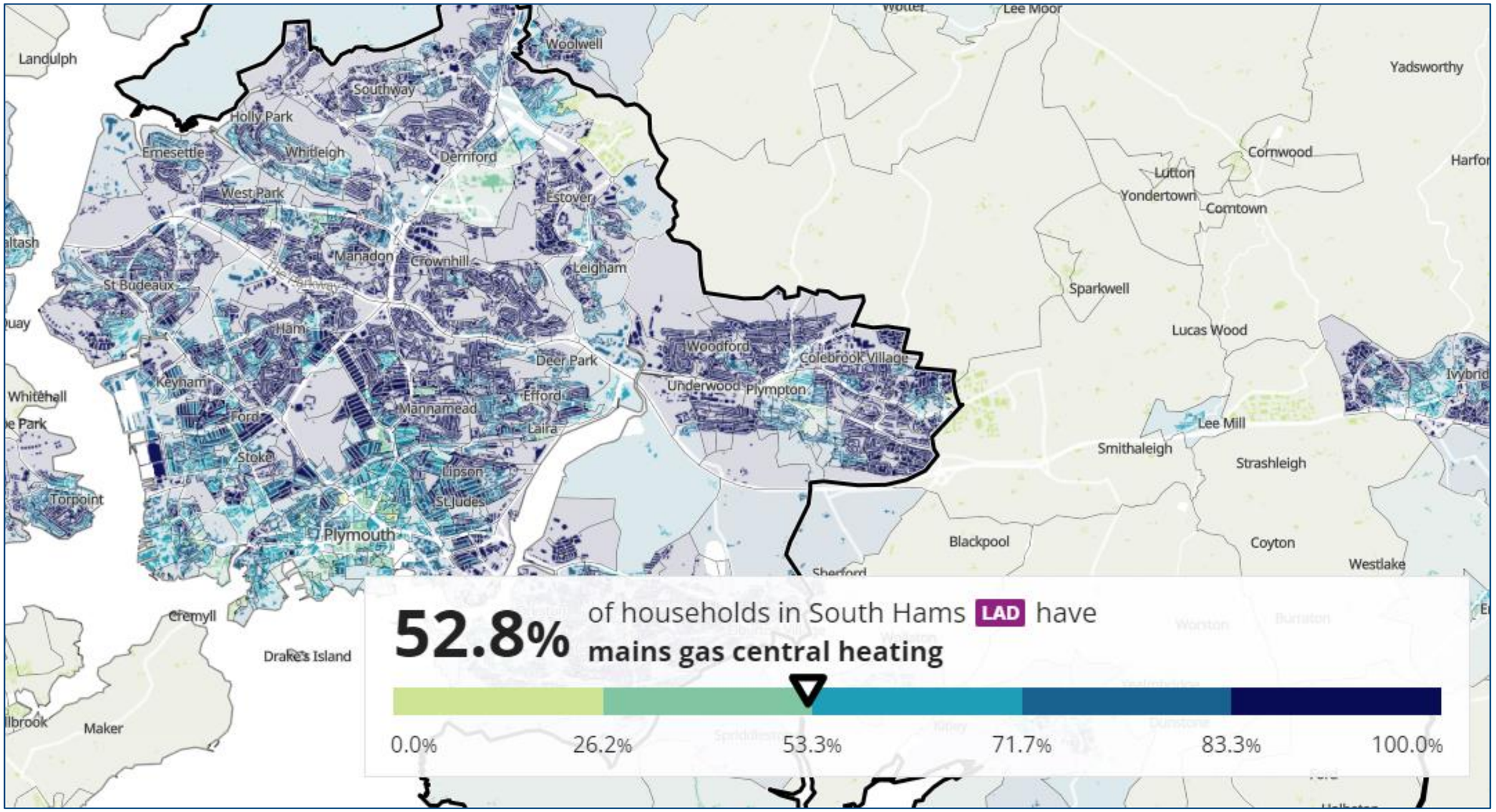
Department for Energy Security & Net Zero

Plymouth

Map E

Physical Constraints

F – Off-Gas Grid areas in Plymouth



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

Guidance Box 21:
ZTCs should complete Table 9 below with a list of the most important reports and studies that have been shared with DESNZ by local stakeholders for the purposes of the HNZ Pilot and other purposes set out in the Department's Data Privacy Notice.

[1 page]

Throughout the delivery of the HNZ Pilot in Plymouth, information resources have been compiled for use during future DESNZ-led activities related to the national rollout of HNZ Policy and progression of current and planned Heat Network developments.

These resources will remain restricted to DESNZ and the LA until further notice and will not be shared with external organisations without express permission being sought. This is to ensure the Department remains within its Data Privacy Notice as shared with stakeholders providing the information.

Table 10: Pilot standardised information resources

Information resource	Description of resource
Stakeholder Directory	A directory listing key stakeholder identified and approached during the Pilot project, 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 11: Pilot 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 Plymouth City Council
Derriford Decarbonisation Opportunity, 2023	Buro Happold HNDU Study commissioned by Plymouth City Council
Devonport Heat Network Pre-Feasibility Study	Buro Happold HNDU Study commissioned by Plymouth City Council

Barne Barton Heat Network Feasibility Study	Buro Happold HNDU Study commissioned by Plymouth City Council

This confidential report is the property of the UK Government, Department of Energy Security and Net Zero.

Disclaimer

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

Due to the sensitive nature of HNZ Pilot outputs, ahead of national policy being written as law, please be aware that DESNZ is managing access to this report, and recording people and organisations with whom it has been shared, for audit purposes.

This report contains outputs which are from a pilot phase of HNZ policy and process development. As such, the contents, including data shown in maps, technical and economic data within the report, are likely to change. **No part of this report shall be relied upon for any business decisions.**