mesh

Energy and Sustainability Report

1 Steele's Studio

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+ Andy Sadler

+ Lead Energy Consultant

+ 0844 500 3383

+ asadler@mesh-energy.com

+ www.mesh-energy.com

Contents

1 Executive Summary

The proposed site is located at 1 Steele's Studio Haverstock Hill, London NW3 4RN and includes part demolition part refurbishment to create a single dwelling. Below is an outline of how the project will meet the requirements of the applicable planning policy of the London Borough of Camden.

Policy CC1 Climate change mitigation and Policy CC2 Adapting to climate change
SAP 2012 methodology is used to model carbon emissions of the proposed development. The report assesses the baseline emissions and the reductions due to fabric first and zero and low carbon technologies.

Camden Borough Local Plan: 2017, Adopted 3rd July 2017, promote all new developments planning applications to demonstrate a reduction in energy demands through the on-site installation and implementation of decentralised and renewable or low carbon energy sources.

All new residential developments will be required to demonstrate a 19% CO2 reduction below part L 2013 Building Regulations.

A range of energy efficiency measures are to be incorporated into the homes in order to reduce carbon emissions.

The table below shows the baseline carbon emission from the site and demonstrated a 34% reduction in carbon emissions.

	kgCO2/Year
Baseline carbon emissions	6,126.17
Carbon emission from 'Fabric First' approach	6,073.29
Carbon emissions with renewable and low carbon technologies	4,081.89
Total carbon savings	2,04.29
Percentage Reduction	34%

Table 1: Carbon Reduction Summary

Policy CC3 Water and flooding
The client is committed to reducing water usage and has targeted 105 litres per person per day water usage through specifying efficient sanitaryware and white goods.

The development is in a flood zone 1, meaning there is minimal risk from flooding. Whilst the local geology is not suitable for a soakaway the client is committed to reducing the sites impact on surface water and is proposing to increase the permeable area and introducing watt butts as a means of reducing off site flow rates.

Policy CC4 Air Quality
The Local Plan looks favourable on improving housing stock where possible. The proposal makes use of the existing structure where possible with limited demolition on site. The landscaping design promotes existing trees, while increase on site lawn and low level planting.

The use of the ground source heat pump for space and water heating means that there will be zero NOx emission.

The site is well services by public transport with both bus and train stops close by. The Client will also be providing space for cycle storage.

Policy CC5 Waste
The Client is committed to reducing waste in both the construction phase and during building operation.

Construction waste will be reduced through managed procurement, re-used on site where possible and segregated for recycling off site.

The Client is providing both internal and external bins for waste segregation, the Council operate a food waste scheme, and a compost bin will provide for garden waste.

2 Planning Policy

2.1 National Planning Policy Framework (NPFF)

To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

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

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. They should:

- have a positive strategy to promote energy from renewable and low carbon sources;
- design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;
- support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning; and
- identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

When determining planning applications, local planning authorities should:

- not require applicants for energy development to demonstrate the overall need for renewable or low carbon energy and also recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

- approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should also expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

2.2 London Plan 2016 and 2017 Draft Consultation

London's Response to Climate Change (Chapter 5)

Policies from the London Plan offering guidance on the planning decision, and for which apply to the proposed scheme, are detailed below. It should be noted that a large number of these policies apply only to major developments, defined as *'those where the number of dwellinghouses to be provided is 10 or more'*. These, therefore, fall outside the requirements of this proposal. For clarity these have been excluded from the outline below.

Minimising Carbon Dioxide emissions (Policy 5.2) - *Planning Decisions*
Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1 Be lean: use less energy
2 Be clean: supply energy efficiently
3 Be green: use renewable energy

Decentralised energy in development proposals (Policy 5.6) - *Planning decisions*
Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

Renewable energy (Policy 5.7) - *Planning decisions*
Within the framework of the energy hierarchy (see Policy 5.2) above.

Urban greening (Policy 5.10) - *Planning decisions*
Development proposals should integrate green infrastructure from the beginning of the design process to contribute to urban greening, including the public realm. Elements that can contribute to this include tree planting, green roofs and walls, and soft landscaping.

Sustainable drainage Policy (5.13) - ***Planning decisions***
Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. store rainwater for later use
2. use infiltration techniques, such as porous surfaces in non-clay areas
3. attenuate rainwater in ponds or open water features for gradual
4. attenuate rainwater by storing in tanks or sealed water features for gradual release
5. discharge rainwater direct to a watercourse
6. discharge rainwater to a surface water sewer/drain
7. discharge rainwater to the combined sewer.

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

Water use and supplies (5.15) - ***Planning decisions***
Development should minimise the use of mains water by:

a. incorporating water saving measures and equipment
b. designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day.

2.3 London Borough of Camden Local Plan

Section 8 of Camden Local Plan details planning requirements for sustainability and climate Change.

Policy CC1 Climate change mitigation
The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
d. support and encourage sensitive energy efficiency improvements to existing buildings;
e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

Policy CC2 Adapting to climate change
The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as:

a. the protection of existing green spaces and promoting new appropriate green infrastructure;
b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;
c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and
d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.
e. Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable design and construction measures
The Council will promote and measure sustainable design and construction by:

f. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
g. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;
h. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve “excellent” in BREEAM domestic refurbishment; and
i. expecting non-domestic developments of 500 sqm of floorspace or above to achieve “excellent” in BREEAM assessments and encouraging zero carbon in new development from 2019.

Policy CC3 Water and flooding
The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

a. incorporate water efficiency measures;
b. avoid harm to the water environment and improve water quality;
c. consider the impact of development in areas at risk of flooding (including drainage);
d. incorporate flood resilient measures in areas prone to flooding;
e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and
f. not locate vulnerable development in flood-prone areas.

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

The Council will protect the borough’s existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.

Policy CC4 Air Quality
The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality.

Consideration must be taken to the actions identified in the Council’s Air Quality Action Plan. Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact.

Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

Policy CC5 Waste
The Council will seek to make Camden a low waste borough.

a. aim to reduce the amount of waste produced in the borough and increase recycling and the reuse of materials to meet the London Plan targets of 50% of household waste recycled/composted by 2020 and aspiring to achieve 60% by 2031;
b. deal with North London's waste by working with our partner boroughs in North London to produce a Waste Plan, which will ensure that sufficient land is allocated to manage the amount of waste apportioned to the area in the London Plan;
c. safeguard Camden's existing waste site at Regis Road unless a suitable compensatory waste site is provided that replaces the maximum throughput achievable at the existing site; and
d. make sure that developments include facilities for the storage and collection of waste and recycling.

3 The Proposed Development

3.1 Overview

The Client has instructed Mesh Energy to produce a robust response to support the local planning policy of the London Borough of Camden. This report sets out the detail on how the Client will meet their requirements in reducing the development's overall environmental impact. This includes reducing carbon emissions through a fabric first approach and low carbon and renewable technologies, reducing waste and water use and protecting air quality. Figure 1 below shows the proposed site layout.

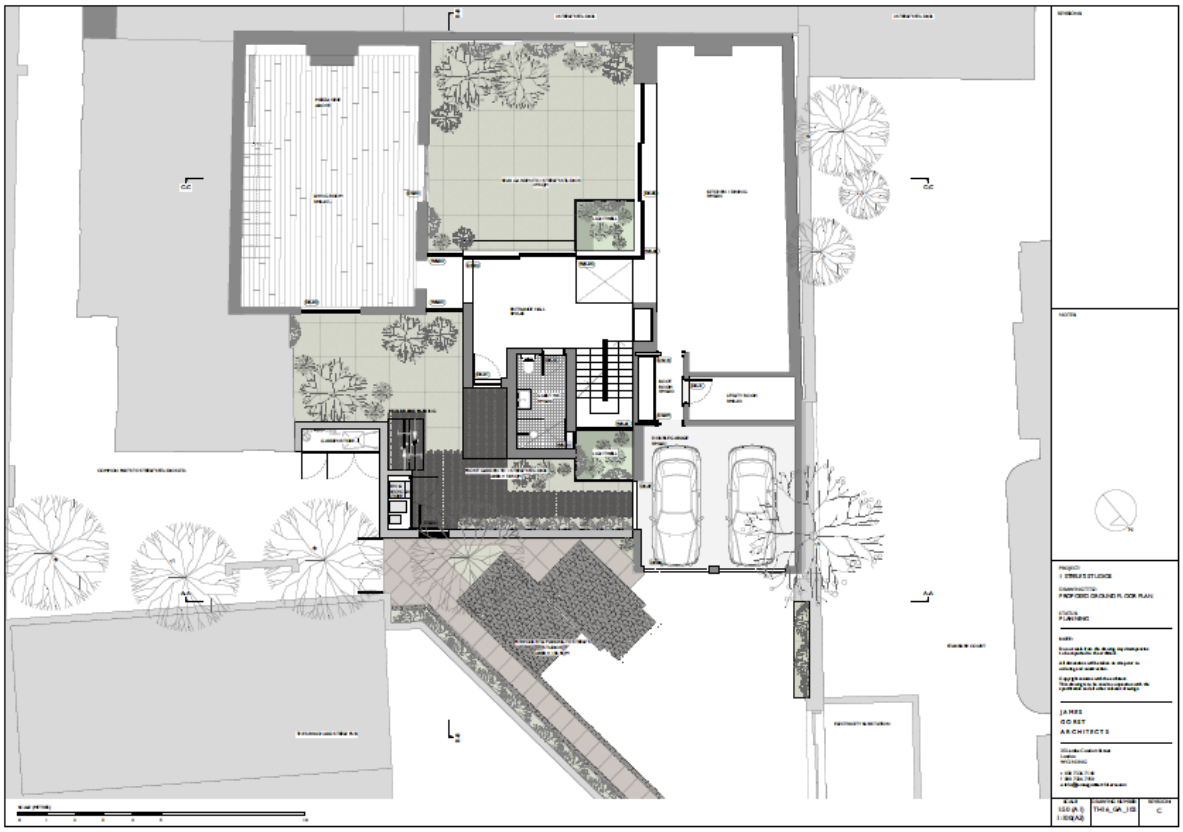

Figure 1: Site Plan

4 Addressing London Borough of Camden's Local Plan and the London Mayor's Hierarchy

4.1 Policy CC1 Climate change mitigation

4.1.1 Fabric First Approach – 'BE LEAN'

In recent years both national and local planning policy has moved towards a 'fabric first' approach. This approach means that the property will gain from lower energy bills and carbon emissions for the life of the property, independent of the technology used to heat the home. The home owner can then take advantage of future technologies in the knowledge that the fabric of the home has been designed in such a way as to minimise heat loss. The approach is known as the 'Be Lean' part of the London Mayors Energy Hierarchy.

The client is committed to the fabric first approach and has proposed target u-values well below the limiting values of the current Building Regulations. A comparison of the Building Regulation u-values and those targeted by the client, along with the percentage improvements are listed in Table 2 below.

Element	Building Regulations	Target U-value	Improvement
Basement/Ground Floor (w/m^2)	0.25	0.10	60%
Exposed Floor Areas (w/m^2)	0.25	0.16	36%
External Wall (w/m^2)	0.30	0.18	40%
Party Wall (w/m^2)	0.20	0.00	100%
Roof – Insulated at rafter (w/m^2)	0.20	0.14	30%
Door (w/m^2)	2.0	1.2	40%
Window (w/m^2)	2.0	1.2	40%
Air leakage rate m^3 (h/m^2) @ 50	10.0	4.00	60%

Table 2: Limiting u-values compared to the proposed construction

4.1.1.1 SAP 2012 Baseline Building Fabric

A baseline building is constructed in accordance with the proposed building shape and size, and performance requirements set in the Part L1A 2010 edition (incorporating 2011, 2013 and 2016 amendments) using the Target Emission Rate (TER) calculation from SAP 2012 methodology for Energy Ratings of Dwellings. The baseline fabric performance specification for each building element can be seen in Table 5 below.

Baseline Parameters	Performance
External walls including semi exposed walls	0.18 W/m²K
Floors	0.13 W/m²K
Roofs	0.13 W/m²K
Opaque door (<30% glazed area) Sem-glazed (30%-60% glaze area) Windows	2.00 W/m²K 1.20 W/m²K 1.40 W/m²K Solar energy transmittance = 0.63 Light transmittance = 0.80

Thermal bridging	0.15 W/m²K
Air permeability	5 m³/h·m² at 50 Pa

Table 3: Part L1A 2010 Baseline Fabric Performance Specification

The baseline SAP 2012 output suggests that the predicted site wide carbon emissions will be **6,127 kgCO_2** per year. This includes regulated emissions for space and water heating along with pumps, fans and lighting. This is detailed below in table 4.

Space Heating kgCO2/Year	Water Heating kgCO2/Year	Pumps and fans kgCO2/Year	Lighting kgCO2/Year	Total kgCO2/Year
5,037.24	606.85	38.93	438.16	6,126.17

Table 4: Total Development Carbon Emission (SAP 2012 Baseline)

4.1.1.2 Proposed Building Fabric

The client has proposed the following fabric specification to meet the requirement of the Camden Borough Council Local Plan. Again, this was modelled using SAP 2012 methodology.

Proposed Parameters	**Performance**
External walls including semi exposed walls	0.18 W/m²K
Floors	0.10 W/m²K
Exposed floors	0.16 W/m²K
Roofs – Insulated at rafter level	0.14 W/m²K
Opaque door (<30% glazed area)	1.20 W/m²K
Semi-glazed (30%-60% glaze area)	1.20 W/m²K
Windows	1.20 W/m²K Solar energy transmittance = 0.63 Light transmittance = 0.80
Thermal bridging	<0.05 W/m²K
Air permeability	4 m³/h·m² at 50 Pa

Table 5: Proposed Development Fabric Performance Specification

The SAP 2012 output for the proposed development suggest that the regulated site wide carbon emission will be **6,073 kg** of CO_2 per year. Detailed in table 6 below.

Space Heating kgCO_2/Year	Water Heating kgCO_2/Year	Pumps and fans kgCO_2/Year	Lighting kgCO_2/Year	Total kgCO_2/Year
5,015.99	580.22	38.93	438.16	6,073.29

Table 6: Total Proposed Development Carbon Emissions

Based on the 'Fabric First' approach, the development has achieved a site carbon saving of 47.88 CO_2 per year, which is an improvement of just over **1%** against the baseline figures.

Baseline Site Carbon Emissions ($kgCO_2$/Year)	6,126.17
Actual Site Wide Site Carbon Emissions ($kgCO_2$/Year)	6,073.29
Total Savings due to fabric first approach ($kgCO_2$/Year)	52.88
Percentage Reduction	**1%**

Table 7: Proposed Development carbon Reduction

4.1.2 Community heating and CHP – 'Be Clean'

Reviewing the London Heat Maps (January 2016), there is currently no existing heat network infrastructure close to the development (see figure 2, below). The size of the proposal would make any connection at this stage cost prohibitive.

When looking at other community schemes and combined heat and power, the cost and complexity and space requirements would make proposing such a scheme on this development unviable. The London Plan also make preference to low NOx emission technologies as a priority above CHP plant. The client is proposing a ground source heat pump with zero NOx at source.

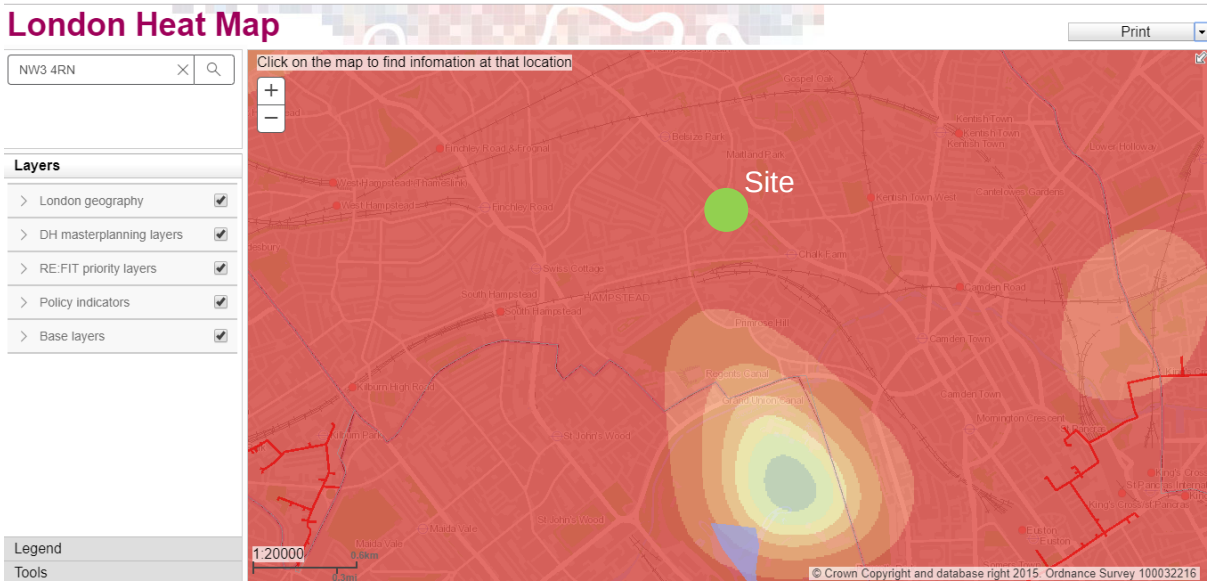

Figure 2: London Heat Map Centred on Site

4.1.3 Technology Options – 'Be Green'

Having looked at the fabric and the energy reduction required to heat the home, the client has assessed the most appropriate low carbon and renewable technologies available. These are listed below with an appraisal of their suitability.

4.1.3.1 Low Carbon Technologies

Combined Heat and Power (Micro CHP)

Micro combined heat and power (micro-CHP) is a technology which generates heat and electricity simultaneously, from the same energy source, in individual homes or buildings. The main output of a micro-CHP system is heat, with some electricity generation, at a typical ratio of about 6:1 for domestic appliances.

A domestic system will generate up to 1kW of electricity once warmed up: the amount of electricity generated over a year depends on how long the system is able to run. Any electricity you generate and don't use can be sold back to the grid.

Site review

While a combined heat and power plant system would work on the site, the client has a preference for installing a ground source heat pump (GSHP), which will offer better performance than the CHP plant and as such this technology is being discounted. Details on the proposed GSHP can be found below.

Mechanical Ventilation with Heat Recovery (MVHR)

Mechanical air supply in air tight buildings is extremely important to ensure comfort levels. Mechanical ventilation with heat recovery takes heat from warm moist air extracted from wet rooms such as kitchens and bathrooms, and pre-warms fresh outside air supplied to living areas. An efficient system can recycle around 90% of the extracted heat.

Site review

Due to the number of wet rooms within the proposed dwelling the ventilation system would require suitably sized fan power. Because MVHR is always running there is a negative impact on the property's energy requirements, which in this case outweighs the benefit.

Gas Saver

Gas savers work by recycling heat from the flue gases that would normally be lost into the atmosphere and transferring it back into the cold-water supply through the use of a heat exchanger. The unit sits above the gas boiler.

Site review

The client is proposing to use a heat pump for space and water heating and as such a gas saver is not suitable.

Waste Water Heat Recovery (WWHR)
Waste water with heat recovery works by pre heating the cold-water supply using the heat from the water as it drains from the shower. This pre heated water can then be recirculated back into the shower feed or back into the water heater or a mix of the two. The only requirement is that you have room within the floor void below the shower to enable a unit to fit although new designs mean there are now a variety of installation options.

Site Review
There is scope for using WWHR systems, in particular within the houses where there are a number of en-suite rooms with showers. A WWHR system would expect to see a saving of around 5%. At present there are no plans to include WWHR in the design and savings are sought elsewhere.

4.1.3.2 Renewable Technologies

Air Source Heat Pump (ASHP)
Air source heat pumps work by transferring heat from the external air into usable heat for space and water heating. The system can either be a monobloc system, which has everything in one external unit or s split system, which has both an external fan unit and an internal heat exchanger.

Site Review
Using air source heat pumps on the site is considered a viable option to meeting both the space heating and hot water demands for the development. A high efficiency air source heat pump will help significantly reduce the site wide energy use when compared to pure electric heating. The client is keen to install a heat pump on site, but at current the preferred option is to explore the use of ground source, which are more efficient than air source.

Ground Source Heat Pump (GSHP)
Ground source heating uses electricity to convert energy gathered from the ground into low temperature water for domestic heating and hot water use. The energy is collected externally via horizontal loops buried beneath the ground or alternatively by vertical boreholes (to a depth of 100m) if space is restricted.

Site review
Ground source heat pumps can utilise boreholes, as there is going to be boreholes dug as part of the basement works the client is keen to investigate the option of using ground source heat pumps using boreholes.

Photovoltaic Panels (PV)
Solar photovoltaic panels use solar energy to produce electricity that can be used within the home and reduce the amount of energy used by the household from the main electricity network and in turn reduce the overall electricity bill for the home.

Site review
The site offers potential for the installation of photovoltaic panels for energy production, with a roof suitable for installing between 4 and 6 panels or around 1kWp. This would mean the site has a potential to generate 1,020kWh of energy per year.

Solar Hot Water (SHW)
Solar thermal uses panels or vacuum tubes orientated towards the sun that absorb energy. The water in the panels or tubes is heated and then pumped down to a hot water cylinder or thermal store to exchange heat via an indirect secondary coil in the water cylinder. Solar thermal systems are predominantly used to supplement domestic hot water but can also be and space heating using thermal stores.

Site review
Solar thermal panels could help the occupants in meeting their hot water demands and as such reducing the energy demands of the development. The roof spaces available could easily accommodate the recommended installation of 1m2 per person. The client is keen to limit the amount of roof space taken up by renewable technology. Photovoltaic panels are more efficient in energy production the SHW so it is recommended that PV is utilised above SHW.

Biomass Boiler
Domestic biomass systems rely on solid fuels such as pellets or chopped and seasoned logs to produce high grade heat for the home and hot water systems. Fuel is combusted in the boiler, stored in a large thermal store and distributed to the home heating system as required.

Site review
Biomass boilers require large areas to hold the equipment and store the fuel. Infrastructure would also need to be in place to allow for delivery of the fuel. These systems are normally associated with large single houses or large developments that can then benefit from a community heating scheme. The size of the development and availability of space for a storage area means that this technology is not suitable for the development.

4.1.3.3 Most Appropriate Technology

The client is keen to design a highly efficient property that will continue to offer benefit in the long run. As such a ground source heat pump has been chosen as the preferred option for providing space heating and domestic hot water, with photovoltaic panels to offset some of the properties electrical demand. This proposal will meet both the demands of the site, the client's preference and the Camden Local Plan.

The installation of a ground source heat pump in conjunction with the fabric first approach, will provide a significant reduction in the development's overall energy use and it is therefore considered a viable option in meeting the requirements set out in the London Borough of Camden's Local Plan. The next section details the carbon emissions based on the above approach.

4.1.3.4 Baseline technology specification

SAP 2012 baseline carbon emission for the building regulations target 'notional' building have the following baseline performance characteristics. Energy demands from this notional building will be compared against the actual proposed design to demonstrate the improvement above that of the current building regulations performance.

Baseline Parameters	Performance
Ventilation system	Intermittent extract
Main heating fuel (space and water)	89.5% Eff. Mains gas Boiler and radiators with interlock and weather compensator
Design flow temperature	> 45°C
Cylinder	500 Litres
Lighting	100% Low energy light fittings
Air conditioning	None

Table 8: SAP 2012 Baseline Performance Specification

The regulated carbon emissions for space and water heating, pumps and fans and lighting, calculated based on this notional building are summarised in table 9 below. Detailed calculations can be found in a supplementary document to this report.

Space Heating $kgCO_2$/Year	Water Heating $kgCO_2$/Year	Pumps and fans $kgCO_2$/Year	Lighting $kgCO_2$/Year	Total $kgCO_2$/Year
5,015.99	580.22	38.93	438.16	6,073.29

Table 9: Total Development Carbon Emission (Improved fabric)

4.1.3.5 Proposed technology specification

SAP 2012 methodology has also been used to assess the performance of the proposed development. Table 10 below detailed the proposed technology for the development.

Actual Parameters	Performance
Ventilation system	Intermittent extract
Main heating fuel (space and water)	Ground source heat pump with a seasonal efficiency > 320%
Design flow temperature	> 35°C
Cylinder	500 Litres
Lighting	100% Low energy light fittings
Air conditioning	Small single zone AC to gym area
Photovoltaic (PV)	1kWp of PV

Table 10: Proposed Development Performance Specification

The carbon emissions, calculated based on this proposed development are summarised in table 11 below. Detailed calculations can be found in a supplementary document to this report.

Space Heating $kgCO_2$/Year	Water Heating $kgCO_2$/Year	Pumps and fans $kgCO_2$/Year	Lighting $kgCO_2$/Year	Total $kgCO_2$/Year
3,524.84	541.48	15.57	438.16	4,520.05
Reduction in carbon emissions due to Photovoltaic				438.16
Total Carbon Emissions				4,081.89

Table 11: Total Development carbon emission (Proposed Development Specification)

4.1.3.6 Site Assessment GSHP

Bore holes are to be dug as part of basement / structural works and it is expected that this will provide enough area for the property's energy demands. Based on the SAP Calculation it is estimated that the heat loss at an external temperature of -2°C is around 10kW.

Therefore, a small ground source heat pump, like the Vaillant flexoterm, would be suitable. There is a dedicated plant room within the basement, which would provide adequate space for the equipment required for a GSHP installation.

4.1.3.7 Site Assessment for Photovoltaic

Slope angle [°]:	35
Azimuth angle [°]:	0
Yearly PV energy production [kWh]:	1070
Yearly in-plane irradiation [kWh/m²]:	1310
Year to year variability [kWh]:	28.30
Changes in output due to:	
Angle of incidence [%]:	-3.2
Spectral effects [%]:	1.9
Temperature and low irradiance[%]:	-3.9
Total loss [%]:	-18.5

The client is proposing to install a Sunpower E20-327-C-AC PV panels or similar with an output of 327Wp per panel measuring 1558mm long by 1046mm wide. It is proposed that 4 panels are installed providing a total output of 1.31kWp and a roof area of 10m^2.

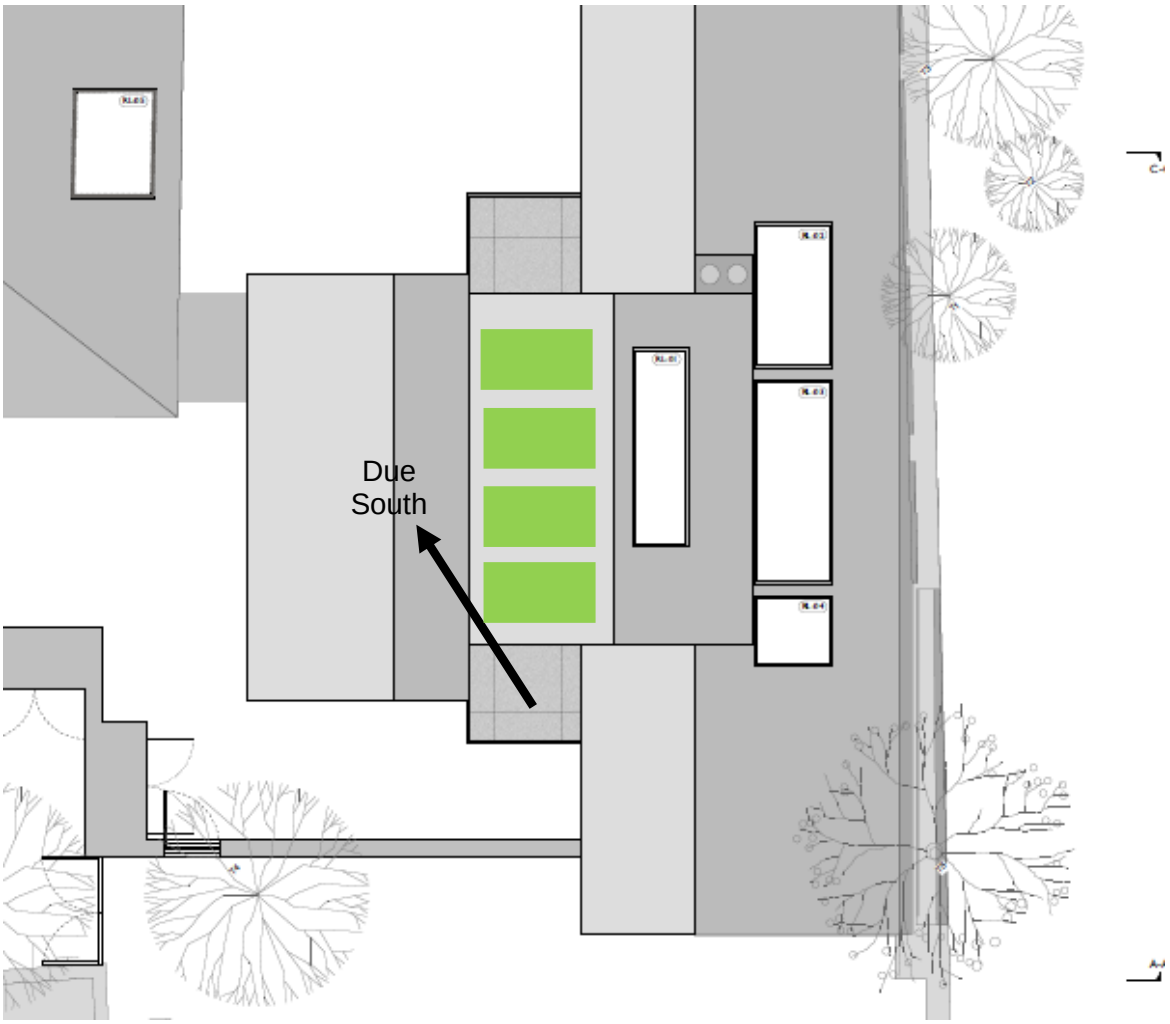

Figure 3: Proposed PV Layout (Panels marked in green)

4.1.3.8 Total Carbon reduction

Below is a table showing the comparison between the SAP 2012 baseline technology performance and the specification proposed by the client. It clearly shows a reduction in use as a result of using renewable and low carbon technology, with an annual saving of **1,991.40 kg of CO_2 per year** site wide, which is a **33%** reduction.

Fabric First Carbon Emissions ($kgCO_2$/Year)	6,073.29
Carbon Emissions for Low Carbon Technologies ($kgCO_2$/Year)	4,081.89
Total Savings due low carbon technologies ($kgCO_2$/Year)	1,991.40
Percentage Reduction	**33%**

Table 12: Proposed Development Carbon Reduction)

5 Policy CC2 Adapting to climate change

5.1 Green spaces

The client is keeping all trees within the site boundary, while adding additional lawn and low-level planting as part of the scheme. See the post development plan in Figure 1 at the beginning of this report.

5.2 Cooing and the urban heat island

The proposed design addresses the London Plans 'cooling hierarchy' without the need to install active cooling. This includes the following steps: -

- Minimise internal heat generation through energy efficient design
- Reduction of heat entering the building in summer months
- Manage heat through thermal mass and high ceilings
- Passive ventilation
- Mechanical ventilation
- Active cooling

The SAP has been undertaken with windows being fully openable during hot weather i.e. Passive Ventilation, providing an air change rate of 8ACH, demonstrating **no significant** risk of overheating.

5.3 Sustainable design and construction measures

The client if fully committed to sustainable design, reducing the environmental impact of the property through both excellent fabric design and renewable and low carbon technologies. This has been fully explored in addressing Policy CC1 above.

6 Policy CC3 Water and flooding

6.1 Water efficiency measures

The development will incorporate measure to limit the water consumption to **105 litres per person per day**, this includes using efficiency sanitaryware and white goods as detailed in table 13 below.

WC	4/2.6 litres dual flush
Shower	8 l/min
Bath	170 litres
Basin taps	5 l/min
Sink taps	6 l/min
Dishwasher	1.25 l/place setting
Washing machine	8.17 l/kilogram

Table 13: Proposed water efficiency measures

6.2 Flood risk

Planning policy encourages new development to be located away from areas that are susceptible to flooding. As can be seen in Figure 4 below, the site is in Flood Zone 1; the means the risk to the property of fluvial flooding is less than 0.1% chance of flooding in any year. As such mitigation methods are not required.

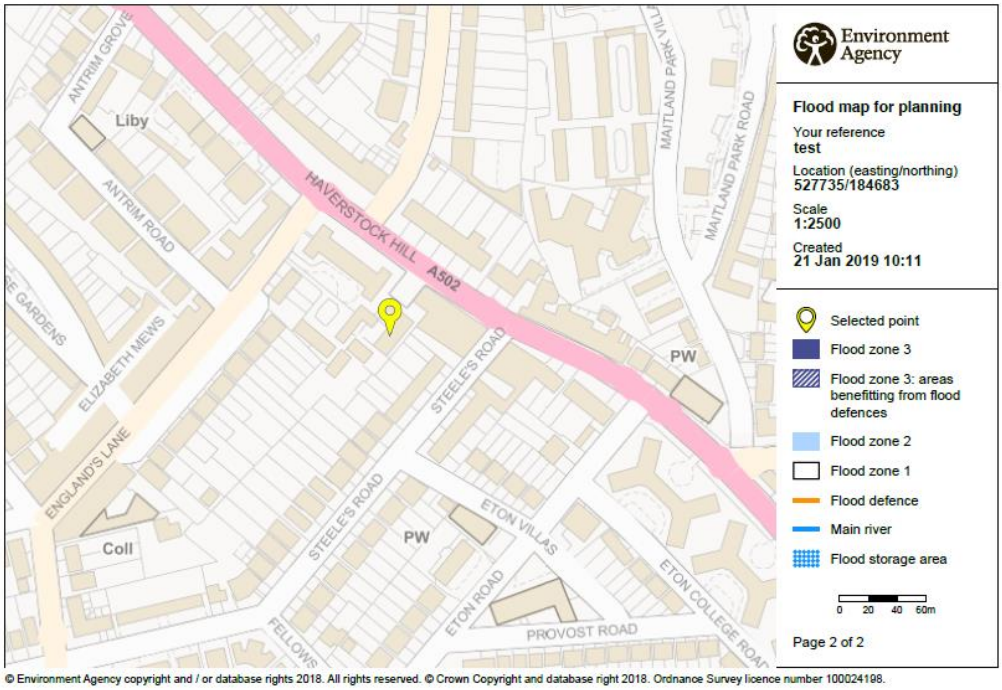

Figure 4: EA Flood Risk Map

Planning policy also requires a development to consider all sources of flooding. The environment agencies surface water flood map (Figure 5) shows that there is a low to very low risk at the site itself, but a high to medium risk on the adjacent road, Haverstock Hill. The pluvial risk on this road suggests a depth of 300mm and a velocity of 0.25m/s flow south east away from the development.

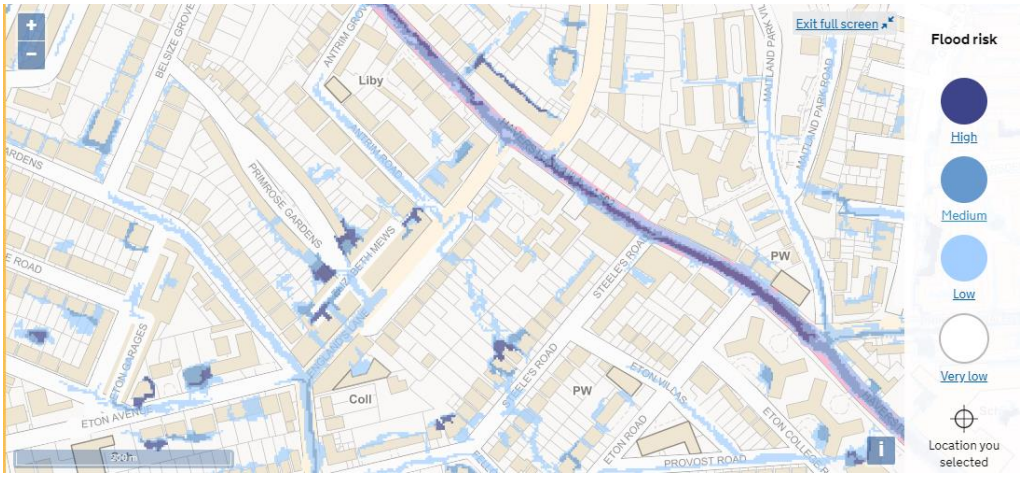

Figure 5: EA Surface Water Flooding

6.2.1 Sustainable drainage

Having reviewed the site and the local geology, there are two possible types of sustainable drainage for the site, this includes permeable paving and green roofs and rainwater re-use. A pre-development and post-development review are detailed in the following sections.

Permeable paving	
Green roofs and rainwater re-use	

6.2.1.1 Pre-development

The current site consists of lawn, hard paving, planting and tarmac. See site layout in figure 6 below.

Site break down

Rear garden (50% paving, 50% planting): 84sqm total area, 42sqm permeable area
Front Garden (100% lawn and planting: 66sqm total area, 66sqm permeable area
Parking: (100% Tarmac):156sqm, 0sqm permeable area.
Total area: 306sqm, 108sqm permeable

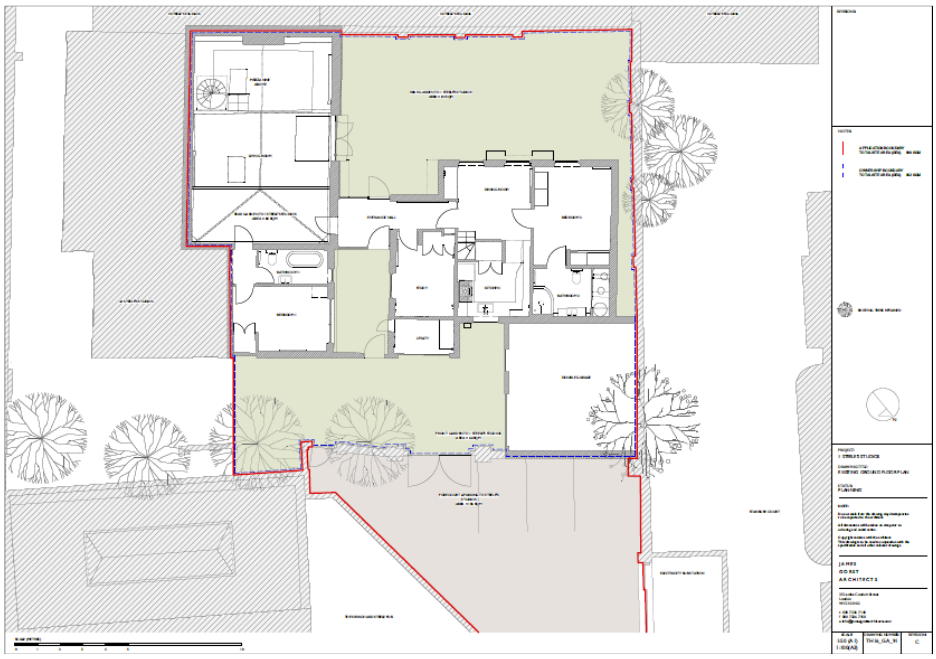

Figure 6: Landscaping Plan Pre-Development

6.2.1.2 Post Development

The proposed site consists of lawn, planting and permeable paving. See site layout in figure 7 below.

Site Breakdown
Rear garden: (100% lawn and planting), 49sqm total area, 49sqm permeable area
Front Garden:(100% lawn and planting), 58sqm total area, 59sqm permeable area
Parking: (50% tarmac, 50% permeable paving), 156sqm total area, 78sqm permeable area
Extended building foot print, 43sqm
Total: 306sqm, 186sqm permeable area

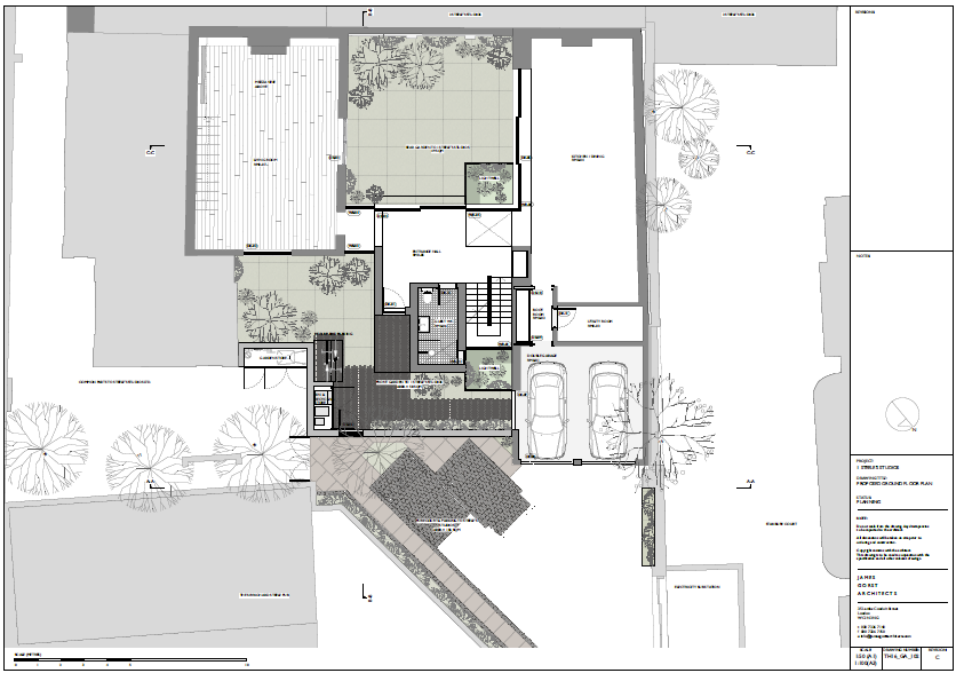

Figure 7: Landscaping Plan Post-Development

Soakaway options are somewhat limited due to local geology build-up of the site being mainly heavy London Clay.

The client will provide a 120 litre water butt to collect roof water runoff to help reduce the overall runoff rate from the site.

7 Air quality

7.1 Emissions from construction and demolition

There will not be significant demolition works on site and as such dust impact on local air quality is likely to be minimal. The client will implement a policy for the control of dust and emissions, and this will be communicated to all site staff.

The planning policy actively promote retaining and improving existing buildings above demolition projects. As this project consists mainly of improving an existing building it should be considered favourably.

The client will use local building suppliers and contractors where feasible to ensure that delivery journeys are kept to a minimum.

A number of mature trees as well as new planting is included in the design to aid clean air.

7.2 Emissions from the combustion of fuel for energy within the building

As part of meeting Policy CC1 and CC2 the client is proposing to use an electric ground source heat pump for both space and water heating and as such there will be zero onsite NOx emissions.

7.3 Emissions from transport to and from the building

Due to the nature of the development, there is not expected to be an increase in the number of vehicles at the property. The client is providing cycle storage to encourage the use of sustainable transport.

The development is within a safe walking route of Belize Park and Chalk Farm both on the Northern Line. Transport for London bus route 168 and N5 service the site offering connections to central London.

8 Policy CC5 Waste

8.1 Storage of Non-recyclable Waste and Recyclable Household Waste

External storage is to be provided with inclusive access and usability (See site plan in figure 8 below). The London Borough of Camden Council provision includes a 240 litre bin for general waste, and a 240 litre / 120 litre bin for recycling waste. A domestic food waste collection is also provided by the Council.

The client will provide both a general waste bin and recycle waste bin within the kitchen, with a minimum total capacity of 60 litres. The local Council provide a caddy for food waste.

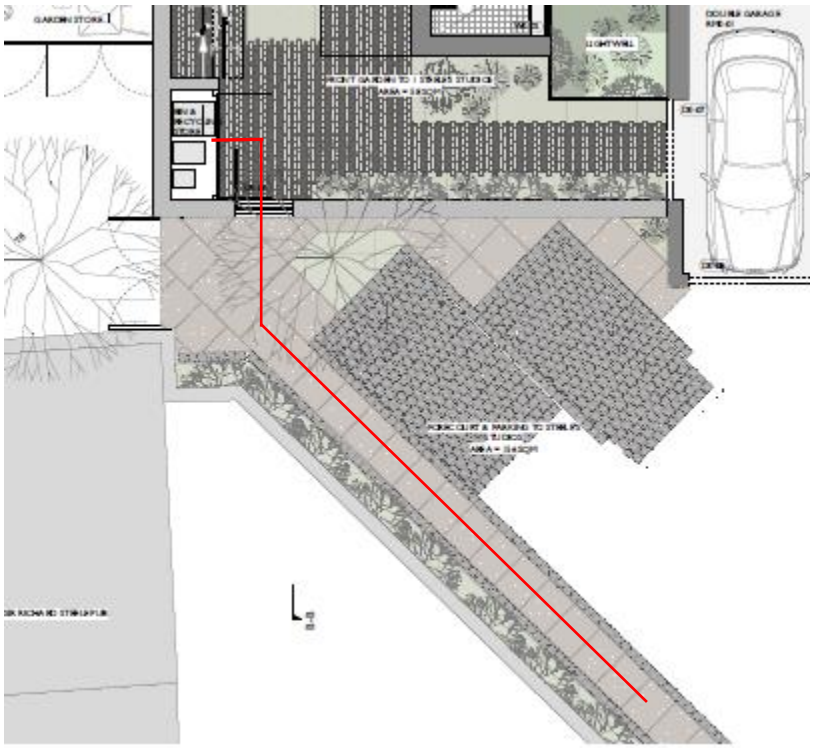

Figure 8: Waste Storage and Access Route

8.2 Construction waste

The client is committed to reducing construction waste where possible, this will include managing on site deliveries to minimize damage to materials, designing to industry standard lengths to minimise off cuts, re-use building materials on site where ever possible and segregating construction waste for offsite recycling.

8.3 Composting

Along with the Council provided food waste caddy, the client will also provide a 210-litre compost bin. See site layout above in figure 6 for potential positioning.

9 Conclusion

9.1 Climate change mitigation

This report has demonstrated that the development will meet the London Borough of Camden Borough Local Plan.

Policy CCS1: Climate change mitigation.

- 1% carbon saving as a result of improved fabric specification above building regulation standards.
- The use of a ground source heat pump will help save 25% of carbon emissions per year.
- It is predicted that the installation of 1.31kWp of Photovoltaic will save 7% of carbon a year.
- Total onsite savings of 33% per year

Policy CC2 Adapting to climate change

- Keeping all existing trees within the site, while adding smaller areas of planting and green areas.
- Increasing the permeable surface area by 78sqm.
- Installing a 120 Litre water butt to help reduce the rate of water runoff from roof areas.
- A design stage SAP assessment has been undertaken, which demonstrates that there is no risk of overheating.
- Cycle storage is included in the design to encourage sustainable transport.
- The site is within walking distance from key transport infrastructure.

Policy CC3 Water and flooding

- A water efficiency calculator has been calculated to demonstrate the dwelling will achieve 105 Litres per person per day through water efficiency methods.
- The development is in flood zone 1, low probability of flooding.
- Risk of surface water flooding is also low.
- Increase in permeable surface area by 78 sqm and a 120 Litre water butt will help reduce water run-off from site.

Policy CC4 Air Quality

- zero NOx emissions at point of use with the use of GSHP for space and water heating.
- The Client will adopt best practise air and dust policies during the construction phase.
- The client will select local contractors and suppliers, where possible, to minimize transport journeys.

Policy CC5 Waste

- 60 Litre Internal bins for general waste and recycled waste will be provided in the kitchen areas.
- 240/120 Litre wastes bins will be provided for general waste and for recycled waste.
- The Council provide caddy bins for food waste as part of a wide waste strategy.
- A 210-litre compost bin is to be provided for garden waste.
- Segregation of construction waste on site
- 'Just in time' purchasing to reduce risk of damaged building materials
- Design to standard sized if practical to reduce 'of cut' waste
- Where possible re-use construction waste material on site.

Section 8 below includes a summary of the Zero Low Carbon Technology as required under section 25a of the Building Regulations.

10 Building Regulation 25a LZC Summary

	Energy Generation	Return on investment	Physical, Spatial & Land Use Impact	Noise Impact	Suitability of technology	Feasibility
 Wind Turbine	Electric	n/a	Are wind speeds at least 6 m/s for stand-alone or at least 3.5m/s for small scale Is the area free from obstructions that could cause local wind turbulence	Wind turbines generate noise that can be heard up to a few hundred metres away. However, this level is normal only marginal greater than the actual wind noise itself.	The location of the site within a built up area makes this technology unsuitable.	No
 Photovoltaics	Electric	n/a	Will the buildings have an east to west (through south) facing roof or flat roof? Are roofs free from overshadowing for most of the day from buildings or other structures?	None	The installation of PV meets the requirement in energy production	Yes
 Solar Thermal	Hot Water	Renewable Heat Incentive (RHI)	Will the buildings have a year-round demand for hot water Will the buildings have an open aspect south east to south west facing roof of at least 4m2? Is there space for hot water cylinder near the panels Is the building in a conservation area	None	Solar hot water works best when the panels can be located close to the water storage.	Yes

	Energy Generation	Return on investment	Physical, Spatial & Land Use Impact	Noise Impact	Suitability of technology	Feasibility
 Biomass Boiler	Heat and Hot Water	Renewable Heat Incentive (RHI)	Is there a local supply and space for storage of biomass fuel or can one be set up? Is a room heater or boiler required	Normal noises associated with boiler plant. Potential additional noise generation associates with the fuel deliveries.	This is not suitable for the site because of the size of the systems and storage of fuel	No
 Air Source Heat Pump	Heat and Hot Water	Renewable Heat Incentive (RHI)	Is there space for siting the heat pump, including the desired room for air movement?	Minimal noise	The use of ASHP is suitable in meeting the requirements of the planning condition.	Yes
 Ground Source Heat Pump	Heat and Hot Water	Renewable Heat Incentive (RHI)	Will there be room for a horizontal buried pipe?Is the ground suitable for vertical pipe system?	Minimal noise	Lack of The client is keen to implement this technology with the use of vertical boreholes.	Yes
 Combined Heat and Power	Heat and Hot Water	n/a	CHP works well with a large demand (large plots) to create more electricity generation, as the boiler itself is not that efficient in small requirements.	Normal noises associated with boiler plant	The size of the dwellings within this development makes the installation of CHP plant inefficient.	No

mesh

CONTACT US

08445 003383
mesh-energy.com
info@mesh-energy.com

1 Park Lane
Lower Froyle
Hampshire GU34 4LU

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