



Energy/Renewable Energy Statement and Sustainability Statement (including CSH Pre-Assessment) for Planning Application

Green Dragon, Wrexham

Prepared for Caldecotte Consultants in respect of construction of 7 dwellings at Land at Green Dragon, Wrexham

Energy/Renewable Energy Statement and Sustainability Statement (including CSH Pre-Assessment)

This document is the sustainability assessment, and includes an initial overview of the Code for Sustainable Homes and a preliminary Energy/Renewable Energy Statement, prepared based on information provided by the design team and sets out the probable credits that will be scored to achieve a minimum CSH Level 3 rating. It is submitted as part of the application for planning permission at land at Green Dragon, Wrexham.

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Executive Summary

This document is the sustainability assessment, and includes an initial overview of the Code for Sustainable Homes and a preliminary Energy/Renewable Energy Statement, prepared based on information provided by the design team and sets out the probable credits that will be scored to achieve a minimum CSH Level 3 rating. It is submitted as part of the application for planning permission at Green Dragon, Wrexham.

The report is based around the principles of sustainable development. For the initial Code for Sustainable Homes assessment the lowest common denominator (worst case scenario) has been assumed to ensure that all units will achieve CSH level 3.

The proposed minimum scores that will be achieved for the building in each credit category are represented in table 1.1 below.

Table 1.1: Achievable minimum credit score by category for the building

Category	Available Credits	Credits Achieved	points achieved	% age of category achieved
Energy	29	14.00	17.57%	48%
Water	6	4.00	6.00%	66%
Materials	24	15.00	4.5%	62%
Surface Water Run Off	4	2.00	1.10%	50%
Waste	7	7.00	6.40%	100%
Pollution	4	3.00	2.10%	75%
Health and Well Being	12	4.00	4.66%	33%
Management	9	9.00	10.00%	100%
Ecology	9	4.00	5.33%	44%

Totals 57.66% LEVEL 3

*Weighting figures are only approximate and calculations should be made using an approved calculator

The total minimum score achieved by residential development at Green Dragon is 57.66 which gives a rating of Code Level 3.

The energy consumption and resulting carbon dioxide emissions of the new development at Green Dragon will be minimised following the Energy Hierarchy of 'be lean be clean, be green'.

The building will be designed to be lean by improving energy consumption as compared with building regulations and a thermally efficient building. In line with Wrexham's Planning Guidance,

the energy use and the renewable energy contribution of the building has been estimated. In this instance a worst case scenario Standard Assessment Procedure (SAP) has been carried out using as standard construction specification as supplied by Caldecotte Consultants, full details are available in Appendix 2.

The use of photovoltaic's has been included in the design which is estimated to provide 10% of the energy requirement for each dwelling from renewable resources.

Part 1 – Introduction and context

1.1 Document structure

This first part of this document sets the context and objectives for this document and also gives a brief description of the development.

The second section reviews the development in the context of the Wrexham's Planning Guidance.

Section three reviews criteria for evidence and the process that must be followed to achieve Code for Sustainable Homes.

Part four of the document reviews the credits which will be scored to achieve Level 3.

Section 5 reviews renewable energy possibilities and demonstrates the chosen technology at this time to achieving 10% from renewables target.

This report has been prepared in response to the planning requirements and guidelines outlined during the pre-application meeting and communication.

1.2 Project Description

The project comprises the development of erection of 7 houses, further details can be found in the Design and Access Statement.

1.3 Context

Based on the information received, it is anticipated that a number of credits would be easily achieved and that these credits would enable a rating of **Level 3** to be achieved. These credits represent best practice in some field but are all considered to be easily achievable.

This document addresses these issues by achieving the following objectives. Though the objectives are interlinked, they are presented below in separate chapters for clarity.

Objective 1

Give an overview of the requirements of the Code for Sustainable Homes.

Objective 2

Develop an understanding of the credits which are required to achieve a CSH Level 3 rating

Objective 3

Develop overview of suitable renewable technologies and their contribution to 10% target from renewables

Part 2 – Sustainability Assessment

2.1 Land and Buildings

The new development will be on previously developed land. The current buildings/site offered the opportunity to improve the look of the site, enhance the local environment and provide enhanced visual amenity in the area.

2.2 Use of Natural Systems

Flexibility – The houses have been designed using the principles of Lifetime Homes, to allow the straightforward rearrangement as space requirements change over time.

Adapting to Climate Change – Adaption to climate change ensures that buildings will be adaptable to climate change and the physical impacts of it, such as severe weather and temperature increases. Ensuring climate change has been considered during design and construction will ensure robustness and longevity of the building under changing conditions.

2.3 Energy

Energy Demand Assessment - In accordance with Wrexham Planning Guidance the predicted energy consumption of one of the dwellings has been calculated using SAP. Further details of the energy and renewables approach can be found in section 5.

Efficiency – The building will be designed to minimise energy use. This will primarily be achieved through maximising building's envelope, enhanced by design and use of efficient mechanical systems. These could include:

- Specifying high efficiency solar control glazing to minimise transmission of thermal radiation
- Use of solar shading devices for occupant control again to minimise transmissions
- High efficiency internal and external lighting with daylight control and occupancy sensors

Renewable Energy - Further to energy efficiency design, some of the building's energy will be provided by renewables, photovoltaic's have been included in the design at this stage.

Materials - All building elements will include a 'Green Guide to Specification' rating. This will enable design team and the developer to specify materials and building components from sustainable sources and will achieve the mandatory requirement of the Code for Sustainable Homes.

Water – Potable water use of 105 litres per person per day will be targeted through a combination of water efficient fittings. The use of non-potable water has been considered, but based on current information is not considered necessary and the use of grey water recycling could potentially impact on the space within the units.

2.4 Comfort and Security

Information is to be provided to all occupants in form of a home user guide, covering information relevant to the living environment and environmental performance of the building. This will help ensure that the building systems operate as designed and keep the carbon emissions reduced during occupation.

2.5 Environment and Biodiversity

The building has been designed to contribute to the community and enhance the local built environment. Planting could be considered to contribute to enhancing the biodiversity of the area.

2.6 Waste

A site waste management plan will be employed during the construction of the building and measures for recycling during occupation will be designed into the units and within the development as a whole.

Part 3 – Sustainability Assessment Code for Sustainable Homes– Overview

3.1 Code for Sustainable Homes

The Code for Sustainable Homes (the Code) was introduced in England¹ in April 2007 following extensive consultation with environmental groups and the home building and wider construction industries.

The Code is a voluntary standard designed to improve the overall sustainability of new homes by setting a single framework within which the home building industry can design and construct homes to higher environmental standards and offers a tool for developers to differentiate themselves within the market. Where it is used the Code also gives new homebuyers better information about the environmental impact of their new home and its potential running costs.

The Code complements the system of Energy Performance Certificates for new homes, which will be introduced in April 2008 under the Energy Performance of Buildings Directive (EPBD).

Code for Sustainable Homes builds upon EcoHomes system in a number of ways, for example:

- Introduces minimum mandatory standards for each level
- Introduces mandatory Post Construction Review (PCR)

3.2 Categories, Scoring & Weighting

The Code for Sustainable Homes was devised to provide an established method of benchmarking the performance of developments so that the environment impact of buildings can easily be understood and compared. The issues assessed by the Code for Sustainable Homes (CSH) are grouped into the nine categories listed below:

- Energy and CO₂
- Water
- Materials
- Surface water run-off
- Waste
- Pollution
- Health and Well Being
- Management and
- Ecology.

¹ The Code does not apply in Scotland. The National Assembly for Wales recently announced that they would be adopting the Code in the near future, and Northern Ireland will be requiring Code Level 3 for all public sector housing from April 2008.

Scoring System

Credits are available for each issue meeting the specified levels of performance. Each category is allocated a total maximum score in terms of percentage points out of 100.

The weighting system is designed to reflect the importance of that environmental category.

The CSH has 6 levels as follows;

- Code Level 1 – above regulatory standards and a similar standard to BRE's EcoHomes PASS level and the EST's Good Practice Standard for energy efficiency
- Code Level 2 – a similar standard to BRE's EcoHomes GOOD level
- Code Level 3 – a broadly similar standard to BRE's EcoHomes VERY GOOD level and the EST's Best Practice Standard for energy efficiency
- Code Level 4 – Broadly set at current exemplary performance
- Code Level 5 – Based on exemplary performance with high standards of energy and water efficiency
- Code Level 6 – standard based on zero carbon emissions for the dwelling and high performance across all environmental categories.

The Code Level is awarded on the basis of achieving BOTH a set of mandatory minimum standards and a minimum overall score.

The final rating is determined by the Assessor and quality assured and certified by the BRE. These purportedly correlate to EcoHomes as follows:

Code Level	EcoHomes Rating	
1 star	Pass	Most developments should be able to achieve this with minor design/ specification changes
2 star	Good	The developer has been able to demonstrate good practice in most areas
3 star	Very Good	Development pushing forward the boundaries of environmental performance will achieve this
4 star	Excellent	Developments demonstrating exemplary environmental performance across the full range of issues will achieve this
5 star	Better than Excellent	Developments demonstrating exemplary environmental performance with high standards of energy and water efficiency will achieve this
6 star	Better than Excellent	Currently aspirational standard with experimental technologies

A Code Level is awarded on the basis of achieving both a set of mandatory minimum standards and a minimum overall score. For most of the issues within the Code assessment, developers and designers can choose standards to suit a given site and development. This offers flexibility in achieving the standards, but it is less flexible than EcoHomes©.

Weighting

Within these nine credit categories are a varying number of individual credit criteria (34 in total) which can be scored as outlined in Table 2.1 below.

An environmental weighting is applied to each credit scored and this varies from category to category as in Table 2.1 below. The weighting factors have been derived from consensus based research with various groups such as government, material suppliers and lobbyists. This research was carried out by BRE to establish the relative importance of each environmental issue.

The total achieved scores from each category are multiplied by the weighting factor to give the final score for that category. In Table 2.1 below the categories which have the highest weighting factors have been highlighted.

Table 2.1 – CSH and BREEAM Categories and Weightings

Credit Categories			
Category	Credits Available	Weighting*	Score for 1 credit
Energy and CO ₂ Emissions	29	36.4%	1.26
Water	6	9%	1.50
Materials	24	7.2%	0.30
Surface Water Run-off	4	2.2%	0.55
Waste	7	6.4%	0.91
Pollution	4	2.8%	0.70
Health and Well Being	12	14%	1.17
Management	9	10%	1.11
Ecology	9	12%	1.33
Totals	104	100%	

*Weighting figures are only approximate and calculations should be made using an approved calculator

Achieving credits in the highlighted categories will gain the development a higher score for achieving fewer credits.

3.3 Mandatory Credits

The Code assigns one or more performance requirements (assessment criteria) to all of the environmental issues. When each performance requirement is achieved, a credit is awarded (except the four mandatory requirements with no associated credits). The total number of credits available to a Category is the sum of credits available for all the issues within it.

Mandatory minimum performance standards are set for some issues. For four of these, a single mandatory requirement is set which must be met, whatever Code level rating is sought. Credits are not awarded for these issues. Confirmation that the performance requirements are met for all four is a minimum entry requirement for achieving a level 1 rating. The four un-credited issues are:

- Environmental impacts of materials
- Management of Surface Water Runoff from developments
- Storage of non-recyclable waste and recyclable household waste
- Construction site waste management.

If the mandatory minimum performance standard is met for the four un-credited issues, three further mandatory issues need to be considered.

These are agreed to be such important issues that separate government policies are being pursued to mitigate their effects. For two of these, credits are awarded for every level of achievement recognised within the Code, and minimum mandatory standards increase with increasing rating levels.

The two issues with increasing mandatory minimum standards are:

- Dwelling emission rate
- Indoor water use.

The final issue with a mandatory requirement for Level 6 of the Code is Lifetime Homes, which is not relevant for the purposes of this development.

The table below illustrates how for the creditable mandatory issues the minimum mandatory standards increase with increasing rating levels. For CO₂ emissions there are increased mandatory minimum standards for each increase in Code Level.

	Level					
	1	2	3	4	5	6
Energy (% improvement over ADL1 2006)	10%	18%	25%	44%	100%	neutral
Water (l per bedspace per day)	125	125	105	105	80	80

These mandatory credits must be achieved for a development to achieve the relevant CSH Level. The most challenging of these targets are those set in the Energy and Water credit categories.

The mandatory credits for 'CSH Level 3' will give 8 credits, with the remainder of the credits in each case being made up from Tradable Credits. These credits must then be multiplied by the weighting factor to show what score is achieved.

Part 4 – Achieving Code for Sustainable Homes Level 3

4.1 Summary

The spreadsheet on the following pages outlines the credits that will be achieved to achieve the required Level 3 rating in the Likely Credits column.

Approach to Code for Sustainable Homes

The following sections outline the types of steps which could be taken to help achieve the level 3 target.

4.2 Spreadsheet

CODE FOR SUSTAINABLE HOMES				
Credit Summary: Green Dragon				
Credit Summary:		Credit no.	Credits Available	Likely Credits
Energy	Dwelling Emission Rate	E1	15	5.00
	Building Fabric	E2	2	0.00
	Internal Lighting	E3	2	2.00
	Drying Space	E4	1	1.00
	Energy Labelled White Goods	E5	2	1.00
	External Lighting	E6	2	2.00
	Low/Zero Carbon Technologies	E7	2	0.00
	Cycle Storage	E8	2	2.00
	Home Office	E9	1	1.00
Section Credit Total			29	14
Weighted Section Total			17.57%	
Water	Indoor Water Use	W1	5	3.00
	External Water use	W2	1	1.00
Section Credit Total			6	4
Weighted Section Total			6.00%	
Materials	Environmental Impact of Material	MAT1	15.00	12.00
	Responsible Sourcing of Materials – Basic	MAT2	6.00	2.00
	Responsible Sourcing of Materials - Finishing	MAT 3	3.00	1.00
Section Credit Total			24	15
Weighted Section Total			4.50%	
Surface Water Run-off	Management of Surface Water Run-off	SUR1	2	0.00
	Flood Risk	SUR2	2	2.00
Section Credit Total			4	2
Weighted Section Total			1.10%	
Waste	Storage of Non and Recyclable Household Waste	Wst1	4	4.00
	Construction Site Waste Management	Wst2	2	2.00
	Composting	Wst3	1	1.00
Section Credit Total			7	7
Weighted Section Total			6.40%	
Pollution	GWP of Insulants	P1	1	1.00
	NOx Emissions	P2	3	2.00
Section Credit Total			4	3
Weighted Section Total			2.10%	
Credit Summary:		Credit no.	Credits Available	Likely Credits
Health and Wellbeing	Daylighting	HW1	3	0.00
	Sound Insulation	HW2	4	3.00
	Private Space	HW3	1	1.00
	Lifetime homes	HW4	4	0.00
Section Credit Total			12	4
Weighted Section Total			4.66%	

CODE FOR SUSTAINABLE HOMES				
Credit Summary: Green Dragon				
Manage ment	Home user Guide	M1	3	3.00
	Considerate Constructors	M2	2	2.00
	Construction Site Impacts	M3	2	2.00
	Security	M4	2	2.00
Section Credit Total			9	9
Weighted Section Total			10.0%	
Ecology	Ecological value of site	LE1	1	0.00
	Ecological Enhancement	LE2	1	1.00
	Protection of Eco Features	LE3	1	0.00
	Change in ecological value of the site	LE4	4	3.00
	Building Footprint	LE5	2	0.00
Section Credit Total			9	4
Weighted Section Total			5.33%	
TOTALS:				
TOTALS:				57.66
RATING:				3

The following section sets out the proposed minimum scores that will be achieved for the building in each credit category. This is represented in table 4.1 below. These universal credits are then summarised with a brief description of what is needed to achieve the credits.

Table 4.1: Achievable minimum credit score by category for the building

Category	Available Credits	Credits Achieved	% age of category Achieved
Energy	29	12	48%
Water	6	3	66%
Materials	24	16	62%
Surface Water Run off	4	2	50%
Waste	7	7	100%
Pollution	4	3	75%
Health and Well Being	12	4	33%
Management	9	9	100%
Ecology	9	6	44%

Totals Level 3

*Weighting figures are only approximate and calculations should be made using an approved calculator

The total minimum score achieved by residential development at Green Dragon, Wrexham is 57.66% which gives a rating of 'Level 3'.

4.1 Energy and CO₂ Emission

To achieve 'CSH Level 3' a mandatory five credits must be achieved under Ene 1 – Energy and CO₂ Emissions.

It has been estimated that this project is likely to achieve 5 credits. This has been assessed on a worst case scenario basis using unit * and on the specification provided by Caldecotte Consultants. The design specification and SAP calculation is provided at appendix 2.

The achievement of a heat loss parameter of less than or equal to 1.3 achieves credits. This could be achieved by using materials with good thermal performance and maximising airtightness of the buildings through good seals (proposed 8 m/hr air loss) Thermal bridging could be reduced by for example using plastic wall ties, filling the cavity and leaving no gaps and installing cavity plugs around the windows etc.

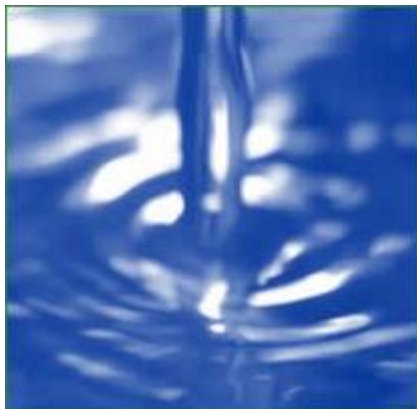
Further credits could be achieved here with inclusion of design backstops detailed later.

The design team have also targeted further credits in the Energy Section by including where possible the following measures:

- 100% of light fittings will be dedicated energy efficient. This will comprise lamp, control gear and housing reflector shade or diffuser, the fitting will only be capable of accepting lamps having a luminous efficacy greater than 40 lumens per circuit watt. (tubular and compact fluorescent fittings).
- Drying facilities of at either 4m or 6m (dependent on size of unit) to be provided in the bathroom or with posts, footings and fixings in the garden area.
- Information the EU Energy Labelling Scheme is to be provided to every unit.
- Where there is the requirement for external lighting it will be energy efficient and controlled through time switch or daylight sensor. Space Lighting - external entrances, internal porch areas, external steps and pathways will be equipped with dedicated fluorescent fittings (at least) and controlled by time clock or daylight sensors. Burglar Security lighting - max wattage 150w, PIRs and daylight cut off sensors. Other Security Lighting - dedicated energy efficient fittings and daylight cut off sensors or timers.
- Provision of secure and adequate cycle storage for some dwellings.
- Internal layout with space for a home office in the future.

4.2 Water

The achievement of at least 3 credits under Water 1 is required to meet the minimum rating of 'Code Level 3'.



In order to achieve Code Level 3 a predicted maximum water consumption of 105 litres/person/day must be achieved. This can be achieved through the use of water efficient appliances or off set through the use of rainwater harvesting or grey-water recycling.

Installation Type	Unit of Measure	Litres of water/person/day
WC (dual Flush)	Full flush	4
	Part flush	2.6
Wash Hand Basin	Litres/min	14
Shower	Litres/min	6
Bath	Capacity to overflow	140
Kitchen sink taps	Litres/min	6
Washing Machine	Typical practice or actual	Typical
Dishwasher	Typical practice or actual	Typical
Total internal Use		105

Typical Water fittings to meet CSH Level 3 (with greywater or rainwater harvesting greater flows could be achieved)

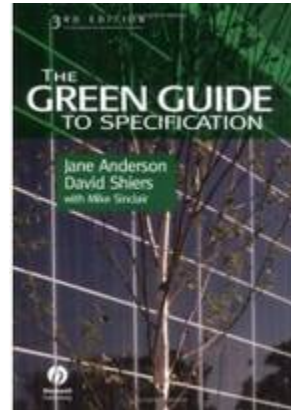
Rainwater harvesting has been considered by Caldecotte Consultants but is not considered appropriate at this stage, whilst greywater recycling facilities within the units could impact on available internal space.

4.3 Materials

Sustainability considerations relevant to CSH will be adopted across the site, namely:

- Making use of A rated materials and avoiding the use of C rated materials as defined by The Green Guide to Specifications
- Ensuring the majority of timber and other building materials are from sustainably certified sources (e.g. PEFC, EMS, etc)

A detailed report on materials could be prepared as a discussion document however steps should be taken to avoid the use of C rated materials and to use A or A+ rated materials wherever possible.



100% of all timber for both basic building elements must be obtained from appropriately certified legal sources. In addition, 80% of building element timber (e.g. roof trusses, flooring systems, frames etc) should be procured from sustainably certified forests (as recognised in the Code), notably those certified under the PEFC and SFI schemes.

Of the remaining building elements at least 80% will be sourced from organisations that, as a minimum, can provide evidence of that an environmental management system (EMS) is in place with that supplier.

A detailed report on materials could be prepared as a discussion document however steps should be taken to maximise the use of reused and certified materials. Reused materials achieve maximum points so design incorporating demolition materials could achieve additional credits.

4.4 Surface Water Run Off

For all code levels, as a mandatory minimum the peak run off rate is to be no greater for the developed site than it was for the pre-development site.

Additional credits can be achieved for building on sites with low risk of flooding, which this site is falls under, as per the Environment Agency website.

4.5 Waste

For all code levels there is a mandatory requirement, with no credits available, to provide sufficient space for waste storage. The development will be part of the LA refuse recycling scheme it is assumed that the provided bins for non recyclable waste will exceed the mandatory minimum of 170litres and that there will be the sorting of waste before collection into at least 3 different types and the bins provides are 30litre capacity.

Space has been allocated in the rear garden for the storage of the containers and is fully accessible to disabled people.

There is sufficient space for 3 internal storage bins with a minimum total capacity of 30 litres (no bin to be smaller than 7 litres)



A Site Waste Management Plan will be produced to minimise waste generation on site. The Plan will include procedures and commitments to sort, reuse and recycle construction waste on site.

4.6 Pollution

The design team will aim to target 3 pollution credits by;

- Specifying all insulating materials in the elements of the dwelling [including loft hatch, water cylinder, pipe insulation etc], will only use substances that have a GWP of less than 5 for both manufacture and insulation.
- Specifying a space heating system with low NO_x emissions (less than 100mg/kWh for one or less than 70mg/kWh for two credits).

4.7 Health and Well Being

The design team will aim to target 8 Health and Wellbeing credits by considering the following;

- Maximise daylight whilst minimising heat loss and heat gain
- Consulting with acoustician on noise and sound insulation issues
- The development will provide private space to add to the quality of the development.
- The development will aim to ensure compliance with the 16 points under Lifetime Homes.

4.8 Management

The design team will aim to target Management credits by the following measures

- Home User Guide covering information on the operation and environmental performance of the building. The guide will include specific information on building service, energy performance, water use, recycling and waste, transport facilities and emergency services.
- Committing to being registered with the Considerate Constructors Scheme, and will achieve a minimum score of 32 to qualify for two points under CSH.
- Adopting best practice on air and water pollution, monitoring the environmental impacts of construction, such as water consumption and by ensuring that at all construction timber on site is 100% legally and responsibly sourced will ensure credits are achieved.
- Consulting with the local crime prevention officer and their recommendations to ensure the security of the home will be implemented.



4.9 Ecology

The development has some trees on site therefore at this stage the site is considered as being land of with ecological value, so this credit has not been awarded. The engagement of an ecologist would be required to confirm these assumptions. Options to maximise credits in this section include:



- The appointment of a *Qualified Ecologist* and implementation their general recommendations in landscaping.
- Enhancing ecological value of site with appropriate landscaping.

Part 5 – Energy/Renewable Energy Statement

5.1 Energy Demand Assessment

In accordance with Wrexham Planning Guidance, the predicted carbon emissions of the building have been estimated using the provided construction specification. A summary of the data for the specified building is given in the table below:

Development Data	Green Dragon			
Unit *	TER	DER	% improvement	Comment
Basic Specification and woodburner	23.91	21.28	10	Compliance with Building Regulations
Photovoltaics	23.91	17.89	25	Achieves CSH Level 3 requirement 15% improvement from use of renewables

5.2 Energy Efficient Design

The resultant carbon dioxide emissions of the new development will be minimised by following the Energy Hierarchy of 'Be Lean Be Clean Be Green'. The design team has considered the energy efficiency measures (Be Lean) carefully to ensure that the performance of the building can be improved without affecting the character of the building and the local area. Measures which will be used include:

Design Backstops

Opaque elements W/m ² .K	Roof	0.10
	walls	0.24
	exposed floors	0.20
Windows and doors W/m ² .K	1.5 if glazed, or 1.0 if solid.	
Space and hot water heating	Gas central heating systems conform to CH _{ES} HR5 or HC5.	
Lighting (internal) Percentage of all fixed lighting to be dedicated low energy (i.e. only accept low energy lamps with luminous efficacy of greater than 40 lumens per circuit Watt).	100%. The lamp fitting may contain one or more lamps and should include the ballast, appropriate housing, reflector, shade or diffuser or other appropriate device for controlling the output of light. If tubular fluorescent lamps are used, T8 (26mm tube diameter) lamps, or preferably T5 (16mm diameter) lamps should be specified.	
Lighting (external)	Maximum lamp capacity of 150 Watts per fitting with controls that automatically switch off: 1. When there is enough daylight; and 2. When it is not required at night, or only energy efficient light fittings greater than 40 lumens per circuit Watt and compatible	

White Goods	All major electrical appliances (i.e. refrigerators, freezers, washing machines, tumble dryers, washer-dryers and dishwashers) supplied with the dwelling to be Energy Saving Recommended.
Air permeability	Assumed 10
Drying space	Facilities provided outside, however a ventilated space for drying clothes could be provided within the house. This could be either an unheated space with good ventilation, or a heated space with adequate, controlled ventilation.

By ensuring that the implementation of this design backstops, or similar, the percentage improvement over and above building regulations that can be achieved is around 10% figure, dependant on the units position, (% improvement Target Emission Rate and Dwelling Emission Rate), with the inclusion of photovoltaic's this is increased to 25%.

5.3 Renewable Energy

Renewable Energy technologies have been assessed. The following sections are a summary of the findings and conclusions. A copy of the SAP output can be found in Appendix 2.

5.31 Biomass Heating

Biomass is generally considered to be a near carbon neutral source of heating, as carbon dioxide released through burning biomass is later sequestered by trees being re-planted. Biomass is usually assumed to have a carbon dioxide emissions factor of 0.025kg CO₂/kWh (compared with 0.194 for natural gas) due to processing and transportation of the fuel. This technology can therefore offer significant carbon dioxide emission savings for a relatively modest cost.

The design team have provided space for the provision of a woodburner within each of the dwellings, however this has not been taken into account in the % provided by renewables.

5.32 Ground Source Heating

Ground source heating and cooling systems make use of the large thermal capacity of either the water of the ground beneath the building. Heat can therefore be stored and used as required over the year. There are two types of systems: open and closed systems.

A ground source heat pump uses a compression/expansion cycle to extract heat from the ground and transfer it to a building heating system. The process uses the same principle as a domestic refrigerator or air conditioning unit, moving heat from one place to another against the gradient of heat flow. The heat is extracted from the ground using a series of bore holes in direct contact with the rock or using a high density network of shallow buried

pipes that are in contact with the soil. Heat pumps require electricity to drive the compression cycle; this electricity needs to be offset by renewable source if the technology is to be considered truly zero-carbon. The efficiency of a heat pump is determined by its Coefficient of Performance (CoP) which determines how many units of heat are produced per unit of electrical input, for example a CoP of 3 would produce 3 units of heat for every unit of electricity.

The proportion of heat supplied from ground source heat pumps is controlled by the area of undeveloped space available for the installation of bore holes and shallow buried arrays of pipes. The two tables below outline the technical assumptions utilised within the analysis. The energy output is a function of the assumptions utilised in terms of space available for installing these systems.

Open System

An open loop ground system operates by abstracting ground water from one borehole and injecting building heat into the water. Ground water from an aquifer is pumped to a heat exchanger then transfers its heat to the heat pump. After it leaves the building, the water is pumped back into the same aquifer via a second well, called a discharge well, located at a suitable distance from the first.

Closed System

A closed ground system consists of exchanging heat between the system and the ground through heat exchanger pipes. Building cooling or heating is then achieved by absorbing or rejecting heat from or into the fluid.

Whilst there is space for either of the above, these have not been considered at this stage as they could be implemented without affecting the external appearance of the development and the need to revisit the planning process. For this reason ground source heating has not been included in the design.

5.33 Solar Thermal Heating

A solar thermal heating system uses either flat plate or vacuum tube collectors to collect heat from the sun. During the day, water is circulated through the collectors and is heated by the sun. The water is then stored in a tank, to be used when required.

The remaining energy for hot water would be supplied by gas boilers. The system would also require large water storage tanks in addition to the gas boiler as a back up system. These would have an effect on the space within the units, requiring space within the storage space.

For these reasons solar water heating has not been considered at this time.

5.34 Photovoltaics

Photovoltaic (PV) technology converts solar energy into electricity. There are three types of panel currently available; polycrystalline, monocrystalline and amorphous. The majority of commercially available PV technology utilises mono-crystalline silicon cells.

Mono-crystalline PV technology is currently able to convert a maximum of 13-17% of the solar energy it receives into electricity; a significant proportion of the remaining energy is lost as un-recoverable heat. The generating capacity of PV cells is measured in kilowatts peak (kWp) or the maximum peak output that can be expected from an array. Electrical generation from PV cells is modest, a 1 kWp array can be expected to yield 750-800 kWh p.a.; this translates to approximately 100 kWh p.a. from a 1m² mono-crystalline PV array.

The electrical generation from a PV array depends primarily on the amount of solar radiation available at the site. The amount of solar radiation available (kWh/m²) is a function of the geographical location (latitude) and the orientation and shading of the PV array. The strength (irradiance) of the sun also varies according to time of year, time of day and atmospheric conditions.

It has been assumed on the basis that there is 5m² for each dwelling generating 0.65kWp/flat (using S170SP4 170wp module from SolarTech Ltd). The SAP indicates that this area of panels would produce an annual carbon emissions reduction of around 15%.

5.4 Conclusion

The energy consumption and resulting carbon emissions of development at the Green Dragon will be reduced by implementing a combination of energy efficiency measures and renewable technologies.

The energy consumption of the building will be improved over and above the current 2006 building regulations, through a variety of measures following the London Plan Energy Hierarchy as set out above. Energy consumption will also be reduced by designing and specifying renewable energy systems.

Based on the SAP calculations photovoltaic's are proposed which will provide a reduction in the annual carbon emissions against the baseline to a maximum of 15%. This would be the preferred strategy at this time and represents one potential way of achieving the policy requirements for both renewable energy and CSH level 3.

Appendix 1

Code for Sustainable Homes Pre-Assessment Estimator

Appendix 2

Construction Specification and SAP Results

Appendix 3

Plans



RESULTS

Development Name:	Green Dragon, Wrexham
Dwelling Description:	Erection of 7 houses
Name of Company:	Caldecotte Group
Code Assessor's Name:	A Morgan
Company Address:	SustainEnable Ltd Weedon Northampton
Notes/Comments:	Green Dragon, Wrexham Pre-assessment estimator for planning purposes dated October 2009

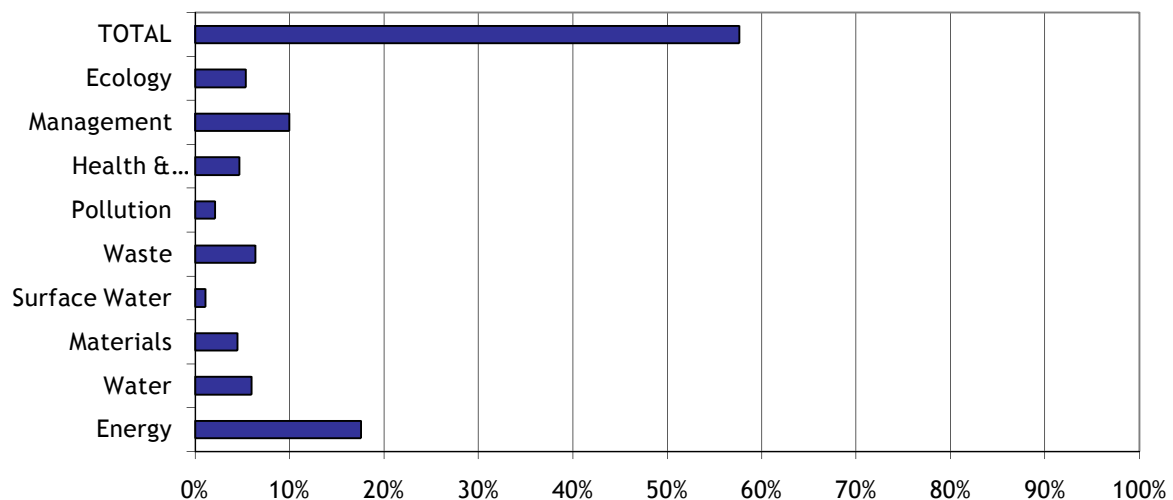
PREDICTED RATING - CODE LEVEL: 3

Mandatory Requirements: All Levels

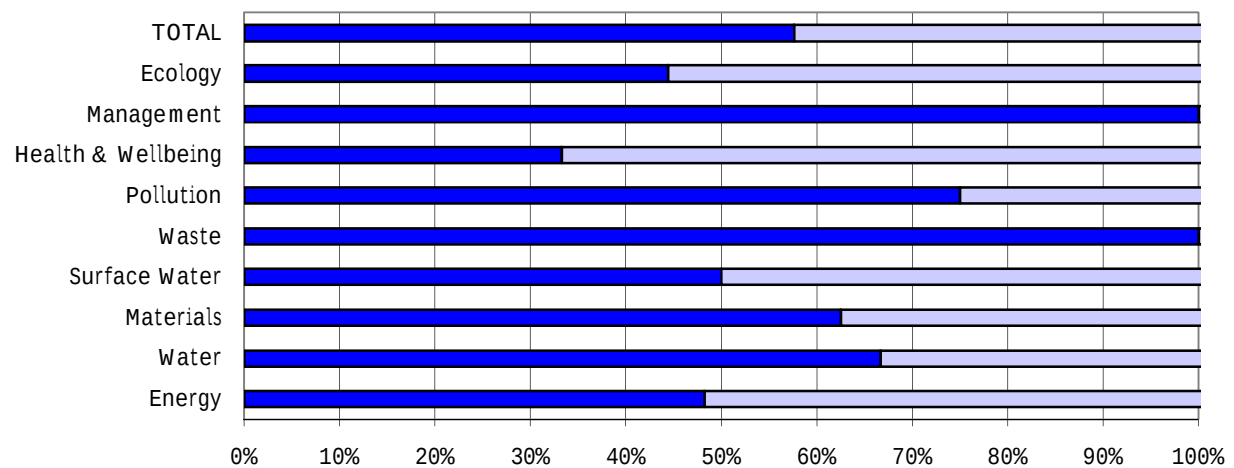
% Points: 57.66% - Code Level: 3

Breakdown: Energy - Code Level: 3
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.

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CATEGORY 1 ENERGY		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 48.00%		Credits		Level
Contribution to Overall Score: 17.57 points		14 of 29 Credits		Level 3
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 2005. Minimum standards for each Code level apply. Select the % improvement / Mandatory Requirement 0% improvement ☐ OR 10% Improvement ☐ OR 14% Improvement ☐ OR 18 % Improvement ☐ OR 22% Improvement ☐ OR 25% Improvement ☒ OR 31% Improvement ☐ OR 37% Improvement ☐ OR 44% Improvement ☐ OR 52% Improvement ☐ OR 60% Improvement ☐ OR 69% Improvement ☐ OR 79% Improvement ☐ OR 89% Improvement ☐ OR 100% Improvement ☐ OR Zero Carbon Home* ☐ * as defined in the Code Technical Guide	5 of 15 Credits	Level 3	
Ene 2 Building Fabric	Credits are awarded based on the Heat Loss Parameter (HLP) obtained from the SAP 2005 calculations. This is based on the level of insulation provided in the dwellings. Select a HLP range Greater than 1.30 ☒ OR Less than or equal to 1.30 ☐ OR Less than or equal to 1.10 ☐	0 of 2 Credits	-	
Ene 3 Internal Lighting	Credits are awarded based on the percentage of fixed internal fittings that are dedicated energy efficient provided in habitable spaces within the dwelling. Select the % of dedicated energy efficient fittings Less than 40% ☐ OR Greater than or equal to 40% ☐ OR Greater than or equal to 75% ☒	2 of 2 Credits	-	

Issue		Credits	Level
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	-
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 ☒ A+ Rated Fridges and Freezers ☐ Combination of rated white goods with EU Energy Labelling Scheme ☐	1 of 2 Credits	-
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 OR provision of dual lamp luminaires with both space and security lamps compliant with the above energy efficiency requirements. 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 ☒	2 of 2 Credits	-
* Statutory safety lighting is not covered by this requirement			

Issue	Credits	Level
Ene 7 Low or Zero Carbon Technologies Credits are awarded where either there is a 10% or 15% reduction in total carbon emissions that result from using low or zero carbon technologies. Note that where funding has not been granted through the Low Carbon Buildings Programme, a feasibility study is required that meets the Code requirements. 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 ☐	0 of 2 Credits	-
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* 2.0 * if you have storage for 1 cycle per two dwellings insert 0.5 in number of cycles stored per dwelling	2 of 2 Credits	-
Ene 9 Home Office A credit is awarded for the provision of space for a home office. The location, space and services provided must meet the Code requirements. Will there be provision for a Home Office? ☒ OR No ☐	1 of 1 Credits	-

CATEGORY 2 WATER		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 66.00%		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	
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	-	

CATEGORY 3 MATERIALS		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 62.00%		Credits		Level
Contribution to Overall Score: 4.50 points		15 of 24 Credits		All Levels
Mat 1 Environ- mental Impact of Materials	<u>Mandatory Requirement:</u> At least three of the five key building elements must achieve a Green Guide 2008 Rating of A+ to D. <u>Tradable Credits:</u> 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	
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	-	
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	-	

CATEGORY 4 SURFACE WATER RUN-OFF		Overall Level: 3	Overall Score	57.66
% 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. 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 or default case compliance ☒ Code compliant SUDS systems ☐ Non Code compliant SUDS systems ☐ Site discharges rainwater directly to a tidal estuary or the sea ☐	0 of 2 Credits	All Levels	
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 appropriate 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	-	

CATEGORY 5 WASTE		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 100.00%		Credits		Level
Contribution to Overall Score: 6.40 points		7 of 7 Credits		All Levels
Was 1 Storage of non- recyclable waste and recyclable household waste	<u>Mandatory Requirement:</u> 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. <u>Tradable Credits</u> 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 (capacity 30 litres) ☒ External Storage, no Local Authority collection scheme 3 separate internal storage bins (capacity 30 litres) ☐ 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	

Issue		Credits	Level
Was 2 Construction Site Waste Management	Mandatory Requirements: A SWMP plan including the monitoring of waste generated on site and the setting of targets to promote resource efficiency must be produced and implemented. Tradable Credits: The SWMP should also include procedures and commitments for minimising waste and/ or commitments to sort, reuse and recycle construction waste. Mandatory Requirement Is the development cost less than £300K? ☐ Contents of the SWMP Does the SWMP include: + monitoring of waste generated on site? ☒ + targets to promote resource efficiency? ☒ + the waste groups? ☒ + compliance with best practice? ☒ + procedures for reducing waste? ☒ + commitments for reducing waste? ☒ + procedures to sort, reuse and recycle waste? ☒ + commitments to sort, reuse and recycle waste? ☒	2 of 2 Credits	All Levels
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 ☐	1 of 1 Credit	-
* including if a automated waste collection system is in place			

CATEGORY 6 POLLUTION		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 75.00%		Credits		Level
Contribution to Overall Score: 2.10 points		3 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	-	
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 ☐	2 of 3 Credits	-	

CATEGORY 7 HEALTH & WELLBEING		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 33.00%		Credits		Level
Contribution to Overall Score: 4.66 points		4 of 12 Credits		-
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 <u>Room</u> 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%. *Tick the box if there is no study/ home office as this aspect of the credit will be awarded by default.	0 of 3 Credits	-	
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	-	

Issue	Credits	Level
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 ☐	1 of 1 Credits -
Hea 4 Lifetime Homes	<u>Mandatory Requirement:</u> Lifetime Homes is mandatory when a dwelling is to achieve Code Level 6. <u>Tradable credits:</u> 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 Credit not sought ☒	0 of 4 Credits -

CATEGORY 8 MANAGEMENT		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 100.00%		Credits		Level
Contribution to Overall Score: 10.00 points		9 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	-	
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 ☐ <u>Considerate Constructors</u> ☐ OR Best Practice: Score between 24 and 31.5 ☐ OR Best Practice+: Score between 32 and 40 ☒ <u>Alternative Scheme*</u> ☐ 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.	2 of 2 Credits	-	
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 <u>Monitor, report and set targets, where applicable, for:</u> - CO₂/ energy use from site activities ☐ - CO₂/ energy use from site related transport ☐ - water consumption from site activities ☒ <u>Adopt best practice policies in respect of:</u> - air (dust) pollution from site activities ☒ - water (ground and surface) pollution on site ☒ <u>80% of site timber</u> is reclaimed, re-used or responsibly sourced ☒	2 of 2 Credits	-	

Issue		Credits	Level
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	-

CATEGORY 9 ECOLOGY		Overall Level: 3	Overall Score	57.66
% of Section Credits Predicted: 44.00%		Credits		Level
Contribution to Overall Score: 5.33 points		4 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.	0 of 1 Credits	-	
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 <i>Suitably Qualified Ecologist</i> 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	-	
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.	0 of 1 Credits	-	

Issue		Credits	Level
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 ☐	3 of 4 Credits	-
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	

DESIGN INPUT & RESULTS

Users Ref: 4908-0001-633

Issued on: 9.November.2009

Prop Type Ref:

Property: Plot 1, Green Dragon, Bennions Road, Wrexham, LL13 7AP

DER: 17.89

TER: 23.91

SAP Rating: 85 B

SAP Energy Cost: £193.54

CO2 Emissions: 1.55 t/year

EI Rating: 85 B

Energy used: 115 kWh/m2/year

Ene1: 3

ZC: 0.00

Surveyor: 4908-0001, Alison Cleaver, Tel: 01858 434392, Fax: 01858 468338

Address: 7 Overfield Avenue, Market Harborough, Leics, LE16 7LS

Client:

Software Version: EES SAP 2005.018.01, June 2009 (Design System), BRE SAP Worksheet 9.81

SAP version: 9.81 Regs Region: England and Wales (Part L1A 2006), Calculation Type: New Build

SUMMARY OF INPUT DATA FOR DWELLING AS DESIGNED:

Page 1 of 2

Region & Orientation		Region: WA Wales (14), House Orientation: S South							
1.0 Property Type		H House, E End Terrace							
2.0 Number of Storeys		2							
3.0 Date Built		2009							
4.0 Sheltered Sides		2							
5.0 Sunlight/Shade		A Average or unknown							
6.0 Internal Walls Perimeter		26.95 m, 23.55 m							
7.0 Internal Floor Area		47.28 m2, 43.45 m2							
8.0 Living Area		18.26, fraction: 0.20							
9.0 Average Storey Height		2.40 m, 2.60 m							
9.1 Conservatory		None							
Openings	Description	Glazing Type	Solar Trans	Frame or Door Type	Air Gap	Argon Fill	Orientation	Uvalue	Area
10.0 Ext. Doors	front & back door	Double,Low E,Soft Coat	0.63	Glazed Wood	16 mm	No		2.40 (T)	3.80
Draught Lobby									
11.0 Windows	kit, liv, study, beds,bath	Double,Low E,Soft Coat	0.63	Wood	16 mm	No	South (0°)	1.80 (T)	9.89
	kit,bed	Double,Low E,Soft Coat	0.63	Wood	16 mm	No	South-East (45°)	1.80 (T)	2.17
	study liv beds	Double,Low E,Soft Coat	0.63	Wood	16 mm	No	North (180°)	1.80 (T)	8.32
Openings Average: U: 1.89		Uvalue legend: (T) = Uvalue defaulted from SAP Table (M) = Manufacturer supplied							
13.0 Draught Proofing		100%							
14.0 Thermal Bridging		Default - Robust Construction							
Thermal Bridges Y		0.080 Description							
15.0 Pressure Test (q50)		Air permeability 10.0 m³/h.m² (assumed)							
16.0 Mechanical Ventilation		None, Windows open during hot weather: Windows fully open							
		Cross ventilation possible: Yes							
17.0 Fans, Chimneys, Flues		4, 0, 1							
17.1 Lighting		Light fittings: 12, L.E.L. fittings: 10, External lights: Yes, controlled: Yes							
	Description	U-value	Shelter	Room in Roof	Area	Timber	Curtain Walling		
18.0 Wall Types	ext cavity wall	0.24	0.00		101.73 (X)	No	No		
Walls uvalue average: U: 0.24									
19.0 Plane Roofs	Roof type 0	0.10			47.28				
Roofs uvalue average: U: 0.10									
20.0 Ground Floor Types		0.20			47.28 (X)	No			
Floors uvalue average: U: 0.20									
20.1 Thermal Mass		Simple Thermal Mass Parameter calculation: 8.00							
		Ground Floor Mass: Medium - solid floor							
		External Wall Mass: Medium - masonry walls (cavity fill or external insulation) with plasterboard on dabs							
		Separating Wall Mass: Medium - masonry walls with plasterboard on dabs							
		Internal Partition Mass: Low - plasterboard on timber/steel stud							
20.2 Fixed Air Conditioning		No							
21.0 Main Heating		BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pumped: pump in heated space							
MHS Efficiency		Database: 90.1%							
Manufacturer & Model		Worcester, Greenstar, 24i junior, 90.10%							

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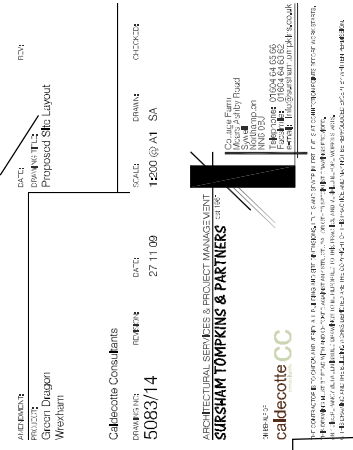
Software Version: EES SAP 2005.018.01, June 2009 (Design System), BRE SAP Worksheet 9.81

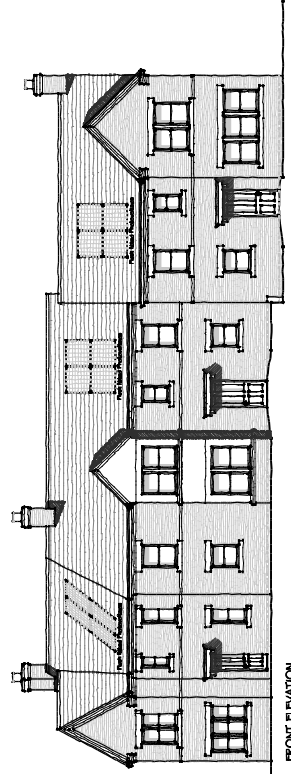
SAP version: 9.81 **Regs Region:** England and Wales (Part L1A 2006), **Calculation Type:** New Build

SUMMARY OF INPUT DATA FOR DWELLING AS DESIGNED:

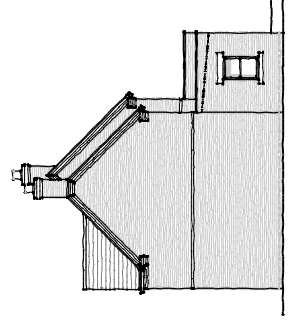
Page 2 of 2

Heating Controls	CBI Time and temperature zone control Boiler interlock - Yes
Underfloor Heating	None
Combi Type	StandardCombi
Combi Keep Hot	GasTimeClock
21.1 Secondary Heating	RWM Wood closed room heat, HETAS approved
SHS Details	Efficiency: 65.0%
22.0 Hot Water Heating	HWP From the primary heating system
Solar Water Heating	None
23.0 Thermal Store	None
24.0 Hot Water Cylinder	None
Insulation	No cylinder
Volume	
25.0 Community Heating	None
CHP Unit	
26.0 Electricity Tariff	S - Standard
27.0 Photovoltaic Unit	PV cells Peak Power: 0.65 Orientation: South, Elevation: 30°, Overshading: None or little (< 20%)
27.1 Micro Wind Turbines Count	0
27.2 Small-scale Hydro electricity	0.00
28.0 Special Features	None

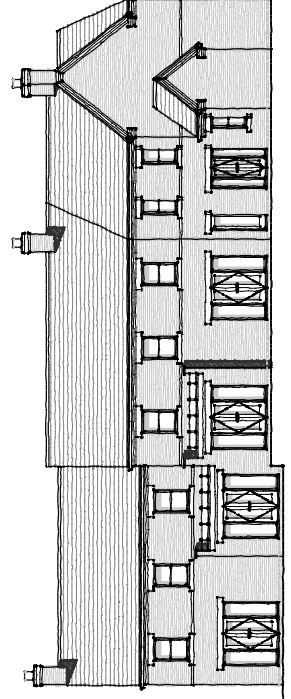




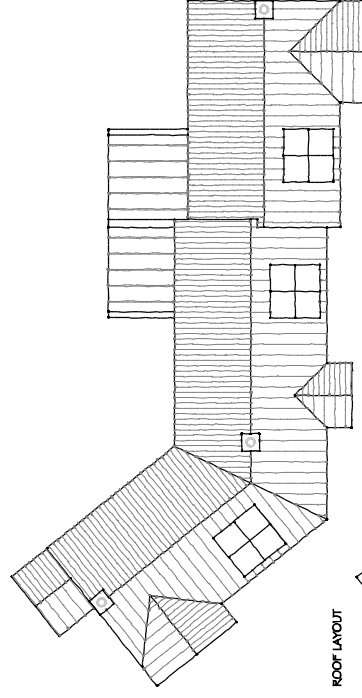
FRONT ELEVATION



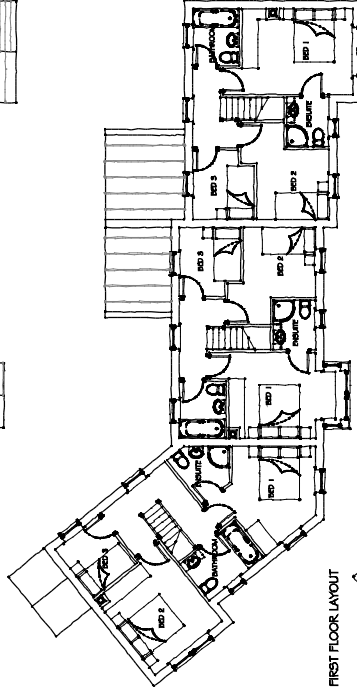
SIDE ELEVATION (PLOT 3)



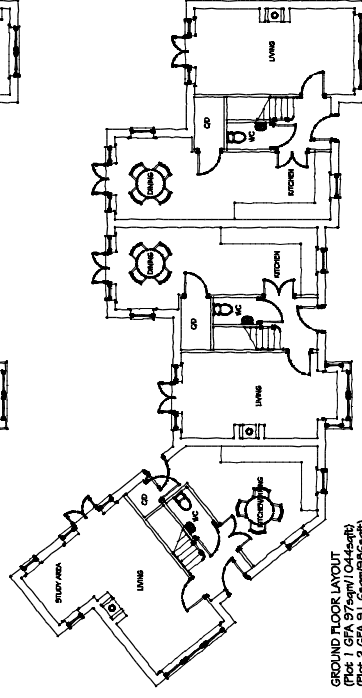
REAR ELEVATION



ROOF LAYOUT



FIRST FLOOR LAYOUT



GROUND FLOOR LAYOUT
(Plot 1 GFA 97sqm/1044sqft)
(Plot 2 GFA 91.6sqm/986sqft)
(Plot 3 GFA 95.5sqm/1028sqft)

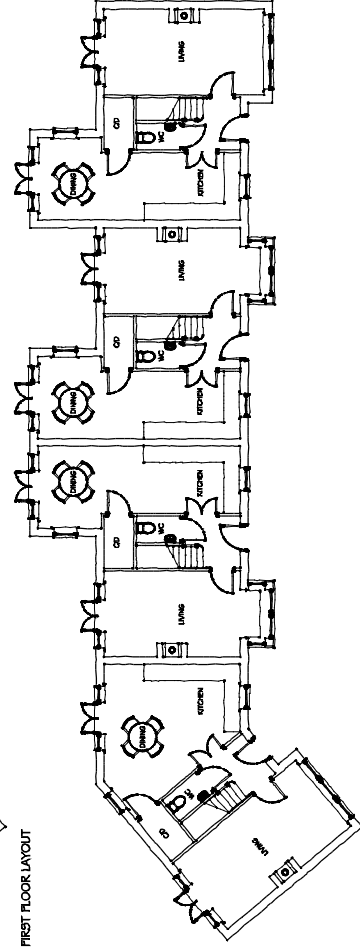
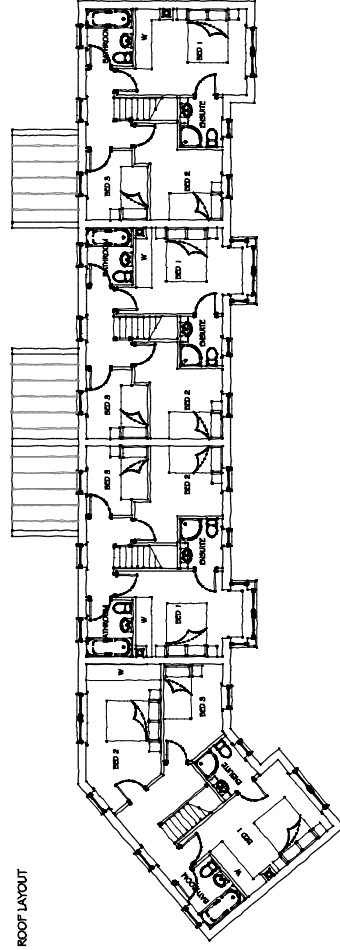
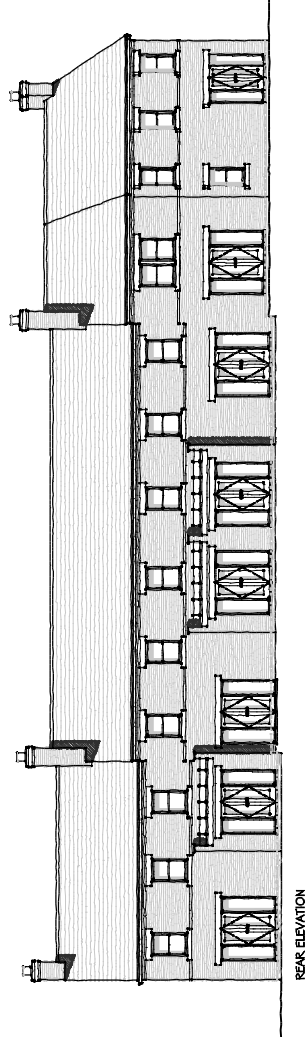
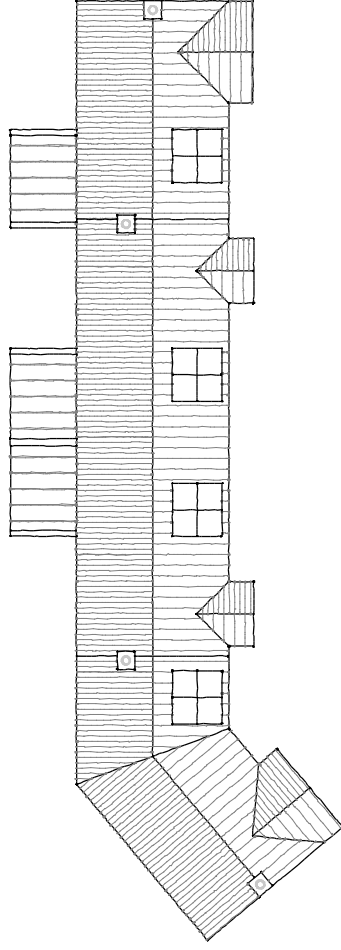
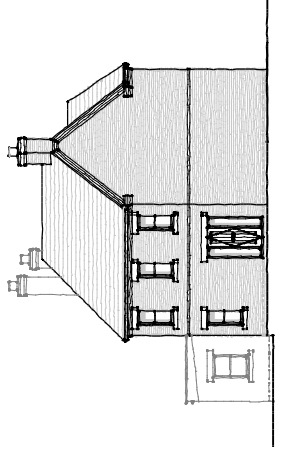
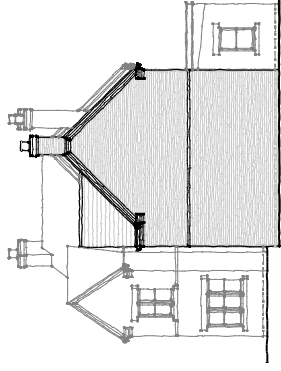
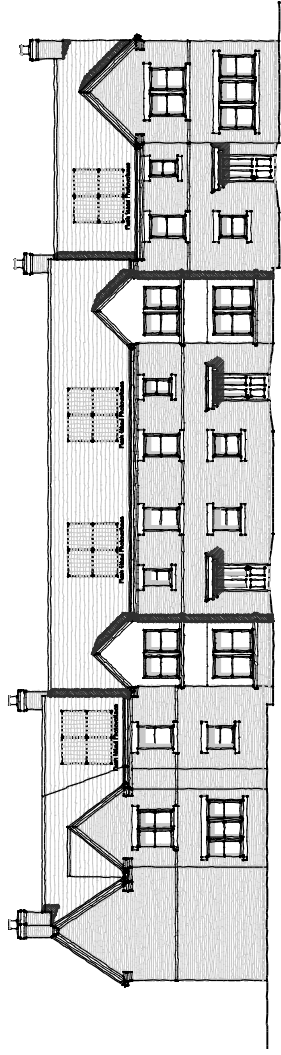
SUSTAINABILITY NOTES
 100% dedicated energy efficient lighting
 External lighting - dedicated energy efficient
 Potential Home Office in Bed 2
 Water use to be less than 105 litres/person/day
 Class 5 Boiler
 Secured by Design - physical security
 Woodburners to all plots
 Kitchen recycling bins

52 11 09 55 10 09 56 10 09 57 10 09 58 10 09 59 10 09 60 10 09 61 10 09 62 10 09 63 10 09 64 10 09 65 10 09 66 10 09 67 10 09 68 10 09 69 10 09 70 10 09 71 10 09 72 10 09 73 10 09 74 10 09 75 10 09 76 10 09 77 10 09 78 10 09 79 10 09 80 10 09 81 10 09 82 10 09 83 10 09 84 10 09 85 10 09 86 10 09 87 10 09 88 10 09 89 10 09 90 10 09 91 10 09 92 10 09 93 10 09 94 10 09 95 10 09 96 10 09 97 10 09 98 10 09 99 10 09 100 10 09 101 10 09 102 10 09 103 10 09 104 10 09 105 10 09 106 10 09 107 10 09 108 10 09 109 10 09 110 10 09 111 10 09 112 10 09 113 10 09 114 10 09 115 10 09 116 10 09 117 10 09 118 10 09 119 10 09 120 10 09 121 10 09 122 10 09 123 10 09 124 10 09 125 10 09 126 10 09 127 10 09 128 10 09 129 10 09 130 10 09 131 10 09 132 10 09 133 10 09 134 10 09 135 10 09 136 10 09 137 10 09 138 10 09 139 10 09 140 10 09 141 10 09 142 10 09 143 10 09 144 10 09 145 10 09 146 10 09 147 10 09 148 10 09 149 10 09 150 10 09 151 10 09 152 10 09 153 10 09 154 10 09 155 10 09 156 10 09 157 10 09 158 10 09 159 10 09 160 10 09 161 10 09 162 10 09 163 10 09 164 10 09 165 10 09 166 10 09 167 10 09 168 10 09 169 10 09 170 10 09 171 10 09 172 10 09 173 10 09 174 10 09 175 10 09 176 10 09 177 10 09 178 10 09 179 10 09 180 10 09 181 10 09 182 10 09 183 10 09 184 10 09 185 10 09 186 10 09 187 10 09 188 10 09 189 10 09 190 10 09 191 10 09 192 10 09 193 10 09 194 10 09 195 10 09 196 10 09 197 10 09 198 10 09 199 10 09 200 10 09 201 10 09 202 10 09 203 10 09 204 10 09 205 10 09 206 10 09 207 10 09 208 10 09 209 10 09 210 10 09 211 10 09 212 10 09 213 10 09 214 10 09 215 10 09 216 10 09 217 10 09 218 10 09 219 10 09 220 10 09 221 10 09 222 10 09 223 10 09 224 10 09 225 10 09 226 10 09 227 10 09 228 10 09 229 10 09 230 10 09 231 10 09 232 10 09 233 10 09 234 10 09 235 10 09 236 10 09 237 10 09 238 10 09 239 10 09 240 10 09 241 10 09 242 10 09 243 10 09 244 10 09 245 10 09 246 10 09 247 10 09 248 10 09 249 10 09 250 10 09 251 10 09 252 10 09 253 10 09 254 10 09 255 10 09 256 10 09 257 10 09 258 10 09 259 10 09 260 10 09 261 10 09 262 10 09 263 10 09 264 10 09 265 10 09 266 10 09 267 10 09 268 10 09 269 10 09 270 10 09 271 10 09 272 10 09 273 10 09 274 10 09 275 10 09 276 10 09 277 10 09 278 10 09 279 10 09 280 10 09 281 10 09 282 10 09 283 10 09 284 10 09 285 10 09 286 10 09 287 10 09 288 10 09 289 10 09 290 10 09 291 10 09 292 10 09 293 10 09 294 10 09 295 10 09 296 10 09 297 10 09 298 10 09 299 10 09 300 10 09 301 10 09 302 10 09 303 10 09 304 10 09 305 10 09 306 10 09 307 10 09 308 10 09 309 10 09 310 10 09 311 10 09 312 10 09 313 10 09 314 10 09 315 10 09 316 10 09 317 10 09 318 10 09 319 10 09 320 10 09 321 10 09 322 10 09 323 10 09 324 10 09 325 10 09 326 10 09 327 10 09 328 10 09 329 10 09 330 10 09 331 10 09 332 10 09 333 10 09 334 10 09 335 10 09 336 10 09 337 10 09 338 10 09 339 10 09 340 10 09 341 10 09 342 10 09 343 10 09 344 10 09 345 10 09 346 10 09 347 10 09 348 10 09

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[illegible]



GROUND FLOOR LAYOUT
(Plot 4 GFA 94sqm/1012sqft)
(Plots 5 & 6 GFA 91.63sqm/986sqft)
(Plot 7 GFA 105.4sqm/1134sqft)

SUSTAINABILITY NOTES
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 External lighting - dedicated energy efficient
 Potential Home Offices in Bed 2
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Proposed/Revised AMENDMENTS PROJECT:	22 11 09 DATES:	22 11 09 DRAWING TITLE:	A REV:
Green Dragon Vietnam		Phase 4 - 7 Proposed Plans & Elevations	
Cardiofile Consultants	DATE:	SCALES:	CHECKED:
5083/12 A	22 10 09	1:100 @ A 1/4"=1'	5/4/09
DRAWING NO:	REVISIONS:		

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