SUSTAINABILITY STATEMENT
LAND AT THE OLD VICARAGE FIELD AND THE OLD YARD ESTATE,
TURNERS HILL,
WEST SUSSEX.
RH10 4PA

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This report provides a brief overview of the range of opportunities for sustainable energy and is not intended as detailed design advice. As such data and information should only be treated as indicative at this stage of the process. Further investigation can be undertaken when more accurate and detailed information is required on specific measures.

INTRODUCTION

This Statement has been prepared in support of a planning application for the erection of 40 new dwellings on land off Church Road, Turners Hill, West Sussex. The development comprises a mix of detached, semi-detached, terraced houses and flats.

The Statement includes an energy demand assessment showing how the dwellings thermal envelope will be designed to reduce the predicted energy load, and therefore carbon emissions, using the improvement to the thermal element 'U' values, air permeability, heating and hot water systems. The overall aim of the dwellings design is to ensure maximum possible reduction in carbon emissions within the constraints set by the nature and form of the development and the individual site characteristics.

Working drawings have yet to be produced, but energy rating calculations using SAP 10 have been carried for all the units based upon the construction specification set out within report, and the detailed planning drawings. These calculations provide an accurate assessment of the carbon dioxide emissions arising from the dwellings and demonstrate compliance with Part L (2021) Conservation of Fuel and Power of the Building Regulations.

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 – December 2024 (amended February 2025)

Paragraph 165 states:

"To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that

adverse impacts are addressed appropriately (including cumulative landscape and visual impacts)

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co- locating potential heat customers and suppliers."

Paragraph 166 states:

In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Regional and Local Policies

The report demonstrates the sustainability credentials of the development to address Mid Sussex District Council's Policy DP39 Sustainable Design and Construction of the Mid Sussex District Plan 2014-2031 adopted in March 2018.

Policy DP39 - Sustainable Design and Construction Strategic Objective. To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change.

"All development proposals must seek to improve the sustainability of development and should where appropriate and feasible according to the type and size of development and location, incorporate the following measures:

- Minimise energy use through the design and layout of the scheme including through the use of natural lighting and ventilation;
- Explore opportunities for efficient energy supply through the use of communal heating networks where viable and feasible;
- Use renewable sources of energy;
- Maximise efficient use of resources, including minimising waste and maximising recycling/ re-use of materials through both construction and occupation;
- Limit water use to 110 Litres/Person/Day in accordance with Policy DP42: Water Infrastructure and the Water Environment;

- Demonstrate how the risks associated with future climate change have been planned for as part of the layout of the scheme and design of its buildings to ensure its longer-term resilience

The development has been assessed under the following categories: -

- Minimise energy consumption through the incorporation of renewable energy sources.
- Achieve a maximum water consumption of 110 Litres/Person/Day
- Environmental impact of materials
- Health and well being
- Management
- Provision of electric vehicle charging points.
- Overheating mitigation.

ASSESSMENT METHODOLOGY

The baseline energy demand and carbon dioxide emissions for the dwellings have been established by preparing SAP 10 calculations for each unit. These calculations have been based upon certain assumptions with regards 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 (2021)

	Kg CO_2/kWh
Natural Gas	0.21
Grid Supplied Electricity	0.136
Electricity Sold to Grid	0.136

In assessing this proposal, we have also been informed by following guidance BRE Green Guide to Specification which is The Building Research Establishment Green Guide to Specification lists building materials and components and ranks their potential life cycle environmental impact.

PROPOSAL

Plot Number	**Unit Type**	**Front Door Orientation**	**Area (Internal)**
Plot 1	1-Bed Flat	North-East	50.96m²
Plot 2	1-Bed Flat	South-East	50.43m²
Plot 3	1-Bed Flat	North-West	50.41m²
Plot 4	1-Bed Flat	North-East	50.96m²

Plot 5	1-Bed Flat	South-East	50.43m²
Plot 6	1-Bed Flat	North-West	50.41m²
Plot 7	1-Bed Semi-Detached	North-East	57.72m²
Plot 8	1-Bed Semi-Detached	North-East	57.72m²
Plot 9	2-Bed End Terrace	South-East	79.00m²
Plot 10	2-Bed Mid Terrace	South-East	79.00m²
Plot 11	3-Bed End Terrace	South-East	95.06m²
Plot 12	4-Bed Detached	South-West	150.22m²
Plot 13	4-Bed Detached	South-West	210.82m²
Plot 14	3-Bed Detached	North-West	116.87m²
Plot 15	3-Bed Semi-Detached	North-West	95.06m²
Plot 16	3-Bed Semi-Detached	North-West	95.06m²
Plot 17	4-Bed Detached	South-East	150.22m²
Plot 18	3-Bed Semi-Detached	South-East	95.06m²
Plot 19	3-Bed Semi-Detached	South-East	95.06m²
Plot 20	3-Bed Semi-Detached	South-East	95.06m²
Plot 21	3-Bed Semi-Detached	South-East	95.06m²
Plot 22	4-Bed Detached	South-West	173.41m²
Plot 23	3-Bed Detached	South-East	142.04m²
Plot 24	3-Bed Detached	South-East	142.04m²
Plot 25	4-Bed Detached	North-West	173.41m²
Plot 26	4-Bed Detached	North-West	210.82m²
Plot 27	3-Bed Detached	South-West	116.87m²
Plot 28	3-Bed End Terrace	West	94.86m²
Plot 29	3-Bed Mid Terrace	West	94.86m²
Plot 30	3-Bed End Terrace	West	94.86m²
Plot 31	3-Bed Semi-Detached	West	95.06m²
Plot 32	3-Bed Semi-Detached	West	95.06m²

Plot 33	3-Bed End Terrace	West	94.86m²
Plot 34	3-Bed Mid Terrace	West	94.86m²
Plot 35	3-Bed End Terrace	West	94.86m²
Plot 36	3-Bed Semi-Detached	South	93.00m²
Plot 37	2-Bed Semi-Detached	South	79.00m²
Plot 38	4-Bed Detached	South-West	173.41m²
Plot 39	2-Bed Semi-Detached	North-West	79.00m²
Plot 40	2-Bed Semi-Detached	North-West	79.00m²
TOTALS	**40 Plots**	**/**	**4,091.87m²**

ENERGY EFFICIENCY

Minimise energy consumption through the incorporation of renewable energy sources.

Energy assessment calculations have been carried to establish the energy requirements and fuel use, for the dwellings using the information provided on the detailed planning submission drawings. For the purposes of these calculations the performance for the thermal elements, controlled fittings, heating and hot water were chosen so that compliance with the all the criterion of Part L (2021) of the Building Regulations is achieved.

The dwellings have 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 dwellings that have the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric. Using these calculations low-carbon and/or renewable technologies have been considered to provide or supplement the heating and hot water.

The following assumptions were made for the thermal elements, controlled fittings, heating and hot water for the dwellings: -

Ground floors - 'U' value 0.11 W/m^2K

Exposed first floors - 'U' value 0.13 W/m^2K

Brick faced timber frame external walls - 'U' value 0.18 W/m^2K

Boarded or tile hung timber frame external walls - 'U' value 0.18 W/m^2K

Dormer walls - 'U' value 0.18 W/m^2K

Windows – 'U' value 1.20 W/m^2K

Solid doors – 'U' value 1.00 W/m^2K

Space heating – Air source heat pumps serving underfloor heating or radiators.

Heating controls – Time and temperature zone control.

Thermal bridging – Table R2 BRE SAP 10 document

Secondary heating – HETAS approved log burning stove to plots where chimneys are shown.

Water heating – From air source heat pump linked to indirect insulated hot water cylinder from system boiler with a standing loss of 1.8 kWh/day.

Ventilation – Individual extract fans.

Air permeability – 5.00m^3/hm2 (@50pa)

Lighting – Light fittings with lamps with a minimum luminous efficacy of 75 light source lumens per circuit-watt and local controls to allow for the separate control of lighting in each space or zone.

Building Envelope - The proposed 'U' values of the building envelope must meet Building Regulations Part L (2021) standards and additional improvements to 'U' values will consequently reduce the building's heating requirements.

There is a commitment to exceed the minimum 'U' values required by the Building Regulations. The dwellings will likely be timber frame construction with beam & block ground floors. 'U' values have been based upon the use of 140mm timber frame walls insulated with 120mm PIR insulation. The Ground floor will be insulated with 150mm Celotex insulation under a 75mm cement screed. Loft spaces will be insulated with 400mm mineral wool with rafters having PIR insulation between & under rafters.

The following U-values are set as the backstop:

Element	Part L (2021) Limiting 'U' Value	Proposed 'U' value	Proposed Improvement
	W/m^2K	W/m^2K	
External Walls	0.26	0.18	31%
Dormer Walls	0.26	0.18	31%
Ashlar Walls	0.26	0.18	31%
Ceiling Level Insulation	0.16	0.11	31%
Flat Roof	0.16	0.13	19%
Rafters	0.16	0.13	19%
Ground Floor	0.18	0.11	39%
Windows	1.60	1.20	25%
External Doors	1.60	1.00	38%

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 8.00 m^3 of air per hour per m^2 of envelope area, at 50Pa. For the purposes of this report, it has been assumed that each dwelling will achieve a permeability of 5.00 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. Bespoke thermal bridges Psi values will be calculated at Building Regulation submission stage. BRE appendix R Psi values have been used for the purposes of preparing this report.

Ventilation - As a result of increasing thermal efficiency and air tightness, Building Regulations Approved. Document F was also revised in 2021 to address the possibility of overheating and poor air quality. It is assumed mechanical extract ventilation will be provided to all WCs, bathrooms and kitchens.

Active Design Measures will include:

Efficient Lighting and Controls - Throughout the scheme natural lighting will be optimised.

Approved Document L requires all light fittings to be dedicated low energy fittings i.e., 75 lumens per circuit Watt.

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 dwellings by electrically powered air source heat pumps.

A 'fabric first' approach has been considered during the preparation of the preliminary planning stage SAP calculations & energy statement. The Dwelling Fabric Energy Efficiency (DFEE) required to achieve compliance with Part L1A (2021) demonstrates that the dwellings have improved on the Target Fabric Energy Efficiency (TFEE).

The results from the TFEE/DFEE calculations from the SAP calculations are as follow:

Plot Number	TFEE (BASELINE)	DFEE (PLANNING)	% Reduction
Plot 1	37.20 kWh/m²/yr	36.20 kWh/m²/yr	**2.67%**
Plot 2	38.52 kWh/m²/yr	37.50 kWh/m²/yr	**2.66%**
Plot 3	39.69 kWh/m²/yr	38.69 kWh/m²/yr	**2.52%**
Plot 4	34.74 kWh/m²/yr	34.71 kWh/m²/yr	**0.00%**
Plot 5	35.26 kWh/m²/yr	35.26 kWh/m²/yr	**0.00%**
Plot 6	35.78 kWh/m²/yr	35.78 kWh/m²/yr	**0.00%**
Plot 7	38.95 kWh/m²/yr	38.52 kWh/m²/yr	**1.10%**
Plot 8	39.94 kWh/m²/yr	39.51 kWh/m²/yr	**1.07%**

Plot 9	37.37 kWh/m²/yr	36.92 kWh/m²/yr	**1.20%**
Plot 10	31.06 kWh/m²/yr	30.35 kWh/m²/yr	**2.28%**
Plot 11	34.71 kWh/m²/yr	34.25 kWh/m²/yr	**1.32%**
Plot 12	40.01 kWh/m²/yr	39.59 kWh/m²/yr	**1.06%**
Plot 13	38.82 kWh/m²/yr	38.48 kWh/m²/yr	**0.87%**
Plot 14	39.23 kWh/m²/yr	38.81 kWh/m²/yr	**1.07%**
Plot 15	33.20 kWh/m²/yr	32.75 kWh/m²/yr	**1.38%**
Plot 16	33.20 kWh/m²/yr	32.75 kWh/m²/yr	**1.38%**
Plot 17	40.01 kWh/m²/yr	39.59 kWh/m²/yr	**1.06%**
Plot 18	34.15 kWh/m²/yr	33.69 kWh/m²/yr	**1.35%**
Plot 19	34.15 kWh/m²/yr	33.69 kWh/m²/yr	**1.35%**
Plot 20	34.15 kWh/m²/yr	33.69 kWh/m²/yr	**1.35%**
Plot 21	34.15 kWh/m²/yr	33.69 kWh/m²/yr	**1.35%**
Plot 22	40.38 kWh/m²/yr	39.96 kWh/m²/yr	**1.04%**
Plot 23	40.15 kWh/m²/yr	39.73 kWh/m²/yr	**1.03%**
Plot 24	40.15 kWh/m²/yr	39.73 kWh/m²/yr	**1.03%**
Plot 25	39.77 kWh/m²/yr	39.35 kWh/m²/yr	**1.06%**
Plot 26	33.94 kWh/m²/yr	38.60 kWh/m²/yr	**0.87%**
Plot 27	40.54 kWh/m²/yr	40.12 kWh/m²/yr	**1.04%**
Plot 28	34.26 kWh/m²/yr	33.79 kWh/m²/yr	**1.35%**
Plot 29	30.68 kWh/m²/yr	29.96 kWh/m²/yr	**2.32%**
Plot 30	34.26 kWh/m²/yr	33.79 kWh/m²/yr	**1.35%**
Plot 31	34.01 kWh/m²/yr	33.55 kWh/m²/yr	**1.35%**
Plot 32	34.01 kWh/m²/yr	33.55 kWh/m²/yr	**1.35%**
Plot 33	34.26 kWh/m²/yr	33.79 kWh/m²/yr	**1.35%**
Plot 34	30.68 kWh/m²/yr	29.96 kWh/m²/yr	**2.32%**
Plot 35	34.26 kWh/m²/yr	33.79 kWh/m²/yr	**1.35%**

Plot 36	36.67 kWh/m²/yr	36.22 kWh/m²/yr	**1.25%**
Plot 37	36.34 kWh/m²/yr	35.89 kWh/m²/yr	**1.25%**
Plot 38	40.51 kWh/m²/yr	40.09 kWh/m²/yr	**1.04%**
Plot 39	35.68 kWh/m²/yr	35.23 kWh/m²/yr	**1.24%**
Plot 40	36.39 kWh/m²/yr	35.94 kWh/m²/yr	**1.22%**
TOTALS	**1451.23 kWh/m²/yr**	**1437.23 kWh/m²/yr**	**0.95%**

ESTABLISHING ENERGY DEMAND AND CARBON DIOXIDE EMMISIONS

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

Plot Number	TER (BASELINE)	Area
Plot 1	13.92 $kgCO_2/m^2/yr$	50.96m²
Plot 2	14.29 $kgCO_2/m^2/yr$	50.43m²
Plot 3	14.54 $kgCO_2/m^2/yr$	50.41m²
Plot 4	13.50 $kgCO_2/m^2/yr$	50.96m²
Plot 5	13.82 $kgCO_2/m^2/yr$	50.43m²
Plot 6	13.90 $kgCO_2/m^2/yr$	50.41m²
Plot 7	13.38 $kgCO_2/m^2/yr$	57.72m²
Plot 8	13.59 $kgCO_2/m^2/yr$	57.72m²
Plot 9	11.56 $kgCO_2/m^2/yr$	79.00m²
Plot 10	10.35 $kgCO_2/m^2/yr$	79.00m²
Plot 11	10.17 $kgCO_2/m^2/yr$	95.06m²
Plot 12	9.00 $kgCO_2/m^2/yr$	150.22m²
Plot 13	7.67 $kgCO_2/m^2/yr$	210.82m²
Plot 14	10.09 $kgCO_2/m^2/yr$	116.87m²
Plot 15	9.93 $kgCO_2/m^2/yr$	95.06m²
Plot 16	9.93 $kgCO_2/m^2/yr$	95.06m²

Plot 17	9.00 $kgCO_2/m^2/yr$	150.22m^2
Plot 18	10.13 $kgCO_2/m^2/yr$	95.06m^2
Plot 19	10.13 $kgCO_2/m^2/yr$	95.06m^2
Plot 20	10.13 $kgCO_2/m^2/yr$	95.06m^2
Plot 21	10.13 $kgCO_2/m^2/yr$	95.06m^2
Plot 22	8.56 $kgCO_2/m^2/yr$	173.41m^2
Plot 23	8.51 $kgCO_2/m^2/yr$	142.04m^2
Plot 24	8.51 $kgCO_2/m^2/yr$	142.04m^2
Plot 25	8.42 $kgCO_2/m^2/yr$	173.41m^2
Plot 26	7.69 $kgCO_2/m^2/yr$	210.82m^2
Plot 27	10.37 $kgCO_2/m^2/yr$	116.87m^2
Plot 28	10.09 $kgCO_2/m^2/yr$	94.86m^2
Plot 29	9.34 $kgCO_2/m^2/yr$	94.86m^2
Plot 30	10.09 $kgCO_2/m^2/yr$	94.86m^2
Plot 31	10.07 $kgCO_2/m^2/yr$	95.06m^2
Plot 32	10.07 $kgCO_2/m^2/yr$	95.06m^2
Plot 33	10.09 $kgCO_2/m^2/yr$	94.86m^2
Plot 34	9.34 $kgCO_2/m^2/yr$	94.86m^2
Plot 35	10.09 $kgCO_2/m^2/yr$	94.86m^2
Plot 36	10.70 $kgCO_2/m^2/yr$	93.00m^2
Plot 37	11.43 $kgCO_2/m^2/yr$	79.00m^2
Plot 38	8.59 $kgCO_2/m^2/yr$	173.41m^2
Plot 39	11.20 $kgCO_2/m^2/yr$	79.00m^2
Plot 40	11.35 $kgCO_2/m^2/yr$	79.00m^2
TOTALS	**423.67 $kgCO_2/m^2/yr$**	**4,091.87m^2**

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

- **1,733,603 kg CO2 per year**

RENEWABLES TECHNOLGIES

District Heating

A review of local maps shows that no district heating networks currently exist within proximity to the site.

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 necessarily 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 units 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 similar 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. Communal heating with CHP is therefore not proposed.

Solar Photovoltaic

Photovoltaic panels convert energy from the sun into electricity through semi-conductor cells mounted in solar panels. The panels are connected to an inverter to turn DC output into AC for use in the building to which they are attached, and to be fed back into the grid when not required. This technology is considered suitable for the development; however, the client's preference is for air source heat pumps to be used to demonstrate compliance.

Solar Hot Water Systems

Solar water heating systems use energy from the sun to heat water stored in a hot water cylinder via solar collectors on the roof of the building. Whilst theoretically solar hot water heating panels could be used, additional technologies would be required to achieve sufficient reduction in carbon emissions. Therefore, solar hot water heating is not proposed.

Biomass Heating

Domestic scale boilers such as woodchip fed systems remain very costly and very large and the requirements for siting both the boilers and the fuel source are considered impractical for this development.

Ground Source Heat Pumps

Ground Heat pumps are used to extract heat from the ground to provide both space and water heating. Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same process as a refrigerator. Fluid is circulated through pipes buried in the ground which passes through a heat exchanger in the heat pump which extracts heat from the fluid. The heat pump raises the temperature of the fluid via the compression cycle to supply hot water to the building. The ground pipe system can be horizontal or vertical via boreholes. This technology is not being considered for this development as there is insufficient space for a ground pipe system and the installation cost of boreholes would be prohibitive.

Air Source Heat Pumps

Air source heat pumps are used to extract heat from the air to provide both space and water heating. Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same process as a refrigerator. Air passes through a heat exchanger in the heat pump which extracts heat from the fluid. The heat pump raises the temperature of the fluid via the compression cycle to supply hot water to the building. Because of the nature of air source heat pumps consideration must be given to the plant noise and the visual impact of external plant. This technology is considered suitable and is proposed on all plots.

SUMMARY OF CALCULATIONS & PROPOSALS FOR LOW-CARBON AND RENEWABLE TECHNOLOGIES

The total site maximum carbon dioxide emissions (TER) are calculated as **1,733,603 kg CO2 per year** with DER CO2 emissions of **722,542 kg CO2 per year.** This demonstrates a saving of **58.32%** across the site with by implementing fabric energy improvements & the use of air source heat pumps.

Various technologies have been considered above and whilst wind turbines, combined heat and power, ground source heat pumps, solar hot water heating panels are not considered appropriate the use of air source heat pumps are considered feasible and appropriate.

The results from the SAP calculations are summarised as follows:

Plot Number	TER (BASELINE)	DER (PLANNING)	TER/DER Reductions	Area
Plot 1	13.92 $kgCO_2/m^2/yr$	5.44 $kgCO_2/m^2/yr$	60.92%	50.96m^2
Plot 2	14.29 $kgCO_2/m^2/yr$	5.54 $kgCO_2/m^2/yr$	61.23%	50.43m^2
Plot 3	14.54 $kgCO_2/m^2/yr$	5.61 $kgCO_2/m^2/yr$	61.42%	50.41m^2
Plot 4	13.50 $kgCO_2/m^2/yr$	5.39 $kgCO_2/m^2/yr$	60.07%	50.96m^2
Plot 5	13.82 $kgCO_2/m^2/yr$	5.49 $kgCO_2/m^2/yr$	60.27%	50.43m^2
Plot 6	13.90 $kgCO_2/m^2/yr$	5.51 $kgCO_2/m^2/yr$	60.36%	50.41m^2
Plot 7	13.38 $kgCO_2/m^2/yr$	5.31 $kgCO_2/m^2/yr$	60.31%	57.72m^2
Plot 8	13.59 $kgCO_2/m^2/yr$	5.36 $kgCO_2/m^2/yr$	60.56%	57.72m^2
Plot 9	11.56 $kgCO_2/m^2/yr$	4.72 $kgCO_2/m^2/yr$	59.17%	79.00m^2
Plot 10	10.35 $kgCO_2/m^2/yr$	4.38 $kgCO_2/m^2/yr$	57.68%	79.00m^2
Plot 11	10.17 $kgCO_2/m^2/yr$	4.33 $kgCO_2/m^2/yr$	57.42%	95.06m^2
Plot 12	9.00 $kgCO_2/m^2/yr$	3.77 $kgCO_2/m^2/yr$	58.11%	150.22m^2
Plot 13	7.67 $kgCO_2/m^2/yr$	3.37 $kgCO_2/m^2/yr$	56.06%	210.82m^2

Plot 14	10.09 $kgCO_2/m^2/yr$	4.14 $kgCO_2/m^2/yr$	58.97%	116.87m^2
Plot 15	9.93 $kgCO_2/m^2/yr$	4.27 $kgCO_2/m^2/yr$	57.00%	95.06m^2
Plot 16	9.93 $kgCO_2/m^2/yr$	4.27 $kgCO_2/m^2/yr$	57.00%	95.06m^2
Plot 17	9.00 $kgCO_2/m^2/yr$	3.77 $kgCO_2/m^2/yr$	58.11%	150.22m^2
Plot 18	10.13 $kgCO_2/m^2/yr$	4.32 $kgCO_2/m^2/yr$	57.35%	95.06m^2
Plot 19	10.13 $kgCO_2/m^2/yr$	4.32 $kgCO_2/m^2/yr$	57.35%	95.06m^2
Plot 20	10.13 $kgCO_2/m^2/yr$	4.32 $kgCO_2/m^2/yr$	57.35%	95.06m^2
Plot 21	10.13 $kgCO_2/m^2/yr$	4.32 $kgCO_2/m^2/yr$	57.35%	95.06m^2
Plot 22	8.56 $kgCO_2/m^2/yr$	3.61 $kgCO_2/m^2/yr$	57.83%	173.41m^2
Plot 23	8.51 $kgCO_2/m^2/yr$	3.91 $kgCO_2/m^2/yr$	54.05%	142.04m^2
Plot 24	8.51 $kgCO_2/m^2/yr$	3.91 $kgCO_2/m^2/yr$	54.05%	142.04m^2
Plot 25	8.42 $kgCO_2/m^2/yr$	3.58 $kgCO_2/m^2/yr$	57.48%	173.41m^2
Plot 26	7.69 $kgCO_2/m^2/yr$	3.37 $kgCO_2/m^2/yr$	56.18%	210.82m^2
Plot 27	10.37 $kgCO_2/m^2/yr$	4.22 $kgCO_2/m^2/yr$	59.31%	116.87m^2
Plot 28	10.09 $kgCO_2/m^2/yr$	4.30 $kgCO_2/m^2/yr$	57.38%	94.86m^2
Plot 29	9.34 $kgCO_2/m^2/yr$	4.08 $kgCO_2/m^2/yr$	56.32%	94.86m^2
Plot 30	10.09 $kgCO_2/m^2/yr$	4.30 $kgCO_2/m^2/yr$	57.38%	94.86m^2
Plot 31	10.07 $kgCO_2/m^2/yr$	4.30 $kgCO_2/m^2/yr$	57.30%	95.06m^2
Plot 32	10.07 $kgCO_2/m^2/yr$	4.30 $kgCO_2/m^2/yr$	57.30%	95.06m^2
Plot 33	10.09 $kgCO_2/m^2/yr$	4.30 $kgCO_2/m^2/yr$	57.38%	94.86m^2
Plot 34	9.34 $kgCO_2/m^2/yr$	4.08 $kgCO_2/m^2/yr$	56.32%	94.86m^2
Plot 35	10.09 $kgCO_2/m^2/yr$	4.30 $kgCO_2/m^2/yr$	57.38%	94.86m^2
Plot 36	10.70 $kgCO_2/m^2/yr$	4.46 $kgCO_2/m^2/yr$	58.32%	93.00m^2
Plot 37	11.43 $kgCO_2/m^2/yr$	4.69 $kgCO_2/m^2/yr$	58.97%	79.00m^2
Plot 38	8.59 $kgCO_2/m^2/yr$	3.62 $kgCO_2/m^2/yr$	57.86%	173.41m^2
Plot 39	11.20 $kgCO_2/m^2/yr$	4.63 $kgCO_2/m^2/yr$	58.66%	79.00m^2
Plot 40	11.35 $kgCO_2/m^2/yr$	4.67 $kgCO_2/m^2/yr$	58.85%	79.00m^2
TOTALS	**423.67 $kgCO_2/m^2/yr$**	**176.58 $kgCO_2/m^2/yr$**	**58.32%**	**4,091.87m^2**

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

- **722,542 kg CO2 per year**

CONCLUSION

The dwellings thermal envelope will be designed to reduce the predicted energy load of the building using the improvement to the thermal element U values, air permeability and heating systems. The overall aim of the dwellings design is to ensure maximum possible reduction in carbon emissions within the constraints set by the nature and form of the development and the individual site characteristics.

The detailed design of the development sought to achieve as its objective compliance under Part L (2021) of the Building Regulations. Consideration has also been given to the overall appearance of the development. If the majority of the dwellings roof areas were covered in solar panels, there is no doubt that the visual impact would be significant and probably unacceptable. In the circumstances, a balance has been drawn between seeking to ensure that no harm occurs to the character and appearance whilst maximising CO_2 emission reduction.

The SAP worksheets in the appendix demonstrate compliance with all the criteria of Part L (2021) and are summarised below.

Achieve a maximum water consumption of 110 litres per person per day.

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 this development will ensure that the water use target of 110 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 dwellings:

• 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 and the results are included in the appendix. Below is a typical specification which will achieve 110 litres per person per day.

Appliance	Flow rate or capacity	Total Litres
WCS	2.6/4 litres dual flush	13.53
Basin	5.00	9.48
Shower	8.00	34.96
Bath	170.00	18.70
Sink	6.00	13.00
Washing Machine	8.17	17.16
Dishwasher	1.25	4.50
		111.33

111.13 x 0.91 Litres/Person/Day (Normalisation Factor) = **101.3 Litres/Person/Day**

101.30 + 5.00 Litres/Person/Day (External Water Usage) =**106.30 Litres/Person/Day**

Water Consumption (Building Regulation 17 K) = **106.30 Litres/Person/Day**

Environmental impact of materials

The following five key elements of the construction will achieve a BRE Green Guide 2006 rating between. A+ and D

- Roof structure and finishes
- External walls
- Upper floor
- Internal Walls
- Windows and doors

External materials will be locally sourced to reduce transport mileage and environmental impact, where reasonably practicable.

The dwellings will be constructed using pre-insulated timber frames manufactured off-site to maximise thermal efficiency, to minimise waste and from managed sustainable sources.

Subject to planning conditions external materials will be locally sourced to reduce transport mileage and environmental impact, where reasonably practicable.

The dwellings will be constructed using pre-insulated timber frames manufactured off-site to maximise thermal efficiency, minimise waste. The timber will be from managed sustainable sources.

The proposed boilers will be selected to have a dry NO_X level (mg/kWh) of less than 70.

Health and well-being.

Adequate day lighting to kitchens, living rooms, dining rooms and home working spaces will be provided in accordance with the CIBSE Day Light Monitoring Groups recommendations, where possible.

Garden areas will be provided as compliant individual spaces.

Management.

Home user guides to be provided.

Consideration will be given to energy usage and water consumption on site to minimise impact to the environment.

Part Q of the Building Regulations will be complied with for security.

Provision of electric vehicle charging points.

Electric vehicle charging is to be provided with one active charging point per dwelling in accordance with Part S of the Building Regulations.

Overheating Mitigation

The dwellings will be designed to comply with Part O (2021) of the Building Regulations to mitigate overheating.

Alex Pelling.
OCDEA

APPENDIX

PART L SAP Worksheets

PART G Water Efficiency Calculations