Environmental Sustainability Plan

Building P1

King's Cross Central
General Partner Ltd

September 2012

King's Cross

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Executive Summary

This Environmental Sustainability Plan has been prepared to explain the contribution that Building P1 will make to delivering sustainable development on the King's Cross Central site. Specifically this document responds to the relevant planning conditions of the King's Cross Central outline planning permission (ref. 2004/2307/P) dated 22 December 2006, namely conditions 17 and 45, and the associated Section 106 Agreement obligations relating to sustainability.

Building P1 will provide a 13-storey mixed-use scheme comprising residential accommodation located above a 2-storey co-located primary school and school for the hearing impaired, commercial unit and community meeting facilities. Under the Section 106 agreement, the school will be delivered as a "Shell and Core" building by King's Cross Central General Partner Ltd for London Borough of Camden (LBC) to take over and fit out.

The building has been designed to achieve a high level of sustainability, with the school targeting an 'Excellent' rating under BREEAM New Construction 2011 (condition 17 requires 'Very Good') and the residential units targeting Code for Sustainable Homes (2010) Level 4 (condition 17 requires Ecohomes 'Very Good' or equivalent). The combination of fabric performance, energy efficiency measures and the sourcing of heat and power from the low-carbon district energy centre will result in significant overall annual CO_2 emissions reductions relative to the Building Regulations Part L 2010 target emission rate.

The key sustainability and low carbon measures proposed are summarised below.

Condition 17(A) Energy Efficiency Measures

Explain how the proposed building design realises opportunities to include design and technology energy efficiency measures.

- Enhanced building envelope thermal performance through the specification of better practice U–values and air tightness standards.
- The use of passive solar design measures, such as optimising building orientation to minimise direct solar gain whilst ensuring good levels of daylighting to the school playground and to the residential units. Key learning spaces are positioned at the perimeter in order to gain maximum benefit from the available daylight.
- Energy efficient lighting with high efficacy within the school building, community meeting facilities and the residential units will be specified. It is also proposed that the school building, community space and the landlord areas in the residential parts will make use of intelligent controls, including presence detection and daylight dimming to significantly reduce electrical consumption of the lighting installation, and reduce the overheating risk from unwanted internal heat gains.
- For the residential units and the school building/community meeting facilities, mechanical ventilation with heat recovery is proposed.
- The dwellings have been designed such that they do not require air conditioning but the prevailing market may dictate the need to install comfort cooling in the higher value units.
- There is an emphasis on building services system operational efficiencies and a comprehensive metering strategy to enable interrogation of electrical, gas and water usage. The residential units will be fitted with individual heat meters to enable billing according to use, and thereby promote efficient behaviour.
- An intelligent 'building management system' is envisaged for the school building and community meeting facilities to monitor and control the facility's energy performance and comfort conditions.

Condition 17(B) Reduction in carbon emissions

Explain the reduction in carbon emissions achieved through building design and technology measures, compared with the emissions permitted under the national Building Regulations prevailing at the time the application for the approval of reserved matters is submitted.

- In accordance with the target set out in the Section 106 Agreement, Building P1 will be designed to achieve carbon emissions a minimum of 5% lower than Part L 2010 of the Building Regulations through good passive building design, thermal and energy efficiency measures and use of efficient controls and technology (i.e. prior to the contribution of the low-carbon supply and renewable energy measures). For the residential units, the energy assessment made to date shows 5.7% carbon savings compared to Part L 2010; thus exceeding the target of 5%.
- The project team is responsible for the shell and core of the school building only. Due to the 5% CO_2 savings target, the project team has specified a building fabric for the school (and the community meeting facilities), which is predicted to perform 10% better than the building fabric for the Building Regulations compliant notional building.

Condition 17(C) and Condition 46: Green and/or brown roofs

Explain the specification for any green and/or brown roof.

- A podium level communal garden and container planting, the opportunity to incorporate vertical planting within the playground boundary fence structure and brown roofs at roof level will encourage ecological enhancement and local biodiversity.
- It is proposed that wildlife and other planting features will act as a learning resource for the school.

Condition 17(D): Energy supply

Explain how energy shall be supplied to the building, highlighting:

I. How the building relates to the site-wide strategy for district heating incorporating tri-generation from distributed combined heat and power;

II. How the building relates to the strategy for using bio-fuel boilers to supplement the energy supplied through the district heating system;

III. The assessment of the cost-effectiveness and reliability of the supply chain for bio-fuels; and

IV. Any other measures to incorporate renewables.

- Connection to the site's energy centre allows Building P1 to take advantage of the low-carbon benefits associated with district heating and CHP. The energy centre will deliver all of the heat for space heating and the hot water demand of the building, and the electrical power generated will offset a significant percentage of the building's demand.
- The use of low-carbon energy supplies and passive design measures result in a building achieving an overall reduction in CO_2 of 20.15% against Part L 2010. This is increased to 32.2%, accounting for the potential introduction of biomass fuels in the future.

Condition 17(E): BREEAM / Code for Sustainable Homes rating

Explain how the proposed building(s) have been designed to achieve a BREEAM and/or Ecohomes rating of "very good" (or an equivalent assessment method and rating) or better.

- A preliminary 'BREEAM New Construction 2011 Education' assessment has been carried out by a BREEAM Accredited Professional which has identified an indicative score of 72%, representing a rating of 'Excellent' for the design as currently progressed. The design team is therefore confident of targeting an Excellent rating.
- A preliminary Code for Sustainable Homes assessment has been carried out by a licensed assessor which has identified an indicative score of 72%, which represents a Level 4 rating for the design as currently progressed. A Code level 3 rating would be regarded as broadly the equivalent of an Ecohomes Very Good rating.

Condition 17(F): Wildlife Features

The Environmental Sustainability Plan shall explain the incorporation of bird boxes, bat roosts and other wildlife features on the building.

See Condition 17(C).

Condition 45: Drainage

Explain how the new drainage infrastructure within the site shall be designed to achieve a combined (storm and foul) peak discharge to the existing combined sewer of 2,292 litres/second or less.

- The surface water discharge peak flows for Building P1 are 139 l/s and 8 l/s for surface water and foul water, respectively. The site-wide drainage networks have been designed on this basis, using SUDS principles to provide an overall peak flow reduction of 10% (based on a 1 in 30 year storm). Building P1 has been designed so that the above discharges will not be exceeded and that the site-wide maximum discharge to the existing combined sewer will not exceed 2292 l/s.

S106 - Section AA: Water

Section AA of the Section 106 agreement places an obligation to use reasonable endeavours:

I. To incorporate within the detailed design water efficiency measures such that the design secures at least 40% of the potable water consumption credits available under the BREEAM methodology which represents a reduction of approximately 20-30% against typical water consumption;

II. To incorporate one or more of groundwater abstraction, grey-water and black-water recycling and rainwater harvesting as alternative water supplies to meet 5% or more of the non-potable water needs; and

III. To ensure that the design for the treatment of storm water run-off incorporates, where practicable, filtration, attenuation and other techniques that is consistent with current best practice on SUDS, to control the timing and volume of flows.

- Low water use sanitary fittings and appliances will be specified such that internal water use in the dwellings, community meeting facilities and the school will improve upon typical benchmark performance by 25-30%.
- Water meters, controls and detection systems are envisaged in order to effectively manage the school's water consumption.
- The school landscaping proposals include water butts to collect rainwater runoff so that pupils can manually water the areas of planting intended to facilitate learning.
- The potential for rainwater collection for WC flushing in dwellings, and for collection, recycling and re-use of grey-water and black-water have been reviewed. The built form and plant room space constraints mean that these technologies are not viable for Building P1.

- Sustainable Urban Drainage Systems (SUDS) techniques will be integrated wherever practical into the P1 design to affect source control and storm water retention/infiltration, provide permeable surfaces and encourage evapotranspiration (e.g. from green/brown roofs).
- Soft landscaping and a brown roof are proposed. These features will help reduce the peak flow and the total volume discharged from the roof by attenuating or detaining rainfall and, on warmer days, by encouraging evapotranspiration.

S106 - Section Y: Construction materials and waste

Section Y of the S.106 Agreement imposes obligations to:

Implement the Construction Materials and Purchasing Strategy

Apply the Construction Materials and Purchasing Strategy to agree specifications and targets in contracts with contractors, designers and suppliers of services in relation to construction

Use reasonable endeavours

I. to minimise packaging waste associated with the delivery of construction materials

II. to produce topsoil and subsoil that uses subsoil and crushed rubble from the site combined with organic material for use in areas of landscaping

III. to achieve the Construction Targets.

- The Construction Materials and Purchasing Strategy will be implemented.
- Packaging used to protect construction materials and assemblies in transportation will be kept to a minimum and wherever possible returned to be re-used.
- In addition to the Section 106 requirements, the project contractor has its own corporate construction targets which will be applied to the proposed development.
- Maximum credits under the Code for Sustainable Homes and BREEAM for mitigating construction site impacts have been targeted, which include monitoring and reducing resource use and waste production.
- The team will target the achievement of the Section 106 Construction targets.

S106 - Section Z: Waste

Section Z of the S.106 Agreement imposes obligations to:

I. Provide occupiers with Waste Information Packs and use reasonable endeavours to obtain feedback on the success or popularity of the initiatives contained within the Packs

II. Use reasonable endeavours to incorporate within the detailed design best practice design solutions that provide for waste segregation and storage areas and to maintain the solutions that are implemented

III. Provide and maintain segregated waste containers within the Public Realm areas at suitable locations and in appropriate numbers

- A simple ‘home user guide’ and a ‘building user guide’ will be prepared which will include information on waste and recycling for both the residential occupants and the school/community meeting facilities.
- Dedicated storage space and containers will be provided to encourage building users to recycle.
- Sufficient communal refuse storage space will be provided in compliance with Camden Council’s waste collection policy.

1 Introduction

1.1 The Purpose of this Plan

This Environmental Sustainability Plan has been prepared to explain the contribution that Building P1 will make to delivering sustainable development on the King's Cross Central site. Specifically, this document responds to the relevant planning conditions of the King's Cross Central outline planning permission (ref. 2004/2307/P) dated 22 December 2006, namely, condition 17 and 45. It provides details of the strategies adopted to demonstrate that the building achieves an advanced sustainability performance against the standard design for a building of this scale and mixed-use function in a central urban environment. The plan also details how obligations contained within sections AA, Y and Z of the Section 106 Agreement will be met.

This document should be read in the context of other plans and documents forming the Building P1 planning submission, including the Planning Compliance Report; the Urban Design Report; and the summaries of the Code for Sustainable Homes (CSH) and BREEAM pre-assessments which are included within this document.

1.2 Description of Building P1

The P1 development is located in the northern area of King's Cross Central (KXC), as shown in Figure 1.1. The proposals will provide a new, vibrant residential environment comprising open market and 'key worker' affordable apartments. The residential accommodation will be located above a learning environment that brings together the Frank Barnes School for deaf and hard of hearing children; and a new mainstream primary school all under one roof. The desire is to create London's best teaching and learning environment for both mainstream and deaf/hard of hearing children. In addition, the ground floor includes community meeting facilities and a small commercial unit. A single storey basement area for car parking and plant lies beneath the majority of the school/community facility footprint.

Under the Section 106 Agreement, the school will be delivered as a "Shell and Core" by King's Cross Central General Partner Ltd (KCCGP) for London Borough of Camden (LBC) to take over and fit out. The community meeting facilities will be delivered to a Category A finish, although the full specification for fit-out is still to be determined. The facility will then be leased to and managed by LBC (or an appropriate alternative organisation).

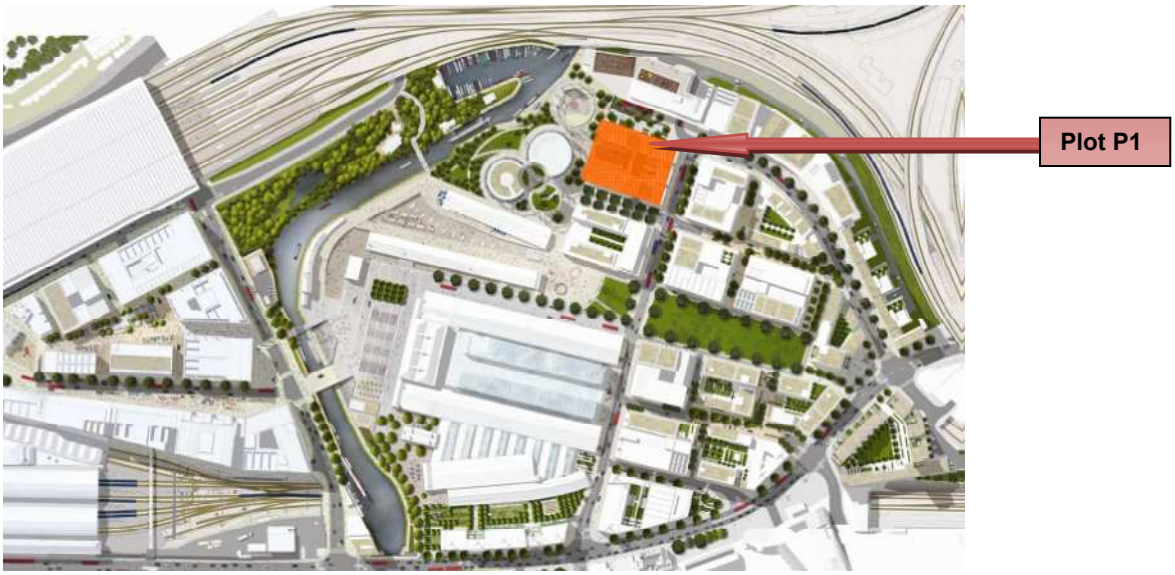


Figure 1.1: Site plan showing the location of P1 in the context of the northern King's Cross Central masterplan

The perimeter of the development is open at the south west corner to allow long views out across the Regent's Canal and to allow as much daylight and sunlight as possible to be brought into the heart of the site. The open corner accommodates, at ground level, the playground and outdoor learning spaces for the school.

The central garden is located above the school and contains rooflights to enable natural light penetration to the circulation spaces of the deep plan school below. The landscaping proposals explore innovative approaches to delivering greenery to the scheme, and the strategy extends to the full height of the building through a variety of opportunities for informal planting on terraces and balconies.

The proposal for Building P1 is to deliver an exceptional and sustainable urban scheme which meets the environmental, social and economic needs of the local community. It has been designed in close co-operation with LBC officers to address the relevant conditions and associated obligations from the outline planning permission and to achieve the desired CSH and BREEAM ratings.

Figures 1.2, 1.3, 1.4 and 1.5 below are the North, South, East and West Elevations

2 Response to Planning Conditions

2.1 Condition 17 (A): Energy Efficiency Measures

Explain how the proposed building design realises opportunities to include design and technology energy efficiency measures.

2.1.1 Overview

Building P1 is a mixed-use building, with a school, community meeting facilities and a small commercial unit proposed for the lower levels and residential accommodation located above. The measures described in this section therefore relate to the building and its energy performance as a whole, with a description of measures specific to each element where appropriate.

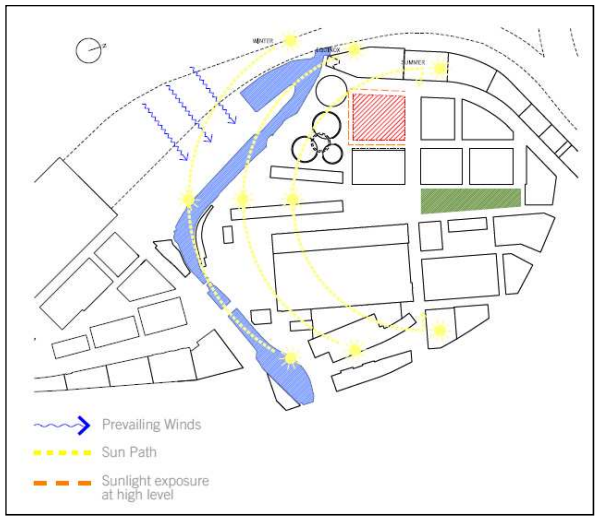
The building has been designed from the outset with energy efficiency as a key driver. Whilst power, heating and hot water supplies will be provided via the low carbon district energy system, the project team recognises the need to reduce the energy demand of the building through the application of the following design methodologies:

- **Passive Design** – A concrete frame and slabs mean the building has a high thermal mass, and the design of the building facade minimises summer cooling loads and winter heating demand.
- **Active Design** - The specification of energy efficient equipment and controls to reduce energy consumption within the dwellings. The school/community meeting facilities fit-out should also adopt this approach.

By embracing passive and active design, Building P1 will also be 'future-proofed' to ensure it is resilient to climate change impacts thereby continuing to meet the future operational needs of the occupants.

2.1.2 Physical form of the building

Building P1 is located on the northern edge of the KXC site and is bounded to the west by T1, to the east by P2, to the north by S1 and to the south by the relocated gas holder structures. P1 has been orientated to facilitate daylight penetration from the south west to the heart of the scheme and to the enclosed play/recreation areas (Figure 2.1), and to take advantage of the sun path and environmental conditions for the plot (Figure 2.2). A full description of the Building P1 scheme is provided in the Urban Design Report.



Figures 2.1 and 2.2 View from the south west into the heart of the P1 scheme, and the sun path diagram (the red square represents the footprint of building P1)

2.1.3 Building envelope, specification and thermal performance

The external envelope acts an important climatic modifier. A well-designed external envelope can significantly reduce energy demand. The need to address thermal comfort issues in summer has had a strong influence upon the design of the building.

The building fabric performance in terms of the specified glazing standard and insulation levels performs significantly better than the minimum requirements of Part L of the Building Regulations 2010, as shown in Table 2.1 below.

Table 2.1: Building fabric U-values for Building P1 against 2010 Building Regulations

(ie. worst acceptable values)

Element	**Part L 2010 U-values (W/m^{2}K)**	**Proposed U-values for P1 (W/m^{2}K)**
External Wall	0.30	0.15
Roof	0.20	0.20 in general 0.12 for duplex apartments
Exposed Floor	0.25	0.10 (school above basement)
Glazing (Residential)	2.00	1.4 (including frame)
Glazing (School)[1]	2.00	1.1 (including frame)

The building construction process shall incorporate robust details as developed by the Building Research Establishment (BRE) in order to ensure a building air tightness of 5m^3/hr/m^2 for all building elements. This figure is a significant improvement on the maximum allowable Building Regulation Part L 2010 level of 10m^3/hr/m^2 and will assist in reducing the building energy consumption by increasing the air tightness of the building and, as a consequence, reducing the energy required to heat the spaces.

2.1.4 Passive Design

The provision of natural daylighting is an important consideration in passive solar design, and has been achieved within the constraints of the site footprint and the building's dense urban context.

Many design options have also been explored to optimise daylighting to the school. However, due to a number of physical constraints and the need to balance critical issues related to space and internal layout, it is not possible for all spaces to benefit from good levels of natural light. Key learning spaces have been prioritised over circulation, welfare and administrative functions with classrooms deliberately positioned at the perimeter of the layout in order to gain maximum benefit from the daylighting offered by the glazing design.

For the dwellings, Table 2.2 below indicates the recommended dwelling daylight factors from the BRE 'Site Layout for Daylight and Sunlight: A Guide to Good Practice 1991', which is also replicated in the 'Code for Sustainable Homes – Technical Guide 2010'.

[1] To achieve thermal and acoustic performance, secondary glazing is anticipated.

Table 2.2: Summary of dwelling recommended daylight factor from Code for Sustainable Homes

Area	**Recommended Daylight Factor (ADF)**
Kitchen	2%
Living Room	1.5%
Bedroom	1%

The way in which the P1 development relates to the above recommended daylight factors for residential units is addressed within the separate Daylight and Sunlight Report prepared by AECOM and included as part of the Reserved Matters submission.

As well as the daylight considerations, the potential impact of summertime overheating has also been considered. The geometry of the building and the recessed balconies lend themselves to self-shading on the east and west facades, which will reduce unwanted solar gain to the apartments. This will be further reduced through the high performance of the building fabric. The SAP (Standard Assessment Procedure) calculation methodology has been used to assess overheating risk for sample apartments and the results indicate that this risk is not significant due to the implementation of the above mitigation measures.

In parallel, an IES <virtual environment> dynamic model has been developed for the school building/community meeting facilities, which demonstrates that the proposed community space and the 'as-designed' school are not likely to exceed acceptable overheating criteria in standard conditions. Nevertheless space has been allowed for the provision of cooling plant at a future date, should LB Camden which to specify it.

2.1.5 Scope for using thermal mass

Utilising the thermal mass of a building can reduce peak heating and cooling loads and thus reduce annual energy consumption. Incorporating the building's thermal mass within occupied areas can reduce or remove the need for mechanical cooling systems.

To exploit the thermal mass of the building, either direct or indirect contact is required between the structure and the occupied space, via exposed surfaces or energy exchange systems. Given that much of the building is residential there is a limited opportunity to expose the thermal mass directly; this is because the internal finishes, such as carpets, will reduce the effectiveness of the concrete structure as an energy store within the apartments. For the school building, KCCGP are providing shell and core only. Opportunities for exploiting thermal mass will exist for consideration at the fit-out stage, but these will need to be balanced with the functional requirements of the school, including the specialist requirements for the school for the mass.

2.1.6 Choice and design of building services

The building services strategy has been designed to maximise the use of the site-wide, low-carbon district energy system. The district heating pipework will enter the building at basement level and heat is then transferred via a heat exchanger to a secondary circuit.

Dwellings:

Each dwelling will be fitted with a Heat Interface Unit (HIU) to provide hot water and space heating. Each dwelling will also have a heat meter to facilitate individual billing according to use. All pumps and drives will be inverter-driven, allowing them to match the energy requirements of the building. Space heating will be provided by underfloor heating (market dwellings) or radiators incorporating thermostatic control valves (key worker affordable housing), both allowing a degree of user control within each room and the ability to reduce further energy requirements on a room by room basis.

The proposed passive and energy efficient design measures set out in this section are designed to provide a comfortable internal environment without the need for mechanical cooling. Nonetheless there is a market expectation that comfort cooling may need to be provided in the larger, high-value apartments. The 'Home User Guide' provided to occupants of any relevant units will include a section on the efficient use of the comfort cooling system in order to encourage minimised use.

The opportunities for recovering waste heat from any installed cooling systems have been considered, but there would be no energy benefits from such low grade heat in a building supplied by the low carbon district heating scheme.

The school/community meeting facilities:

The school and community meeting facilities will each have their own metered district heating supply which will provide, via a plate heat exchanger, all of the heat for hot water and space heating. All pumps and drives will be inverter-driven, allowing them to match the energy requirements of the building.

The proposals include a space allocation for plant to provide cooling within the school, if the need should arise at a later date. At present, cooling is limited to high efficiency DX (direct expansion) or VRF (variable refrigerant flow) systems which will be specified for server rooms, the IT suite etc.

Controlling the building services:

A Building Management System (BMS) will be installed for the landlord areas in the residential accommodation. The system being considered would have the ability to control and monitor the following:-

a. District heating system plate heat exchangers (secondary side)

b. Secondary heating pumps

c. Cold water storage high and low water level alarms

d. Cold water booster systems

e. Incoming electricity metering and Building Regulations Part L compliant sub-metering

f. Monitoring of heat energy metering within the apartments

g. Monitoring of water meters within the apartments

The use of a BMS will enable automatic system control to ensure correct operation of the building. Monitoring of the building services systems assists in maintaining optimum energy consumption through data interrogation and resolution of potential problems.

The project team expects that a separate BMS will be installed to monitor and control the mechanical, electrical, public health and fire protection systems in the school and community meeting facilities, in a similar manner to that controlling the landlord areas for the residential part.

2.1.7 Ventilation strategy

For the residences, ‘whole house’ mechanical ventilation with integral heat recovery units (MVHR) are to be provided.

Mechanical ventilation has been specified throughout the school building to ensure adequate ventilation levels can be achieved within the acoustic constraints of the site and the building occupants.

2.1.8 Scope for intelligent lighting

The internal lighting systems for the residential part of building have been specified to produce further reductions in energy consumption. The following lighting strategy has been applied:

- The lighting installation will employ low-energy, high efficiency light fittings. In addition to reducing energy use associated with lighting, this strategy will help to limit unwanted heat gains.
- Lighting in the service corridors and communal areas will be controlled via timers and passive infra-red (PIR) movement detectors which ensure that the luminaries will dim/turn off when not required.
- Communal staircases will utilise timeclock and PIR facilities to control the lighting of the spaces during the daytime.
- External lighting will be zoned and controlled via an astrological time clock and photocell daylight sensors.
- Car park lighting will be controlled via PIR detection sensors to ensure lighting is used only when required.

For the school building and community meeting facilities, it is expected that the fit-out phase will ensure the lighting is in accordance with BREEAM design criteria where applicable.

2.1.9 Plant sizing

Plant sizing has been designed to optimise the efficiency of the systems, by matching installed capacity to building demand. The district energy centre and main electrical sub-station within Building T1 have been constructed and commissioned and provide thermal energy (i.e. heat and hot water) and electrical power for Building P1.

The mechanical building services will be specified to achieve high annual energy efficiency operation. All equipment shall be selected in accordance with the domestic heating and non-domestic heating, cooling and ventilation compliance guides published by the Department for Communities and Local Government (DCLG) – 2010 editions.

2.2 Condition 17 (B): Reduction in Carbon Emissions

Explain the reduction in carbon emissions achieved through building design and technology measures, compared with the emissions permitted under the national Building Regulations prevailing at the time the application for the approval of reserved matters is submitted.

Building P1 is a mixed-use scheme comprising a residential development, which falls under the control of Building Regulation Approved Document Part L1A (ADL1A), and a school/community meeting facility, which falls under Building Regulation Approved Document Part L2A (ADL2A). Separate calculations are therefore required to be undertaken to establish the building regulations targets (via the notional building) and predicted actual performance of the two different building types (residential and non-residential).

Residential Development

The residential areas of the development have been assessed using SAP (Standard Assessment Procedure) with representative examples being analysed to show that the design will comply with the condition and carbon emission targets. The representative apartments are shown on figure 2.2. These representative apartments have been used to determine the overall performance calculated, based on an area weighted average.

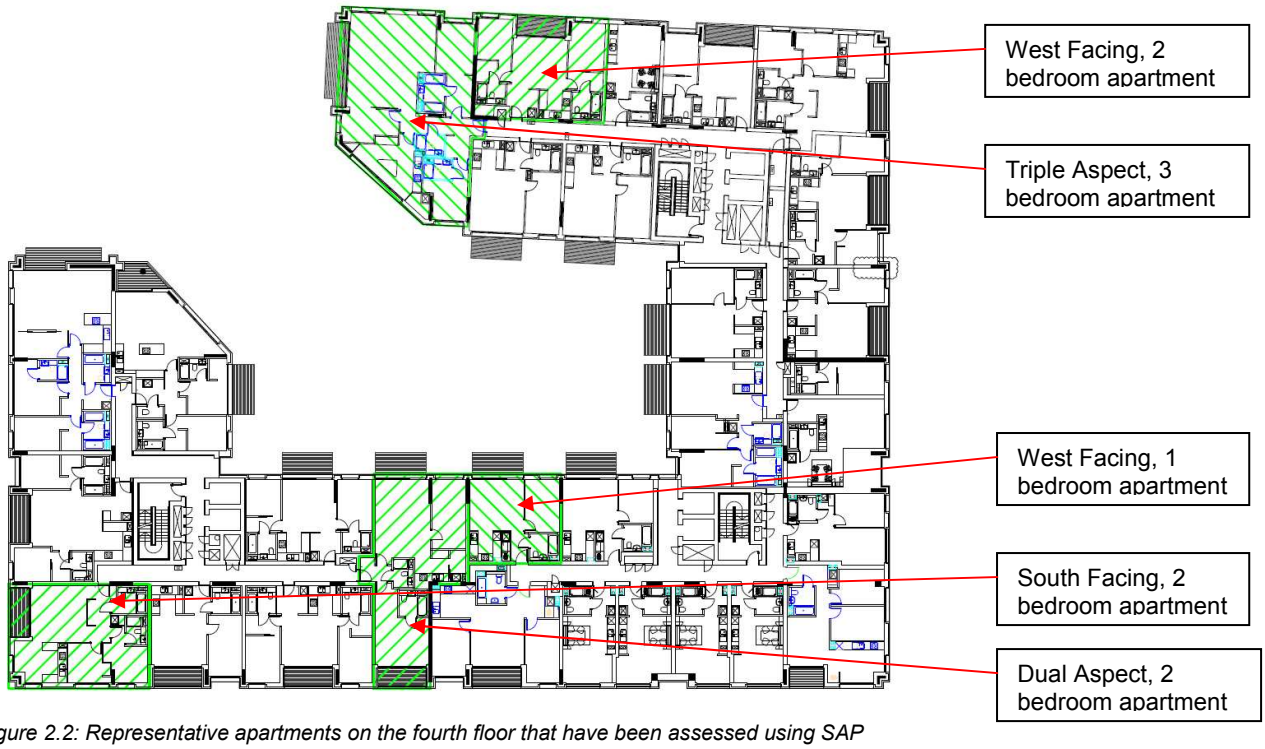


Figure 2.2: Representative apartments on the fourth floor that have been assessed using SAP

The Section 106 Agreement targets each new KXC building to achieve a 5% carbon emissions reduction against Part L of the prevailing Building Regulations (now the 2010 Building Regulations) based on the use of energy efficient and passive design measures alone (i.e. excluding any contribution from the low-carbon district energy supply and renewables).

On the basis of the passive design measures set out in Section 2.1, the area weighted carbon emissions (derived from the Dwelling Emissions Rate – DER in kg $CO_2/m^2/yr$ calculated for the example apartments above) from the residential areas of Building P1 are currently predicted to be 25.3 tonnes CO_2/year, which is 5.7% below the carbon emissions derived from the Target Emissions Rate (TER) of 26.8 tonnes CO_2/year. These calculations have been undertaken on a 'worst case' basis with up to 30% of dwellings being comfort cooled. However it is currently proposed that only a small number of duplex penthouses will be comfort-cooled, so the DER of 25.3 tonnes Co2/year will over-report the carbon emissions associated with cooling. It should

also be noted that the results are based on an infiltration/air permeability rate of 5 m3/hr/m2 @ 50Pa, which could potentially be reduced, thereby increasing the saving and the margin further.

See Appendix 1 for a sample SAP assessment. Consequently, the residential element of the building is anticipated meet the target 5% reduction set by the Section 106 Agreement.

Figure 2.3 shows the comparison of the area weighted carbon emissions (derived from the TER) for the residential areas of Building P1 against the area weighted carbon emissions (derived from the DERs) for the proposed design, excluding contributions made by the district heating supply and renewables.

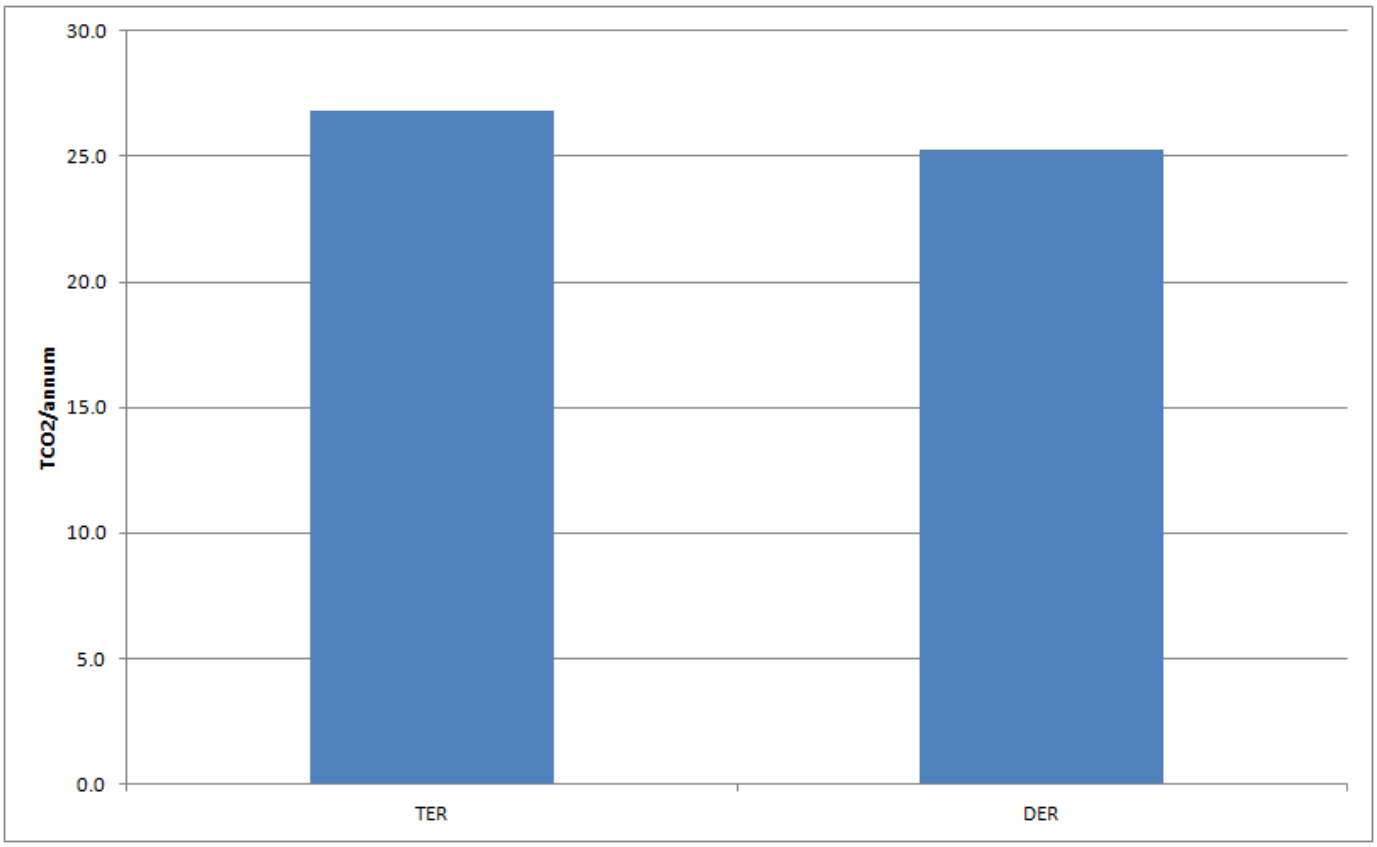


Figure 2.3: Part L 2010 Estimated Carbon Emissions (excluding contributions from CHP and renewables)

The design team is targeting CFSH Level 4 rating for the apartments. To achieve this rating will require a mandatory minimum performance in relation to CO_2 emissions.

School/Community Meeting Facilities

The school building is to be constructed to shell and core under the Section 106 Agreement. The community meeting facilities will be delivered to Category A finish, although the full specification for the fit-out is still to be finalised pending confirmation of the eventual operator. As noted above, both elements need to deliver a 5% improvement in CO_2 emissions compared to Part L through building design and technology measures. The building services that are critical in the calculation of the carbon emissions of the school and community meeting facilities will be designed, specified and installed as part of the fit out works.

In accordance with the requirement to provide a 5% improvement in CO2 emissions compared to part L, the building fabric that will be provided as part of the shell and core works have been specified to provide a performance that is at least 5% better than that in the building regulations notional building, against which the actual building design will be compared.

In accordance with this, the area weighted U-value for all of the building thermal elements is 0.50 W/m^2K, which is 10% better than the notional building, that has an area weighted U-value of 0.56 W/m^2K. The design infiltration/air permeability rate for the building will be 5.0 $m^3/hr/m^2$ @ 50Pa; this matches the performance of the notional building.

The design team is targeting a BREEAM Excellent rating for the school building. To achieve this rating will require a mandatory minimum performance in relation to CO_2 emissions.

2.3 Condition 17 (C): Provision of Green and /or Brown Roof

Explain the specification for any green and/or brown roof.

The landscaping strategy comprises:

- a podium level communal garden;
- the opportunity to incorporate vertical planting within the playground boundary fence structure; and
- brown roofs at roof level.

All of these features, but particularly the latter two, will encourage ecological enhancement and local biodiversity.

Figure 2.4 below indicates the extent of the proposed planting and brown roofs.

The scheme includes some 734 square metres of brown roofs on top of the vertical tower elements. In addition, there would be a planted landscaped garden of some 576 square metres at podium level 2. Some 1,104 square metres of private outdoor roof terraces and extensive balconies (2,035 square metres) would provide further opportunities for planting

It is anticipated that this strategically located green infrastructure will act as a wildlife corridor or ‘ribbon’, providing connectivity between other green spaces and wildlife areas within the King’s Cross Central footprint and beyond.

It is proposed that wildlife and other planting features will act as a learning resource for the school.

This strategy will offer multiple environmental and social benefits. The podium garden will provide recreational garden space for use by occupants. The project team will include a landscape architect, who will select a species mix having regard to the local biodiversity action plan (BAP).

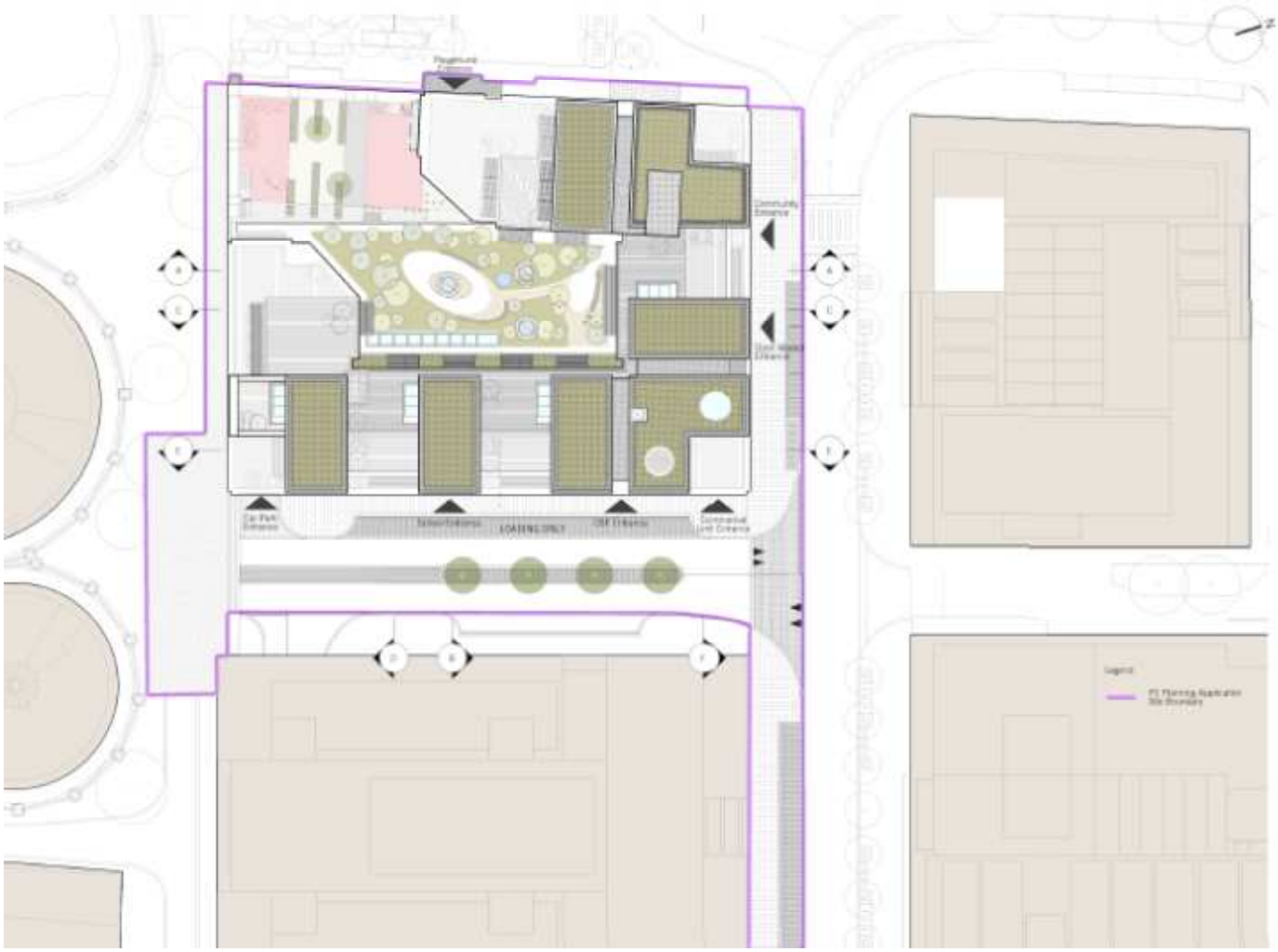


Figure 2.4 Aerial image of Building P1, indicating the extent of the brown roofs and soft landscaping

The brown roofs and other soft landscaping will provide evaporative cooling, as well as some level of rainwater attenuation, and will contribute to reducing the Urban Heat Island effect. This will be particularly important when considered in the context of climate change and the adaptive capacity of the KXC site to deal with projected increases in hot weather events.

Atmospheric carbon dioxide will be absorbed by the plants, allowing them to play a part, albeit small, in offsetting the emissions of the building. This offset has not been included in the Building Regulations calculations but forms a benefit in its own right.

2.4 Condition 17 (D): Energy Supply

Explain how energy shall be supplied to the building, highlighting:

I. How the building relates to the site-wide strategy for district heating incorporating tri-generation from distributed combined heat and power;

II. How the building relates to the strategy for using bio-fuel boilers to supplement the energy supplied through the district heating system;

III. The assessment of the cost-effectiveness and reliability of the supply chain for bio-fuels; and

IV. Any other measures to incorporate renewables.

2.4.1 The KXC Energy Centre

The T1 Energy Centre has already been approved, constructed and commissioned. The necessary heat and power distribution infrastructure is being installed across the site to enable the connection of each new building to the district energy network. The thermal energy supplied to Building P1 will be used to provide all of its space heating and hot water demands. The combined heat and power (CHP) engines to be installed within the T1 Energy Centre will also generate electrical power, which will offset a significant percentage of the building's demand.

Due to the relatively low cooling demands for the building, no absorption chillers are proposed in Building P1.

When fully operational, it is anticipated that the T1 Energy Centre will include the following principal items.

- 3 no. 1.8 MWth gas fired CHP engines
- A thermal store, integral to the CHP operating hours strategy
- 3 no. 9 MWth gas boilers

These items will be installed on a phased basis as the scheme reaches critical mass, in order to meet peak demands and optimise efficiency. As part of the energy strategy, a temporary Energy Pod has been installed on Plot Q1 initially to provide heat for the commissioning of plant during the construction of UAL and subsequently to meet occupant demand from September 2011. Similarly, the Energy Pod has provided heat for plant commissioning during the development of Building R4 (now completed and occupied as Rubicon Court).

KCCGP and its partners have now established the Energy Services Company (ESCo) to run the district heating, and remain committed to completing the works on site to install utilities and district energy infrastructure, for example within the Eastern Goods Yard and along Goods Street. It is envisaged that the T6 student housing building will trigger the 'switch on' of CHP engines and boilers in the T1 Energy Centre. At that point, the Energy Pod on Q1 can either be decommissioned, or retained (either at that location or elsewhere) for a period of time to assist with commissioning, or provide service resilience.

As outlined in previously submitted (and approved) Environmental Sustainability Plans, future provision has been made within the KXC development for the inclusion of biomass boilers. At this time, a robust commercial case to support the inclusion of biomass cannot be made; however, this position continues to be actively monitored. The scope for a secondary energy centre within Plot T2 could provide for its inclusion later, subject to procurement of an appropriate fuel source in line with clause 20(a) of Section X of the Section 106 Agreement.

The carbon emission calculations used within this report have assumed that, in total, 62.5% of the thermal energy used across the KXC site will be produced by CHP with the remainder provided by gas fired boilers. Furthermore, it has been assumed that the Energy Centre (once fully operational) will operate such that on average just over 50% of Building P1's annual heating and hot water demand will be supplied from the gas-fired CHP plant and just under 50% from gas-fired boilers.

The CHP plant will also, of course, generate power. Some 79% of electricity consumption across the KXC site will be offset by on-site electricity generation. Additional assessments have been carried out to show the further reduction in overall CO_2 emissions from Building P1 if the Energy Centre were to provide 16% of the annual heating demand of the building via biomass boilers, 34% from gas-fired boilers and 50% from CHP, see next section.

2.4.2 CO_2 savings arising from the District Energy System

Residential Development

Taking into account the passive design and energy efficiency measures set out in Section 2.1 of this plan and the contribution made by the building's connection to the low-carbon district energy system, the area weighted carbon emissions are further reduced from 25.3 tonnes CO_2/year to 21.4 tonnes CO_2/year, representing an overall 20.15% reduction in emissions against Part L of the 2010 Building Regulations (the area weighted TER). The addition of biomass boilers within the Energy Centre would result in a further, reduction in CO_2 emissions of 3.2 tonnes CO_2/year, equating to an overall saving of 32.1% against the area weighted Part L TER.

Figure 2.5 below provides a comparison of the target carbon emissions (derived from the TER) against the dwelling carbon emissions (derived from the DER) for the proposed design, including the CO_2 emissions reductions made as a result of the connection to the low-carbon energy supply and the potential introduction of biomass fuels.

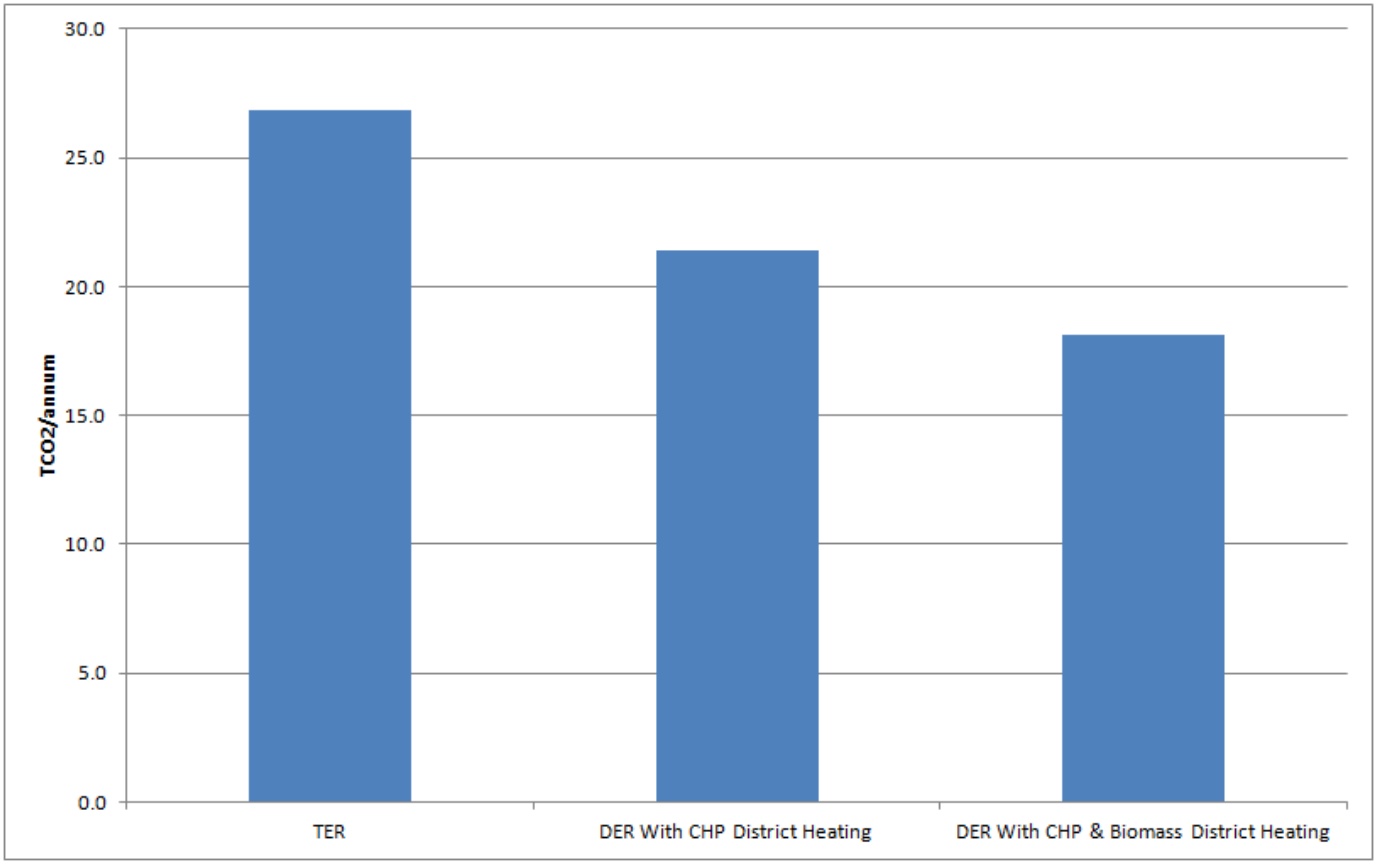


Figure 2.5: Estimated Building P1 Part L CO_2 Emissions (including contributions from CHP and biomass in tonnes CO_2)

School/Community Meeting Facilities

Based on the performance of a typical school and the emerging specification for the community meeting facilities, we anticipate that the inclusion of low carbon heat from the district heating scheme will provide a further 20% - 30% reduction in the carbon emissions of these two elements.

2.4.3 Renewable energy options

The September 2005 Energy Assessment and Parameter Plan KXC021 does not highlight plot P1 as a priority location for renewable energy generation. However, a number of technologies were considered for suitability but discounted during early stage design due to a number of factors.

- Solar Photovoltaic (PV) - While building integrated PV provides a suitable option for renewable energy generation, Building P1's location and structural form would mean that the contribution from any PV installed would be limited. The stepped terraces and roof areas have been designed to maximise opportunities for outdoor space and gardens for the building's occupants, and biodiversity thus providing both social and environmental sustainability benefits that go beyond carbon.
- Wind turbines – The building location and proximity to other constructed/planned buildings would be likely to affect the performance of building integrated turbines, meaning any contribution to overall site-wide generation would be limited. Proximity to other buildings could also lead to issues associated with noise and flicker for neighbouring residents.
- Ground source heat pumps (GSHP) - Typically this type of system is best suited to a building where heating and cooling loads are relatively balanced. Given that very limited, if any, cooling will be provided to P1 and that the thermal energy demands of the building will be supplied from the low-carbon district energy system, there is little benefit to be gained from a GSHP system. Furthermore, due to the presence of tunnels which run beneath and alongside the building, the numbers of boreholes to supply a GSHP would be restricted, thus limiting the size and contribution that any GSHP system could offer.
- Solar hot water – Similarly to PV, the proposed uses of the roofs mean there is no available area to locate solar hot water panels. Furthermore the building has been designed to make full use of the heating supplied by the King's Cross Central district energy system for hot water provision, and supply from solar would be competing for the hot water demand. If solar hot water panels were installed, they would need to supply a communal hot water system, so all dwellings could benefit, which is not feasible.

2.5 Condition 17 (E): BREEAM and Code for Sustainable Homes

Explain how the proposed building(s) have been designed to achieve a BREEAM and/or Ecohomes rating of "very good" (or an equivalent assessment method and rating) or better.

2.5.1 BREEAM Rating

BREEAM is a recognised methodology to drive improvement in the sustainability performance of buildings. The standards set by BREEAM are being used to maximise the effectiveness of the issue-specific strategies, including energy, water and waste, addressed in this Plan.

The project team is fully committed to going beyond the requirement of the condition for a 'Very Good' rating, aspiring to achieve an 'Excellent' rating for the school development and the design is currently on target for an Excellent rating under the latest version of BREEAM – 'BREEAM New Construction 2011'. It should be noted that BREEAM 2011 includes a suite of new credit issues, particularly relating to post-occupancy, and sets far more stringent minimum standards for schemes seeking an Excellent or above than its predecessor.

A preliminary assessment has been carried out by the project team and the AECOM BREEAM assessor (also a BREEAM Accredited Professional) reviewing the anticipated design features of the completed building. This indicates that an overall score of 72% could be achieved, which equates to a BREEAM Excellent rating. It should be noted that the pre-assessment is provisional on the basis that the building is "shell and core" and so not all aspects are within the remit of the project team, and all of the documentary evidence required for a formal assessment (in the form of tender documents and drawings etc) is not yet available at this planning stage. Full evidence will be gathered in due course at the detailed design stages as the project progresses.

Table 2.3 on the following pages summarises the performance in each of the BREEAM sections as a result of the credits targeted by the P1 design team at this stage.

Table 2.3 Target performance under BREEAM New Construction 2011

Credit Summary BREEAM New Construction 2011		Credit no.	Credits Available	Anticipated credits
Management	**Sustainable Procurement**	**Man 01**	**8**	8
	Responsible Construction	**Man 02**	2	2
	Construction Site Impacts	**Man 03**	5	5
	Stakeholder Participation	**Man 04**	4	4
	Life Cycle Cost	**Man 05**	3	0
Section Credit Total			22	19
Weighted section total			12%	10.36%
Health	**Visual comfort**	**Hea 01**	3	1
	Indoor air quality	**Hea 02**	4	1
	Thermal comfort	**Hea 03**	2	2
	Water quality	**Hea 04**	1	1
	Acoustic performance	**Hea 05**	3	3
	Safety and security	**Hea 06**	2	2
Section Credit Total			15	10
Weighted section total			15%	10.00%
Energy	**Reduction of CO_2 emissions**	**Ene 01**	15	7
	Energy monitoring	**Ene 02**	1	1
	Energy efficient external lighting	**Ene 03**	1	1
	Low or zero carbon technologies	**Ene 04**	5	3
	Energy efficient equipment	**Ene 08**	2	2
Section Credit Total			24	14
Weighted Section Total			19%	11.08%
Transport	**Public transport accessibility**	**Tra 01**	3	3
	Proximity to amenities	**Tra 02**	1	1
	Cyclist facilities	**Tra 03**	2	1
	Travel plan	**Tra 05**	1	1
Section Credit Total			7	6
Weighted Section Total			8%	6.86%
Water	**Water consumption**	**Wat 01**	5	2
	Water monitoring	**Wat 02**	1	1
	Water leak detection & prevention	**Wat 03**	2	1
	Water efficient equipment	**Wat 04**	1	1
Section Credit Total			9	5
Weighted section total			6%	3.33%

Table 2.3 Cont'd

Materials	**Life cycle impacts**	**Mat 01**	6	3
	Hard landscaping/boundary protection	**Mat 02**	1	0
	Responsible sourcing of materials	**Mat 03**	3	1
	Insulation	**Mat 04**	2	2
	Designing for robustness	**Mat 05**	1	1
Section Credit Total			13	7
Weighted Section Total			12.5%	6.73%
Waste	**Construction waste management**	**Wst 01**	4	3
	Recycled aggregates	**Wst 02**	1	1
	Operational waste	**Wst 03**	1	1
Section Credit Total			6	5
Weighted Section Total			7.5%	6.25%
Land use & Ecology	**Site selection**	**LE 01**	2	2
	Ecological value/Protection	**LE 02**	1	1
	Mitigating ecological impact	**LE 03**	2	1
	Enhancing site ecology	**LE 04**	3	1
	Long term impact on biodiversity	**LE 05**	2	2
Section Credit Total			10	7
Weighted Section Total			10%	7.00%
Pollution	**Impact of refrigerants**	**Pol 01**	3	3
	NOx emissions	**Pol 02**	3	3
	Surface water run-off	**Pol 03**	5	5
	Reduction of night time light pollution	**Pol 04**	1	1
	Noise attenuation	**Pol 05**	1	1
Section Credit Total			13	13
Weighted section total			10%	10.00%
Innovation	**Sustainable Procurement**	**Man 01**	1	0
	Responsible Construction	**Man 02**	1	1
	Visual comfort	**Hea 01**	1	0
	Reduction of CO_2 emissions	**Ene 01**	1	0
	Low & Zero Carbon Technologies	**Ene 04**	1	0
	Water Consumption	**Wat 01**	1	0
	Life cycle impacts	**Mat 01**	1	0
	Responsible sourcing materials	**Mat03**	1	0
	Construction Site Waste	**Wst 01**	1	0
	Recycled aggregates	**Wst 2**	1	0
Section Credit Total			10	1
Weighted section total			10%	1.00%
	Total Points Scored			**72.62%**
	BREEAM 2011 Rating			**EXCELLENT**

2.5.2 The Code for Sustainable Homes

The BRE EcoHomes assessment system, referred to in Condition 17(E), was effectively superseded in April 2007 for all new residential projects by the Government's *Code for Sustainable Homes* ('Code') scheme. The Code is an equivalent system of assessment for the purposes of this Condition. Although most credits under the Code are 'tradable' (i.e. chosen at the discretion of the design team) there are a number of mandatory credits associated with each Code Level rating; the most significant of these fall within the energy and the water sections.

The Code provides an overall score and rating for each individual dwelling across 6 levels, with Level 6 equating to a home with 'zero net carbon emissions'. A Code level 3 rating would be regarded as broadly the equivalent of an Ecohomes Very Good rating.

Notwithstanding that a Code Level 3 would discharge this part of the condition, the project team proposes to target a Code Level 4 rating for each dwelling, which in addition to setting a threshold minimum total score, requires a 25% CO_2 improvement on Part L 2010 regulated emissions and a maximum internal water use rate of 105 litres/person/day.

Building P1 has been registered against the latest version of the Code Technical Guidance (November 2010) and a preliminary assessment has been carried out by the project team. The early design pre-assessment indicates that an overall score of 72% could be achieved, which equates to a Level 4 rating – the threshold is greater than 68.0%.

It should be noted that the pre-assessment is provisional on the basis that the design is still at an early stage, and all of the documentary evidence required for a formal assessment (in the form of tender documents and drawings etc) is not yet available at this planning stage. Full evidence will be gathered in due course at the detailed design stages as the projects progress.

Table 2.4 on the following page summarises the performance in each of the Code sections as a result of the credits targeted by the P1 design team at this stage.

Table 2.4 Target performance under The Code for Sustainable Homes 2010

Points Summary		Points Available	Target points
Energy	Dwelling Emission Rate	11.7	4.1
	Fabric energy efficiency	10.6	10.0
	Energy display devices	2.3	2.3
	Drying Space	1.2	1.2
	Energy Labelled White Goods	2.3	1.2
	External Lighting	2.3	2.3
	Low or Zero Carbon Technologies	2.3	2.3
	Cycle Storage	2.3	1.2
	Home Office	1.2	0.0
	Section Total	**36.4**	**24.7**
	Percentage of points achieved within this section		0.7
Water	Indoor Water Use	7.5	4.5
	External Water Use	1.5	0.0
	Section Total	**9.0**	**4.5**
	Percentage of points achieved within this section		0.5
Materials	Environmental Impact of Materials	4.5	1.8
	Responsible Sourcing of Materials - Basic Building Elements	1.8	0.6
	Responsible Sourcing of Materials - Finishing Elements	0.9	0.0
	Section Total	**7.2**	**2.4**
	Percentage of points achieved within this section		0.3
Surface Water	Management of Surface Water Run-off from developments	1.1	0.6
	Flood Risk	1.1	1.1
	Section Total	**2.2**	**1.7**
	Percentage of points achieved within this section		0.8
Waste	Storage of non-recyclable waste and recyclable household waste	3.2	3.2
	Construction Site Waste Management	2.4	2.4
	Composting	0.8	0.8
	Section Total	**6.4**	**6.4**
	Percentage of points achieved within this section		1.0
Pollution	Global Warming Potential (GWP) of Insulants	0.7	0.7
	NO_X Emissions	2.1	2.1
	Section Total	**2.8**	**2.8**
	Percentage of points achieved within this section		1.0
Health & Wellbeing	Daylighting	3.5	1.2
	Sound Insulation	4.7	1.2
	Private Space	1.2	1.2
	Lifetime Homes	4.7	4.7
	Section Total	**14.0**	**8.2**
	Percentage of points achieved within this section		0.6
Management	Home User Guide	3.3	3.3
	Considerate Constructors Scheme	2.2	2.2
	Construction Site Impacts	2.2	2.2
	Security	2.2	2.2
	Section Total	**10.0**	**10.0**
	Percentage of points achieved within this section		1.0
Ecology	Ecological Value of the Site	1.3	1.3
	Ecological Enhancement	1.3	1.3
	Protection of Ecological Features	1.3	1.3
	Change in Ecological Value of Site	5.3	5.3
	Building Footprint	2.7	2.7
	Section Total	**12.0**	**12.0**
	Percentage of points achieved within this section		**1.0**

Total Points Scored	**72.57**
Code for Sustainable Homes Rating	**Level 4**

2.6 Condition 17 (F): Wildlife Features

The Environmental Sustainability Plan shall explain the incorporation of bird boxes, bat roosts and other wildlife features on the building.

The landscape strategy (as described in our response to condition 17(C) in Section 2.3) offer opportunities for ecological enhancement and increased biodiversity, helping Building P1 to make a contribution towards fulfilling objectives within the London Biodiversity Action Plan. Additionally, it is proposed that wildlife and other planting features will be provided as a learning resource for the school development.

The AECOM project ecologist has carried out an assessment of Building P1 and provided a number of ecological enhancement recommendations for both the residential and school elements. These recommended measures will be considered as part of the overall landscaping strategy for the building and implemented where practical to do so. In summary, the enhancement measures under consideration include, but are not limited to:

- Planting of native species as far as possible (i.e. avoidance of ornamental species), to attract insects, birds and fauna identified in the Local Biodiversity Action Plan;
- A wild flower ‘bank’ within the school development planted with seed mix (following advice guidelines provided by the ecologist) to increase the species diversity and benefit wildlife, this mix would include nectar producing plants;
- Bird nest boxes on the perimeter fence of the school suitable for house sparrows and common swifts (Local Biodiversity Action Plan species);
- Provision of bat boxes/bricks within the development;
- Potential planting along the playground perimeter fence.

The ecology assessment concludes that implementation of the recommendations will significantly enhance the ecological value of the Plot P1 site, and support an increase in the local site biodiversity.

2.7 Condition 45: Drainage

Explain how the new drainage infrastructure within the site shall be designed to achieve a combined (storm and foul) peak discharge to the existing combined sewer of 2,292 litres/second or less.

2.7.1 Site Wide Drainage Infrastructure

The figure of 2292 l/s in the wording to Condition 45 describes the maximum peak (storm and foul) discharge which is permissible for the site as a whole to discharge to the existing combined sewers. The peak discharge will be split between the Camden Sewer and the York Way Sewer (for Northern Area) and the Camley Sewer / Fleet Sewer (for the Southern Area).

The cumulative peak discharge from the many building plots and areas of infrastructure will exceed 2292 l/s under certain weather conditions. In these instances, the site wide drainage infrastructure, including online and offline attenuation (see below), will attenuate peak flows discharging from individual plots, adopted highway and public realm, enabling cumulative peak flows to be reduced to 2292 l/s or less.

The site wide surface and foul water disposal strategy can be summarised as follows:

- To provide separate surface and foul water networks, combining only at the final manhole prior to connection into the existing Thames Water sewerage network;
- To provide online attenuation (for example oversized pipe work) and offline attenuation (for example proprietary modular underground storage systems / tanks) to buffer peak flows generated within the site down to the agreed discharge rates into the existing Thames Water sewerage network;
- To ensure that no above ground flooding occurs during the worst case 1 in 30 year storm event;
- To ensure that no internal building flooding occurs during the worst case 1 in 100 year (+20%) storm event;
- To accord with PPS 25 and Sewers For Adoption 6th Edition;
- To discharge at various locations into the sewerage network; and
- To design the above infrastructure such that combined surface and foul water flows do not exceed 2292 l/s during a 1 in 30 storm event.

The site wide drainage infrastructure at King's Cross Central can be described in terms of three drainage infrastructure areas, incorporating both building plots and infrastructure/public realm. These are described in Table 2.5 below.

Drainage Infrastructure Area		
	Plot developments	**Infrastructure / Public Realm**
Eastern Goods Yard	The Granary Complex, Q1, Q2, R1, R2, R3, R4, R5, S1, S2, T1, T2, J1, H1, K1, K2, K3, K4 and 50% of I1)	Transit Street, Wharf Road, Goods Street, Granary Square, Cubitt Park and Handyside Park
Southern Area Infrastructure	A1, A2, A3, A4, A5, B1, B2, B3, B4, B5, B6, D1, D2, F1 and V1	The Boulevard, Goods Way, Station Square and Pancras Square
Remainder of the Northern Area including the Triangle Site	M1, M2, N1, N2, **P1**, P2, S3, S4, S5, T3, T4, T5, T6 and W1	Canal Street and Cubitt Square

Table 2.5 – Drainage Infrastructure Areas

Table 2.6 identifies the assumed peak foul and surface water flows from each of the building plots which underpins the design of the site-wide infrastructure. The foul water figures are based on CIRIA 177 Variable Peaking Factor and the assumed foul water discharges from various land uses are identified in Table 2.7. The surface water peak flows are based on a 1 in 30 year storm. It should be noted that it is most unlikely that the foul and surface water peak discharges from each individual plot will coincide with each other.

Generally, foul water discharges represent small but consistent flows subject to diurnal patterns. For example, residential properties will exhibit two peaks within their diurnal flow pattern, one in the morning and one in the early evening.

Surface water discharges, on the other hand, exhibit extreme variations in flow, directly related to rainfall intensity.

The surface water discharge from each plot development will have its own unique hydrograph (identifying the variation between flow and time – the peak of which only lasting for a few minutes in most cases). Each one of these peaks (within the hydrographs) combine within the main drainage infrastructure at different points in time during the storm event, creating an averaged flow within the pipe network.

These flows will discharge into the Thames Water network via flow hydraulic controls at the downstream end of each network. These hydraulic controls limit the discharges to a combined maximum of 2292l/s. Where the plot development discharges combine to produce flows in excess of the maximum allowable discharge, water will be held within the drainage infrastructure which has been specifically sized to accommodate these flows.

	Assumed Peak Flows (l/s)	
Plot reference	**Surface Water (1 in 30 year event)**	**Foul Water**
Remainder of Northern Area		
M1	61	4.6
M2	82	7.1
N1	151	7.5
N2	57	-
P1	139	8
P2	122	19.4
S3	95	4.2
S4	106	12
S5	90	5.1
T3	83	9
T4	63	7.2
T5	49	6.5
T6	39	4.3
W1	67	11.8
Totals	**1204**	**106.7**

Table 2.6 – Peak Surface and Foul Water Flows for the Remainder of the Northern Area

Land Use	**Demand Options**	**Discharge to Sewer (l/day/hd)**	**l/s/head**	**Operational Hours**	**Population Density (m2 per person)**
Residential	-	152	0.0023457	18	36.2
Student Accommodation	-	152	0.0023457	18	19.5
Retail	Large Retail	26.6	0.0009236	8	40
Food/Drink	Customer/day 2hr sittings	28.5	0.0009896	8	1.4
Education	General	19	0.0006597	8	10
Business	Without Canteen	41	0.0014236	8	12
Hotel		133	0.0046181	8	20
Leisure	Sports club	142.5	0.0049479	8	40

Table 2.7 Foul water discharges from various land uses

2.7.2 Drainage Infrastructure Relating to Plot P1

Building P1 is serviced by the Western Goods Yard (ie part of the remaining Northern area) drainage systems (Table 2.5) which discharge directly via a restricted discharge in to the combined Thames Water sewer known as the Camden Sewer. The drainage networks have been designed on SUDS principles providing an overall peak flow reduction of 10% (based on a 1 in 30 year storm).

The connection to the Camden Sewer has been approved in principle for the network serving Building P1. The design discharges reflect the assumptions described in Tables 2.6 and 2.7 (above). The design discharges for P1 are 139 l/s and 8 l/s for surface water and foul water, respectively.

It should be noted that the figures in Table 2.6 do not specifically include public realm areas. However, the public realm in the northern part of the site was included in the hydraulic model used during the design of the infrastructure to ensure that each of the drainage sub catchments (buildings and public realm) are attenuated and the flows into the combined Thames Sewer restricted so that the permissible discharges set out in the Outline Planning Permission are not exceeded.

3 Section 106 Agreement

3.1 Section AA: Water

Section AA of the Section 106 agreement places an obligation to use reasonable endeavours:

- ***To incorporate within the detailed design water efficiency measures such that the design secures at least 40% of the potable water consumption credits available under the BREEAM methodology which represents a reduction of approximately 20-30% against typical water consumption;***
- ***To incorporate one or more of groundwater abstraction, grey-water and black-water recycling and rainwater harvesting as alternative water supplies to meet 5% or more of the non-potable water needs; and***
- ***To ensure that the design for the treatment of storm water run-off incorporates, where practicable, filtration, attenuation and other techniques that is consistent with current best practice on SUDS, to control the timing and volume of flows.***

3.1.1 Domestic water use

The Code for Sustainable Homes water calculation methodology has been applied in relation to residential water consumption.

The environmental benefits that can be achieved by installing carefully selected water efficient sanitaryware and appliances have been recognised by the project team and the proposals seek to reduce the internal consumption rate of the dwellings to 105 litres/person/day as a maximum. This would represent at least a 30% reduction against typical water consumption, and is a mandatory requirement of Level 4 of the Code.

In order to achieve this consumption rate within the residential element of the building, the project team will specify water efficient sanitary fittings and appliances as standard to all dwellings.

A priority objective for the project team is to significantly enhance the ecological value of the P1 site, particularly through the promotion of the Local Biodiversity Action Plan. The proposals therefore include extensive brown roofs, soft landscaping and planting features, as described in Sections 2.3 and 2.6. It will be critical to maintain these features and protect against drought risks if the ecological value is to be retained. The planting of native species will help to some extent since these species tend to be resilient to the current UK climate and can readily go for periods of time without precipitation. However, during the growing season and summer months it will be necessary to provide some level of irrigation to podium garden and living wall to ensure continued, healthy growth. However, this system will only be used when necessary.

3.1.2 School water use

BREEAM 2011 applies a revised water calculation methodology and the BREEAM 2011 water calculator tool has been used to provide an indicative consumption rate for the school development. It is envisaged that the school will achieve a high standard of water efficiency through an approach that combines water efficient sanitaryware with devices to control and monitor consumption. Water metering linked to the Building Management System, to enable monitoring and evaluation of water usage by the building manager, and a leak detection and prevention system to enable swift remediation in the event of a major leak should be installed as part of the fit out.

Based on initial calculations, it is anticipated that a 25-30% reduction against typical water consumption could be achieved through implementation of these water efficiency measures. A minimum of 4 credits will be achieved in the water usage section of the BREEAM assessment, in line with the Section 106 agreement.

The school landscaping proposals include water butts to collect rainwater runoff so that pupils can manually water the areas of planting intended to facilitate learning.

3.1.3 Water recycling

Water reuse has been investigated for P1 building to further reduce the demand for mains-supplied water for WC flushing. Although rainwater harvesting is the most common system for using recycled water, the opportunities for collection from roof areas are reduced by the structural form and mixed use function of the building and would prove extremely challenging in terms of the additional collection and distribution infrastructure required. In addition, there would be disproportionate costs in relation to the value of the water saved; there would be a penalty associated with the necessary energy used to operate such a system and distribute the water round the building; and there are space constraints, either for a communal system or for individual systems within dwellings.

Communal and individual greywater recycling systems have been investigated for use by the school and residential units. However, it has been considered that neither would be viable for Building P1 due largely to the significant plant room space constraints within the building. In terms of the school, the location of residential accommodation above means the majority of plant systems must be located within the basement levels; which it already shares with other essential building facilities. The building services strategy has rationalised the space available for plant as far as practicable and there would be insufficient space to accommodate a central greywater recycling system.

Single greywater recycling systems within the dwellings would also be impractical due to space constraints and the prohibitive cost of supplying individual systems to several hundred units.

3.1.4 Sustainable drainage

Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as Sustainable Urban Drainage Systems (‘SUDS’) and tend to be more sustainable than conventional drainage methods. SUDS will be integrated wherever practical into the P1 design to affect source control and storm water retention/infiltration, provide permeable surfaces and encourage evapotranspiration (e.g. from green/brown roofs).

As described in Section 2.3 of this ESP, a soft landscaping and brown roof strategy is proposed. These features will help reduce the peak flow and the total volume discharged from the roof by attenuating or detaining rainfall and, on warmer days, by encouraging evapotranspiration.

3.2 Section Y: Construction Materials and Waste

Section Y of the S.106 Agreement imposes obligations to:

Implement the Construction Materials and Purchasing Strategy

Apply the Construction Materials and Purchasing Strategy to agree specifications and targets in contracts with contractors, designers and suppliers of services in relation to construction

Use reasonable endeavours

I. ***to minimise packaging waste associated with the delivery of construction materials***

II. ***to produce topsoil and subsoil that uses subsoil and crushed rubble from the site combined with organic material for use in areas of landscaping***

III. ***to achieve the Construction Targets.***

3.2.1 Construction Materials and Purchasing Strategy

The project team intends that best practice will be applied to the Building P1 development and surpassed wherever practicable, in order to maximise resource efficiency. The Construction Materials and Purchasing Strategy set out in the S106 Agreement will be adopted, while careful planning and effective control will ensure that waste during the construction phase is minimised.

3.2.2 Packaging waste

Packaging used to protect construction materials and assemblies in transportation will be kept to a minimum and wherever possible returned to be re-used.

3.2.3 Soil

As much as is practicable of the covering material for the brown roofs will be sourced from the arisings generated by the site clearance and preparation of levels, with the addition of appropriate organic material. The Earthworks and Remediation Plan addresses the nature and quantity of arisings and the arrangements for their re-use or disposal as appropriate.

Due to the brownfield nature of the site, there are no natural topsoil or subsoil resources on site. A Topsoil Manufacture Feasibility Study has been undertaken by Tim O'Hare Associates to assess the suitability of site wide clay fill from the King's Cross Central site as a constituent of manufactured topsoil, rather than importing material onto site for landscaping use. Due to the density, plasticity and poor drainage qualities associated with clay fill, the study concludes that manufactured topsoil derived from this material would not be suitable for use in permanent landscaping schemes such as brown roofs (which require a light weight substrate) or planted beds/tree pits in the secondary streets. As such, it is recommended that imported organic material is used in these areas.

3.2.4 Construction Targets

The aspiration to achieve a BREEAM rating of 'Excellent' will be the principal driver for the team's endeavours to achieve the best possible performance against the Construction Targets. BREEAM credits cover the Green Guide rating of the major building elements, the environmental impacts of paints and varnishes, the use of recycled aggregate, the responsible sourcing of materials and the global warming potential of insulants, all matters addressed by the Construction Targets.

At this early stage the exact degree to which all the Construction Targets will be achieved cannot yet be determined, because the precise specifications and quantities of many of the materials have not yet been finalised. It has already been confirmed that all timber products, and also the temporary timbers used for site works at the construction phase, will be sustainably-sourced through an auditable supply chain and that ozone-depleting substances will not be used.

The residential units are targeting maximum credits under the Code for Man 3 Construction Site Impacts. This will require the development to implement procedures that cover 4 or more of the items listed below:

- Monitor, report, and set targets for CO_2 production or energy use arising from site activities;
- Monitor and report CO_2 or energy use arising from commercial transport to and from site;
- Monitor, report and set targets for water consumption from site activities;
- Adopt best practice policies in respect of air (dust) pollution arising from site activities;
- Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site;
- 80% of site timber is reclaimed, reused or responsibly sourced

The school is expected to target maximum BREEAM credits for Construction Site Impacts Man 3 as well, and it will be the same contractor.

In addition to the Section 106 requirements, the project contractor may have its own corporate construction targets which will be applied to the building.

3.3 Section Z: Waste

Section Z of the S.106 Agreement imposes obligations to:

I. Provide occupiers with Waste Information Packs and use reasonable endeavours to obtain feedback on the success or popularity of the initiatives contained within the Packs

II. Use reasonable endeavours to incorporate within the detailed design best practice design solutions that provide for waste segregation and storage areas and to maintain the solutions that are implemented

III. Provide and maintain segregated waste containers within the Public Realm areas at suitable locations and in appropriate numbers.

3.3.1 Waste information Packs

To comply with Section Z of the Section 106 Agreement, a simple 'Home User Guide' will be provided to all dwelling occupants, and a 'Building User Guide' to the school occupants. This guide will include information on operational issues, such as design features, energy and water, and the site and its surroundings. As part of the guide, information will be provided on the site's waste and recycling facilities and initiatives, and arrangements will be made to monitor their effectiveness in encouraging waste minimisation.

3.3.2 Design Proposals

Details regarding the Waste and Refuse Strategy are included in the submitted Urban Design Report. Communal refuse chutes for residents will be provided directing both non-recyclable and recyclable waste to a central storage and collection point. The school development will have its own dedicated waste and recycling collection and storage area.

Sufficient communal refuse storage areas will be provided in compliance with LB Camden's waste collection policy.

In line with the Code's compliance criteria, the development proposes the following strategy for operational waste and recycling, to be incorporated as part of the detailed design:

- Storage of non-recyclable waste

The space for waste storage will be at least the minimum recommended by BS 5906 (British Standards, 2005) i.e. 100 litres volume for a single bedroom dwelling, with a further 70 litres volume for each additional bedroom. Adequate external space will be allocated to accommodate the Local Authority collection scheme. All containers will be accessible to disabled people and sited on a hard, level surface.

- Storage of recyclable household waste

The following Code credits will be achieved to reflect the provision of dedicated internal storage for recyclable household waste:

1. At least, three internal storage bins
    - all located in an adequate internal space
    - no individual bin smaller than 15 litre
    - minimum total capacity 60 litres
    - be located in an adequate external space
    - be sized according to the frequency of collection, based on guidance from the recycling scheme operator store at least 3 types of recyclable waste in identifiably different bins
    - be located within 30m of an external door.

The school will need to address the BREEAM criteria for storage of non-recyclable and recyclable waste as part of the fit-out.

Appendix 1

SAP output from assessment of a sample dwelling

L1A 2010 - Regulations Compliance Report

Design - Draft

NHER

This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix A of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Mr Noah Nkonge	Assessor number	4759
Client		Last modified	15/08/2012
Address	5 4F Ex Sng Aspect, KX P1		

Check	Evidence	Produced by	OK?
Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target			
TER (kg $CO_2/m^2.a$)	Fuel = Mains gas Fuel factor = 1.00 TER = 14.53	Authorised SAP Assessor	
DER for dwelling as designed (kg $CO_2/m^2.a$)	DER = 13.51	Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 13.51 < TER 14.53	Authorised SAP Assessor	Passed
Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits			
Fabric U-values			
Are all U-values better than the design limits in Table 2?	Element / Weighted average / Highest Wall: 0.15 (max 0.30) / 0.15 (max 0.70) Party wall: 0.00 (max 0.20) / N/A Floor: (no floor) Roof: (no roof) Openings: 1.40 (max 2.00) / 1.40 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridging			
How has the loss from thermal bridges been calculated?	Thermal bridging calculated using default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems			
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Main heating system: Mains gas, Combi boiler High eff condensing Data from manufacturer Efficiency = 91.00% 2009 SEDBUK Minimum = 88.00% Secondary heating system: None	Authorised SAP Assessor	Passed
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	No hot water cylinder	Authorised SAP Assessor	
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	Space heating control: Programmer, room thermostat and TRVs Hot water control: No hot water cylinder Boiler interlock (main system 1)	Authorised SAP Assessor	Passed

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 26 Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Slight Overheating risk (July) = Medium Overheating risk (August) = Medium Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 3.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of the dwelling, as designed, is consistent with the DER			
Design air permeability ($m^3/(h.m^2)$ at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery: SFP = 0.40 W/(litre/sec) Max SFP = 1.5 W/(litre/sec) Heat recovery efficiency = 91.00 % Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than 0.2W/m^2K: • East Wall (0.00) • South Wall (0.00) • West Wall (0.15) • North Wall (0.00) The following openings have a U-value less than 1.5W/m^2K: • Window reference 1 (1.40) • Window reference 3 (1.40) • Window reference 2 (1.40)	Authorised SAP Assessor	

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