MAINERASSOCIATES

Energy Statement:

WORLDWIDE HOUSE

Residential

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1.0 EXECUTIVE SUMMARY

Mainer Associates have been commissioned to compile an Energy Statement for the proposed 3rd Floor extension at Worldwide House, Bayham Street, London. This report has been compiled to identify strategies to meet the requirement to achieve 20% reduction in CO_2 through the installation of low or zero carbon technologies. We have also included a Code for Sustainable Homes (CSH) Pre-Assessment report in line with Camden Council's planning guidance.

Outline, high level, SAP calculations have been undertaken to establish anticipated energy demand and how the implementation of low and zero carbon technologies can contribute to reducing the CO_2 emissions by 20%, in doing so, meeting the requirements of the Local Planning Authority.

The table below show an overview of the energy modelling results. The use of photovoltaic panels or air source heating has been demonstrated to be sufficient to achieve the 20% reduction in CO_2 target.

Dwelling	SAP	DER	TER	% Improvement
Flat 1 Baseline	B 83 (82.85)	16.9	16.69	-1.26
Flat 2 Baseline	B 84 (84.03)	15.73	15.97	1.5
Flat 1 -rev A (Fabric)	B 84 (83.74)	15.37	16.69	7.91
Flat 2 -rev A (Fabric)	B 86 (85.57)	13.44	15.97	15.84
Flat 1 -rev B (Wood & Control)	B 84 (84.14)	13.59	16.69	**18.57**
Flat 2 -rev B (Wood & Control)	B 86 (85.55)	12.31	15.97	**22.92**
Flat 1 -rev C (ASHP)	C 75 (74.57)	23.41	28.12	**16.75**
Flat 2 -rev C (ASHP)	C 77 (77.28)	20.42	26.97	**24.29**
Flat 1 -rev D (PV)	B 87 (87.45)	12.73	16.69	**23.73**
Flat 2 -rev D (PV)	B 87 (87)	13.14	15.97	**17.72**

During detailed design, full calculations will be undertaken as part of a costing exercise in order to specify the most appropriate solution in terms of cost whilst achieving the 20% reduction.

A CSH Pre-Assessment report has also been undertaken and this can be found in the Appendix of this report. The assessment details how the extension of the building will meet a CSH Level 3 standard.

2.0 INTRIDUCTION

Mainer Associates have been commissioned to compile an Energy Statement for the proposed 3rd Floor extension at Worldwide House, Bayham Street, London. This report has been compiled to identify strategies to meet the requirement to achieve 20% reduction in CO2 emissions through the installation of low or zero carbon technologies. We have also included a Code for Sustainable Homes (CSH) Pre-Assessment report in line with Camden Council's planning guidance.

This report will detail the various methods of achieving the percentage reduction as required by the Local Authority. The requirements for compiling Energy Statements can be found in both: Energy Planning: GLA Guidance on preparing energy assessments; and Camden Planning Guidance, Sustainability. A review of this documentation can also be found in the main body of the report.

In addition to the Energy Statement, we have also undertaken a CSH Pre-Assessment to accompany the application. This document can be found in the Appendix of this report and it demonstrates that a CSH Level 3 rating is targeted in line with the Planning Authority's requirements.

3.0 THE SITE

The site on Bayham Street in the London Borough of Camden currently consists of a three storey block of commercial offices. The planned extension will comprise a fourth storey across the entire footplate of the existing building. As a result of the extension, the existing plant on the roof will need to be relocated to the roof of the new extension.

The new development will comprise two single storey flats across the entire floor. There will also be a large scale refurbishment of the existing commercial block, however, this is not covered within this report. This Energy Statement only refers to the new residential extension.

4.0 PLANNING POLICY CONTEXT

4.1 National

On the basis of the information from the Government's Sustainable Development Strategy, 'Securing the Future' (2005), priorities for the UK can be summarised as:

- Sustainable Consumption and Production;
- Climate Change and Energy;
- Natural Resource Protection and Environmental Enhancement;
- Sustainable Communities.

The construction of new buildings provides a real opportunity to reduce the carbon emissions associated with the built environment. New techniques and innovative technologies are allowing new build projects to achieve ever increasing levels environmental performance.

All new residential self-contained dwellings must also be assessed using the Standard Assessment Procedure (SAP) and comply with Part L of the Building Regulations. SAP assessments are undertaken to assess the energy usage and efficiency of new build dwellings. As such we have used SAP to review the options for renewable technologies within this report.

4.2 Regional

'The London Plan: Spatial Development Strategy for Greater London' outlines the broad commitment to minimising the impacts of climate change through the achievement of a Carbon reduction target. By 2025, the Mayor will seek to achieve a 60% reduction in Carbon over 1990 levels.

The built environment is considered the largest contributor to the Carbon emissions within Greater London and as such, stringent targets have been set for new developments. Not only have targets been outlined in the document but also the methodology for achieving the target. The energy hierarchy must be considered in all cases. Below is an extract from The London Plan detailing how this hierarchy should be considered.

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

'Energy Planning: GLA Guidance on preparing energy assessments' details the requirements for the compilation of Energy Statements to accompany Planning Applications within London.

Using the principles of the Energy Hierarchy, this document outlines the requirements for the production of Energy Statements for new developments within Greater London.

This document states that Energy Strategy documents should include the following:

- A target for regulated CO2 reductions.
- A target for regulated CO2 emissions savings through energy demand.
- Reduction measures.
- Commitment to communal heating infrastructure, if appropriate for the development, and evidence of investigation into the existence of any wider district networks that the development could be connected to.
- Investigations of the feasibility and, where viable, commit to the installation of CHP In the proposed development.
- Large-scale developments should provide a feasibility assessment to ensure that CHP is sized to minimise CO2 emissions.
- Identification of measures to minimise unregulated emissions.
- Where appropriate we will expect an initial feasibility test for renewable energy technologies to be undertaken with a resulting commitment to further reduce CO2 emissions through the use of onsite renewable energy generation.
- Where the required improvement on a development's Target Emission Rate is not met a commitment to ensure the shortfall is met off-site using the provision established by the borough.

4.3 Local

As with the planning documents outlined above, the Camden Core Strategy 2010 – 2025, Adoption version 2010, places an emphasis on the energy hierarchy for reducing the Carbon emissions of the borough as a whole. It goes on to say that assessment methodologies such as CSH should be used to demonstrate the environmental performance of the built environment.

Once the energy use of the building is reduced, The Core Strategy encourages the use of energy efficient and renewable technologies to meet the reduced demand. The target that has been set in The Core Strategy is for developments to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation.

Camden Planning Guidance 3: Sustainability (CPG 3), provides further confirmation of what must be included within an Energy Statement. The following from CPG 3 indicates the headings that should be used:

- Baseline energy demand and carbon dioxide emissions
- Reduce the demand for energy
- Supply energy efficiently

- Conclusion

Again, referring back to the energy hierarchy, CPG 3 highlights how the hierarchy should be considered within an energy statement. Section 6 mirrors the London Plan and Core Strategy documents outlining the 20% reduction in CO2 through the use of renewable technologies. For clarity, the technologies outlined in CPG 3 as being 'renewable, are as follows:

- Solar/Thermal Hot Water Panels
- Photovoltaic (PVs)
- Ground Source Heat Pumps (GSHP) or geothermal
- Air source heat pumps (ASHP)
- Biomass heating and power
- Wind turbines

This Energy Statement will consider the use of the above, in addition to energy efficiency, and demonstrate options for compliance with the target of a 20% reduction in CO2.

5.0 ENERGY STATEMENT

This Energy Statement is compiled in order to demonstrate how the savings in carbon, outlined as targets within the Core Strategy, can be achieved on the Worldwide House 3rd floor extension.
The Energy Statement must demonstrate compliance with the targets set out in the Core Strategy as outlined in the previous sections. The focus of this report is the following requirement:

"A 20% reduction in Carbon emissions must be achieved through the use of renewable and low carbon technologies."

5.1 Energy Hierarchy

Energy and Carbon reduction should be considered as part of any development in the following order starting with the action at the top:

- Energy conservation - Changing wasteful behaviour to reduce demand.
- Energy efficiency - Using technology to reduce demand and eliminate waste.
- Exploitation of renewable, sustainable resources.

- Exploitation of low-carbon technologies.
- Exploitation of conventional resources.

Government guidance for carbon performance suggests a hierarchy of good practice in low carbon design. The figure illustrates this hierarchy.

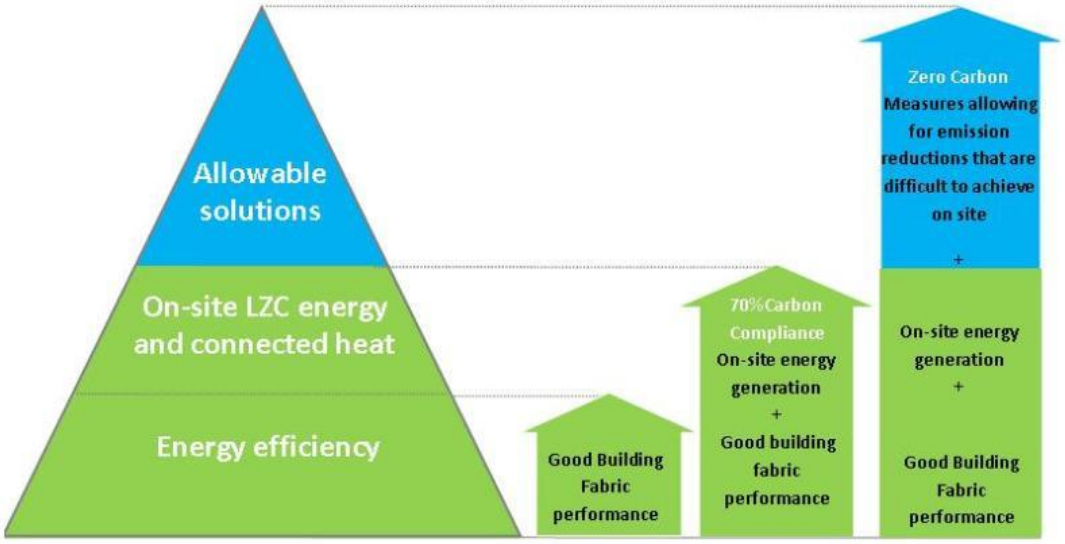


Fig 1 - Low Carbon Design Hierarchy

Whilst the building envelope is contrained to some degree by the nature of the developemnt as an extension of an existing building, consideration has been given to the integration of any proposed low and zero carbon energy sources with fixed services such as heating and hot water.

The last element of the hierarchy is the use of renewable energy solutions to generate the energy used on site. Ideally, these renewable energy sources should be installed locally.

5.2 Methodology

Given the development is an extension of an existing building, but is a new build, self-contained dwelling, we have opted to use the Standard Assessment Procedure. These calculations can then be taken forward to design stage where they will need to be finalised and issued to Building Control. Please note the calculations outlined in this report are for illustrative purposes only and further information would be required in order to finalise these for Building Regulations.

As part of this energy statement we have set the baseline as Part L compliance. We have then used this data to calculate the percentage reduction in CO2 resulting from the installation of fabric first solutions and renewable technologies. Given the building will be built to Part L of the Building Regulations, we have assumed that this will be achieved without the need for renewable technologies. This ensures compliance with the energy hierarchy as detailed in the relevant planning documentation outlined above.

Given the likely solutions for meeting the 20% reduction target, we will also demonstrate that the 'providing energy efficiently' part of the hierarchy, as well as the 'renewable energy' element will be covered using a variety of solutions.

Overall this document provides confirmation that the developer is aware of their responsibilities with respect to energy reduction, prior to the demonstration of this through detailed design and full SAP calculations.

5.3 Overview of Low & Zero Carbon Technologies

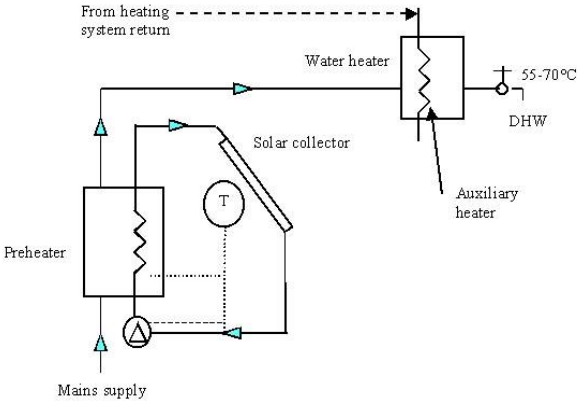
HIGH EFFICIENCY/CONDENSING BOILERS

A high efficiency condensing boiler works on the principle of recovering as much as possible of the waste heat which is normally rejected to the atmosphere from the flue of a conventional (non-condensing) boiler.

This is accomplished by using heat exchangers within the boiler which maximises heat transfer from the burner as well as recovering useful heat which would normally be lost with the flue gases. When in condensing mode (condensing boilers do not condense all of the time) the flue gases give up their 'latent heat' which is then recovered by the heat exchanger within the boiler or on top of the boiler through a Zenex Gas Saver unit. This is then used as a pre-heat for the cold feed so the boiler does not have to work to full capacity.

The result of recovering heat from the exhaust flue gas means less primary gas demand. This subsequently reduces CO2 emissions.

SOLAR COLLECTORS



Solar collectors collect both direct and diffuse solar radiation. Heat is transferred to the circulating liquid via heat exchange pipes that run through the solar collector. The circulating fluid in the solar collector is a mixture of water and glycol (antifreeze). This is to enable operation in winter and maximises efficiency similar to run around coils in a ventilation system, which use the same water and antifreeze mix. The water and antifreeze mixture is used to extract heat from the panels, so increasing the temperature of the water/circulating fluid. The water is then used to pre-heat the building domestic hot water as shown in the diagram above. The preheated water is then topped up using the a system or combination boiler.

GROUND SOURCE HEAT PUMP (GSHP)

There are a multitude of GSHP's available in the construction industry, each GSHP is installed differently and subsequently perform differently, however the principle of operation is fundamentally the same.

A GSHP removes heat from the earth or ground water in cold weather and transfers it to the building through an underground piping system. Whether ground or water is used as the source, the process remains the same and can reverse in warm weather as heat is transferred to the ground. GSHP's work by circulating water or a water/antifreeze solution, generally through a closed loop of pipe that is buried in the ground or set beneath water. The refrigerant cycle within a GSHP system comprises a two phase process, operating in the vapour and liquid phases. A GSHP can be categorised as having closed or open loops and these loops can be installed in three ways:

- horizontally,
- vertically,
- in a river / pond or lake.

The selection process for a GSHP depends on the area of the site / land, soil and rock type at the project. These factors will help determine the most economical choice for installation of the ground loop.

AIR SOURCE HEAT PUMP (ASHP)

Air source heat pump (ASHP) systems operate in a similar manner to GSHP systems, only they extract heat energy from the air, rather than the ground. They offer a simpler and cheaper alternative to GSHP's in that,

generally, they offer much greater flexibility with regards to their installation and do not require the prior geological work needed by GSHP's.

With a typical SAP rated efficiency of 250%, they are not quite as efficient as GSHP's which are 320% efficient. They do, however, offer a renewable energy source to provide low grade hot water for suitable for domestic hot water or under floor heating installations.

When utilised with radiator systems it must be understood that most existing wet heating systems are sized for a water temperature of 80°C. A heat pump can usually achieve a maximum heating water flow temperature of around 45°C. This is ideally suited to under-floor heating systems, where low surface temperatures are required, but does not lend itself well to existing radiator installations without a commitment to reduce building heat losses through fabric improvement.

For this reason, radiators for a heat pump system may need to be significantly larger than those for a system served by a conventional boiler. The flow temperature of an ASHP system can be raised by the use of an electric top-up heater.

BIOMASS BOILERS

Biomass constitutes all non-fossil organic materials that have intrinsic chemical energy content. This includes all water and land-based vegetation and trees or virgin biomass, such as log wood or thinning from local forests, prunings from roadsides or parks, grasses and energy crops and in some countries, residues from agriculture or food processing e.g. nutshells or olive pits, wood chips, recycled untreated wood or palletising residues from wood processing. Also all waste biomass such as municipal solid waste, municipal bio solids (sewage) and animal wastes (manures), forestry and agricultural residues, and certain types of industrial wastes are classified as biomass. Through using these resources, a possible disposal problem can be turned into a high quality fuel and local suppliers of wood fuels will gain extra income and enhance local economic turnover.

Biomass can be used on a domestic or industrial scale. For a large scale biomass power plant, the chipped, shredded and dried fuel is fed into a boiler or gasifier, from there the gas is collected and used.

Boilers providing heat to the site could operate via biofuel. Biofuel is any fuel that derives from biomass - recently living organisms or their metabolic byproducts, such as manure from cows. It is a renewable energy, unlike other natural resources such as petroleum, coal and nuclear fuels. The carbon in biofuels was recently extracted from atmospheric carbon dioxide by growing plants, so burning it does not result in a net increase of carbon dioxide in the Earth's atmosphere.

The use of biofuel would mean the requirement for biofuel storage and regular deliveries. A hard standing is therefore required for a delivery truck or hopper, along with suitable protection from the elements. A trade-off between frequency of fuel deliveries and storage space is usually sought.

Maintenance of biomass boilers is considerably more onerous than for a conventional boiler. Ash residues mean that the plant must be shut down for cleaning on a regular basis.

WIND TURBINES

Wind turbines generate electricity from natural wind power via the rotation of their rotors. Turbines are classified as either 'small scale' (6kW to 50kW capacity), 'medium scale (between 50kW and 250kW output) or 'large scale' (250kW to 5MW output).

Large scale turbines are unlikely to be awarded planning permission in urban areas due to aesthetic and safety constraints. All turbines require clear access to wind speeds which achieve 6m/s or greater on a regular basis. The presence of buildings or variation in the local landscape can all affect the feasibility of a turbine installation.

In order to fully assess the viability of a turbine installation, local weather data at the proposed installation site should be collected for a minimum of 6 months, but ideally for 12 months, to allow accurate generation estimations to be made. This data would be collected via an anemometer on a mast to the height of the proposed turbine. This installation would also normally require planning permission.

PHOTOVOLTAIC (PV) PANELS

PV panels collect direct and diffuse solar energy and convert this into electricity which can be used on site or exported to the national electrical grid. Arrays of PV panels can be of almost any size and are normally installed on roof tops to ensure that they are cleared of any potential obstructions or shades.

The introduction of the Government's Feed-In Tariff (FIT) scheme has meant that PV is now a mainstream technology, used widely in domestic and commercial applications. As such, the cost of this technology has reduced dramatically over the last few years.

PV panels are available in monocrystalline, polycrystalline or amorphous thin-film types, which vary in efficiency and cost (monocrystalline being the more expensive and most efficient).

5.4 Feasibility Assessments

The table below provides an initial overview of the feasibility of the various technologies discussed in the previous section. A traffic light system has been adopted to represent the anticipated feasibility of these measures prior to undertaking modelling of the site.

The traffic light system should be interpreted as follows:

Red – Technology not suitable.
Amber – Technology may be suitable depending on building energy demands.
Green – Technology likely to be suitable given appropriate payback and operational constraints are met.

LZC Technology	Feasibility Comment	Feasible	Likely >20% reduction in CO2
Wind Turbines	Given the location of the site it is likely that local planning conditions and landscape features may render a turbine unviable. This should be considered as a high level assessment of feasibility only, as local site conditions and recorded wind data should be considered prior to full rejection of this proposal.	No	Yes
Photovoltaic Panels	PV panels are likely to be suitable given the facility to incorporate these into the design of the new 3rd floor roof. The effects of any shading caused by surrounding buildings would need to be considered, but it is not anticipated that this would render PV non-viable. We would propose full output modelling of the system in situ to confirm the effectiveness of this technology and confirm how much PV would be required to meet the 20% target.	Yes	Yes
Solar Collectors	Solar hot water panels are likely to be suitable given the high hot water demand for the two units. It is likely that the solar thermal system will not meet the 20% reduction in Carbon, however, we have taken this technology forward for further investigation..	Yes	No
High Efficiency/ Condensing Boilers	If conventional gas fired heating is adopted then this should be via high efficiency or condensing boilers. This could operate via a district heating system for each zone or a separate unit for each building. The status of existing gas infrastructure on the site will need to be fully examined to ensure the feasibility of this option. It is likely that the installation of this technology would be required as a minimum to achieve Building Regulation Part L compliance, therefore, it is unlikely to provide the 20% reduction.	Yes	No

CHP	CHP is unlikely to be viable as the site will not have the consistent base loads required to support the significant financial outlay for this type of technology. CHP operates most effectively if it can operate at a constant load continuously. If there is insufficient heat demand then excess heat has to be purged to the atmosphere as waste. Clearly this is not advisable. A full financial assessment of the viability of CHP is a complex and detailed procedure and, as such, it is beyond the scope of this report.	No	No
ASHP	Air source heating could be used to serve the heating and hot water demands, given sufficient space for external plant compounds where current plant for the other floors is being relocated. ASHPs must also be supported by the use of further energy saving measures such as a higher performing fabric, due to the low output temperatures produced by the heat pumps. ASHPs perform best when combined with underfloor heating due to the low output temperatures. This is also likely to be suitable for this development.	Yes	Yes
Biomass Boilers	Biomass boilers are likely to be able to provide a significant carbon saving over gas fired or electrically driven cooling. However, the operational risks, high maintenance demands and fuel storage requirements are likely to result in this being non-viable given the nature and location of the site. We have undertaken one model using a wood burning fire to show that the 20% Carbon reduction can be achieved.	No	Yes
Fabric	Far more so than renewable technologies, improvements to the fabric are a far more sustainable option. Firstly the life cycle benefits of improvements to fabric far outweigh those of renewable technologies that will require multiple replacement. Secondly, a fabric first approach is more attune to the energy hierarchy that most planning guidance is, or should be, based upon. The reduction of demand is far more important than serving a high demand with renewable and low Carbon solutions. The changing face of the UK energy grid means that a low Carbon solution now, may not be low Carbon in the future. It is safe to say that improvements to the fabric will always be low Carbon.	Yes	No
GSHP	Ground source heating could be used to serve heating and DHW demands for the site, given sufficient space and suitable ground conditions to accommodate the required slinky system or bore holes. Given the nature and location of the site it is unlikely that the required ground loops or bore holes could be created to serve such a system.	No	No

5.5 Site Energy Models

BASELINE

In order to develop the baseline from which we will calculate the percentage improvements we have undertaken high level SAP calculations. Further details on the SAPs can be found in the appendix.

Please note the assumptions below for the Baseline scenario:

- LOW thermal mass
- Thermal bridging 0.08 or better
- Wall to core 0.3 u-value
- External wall 0.2 u-value
- Roof 0.12 u-value
- Door to core 2.2 u-value
- Windows and bifold 1.6 u-vValue
- Natural ventilation
- Boiler - Netatec plus 33GA
- Time and temp zone control
- NO secondary heating
- 100% low e lights

The baseline for each flat is slightly different as we have assumed compliance with Part L as a minimum. As a result we have made each of the flats, through a process of averaging, only just pass Part L. From this point we can demonstrate the percentage improvements.

The following two baselines show how we have got them to simply pass Part L:

Flat 1 Baseline

- Air pressure test 8.1
- 3 local extract fans

Flat 2 Baseline

- Air pressure test 10
- 4 Local extract fans

The following revisions have been put together to produce a number of scenarios in order to ascertain the most appropriate means of achieving the target of a 20% reduction in Carbon. Each revision has been calculated using SAP as per the baseline models.

Flat 1 -rev A (Fabric)

- Achieving 10% using fabric first approach
- Reduce front door u-value to 1.4
- Reduce pressure test result to 4
- MVHR - (Greenwood fusion HRV2 assumed)

Flat 2 -rev A (Fabric)

- Achieving 10% using fabric first approach
- Reduce front door u-value to 1.4
- Reduce pressure test result to 4
- MVHR - (Greenwood fusion HRV2 assumed)

Flat 1 -rev B (Wood burner & Control)

- As revision A plus;
- Delayed start thermostat;
- Enhanced load compensation;
- Wood burning stove; and
- Window u-value reduced to 1.4.

Flat 2 -rev B (Wood burner & Control)

- As revision A plus;
- Delayed start thermostat;
- Enhanced load compensation;
- Wood burning stove; and
- Window u-value reduced to 1.4.

Flat 1 -rev C (ASHP)

- Walls u-value 0.3
- Roof u-value 0.18
- Thermal bridging removed - 0.15

- Door u-value 3.0
- Windows u-value 1.8
- MVHR - Greenwood fusion HRV2
- Pressure test 4
- ASHP - Mitsubishi Ecodan 5KW
- Time and temp zone control
- Water cylinder 250L losses of 1.8 kw/day

Flat 2 -rev C (ASHP)

- Walls u-value 0.3
- Roof u-value 0.18
- Thermal bridging removed - 0.15
- Door u-value 3.0
- Windows u-value 1.8
- MVHR - Greenwood fusion HRV2
- Pressure test 4
- ASHP - Mitsubishi Ecodan 5KW
- Time and temp zone control
- Water cylinder 250L losses of 1.8 kw/day

Flat 1 -rev D (PV)

- As baseline but with 1.5 kwP PV installed

Flat 2 -rev D (PV)

- As baseline but with 1.5 kwP PV installed

Flat 1 -rev E (Solar Thermal)

- As baseline but with Solar thermal

Flat 2 -rev E

- As baseline but with Solar thermal

5.6 Energy Model Results

The results of the various SAP calculations are outlined in the table below. Please also note that full SAP calculation sheets can be found in the appendices of this report:

Dwelling	SAP	DER	TER	% Improvement
Flat 1 Baseline	B 83 (82.85)	16.9	16.69	-1.26
Flat 2 Baseline	B 84 (84.03)	15.73	15.97	1.5
Flat 1 -rev A (Fabric)	B 84 (83.74)	15.37	16.69	7.91
Flat 2 -rev A (Fabric)	B 86 (85.57)	13.44	15.97	15.84
Flat 1 -rev B (Wood & Control)	B 84 (84.14)	13.59	16.69	**18.57**
Flat 2 -rev B (Wood & Control)	B 86 (85.55)	12.31	15.97	**22.92**
Flat 1 -rev C (ASHP)	C 75 (74.57)	23.41	28.12	**16.75**
Flat 2 -rev C (ASHP)	C 77 (77.28)	20.42	26.97	**24.29**
Flat 1 -rev D (PV)	B 87 (87.45)	12.73	16.69	**23.73**
Flat 2 -rev D (PV)	B 87 (87)	13.14	15.97	**17.72**
Flat 1 -rev E (Solar Thermal)	B 83 (83.49)	16	16.69	4.13
Flat 2 -rev E (Solar Thermal)	B 85 (84.58)	14.98	15.97	6.2

DER – Dwelling Emission Rate

TER – Target Emission Rate

The table above shows the percentage improvements for the different scenarios. There are a number of scenarios that will meet the 20% reduction in Carbon through low and zero Carbon technologies.

The biomass wood burning option does meet the 20% reduction in Carbon, however, there may well be issues with air quality, supply of wood and fire safety that are likely to render the option unsuitable.

Both ASHPs and PV will each provide the 20% reduction and in fact, a combination of the two technologies would be a good match. ASHPs combined with an underfloor heating system would be an ideal heating and hot water solution. PV could be installed to offset some of the daytime electricity use of the ASHP.

Whilst the fabric first option does not get the development to the 20%, this should be considered as the new baseline, as long as the Planning Authority allow this to be considered within the calculation of 20%

6.0 CODE FOR SUSTAINABLE HOMES

The Code for Sustainable Homes is an environmental assessment rating method for new homes which assesses environmental performance in a three-stage process (Pre-Assessment, Design Stage and Post Construction Stage) using objective criteria and verification. The results of the Code assessment are recorded on a certificate assigned to the dwelling.

The report 'Code for Sustainable Homes: A step-change in sustainable home building practice (Communities and Local Government, 2006)' defined a set of nine categories of environmental impact which are assessed within a Code Assessment.

Within each category, credits are awarded for achieving specified degrees of performance. The weighting factors show the contribution made by each category to the total performance recognised and rewarded by the Code. The total available contribution is expressed as 100 per cent. The weighting of each category is expressed as a fraction of this, such that the sum of all the category contributions equals 100 per cent.

Code assessments are normally carried out in three stages:

- Pre-Assessment
- Design stage (DS), leading to an interim certificate
- Post construction stage (PCS), leading to a final certificate.

The Pre-Assessment Stage is not submitted to the BRE but is perhaps the most important. This sets the baseline for the assessment so the Assessor and project team know where credits are being targeted.

The assessment process for the latter two stages is very similar. Evidence is collated and used as the basis for the assessor to determine how many credits are to be awarded for each issue. A summary report is submitted to the Code service provider for quality assurance and certification.

6.1 CSH Results

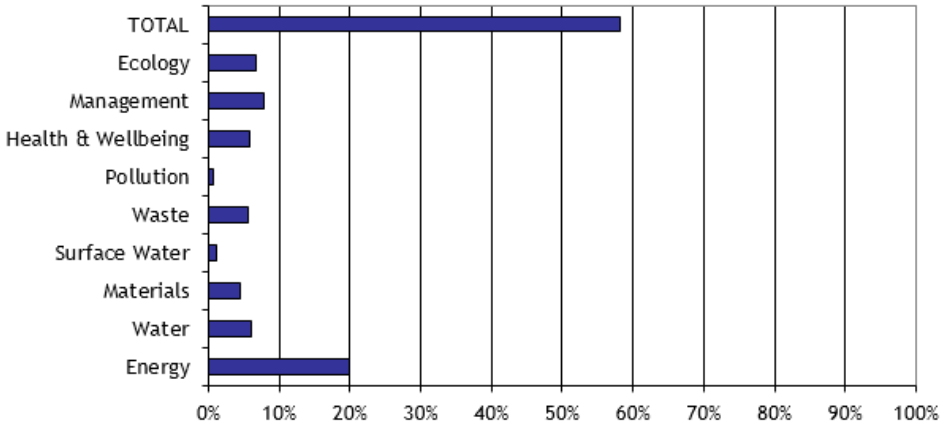
The table below highlights how a CSH 'Level 3' rating could be achieved for the development. A full breakdown of credits targeted can be found in the Appendices.

PREDICTED RATING - CODE LEVEL: 3

Mandatory Requirements: **All Levels**

% Points:	58.12%	- Code Level: 3
Breakdown:	Energy	- Code Level: 4
	Water	- Code Level: 4

Graph 1: Predicted contribution of individual sections to the total score and percentage of total achievable score



A score of 58.12% has been calculated using the CSH Pre-Assessment tool. It is important to note that the targeted credits are likely to change once the design development stages progress and client requirements for fitting out the apartments come to the fore. At this stage, a full Code assessment would be required.

There are areas for improvement within the assessment and further credits should be targeted to ensure the 57% required for CSH Level 3 is achieved. There are also a number of mandatory credits that must be achieved in order to gain the CSH Level 3 rating. Failure to do so would mean the rating could not be achieved even if the overall score was over the 57% required for CSH Level 3.

It is important that an assessor is appointed throughout the whole project to help ensure the desired rating is achieved. Mainer Associates have only been appointed to undertake the pre-assessment report and as such, take no responsibility for the assessment past this stage unless appointed to do so.

7.0 CONCLUSIONS

This report details how a CSH Level 3 ratings can be achieved on the proposed development at Worldwide House, Camden, London. This report only refers to the top floor extension to the existing property.

A Code score of 58.12% has been achieved at the pre-assessment stage which is only 1% over the threshold for the Code Level 3 rating. We would advise that further credits are sought during the design and construction of the development to ensure the desired rating is achieved.

With regard to the Energy Statement element of the report, and the achievement of the 20% reduction in CO2 from renewable and low Carbon solutions, we have put forward a number of options that will need to be considered at the detailed design stage.

Should the Planning Authority allow 'fabric first' measures to considered within the calculation, we would advise that this the primary solution that is implemented. This would further improve the feasibility of other technologies. From this point (around a 10% reduction in Carbon), either PV or ASHPs should be selected to deliver the remaining 10% reduction. From a thermal comfort perspective, it is likely that, in order to get the most out of an ASHP solution, improvements to the fabric would be required.

If the Planning Authority do not accept 'fabric first' measures as part of the 20% reduction, then either ASHPs or PV cells would achieve the 20% reduction on their own. They would simply be larger systems than if the 10% was achieved through fabric measures.

8.0 APPENDICES

APPENDIX A – SAP Calculations DRAFT

APPENDIX B – Code for Sustainable Homes – Pre-Assessment

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Results

Development Name:	Worldwide House
Dwelling Description:	2 Apartments
Name of Company:	Mainer Associates
Code Assessor's Name:	Ben Wells
Company Address:	Mainer Associates Ltd 8 Norbreck Avenue Chorlton, Manchester. M21 8TG
Notes/Comments:	

PREDICTED RATING - CODE LEVEL: 3

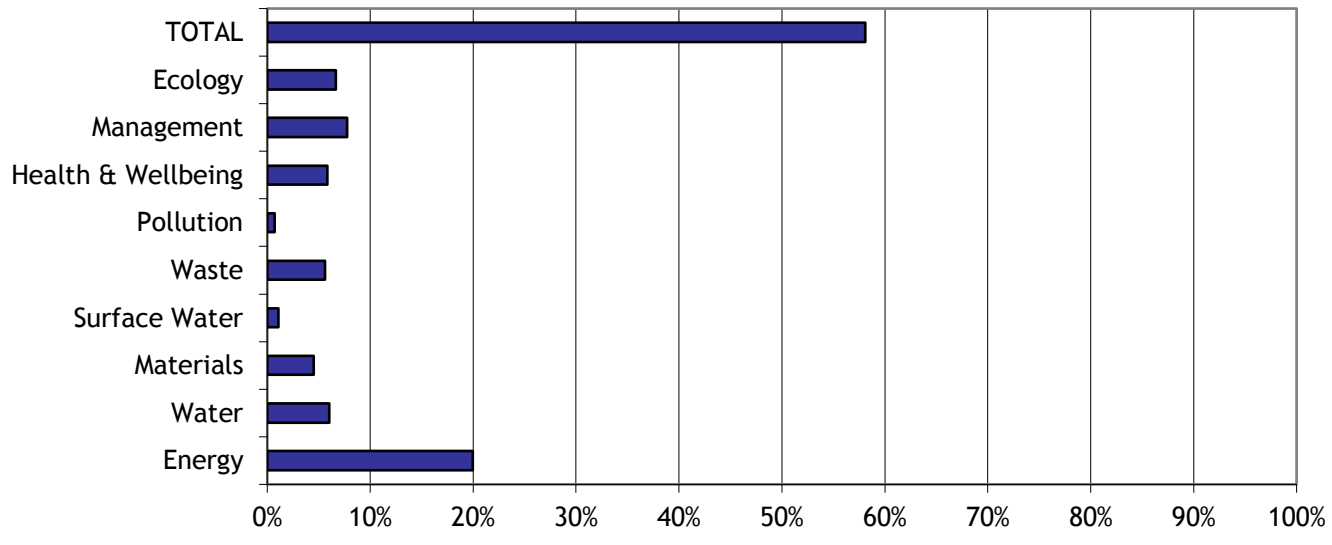
Mandatory Requirements: All Levels

% Points: 58.12% - Code Level: 3

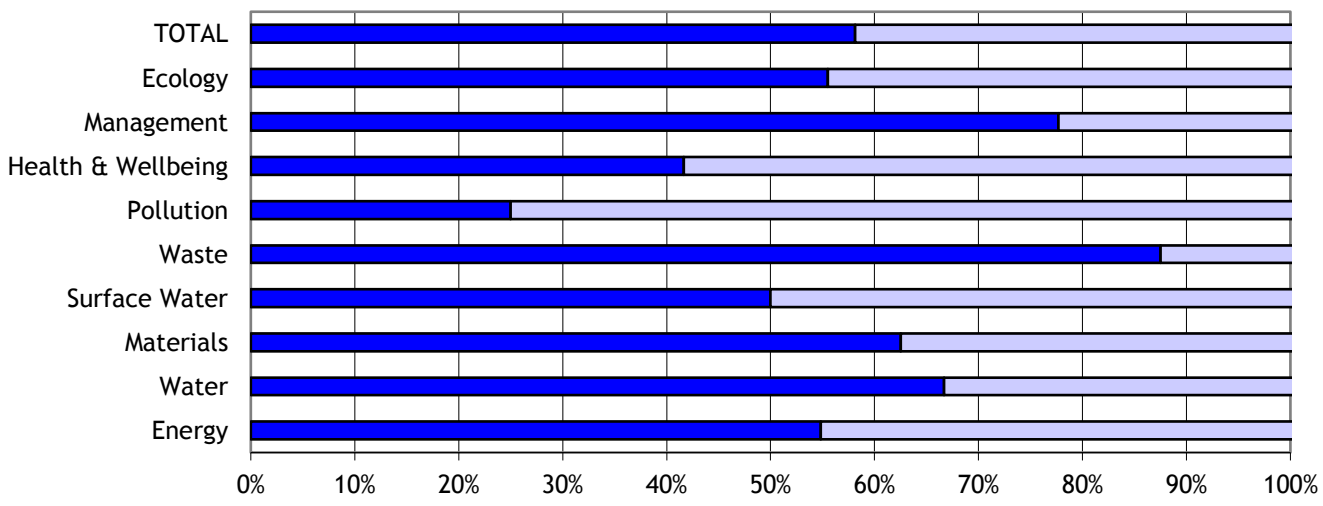
Breakdown: Energy - Code Level: 4

Water - Code Level: 4

Graph 1: Predicted contribution of individual sections to the total score and percentage of total achievable score



Graph 2: Predicted percentage of credits achievable: Total and by Category



NOTE: The rating obtained by using this Pre Assessment Estimator is for guidance only. Predicted ratings may differ from those obtained through a formal assessment, which must be carried out by a licensed Code assessor.

CATEGORY 1 ENERGY	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted: 54.83		Credits	Level		
Contribution to Overall % Score: 19.96 points		17.0 of 31 Credits	Level 4		
Ene 1 Dwelling Emission Rate	Credits are awarded based on the percentage improvement of the Dwelling Emission Rate (DER) over the Target Emission Rate (TER) as calculated using SAP 2009. Minimum standards for each Code level apply. The Code energy calculator can be used to calculate a predicted score. Enter the predicted score What is the predicted number of credits? 3.0 OR Are zero net CO_2 emissions achieved? ☐	3.0 of 10 Credits	Level 4	SAP calculations must be undertaken and credits are awarded for high performance.	
Ene 2 Fabric Energy Efficiency	Credits are awarded based on the Fabric Energy Efficiency (kWh/m^2/yr) of the dwelling. Minimum standards apply at Code levels 5 and 6. The Code energy calculator can be used to calculate a predicted score. Enter the predicted score Apartments, Mid-terrace ○ OR End terrace, Semi and Detached ○ OR Staggered Mid terrace ◉ What is the predicted number of credits? 3.0	3.0 of 9 Credits	-	FEE figures will need to be calculated in order to award credits.	
Ene 3 Energy Display Devices	Credits are awarded where a correctly specified Energy Display Device is installed monitoring electricity and/or primary heating fuel consumption. Select whether the EDD monitors electricity and/or fuel None Specified ○ Primary Heating only ○ OR Electricity only ○ OR Electricity and primary heating fuel ◉	2 of 2 Credits	-	Energy display devices will need to installed covering both electricity and primary heating.	

Issue		Credits	Level	Assumptions Made	Evidence Required
Ene 4 Drying Space	One credit is awarded for the provision of either internal or external secure drying space with posts and footings or fixings capable of holding 4m+ of drying line for 1-2 bed dwellings and 6m+ for dwellings with 3 bedrooms or greater. Will drying space meeting the criteria be provided? Yes ◉ OR No ○	**1 of 1 Credits**	-	Compliant internal drying space will need to be provided.	
Ene 5 Energy Labelled White Goods	Credits are awarded where each dwelling is provided with either information about the EU Energy Labelling Scheme, White Goods with ratings ranging from A+ to B or a combination of the previous according to the technical guide. Select the appropriate option below EU Energy labelling information **only** ☐ A+ rated appliances ☑ A rated washing machine and dishwasher ☑ B rated tumble dryer or washer dryer ☑ EU Energy labelling information provided ☐	**2 of 2 Credits**	-	White goods will need to be provided and they must be A+ rated in most cases.	
Ene 6 External Lighting	Credits are awarded based on the provision of space lighting* with dedicated energy efficient fittings and security lighting fittings with appropriate control gear.. Space Lighting None provided ○ OR Non Code compliant lighting ○ OR Code compliant lighting ◉ Security Lighting None provided ○ OR Non Code compliant lighting ○ OR Code compliant lighting and controls ◉ Dual lamp luminaires Compliant with both above criteria ☐ * Statutory safety lighting is not covered by this requirement	**2 of 2 Credits**	-	External lighting will need to be designed in line with the requirements.	

Issue		Credits	Level	Assumptions Made	Evidence Required
Ene 7 Low or Zero Carbon Technologies	Credits are awarded where there is a 10% or 15% reduction in CO_2 emissions resulting from the use of low or zero carbon technologies. Select % contribution made by low or zero carbon technologies Less than 10% of demand ○ OR 10% of demand or greater ○ OR 15% of demand or greater ◉	**2 of 2 Credits**	-	LZCs will be installed to meet the planning requirement of a 20% reduction in CO2.	
Ene 8 Cycle Storage	Credits are awarded where adequate, safe, secure and weather proof cycle storage is provided according to the Code requirements. Fill in the development details below Number of bedrooms: 2 Number of cycles stored per dwelling* 1.0 * if you have storage for 1 cycle per two dwellings insert 0.5 in number of cycles stored per dwelling	**1 of 2 Credits**	-	Cycle storage must be at least 1 per every two bed flat. The proivision must also be in line with the requirements.	
Ene 9 Home Office	A credit is awarded for the provision of a home office. The location, space and services provided must meet the Code requirements. Will there be provision for a Home Office? Yes ◉ OR No ○	**1 of 1 Credits**	-	Home office facilities must be provided.	

CATEGORY 2 WATER	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted: 66.66		Credits	Level		
Contribution to Overall Score: 6.00 points		4 of 6 Credits	Level 4		
Wat 1 Indoor Water Use	Credits are awarded based on the predicted average household water consumption, calculated using the Code Water Calculator Tool. Minimum standards for each code level apply. Select the predicted water use / Mandatory Requirement greater than 120 litres/ person/ day ○ OR ≤ less than 120 litres/ person/ day ○ OR ≤ less than 110 litres/ person/ day ○ OR ≤ less than 105 litres/ person/ day ◉ OR ≤ less than 90 litres/ person/ day ○ OR ≤ less than 80 litres/ person/ day ○	3 of 5 Credits	Level 3 AND Level 4	3 credits must be achieved for a level 3 rating. We have set this as the minimum.	
Wat 2 External Water Use	A credit is awarded where a compliant system is specified for collecting rainwater for external irrigation purposes. Where no outdoor space is provided the credit can be achieved by default. Select the scenario that applies No internal or communal outdoor space ○ OR Outdoor space with collection system ◉ OR Outdoor space without collection system ○	1 of 1 Credits	-	External water butts will need to be provided in line with the requirements.	

CATEGORY 3 MATERIALS	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted: 62.50		Credits	Level		
Contribution to Overall Score: 4.50 points		15 of 24 Credits	All Levels		
Mat 1 Environm-ental Impact of Materials	Mandatory Requirement: At least three of the five key building elements must achieve a Green Guide 2008 Rating of A+ to D. Tradable Credits: Points are awarded on a scale based on the Green Guide Rating of the specifications. The Code Materials Calculator can be used to predict a potential score. Mandatory Requirement Will the mandatory requirement be met? ☑ Enter the predicted score What is the predicted number of credits? 12	12 of 15 Credits	All Levels	We have assumed 12 credits at this stage. This will need to be verified by the project team.	
Mat 2 Responsible Sourcing of Materials - Basic Building Elements	Credits are awarded where materials used in the basic building elements are responsibly sourced. The Code Materials Calculator can be used to predict a potential score. Enter the predicted Score What is the predicted number of credits? 2	2 of 6 Credits	-	The contractor will be required to provide environmental certificates for the majority of materials.	
Mat 3 Responsible Sourcing of Materials - Finishing Elements	Credits are awarded where materials used in the finishing elements are responsibly sourced. The Code Materials Calculator can be used to predict a potential score. Enter the predicted Score What is the predicted number of credits? 1	1 of 3 Credits	-	The contractor will be required to provide environmental certificates for the majority of materials.	

CATEGORY 4 SURFACE WATER RUN-OFF	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted:	50.00%	Credits	Level		
Contribution to Overall Score:	1.10 points	2 of 4 Credits	All Levels		
Sur 1 Management of Surface Water Run-off from developments	Mandatory Requirement: Peak rate of run-off into watercourses is no greater for the developed site than it was for the pre-development site and that the additional predicted volume of rainwater discharge caused by the new development is entirely reduced as far as possible in accordance with the assessment criteria. Desiging the drainage system to be able to cope with local drainage system failure. Tradable Credits: Where SUDS are used to improve water quality of the rainwater discharged or for protecting the quality of the receiving waters. Mandatory Requirement Will the mandatory requirement be met? ☑ Select the appropriate option No SUDS ☑ No runoff into watercourses for the first 5 mm of rainfall ☐ Runoff from hard surfaces will receive an appropriate level of treatment ☐	0 of 2 Credits	All Levels	The rate of run-off must be no greater for the post development site than prior to development.	
Sur 2 Flood Risk	Credits are awarded where developments are located in areas of low flood risk or where in areas of medium or high flood risk appropriate measures are taken to prevent damage to the property and its contents in accordance with the Code criteria in the technical guide. Select the annual probability of flooding (from PPS25*) Zone 1 - Low ◉ OR Zone 2 - Medium ○ OR Zone 3 - High ○ Select the apropriate option(s) Low risk of flooding from FRA** ☑ All measures of protection are demonstrated in FRA ☐ Ground floor level and access routes are 600 mm above design flood level ☐ * Planning Policy Statement 25 - Planning and Flood Risk ** FRA - Flood Risk Assessment	2 of 2 Credits	-	A site specific FRA must be completed to demonstrate the site is at low risk of flooding.	

CATEGORY 5 WASTE	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted:	87.00%	Credits	Level		
Contribution to Overall Score:	5.60 points	7 of 8 Credits	All Levels		

Was 1 Storage of non-recyclable waste and recyclable household waste	Mandatory Requirement: The space provided for waste storage should be sized to hold the larger of either all external containers provided by the Local Authority or the min capacity calculated from BS 5906. Tradable Credits are awarded for adequate internal and/ or external recycling facilities. **Mandatory Requirement** Will the minimum space be provided and be accessible to disabled people? ☑ **Internal Recyclable household waste storage** Where there is no external recyclable waste storage and no Local Authority collection scheme Internal storage (capacity 60 litres) ☐ **Local Authority collection Scheme** Post Collection sorting Internal storage (capacity 30 litres) ☑ Pre-collection sorting Internal storage (3 separate bins, capacity 30 litres) ☐ **External Storage, no Local Authority collection scheme** 3 separate internal storage bins (capacity 30 litres) ☐ **AND** Houses External Storage(capacity 180 litres) ☐ Flats Private recycling operator ☐ 3 or greater types of waste collected ☐	0 of 2 Credits 4 of 4 Credits 0 of 4 Credits	All Levels	Internal and communal waste storage must be compliant with the criteria.	

Issue		Credits	Level	Assumptions Made	Evidence Required
Was 2 Construction Site Waste Management	A credit is awarded where a compliant SWMP is provided with targets and procedures to minimise construction waste. Credits are available where the SWMP include procedures and commitments for diverting either 50% or 85% of waste generated from landfill. SWMP details Does the SWMP include: + No SWMP ○ + SWMP with targets and procedures to minimise waste? ○ + SWMP with procedures to divert 50% of waste ○ + SWMP with procedures to divert 85% of waste ◉	**3 of 3 Credits**		A SWMP must be provided that confirms 85% diversion from landfill rate.	
Was 3 Composting	A credit is awarded where individual home composting facilities are provided, or where a community/ communal composting service, either run by the Local Authority or overseen by a management plan is in operation. Select the facilities available No composting facilities ◉ Individual composting facilities ○ OR Communal/ community composting*? ○ Local Authority ☐ OR Private with management plan ☐ * including if an automated waste collection system is in place	**0 of 1 Credit**	-	Not targeted.	

CATEGORY 6 POLLUTION	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted: 25.00%		Credits	Level		
Contribution to Overall Score: 0.70 points		1 of 4 Credits	All Levels		
Pol 1 Global Warming Potential (GWP) of Insulants	A credit is awarded where <u>all</u> insulating materials only use substances (in manufacture AND installation) that have a GWP of less than 5. Select the most appropriate option All insulants have a GWP less than 5 ◉ OR Some insulants have a GWP of less than 5 ○ OR No insulants have a GWP of less than 5 ○	1 of 1 Credits	-	Insulation materials must meet this criteria.	
Pol 2 NOx Emissions	Credits are awarded on the basis of NOx emissions arising from the operation of the space and water heating system within the dwelling. Select the most appropriate option Greater than 100 mg/kWh ◉ OR Less than 100 mg/kWh ○ OR Less than 70 mg/kWh ○ OR Less than 40 mg/kWh ○ OR Class 4 boiler ○ OR Class 5 boiler ○ OR All space and hot water energy requirements are met by systems who do not produce NOx emissions ○	0 of 3 Credits	-	We have assumed electric heating, therefore, this credit will not be achieved. If a gas central wet system is specified, this could be achieved.	

CATEGORY 7 HEALTH & WELLBEING	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted: 41.00%		Credits	Level		
Contribution to Overall Score: 5.83 points		5 of 12 Credits	No level		
Hea 1 Daylighting	Credits are awarded for ensuring key rooms in the dwelling have high daylight factors (DF) and a view of the sky. Select the compliant areas Room Kitchen: Avg DF of at least 2% ☐ Living Room*: Avg DF of at least 1.5% ☑ Dining Room*: Avg DF of at least 1.5% ☑ Study*: Avg DF of at least 1.5% ☑ 80% of working plane in all above rooms receive direct light from the sky? ☑ Any room used for Ene 9 Home Office must also achieve a min DF of 1.5%.	2 of 3 Credits	-	Daylighting calculations will need to be undertaken to confirm this.	
Hea 2 Sound Insulation	Credits are awarded where performance standards exceed those required in Building Regulations Part E. This can be demonstrated by carrying out pre-completion testing or through the use of Robust Details Limited. Select a type of property Detached Property ○ Attached Properties: - Separating walls and floors only exist between non habitable spaces ○ - Separating walls and floors exist between habitable spaces ◉ Select a performance standard Performance standard not sought ○ Airborne: 3db higher; Impact: 3dB lower ○ OR Airborne: 5db higher; Impact: 5dB lower ◉ OR Airborne: 8db higher; Impact: 8dB lower ○	3 of 4 Credits	-	An acoustic report and post completion testing, OR the use of Robust Details, will confirm the number of credits here.	

Issue		Credits	Level	Assumptions Made	Evidence Required
Hea 3 Private Space	A credit is awarded for the provision of an outdoor space that is at least partially private. The space must allow easy access to all occupants. Will a private/ semi-private space be provided? Yes, private/semi-private space will be provided ○ OR No private/semi-private space ◉	**0 of 1 Credits**	-	Not assumed.	
Hea 4 Lifetime Homes	Mandatory Requirement: Lifetime Homes is mandatory when a dwelling is to achieve Code Level 6. Tradable credits: Credits are awarded where the developer has implemented all of the principles of the Lifetime Homes scheme. Mandatory Requirement Dwelling to achieve Code Level 6? ☐ Lifetime Homes Compliance All Lifetime Homes criteria will be met ○ OR Exemption from LTH criteria 2/3 applied ○ Credit not sought ◉	**0 of 4 Credits**	**No level**	Not assumed.	

CATEGORY 8 MANAGEMENT	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted: 77.00%		Credits	Level		
Contribution to Overall Score: 7.77 points		7 of 9 Credits	All Levels		
Man 1 Home User Guide	Credits are awarded where a simple guide is provided to each dwelling covering information relevant to the 'non-technical' home occupier, in accordance with the Code requirements. Tick the topics covered by the Home User Guide Operational Issues? ☑ Site and Surroundings? ☑ Is available in alternative formats? ☑	3 of 3 Credits	-	Building User Guides compliant with the credit must be compiled.	
Man 2 Considerate Constructors Scheme	Credits are awarded where there is a commitment to comply with best practice site management principles using either the Considerate Constructors Scheme or an alternative locally/ nationally recognised scheme. Select the appropriate scheme and score No scheme used ◉ Considerate Constructors OR Best Practice ○ OR Significantly Beyond Best Practice ○ Alternative Scheme* OR Mandatory + 50% optional requirements ○ OR Mandatory + 80% optional requirements ○ * In the first instance, contact a Code Service Provider if you are considering to use an alternative scheme.	0 of 2 Credits	-	The CCS must be adhered to and a score of 35 or above achieved if this credit was to be targeted.	
Man 3 Construction Site Impacts	Credits are awarded where there is a commitment and strategy to operate site management procedures on site as following: Tick the impacts that will be addressed Monitor, report and set targets, where applicable, for: - CO_2/ energy use from site activities ☑ - CO_2/ energy use from site related transport ☑ - water consumption from site activities ☑ Adopt best practice policies in respect of: - air (dust) pollution from site activities ☐ - water (ground and surface) pollution on site ☑ 80% of site timber is reclaimed, re-used or responsibly sourced ☐	2 of 2 Credits	-	Construction site impacts must be monitored in line with the requirements.	

Issue		Credits	Level	Assumptions Made	Evidence Required
Man 4 Security	Credits are awarded for complying with Section 2 - Physical Security from Secured by Design - New Homes. An Architectural Liaison Officer (ALO), or alternative, needs to be appointed early in the design process and their recommendations incorporated. Secured by Design Compliance Credit not sought ○ OR Secured by Design Section 2 Compliance ◉	**2 of 2 Credits**	-	Secure by Design must be achieved.	

CATEGORY 9 ECOLOGY	Overall Level: 3	Overall Score	58.12	Assumptions Made	Evidence Required (The below cells can be formatted by assessors if required.)
% of Section Credits Predicted: 55.00%		Credits	Level		
Contribution to Overall Score: 6.66 points		5 of 9 Credits	All Levels		
Eco 1 Ecological Value of Site	One credit is awarded for developing land of inherently low value. Select the appropriate option Credit not sought ○ OR Land has ecological value ○ OR Land has low/ insignificant ecological value* ◉ * Low ecological value is determined either a) by using Checklist Eco 1 across the whole development site; or b) where an suitably qualified ecologist is appointed and can confirm or c) produces an independent ecological report of the site, that the construction zone is of low/ insignificant value; AND the rest of the development site will remain undisturbed by the works.	1 of 1 Credits	-	Following a site visit, it is likely that we would be able to confirm the site as low ecological value.	
Eco 2 Ecological Enhancement	A credit is awarded where there is a commitment to enhance the ecological value of the development site. Tick the appropriate boxes Will a *Suitably Qualified Ecologist* be appointed to recommend appropriate ecological features? ☑ AND Will all key recommendations be adopted? ☑ AND 30% of other recommendations be adopted? ☑	1 of 1 Credits	-	An ecologist must be appointed and their recommendations implimented.	
Eco 3 Protection of Ecological Features	A credit is awarded where there is a commitment to maintain and adequately protect features of ecological value. Type and protection of existing features Site with features of ecological value? ○ OR Site of low ecological value (as Eco 1)? ◉ AND All* existing features potentially affected by site works are maintained and adequately protected? ☐ *If a suitably qualified ecologist has confirmed that a feature can be removed due to insignificant ecological value or poor health conditions, as long all the rest have been protected, then this box can be ticked.	1 of 1 Credits	-	An ecologist must be appointed and their recommendations implimented.	

Issue		Credits	Level	Assumptions Made	Evidence Required
Eco 4 Change of Ecological Value of Site	Credits are awarded where the change in ecological value has been calculated in accordance with the Code requirements and is calculated to be: Change in Ecological Value Major negative change: fewer than -9 ○ Minor negative change: between -9 and -3 ○ OR Neutral: between -3 and +3 ◉ Minor enhancement: between +3 and +9 ○ Major enhancement: greater than 9 ○	**2 of 4 Credits**	-	An ecologist must be appointed and their recommendations implimented.	
Eco 5 Building Footprint	Credits are awarded where the ratio of combined floor area of all dwellings on the site to their footprint is: Ratio of Net Internal Floor Area: Net Internal Ground Floor Area Credit Not Sought ◉ OR Houses: 2.5:1 OR Flats: 3:1 ○ OR Houses: 3:1 OR Flats: 4:1 ○ OR Houses & Flats Weighted (2.5:1 & 3:1) ○ OR Houses & Flats Weighted (3:1 & 4:1) ○	**0 of 2 Credits**		Not targeted.	