



## **Sustainability & Energy Statement**

**Hillcrest & Tussucks  
The Causeway  
Therfield  
Royston  
SG8 9PP**

**August 2025**

This statement has been prepared by UKSAPs on behalf of their clients, to support a planning application for the construction of seven new residential dwellings.

It is based on evidence supplied by the architect & developer and preliminary SAP 10.2 calculations.

Steve Saward

UKSAPs

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<https://uksaps.co.uk>

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### Version Control

| Version | Date       | Note                 |
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| 1.0     | 11/08/2025 | Final for submission |

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## 1. Executive Summary

This Sustainability & Energy Statement is in support of a planning application for the construction of seven residential dwellings, on land located at Hillcrest & Tussucks, The Causeway, Therfield, SG8 9PP. In the first instance, the Statement addresses relevant sustainability policies of the North Hertfordshire Local Development Framework Design Supplementary Planning Document (SPD), July 2011. It also takes into consideration policies in the Local Plan 2011-2031 and the Sustainability SPD 2024. Overall, the development proposal meets all of the applicable policy requirements.

In addition, the development meets the requirements of existing Local Plan with regard to energy and carbon dioxide reductions. Relative to the baseline energy demand and carbon dioxide emissions, improvements to the proposed fabric and services of the development reduced carbon emission by 15.4%. Evaluation of all possible renewable energy technologies demonstrated that the most suitable is the installation of air source heat pumps to provide space heating and hot water for each of the dwellings. This will contribute to a reduction in carbon dioxide emissions of 69.9% overall, fully meeting and significantly exceeding the policy requirements as shown in the following table.

| Stage                                  | Carbon dioxide emissions |                                  |             |                        |
|----------------------------------------|--------------------------|----------------------------------|-------------|------------------------|
|                                        | t CO <sub>2</sub> / yr   | Reduction t CO <sub>2</sub> / yr | % reduction | Cumulative % reduction |
| Baseline: AD Part L 2013 compliance    | 13.08                    | ---                              | --          | ---                    |
| Lean Case (energy efficiency measures) | 11.07                    | 2.01                             | 15.4        | 15.4                   |
| Clean Case (Community)                 | 11.07                    | 0.0                              | 0.0         | 15.4                   |
| Green Case (renewable energy)          | 3.94                     | 7.13                             | 64.4        | 69.9                   |

## 2. Introduction

This report is for submission in support of a planning application for the creation of seven new residential dwellings (minor development). It is intended to demonstrate that environmental sustainability has been considered and addressed in accordance with planning policy showing how a range of sustainability criteria will be met including how carbon dioxide emissions will be reduced in compliance with Building Regulations Approved Document Part L, Volume 1, 2021.

This report is divided into two parts to separately address the specific Sustainability and Energy requirements;

- i. A Sustainability Assessment addressing all of the issues in relevant policies of the current North Hertfordshire Local Plan, Design Supplementary Planning Document (SPD), July 2011 and the Sustainability SPD, September 2024 .
- ii. An Energy Assessment to demonstrate how the dwellings will meet Building Regulations Approved Document Part L, Volume 1:Dwelling, 2021 and how this will be achieved by the improvement to the building fabric & services and the use of on-site renewable technology. Again, this agrees with same policy documents as for Sustainability.

### 3. Policy Context

The National Planning Policy Framework (NPPF, 2023) paragraph 11 sets a presumption in favour of sustainable development. National and regional planning policy is enacted and applied at the local level and in that context the main policy applicable to the sustainability appraisal of this development is the North Herts Local Plan 2011-2031, adopted 8 November 2022, the Design SPD, January 2011 and the Sustainability SPD 2024.

In essence the Sustainability SPD states that

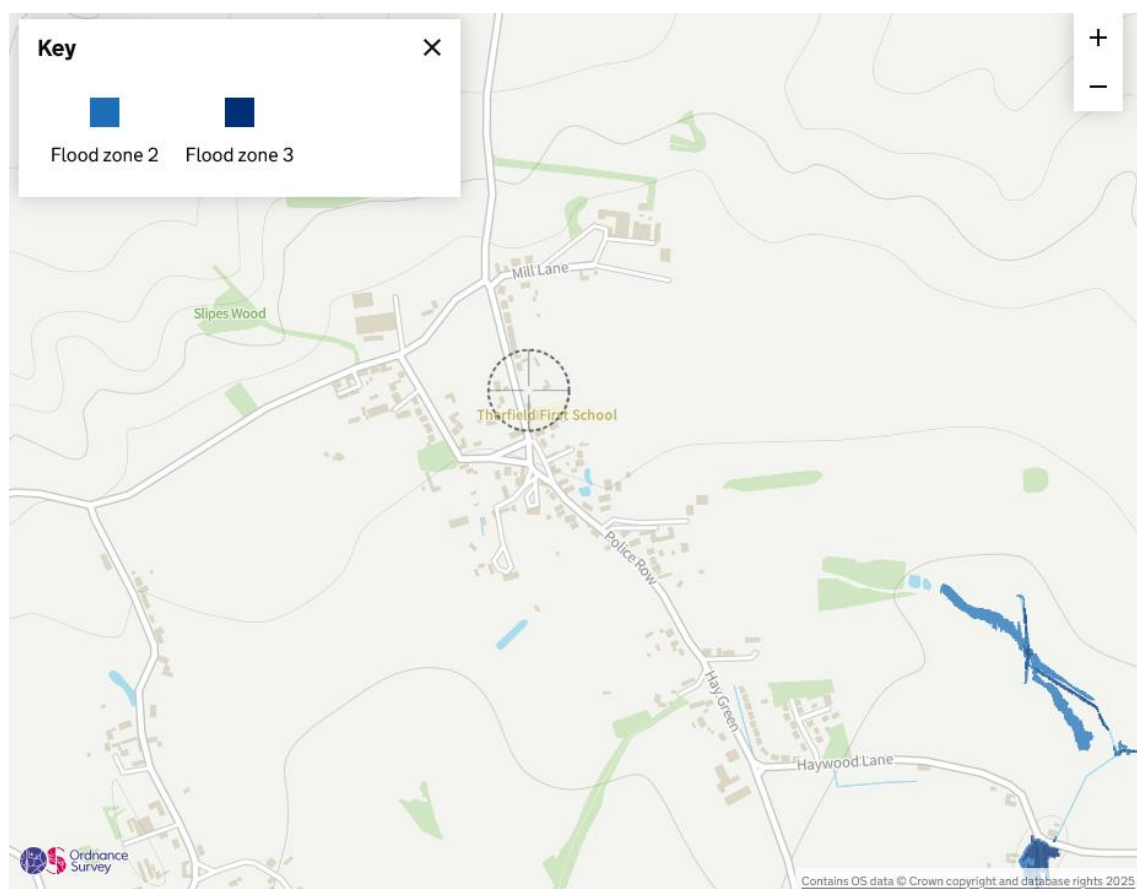
*For minor development (less than 10 dwellings) applicants will complete and submit a Sustainability and Energy Statement which is subject to a review by officers as part of the application process*

## 4. Sustainability Assessment

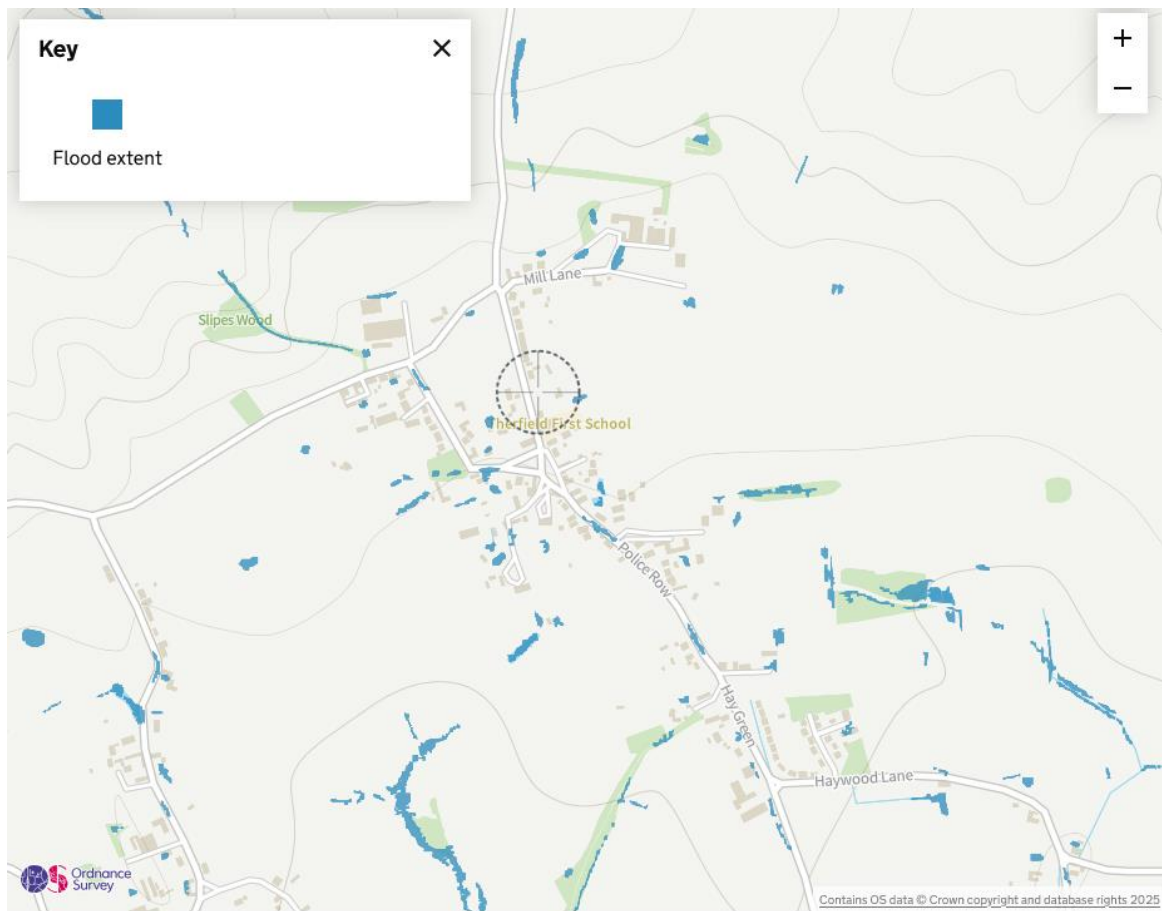
The following sections cover all of the relevant policies in the existing Local Plan and SPDs.

### 4.1 Management of Flood Risk

The Environment Agency Flood map (<https://flood-map-for-planning.service.gov.uk/> accessed 11 August 2025) shows that the site is in Flood Zone 1 with regard to the risk of flooding from rivers, Figure 1. In addition there is only a low risk of surface water flooding, Figure 2. As the risk of flooding from all sources is low, flood risk mitigation measures are not required.



**Figure 1. Flood risk from rivers centred on development site.**



**Figure 2. Flood risk from surface water, centred on development site.**

## 4.2 Water efficiency

Calculation of the average water use of the dwellings has been carried out using the method set out in The Water Efficiency Calculator for New Dwellings (2009) using a generic specification for the dwellings. The results are presented in Table 1.

**Table 1. Water Efficiency Calculation**

| Installation Type                                    | Unit of Measure               | Capacity/<br>flow rate | Use<br>Factor | Fixed Use<br>(L/person/day) | L/person/<br>day |
|------------------------------------------------------|-------------------------------|------------------------|---------------|-----------------------------|------------------|
| WC (dual flush)                                      | Full flush vol.               | 4.0                    | 1.46          | 0.00                        | 13.54            |
|                                                      | Part flush vol.               | 2.6                    | 2.96          | 0.00                        |                  |
| Taps (excl. kitchen/utility)                         | Flow rate (litres/min)        | 4.0                    | 1.58          | 1.58                        | 7.90             |
| Bath (shower also present)                           | Capacity to overflow (litres) | 180                    | 0.11          | 0.00                        | 19.30            |
| Shower (bath also present)                           | Flow rate (litres/min)        | 9.0                    | 4.37          | 0.00                        | 39.33            |
| Kitchen/utility sink taps                            | Flow rate (litres/min)        | 4.0                    | 0.44          | 10.36                       | 12.12            |
| Washing machine                                      | Litres/kg dry load            | 8.17 (default)         | 2.1           | 0.00                        | 17.16            |
| Dishwasher                                           | Litres/place setting          | 1.25 (default)         | 3.6           | 0.00                        | 4.50             |
| Waste disposal                                       | Litres/use                    | 0                      | 3.08          | 0.00                        | 0.00             |
| Water softener                                       | Litres/person/day             | ---                    | 1.00          | 0.00                        | 0.00             |
| Total calculated use (litres/person/day)             |                               |                        |               |                             | 114.3            |
| Normalisation factor                                 |                               |                        |               |                             | 0.91             |
| Total internal water consumption (litres/person/day) |                               |                        |               |                             | <b>104.1</b>     |
| External use                                         |                               |                        |               |                             | 5.0              |
| <b>Total water consumption (litres/person/day)</b>   |                               |                        |               |                             | <b>109.1</b>     |

The development will ensure that the maximum water use is limited to less than 110~L/person/day. This will be achieved by the use of low flow rate taps and showers (fitted with flow restrictors where necessary), dual flush WCs and low-capacity baths. It is not planned to install a rainwater harvesting system as the required level can be achieved without the use of rainwater. However, each dwelling will be provided with a water butt to collect rainwater for garden use.

### 4.3 Sustainable Urban Drainage Systems (SuDS)

The site currently consists of a largely 'greenfield' area with a workshop building and associated hardstanding. As such, the area of permeable surface will reduce post-development relative to pre-development, with a potential increase in surface water run-off. To minimise the impact on local infrastructure and to ensure the risk of flooding elsewhere is reduced, SuDS will be implemented in accordance with The SuDS Manual, 2015. All external hard landscaping areas will consist of permeable paving or other permeable surfaces. It is expected that approval of the detailed design of these features will be a condition of the planning consent.

Foul water/sewage will connect to the public foul sewer. The development proposal will be subject to approval by the local wastewater/sewerage provider as part of the consultation process.

#### 4.4 Pollution – Air, Noise, Land & Light

##### **Air**

Policies will be in place during construction to minimise air pollution from dust and other particulates in compliance with current legislation. In particular, use will be made of the London Plan, “The Control of Dust and Emissions during Construction and Demolition, Supplementary Planning Guidance” July 2014.

The residential units will use air source heat pumps to provide heating and hot water and as such there will be no local emissions associated with their use.

##### **Noise pollution**

As a residential development there will be limited noise emissions from the development itself.

Construction of all residential units will comply with Building Regulations AD Part E. Where appropriate, on-site testing will be carried out to ensure sound transmission between dwellings meets the necessary standard.

##### **Light pollution**

To minimise light pollution, all external lighting where fitted will consist of low energy light fittings with a luminous efficacy of greater than 40 lumens per circuit watt. Control systems will be installed to ensure that the external lighting does not operate unnecessarily i.e. it will not operate during daylight hours or when external spaces are unoccupied.

##### **Land (Contamination)**

The site is currently a greenfield site; no ground contamination is suspected.

## 4.5 Materials

In order to ensure the highest levels of sustainability in resource management all materials will meet following criteria as appropriate

- All of the key elements of the building envelope (external walls, windows roof, upper floor slabs, internal walls, floor finishes / coverings) are to achieve a rating of A+ to D in the BRE's The Green Guide to specification.
- can be sustainably sourced;  
at least 70% of timber and timber products should be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) supplies.
- are durable to cater for their level of use and exposure; and will not release toxins into the internal and external environment, including those that deplete stratospheric ozone.

Where possible, materials will be sourced locally therefore minimising the distance materials will need to travel by road. However, in the context of sustainability and minimising the environmental impact of materials over the lifetime of the building, priority will be given to sourcing materials that have the highest rating in the BRE Green Guide to Specification with all of the key elements achieving a D to A+ Green Guide to Specification rating. Priority will be given to the reuse of materials, then preference given to the use of recycled materials before the use of virgin material is accepted.

At least 70% of all timber used on site will be certified as coming from sustainable sources (FSC, PEFC or similar) and all timber will be legally sourced.

All insulation material will either be unblown or if blown have a Global Warming potential of less than 5 and have not used CFCs or HCFCs in their manufacture.

## 4.6 Waste

Whilst a Site Waste Management Plan is no longer a legal requirement, waste generated during the construction phase will be minimised by close attention to the tendering and ordering process and implementation of the waste hierarchy.

The total size of the external waste and recycling containers will meet the requirements of BS 5906:2005 (100 Litres per one bedroom property plus 70 litres for each additional bedroom). Each dwelling will be provided with a purple lidded non-recyclable rubbish bin (180L), a black lidded mixed recycling bin (240L) and a blue lidded recycling bin (240L) for cardboard and paper recycling, a total of 660L. The largest proposed property is five bedrooms and therefore has a total domestic waste storage requirement =  $100 + (4 \times 70) = 340$  litres, which is easily met by the local council bin provision. In addition a food waste caddy is also provided for weekly collection.

The final design of waste storage areas is usually subject to a planning condition as of part of any planning consent.

#### 4.7 Biodiversity Protection and Enhancement

The Environment Act 2021 introduced a requirement for planning applications to provide a 10% Biodiversity Net Gain (BNG). The 10% BNG requirement became mandatory for major developments from the 12<sup>th</sup> February 2024 and from 2nd April 2024 for small sites. BNG will be measured using the statutory biodiversity metric or the small sites metric if development meets the criteria to do so. A separate BNG assessment is to be submitted as part of this application or will be conditioned on approval of the application.

#### 4.8 Sustainability — Summary

The foregoing Sustainability Statement addresses all of the issues set out in relevant North Hertfordshire District Council policies.

## 5. Energy Assessment

### 5.1 Introduction

To comply with the policy requirements the Energy Assessment follows a standard hierarchical approach to demonstrate how the design of the development will reduce carbon dioxide emissions by meeting the requirements of the latest version of Building Regulations Approved Document L, Volume 1: Dwellings 2021.

### 5.2 Overheating and Adapting to Climate Change

Key features of the design of the development that are included to avoid overheating are the dual aspect of the dwellings which will enable occupants to cross-ventilate. Low solar gain (g value) glass will be installed in all external glazing as necessary, although this needs to be balanced against the impact this has on increasing heating requirements outside of the summer months.

No active cooling systems will be installed.

### 5.3 Energy demand

The basic principle followed for the design of the development is to initially reduce the energy demand of the dwelling by means of a 'fabric first' approach. This means that heat loss elements such as floors, walls, roofs and openings exceed the minimum elemental performance requirements of Building Regulations Approved Document Part L 2021.

Although passive solar gain can be a significant advantage, not all dwellings on small sites, where flexibility in the orientation of the dwellings is limited, can take maximum advantage. Excessive solar gain during the summer months can lead to potential issues with overheating. Ultimately, residents will be able to purge ventilate by opening windows, which, combined with low solar gain glass and appropriate window coverings, will enable residents to reduce the risk of overheating without the need for mechanical cooling.

The space heating, hot water, pumps, fans and lighting energy requirements were calculated using the detailed Bredem-12 method developed by the Building Research Establishment and used in the SAP 10.2 calculation and referenced in the latest version of the Building Regulations Approved Document L, Volume 1.

Whilst the importance of thermal mass is recognised as being important in levelling out fluctuations in internal temperatures this again needs to be balanced against the benefit of construction methods with low thermal mass e.g. timber frame, which can more easily achieve higher levels of thermal insulation.

This Energy Statement takes a standard hierarchical approach as follows:

### **1. Baseline.**

A calculation of baseline energy demand, demonstrating the projected annual heating, cooling, and electricity demand of the development. The assessment shows the carbon dioxide emissions resulting from the predicted energy use.

### **2. Energy Efficiency (Lean).**

An explanation of how the total energy demand and carbon dioxide emissions will be reduced relative to the baseline energy demand through potential improvements to building energy efficiency standards, recalculation of total energy demand and associated carbon dioxide emissions.

### **3. CHP/CCHP (Clean).**

Proposals for the reduction of energy demand and carbon dioxide emissions from heating, cooling and electrical power, including the feasibility of Combined Heat and Power / Combined Cooling, Heating, and Power systems, and community heating systems.

### **4. Renewable Energy (Green).**

Details of any renewable energy technologies to be incorporated in the development, demonstrating how much carbon dioxide emissions from expected energy use will be reduced through on-site renewable energy generation.

The starting point for the new dwellings was to determine the performance of the “baseline” for the dwellings using the levels of insulation performance and building services equipment consistent with the dwelling achieving compliance with Approved Document L: 2021. The specific energy consumption figures for space heating, hot water and lighting were then extracted. It is then normal for the calculations to be repeated using improved U-values proposed for the scheme by the applicant and other possible improvements to building services. However, with the update to Part L in 2021 it is now the case that just to comply with the requirements necessitates the use of low u-values and highly efficient building services anyway.

The results obtained from this analysis are presented in the following sections.

## **5.4 Energy demand and efficiency (Baseline)**

The total energy demand and associated emissions have been calculated taking full account of energy demands for space heating and hot water, and electricity for pumps, extract fans and lights. The specific carbon dioxide emission figures were then extracted from the SAP 10.2 software and are shown in Table 2. Overall, the baseline carbon dioxide emissions are calculated to be 13.08 t/yr.

**Table 2. Baseline Energy Demand and Emissions**

| Energy use       | Energy (kWh/yr) | CO <sub>2</sub> emission (kg/yr) |
|------------------|-----------------|----------------------------------|
| Space heating    | 38,580          | 8,102                            |
| Water heating    | 21,877          | 4,594                            |
| Pumps, fans etc. | 602             | 83                               |
| Lighting         | 2,076           | 300                              |
| <b>Total</b>     | <b>63,135</b>   | <b>13,079</b>                    |

## 5.5 Energy efficiency measures (Lean)

For the Lean Case, the change to the Part L Building Regulations in 2021 has meant that there are fewer opportunities to make improvements to the building fabric which will result in significant changes to the carbon dioxide emissions. Any differences from the criteria used to establish the baseline are detailed in Appendix 1. The impact of the changes are detailed in Table 3, showing an overall reduction of 15.4% in carbon dioxide emissions.

**Table 3. Baseline & Lean Case Carbon Dioxide Emissions**

| Energy use         | Energy (kWh/yr) |               | CO <sub>2</sub> emission (kg/yr) |               |
|--------------------|-----------------|---------------|----------------------------------|---------------|
|                    | Baseline        | Lean Case     | Baseline                         | Lean Case     |
| Space heating      | 38,580          | 36,531        | 8,102                            | 7,672         |
| Water heating      | 21,877          | 14,087        | 4,594                            | 2,958         |
| Pumps, fans etc.   | 602             | 602           | 83                               | 83            |
| Lighting           | 2,076           | 2,446         | 300                              | 353           |
| <b>Total</b>       | <b>63,135</b>   | <b>53,666</b> | <b>13,079</b>                    | <b>11,066</b> |
| <b>% reduction</b> |                 |               |                                  | <b>15.4</b>   |

## 5.6 Decentralised Energy (Clean)

Although the feasibility of Combined Heat and Power (CHP) and Combined Cooling, Heating, and Power (CCHP) systems was considered, the nature of the development precludes the use of such technology. Such systems are better suited to those developments that have a constant heat demand such as residential care homes, leisure centres, hotels or large mixed-use developments. It is less suited to exclusively residential developments which is the subject of this planning application.

Consideration has also been given to the feasibility of connecting to an existing or planned district heating network. No current local or district heat network exist in the locality of the development.

The installation of an on-site community space heating and hot water network in the development site itself has been considered. However, it seems unlikely that the system could be connected to a local heat network in the foreseeable future, reducing the value of installing a community based system now.

## 5.7 Renewables (Green)

In accordance with the requirements of the Local Plan Policy the next step is to reduce the carbon dioxide emissions to achieve compliance with Part L Volume 1, 2021.

Renewable energy sources are those defined by EU Directive 2009/28/EC and include, wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. All possible domestic renewable energy technologies were evaluated in relation to the site. Most technologies were excluded because of the nature of the site in terms of the type of development (residential) and location as described in Table 4.

**Table 4. Feasibility of Renewable Energy**

| Technology                     | Criteria                                                                                                                                                                                                                                                        | Assessment                                                                                                                                                                                                                                                        | Overall suitability       |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Biofuels</b>                | Year-round heat demand<br>Established supply chain.<br>Sufficient space for delivery of fuel<br>Sufficient space for storage of fuel<br>Sufficient space for boiler and auxiliary equipment<br>Can the flue be designed to meet planning authority requirements | Development is residential with seasonal and daily variations in heat demand.<br>Limited space on site for location of plant room and storage of fuel. Fuel delivery issues re. traffic movements to and from site.<br>Biomass has relatively high NOx emissions. | Not suitable              |
| <b>Ground Source Heat Pump</b> | Sufficient space for horizontal coil or separation of multiple boreholes<br>Ground suitable for vertical drilling and avoidance of obstacles.<br>Sufficient space for GSHP and auxiliary equipment                                                              | Closed loop indirect borehole system possible but insufficient space for horizontal coils.<br>Potentially unsuitable soil and geological conditions.                                                                                                              | Not suitable              |
| <b>Air Source Heat Pump</b>    | Sufficient space for ASHP and auxiliary equipment<br>Sufficient distance between installation and neighbours to avoid noise disturbance                                                                                                                         | Sufficient space for dwelling to be provided with ASHP.<br>Any potential noise and vibration issues would need to be addressed but easily mitigated.                                                                                                              | <b>Suitable</b>           |
| <b>Hydroelectricity</b>        | Nearby watercourse with sufficient head<br>Permission available for access to a watercourse<br>Climate change modelling confirms longevity of watercourse (25 yrs)                                                                                              | No suitable water course nearby.                                                                                                                                                                                                                                  | Not suitable              |
| <b>Solar PV</b>                | Suitable roof orientation, lack of shading<br>Sufficient roof space                                                                                                                                                                                             | Would need to be mounted on west facing front roof elevations. Orientation is less than ideal. Modest-significant shading from trees to some plots.                                                                                                               | <b>Partially suitable</b> |

| Technology           | Criteria                                                                                                                                                                                                              | Assessment                                                                                                                                                                                                                          | Overall suitability |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Solar thermal</b> | Suitable roof orientation, lack of shading.<br>Sufficient roof space.<br>Year-round hot water demand.<br>Compatibility with proposed heating system.<br>Sufficient space for communal or individual hot water storage | Would need to be mounted on west facing front roof elevations. Orientation is less than ideal. Modest-significant shading from trees to some plots.<br><br>Used alone, it would not reduce CO <sub>2</sub> emissions significantly. | Not suitable        |
| <b>Wind turbines</b> | Sufficient wind speed.<br>Area free from obstructions / causes of turbulence.<br>Sufficient open space for installation.<br>Sufficient distance between installation and neighbours to avoid noise disturbance        | Wind turbines not favoured by planning authorities or neighbours. Not supported by national government.<br><br>Potential noise and vibration issues.                                                                                | Not suitable        |

The most suitable renewable energy option is the installation of individual air source heat pumps to each of the dwellings to provide space heating and hot water. Overall, these have the potential to help reduce carbon dioxide emissions across the development by at least 35%. The choice of make and model of heat pump will be made in order to minimise potential noise, with preference given to products that are Quiet Mark certified ([www.quietmark.com](http://www.quietmark.com)).

**Table 5. Impact of Air Source Heat Pumps on carbon dioxide emissions**

| Energy use            | CO <sub>2</sub> emission (kg/yr) |               |                                            |
|-----------------------|----------------------------------|---------------|--------------------------------------------|
|                       | Baseline                         | Lean Case     | Green case                                 |
| Primary space heating | 8,102                            | 7,672         | 1,841                                      |
| Water heating         | 4,594                            | 2,958         | 1,731                                      |
| Pumps, fans etc.      | 83                               | 83            | 0                                          |
| Lighting              | 300                              | 353           | 365                                        |
| <b>Total</b>          | <b>13,079</b>                    | <b>11,066</b> | <b>3,937</b>                               |
| <b>% reduction</b>    |                                  | <b>15.4</b>   | <b>69.9 cf. baseline<br/>64.4 cf. Lean</b> |

## 5.8 Energy – Summary

The foregoing projected results show that this development proposal meets the requirements of the applicable planning policies relating to energy efficiency and the reduction of carbon dioxide emissions, particularly as a result of the use of renewable technology. The baseline annual regulated energy demand and associated carbon dioxide emissions for the proposed development

are 63,135 kWh and 13.08 tonnes respectively. Improvements to the baseline building fabric and services, provided a 15.4% reduction in CO<sub>2</sub> emissions, Table 6.

**Table 6. Regulated carbon dioxide reduction at each stage of the energy hierarchy**

| Energy - Stage                         | Carbon dioxide emissions |                                     |             |                           |
|----------------------------------------|--------------------------|-------------------------------------|-------------|---------------------------|
|                                        | t CO <sub>2</sub> / yr   | Reduction<br>t CO <sub>2</sub> / yr | % reduction | Cumulative<br>% reduction |
| Baseline: AD Part L 2013 compliance    | 13.08                    | ---                                 | --          | ---                       |
| Lean Case (energy efficiency measures) | 11.07                    | 2.01                                | 15.4        | 15.4                      |
| Clean Case (Community)                 | 11.07                    | 0.0                                 | 0.0         | 15.4                      |
| Green Case (renewable energy)          | 3.94                     | 7.13                                | 64.4        | 69.9                      |

Evaluation of all possible renewable energy technologies demonstrated that the most suitable, in terms of reducing carbon dioxide emissions, is the installation of air source heat pumps to provide space heating and hot water. Such systems could contribute to the overall reduction in carbon dioxide emissions of more than 69%.

## 6. References

- National Planning Policy Framework, 2023. Ministry of Housing, Communities & Local Government
- North Hertfordshire Local Plan 2011 – 2031. 08 November 2022
- North Hertfordshire District Council, Local Development Framework. Design Supplementary Planning Document (SPD) July 2011.
- North Herts Council. Sustainability, Supplementary Planning Document. September 2024
- The Building Regulations 2010. Approved Document L Conservation of fuel and power. Volume 1:Dwellings. 2021 edition incorporating 2013 amendments
- The Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP 10.2). Version 10.2 (03-02-2022)

## 7. Appendices

### Appendix 1. SAP values for establishment of Baseline and Lean cases

| Element / system | Baseline                                        | Lean                                               |
|------------------|-------------------------------------------------|----------------------------------------------------|
| Windows          | U = 1.2 W/m <sup>2</sup> K<br>g value 0.63      |                                                    |
| Glazed doors     | U = 1.2 W/m <sup>2</sup> K<br>g value 0.63      | <b>U = 1.3 W/m<sup>2</sup>K</b><br>g value 0.63    |
| Ground floor     | U = 0.13 W/m <sup>2</sup> K                     | <b>U = 0.12 W/m<sup>2</sup>K</b>                   |
| External walls   | U = 0.18 W/m <sup>2</sup> K                     |                                                    |
| Roof             | U = 0.11 W/m <sup>2</sup> K                     | <b>U = 0.10 W/m<sup>2</sup>K</b>                   |
| Thermal bridging | y = 0.030 – 0.051                               |                                                    |
| Ventilation      | Natural, intermittent extract fans              |                                                    |
| Air permeability | 5.0 m <sup>3</sup> /(h.m <sup>2</sup> ) at 50Pa | <b>4.0 m<sup>3</sup>/(h.m<sup>2</sup>) at 50Pa</b> |

Differences are shown in bold

### Appendix 2. Carbon emissions by fuel type:

| Energy Source | Emissions factor<br>kg CO <sub>2</sub> /kWh |
|---------------|---------------------------------------------|
| Mains gas     | 0.210                                       |
| Electricity   | 0.136*                                      |

\*CO<sub>2</sub> factors for grid electricity vary by month. The average figure given is therefore not used directly. Instead, the monthly figures given in SAP 10.2 Table 12d are used in the SAP worksheet calculations.