energycounsel
engineering sustainable buildings

Environmental Standards Statement

Ref: Z60104

Former Royal British Legion Site

Woodhouse Lane,
Wythenshawe,
Manchester

for

Rowlinson Construction Ltd

Gardale House,
118b Gatley Road,
Cheadle,
SK8 4AU

Energy Counsel
Viridor House
No.3 Bolholt Terrace
Bury/Gtr Manchester
BL8 1PP
Tel: +44 (0)161-762 1055
Fax: +44 (0)161-761 1094

www.energycounsel.co.uk

PASSIVE HOUSE DESIGNER CERTIFIED PASSIVE HOUSE DESIGNER
BREEAM ACCREDITED PROFESSIONAL
LOW CARBON ENERGY ASSESSORS
CIBSE Certification Ltd.
bsi FS 560187
UKAS MANAGEMENT SYSTEMS 0003

Document Status – Final

Ref: Z60104			Date
Produced by:	[redacted]	Paul Ahern OCDEA | LCC	30th April 2025
Checked by:	[redacted]	Matthew Adams BEng (Hons) LCEA Level 5	1st May 2025
Approved by:	[redacted]	Matthew Gibson BEng (Hons) CEng CEnv Soc Env	2nd May 2025

Disclaimer

This report has been prepared by Energy Counsel with all reasonable skill, care, and diligence within the terms of the Contract with the client, incorporating our Standard Terms and Conditions of Business and taking into account the resources devoted to it by agreement with the Client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client, and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own discretion and risk.

Contents

1. Introduction 7
1.1. Location 8
2. Policy Drivers for Energy Efficiency and Renewable Energy 13
2.1. National Policy 13
2.2. Local Policy 14
3. Methodology 20
4. Baseline Energy Assessment 22
4.1. Predicted Baseline Energy Requirements 22
5. Passive Design and Energy Efficiency 24
5.1. Passive Design Measures 24
5.2. Energy Efficient Systems 24
6. District & Communal Heating Networks 25
6.1. Decentralised Heating Networks 25
6.2. New Heating Networks – Options 25
7. Renewable Energy Technologies 27
7.1. Photovoltaics (PV) 27
7.2. Solar Thermal HW Panels 28
7.3. Ground Source Heat Pump (GSHP) 29
7.4. Air Source Heat Pump/Exhaust Air Heat Pump 30
7.5. Micro Wind Power 30
7.6. Biomass 31
8. Energy Assessment of Proposed Scheme 33
9. Conclusion 36
9.1. Low/ Zero Carbon Technologies (LZT) Discounted 36
9.2. Summary Headlines 37
10. Appendices 39
10.1. LZT Feasibility Table 39
10.2. Specification for Apartment Energy Assessments (ADL1 2021 – SAP 10) 40
10.3. Index of Tables and Figures 42

Executive Summary

This Environmental Standards Statement (ESS) has been developed in support of the planning application for the proposed development of 14No. residential dwellings at Former British Legion Site, Manchester. This statement is to assist with discharging the planning condition 15 which states:

Prior to the commencement of above ground works an Environmental Standards Statement, which addresses sustainability ratings and the provision of renewable energy within the development, shall be submitted for approval in writing by the City Council, as Local Planning Authority. The development shall be carried out in accordance with those details.

The statement will evaluate the technical and economic feasibility of using both passive and low and zero carbon technologies and will assess the practical levels of CO_2 reduction possible for this development to comply with the following planning requirements:

- National Planning Policy Framework (2024)
- Places for Everyone Joint Development Plan 2022 to 2039 (PFE) (March 2024)

The following low and zero carbon technologies have been evaluated:

- Biomass
- Wind
- Biogas
- Air Source Heat Pumps & Exhaust Air Heat Pumps
- Geothermal
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photovoltaic

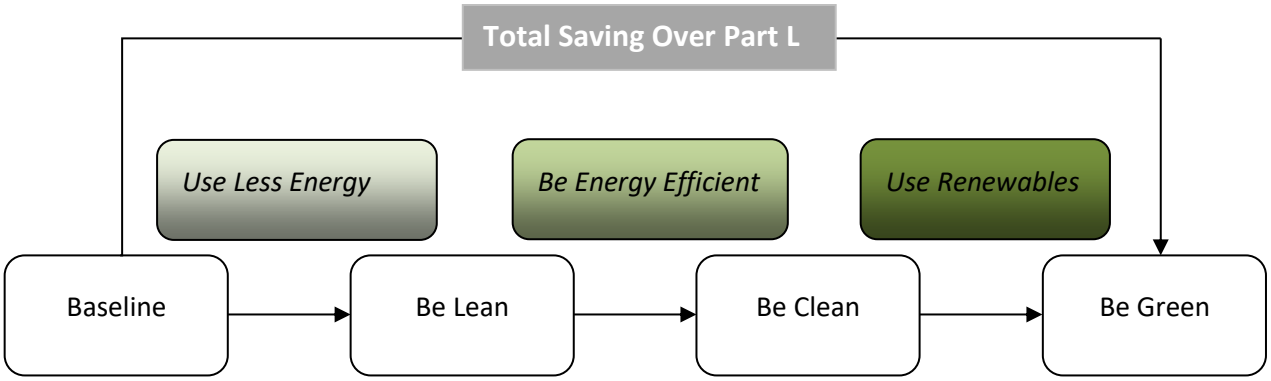
The approach for the residential development at the former British Legion Site, Manchester is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Enhanced building fabric to meet the new Building Regulations ADL1 2021 (15/06/2022)
2. Enhanced air tightness and thermal bridging.
3. Highly efficient mechanical ventilation with heat recovery (MVHR) provided to all apartments.
4. Space heating will be provided by highly efficient direct electric heating
5. Hot water will be provided by highly efficient air to water heat pumps
6. Efficient lighting strategy primarily using CFL or LED type fittings.
7. PV is included with a total allowance of 29.48kWp shared between all apartments via a Solshare system so each apartment benefits from the PV generated. Each apartment will have export capable meters installed.

For the purpose of the assessment, we have evaluated a selection of dwelling types in SAP 10 Standard Assessment Procedure) to provide an accurate estimate of predicted energy/ CO2 emissions. We have completed SAP calculations based on a representative dwelling type to provide an estimation of the worst-case total energy/emissions on site.

Summary

The development has been provided with energy savings through the use of passive improvement measures such as improved energy efficiency. This passive approach to compliance will complement the integrated approach to the sustainable energy objectives of the national and local policies. The use of heat pumps for hot water in the dwellings achieves the necessary levels of carbon reduction.



The principles of a Be Lean, Be Clean, Be Green philosophy have been applied, resulting in a 91.15% carbon emissions improvement and a 63.26% primary energy improvement over Building Regulations Part L1 2021, as indicated in Table 1. A full design specification that confirms inputs used within the SAP calculations is provided within the appendices of this report.

Table 1 - Proposed development CO_2 emissions against Building Regulations Part L1 2021

	Total CO_2 Emissions ($kgCO_2/yr$)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	**10,115**	**53,399**
Proposed Dwelling Performance	**895**	**19,620**
Total Reduction	**9,219**	**33,779**
Percentage Improvement (above ADL1 2021)	**91.15%**	**63.26%**

1. Introduction

The proposed development consists of 14No. residential dwellings located at the former British legion site, Manchester. The development is required to achieve compliance under Building Regulations Approved Document Part L1 (2021).

Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

- National Planning Policy Framework (2024)
- Places for Everyone Joint Development Plan 2022 to 2039 (March 2024)

Throughout this report, passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the 'Be Lean, Be Clean, Be Green' philosophy of relevant planning documents and the Energy Hierarchy.

An assessment of CO_2 emissions will be made based on the calculation methodology dictated by the Standard Assessment Procedure (SAP) and in line with the requirements of Places for Everyone Joint Development Plan (2024).

1.1. Location

The approximate area for the proposed development in Manchester is highlighted by the red line boundary shown in Figure 1. The area in Manchester is called Wythenshawe.

Figure 1 - Location and surrounding area of proposed British Legion residential development.

The site is to be accessed off Woodhouse Lane, Manchester. Existing residential development surrounds the proposed site. Hardstanding car parking spaces are available around the development site for the Wythenshawe Community Housing Group and the Brownwood Hall Church.

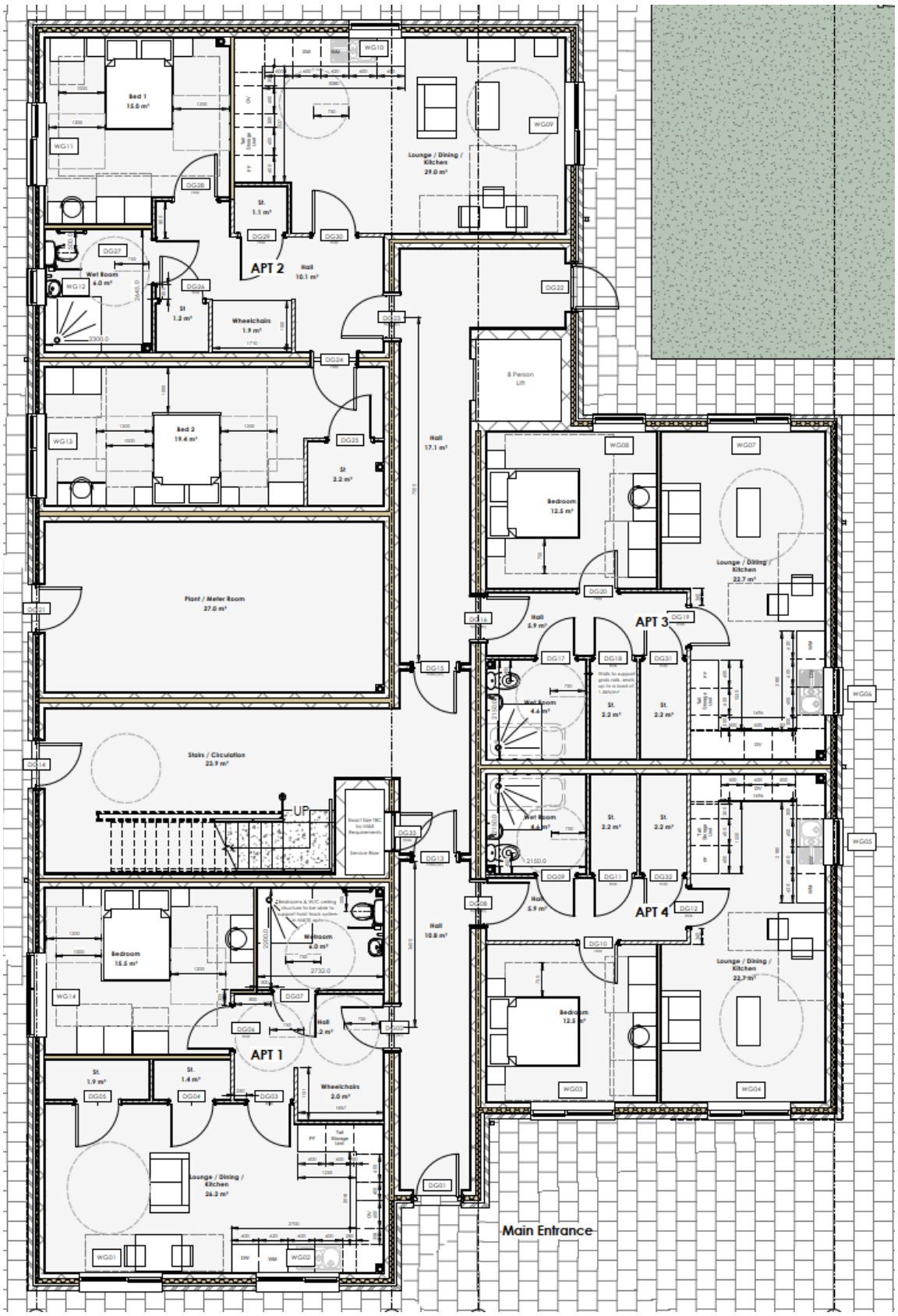
Figure 2 – Architectural site plan for the proposed British Legion residential development

The proposed development consists of 14No. apartment dwellings, arranged across three floors as indicated in Figure 2 above. Plot types and numbers are defined across the site as shown below:

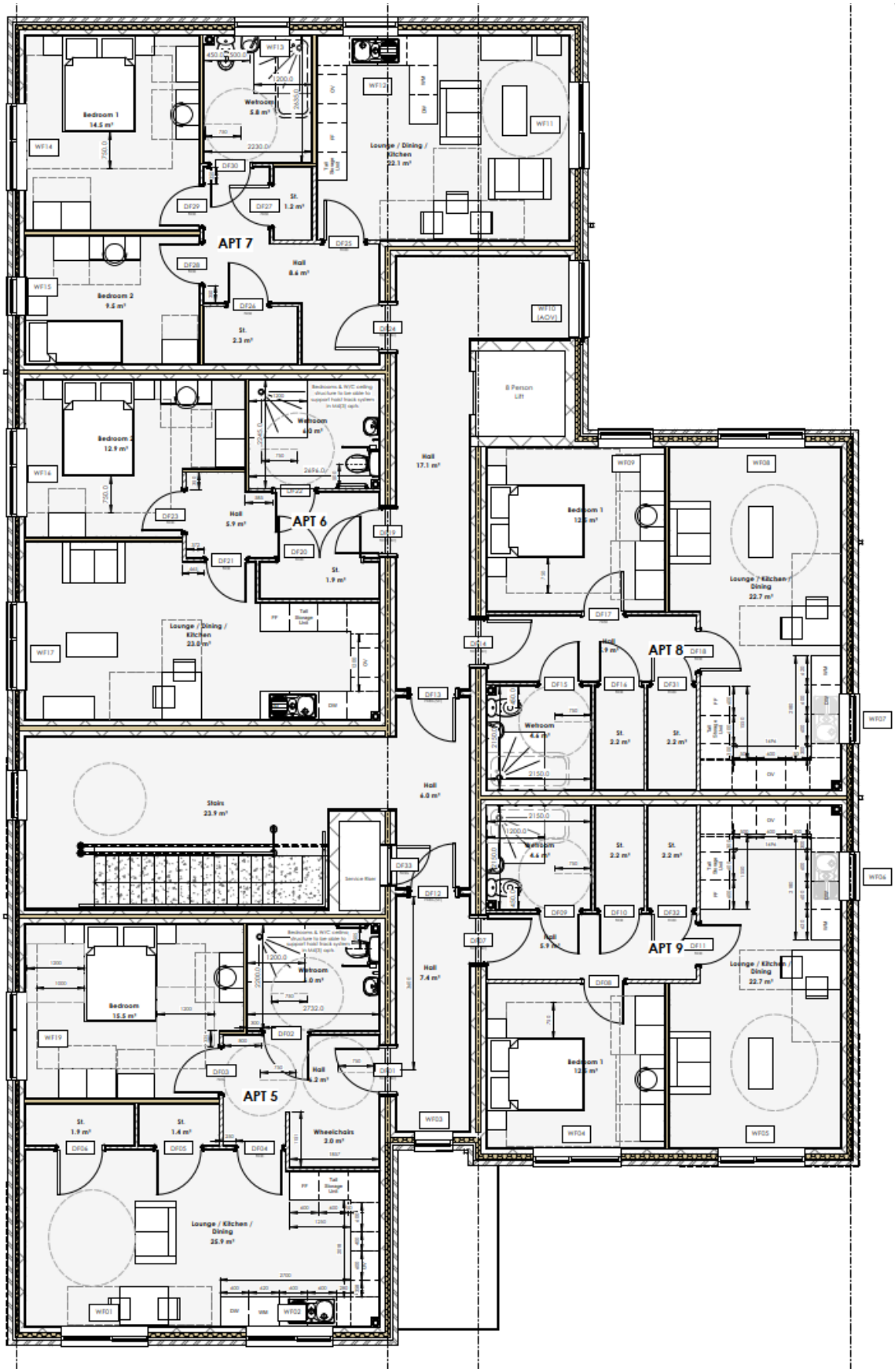
House Type	Description	Number of Units
M4 (3) GF	M4 (3) 2B4P Ground Floor Apartment	1
M4 (2) GF	M4 (2) 1B2P GF Apartment	2
M4 (2) FF	M4 (2) 1B2P Mid Floor Apartment	3
M4 (2) SF	M4 (2) 1B2P Top Floor Apartment	3
M4 (3) GF	M4 (3) 1B2P Ground Floor Apartment	1
M4 (3) FF	M4 (3) 1B2P Mid Floor Apartment	1
M4 (3) SF	M4 (3) 1B2P Top Floor Apartment	1
M4 (2) FF type 2	M4 (2) 2B3P Mid Floor Apartment	1
M4 (2) SF type 2	M4 (2) 2B3P Top Floor Apartment	1
		14

The floor plans for the 14No apartments over three storeys are detailed in the images below:

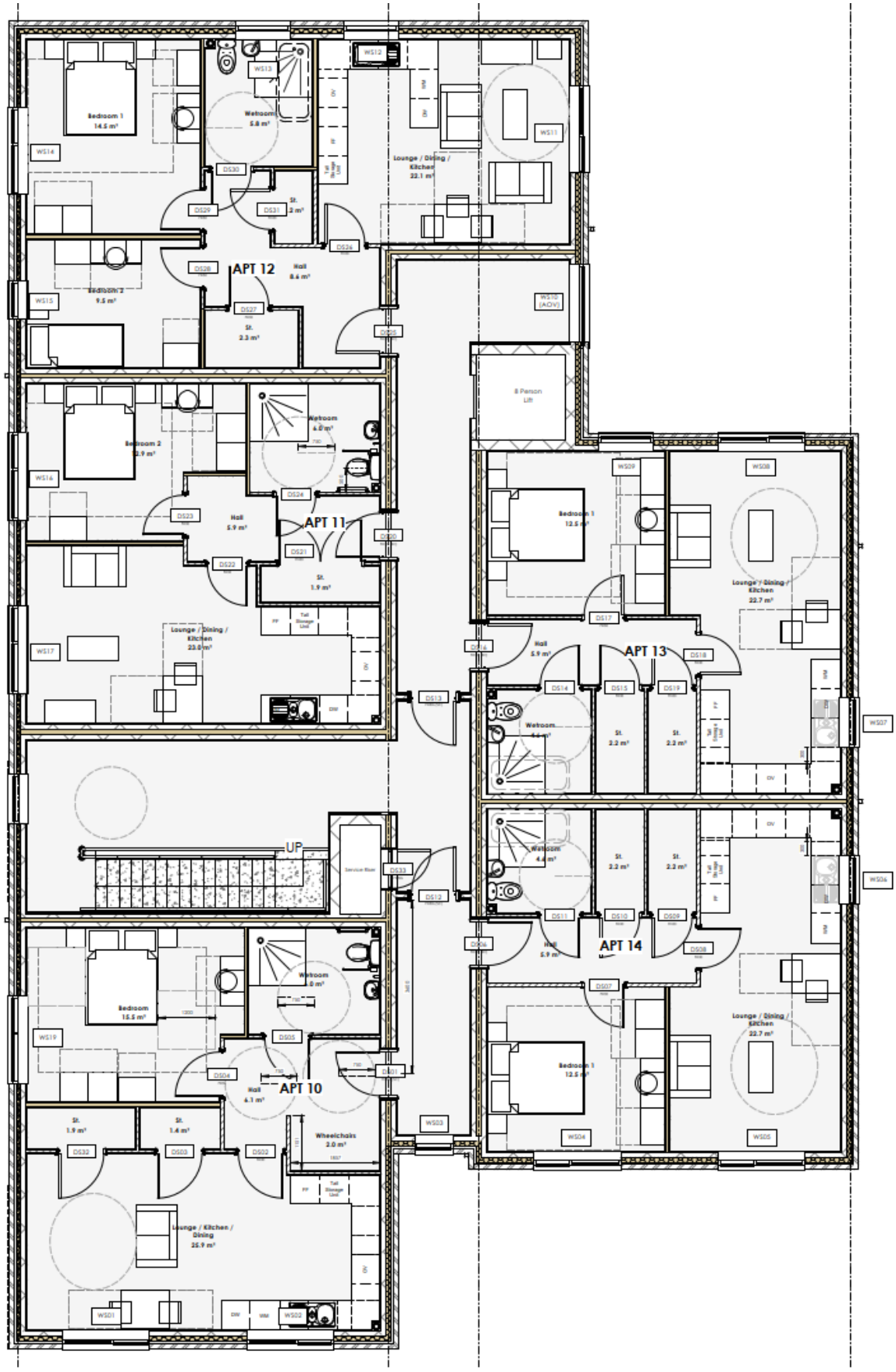
Figure *3* – Floor Plans of the proposed former British Legion site, Manchester residential development.



Ground Floor Plan



First Floor Plan



Second floor plan

2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the proposed development at the former British Legion site, Manchester at both a national and a local level.

2.1. National Policy

The National Planning Policy Framework was published in July 2021 and sets out the government's planning policies for England and they should be applied. Table 2 sets out the relevant energy standards for new developments and provides an indication of the design response to be provided.

Table 2 – Key National Planning Policy Requirements and Design Responses

Section	Policy Requirements	Design Response
14. Meeting the challenge of climate change, flooding and coastal change	The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.	This development will follow the principles set out in the Places for Everyone Joint Development Plan 2022 to 2039 (March 2024), using a 'Be Lean, Be Clean, Be Green' approach in reducing operational carbon emissions. An overview of current decentralised energy schemes in Manchester and an assessment on the potential for future schemes in relation to this development is provided in Section 6 of this report. This sustainability and renewable Environmental Standards Statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.

2.2. Local Policy

The adopted Places for Everyone Joint Development Plan 2022 to 2039 (March 2024) provides a set of guidelines for new development within Manchester. All relevant energy policy within these documents is provided within this section together with a design response.

Table 3 – Key Local Planning Policy Requirements and Design Responses

Places for Everyone Joint Development Plan 2022 to 2039 (March 2024)		
Section	**Policy Requirements**	**Design Response**
Policy JP-S1: Sustainable Development	To help tackle climate change, development should aim to maximise its economic, social and environmental benefits simultaneously, minimise its adverse impacts, utilise sustainable construction techniques and actively seek opportunities to secure net gains across each of the different objectives. Carbon and Energy Within this, new development will have a critical role to play and all new homes and commercial/industrial buildings will need to achieve net zero carbon by 2028.The definition of net zero carbon development has been established by the UK Green Building Council. It is expected that development in the Plan area will apply a net zero carbon approach to operational emissions up until 2028, thereafter emissions in construction should be considered. Minimum carbon reduction targets will be set in line with the Future Homes Standard of 80% or until such a time this is superseded. To provide further confidence in decision making, supporting research23 was commissioned to outline how the pathway to 2028 can be achieved for 'net zero in operation'24 by setting out critical milestones and measures that would be expected when following the energy 'hierarchy' and adopting a fabric first approach. 5.17 Based on the evidence which has informed the 5 Year Environment Plan and achieving net zero carbon in new development, this has shown that there will need to be a significant increase in photovoltaic technology. Therefore, where planning applications for residential development are accompanied by an energy statement,	The proposed former British Legion development will follow the principles of the Energy Hierarchy by adopting a passive fabric-first approach to design rather than adopting the use of renewable technologies. A full energy strategy is provided in Section 8 of this report, following an appraisal of a range of site-specific measures in line with the 'Be Lean, Be Clean, Be Green' approach. A fabric first approach to the development is a much-preferred method with the use of highly efficient heat pumps to provide hot water to the apartments.

<table>
<tr>
<td></td>
<td>the following best practice thresholds should be seen as the starting point in relation to reducing energy demand and onsite renewable energy generation. The thresholds set out in Table 5.1, for post 2025, are consistent with the GM Five Year Environment Plan.

Table 5.1 Best Practice Thresholds for Reducing Energy Demand and Onsite Renewable Energy Generation within residential developments

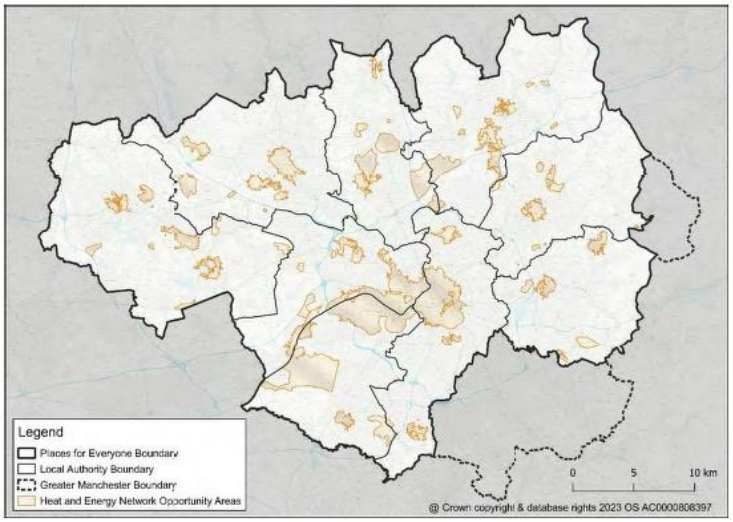
<table>
<tr><th>-</th><th>Space Heat Demand[25]</th><th>Hot Water Energy Demand[26]</th><th>Renewable Energy Generation Targets</th></tr>
<tr><td>2021 - 2025</td><td>Houses (30kWh/m2)

Flats (25kWh/m2)</td><td>20% energy demand reduction in the total heat required for water heating</td><td>*Photovoltaic installation: 20% ground floorspace</td></tr>
<tr><td>2025 - onwards</td><td>Houses (20kWh/m2)

Flats (15kWh/m2)</td><td>^20% energy demand reduction in the total heat required for water heating</td><td>*Photovoltaic installation: 40% ground floorspace</td></tr>
<tr><td>*Ground floorspace used as a proxy for available roof area.</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>^will need to be reviewed with Future Homes Standard 2025 to determine if savings already embedded.</td><td>-</td><td>-</td><td>-</td></tr>
</table>
5.19 By following the energy hierarchy, new development will need to achieve net zero carbon through the maximisation of on-site measures first. However, in circumstances where a development has demonstrated that the hierarchy
has been followed and there are no reasonable alternatives to meet the
minimum carbon reductions, then payment to offset remaining emissions will
also be required. Such payments should be expected to fund other carbon
saving programmes within Greater Manchester to help meet the 5 Year
Environment Plan targets (such as energy efficiency retrofit and renewable
energy installations).</td>
<td></td>
</tr>
<tr>
<td>Policy JP-S2: Carbon and Energy</td>
<td>The aim of delivering a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions, will be supported through a range of measures including:</td>
<td>Renewable technologies have not been specified for this development due to financial viability and</td>
</tr>
</table>

	1. Promoting the retrofitting of existing buildings with measures to improve energy efficiency and generate renewable and low carbon energy, heating and cooling; 2. Promoting the use of life cycle cost and carbon assessment tools to ensure the long-term impacts from development can be captured; 3. Taking a positive approach to renewable and low carbon energy schemes, particularly schemes that are led by, or meet the needs of local communities; 4. Increasing the range of nature-based solutions including carbon sequestration through the restoration of peat-based habitats, woodland management, tree-planting and natural flood management techniques; 5. An expectation that new development will, unless it can be demonstrated that it is not practicable or financially viable; a. Be net zero carbon which applies: • from adoption– to regulated operational carbon emissions; • from 2028 -to all emissions 'in construction'. From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions. Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy, which in order of importance seeks to: i. Minimise energy demand; ii. Maximise energy efficiency; iii. Use renewable energy; iv.Use low carbon energy; and v.Utilise other energy sources. From 2025 any residual carbon emissions that cannot be fully mitigated on-site should be offset, in agreement with the relevant local planning authority through a financial contribution to a carbon offset fund. As an interim measure, development should be consistent with the 2022 Part L Building Regulations unless superseded by changes to building regulations and/or national or local planning policies. b. Incorporate adequate electric vehicle charging points, in line with Part S of the Building Regulations, unless superseded by relevant Local Plan policies, to future proof for the likely long-term demand, taking account of the potential maximum energy demand for the site;	ongoing maintenance issues.

	c. Where practicable, prioritise connection to a renewable energy/heating/cooling network in the first instance or a low carbon energy/heating/cooling network that is adaptable to non-fossil fuels at a later date; d. In residential developments, achieve energy demand reductions in terms of space heat demand; hot water energy demand and the delivery of on-site renewable energy generation, in accordance with Table 5.1. For renewable energy generation priority should be given to PV installation where technically feasible, alternative technologies will be appropriate where the equivalent generation is evidenced. Include a detailed energy statement to demonstrate via site relevant evidence how the development has sought to maximize reductions in carbon emissions in line with relevant policy targets, including the minimisation of overheating risks and appropriate measures for post occupancy evaluation.	
Policy JP-S3: Heat and Energy Networks	The provision of decentralised energy infrastructure is critical to the delivery of our objectives for low carbon growth, carbon reductions and an increase in local energy generation. The following measures will help to achieve this: 1. Delivery of renewable and low carbon energy schemes will be supported with particular emphasis on the use of decentralised energy networks in areas identified as "Heat and Energy Network Opportunity Areas". These have been identified where: • Existing heat/energy networks are operational or have been commissioned; • Proposals for new heat networks/energy networks are being progressed, or future opportunities have been identified in city-region master planning; • Sufficient density of existing heat demand occurs; and • Significant future development is proposed at the strategic development locations. 2. Within the identified "Heat and Energy Network Opportunity Areas", unless it can be demonstrated that there are more effective alternatives for minimising carbon emissions or such connection is not practicable or financially viable, it is expected that:	An overview of the site in relation to current decentralised networks in the region is provided in Section 6.1. A review of district heating opportunities is provided in Section 6 of this report, in line with current local development. The proximity of the site to current decentralised energy networks is illustrated within Section 6.1 of this report.

	• New residential developments that are '10 dwellings or more' or other developments over 1,000 m2 floorspace shall: a. Connect to an existing or planned heat/energy network or be designed to enable future connection (where within 500m of such a network); and/or b. Install a site-wide or communal heat/energy network solution. • An expectation that new industrial development will demonstrate that opportunities for using waste heat locally have been fully examined, and included in proposals; • An expectation that where publicly-owned buildings and assets adjoin new major development sites, opportunities for these buildings and assets to connect to site-wide proposals will be considered; and • An expectation that any site-wide networks will be designed so as to enable future expansion to adjoining buildings or assets as appropriate. Figure 5.1 Heat and Energy Network Opportunity Areas  Flood Risk and the Water Environment 5.39 Climate change and population and economic growth can put increasing pressure on the available potable water supply for homes and businesses. It is important that water is conserved and efficiently used as much as possible to help build resilience to periods of drought; avoid over abstraction; reduce carbon emissions from water treatment and disposal; and protect river and wetland habitats from	Due to the relatively small scale of the development, the development of an energy centre would not be a feasible design solution.

	degradation. All new homes have to meet mandatory national standard set out in Building Regulations (of 125 litres/person/day). Where there is a clear local need, the government's Housing Optional Technical Standards paragraph 013 and 014 set out that local authorities may also consider tighter water efficiency requirements for new homes (110 litres a day) to help manage water demand. This will be determined through the preparation of district local plans.	

3. Methodology

The first step of the full energy strategy assessment has been to undertake a baseline energy assessment. The baseline energy assessment consists of calculating the total CO_2 emissions of the development to meet Building Regulations and then compare the proposed improvement measures against this baseline. Building Regulations Part L1 2021 (SAP) applies to each of the 14No. dwellings and provides carbon emissions from regulated energy.

The building can then be benchmarked/ thermally modelled using the energy hierarchy:

1. Be Lean *A reduction in energy use as a result of passive design and energy efficiency*
Thermal performance of envelope (U values) Glazing design Airtight construction Efficient mechanical ventilation Variable speed fans and pumps Efficient lighting
2. Be Clean *A focus on supplying energy to the development through efficient means*
Connect to low carbon heat networks Develop site wide heat network from single energy centre On site district heating network Provide energy efficient individual heating
3. Be Green *The installation of renewable technologies to meet energy demand where possible*
Consider the feasibility of renewable energy technologies Assess the integration of renewable technologies based on the above measures

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency improvements, district heating, etc.) and finally the use of renewable energy technologies, where

practical. This hierarchy complements the integrated approach to the sustainable energy objectives of the energy hierarchy, as set out in the PFE (2024) planning policies.

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies:

- Biomass heating
- Biomass combined heat and power
- Solar hot water
- Solar photovoltaic
- Ground source heat pumps
- Air source heat pumps / exhaust air heat pumps
- Wind power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, maintenance, and operation, etc.

Feasible renewable energy technologies have been considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site are considered as part of this statement.

4. Baseline Energy Assessment

Energy Counsel have based the analysis on current Building Regulations ADL1 2021 (SAP 10), taking into account solutions that must not only be energy efficient but also practical, reliable and user friendly. Energy Counsel have carried out preliminary SAP 10 calculations for the dwellings. Under Building Regulations Part L1 2021, dwellings must comply with all three metrics set by the notional building shown below.

- Dwelling Emissions Rate (DER) < Target Emissions Rate (TER),
- Dwelling Primary Energy Rate (DPER) < Target Primary Energy Rate (TPER),
- Dwelling Fabric Energy Efficiency Rate (DFEE) < Target Fabric Energy Efficiency Rate (TFEE)

SAP 10 is the Governments Standard Assessment Procedure (SAP) for calculating the energy aspects of a dwelling. SAP is a measure of fuel costs for heating, hot water and lighting for a dwelling. SAP 10 can also be used to ascertain the energy requirements of a development.

To assess the baseline carbon emissions, we must make an estimation of the energy demands through Building Regulations in order to set a target upon which the actual development can be compared.

4.1. Predicted Baseline Energy Requirements

The predicted baseline CO_2 emission and primary energy demands for the development:

Table 4 - Baseline dwelling carbon emissions and primary energy

Our Ref	Dwelling Type	No. of Type	Floor Area m2	TER (Kg CO2/ yr/m2)	TPER (kWh/ yr/m2)	Total Target Carbon Emissions (Kg CO2/yr)	Total Target Primary Energy (kWh/yr)
Z60104	M4 (3) Ground Floor Apt	1	90.96	11.60	60.97	1,055	5,546
Z60105	M4 (2) Ground Floor Apt	2	50.09	13.86	73.35	1,388	7,348
Z60106	M4 (2) Mid Floor Apt	2	50.09	12.43	65.70	1,245	6,582
Z60107	M4 (2) Mid Floor Apt	1	50.09	13.05	69.12	654	3,462
Z60108	M4 (2) Top Floor Apt	3	50.09	13.09	69.27	1,967	10,409
Z60109	M4 (3) Ground Floor Apt	1	61.01	13.92	73.57	849	4,489
Z60110	M4 (3) First Floor Apt	1	61.01	11.60	61.07	708	3,726
Z60111	M4 (3) Top Floor Apt	1	61.01	12.84	67.78	783	4,135
Z60112	M4 (2) Mid Floor Apt type 2	1	66.35	10.29	54.08	683	3,588
Z60113	M4 (2) Top Floor Apt type 2	1	66.35	11.79	62.01	782	4,114
Total		**14**				**10,115**	**53,399**

The baseline carbon emissions rate for the development is **10,115 KgCO_2/yr** and the baseline primary energy rate is **53,399 kWh/yr**.

5. Passive Design and Energy Efficiency

The approach of the development is to embed sustainability into the heart of the design from the outset of the project design process. The design will be developed with sustainable solutions, taking into account the relevant policies and strategies of the Places for Everyone Joint Development Plan (2024). The development will seek to consider all aspects and principles of sustainable development, taking into account environmental, social and economic impacts.

5.1. Passive Design Measures

The philosophy for the site is to achieve as much of the necessary reduction in carbon emissions through the use of passive design techniques and energy efficient measures as possible, before resorting to the use of LZCs. This ensures that the highest standards of building fabric and energy efficiency are achieved, rather than offsetting a poorer performance with LZC contributions.

This will be undertaken through a fabric first energy efficient design approach with high levels of thermal efficiency and a reduction in energy demand through efficient lighting design.

5.2. Energy Efficient Systems

Options have been reviewed for improving the energy efficiency of the development by installing an efficient heating system. The apartments will benefit from high efficiency hot water heat pumps for water heating, with efficient direct electric heating.

6. District & Communal Heating Networks

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the dwellings in line with the energy hierarchy.

6.1. Decentralised Heating Networks

The energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

One of priorities for reducing CO_2 emissions is to reduce the ’s reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de- centralised energy systems.

Decentralised plant generally means any heating and hot water and/or electricity generation provided on a district wide (DHN) or site wide (CHN) basis. DHN and CHN can typically include combined heat and power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

A number of heat network opportunities across the region are at various stages of development. Benefits of district heating networks can include:

- Provision of low carbon / lower cost heat to domestic and commercial customers
- Diversification of the energy mix
- Reductions in region-wide carbon emissions
- Targeting and reduction of fuel poverty
- Potential long-term revenue streams for local authorities
- Alignment with regeneration programmes
- Driving the growth of the low carbon services sector

There are currently no existing district heating networks within proximity to the site. The nearest district heating network is located at Christie Hospital over 3 miles North of the site.

6.2. New Heating Networks – Options

Consideration has been given to adopting a centralised or decentralised energy strategy. A de-centralised energy option would typically be an energy centre distributing heat, hot water and electricity to the development from a single source either as a DHN or CHN. This typically would include boilers and a CHP type unit or district heat pumps, sized to provide the whole development.

Sometimes multiple energy centres are used to split the loads, provide resilience and to serve different buildings.

The proposed heating and hot water demand from the development of 14No. dwellings is not sufficient to justify a DHN or CHN. The existing site is spatially constrained and there is insufficient space to locate the equipment and associated plant.

7. Renewable Energy Technologies

Energy Counsel have reviewed options for the use of on-site renewable energy/ Low or Zero Carbon Technology (LZT) in line with Places for Everyone Joint Development Plan (2024).

This renewable Environmental Standards Statement/strategy reviews the technical and economic feasibility of the following technologies –

- Solar Photovoltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps / Exhaust Air Heat Pumps
- Micro Wind Power
- Biomass

7.1. Photovoltaics (PV)

Photovoltaic panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

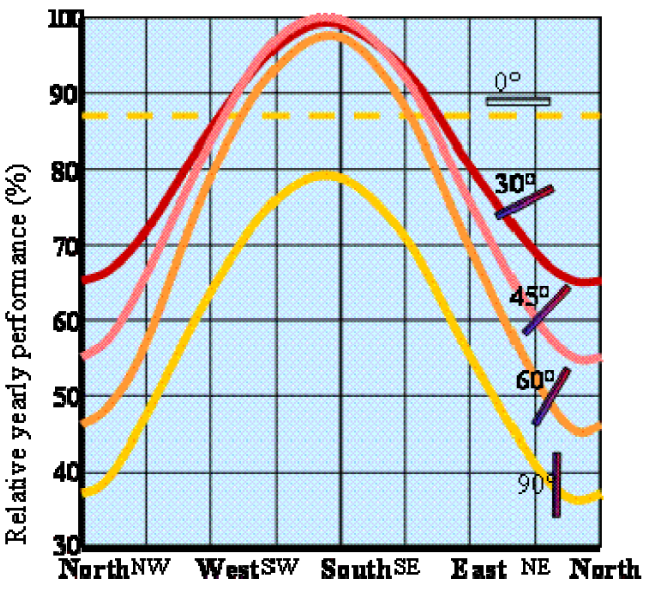


Figure 3 - Performance of photovoltaic panel orientation

The amount of energy PV cells generate is referred to as Kilowatt Peak (KWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. The roof must be strong enough to take the weight of the panels, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle.

The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 35° and 45° and oriented south of west or east are generally suitable. If solar

collectors are oriented away from due south then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph to the right:

The cost to install PV is typically £1,000 - £1,500 per kWp for 'on-roof' panel systems.

Photovoltaic panels have been proposed on the building, connected to each apartment individually to ensure an improved EPC rating. Each apartment will have it's own allowance of PV via a Solshare system. Further details of PV is included within Appendix 10.2 of this report. This method ensures that carbon emission reductions are provided in line with Places for Everyone Joint Development Plan (2024).

Figure 4 - Photovoltaic array on a pitched roof

7.2. Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage; the less pipe work is required.

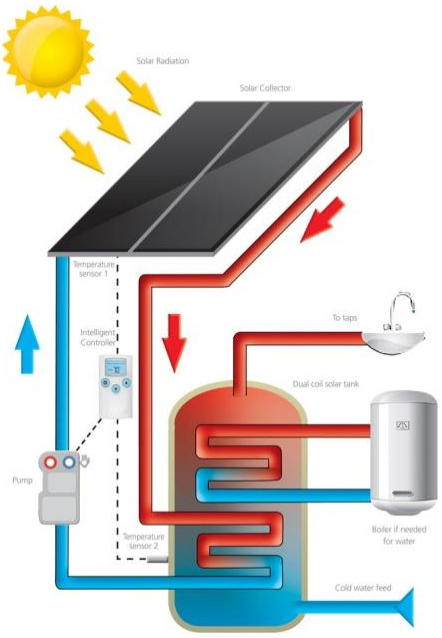


Figure 5 - The principles of a solar thermal system

Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m^2 which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

The use of solar thermal panels are applied best in conjunction with individual heating systems for each dwelling. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however it will not achieve significant carbon savings. Carbon savings of approximately 4-5% are achievable with this technology. The dwellings are unlikely to require sufficient hot water storage to deem solar thermal a feasible technology for this site. For the reasons aforementioned this is not an appropriate option for this scheme.

7.3. Ground Source Heat Pump (GSHP)

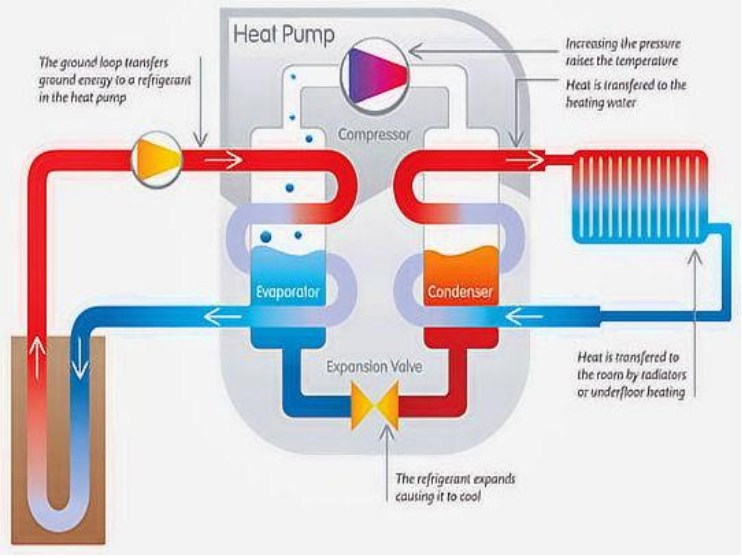


Figure 6 - Principles of a GSHP system

GSHPs have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to apartments as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHPs use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for

the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Due to the scale of these dwelling units, GSHPs are not considered an appropriate design solution.

7.4. Air Source Heat Pump/Exhaust Air Heat Pump

Air source heat pumps (ASHP) and exhaust air heat pumps (EAHP) work in a similar way to GSHP. Air source heat pumps can be fitted on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

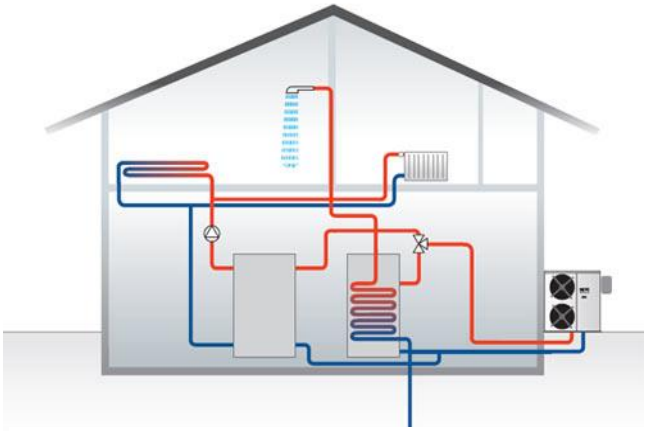


Figure 7 - Principles of an ASHP system

Exhaust air heat pumps such as the NIBE F370 work in a similar manner to ASHP units but have only indoor units (no outdoor compressors) and in addition they also recover heat from their integral exhaust air ventilation system. These units work well on apartment blocks and dwellings where mains gas is unavailable or unsuitable for a development. They are expensive in terms of capital cost of the equipment, installation and the enhanced structural requirements.

ASHPs are considered the most appropriate technology for this scheme and can be utilised for hot water throughout the dwellings. The introduction of this technology ensures that carbon emissions reductions can be provided in line with Places for Everyone Joint Development Plan (2024).

7.5. Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC)

electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

Figure 8 - Mounted wind turbine

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of dwellings
- Mast mounted – Which are free standing

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- The ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwellings or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence

As this development is in an urban area there will be obstacles which reduce wind speed. The average wind speed in this area is 4.8 m/s at a height of 10 metres, which is less than the 6 m/s required. Therefore, micro wind is not a viable technology for this development.

7.6. Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Figure 9 - Biomass boiler and hopper

Air quality issues re also an important factor when looking to install biomass. The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to a communal heating system; there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason, biomass is discounted.

8. Energy Assessment of Proposed Scheme

The former British Legion residential development has adopted the principles of the 'Be Lean, Be Clean, Be Green' approach. The most practical and economically feasible solution for the development is a good quality thermally insulated fabric, air-tight envelope, passive improvements, and the use of direct electric heating with highly efficient hot water heat pumps with efficient ventilation system.

Table 5 - Proposed carbon emissions from the former British Legion site residential development

Ref	Dwelling Type	No.	TER	DER	TPER	DPER	Total Carbon Emissions (Kg CO2/yr)	Total Primary Energy (kWh/yr)
Z60104	M4 (3) Ground Floor Apt	1	11.60	0.62	60.97	22.78	56	2,072
			94.66%		62.64%			
Z60105	M4 (2) Ground Floor Apt	2	13.86	1.01	73.35	26.37	101	2,642
			92.71%		64.05%			
Z60106	M4 (2) Mid Floor Apt	2	12.43	0.98	65.70	22.27	98	2,231
			92.12%		66.10%			
Z60107	M4 (2) Mid Floor Apt	1	13.05	1.67	69.12	25.62	84	1,283
			87.20%		62.93%			
Z60108	M4 (2) Top Floor Apt	3	13.09	1.48	69.27	27.26	222	4,096
			88.69%		60.65%			
Z60109	M4 (3) Ground Floor Apt	1	13.92	0.47	73.57	24.19	29	1,476
			96.62%		67.12%			
Z60110	M4 (3) Mid Floor Apt	1	11.60	1.46	61.07	24.50	89	1,495
			87.41%		59.88%			
Z60111	M4 (3) Top Floor Apt	1	12.84	0.70	67.78	23.04	43	1,406
			94.55%		66.01%			
Z60112	M4 (2) Mid Floor Apt type 2	1	10.29	1.43	54.08	20.65	95	1,370
			86.10%		61.82%			
Z60113	M4 (2) Top Floor Apt type 2	1	11.79	1.18	62.01	23.35	78	1,549
			89.99%		62.34%			
Total		**14**	**91.15%**		**63.26%**		**895**	**19,620**

The carbon emissions are **895 kgCO_2/yr**. This is a total carbon reduction of **9,219 kgCO_2/yr** from the baseline emissions of **10,115 kgCO_2/yr**. This equates to a **91.15%** carbon reduction. The primary energy rate is **19,620 kWh/yr**. This is a primary energy reduction of **33,779 kWh/yr** from the baseline primary energy rate of **53,399 kWh/yr**. This equates to a **63.26%** primary energy reduction.

The development proposal achieves carbon efficiency reductions through a highly efficient thermal fabric, energy efficient lighting and ventilation, improved thermal bridging, low air leakage and highly efficient heat pumps for domestic hot water heating reduce emissions in line with Places for Everyone Joint Development Plan (2024).

9. Sustainable Design and Construction

The design currently includes a number of components that gives the scheme a solid grounding in relation to sustainability. The list below is not exhaustive but spans a range of areas as follows:

9.1. Management

- The contractor will manage and monitor environmental issues during construction process in accordance with their company policy and site management plan. It may include the monthly monitoring and management of energy and water consumption of site activities, separation, streaming and recycling of waste, the reduction of air, dust and ground pollution.

9.2. Health and Wellbeing

- External and internal lighting to the proposed development will be highly efficient and will comply with all current guidelines and regulations.

9.3. Energy

- The development will be designed and constructed to achieve low energy and carbon dioxide emissions, improving upon current Building Regulations Part L1A 2021 using the Be Lean, Be Clean, Be Green energy hierarchy.
- Dedicated energy efficient lighting will be installed internally and externally. The efficacy and colour rendering index ratings will be considered.
- Unregulated energy demand will be assessed and minimised where possible through the selection of energy-efficient appliances and systems.

9.4. Water

- The proposed development will be fitted with a water meter and units will incorporate water saving and efficiency measures that comply with Regulation 36(2)(b) of Part G2 of the Building Regulations to ensure that a maximum of 110 litres of water is consumed per person per day. Suggested water appliance details are shown in Table 6.
- Internal water consumption will be reduced using low flush/ flow appliances. This will include appliances such as aerated and flow regulated taps, low-flow showers and dual flush toilets, where practicable.

Table 6 - Recommend water consumption for residential appliances

Sanitary fittings	Flow rate or capacity		Consumption (L/person/day)
WC (Full Flush)	4	L/flush	13.53
WC (Half Flush)	2.6	L/flush	
Hand Basin Tap	3	L/min	6.32
Shower	6	L/min	43.7
Bath	140	L/capacity	15.40
Kitchen Tap	4	L/min	12.12
Washing Machine	8.17	L/kg dry load	17.16
Dishwasher	1.25	L/place setting	4.50
Total	Incl. normalization factor 0.91		**104.18**

9.5. Materials

- All building and construction materials used on the schemes will aim to be sought from environmentally managed accreditation schemes, (such as EMAS/ ISO 14001 accreditation). All timber will be sourced from a certified chain of custody. All other building materials on this project will be responsibly sourced, where practicable.
- Insulation will have low environmental impact in use and during manufacture.

9.6. Waste

Wherever practicable, site waste as a result of the development will be diverted from landfill.

10. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy, the proposed design solutions are predicted to:

1) Reduce the total carbon emissions by 91.15% compared to new building regulations ADL 2021. New building regs are a 31% improvement on 2013 regs, which in turn were a 6% improvement on 2010 regs upon which the energy policies are based. Therefore, the overall improvement of this project, based on 2006 standards is 128.15% betterment, which is greater than the requested 15% in the energy policy EN6.
2) The heat pumps are the renewables/ low carbon technology. Their contribution to the overall energy reduction under the 'be green' energy hierarchy is approx. 50%.
3) Reduce the total primary energy by 63.26% compared to new building regulations ADL 2021. This is a new metric under Part L.

The approach for the former British Legion site residential development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Enhanced building fabric to meet the new Building Regulations ADL1 2021 (15/06/2022)
2. Enhanced air tightness and thermal bridging.
3. Highly efficient mechanical ventilation with heat recovery system (MVHR) provided to all apartments.
4. Space heating will be provided by highly efficient direct electric heating
5. Hot water will be provided by highly efficient air to water heat pumps
6. Efficient lighting strategy primarily using CFL or LED type fittings.
7. PV is included with a total allowance of 29.48kWp shared between all apartments via a Solshare system so each apartment benefits from the PV generated. Each apartment will have export capable meters installed.

10.1. Low/ Zero Carbon Technologies (LZT) Discounted

- Solar Thermal Hot Water is not a viable option as heat pumps are proposed and hot water demand will be heated and stored efficiently through this system.
- PV has not been included within the preliminary SAP calculations as heat pumps provide the necessary carbon emission reductions required by the Places for Everyone Joint Development Plan (2024).
- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a centralised larger plant space for storing fuel, which on this constrained site is not viable.

- Micro-wind turbines do not work on this type of development due to problems with wind turbulence and mounting of the units. The wind speeds in the area are not conducive to wind power electricity generation and there would be issues with turbulence, wind shading, noise and air traffic.
- GSHPs are not viable for site because of spatial and financial costs. There is no room to accommodate a GSHP vertical bore and associated communal plant room, ground conditions are unknown, and systems are very costly.
- Hot Water Heat Pumps are considered the most viable option for the dwellings and can provide a carbon emission reduction in line with the requirements of Manchester City Council's Core Strategy.

A more detailed overview of LZT technologies is provided in the appendices of this report.

10.2. Summary Headlines

- A fabric-first approach to meeting Places for Everyone Joint Development Plan (2024) energy policy has been undertaken for the proposed residential development at the former British Legion site, Manchester, defined within the 'Be Lean, Be Clean, Be Green' energy hierarchy. The proposed design provides compliance with Building Regulations ADL1 2021, and the application of heat pumps for heating and hot water ensures reductions in line with Places for Everyone Joint Development Plan (2024).
- The use of high-efficiency heat pumps reduces carbon emissions by 91.15% and provides a primary energy reduction of 63.26% when compared to new building regulations Part L 2021.
- Site constraints and viability for District Heating Network (DHN) and Communal Heating Network (CHN) have been reviewed. Existing DHN is not sufficiently close to connect into. In addition to this, the scheme's heating and hot water (HW) demand is too small to justify connection to DHN or CHN.

An overall 91.15% improvement in CO_2 emissions and a 63.26% improvement in primary energy above the Building Regulations baseline is proposed to support our application and to meet policy requirements.

	Total CO_2 Emissions ($kgCO_2/yr$)	**Total Primary Energy (kWh/yr)**
Target Dwelling Performance	**10,115**	**53,399**
Proposed Dwelling Performance	**895**	**19,620**
Total Reduction	**9,219**	**33,779**
Percentage Improvement (above ADL1 2021)	**91.15%**	**63.26%**

10.Appendices

10.1. LZT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Solar photovoltaics	A photovoltaic array is required for the apartments shared individually via a Solshare system to ensure the benefit is provided to each individual flat. This also further reduces carbon emissions in line with BRegs Part L1 2021.	A 1kWp system could save around 213 kg of CO2 / year per dwelling	Average cost for such a system is around £1.5K per dwelling.	Current potential income generation is around £120 minimum per annum per dwelling with a fuel cost saving of around £40 / year per dwelling.
Wind	Average wind speeds on the site according to the NOABL Wind Speed Database are 4.8m/s. To be technically feasible a minimum of 6m/s is required, therefore this site is not considered feasible.	N/A	N/A	N/A
Micro Hydro	There is no capa for micro hydro on this site since there are no local water courses available.	N/A	N/A	N/A
District Heating	There are no existing or planned district heating networks to facilitate connection at this stage.	N/A	N/A	N/A
Solar Hot Water	This technology has been discounted as the level of hot water usage in each dwelling does not merit a storage system, which poses space issues.	Around 270 kg of CO2 / year per dwelling.	£3-5K per dwelling	Income generation from RHI in a 4-person household would be in the region of £340 / year (per dwelling) with a fuel saving of around £65 / year per dwelling
Heat Pumps	GSHP: Ground conditions on site are unknown, and installation of coils are likely not economically viable for this project. ASHP: Provided to all dwellings for hot water only.	GSHP: 2,100 to 3,300 kg CO2 / year per dwelling ASHP: 1,700 to 2,700 kg CO2 / year per dwelling.	GSHP @ £13-20K per dwelling ASHP: £7-11K / dwelling	GSHP: £2,590 minimum annual RHI income generation per dwelling with fuel saving of £440 / year minimum per dwelling ASHP: £920 minimum annual RHI income generation per dwelling with fuel saving of £335 / year minimum per dwelling
Biomass	The small scale of this development would not facilitate the installation of biomass boilers due to the space required for pellet storage.	N/A	N/A	N/A

10.2. Specification for Apartment Energy Assessments (ADL1 2021 – SAP 10)

Item	Brief Description	Notes	Confirm
	The following information is required for the design submission (as per requirements of AD L1).	Please note submission is in two stages. A) **Design**, B) As installed	
1. Dwelling Type			
1.1	Building Regulations Part L1 2021 apply.		
1.2	Post code of site is M16 8AJ.		
1.3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.	*Assumed Standard tariff*	
1.4	It is assumed that the dwellings have a medium thermal mass parameter.	*Masonry Construction*	
2. Floor Construction Details			
2.1	Ground floor is insulated block and beam floor to achieve the U-value stated opposite.	U-Value = 0.11-12W/m²K P/A ratio dependent per flat	
2.2	Exposed floors over unheated plant room to be insulated to achieve the U-value stated opposite.	U-Value = 0.14 W/m^{2}K	
3. Wall Construction Details			
3.1	Main external walls to be masonry construction, fully filled insulated cavity to achieve the U-value stated opposite.	U-Value = 0.18 W/m²K	
3.2	Party walls between dwellings are fully filled and sealed to achieve the U-value stated opposite.	U-Value = 0.0 W/m²K	
3.3	Corridors and stairwells are unheated, therefore corridor walls must be designed as a heat loss wall insulated to achieve the U-Value stated opposite.	U-Value = 0.22 W/m²K	
3.4	Walls between dwelling and unheated plant room to be fully filled insulation to achieve the U-Value stated opposite.	U-Value = 0.23W/m^{2}K	
4. Roof Construction Details			
4.1	All cold conventional roofs are insulated at the ceiling to achieve the U-value indicated opposite.	U-Value = 0.09 W/m²K	
4.2	All flat roofs over dwellings are insulated to achieve the U-value indicated opposite.	U-Value = 0.13 W/m²K	
4.3	All warm sloping roofs insulated at the rafters are insulated to achieve the U-Value indicated opposite.	U-Value = 0.13 W/m²K	
5. Openings			
5.1	Apartment doors open onto cold corridors and U value opposite applies	Ud-Value = 1.4 W/m²K This is a standard value based on a fire rated solid timber door with shelter factor applied	
5.2	All BFRC Certified double-glazed windows and patio type doors/windows with Low-e glass hard coating to achieve the U-Value stated opp.	Ud-Value = 1.3 W/m²K frame and glazing G-value =0.4 *BFRC certified	
5.3	Entrance doors to the block of flats (not to the flats themselves) are installed to achieve the U-value stated opposite.	ADL2A limiting (max) U-Value = 1.6 W/m²K	
6. Ventilation			
6.1	Dwelling Design stage SAP calculation presumes an air permeability of 4m^3/m^2/hr at 50pa will be achieved.	4m^3/m^2/hr at 50pa	
6.2	MVHR is installed in all wet areas incl. bathrooms, ensuites and kitchens	Vent Axia Sentinel Kinetic Plus B	

6.3	No open flues or fireplaces or flue-less gas fires are present anywhere.		
7. Space Heating			
7.1	Space Heating to all apartments is provided by individual wall mounted electric panel heaters	Direct electric panel heating with programmer and appliance stats	
8. Water Heating			
8.1	Hot water is provided by hot water heat pumps with cylinder storage to the flats as indicated opposite	Vaillant Arostor 200l or equivalent.	
8.2	Water usage per person per day is ≤105 Litres.	To exceed Part G. Requires good specification of flow rates on all water consuming appliances – taps, showers, etc	
8.3	Showers will be supplied from the heat pump system	Flow regulated <9l/min	
9. Renewables			
9.1	PV is included. Allowance of 29.48kWp PV shared between the flats on a Solshare system so each apartment benefits from the PV generated electricity. Each flat to have export capable meters installed. Each PV panel to be 440W.	440W PV panels assumed. Total panels = 67 Apt 01 – 7 panels Apt 02 – 9 panels Apt 03 – 5 panels Apt 04 – 5 panels Apt 05 – 4 panels Apt 06 – 3 panels Apt 07 – 3 panels Apt 08 – 4 panels Apt 09 – 4 panels Apt 10 – 6 panels Apt 11 – 4 panels Apt 12 – 5 panels Apt 13 – 4 panels Apt 14 – 4 panels	
10. Other			
10.1	Masonry elements to use recognized construction details (RCD) for thermal bridging junctions where applicable: E2, E3, E4, E5, E7, E10, E12, E16, E17 E18, E20, E21 and P1, P4 and P8 (P3 is zero).	We have used Recognised Construction Details for all psi values listed	
10.2	Split/isolated lintels will be installed to achieve improved thermal bridging as E2	Psi value of 0.015W/mK. Split	
10.3	Low energy (LE) lights are installed throughout.	All apartment and communal lighting to meet an min efficacy of 90 lumens/circuit watt. The Contractor will provide a drawing and schedule of all proposed light fittings with efficacies detailed.	
10.4	All dwellings will require further analysis to comply with part O	Part O overheating assessment required for all dwellings.	
10.5	Provide all design and as built evidential requirements to meet building regulations compliance standards. Refer to EC guide on photographic evidence as attached.	The evidence must be submitted to the OCDEA and Building Control at least 3 weeks before handover for their review and sign off	

10.3. Index of Tables and Figures

Figure 1 - Location and surrounding area of proposed British Legion residential development. 8
Figure 2 – Architectural site plan for the proposed British Legion residential development 9
Figure 3 - Performance of photovoltaic panel orientation 27
Figure 4 - Photovoltaic array on a pitched roof 28
Figure 5 - The principles of a solar thermal system 28
Figure 6 - Principles of a GSHP system 29
Figure 7 - Principles of an ASHP system 30
Figure 8 - Mounted wind turbine 31
Figure 9 - Biomass boiler and hopper 32

Table 1 - Proposed development CO_2 emissions against Building Regulations Part L1 2021 6
Table 2 – Key National Planning Policy Requirements and Design Responses 13
Table 3 – Key Local Planning Policy Requirements and Design Responses 14
Table 4 - Baseline dwelling carbon emissions and primary energy 22
Table 5 - Proposed carbon emissions from the former British Legion site residential development .. 33
Table 7 - Recommend water consumption for residential appliances 35