Energy Statement

36-40 Rickmansworth Road, Northwood

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Executive Summary

This Energy Statement has been prepared in support of a planning application for the erection of a new 3½-storey building comprising 25, 1, 2 and 3-bedroom apartments on land at 36-40 Rickmansworth Road, Northwood. The Statement consists of an energy demand assessment showing how selected energy efficiency, low carbon and renewable energy measures have been considered and those that have been incorporated into the scheme.

The Ministerial Statement made on the 27th March 2015 has withdrawn the Code for Sustainable Homes and the Government have proposed local authorities do not seek to impose Code planning conditions with immediate effect..

Working drawings have yet to been produced but representative SAP calculations have been prepared based upon the construction specification set out within the report and the detailed planning drawings. This provides an accurate assessment of the carbon dioxide emissions arising from the building and allows the testing of differing technologies.

It is proposed to enhance the fabric insulation standards of the apartments above the minimum required by the Building Regulations. In addition it is proposed to install a photovoltaic array of 15.696 kW on the roof of the building. This location will not detrimentally impact on the aesthetics of the development and the Roof Plan attached as Appendix 1 shows a total of 48 x 327W photovoltaic panels.

The reductions in emissions can be summarised as follows:

	Total Emissions	% Reduction
	kg CO_2 per year	
Baseline (Building Regulations TER)	**26,438**	-
Emissions - after energy efficiency	24,714	6.52%
Be Green - after efficiency and LZCs	**17,082**	**35.39%**
Reduction from renewables	**7,632**	**30.88%** (of DER)

1.0 Introduction

This report has been commissioned by Howarth Homes and provides an Energy Statement for the construction of a new 3½-storey building comprising 25, 1, 2 and 3-bedroom apartments on land at 36-40 Rickmansworth Road, Northwood.

The report describes the methodology used in assessing the development and the initiatives proposed.

The building has been designed and will be constructed to reduce energy demand and carbon dioxide emissions. The objective is to reduce the energy demand to an economic minimum by making investment in the parts of the building that have the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric. Once a cost effective structure has been designed, low-carbon and/or renewable technologies will be considered to provide heat and/or electricity.

The following hierarchy will be followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.

2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled "A better quality of life: A strategy for sustainable development in the UK". This sets out four main objectives for sustainable development in the UK:

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

- National Planning Policy Framework - 2012

NPPF Core Planning Principle 17 states;

"support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy)"

Regional and Local Policies

The Development Plan comprises the London Plan (2015) and the Hillingdon Local Plan: Part 1, Saved Unitary Development Plan policies.

London Plan, published March 2015 – the following policies are relevant to the application:

Policy 5.2 - Minimising carbon dioxide emissions

A Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1 Be lean: use less energy

2 Be clean: supply energy efficiently

3 Be green: use renewable energy

B The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential buildings:

Year	***Improvement on 2014 Building Regulations***
2013 – 2016	*35 per cent**

C Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

D As a minimum, energy assessments should include the following details:

a calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy

b proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services

c proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)

d proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

Policy 5.3 - Sustainable design and construction

A *The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.*

B *Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.*

C *Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:*

- *a. minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)*
- *b. avoiding internal overheating and contributing to the urban heat island effect*
- *c. efficient use of natural resources (including water), including making the most of natural systems both within and around buildings*
- *d. minimising pollution (including noise, air and urban runoff)*
- *e. minimising the generation of waste and maximising reuse or recycling*
- *f. avoiding impacts from natural hazards (including flooding)*
- *g. ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions*
- *h. securing sustainable procurement of materials, using local supplies where feasible, and*
- *i. promoting and protecting biodiversity and green infrastructure.*

Policy 5.6 - Decentralised energy in development proposals

A *Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.*

B *Major development proposals should select energy systems in accordance with the following hierarchy:*

- *1 Connection to existing heating or cooling networks*
- *2 Site wide CHP network*
- *3 Communal heating and cooling.*

C *Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.*

London Borough of Hillingdon

Local Plan: Part 1 – Strategic Policies

Hillingdon Council adopted Part 1 of the Local Plan in November of 2012.

The relevant policy extracts are set out below and are edited for clarity:

Policy BE1: Built Environment

The Council will require all new development to improve and maintain the quality of the built environment in order to create successful and sustainable neighbourhoods, where people enjoy living and working and that serve the long-term needs of all residents. All new developments should:

1. Achieve a high quality of design in all new buildings, alterations, extensions and the public realm, which enhances the local distinctiveness of the area, contributes to community cohesion and a sense of place;

2. Be designed to be appropriate to the identity and context of Hillingdon's buildings, townscapes, landscapes and views, and make a positive contribution to the local area in terms of layout, form, scale and materials and seek to protect the amenity of surrounding land and buildings, particularly residential properties;

10. All developments should be designed to make the most efficient use of natural resources whilst safeguarding historic assets, their settings and local amenity and include sustainable design and construction techniques to increase the re-use and recycling of construction, demolition and excavation waste and reduce the amount disposed to landfill;

Policy EM1: Climate Change Adaptation and Mitigation

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

3. Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.

5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.

6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.

8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydro-electricty and a greater use of waste as a resource.

14. Promoting the inclusion of passive design measures to reduce the impacts of urban heat effects.

The Ministerial Statement made on the 25th March 2015 by the DCLG said,

"From the date the Deregulation Bill 2015 is given Royal Assent, local planning authorities and qualifying bodies preparing neighbourhood plans should not set in their emerging Local Plans, neighbourhood plans, or supplementary planning documents, any additional local technical standards or requirements relating to the construction, internal layout or performance of new dwellings. This includes any policy requiring any level of the Code for Sustainable Homes to be achieved by new development; the government has now withdrawn the code, aside from the management of legacy cases. Particular standards or requirements for energy performance are considered later in this statement."

"For the specific issue of energy performance, local planning authorities will continue to be able to set and apply policies in their Local Plans which require compliance with energy performance standards that exceed the energy requirements of Building Regulations until commencement of amendments to the Planning and Energy Act 2008 in the Deregulation Bill 2015."

"This is expected to happen alongside the introduction of zero carbon homes policy in late 2016. The government has stated that, from then, the energy performance requirements in Building Regulations will be set at a level equivalent to the (outgoing) Code for Sustainable Homes Level 4. Until the amendment is commenced, we would expect local planning authorities to take this statement of the government's intention into account in applying existing policies and not set conditions with requirements above a Code level 4 equivalent."

3.0 Assessment Methodology

The baseline energy demand and carbon dioxide emissions for the apartments have been established by preparing a number of SAP calculations for a representative sample of the units.

These calculations have been based upon certain assumptions as to the building specification and these are clarified below. These are not design calculations but serve to establish the environmental, technical and economic viability of various renewable and low carbon technologies.

Emission Factors

The CO_2 emission factors, where applicable, used throughout this report have been taken from the Building Regulation Approved Document L.

	kg CO_2/kWh
Natural Gas	0.216
Grid supplied electricity	0.519
Displaced electricity	0.519

In assessing this proposal we have also been informed by the following guidance:

- **London Sustainability Checklist**

- **BRE Green Guide to Specification**
  The Building Research Establishment Green Guide to Specification lists building materials and components, and ranks their potential life cycle environmental impact.

4.0 Proposal

The proposal is for the construction of a building comprising 25, 1, 2 and 3-bedroom apartments within a single 3½-storey block.

The accommodation schedule in detail is;

Unit Type	Number	Area	Area
		m^2	m^2
1-Bedroom apartment	1	50.0	50.0
1-Bedroom apartment	4	50.3	201.2
1-Bedroom apartment	6	50.9	305.4
1-Bedroom wheelchair apartment	3	64.1	192.3
2-Bedroom apartment	2	70.8	141.6
2-Bedroom apartment	1	73.0	73.0
2-Bedroom apartment	3	74.4	223.2
2-Bedroom apartment	1	77.0	77.0
2-Bedroom apartment	1	86.5	86.5
3-Bedroom apartment	1	107.8	107.8
3-Bedroom duplex apartment	2	130.6	261.2
Totals	**25**		**1719.2**

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean and Be Clean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical. It is possible to exceed Building Regulations requirements (Part L - 2013) through demand reduction measures alone, which typically include a combination of passive design measures (e.g. building design and efficient building fabric) and active design measures (e.g. variable speed motors).

Passive Design Measures

The passive design measures proposed include;

Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The site locates the majority of apartments with principal aspects towards the southwest or northeast although a number have dual aspects towards the northwest and northeast or the southwest and southeast. All apartments benefit from access to direct sunshine at some point throughout the day. There are no apartments will a solely northerly aspect.

Natural Daylighting

The orientation and the size of the windows have been optimised to maximise the amount of natural daylight and therefore reduce the demand for artificial lighting.

Efficient Building Fabric

Building Envelope

U-values of the building envelope must meet Building Regulations Part L standards and further improvements to U-values will reduce the building's heating requirements.

There is a commitment to exceed the minimum U-values required by the Building Regulations

Whilst the construction type has not been fixed it would suit the use of traditional materials within a load-bearing structure. The following U-values have been based upon a 300mm cavity wall with 100mm cavity fully filled with XtraTherm CavityTherm or similar. Floors will be insulated with PIR insulation under a 75mm cement screed and roofs will be insulated with a combination of PIR insulation between and under rafters for sloping ceilings and mineral wool insulation for loft areas.

The following U-values are set as the backstop;

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m^2K	W/m^2K	
External Walls	**0.30**	**0.18**	**40%**
Flat Roof	**0.20**	**0.13**	**35%**
Roof (loft)	**0.20**	**0.09**	**55%**
Floor	**0.25**	**0.15**	**40%**
Windows and External Doors	**2.00**	**1.40**	**30%**

Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building.

The Building Regulations set a minimum standard for air permeability of 10 m^3 of air per hour per m^2 of envelope area, at 50Pa. Air tightness standards at this site will be constructed to the 'Accredited Construction Details' as compiled by Department of Communities and Local Government (DCLG). These will average a 55% improvement over Building Regulations and will achieve a permeability of 4.5 $m^3/hr/m^2$.

Thermal Bridging

Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO_2 reduction targets set out in this strategy.

Accredited Construction Details (ACD's) have been developed to provide the performance standards required to achieve the higher energy efficiency requirements of the Building Regulations. The bridging losses have been calculated using SAP Appendix K Table 1.

Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2006 to address the possibility of overheating and poor air quality. It is assumed mechanical extract ventilation will be provided to all WCs, bathrooms and shower rooms.

Active Design Measures will include;

Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Approved Document L1A requires three in four light fittings (75%) to be dedicated low energy fittings. The development will exceed this and all light fittings will be of a dedicated energy efficient type.

External lighting will be fitted with time controls and light sensors to ensure illumination is restricted to required times. External lighting will be limited to a maximum fitting output of 150w.

Heating

Space heating and hot water demand will be provided to the residential units by natural gas fired combination boilers. The SAPs have been modelled on the use of an Ideal Logic combination boiler.

5.2 Establishing Energy Demand and Carbon Dioxide Emissions

The average 1-bedroom apartment size is 53.5 m^2 and for the purposes of this assessment a unit at 50.9 m2 has been modelled as a ground, mid and top-floor unit.

The average 2-bedroom apartment size is 75.1 m2 and for the purposes of this assessment a unit at 74.4 m^2 has been modelled as a ground, mid and top-floor unit.

A SAP calculation has been completed for one of the duplex apartments at 130.6 m^2.

The results from the baseline SAP calculations are summarised as follows:

1-Bedroom apartment – 50.9 m^2 Ground-floor	**CO_2 TER**	**CO_2 DER**
	kg/m^2/yr	kg/m^2/yr
Space heating	5.70	4.48
Water heating	8.28	8.48
Electricity for pumps and fans & lighting	3.49	3.49
Total	**17.47**	**16.45**

1-Bedroom apartment – 50.9 m^2 Mid-floor	**CO_2 TER**	**CO_2 DER**
	kg/m^2/yr	kg/m^2/yr
Space heating	3.34	2.46
Water heating	8.37	8.57
Electricity for pumps and fans & lighting	3.49	3.49
Total	**15.20**	**14.52**

1-Bedroom apartment – 50.9 m^2 Top-floor	**CO_2 TER**	**CO_2 DER**
	kg/m^2/yr	kg/m^2/yr
Space heating	5.75	4.13
Water heating	8.28	8.49
Electricity for pumps and fans & lighting	3.49	3.49
Total	**17.52**	**16.11**

2-Bedroom apartment – 74.4 m^2 Ground-floor	CO_2 TER	CO_2 DER
	kg/m^2/yr	kg/m^2/yr
Space heating	7.04	6.25
Water heating	6.73	6.44
Electricity for pumps and fans & lighting	3.10	3.10
Total	**16.87**	**15.79**

2-Bedroom apartment – 74.4 m^2 Mid-floor	CO_2 TER	CO_2 DER
	kg/m^2/yr	kg/m^2/yr
Space heating	4.71	3.93
Water heating	6.80	6.52
Electricity for pumps and fans & lighting	3.10	3.10
Total	**14.61**	**13.55**

2-Bedroom apartment – 74.4 m^2 Top-floor	CO_2 TER	CO_2 DER
	kg/m^2/yr	kg/m^2/yr
Space heating	6.77	5.79
Water heating	6.74	6.45
Electricity for pumps and fans & lighting	3.10	3.10
Total	**16.61**	**15.34**

3-Bedroom duplex apartment – 130.6 m^2	CO_2 TER	CO_2 DER
	kg/m^2/yr	kg/m^2/yr
Space heating	6.36	5.88
Water heating	4.22	3.50
Electricity for pumps and fans & lighting	2.79	2.79
Total	**13.37**	**12.17**

The results can be aggregated across similar unit types to arrive at the total site CO_2 emissions;

There are a number of mid-floor apartments, which are over the under-croft car parking spaces and for the purposes of this analysis these are regarded as having the same emissions as ground-floor units. In addition Plot 19 is regarded as a top-floor unit.

	Area	CO_2 TER	CO_2 DER
	m^2	kg/yr	kg/yr
1-Bedroom Ground-floor apartments	165.9	2,898	2,729
1-Bedroom Mid-floor apartments	533.0	8,102	7,739
1-Bedroom Top-floor apartments	50.0	876	806
2-Bedroom Ground-floor apartments	74.4	1,255	1,175
2-Bedroom Mid-floor apartments	363.4	5,309	4,924
2 and 3-Bedroom Top-floor apartments	271.3	4,506	4,162
3-Bedroom duplex apartments	261.2	3,492	3,179
Totals	**1719.2**	**26,438**	**24,714**

The maximum carbon dioxide emissions (based on the TER) are assessed as;

- **26,438 kg CO_2 per year**

With the actual carbon dioxide emissions (based upon the DER) are assessed as;

- **24,714 kg CO_2 per year**

The reduction in site CO_2 emissions as a result of the energy efficiency measures incorporated into the buildings is assessed as;

- **1,724 kg CO_2 per year, which equates to a reduction of 6.52%**

5.3 Renewable Technologies (Be Green)

The energy demand and carbon dioxide emissions established above has been used to test the viability of various renewable and low carbon technologies as follows.

This section determines the appropriateness of each renewable technology and considers the ability of each technology to comply with the planning requirements.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Rickmansworth Road to be 5.4 m/s at 10m above ground level and 6.2 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. In addition the use of wind turbines will have a detrimental aesthetic impact on the appearance of the building.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

Consequently CHP can demonstrate significant CO_2 savings and although not necessary classed as renewable energy (depending on the fuel used) the technology is low carbon.

For a CHP plant to be economic it needs to operate for as much of the time as possible (usually deemed to be in excess of 14 hours per day) and therefore the size of the unit are usually based upon the hot water load of the building (s) with additional boilers meeting the peak space heating demand.

Community heating schemes are similarly communal systems but seek to supply heat only without the electricity production. Therefore, unless using a biomass or biofuel a community heating system will not demonstrate significant CO_2 reductions

In order to optimise a combined heat and power system, the site needs is have a suitable minimum baseload. The baseload demand (hot water) for the apartments is 55,150 kWh per year, which if using a CHP unit with an output of $25kW_{th}$ would run for 6.04 hours per day.

This is not viable and the use of CHP is therefore not proposed.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12^{o} C. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

Ground source heat pumps could be used subject to satisfactory ground investigation to establish whether the sub-strata is appropriate.

However, there is insufficient ground area to accommodate a 'slinky' system and a borehole system would be required, which would lead to prohibitive costs.

Ground source heat pumps are not proposed.

Solar

(i) Solar Water Heating

Solar hot water panels use the suns energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees

In apartment buildings servicing apartments below the top-floor can be problematic for solar thermal panels. In addition the panels displace gas, which has a relatively low carbon factor and therefore the reduction in CO_2 emissions is not as great as when displacing electricity. The total hot water demand of the top-floor apartments is 14,298 kWh per year and assuming panels would reduce energy demand by 50% the reduction in CO_2 emissions is 1,544 kg CO_2 per year, which when combined with energy efficiency measures equates to a total reduction of 12.36%.

This is insufficient to meet the requirements of the planning policy and additional technologies would be required.

Solar hot water heating panels are viable but not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels.

The flat roof of the apartment building provides the opportunity for the installation of a photovoltaic array. Assuming the use of 327W PV panels, to achieve the 35% reduction in emissions required by the planning policy a total of 48 panels would be required. The electricity produced would provide power to the landlords supply with any unrequired electricity being distributed back to the Grid.

Photovoltaic panels are an appropriate technology and when combined with the energy efficient measures incorporated into the design and specification an array of 48 panels would equate to a total reduction in emissions of **9,356 kg CO_2 per year**, which equates to a reduction of **35.39%.**

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps, however the initial heat energy is extracted from the external air rather than the ground. These heat pumps can be reversed to provide cooling to an area although this reduces the coefficient of performance of the pumps.

ASHPs use electricity as the fuel source and where a higher heat demand is required, such as with hot water the CO_2 emissions can be higher than if heating is provided by a comparable gas system. A mains gas supply is available at the site and consequentially ASHPs are not proposed.

Other Technologies

New technologies are becoming available, which do not 'fit' into one of the above categories but which need to be considered and are regarded as low-carbon and/or renewable technologies.

Flue Gas Heat Recovery (FGHR)

One such system is flue gas heat recovery units. These devices are used in conjunction with gas-fired boilers and recover the heat exhausted through the boiler flue.

5.4 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

The total site maximum carbon dioxide emissions (TER) are calculated as **26,438 kg CO_2 per year** with DER CO_2 emissions of **24,714 kg CO_2 per year.**

The planning policy requires a 35% reduction in the TER emissions.

Various technologies are considered above and whilst wind turbines, combined heat and power, ground source and air source heat pumps or solar hot water heating panels are not considered appropriate the use of photovoltaic panels and/or flue-gas heat recovery systems are considered feasible appropriate.

Be Lean

The construction standards proposed include U-values, which demonstrate good practice and improve upon those required by the Building Regulations. Air tightness standards are targeted at a 50% improvement upon the minimum required by the Building Regulations.

The emissions are reduced from the maximum by **1,724 kg CO_2 per year** as a result of the energy efficiency measures. This equates to a reduction of **6.52%.**

Be Green

It is proposed to install a total of 48, 327W photovoltaic panels. These will be installed on the flat roof of the building. There is sufficient space on the flat roof for the panels proposed and an indicative roof plan is attached as Appendix 1. The panels will be installed on racks and gently inclined towards due south.

The reduction in emissions as a result of photovoltaic panels is **7,632 kg CO_2 per year.**

The total reduction in emissions from energy efficiency measures and renewable technologies is therefore calculated as; 9,356 kg CO_2 per year, which equates to a reduction of 35.39% (% of TER).

6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The Environment Agency flood maps show the site is within Flood Zone 1 and therefore of low risk of flooding.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included in the apartments will ensure that the water use target of 105 litres per person per day is achieved.

Water efficient devices will be fully evaluated, and installed, wherever possible. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the apartments:

- Water efficient taps.
- Water efficient toilets.
- Low output showers.
- Flow restrictors to manage water pressures to achieve optimum levels.
- Water meters with guidance on water consumption and savings.

Water consumption calculations have been carried out using the Water Efficiency Calculator provided by the BRE. Although not perfect this calculator gives a good indication of the probable water use in a dwelling, although this is largely dependent on the way on which occupants use their homes.

Below is a typical specification, which would achieve the 105 Litres per person per year target.

Schedule of Appliance Water Consumption		
Appliance	Flow rate or capacity	Total Litres
WC	4/2.6 litres dual flush	14.72
Basin	1.7 litres/min.	5.98
Shower	8 litres/min	24.00
Bath	160 litres	25.60
Sink	4 litres/min	14.13
Washing Machine	Default used	16.66
Dishwasher	Default used	3.90
		104.99

7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber would be sourced, where practical, certified by PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials to will have a zero ozone depleting potential

Construction waste

A Site Waste Management Plan will be prepared which will monitor and report on waste generated on site into defined waste groups.

The Plan will indicate the setting of targets to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

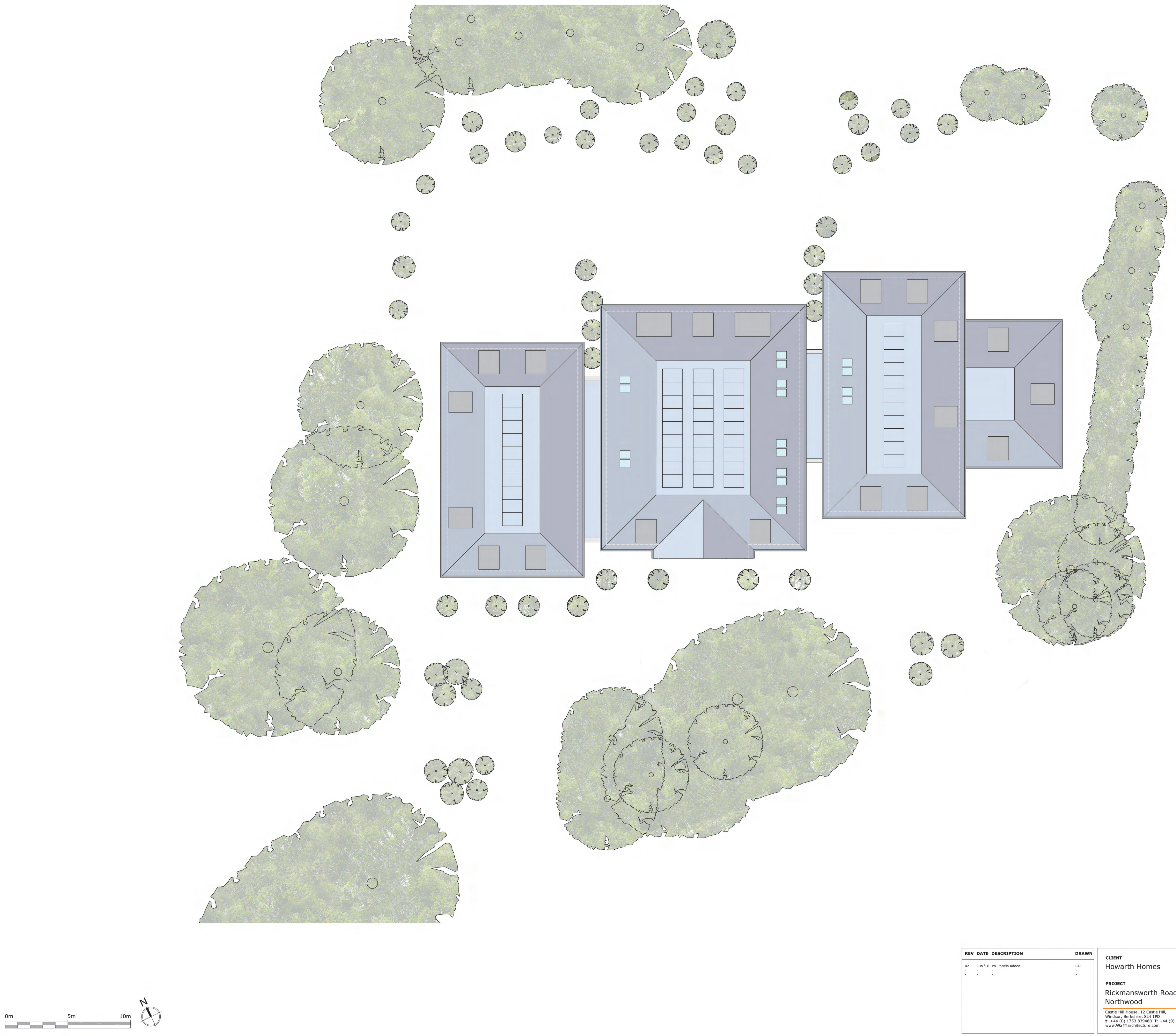
The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials

Appendix 1 – Roof Plan showing Indicative Photovoltaic Panel Locations



willcox and meilwes

REV	DATE	DESCRIPTION	DRAWN
02	Jun '16	PV Panels Added	CD
-	-	-	-
-	-	-	-

CLIENT
Howarth Homes

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DRAWING TITLE
Proposed Roof Plan

PROJECT No	DWG TYPE	DWG No	REV	SCALE
170	PL	204	02	1:200 @ A2
DATE	**DRAWN**	**CHECKED**	**STATUS**	
21/03/2016	KR	BW	For Approval	

RIBA