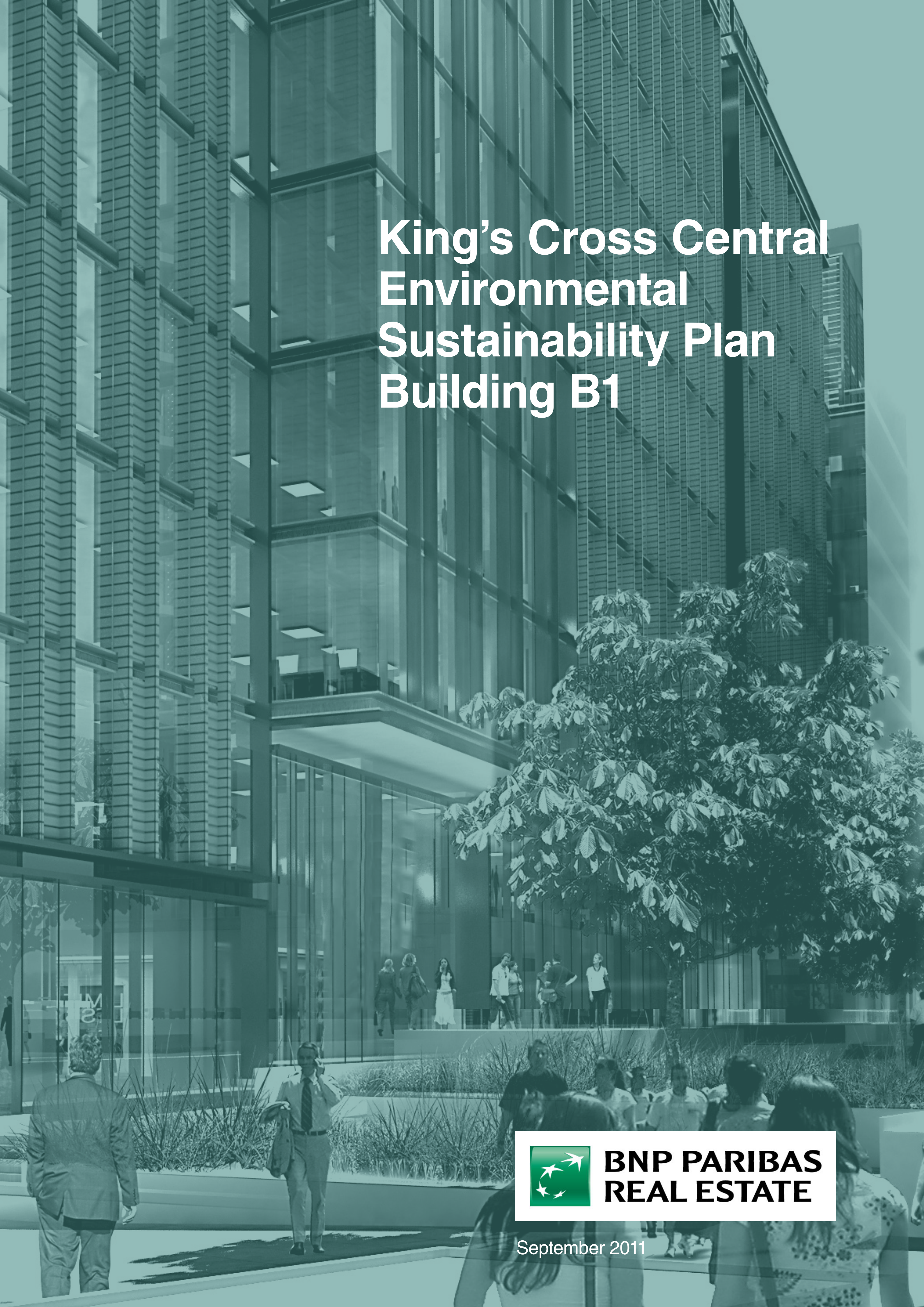
King's Cross Central Environmental Sustainability Plan Building B1



BNP PARIBAS REAL ESTATE

September 2011

Contacts

Hoare Lea

Glen House

200-208 Tottenham Court Rd,

London

W1T 7PL

T: + 44 (0) 20 7890 2500

W: www.hoarelea.com

CONTENTS

GLOSSARY

AC	Alternating Current
AD	Approved Documents (Building Regulations)
AHU	Air Handling Unit
BER	Building Emission Rate
BREEAM	Building Research Establishment Environmental Assessment Method
CHP	Combined Heat & Power Generation
CCHP	Combined Cooling, Heat & Power Generation (Tri-Generation)
CIBSE	Chartered Institution of Building Services Engineers
CLG	Department for Communities and Local Government
CO_2	Carbon Dioxide
DC	Direct Current
DE	District Energy
DHW	Domestic Hot Water
DSM	Dynamic Simulation Software
EC/DC	Electronically Commutated / Direct Current
ESCO	Energy Service Company
GREEN GUIDE	The Building Research Establishment's Green Guide to Specification
GLA	Greater London Authority
KCCLP	Kings Cross Central Limited Partnership
LCEA	Low Carbon Energy Assessor
LG	Lighting Guide *(e.g. Carbon Trust LG007 - Installers' Guide to the Assessment of Energy Efficient Lighting Installations, Carbon Trust, 2004).*
LTHW	Low Temperature, Hot Water
PV	Photovoltaic Cells/Panels
S106	Deed of Planning Obligations Pursuant to Section 106 of the Town and Country Planning Act 1990
TAS	Dynamic thermal and energy simulation package developed by EDSL.

TER	Target Emission Rate
TIMSA	Thermal Insulation Manufacturers and Suppliers Association
HVAC	Heating, Ventilation & Air-Conditioning
Part L2	This refers to 'Approved Document L2A' of the building regulations which sets down the minimum performance and energy efficient measures which will have to be achieved by the King's Cross Central Zone B buildings.
Lean	The efficient use of energy by the Building Services equipment within the building domain.
Clean	The efficient supply of energy (Heat, Power, Cooling, etc.) for the building domain.
Green	The use of renewable technologies to supply energy (Heat, Power, Cooling, etc.)

1.0 INTRODUCTION

This Environmental Sustainability Plan describes the strategies that have been included within the design of Building B1 in response to the planning conditions of the King's Cross Central ('KXC') outline planning permission (ref. 2004/2307/P) dated 22 December 2006 (the 'Outline Planning Permission'). In particular, this document provides information in response to conditions 17, 45, and 48 of that permission, giving details of the strategies adopted and demonstrating that the building achieves a very high standard of sustainability for a development of this scale in an urban environment. The plan also details how obligations contained within sections Y, Z and AA of the S106 Agreement will be met.

Servicing facilities for Building B1 will be provided in the basement within the building footprint. Where reference is made to 'Building B1', this should be taken to include the basement service area included as part of this submission unless stated otherwise.

This Plan should be read in the context of other plans and documents forming the B1 submission, including the Urban Design Report, the Planning Compliance Report the Access and Inclusivity Statement and BREEAM pre-assessment, the latter being included within this document in Appendix B.

2.0 EXECUTIVE SUMMARY

Building B1 lies in the southern part of the KXC site in Development Zone B. The proposed building is predominantly office use with commercial units at upper ground floor level and, in accordance with the KXC Section 106 Agreement, a bicycle storage facility at lower ground floor level and a police office in the basement. B1 will have its own basement service area within the footprint of the building which will be accessed by the vehicular service road and entrance/exit ramp to the shared Zone B basement.

The site sits on the western edge of Development Zone B, bounded by Pancras Road to the west, Pancras Square to the east and secondary streets to the north and south. When complete, Buildings E1 (including the refurbished Stanley Building) and B3 will lie to the south and north of B1, respectively.

Building B1 has been design to achieve a very high standard of sustainability .The building has been registered under BREEAM Offices (2008) since concept design stage and is predicted to achieve an 'Excellent' rating.

The combination of energy efficient measures and the sourcing of heat and power from the low-carbon district energy system result in an overall annual carbon reduction of 21.5% relative to the current 2010 Part L target emission rate (TER). Table 1 compares the predicted absolute carbon emissions at Plot B1 against the adjacent Plot B3 building, where a much bigger percentage reduction is predicted. The table demonstrates that the predicted absolute carbon emissions per square metre are very similar. The difference in the relative carbon savings between the two plots arises from different target emissions rates which are a function of the building regulation national calculation methodology and the different environmental strategies for the two buildings, particularly in relation to heating loads.

	Plot B3	Plot B1
TER (kg CO_2/m^2)	31.3	22.7
BER (kg CO_2/m^2)	17.9	17.8
% Reduction	43	21.5

Table 1: A comparison of the target and predicted carbon emissions at Plots B1 and B3

In summary, the main environmental and sustainability measures that are proposed are:

Condition 17(A) – Energy Efficiency Measures

- Extensive Part L and solar gain modelling has been conducted at the early design stages to understand the thermal, carbon, solar gain and daylight performance of the façade at plot B1. These results have helped form and guide the façade design to optimise the passive performance of the building envelope. This includes:
  - The specification of low U values for all thermal elements.
  - The specification of reduced air permeability.
  - A solid to glazing façade ratio of approximately 42.6% (solid) to 57.4% (glazed)
  - The installation of brise soleil to control overheating at ground floor retail areas, where display glazing is used.
  - A double skin or equivalent performance type façade at lower ground and roof levels, where higher proportions of glazing are desired for architectural reasons.
  - An integrated façade design incorporating vertical fins in terracotta and metal, and overhanging C shaped extrusions to further control solar gain for the majority of office areas.
  - A design philosophy which does not reduce solar gains at the expense of daylight.
  - The introduction of a central atrium with increased glazed area at high roof levels to allow daylight to penetrate the deeper plan office areas.

- As part of the early design stages and modelling exercises, high spec, high performance engineering equipment has been proposed to improve the performance of the building's 'Active' design. This includes:
  - High efficiency EC/DC fan coil units which offer carbon savings comparable to chilled beam systems, but under a much greater range of operating conditions than other alternative ventilation strategies.
  - A displacement ventilation system in atrium areas, to condition air only at ground level, and allow exhaust air to dissipate through a natural stack effect.
  - Highly efficient mechanical ventilation systems providing CIBSE good practice levels of ventilation, high heat recovery performance to minimise fresh air heating and cooling loads, and low central system fan powers.
  - The specification of ancillary areas are not comfort cooled or even heated in some cases as appropriate to the occupation of the space.
  - The use of modern lighting systems, incorporating presence detection, daylight control along perimeter zones, and zones adjacent to the atrium, to reduce the energy required for lighting.
  - The control of lighting in service areas using time clocks, with override switches located in the security room.
  - A Building Energy Management System, including sub metering to tenant areas for heating, cooling and electricity, so that energy use in the building can be understood holistically by the building managers and occupiers.
  - A software control system, allowing individuals to control their local lighting, heating and cooling conditions via their local workstation.
  - The specification of power factor correction equipment, ensuring that the building's power factor is 0.95 or greater, and reducing wasted electrical consumption on the national grid.
  - The specification of centralised domestic hot water production, with all hot water and heating systems fed from the Kings Cross District Heating system.
  - Highly efficient vapour compression chilled water systems operating at a Seasonal Energy Efficiency Ratio (SEER) of 5.5.
  - A free cooling system, which makes use of low ambient external conditions to reject heat directly to atmosphere without the use of refrigeration systems.
  - The proposed use of chilled water thermal buffer storage which will allow the chillers to operate efficiently overnight and store coolth for use during peak demand conditions in the day.
  - The specification of variable speed inverter driven motors will be installed for the majority of fans and pumps in building B1 (note, this includes the EC/DC fans within all fan coil systems).

Condition 17(B) – Reduction in Carbon Emissions

- Excluding the contribution of the low-carbon district energy system, the achievement of carbon emissions 12.5% lower than Part L of the Building Regulations 2010 through the use of good passive building design, energy efficient system selection and intelligent control methodologies.

Condition 17(C) – Provision of Green/Brown Roofs

- The installation of a brown roof of approximately 1296m^2, incorporating a mixed substrate to enhance ecological value of the development and attenuate surface water run-off.
- The incorporation of decked roof terraces at 7th, 8th, 10th and 11th floor levels, totalling 1888m^2, featuring container planting. These terraces also function as a rainwater collection facility for the rainwater system.

Condition 17(D) – Energy Supply

- The connection of Building B1 to the district energy supply system to allow it to take advantage of the low-carbon benefits associated with combined heat and power plant. The district energy system will meet all of the heating and hot water demand for the building. Plot B1 is predicted to have a low domestic hot water and space heating demand, therefore the carbon savings from district heating calculated using the Part L 2010 Building Regulation methodology are not as significant relative to other buildings found at Kings Cross. In practice it is anticipated actual carbon savings will be larger than those estimated using the building regulations.
- The use of a low-carbon energy supply and the aforementioned passive design measures, energy efficient systems and intelligent controls result in Building B1 achieving an overall reduction in CO_2 of 21.5% against the Part L 2010 TER.

Condition 17(E) – BREEAM Rating

- As stated above, an initial BREEAM pre-assessment has been carried out which predicts an overall score of 78.45%, equating to an 'Excellent' rating.

Condition 45 – Drainage

- The surface water discharge peak flows for Building B1 are 215 l/s and 23.16 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 B1 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

- A rainwater harvesting tank is proposed collecting rainwater from roof levels and recycling this for use in toilet fittings and for roof level external use on terrace levels (e.g. washdown, hand watering of planters). Low water use sanitary ware fittings will be specified in conjunction with this, resulting in a total consumption figure of less than 15 litres/person/day.

S106 Section Y – Construction Materials and Waste

- The minimisation of packaging used to protect construction materials and assemblies in transportation.
- Wherever possible, any packaging will be returned to be reused. In addition, to minimise site wastage at the construction phase, prefabrication off-site will be utilised whenever possible.
- In addition to S106 requirements, the project contractor will have its own corporate construction targets which will be applied to the proposed development.
- The targeting of maximum credits under the BREEAM assessment for 'Man 3 – Construction Site Impacts', which include monitoring and reducing resource use and waste production.
- The specification of low VOC content materials for all decorative paints, varnishes, wall hanging and floor adhesives, ceiling tiles, resilient and wood flooring and wood panelling.

S106 Section Z – Waste

- The circulation of a simple 'user' guide to occupants including information on waste and recycling.
- The allocation of a sizeable waste store for Building B1 in the basement service area will allow for the future separation of waste and recyclable materials.

3.0 RESPONSE TO PLANNING CONDITIONS

3.1 CONDITION 17(A): ENERGY EFFICIENT MEASURES

"The Environmental Sustainability Plan shall explain how the proposed building design realises opportunities to include design and technology energy efficiency measures."

3.1.1. Overview

Building B1 has been designed with energy efficiency being one of the key drivers from the outset.

Whilst the offset of electrical energy, 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 both the building and its users through the application of the following design methodologies:

Passive Design – The use of highly efficient façade systems which respond to their orientation and to sun angles in order to minimise cooling loads and artificial lighting energy demand.

Active Design - The specification and management in operation of energy efficient equipment (for example, Building Energy Management Systems, air handling units (AHU), Direct Current (DC) fan coil units, intelligent and high efficiency lighting systems, variable speed pumping etc.) to reduce energy consumption when the building is in use.

By embracing passive and active design, Building B1 will also be 'future-proofed' to ensure it is adaptable to climate change and the future operational needs of the tenants.

3.1.2. Passive Design

3.1.2.1. Physical Form of the Buildings

Building B1 lies in the southern part of the KXC site in Development Zone B. Its location in the context of Zone B is shown on the site plan detail in Figure 1. The building is situated on the west side of the development zone, with Pancras Road running along its western façade. The east façade of B1 overlooks Pancras Square, a new area of public realm which forms the centrepiece to Zone B. Both the north and south façades are bound by secondary streets which run between Buildings B1/B3 and E1/B1 respectively and link Pancras Square with Pancras Road.

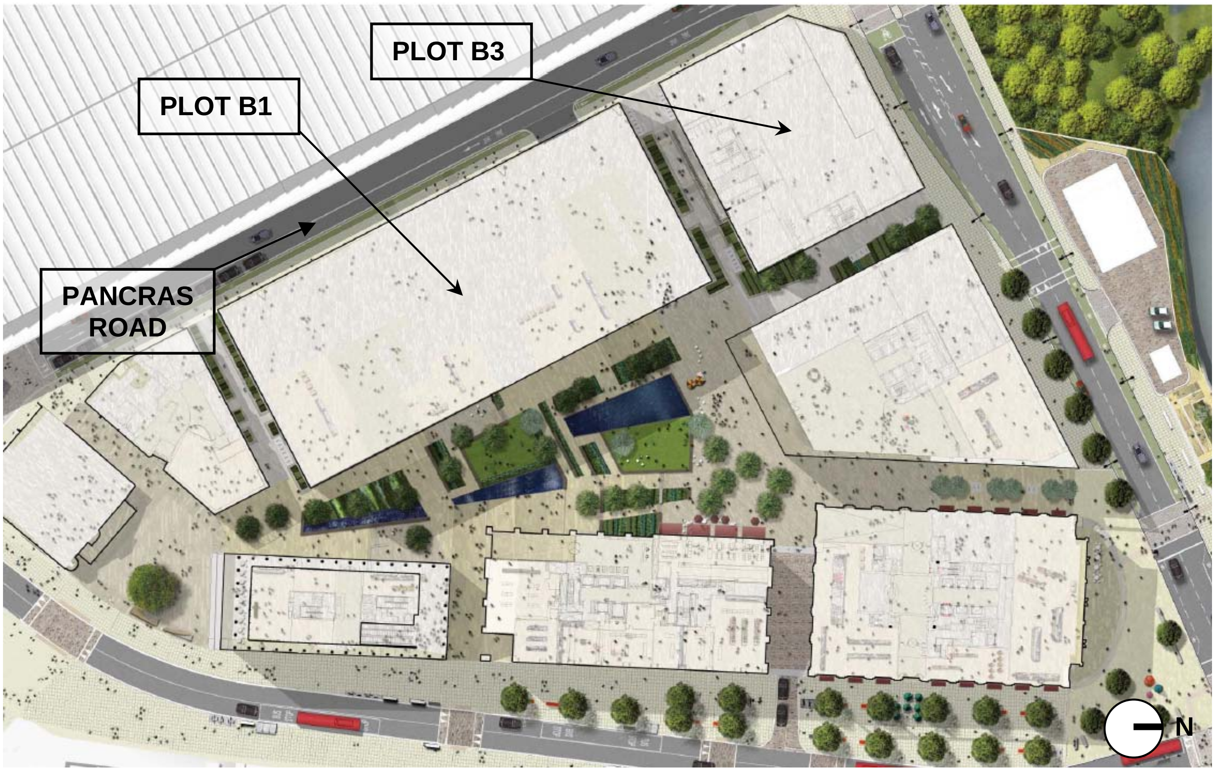


Figure 1: Zone B of the Kings Cross Masterplan, with plot B1 highlighted

B1 is predominantly an 11 storey office building, raising in height form 9 storeys at its southern end to 13 storeys at its northern end (including upper and lower ground floors, excluding basement). Commercial units providing retail/restaurant/café area are proposed at upper floor ground level overlooking Pancras Square. The building also accommodates a bicycle storage facility at lower ground floor level and a police office within the basement. Due to level changes across the site, the building has two entrances; one at lower ground level from Pancras Road and one at upper ground level on Pancras Square. Both entrances are connected by a generous atrium and reception area, with escalators and lifts addressing the level change within this space.

Building B1 will include a service area within its footprint, extending over a mezzanine and basement level. This area will include loading bays, refuse, plant and cycle/car parking facilities. Access to the basement service area will be via the ‘shared Zone B basement.

3.1.2.2. Façade Design

The external envelope of a building can act as an important climatic modifier, with a well-designed façade significantly reducing the building's energy demand.

The building's façades have been developed through detailed thermal modelling analysis using industry-recognised dynamic simulation software (i.e. TAS 9.2.1 by EDSL). A series of modelling studies have been undertaken in order to optimise the proportion and specification of glazing, and to determine the type and extent of external shading elements required to limit solar gains whilst ensuring good levels of natural daylight penetration.

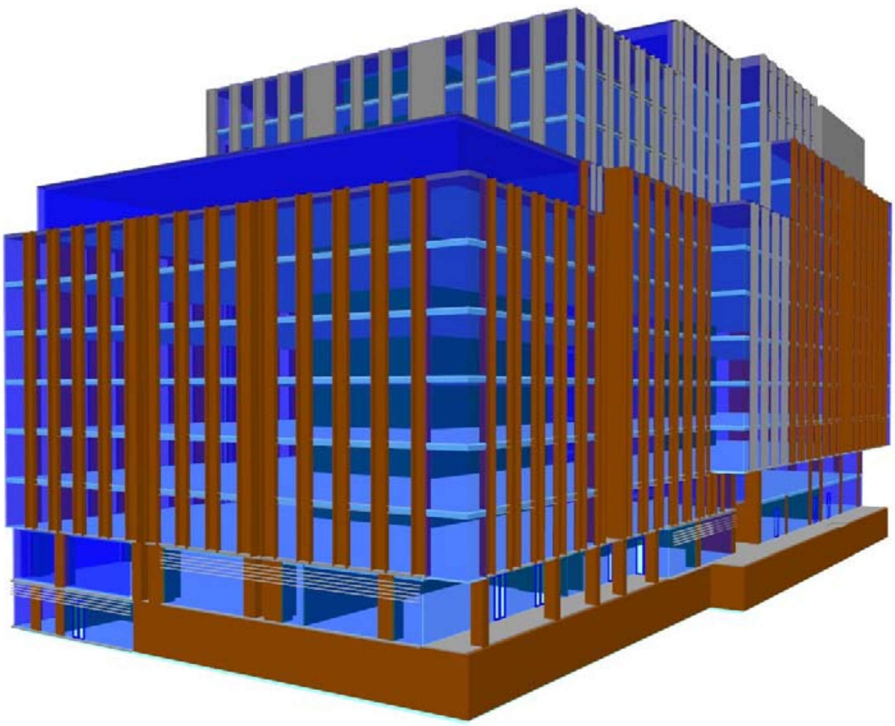


Figure 2: Image of the thermal model developed to inform the energy efficient design of Building B1's façades and engineering services. This demonstrates the detail investigated at ground and basement level including shading fins, double skin façade and canopies.

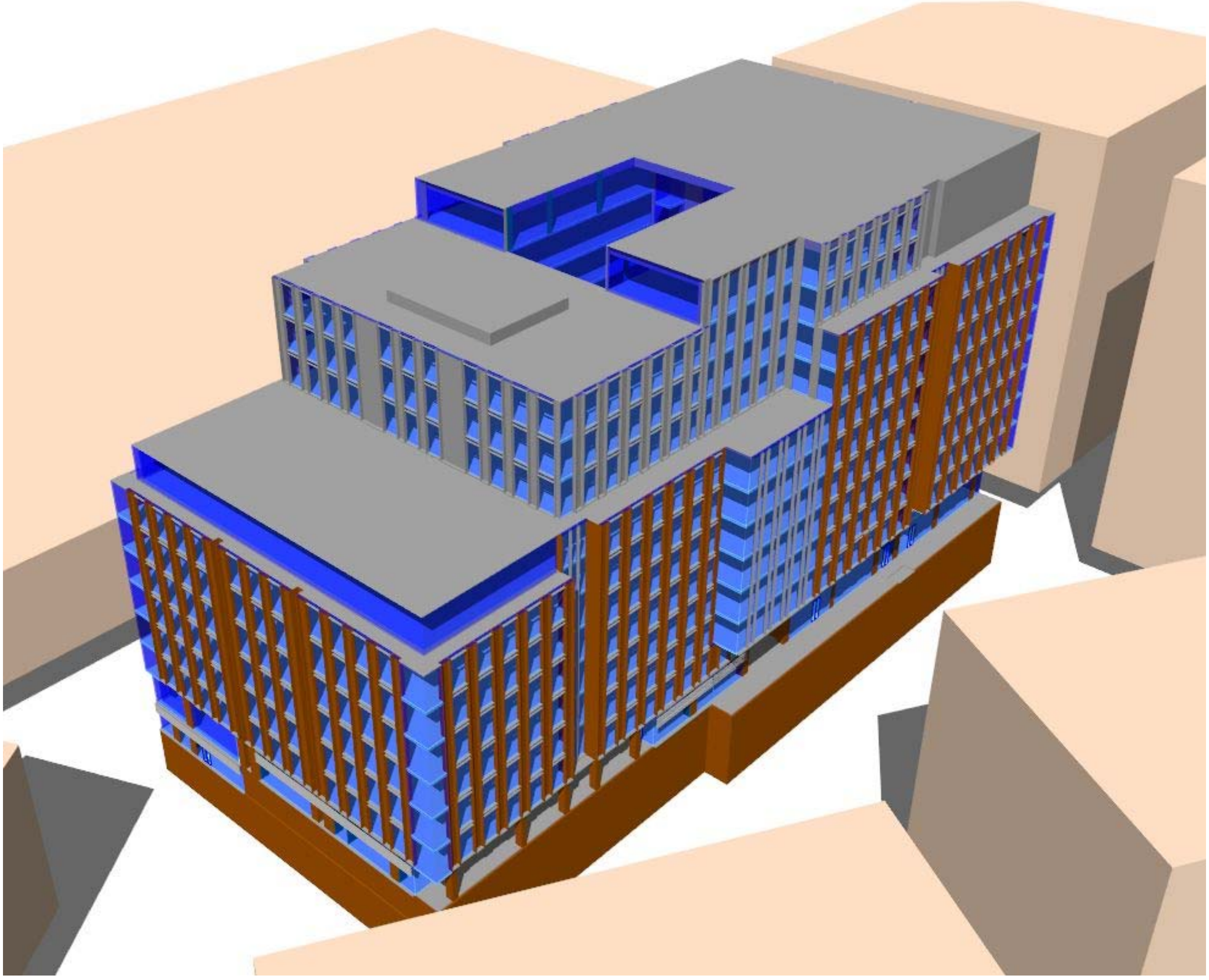


Figure 3: Image of the thermal model from above. This demonstrates how the model was developed taking into account existing and proposed surrounding structures. In particular note the vertical fins which form a key part of controlling solar gain and the central atrium, which is used to introduce daylight into internal spaces. The glazed cap on the atrium space is better illustrated in figure 18. Note also the areas of double skin façade indicated by a deeper blue shading on the 7th and 11th floors.

High performance building fabrics with low U-values and low air-permeability rates that are generally better than the Part L Building Regulation requirements will be specified to minimise uncontrolled heat losses and gains (see Table 2 below).

Element	Part-L Limiting Fabric Parameters U-value ($W/m^2.K$)	Building B1 Limiting Fabric Parameters U-value ($W/m^2.K$)
Roof	0.25	0.18
Floor (including Ground Exposed Surfaces, i.e. basement floor and walls)	0.25	0.18
Walls	0.35	Not applicable for Plot B1 as solid wall elements are accounted for within the curtain wall elements. For comparative purposes these are approximately equivalent to a solid panel U Value of 0.18.
Curtain walling	2.20	1.2 inclusive of framing and solid elements.
Windows, roof windows, roof lights and pedestrian doors	2.20	1.6 inclusive of framing
Air Permeability	$10.0m^3/hr.m^2$ @50Pa	$5.0\ m^3/hr.m^2$ @ 50Pa

Table 2: Building Regulations Part L2 limiting fabric parameters and Building B1 comparative figures

The thermal modelling has informed the design of the building façade to respond to their orientation and subsequent relationship to sun angles. The model has also taken into account the surrounding natural shading to the north and south in all analysis undertaken thus far so that results represent the building as designed. This allows the passive solar design to be tailored to the site characteristics and prevents the introduction of unnecessary levels of solar control that may then reduce daylight on the office floor plates.

On the south, east and west elevations, there is a regular rhythm of vertical terracotta panels interwoven on each floor with horizontal metal C shaped metal profile. At upper levels the terracotta is replaced by solid insulated panels and vertical aluminium fins. The fins and horizontal profile have been shaped to create shading on adjacent windows. The depth of the protrusions and the vertical/horizontal arrangement specifically addresses the different sun angles throughout the year in order to reduce summer solar gains. The arrangement of these elements is shown in the visualisations in figures 3, 4 and 6.

On the north façade the same panel rhythm is retained (2 m glazing, 1 m Solid Insulated Panel) however the terracotta is replaced by a glazed insulated spandrel panel, with no vertical fins. As reduced levels of direct sunlight will fall on this façade (please see figure 8) these are no longer required for shading. The removal of these will also help to maximise daylight along this elevation.

The solid to glass ratio for the building is 42.6% solid, 57.4% glazed. The increased area of solid panel type helps reduce solar gains, whilst also improving thermal performance in comparison to a more highly glazed façade system.

Figure 4: Visualisation of the proposed western and southern façade

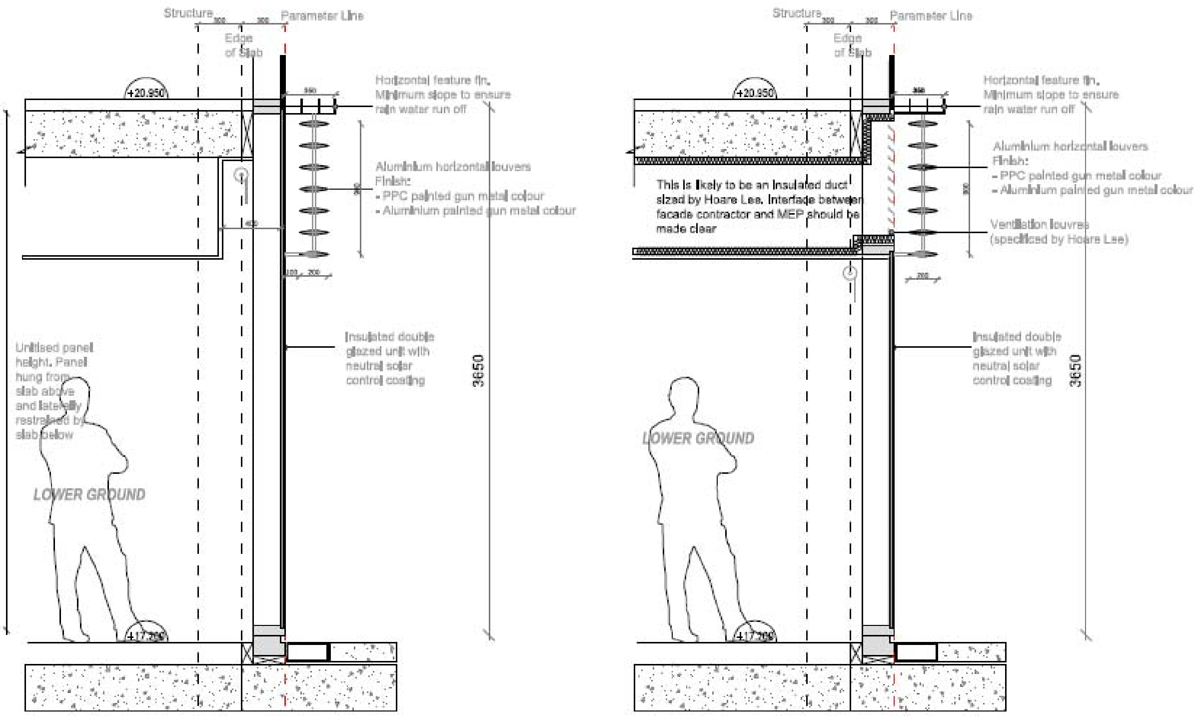


Figure 5: Detail of proposed ground floor brise soleil

At the lower/upper ground and first floor levels, the façade treatment is more transparent with a greater use of glazing across the office and retail uses. Upper ground floor areas along the east façade are assigned to retail use and are therefore intended to be used for product and service display. To control solar gains in these areas where they are not shaded by the overhanging colonnade a high level brise soleil has been added to the ground floor façades. These are 200 mm deep and 900mm tall, wrapped around the façade (see figure 2 for example areas, figure 5 for detail).

The high level brise soleil system helps remove high angle (i.e. summer) solar gains from the space whilst allowing low angle winter sun to penetrate the façade. This system also provides an appropriate area for any local mechanical extract required by a future retail tenant, e.g. use as restaurant.

For consistency this brise soleil system is also used along part of the upper and lower ground on the south façade. This transfers from one floor to the other as the ground level falls away (see figures 2 and 3). The same detail is used in front of office areas along the lower ground floor of the western façade.

There is also a high degree of transparency and extensive use of glazing at the upper ground level along the western, and part of the southern façade, and at the 7th and 11th levels. This is illustrated in figures 2, 3, 4 and 7.

To control summer solar gains in these a double skin glazed façade is proposed. This consists of a single skin of clear float glass mounted in front of a high specification double glazed unit. The cavity between the outer glass skin and double glazing is deeper than typically found in a window (in the order of hundreds of millimetres) and ventilated. Interstitial blinds are fitted as part of this proposed build up, between the clear float glass outer skin and the double glazed unit. The effect of these has been modelled using an assumed blind factor. This represents the fact that these will be fitted at the outset of the building construction, and will be effective at controlling solar gains for these spaces.
Solar radiation falling on a double skin façade is effected in the following manner. Some of the solar radiation is absorbed by the outer clear glass skin and re-radiated as radiation with a longer wave length. The radiation re-radiated is reflected off the double glazing unit or interstitial blind causing the

air in the cavity to heat up as is typically found in a greenhouse. The high levels of ventilation passing through the cavity remove the heat gains and energy from the cavity before they are allowed to pass through the thermal envelope of the building. This lowers the solar gain in the occupied space behind the double skin façade.

Where a double skin façade is installed at the 7th and 11th floors a roof overhang is also used to introduce further shading for high sun angles in peak summer conditions.

Figure 6 summarises the three key façade types on the south, east and west elevation, solid panels (metal or terracotta) with an integrated vertical fin and C shaped panel, double skin façade and the high level brise soleil found at ground floor level.

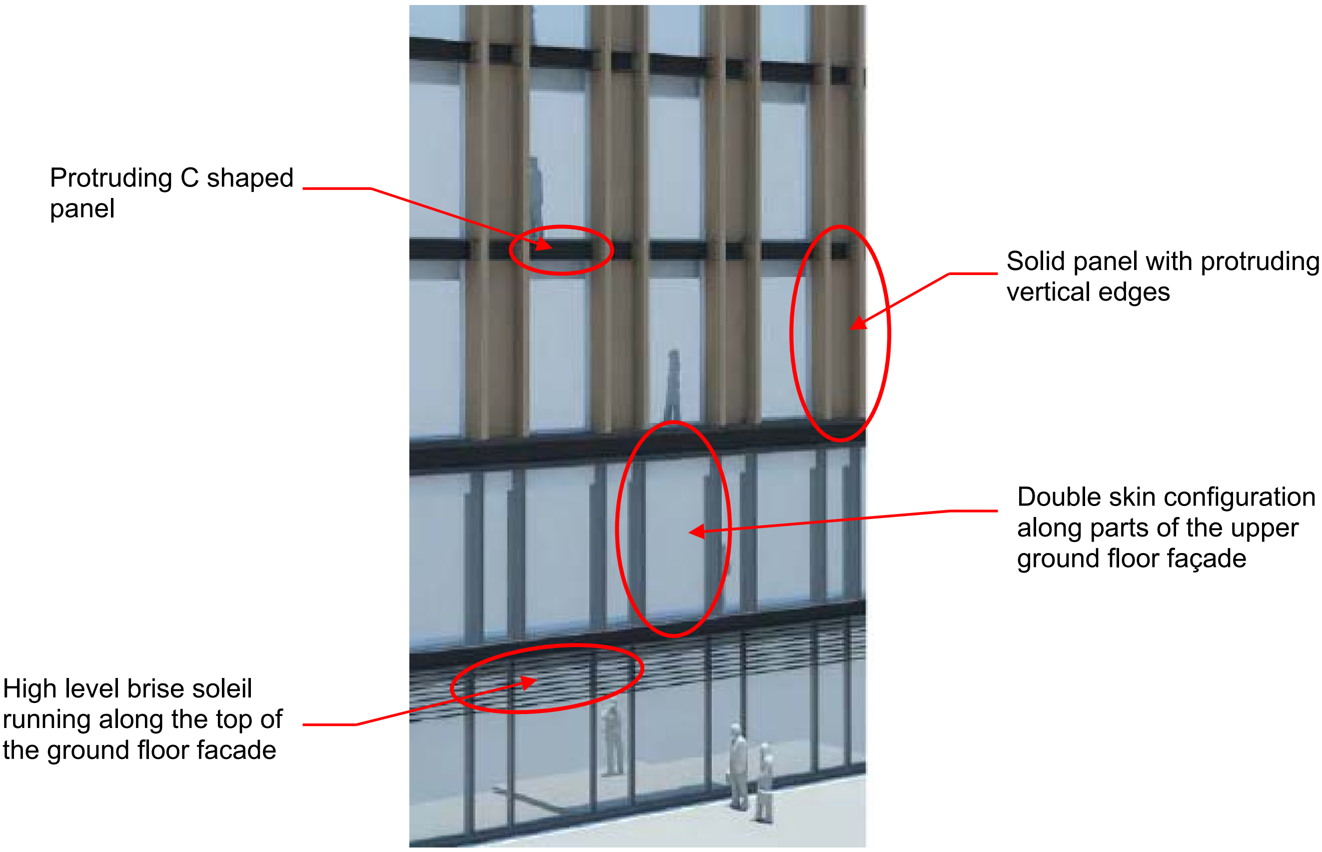


Figure 6: Building B1 – Image of typical south/east/west façade showing solid panels with protruding vertical edges and protruding C shaped spandrel panel running along the top of each floor.

As a marker to the main office entrance, the east façade features a glazed element which sits proud of the surrounding façade. This extends from 2nd to 7th floor level. Vertical 350 mm deep shading fins have been positioned across this façade at alternating 1m and 2m centres to match the rhythm of alternate glazed and solid panels across the rest of the façade (please see figure 7 for visualisation and figure 2 for the modelled equivalent). These reduce peak and aggregate solar gains to this area. High performance glazing with a g value of 0.36 is also proposed for this feature to further reduce solar gains in the area behind it.

All other glazed areas of the façade have been modelled using a g value of 0.4 and a visible light transmittance of 67% to maximise the daylight penetration into office spaces from the façade. Detailed design work will confirm the final specification of glazing, however the current modelled parameters reflect the current design philosophy of the scheme, which is to use high performance glass in limited areas, and allow more daylight penetration where other passive design features control the solar gain through the façade.

In the office areas that do not feature a double skin façade it is envisaged that internal blinds will be installed as part of the fit out for glare control and privacy. These blinds will also assist in alleviating the increased direct solar gains. However, as they would be under the control of the occupants, they have not been included in any of the dynamic thermal modelling simulations to date.

Figure 7: Visualisation of the proposed eastern façade and entrance façade feature

3.1.2.3.

Natural Daylight

From an early stage the requirement for natural daylight has guided the external façade design. As described in section 3.1.2.2 façades have been optimised to minimise direct solar gains whilst maximising daylight provision into the occupied areas. Design studies checking potential daylight levels in the offices have been conducted as early as Stage C of the building design.

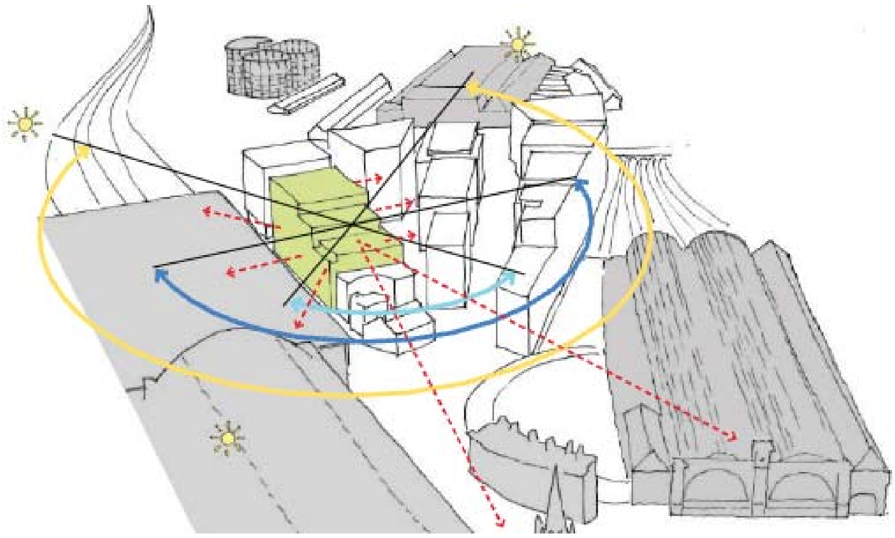
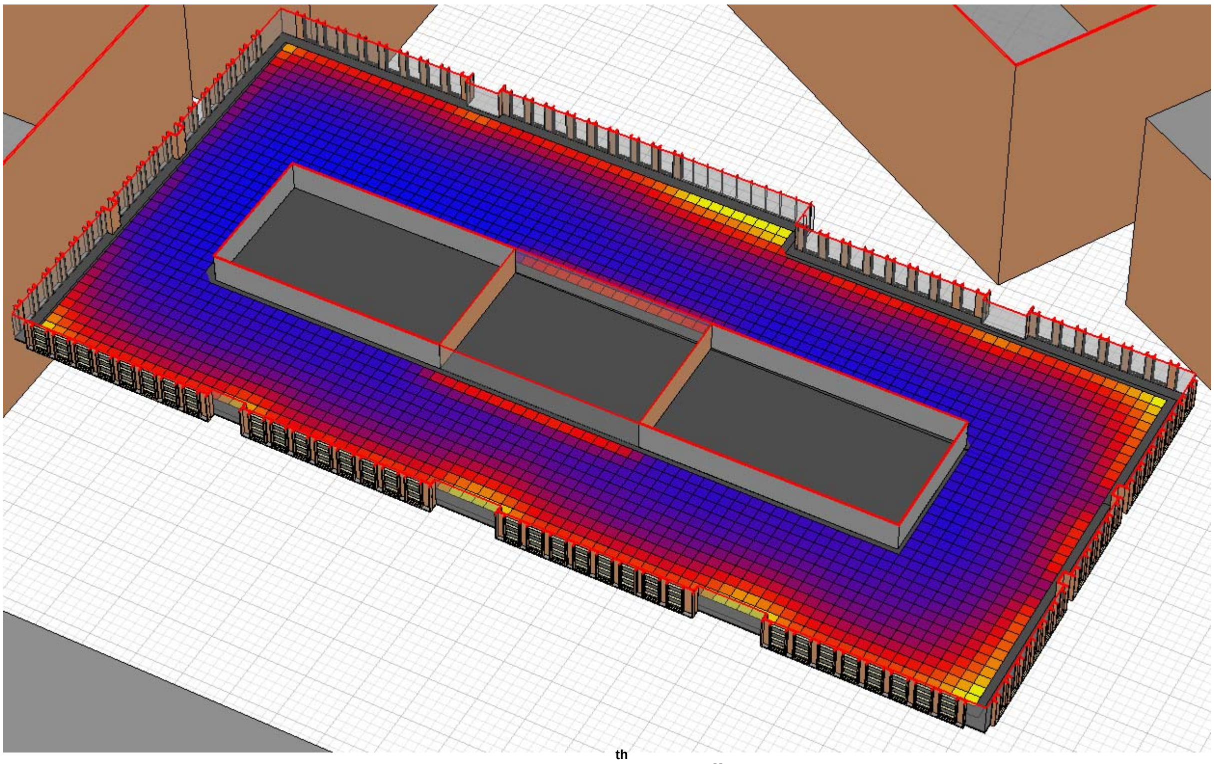


Figure 8: Building B1 – Initial sketch of sun path around the site



Whole Floor
Average Daylight Factor = 2.86%
Minimum Daylight Factor = 0.45%
Uniformity Ratio = 0.157

80th Percentile
Average Daylight Factor = 3.35%
Minimum Daylight Factor = 1.227%
Uniformity Ratio = 0.366

Figure 9: Building B1 – Output from a daylight analysis study of an upper office floor conducted at an early design stage.

These have indicated that a daylight factor greater than 2% may be achieved across 80% of the occupied office floor, however it is unlikely that the uniformity ratio of daylight across the deeper parts of the occupied office space will allow the achievement of the BREEAM daylight credit for all office space (see figure 9 for more information).

In addition to the external façade design, a central atrium extends from upper ground to 11th floor level (this is best viewed in figures 3 and 19).

The atrium has been designed to enable daylight to penetrate deep into the floor plans to enhance the capturing of daylight. At level 11, the office floors are only present on the west, north and east elevations. To the south the atrium is adjacent to the terrace constructed on the roof of level 10. Full height vertical glazing has been installed between the terrace and atrium, with the atrium roof constructed at level 11. This increases the quantity of glazing letting light into the atrium in comparison to a wholly top-lit atrium. As a result the atrium will serve to enhance the levels of daylight penetration in the heart of the office floors.

As well as improving occupant comfort by increasing natural daylight provision, this will also reduce dependency of artificial lighting, thus resulting in significant energy savings.

Figure 10: Building B1 – Visualisation produced as part of the daylight analysis study of the upper office floors conducted at an early design stage (the internal layout is representative having not yet been defined).

3.1.2.4. Scope for using Thermal Mass

A decision was made at early design stages to prioritise efficient structure at Plot B1. As a result a steel frame structural solution was selected with composite deck floor slabs. This form allows the use of materials with a high recycled content (e.g. steel main structure) and higher green guide ratings for some of the basic building elements (e.g floors, see section 4.2.4). However there are few opportunities for utilising thermal mass as part of the building's passive design. These are restricted to limited heavy weight areas of the construction (e.g. basement and cores). Where feasible and appropriate for these elements to form part of an area's final finish they will be exposed to add thermal mass to the conditioned zone immediately adjacent to the element. However the exposure of floor slabs or soffits will have little effect on the internal comfort conditions in the majority of office areas, therefore it was decided on balance that this would not form part of the passive design adopted at Plot B1.

3.1.3. Active Design

3.1.3.1. Ventilation system in office areas

Mechanical ventilation supplemented by efficient EC/DC fan coil units are proposed as a ventilation system for the majority of occupied office space at plot B1.

EC/DC fan coil units were selected for use within Building B1 as they are especially suited to spaces requiring flexible fit out and internal environments that have potentially large cooling loads such as high density offices or trading floor areas. The use of fan coils provide flexibility in the type of loads that a future occupant may introduce to a floor as well as allowing flexibility in the location of the fan coil units to suit different office cellularisation requirements. EC/DC fan coil units are able to provide the required flexibility whilst operating with a high degree of energy efficiency.

EC/DC fan coil units work in a similar manner to conventional Alternating Current (AC) fan coil units but are driven using EC (Electronically Commutated) motors. When running at full load, EC motors can operate 50% more efficiently than AC motors. This arises from the inherent inefficiencies of single phase electrical motors traditionally used in fan coil systems. The national grid is designed to support large motors through the production of a rotating magnetic field using three phase AC electricity. However a rotating magnetic field cannot be produced directly from a single phase supply. Therefore small motors, such as those found typically in AC fan coils use passive electrical components to generate an artificial rotation magnetic field, and vary speed through applying different voltages to the motor using small transformers. The result of this equipment is poor conversion of electrical energy into fan energy and heat losses to the internal environment.

In contrast EC/DC motors use rare earth magnets to provide a rotor (the rotating part) with a permanent magnetic field. This results in an immediate energy saving compared to AC motors where the field is often induced or produced by electromagnets. Power electronics are then used to convert AC electricity from the mains into DC electricity. The DC electricity is controlled by another set of power electronics to efficiently produce a very controllable rotation magnetic field in the motor. The permanent magnets on the rotor are then propelled by this field and produce rotary motion.

The power electronics are much more efficient then the passive components in small AC motors and produce less heat, resulting in direct savings from electrical consumption and indirect savings through a reduction in the cooling load that would be required to remove the heat gains from fan coil equipment.

In addition to this the power electronics fitted to EC/DC motors allow an infinite degree of fan speed control. Traditional AC fan coil systems are commissioned to run at a fixed speed according to the voltage set at the fan coil’s local transformer. Changing this requires physically changing wiring arrangements at the transformer, and therefore any amendment cannot be undertaken automatically. By comparison EC/DC fan coils can be coupled to demand and occupancy sensors, so the fan coil unit can be controlled to operate at the required level needed to meet the heating and cooling loads of the local environment. The benefit of this feature, in addition to the high running efficiency of the motor described above, can provide overall energy efficiency increases of up to 80% compared to AC fan coil units.

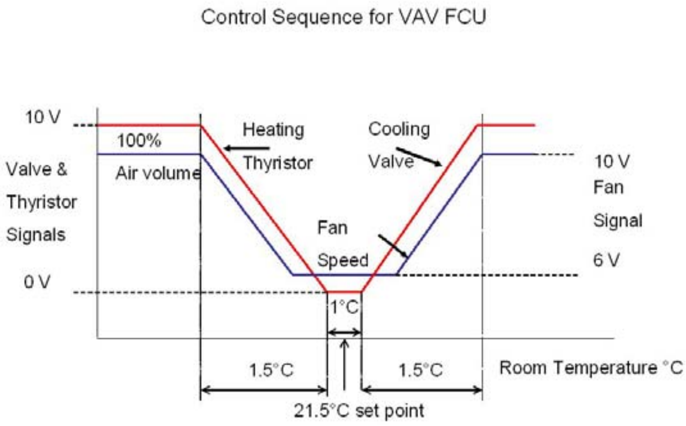


Figure 11: Potential control strategy feasible using the variable speed control of EC/DC fan coil units

It should be noted that dynamic modelling of the variable air volume modulation of the EC/DC motors cannot yet be directly tested under the government's current calculation methodology for Part L calculation. Therefore for the purposes of calculating the BER and carbon emission reductions in sections 3.2 and 3.4 an alternative methodology is used. Whilst the fan coil is modelled as operating at full load fan speed, the Specific Fan Power (SFP) of the fan coil unit is reduced from its full load value of 0.3W/l/s down to 0.2W/l/s to reflect the energy savings obtained through variable speed operation.

3.1.3.2. Ventilation system in the atrium

Where it is not necessary to allow for high occupancy gains at B1, different efficient ventilation strategies have been adopted to reduce energy consumption. At the atrium a low level displacement ventilation strategy is proposed. This treats a minimal amount of ventilation air and introduces this at the atrium floor level to maintain a healthy and comfortable climate where people occupy the ground floor zone. The remainder of the atrium throughout the 11 storey height is not conditioned to a controlled parameter, significantly reducing the volume of air that would require heating or cooling. Extract from the atrium is at roof level via a natural stack effect. Air is not mechanically extracted from this space, instead it is allowed to rise as it heats up and is exhausted at the top of the atrium.

3.1.3.3. Ventilation systems in ancillary areas

Ancillary areas (e.g. toilet cores, basement areas) are mechanically ventilated because they are internal, or beneath ground level, however these spaces are not comfort cooled, therefore do not contribute to the cooling load.

3.1.3.4. Alternative Ventilation strategies

Alternative ventilation strategies were considered at earlier design stages. However these systems were discounted for the following reasons:

- Natural or mixed mode ventilation systems are only suitable where cooling loads from occupation are below 25-30 W/m^2. Above this the naturally ventilated areas tend to overheat to uncomfortable levels because of the build up of heat from occupancy gains. As the occupancy gain from occupants at B1 are not known and considered potentially to be greater than 100 W/m^2 an efficient fan coil system has been specified so that a wide range of conditions can be managed. At lower occupancy gains the EC/DC motor system allows the fan coil fan to be set back to slow speeds, and cooling energy to be minimised, resulting in efficient operation at low load. However the system can also manage a high gain occupancy scenario efficiently by recirculating air in the local areas where these gains arise removing the thermal energy and maintaining comfort conditions.

- Displacement ventilation with additional cooling provided by chilled beams can also be used to service office space. Chilled beams are predominantly radiant and convective cooling systems. This limits chilled beams to typically 70-100 W/m^{2}cooling output. Fan coil units primarily remove heat through forced convection, aided by a small fan unit. This allows a greater quantity of air to be passed over a cooling coil, increasing the cooling capacity to greater than 100 W/m^2.

The advantages and disadvantages of the systems discussed above are summarised in table 3 for clarity.

	Natural Ventilation	Displacement Ventilation & Passive Chilled Beams	Fan Coil Units
Summertime Temperature Control	Above 25° C	24° C +/- 2° C	24° C +/- 2° C
Peak Occupancy	1 Person per 14m^2	1 Person per 8-10m^2	1 Person per 6-8m^2
Small Power Load	5-10 W/m^2	15-20 W/m^2	25-50 W/m^2
Air Quality	Low/Medium	High	Medium
Level of façade solar control required	High	Medium/High	Low/Medium
Office space cellularisation	Difficult	Difficult	Easy
Maintenance	1 - 5 (£/m^2)	6 - 10 (£/m^2)	9 - 15 (£/m^2)
Energy consumption	80%	90%	100% (Ref)
Capital costs (Cat A)	£40–100 £/m^2 (HVAC)	£130-230/ m^2 (HVAC)	£140-220/ m^2 (HVAC)

Table 3: Summary of the advantages and disadvantages of differing ventilation strategies

3.1.3.5. Fresh Air Allowance and Ventilation

The quantities of fresh air are distributed mechanically throughout Building B1 via energy efficient central air-handling plant incorporating variable speed fans and high efficiency heat recovery systems. CIBSE good practice standard ventilation rates of 12 litres/second/person have been specified for all occupied spaces. The maximum specific fan power of the air handling units (AHUs) will be 2.0 W/(l/s) and the efficiency of their heat recovery systems will be at least 70%. Ductwork will be insulated accordingly to minimise heat loss or unwanted heat gains, and specified with low leakage rates which would otherwise result in reduced operational efficiency.

3.1.3.6. Scope for Intelligent and High Efficiency Lighting Systems

The lighting types and spacing of the fittings in the office areas of Building B1 will be limited to provide an intensity of 450-500 lux on the working plane using high efficiency lamps with high frequency control gear. This control gear will also be dimmeable in relevant areas, e.g. perimeter zones and meeting room type spaces. Such measures will limit the energy required to power the lighting and any cooling necessary to offset the lighting heat gain. The target maximum thermal output of lighting whilst delivering this Lux level is approximately 11 W thermal /m^2 floor area. Efficient lighting products and design are required to achieve this.

High frequency ballast will be used with all fluorescent and compact fluorescent lamps to improve occupant well being and energy efficiency. The lettable office lighting installation will comply with CIBSE LG3, LG7 and LG46.

All lighting in office and toilet areas of the building will be controlled by PIR movement detectors, which will monitor occupancy and switch off the lights when the area is vacant for a sustained length of time. Further to this, lighting in perimeter office areas will include intelligent dimming that monitors daylight levels and adjusts the lighting intensity accordingly. It is proposed that two lighting sensors are used in perimeter areas to separately control two lighting zones (see figure 12). Instead of one sensor controlling lights along a 6 m perimeter to achieve an average lux level, one sensor independently controls the first 3 m of the perimeter zone and a ‘back space’ controls the next 3 m zone. In this way the lighting directly adjacent to glazing can be reduced independently to maximise energy savings whilst maintaining the same lighting level across the full perimeter zone. Lighting in communal/lobby areas will include timed control to ensure switching off to reduce energy consumption.

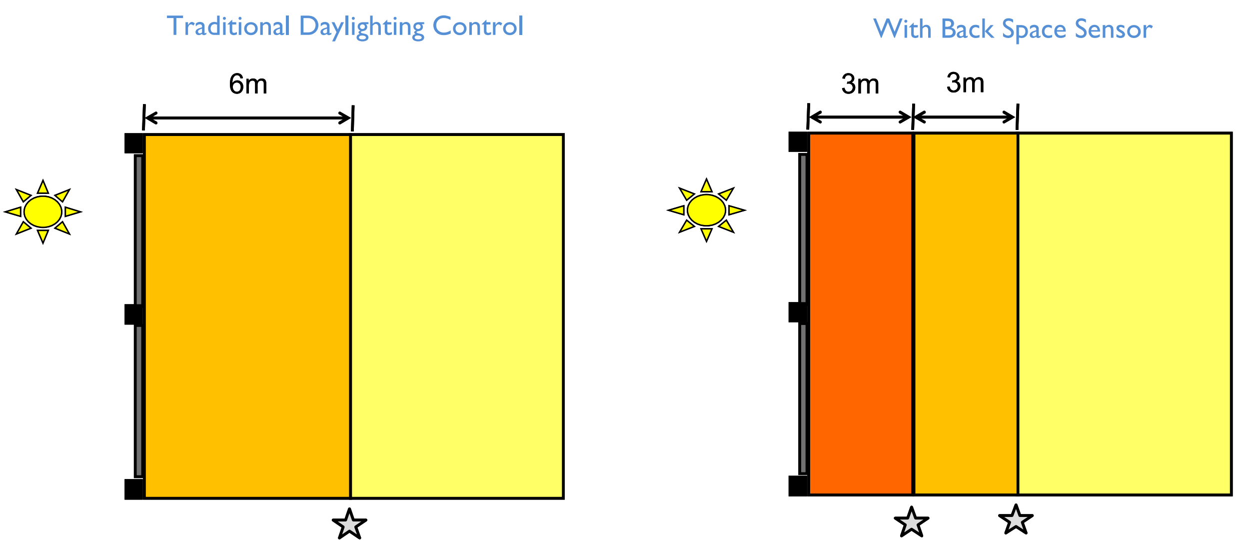


Figure 12: A back-space sensor will help to save more energy from artificial lighting

In the B1 basement service area, lighting will be controlled by a time clock, which shall be used in conjunction with an override switch located in the security room.

3.1.3.7. Building Energy Management System, Controls and Metering

A comprehensive Building Energy Management System ('BEMS') will be installed in the building to monitor and report energy consumption. The system will highlight any out-of-range consumption figures and readings, allowing a preventative approach through interrogation and resolution of potential problems.

Metering of energy usage (i.e. heating, cooling, electricity) on all floors and for each tenancy will allow building owners / occupiers to view and interrogate where potential energy savings can be made.

It is proposed to provide local override control for lighting and heating/cooling zones in office areas to allow a degree of control to occupants over their immediate environment. This would be a software based solution which would be an augmentation of the wider BEMS system.

3.1.3.8. Power Factor Correction

Power factor correction, to 0.95 or greater, will be provided in the building to improve the efficiency of the electrical supply.

3.1.3.9. Heating

All heating demand and Domestic Hot Water demand will be provided from the low-carbon district energy system, therefore negating the need for supplementary boilers in the building. Further details on the district energy systems and the contribution it makes to the building's performance are provided in Section 3.2 of this report.

As explained in section 3.1.3.1 it is proposed that the main office areas incorporate EC/DC fan coil units, which will be used for both heating and cooling. The units in perimeter areas will incorporate a heating coil which will be linked via the buildings Low Temperature Hot Water Circuit to the district heating system serving the development. The fan coil will be able to respond to local heating requirements by recirculating the local air to achieve a comfort condition. The fan coil fan speed and heating water requirement can be controlled locally to achieve the required comfort criteria giving accurate local zone control, without requiring additional heating energy to warm up additional ventilation air volumes.

Unlike perimeter areas, internal areas of the building suffer no direct heat loss provided they are surrounded by conditioned space. For example, a zone in the middle of an office floor plate loses no heat through the floor or ceiling if the floors above and below are conditioned to a similar temperature. Additionally, if there is no nearby external glazing or wall there is no direct heat loss to the external environment. In this scenario, provided the air supply to the internal space is warmed to room temperature there is no requirement to provide additional heat to this space.

Therefore where a fan coil is located in an internal zone without heat loss no heater battery is installed as this is no longer required. This reduces the obstructions to air passing through the unit and therefore improves the efficiency of the fan in the fan coil.

Fan coils will be controlled with interlocks to prevent neighbouring zones undertaking simultaneous heating and cooling (i.e. where one zone is heated and the adjacent zone cools the warm air produced by the first).

Air handling units will contain heat recovery systems to recuperate as much heat from occupancy gains as possible to heat incoming air. Should this not prove sufficient for a given environmental condition, heater batteries in the units will provide additional heat to achieve comfort conditions.

The atrium will have no additional heating systems other than heat supplied through the ventilation air supply, again reducing the energy consumption of this space.

Ancillary spaces such as toilets or changing rooms will only be heated where required to achieve comfort conditions. This reduces the areas in the building that require heating to be installed, thus reducing space heating consumption. Areas that will require heating (e.g. changing or shower rooms) will use weather compensated variable temperature radiator systems to minimise heat energy consumption.

Part L modelling predicts that building B1 will have a relatively low overall space heating and Domestic Hot Water (DHW) demand. The low DHW demand is a typical characteristic of an office occupation, where hot water consumption is generally limited to hand washing in toilet cores. The low space heating demand arises from the high occupancy gains the NCM calculation assumes for the occupancy type predominant at the building. The insulation levels of the façade and external fabric, and the efficiency of the ventilation system in recovering heat from exhaust air helps retain this heat in the building, lowering the demand for space heating. These results can be reviewed in more detail in Appendix A

3.1.3.10. Chilled Water

Chilled water to serve the air handling plant and fan coil units will be provided by high efficiency air-cooled vapour compression chillers located in the roof plant room. An intelligent multiple chiller sequencing operation will be specified to ensure that the vapour compression chiller will operate at peak efficiency, given the cooling load required. For example, 2no. chillers may operate at part-load instead of 1no. at peak load to maximise the seasonal energy efficiency ratio (SEER). A SEER of 5.5 is targeted, compared to the Part L2 requirements of 2.25 (i.e. over a 100% improvement).

In order to provide further efficiency increases in the running of the chillers additional features are proposed as part of the chiller system specification.

Chiller efficiency is related to the outside air temperature passing over the cooling coils. It is proposed to install thermal storage buffer vessels which will allow the chillers to run at night when the ambient air is at its coolest. Coolth is stored in the insulated buffer vessels and used to supply peak loads during the daytime therefore improving efficiencies from the cooling plant.

A free cooling system is also proposed as part of the packaged chiller plant. This is an additional set of cooling coils installed alongside the refrigerant cooling coils so that the cooling fans can draw air across them. When external ambient temperatures are low (for example overnight, or during winter, spring or autumn seasons) chilled water is passed through the additional cooling coils to reject heat energy to the ambient air directly, without using the refrigeration circuit. This is similar to a large radiator being fitted to the chilled water system. The refrigeration circuit is then only used to achieve the difference between the chilled water leaving the radiator, and the design temperature requirement, thus saving energy. This is especially efficient where an annual base cooling load exists, as expected in building B1.

Absorption cooling has not been incorporated at Plot B1 for a number of reasons. Firstly it requires a continual base cooling load over long durations of time to operate effectively. This will not be the case in a speculative office building. Secondly the proposed free cooling system reduces the base cooling load produced on the floorplates and is integrated with the dry air cooling system specified for the development.

As a result, no wet cooling towers or separate condensed water circuit with dry cooling equipment is provided within B1. Either of these (typically a wet system) are required for absorption chiller operation, and would therefore require a dedicated installation at roof level where there is limited space availability for the necessary equipment.

Therefore absorption chillers are not considered a suitable addition to the cooling strategy at building B1.

3.1.3.11. Heat Recovery Systems

The energy required to heat or cool the incoming fresh air supply to the office space will be significantly reduced by using a heat recovery system in the building. The heat recovery system will utilize the thermal properties of the return air to transfer 'free' heat / coolth to the incoming fresh air supply. This will be controlled so as to minimise the demand for any heating and cooling to the fresh air supply.

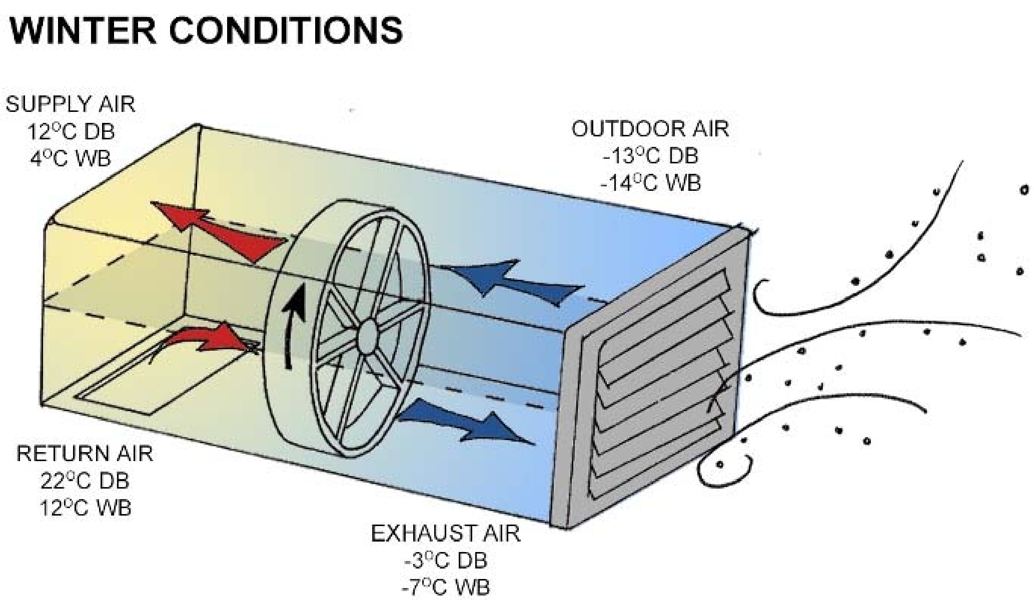


Figure 13: Diagram showing how the thermal wheel operates in winter

The building will use thermal wheels in the AHUs for heat recovery. Thermal wheels continuously rotate allowing the storage of heat from the return air path (> 22°C) to transfer to the incoming air stream (see figure 13 and 14 below). In winter, the warmer return air will combine with the cooler outdoor air and raise the supply air temperature, thus reducing the amount of energy required to heat the incoming air. In summer, the opposite occurs, with the incoming air stream likely to be of a higher temperature than the return air. In this case a transfer of coolth results in a reduction of energy required to cool the air to design conditions. These systems provide the highest heat recovery efficiency available and will significantly reduce the building's overall heating and cooling demand.

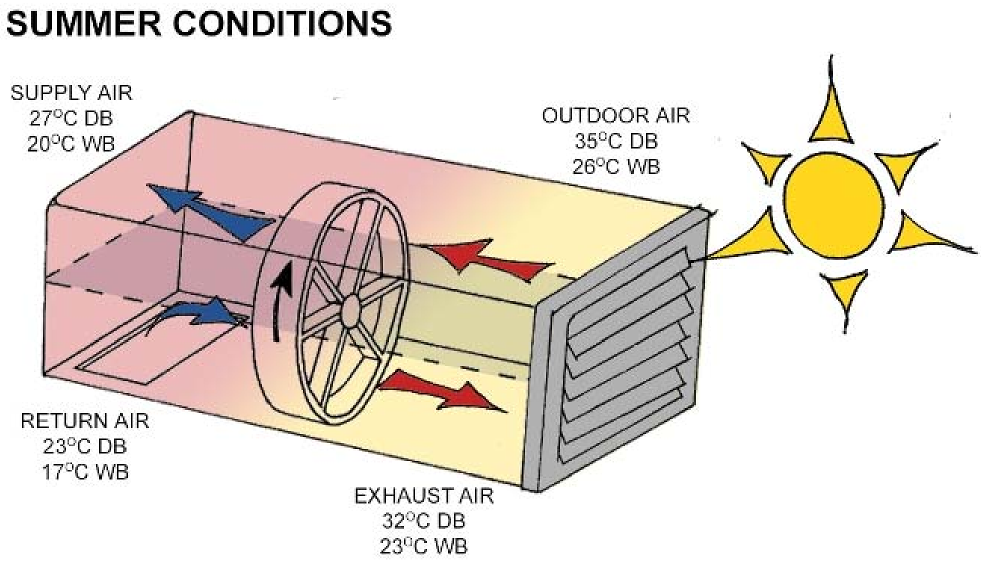


Figure 14: Diagram showing how the thermal wheel operates in summer

3.1.3.12. High Efficiency Variable Speed Drives

Variable speed motors will be specified for the majority of fans and pumps in Building B1. By varying the fan and pump speeds for the chilled water, LTHW and ventilation systems in order to match the building heating and cooling load profiles, fan and pump energy consumption is considerably reduced. This will be maintained and controlled through constant monitoring via the BEMS.

3.2 CONDITION 17(B): REDUCTION IN CARBON EMISSIONS

"The Environment Sustainability Plan shall explain the reduction in carbon emission 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."

As described in Section 3.1.2, Building B1 is primarily an office building and therefore falls within the remit of Building Regulations Document L2A (ADL2A). A dynamic simulation model (DSM) software package, fully accredited for Level 5 Part L/EPC by CLG, has been used under the supervision of a licensed energy assessor (LCEA) to assess regulated carbon dioxide emissions for the building.

A full three-dimensional thermal model for the Building B1 was created in 'TAS version 9.2.1' from the architect's drawings.

This model and the minimum set values for building fabric U-values, plant efficiencies and operational parameters set out in Part-L2 of the Building Regulations 2010 have been used to determine a notional (or benchmark) emission level for the building of 22.7kgCO_2/m^2. For the purposes of Part-L2 2010, this figure is also the TER for the building and therefore the actual emissions rate for B1 (referred to as the BER) would need to equal or improve upon that figure in order to simply comply with the regulations.

For clarity, all comparisons to TER in this document are referred to the modelled TER for plot B1 supplied from district heating fed from CHP and gas boilers as is proposed in the final construction.

The KXC S106 Agreement targets each new building to achieve carbon emissions at least 5% lower than Part L of the prevailing Building Regulations (i.e Building Regulations 2010) using good passive design and energy efficiency measures only such as those set out in section 3.1 previously. On the basis of these measures alone (i.e. disregarding the carbon savings that will be achieved by utilising the low carbon district energy system and any renewables), the carbon emissions for Building B1 are expected to be 19.8kgCO_2/m^2. This represents a 12.7% reduction over the Part-L2 TER (CHP fuel source). Consequently the building exceeds the target 5% reduction set by the S106 Agreement.

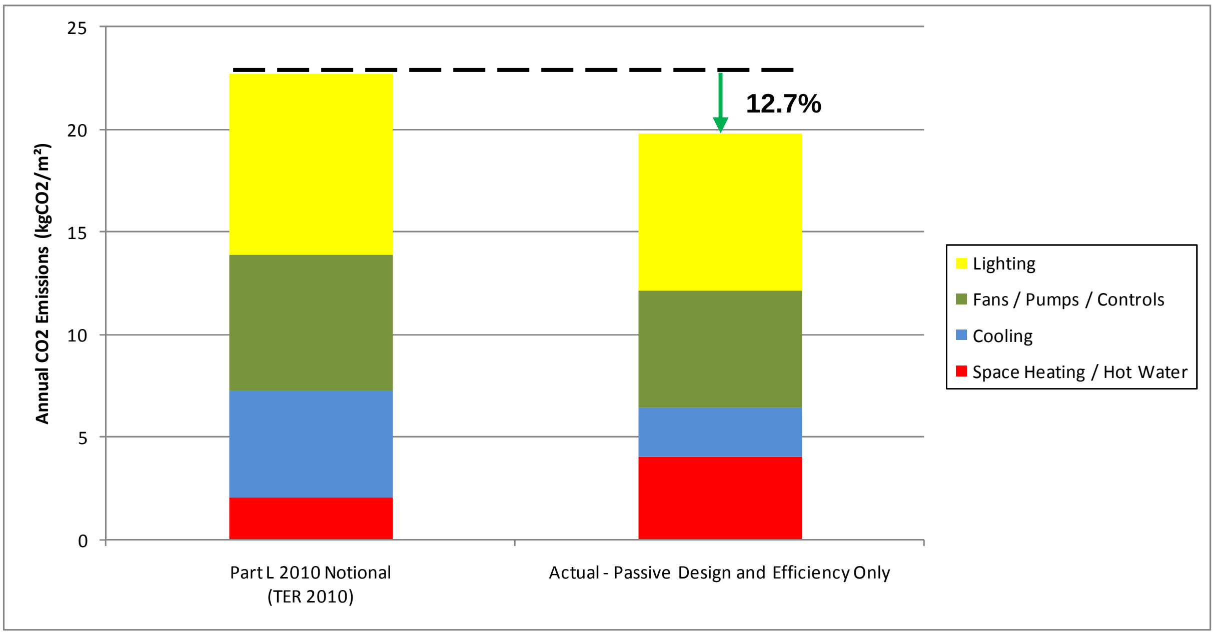


Figure 15: Building B1 - Carbon dioxide emissions resulting from lean building design and technology measures only

Similarly when looking at the building design alone, a comparison with the Econ 19 Good Practice 'Business as Usual' benchmark identified in the KXC Energy Assessment and referred to in the S106 Agreement shows that the CO_2 emissions are reduced by 70%.[1].

[1] ECON19 COMPARISON NOTE: Econ 19 is not directly comparable to Part L2. Econ 19 includes for process loads such as catering facilities, data rooms etc consumed within the building whereas Part L2 does not. It is not possible to estimate a meaningful emission rate for these facilities as their provision will depend on the tenant(s) of the proposed buildings and their individual requirements. Therefore, the Econ 19 targets stated throughout this report have been adjusted by removing this portion of emissions. In this way, Econ 19 has been made as comparable as possible.

Figure 16 below shows the calculated carbon reduction benchmarked against ECON 19, using passive design measures only.

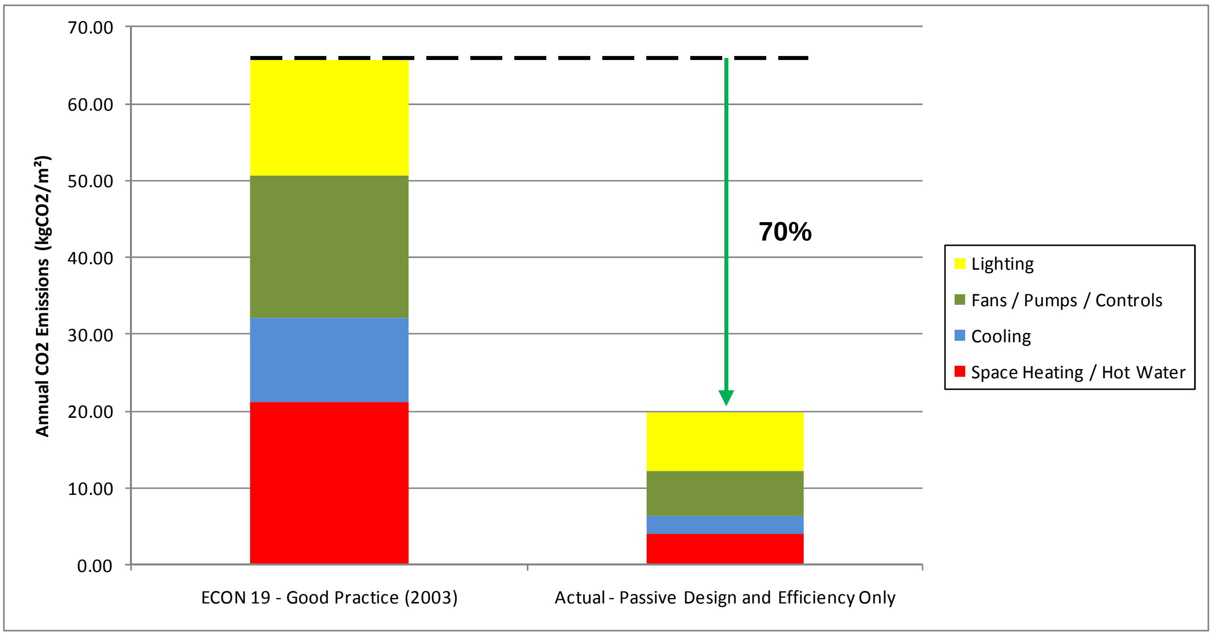


Figure 16: Building B1 - Comparison of Carbon dioxide emissions between the ECON 19 Benchmark and the lean building design and technology measures only

3.3 CONDITION 17(C): PROVISION FOR GREEN AND/OR BROWN ROOFS

"The Environmental Sustainability Plan shall explain the specification for any green and / or brown roof."

The KXC Outline Planning Permission does not, within the Parameter Plans, define Zone B as a priority location for green and/or brown roofs. Nonetheless, it is proposed that biodiverse brown roofs totalling approximately 1296m^2 will be provided, as shown on figure 17. The remaining roof area will be used to house base build plant and future tenant services plant, as well as landscaped roof terraces (see below).

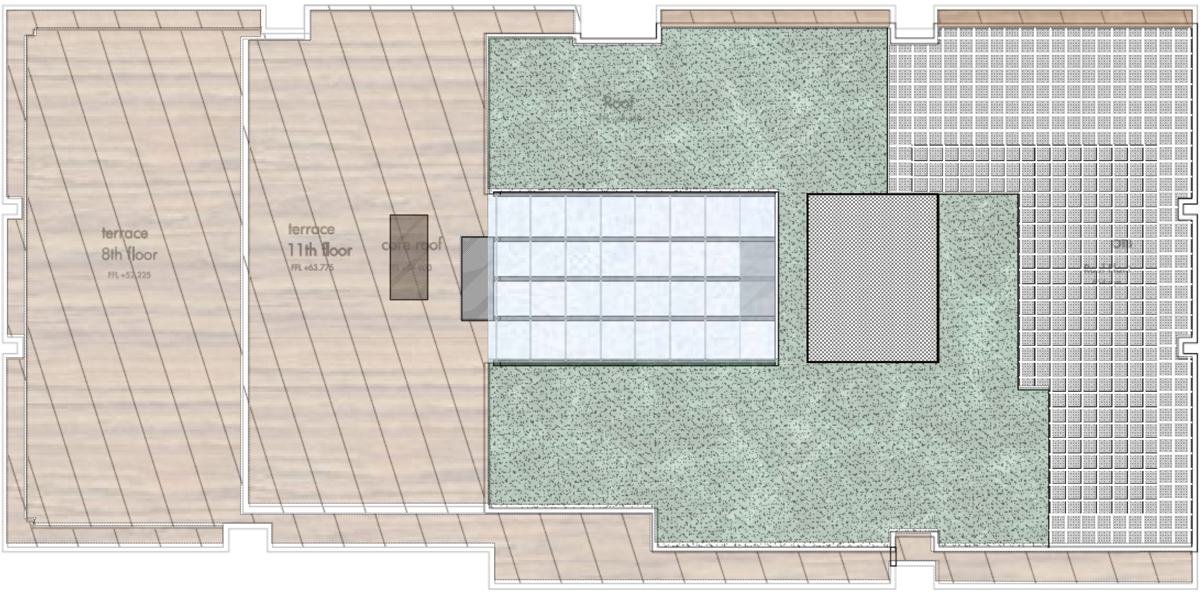


Figure 17: Proposed roof plan at B1 showing biodiverse roof (green area), terrace (brown area) and plant areas (in gray)

The brown roof will incorporate as much recycled content as possible with a substrate consisting a crushed masonry and spoil. Such roofs tend to be based on evolution rather than design and therefore, their maintenance requirements tend to be much lower than those for similar-sized 'green' roofs, making them more appropriate for use at high levels. Although typically not as vegetated as traditional green roofs, the brown roof will become naturally colonised by plant species and a variety of insects and birds (including the black redstart) over time.

Building B1 will also include extensive decked and landscaped roof terraces on the 7th, 8th, 9th, 10th and 11th floors, each varying in size. All of the terraces will be fully accessible to the building occupants. Totalling 1888m^2, these areas partially function as a rainwater collection facility for the rainwater recycling system. As they are a decking type finish these produce a 'cleaner' rainwater than brown or green roof finishes which requires less filtering and processing before re-use for non-potable water consumption.

Each terrace will incorporate raised containers for low level planting and trees. The planting scheme for the B1 roof terraces will include a mix of native and non-native species in order to attract a range of wildlife. Species will be chosen to provide a range of forms and seasonal colour in their leaves and flowers, providing shelter and a continuous source of food for animals, birds and insects. Scented plants will also be used to attract insects such as bees. These will offer some additional (albeit small) ecological value on terrace spaces in addition to the dedicated brown roof areas. Further details regarding the design and planting of the roof and tree terraces are provided in the submitted Urban Design Report for Building B1.

Figure 19: Building B1 - Visualisation of Roof level detail, showing brown roof area, terrace, atrium and landscape terraced levels.

3.4 CONDITION 17(D): REDUCTION IN CARBON EMISSIONS

"The Environmental Sustainability Plan shall explain how energy shall be supplied to the building, highlighting:

a. *How the building relates to the site-wide strategy for district heating incorporating tri-generation from distributed combined heat and power;*
b. *How the building relates to the strategy for using bio-fuel boilers to supplement the energy supplied through the district heating system;*
c. *The assessment of the cost-effectiveness and reliability of the supply chain and bio-fuels;*
d. *Any other measures to incorporate renewables."*

3.4.1. Overview

The T1 Energy Centre has already been approved and constructed. 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 system. The thermal energy thus supplied to Building B1 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 (to be fed into the National Grid), which will offset a significant percentage of the buildings' demand.

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

- 3 No. 1.8MWth gas fired CHP
- A thermal store, integral to the CHP operating hours strategy
- 3 No. 9MWth 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 phased energy strategy, a temporary Energy Pod has been installed on Plot Q1 in order to provide heat for the commissioning of the plant during the construction of UAL and subsequently meet occupier demand from September 2011. Similarly, the Energy Pod will provide heat for plant commissioning during the development of Building R4 which received reserved matters approval in April 2010 and is now under construction.

KCCLP 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 heating infrastructure, for example within Pancras Road. It is envisaged that the T6 student housing building (now under construction) would trigger the 'switch on' of the first CHP engine and boilers in the T1 Energy Centre. At that point, the Energy Pod on Q1 could 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 inclusion of biomass boilers. At this time, a robust commercial case to support the inclusion of biomass cannot yet be made, however, this position continues to be actively monitored. The scope for a secondary energy centre within Plot T2 could provide for their 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 commissioned) would operate such that on average just over 50% of Building B1's annual heating and hot water demand would be supplied from the gas-fired CHP plant and just under 50% from gas-fired boilers (heat for heat).

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 B1 if the Energy Centre were to provide 16% of the annual heating and hot water demand of the building via biomass boilers, 34% from gas-fired boilers and 50% from gas-fired CHP.

3.4.2. CO_2 Savings for the Building Arising From the KXC Energy Centre

Taking into account the passive design and energy efficiency measures set out in section 3.1 of this plan, combined with the contribution made by the connection of Building B1 to the low-carbon district energy system, the BER is further reduced from 19.8kgCO_2/m^2 stated in Section 3.2, to 17.8kgCO_2/m^2, representing an overall improvement of 21.5% compared to the TER under Part L2 2010 or a 73% overall improvement compared to ECON 19 – Good Practice (adapted as per Section 3.2 to enable comparison with Part L).

Figure 20 provides a comparison of the building's TER against the actual emissions rate, including the carbon reductions made as a result of the connection to the low-carbon energy supply.

The percentage improvement is a relative measurement against the TER target. The TER is dependent on the building type and National Calculation Methodology (NCM). For this building type (serviced deep plan office) the building regulations and NCM set a relatively low carbon dioxide target, reducing the relative difference between the BER and TER. Therefore it is important to compare the predicted absolute carbon emissions with other buildings to fully understand Plot B1s performance. Table 4 details a comparison between plots B1 and the adjacent plot B3 where a much bigger percentage reduction is predicted. It can be seen that the absolute carbon emissions per square meter (the BERs) are comparable for the two projects, however the TERs differ significantly. The difference in the relative carbon savings between the two plots arises from different target emissions rates which are a function of the building regulation NCM and the different environmental strategies for the two buildings, particularly in relation to heating loads.

	Plot B3	Plot B1
TER (kg CO_2/m^2)	31.3	22.7
BER (kg CO_2/m^2)	17.9	17.8
% Reduction	43	21.5

Table 4: A comparison of the target and predicted carbon emissions at Plots B1 and B3

The relatively small reduction of CO_2 emissions by 10% resulting from the contribution of the KXC Energy Centre is a consequence of the low heat demand of B1 (see section 3.1.3.9 above) and the impact of this on the Part-L2 2010 accredited software. When the savings from district heating are then included as part of the carbon reduction, there is only a small further reduction in carbon emissions as the saving is relative to the low space heating and hot water demand.

The accredited software is required to ensure compliance with the calculation procedures set down in the Building Regulations and uses a predefined set of parameters for input data and background calculations. These procedures limit the model to assess the CHP usage based on a building's own heat load profile only. Hence, the Building Regulation calculation is based on a "heat-led" CHP model. Due to the extensive number of buildings that the energy centre is serving and their varied energy usage profiles, the CHP engines are likely to operate for longer periods than estimated within our Part L2 calculation. This will only lead to further carbon savings. However, given the limitations of the Part L2 accredited software, we have to follow their set criteria in this case.

The future inclusion of biomass boilers within the energy strategy would further reduce the CO_2 emissions by 0.6 kg CO_2/m^2, (from 17.8 to 17.2kgCO_2/m^2), resulting in an overall improvement of 24% over Part L. The level of this reduction is again a reflection of the building's minimal demand for the heating potentially generated by biomass boilers.

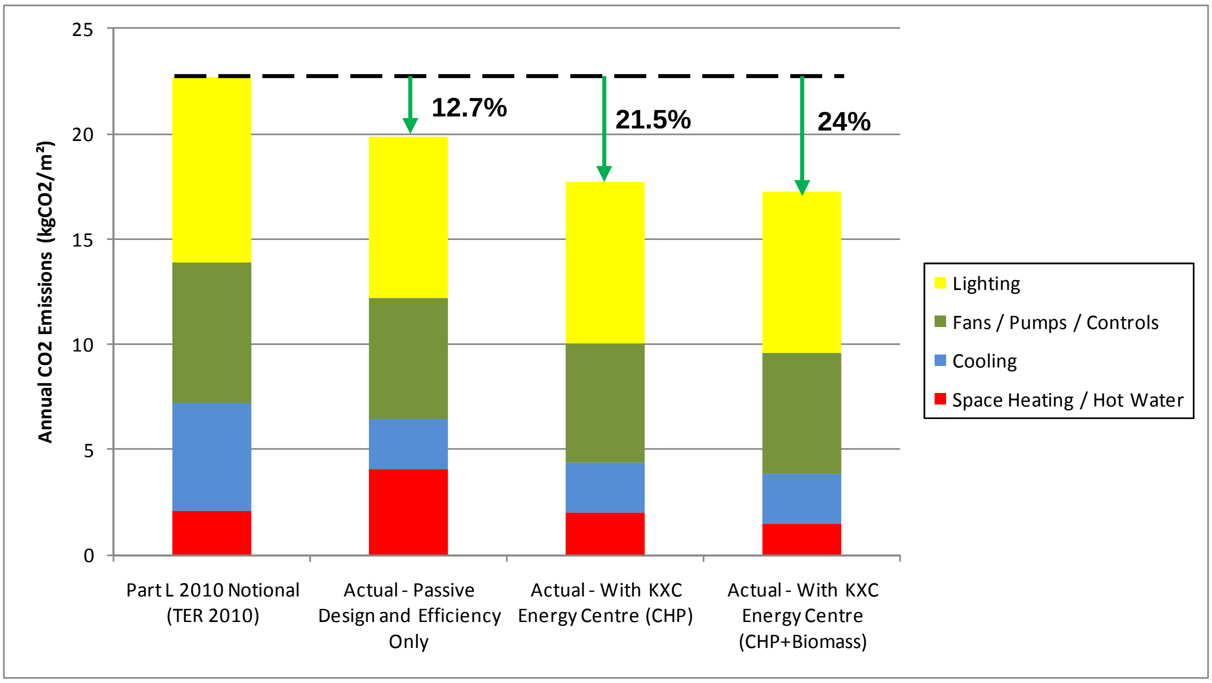


Figure 20: Building B1 annual CO_2 emissions demonstrating the step savings from passive design and connection to the Kings Cross district heating network

3.4.3. CO_2 Savings Arising from Renewable Technologies

The opportunities for exploiting other forms of renewable technology on Building B1 were thoroughly considered during the design process. A range of technologies were examined even though the 2005 Energy Assessment and parameter plan do not highlight B1 as a location where wind turbines or photovoltaic panels are specifically required.

The technologies considered include the preferred on-site renewable technologies (wind turbines, solar water heating, ground source (bore hole) cooling and photovoltaic generation) described in the same assessment.

In summary, the review, by technology, had the following outcomes:

- **Wind turbines** – Though outside the priority zone for wind turbines set by parameter Plan KXC021, the feasibility of the application of wind turbines to the building was assessed. It was considered that wind turbines would be incongruous in long and short range views and the project is moving away from their application in any event. In addition, the use of the roof on B1 for roof terraces and plant, mean that insufficient space would be available to allow for the installation and maintenance of turbines.

- **Solar hot water** – Domestic hot water demand for an office building is relatively small and a solar-powered system would provide only a modest renewables contribution. Furthermore the designs for the building and the basement have been progressed to make full use of the KXC Energy Centre and the use of solar hot water would reduce (albeit marginally) the efficiency of the district energy system.

- **Ground source heat pumps** – Ground source heat pumps (‘GSHP’) are best suited to buildings with roughly equal summer cooling and winter heating requirements, so that across a year the heat extracted and returned to the ground has a neutral thermal polluting effect in the ground. The low heat demand from the KXC Energy Centre means that the building will not be able to offer a balanced heating and cooling application, as preferred by the Environment Agency, and therefore a GSHP would not be able to achieve the carbon savings that will be achieved by using the Energy Centre. The use of the district heating system combined with the building’s high efficiency air-cooled chillers therefore appears to be the lowest carbon solution for B1 and hence the ground source scheme has not been pursued.

- **Photovoltaics (PVs)** – The installation of photovoltaic panels was examined for B1 but as much of the roof space is given over to terraces, plant, or brown roof there is limited capacity for pholtovoltaic arrays. The terraces provide a useful amenity and social space at lower levels, and provide roofscape views of both building B1 and across to adjacent buildings. Therefore it is not proposed to reduce these areas through the installation of PV arrays in these locations. Vertical installation of PV panels on the façade would result in a 30 – 44% reduction in output (depending on orientation) and be further reduced by overshading from adjacent buildings, as well as being technically difficult to incorporate within the façade. Therefore this option was considered unsuitable. Installation above the plant area was also discounted on the basis it would complicate plant maintenance and removal, and potentially reduce the free area for air movement between the plant area and surroundings. The remaining feasible area forms part of the brown roof finish for the building. This area is too small in its own right to make a significant contribution to reducing carbon emissions at building B1, and the cost per tonne of carbon saved would be high for the small PV array. Therefore PVs are not proposed in this location in preference for maximising the brown roofspace in this area.

3.5 CONDITION 17(E): BREEAM RATING

"The Environmental Sustainability Plan shall explain how the proposed building has been designed to achieve a BREEAM rating of 'Very Good' or better."

3.5.1. Overview

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 planning objective for a 'Very Good' rating by aiming to secure an 'Excellent' rating at the post construction stage assessment for B1 under the BREEAM 2008 Offices scheme.

The team has taken a holistic approach to every aspect of the buildings' design utilising passive and active design methodologies to ensure a truly sustainable building is produced. The key design features covering energy, water and resource efficiencies, together with supplier and construction management and commissioning practice, all discussed in other sections of this Plan, fully embrace sustainability best practice and will contribute to delivering a high BREEAM rating.

The initial pre-assessment predicts that an 'Excellent' rating (minimum BREEAM score of 70%) will be achieved under BREEAM Offices 2008, with an overall score of 78.45%. The full list of credits which are being targeted can be seen within the pre-assessment report in Appendix B, but are also summarised in Tables 3 and 4 below.

It should be noted that the pre-assessment is provisional on the basis that 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. Subject to approval full evidence will be gathered at the detailed design stage as the project progresses.

BREEAM Score	BREEAM Rating
79.60%	EXCELLENT

Building Performance by Section					
	Environmental weighting	Credits available	Credits achieved	% Achieved	Weighted Score
Management	12.00%	10.00	10.00	100.00%	12.00%
Health & Wellbeing	15.00%	13.00	11.00	84.62%	12.69%
Energy	19.00%	24.00	13.00	54.17%	10.29%
Transport	8.00%	10.00	10.00	100.00%	8.00%
Water	6.00%	6.00	5.00	83.33%	5.00%
Materials	12.50%	13.00	8.00	61.54%	7.69%
Waste	7.50%	7.00	6.00	85.71%	6.43%
Land Use & Ecology	10.00%	10.00	7.00	70.00%	7.00%
Pollution	10.00%	12.00	9.00	75.00%	7.50%
Innovation	10.00%	10.00	3.00	30.00%	3.00%
				Total BREEAM Score	79.60%

Table 5: showing credit allocation for Building B1 under BREEAM Offices 2008

Further to the indicated credits in tables 5 and 6, Building B1 may be able to achieve additional 'innovative' credits, due to the low-carbon district energy system. However, these credits have not been included because they are awarded on a post-construction basis for each BREEAM assessment and the BRE assess each innovative credit on its own merits.

Management	– Commissioning will be completed in accordance with CIBSE guidelines and seasonal commissioning to be completed to ensure the building performs all year round; – Main contractor will achieve a best practice score under the Considerate Constructors Scheme (i.e. ≥ 32); – Energy, water usage and waste related to the site will be monitored for the duration of the construction; – Timber used during construction will come from a sustainable source or re-used / recycled; – A building user guide will be produced on completion to give details of operation and energy performance.
Health and Well-being	– Glare will be minimised through glare control measures; – All fluorescent and compact fluorescent luminaires will use high efficiency ballasts; – Lighting illuminance levels will be in accordance with CIBSE guidelines; – Lighting, heating and cooling within all occupied areas will be zoned to allow separate control; – Thermal comfort will be assessed via thermal modelling tools, and local occupant control to be incorporated in design; – Consultation with Architectural Liaison Officer.
Energy	– Ambitious CO_2 performance based on passive design, energy efficiency and connection to the Energy Centre leading to a CO_2 index of less than 40; – Sub-metering will be provided in accordance with Building Regulation and BREEAM requirements.
Transport	– A large provision of cycle racks will be made; – Provision of showers, lockers and changing facilities will be allowed for building occupants – A travel plan will be prepared.
Water	– Water-efficient taps, WCs and fittings will be installed, with a rainwater recycling system meeting a proportion of the non-potable water demand; – A pulsed output water meter and audible leak detection system will be fitted to incoming water main; – Sanitary supply shut-off will be fitted to all WC areas.
Materials	– Materials will be responsibly sourced. For timber products this will require FSC or similar certification, and for non-timber products that the materials have EMS certification at either the process stage or the process and extraction phases. – Dedicated storage facility to be provided for recyclable materials (at least $10m^2$ specifically for recyclables).
Ecology	– The land on which the development is constructed is currently considered contaminated and will be decontaminated and remediated prior to construction – Moderate ecological enhancement of the site and positive long term impact on biodiversity. – The contractor shall undertake best practice site management practice with regards to ecology, including where appropriate, the appointment of an ecologist as part of the on-site construction team.
Waste	– A compliant Site Waste Management Plan will be developed; – A significant amount of aggregates used for the development will be recycled or secondary; – Central dedicated storage facility to be provided for recyclable waste.
Pollution	– Refrigerant leaks will be minimised through the implementation of a refrigerant leak detection system; – External lighting will be designed in accordance with the Institution of Lighting Engineers (ILE) Guidance notes for reduction of obtrusive light; – Noise attenuation will be provided.

Table 6: Key targeted BREEAM credits

3.6 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 provision of 1296m^2 of brown roof and 1888m^2 of landscaped terraces (as described in our response to condition 17(C) in Section 3.3, offer opportunities for ecological enhancement and increased biodiversity and help Building B1 to make positive contribution towards fulfilling objectives set out in the London Biodiversity Action Plan.

The proposed brown roof will comprise a mixed substrate intended to encourage plant growth and provide spatial heterogeneity. The use of crushed masonry and soil will compensate for the loss of brownfield habitat and provide an undisturbed environment for wildlife including insects and birds such as the Black Redstart.

Although predominantly a decked finish, the roof terraces at 7th, 8th, 9th, 10th and 11th floor levels will feature raised containers planted with a varied mix of species to establish habitats and provide a good source of food for birds and bats. The design of these spaces will make a further, albeit small, contribution to the ecological enhancement of the site.

Bird and bat boxes will be specifically designed for Building B1 and positioned so that they are clear of any potential predators, publicly accessible areas or excessively bright external lighting, such that they will facilitate the needs of the target species such as Swallows, Black Redstarts and Pipistrelle Bats. The elevated position of the terraces means they should be free of the mammalian predators that are present at ground level, resulting in a safe environment for birds to rear young. External lighting for the terraces will be designed to be sympathetic to the bird and bat populations.

A qualified ecologist will be employed to assess which species are present in the area, and confirm which bird boxes/bat roosts should be installed.

3.7 CONDITION 45: DRAINAGE

"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 l/s or less."

3.7.1. Site wide drainage infrastructure

The figure of 2,292 l/s in 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 York Way Sewer (for areas north of the Regent's Canal) and the Camley Sewer / Fleet Sewer (for the areas south of the Regent's Canal).

The cumulative peak discharge from the many building plots and areas of infrastructure will exceed 2,292 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 2,292 l/s or less.

The objectives of 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% climate change allowance) 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 KXC can be described in terms of three drainage infrastructure areas, incorporating both building plots and infrastructure/public realm. These are described under Table 7 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 7: Drainage Infrastructure Areas

Table 8 identifies the assumed peak foul and surface water flows from the building plots in the Southern Area 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 identified in Table 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.

Plot Reference	Assumed Peak Flows (l/s) for Plots in the Southern Area	
	Surface Water (1 in 30 year event)	Foul Water
A1	68	5.1
A2	94	7.7
A3	122	9.1
A4	155	10.6
A5	193	11.4
B1	215	23.16
B2	63	3.5
B3	93.5	7.6
B4	112	6.7
B5	150	9.4
B6	130	9.9
D1	40	0.5
E1	48	1.9
F1	45	2.4
V1	59	0.1
TOTALS	**1587.5**	**109.06**

Table 8 – Peak Surface and Foul Water Flows

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) combines 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 2,292l/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.

Land Use	Demand Options	Discharge to Sewer (l/day/hd)	l/s/head	Operational Hours	Population Density (m^2 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 9 – Foul Water Discharges from Various Land Uses

3.7.2. Drainage Infrastructure relating to Building B1

Building B1 is served by the Southern Area Infrastructure drainage systems (see Table 7) which discharges into the Thames Water Sewer located within the Thames Water owned Camley Road combined sewer located within Pancras Road. These networks also serve Zone A, the Boulevard, Goods Way, Station Square and Pancras Square.

Thames Water has approved in principle the surface water discharge for four connections. The approved discharges reflect the assumptions described in Tables 7 and 8 (above). The surface water discharge for Building B1 would be 215l/s. The worst case flow from the entire Southern Area Infrastructure is 810 l/s during the 1 in 30 year storm event. Further, the peak foul water flow for the building is assumed to be 23.16l/s.

It should be noted that the figures in Table 8 do not specifically include public realm areas. However, the Zone B public realm 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.

The B1 design team is working closely with the teams responsible for the surrounding infrastructure and adjacent zones, to ensure compatibility with site-wide infrastructure and compliance with the site-wide drainage strategy.

4.0 RESPONSE TO SECTION 106 OBLIGATIONS

4.1 SECTION AA: ENVIRONMENTAL SUSTAINABILITY – 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*
- *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*

4.1.1. Water Efficiency

Building B1 will achieve very high standards of water efficiency through an approach that combines alternative supply via rainwater collection and recycling, with internal water efficiency through design. The design team has used the BREEAM criteria as a benchmark in driving down potable water consumption for the building.

Water efficiency measures will include 'auto shut-off' valves on all toilet hand basins and dual flush WCs. The incorporation of low flow/flush rate sanitary water fittings will reduce the potable water consumption to <4.4m^3 per person per year, or <17 litres per person per day (assuming operation in business hours only) allowing the building to achieve 2 BREEAM credits. This represents a 20% reduction on the levels BREEAM sets as a minimum requirement to achieve 1 credit. Furthermore, PIR sensors and solenoid shut off valves are proposed to isolate potable water supplies to toilet areas when unoccupied. This minimises the waste of potable water from, for example an overflowing or leaking cistern, or a tap left on or dripping.

In total, it is proposed to target over 80% of water credits under the BREEAM water category (please see BREEAM pre-assessment in appendix B for further details).

4.1.2. Alternative Water Supplies

Rainwater harvesting is to be installed on the building. Rainwater will be collected from terraced roof areas (to reduce contamination) and stored in a rainwater tank within the building basement. The water will be filtered prior to entering the tank. A booster pump will be used to deliver the water for the flushing of water closets. It is estimated that non-potable water consumption for flushing will be reduced by an estimated 7.9%.

4.1.3. Sustainable Urban Drainage

Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as Sustainable Urban Drainage Systems ('SUDS'). These systems are more sustainable than conventional drainage methods.

Notwithstanding that this submission includes no public realm areas, SUDS have been integrated wherever possible into the building design to effect source control and storm water retention/infiltration and encourage evapotranspiration. These controls have been located as close as possible to the rainwater source, providing attenuation of the runoff.

As described in Section 3.3 of this Plan, planted terraces will be provided on Building B1. These spaces will be landscaped with container planting that will offer some (albeit limited) evapotranspiration. In addition, the proposed brown roof areas will attenuate rainfall by retaining water in the brown roof build up. This will then be evaporated directly from the roof, or via evapotranspiration through wild flower planting at roof level.

As stated in section 4.1.2 above, rainwater harvesting tanks will be provided in the B1 basement service area to collect surface water run-off from the building's roof. This water will be used to flush toilets and for irrigation of planting on the roof terraces, thereby reducing potable water consumption and the total volume of surface and foul water discharged to drainage.

4.2 SECTION Y: CONSTRUCTION MATERIALS & 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 agreeing 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.

4.2.1. Construction Materials and Purchasing Strategy

The project team intends that best practice will be followed and surpassed wherever practicable, in order to maximize resource efficiency. The Construction Materials and Purchasing Strategy will be adopted, while careful planning and effective control will ensure that waste during the construction phase is minimised.

4.2.2. 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.

4.2.3. Soil

As much as is practicable of the planting media for the landscaped areas of the roof terraces and the green roofs, and 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-won clay fill from the KXC 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 on the roof terrace. As such, it is recommended that imported organic material is used in these areas.

4.2.4. Construction Targets

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 provision of floor coverings in offices, 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.

A materials workshop has already been conducted to understand at preliminary design stages how different elements may perform. The findings from this are summarised in table 10. Full quantities and assessment of all elements will take place during the ongoing design process.

Building Element	Estimated Mass	Estimated BREEAM Green guide rating	Comments
External Walls	Low/Mid mass (depending on façade type)	A – B	The assessment of external walls and windows is complicated as multiple façade types make up the outside of B1 which form an integrated glazing and 'external wall' cladding system. The BRE Green Guide states that terracotta cladding on aluminium framework is potentially an A rated system (Ref Green Guide (GG) No: 906000031 & 906000027). Similarly an extruded aluminium stick type curtain wall system with a stone wool type insulation achieves a B rating (Ref 80651001), Curtain walling systems achieve a D rating (Ref 831500016), however powder coated aluminium windows with a low profile density achieve an 831500023). B1 is proposed to be constructed from a unitary curtain wall cladding system, using aluminium framing, stone wool insulation and a mixture of glazed and solid panels. It is also believed the reduced glazing levels at B1 will move the façade away from the generic green guide curtain wall rating. Ultimately the differing façade types will require a custom assessment from the BRE once details are available, however the architect and executive architect are working to minimise the material quantities in the façade system and maximise the green guide rating this can achieve.
Windows			
Roof	High mass	D	Based upon BRE Green guide rating for a profiled deep metal deck with in-situ cast concrete, waterproof membranes and insulation (GG Ref. 812530060). This is required for structural support of roof level plant, the biodiverse brown roof, and terrace areas, therefore it is difficult to adopt better performing lightweight roof options. AKT are working to improve the performance of this element, however as it is a limited area (in comparison to floor plates and façade) it is believed to represent a smaller fraction of the total material build up, and that the structural function of this area outweighs the benefit of a low green guide rating.
Floor Slabs	Mid-High mass	A+	Based on composite Power floated in situ reinforced concrete ribbed/trough (shallow or deep profile) slab (GG Ref. 807280008, 807280015 & 807280074).
Internal walls	Low – Mid mass	A	Based on internal walls made up of galvanised steel jumbo stud, plasterboard and paint (GG Ref 809760012) in office areas. Additionally Dense solid blockwork painted finish only (GG Ref 809180001) in ancillary areas.
Floor Finishes	Low	Unknown	Floor finishes are currently unknown as these form part of detail design. There has been a commitment to only fit out a sample area of the speculative office in carpet so that the majority of floor area can be directly specified by the future tenant, again eliminating wastage from fully carpeting this area.
Hard Landscaping	High	A	It is proposed to fit the limited area of external hard landscaping with an A rated material matching the public realm proposals of the wider Masterplan. At roof level it is proposed to deck the terraced area using FSC grade timber.
Boundary Protection	N/A	N/A	No boundary protection is required at Plot B1.
Thermal Insulation	Low	A	The design team are proposing that the volume weighted average of thermal insulation used on the project is A rated according to the green guide. To this end it is proposed to predominantly use a stone wool type insulation of an appropriate density (< 100 kg/m^3) in external façade and soffit areas.

Table 10: Findings arising from preliminary materials workshop for plot B1

4.3 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.

4.3.1. Waste Information Packs

To encourage the minimisation of waste generated during the operational life of the building, Waste Information Packs will be provided to occupiers, and arrangements will be made to monitor their effectiveness in encouraging waste minimisation.

4.3.2. Design Solutions

Dedicated and sufficient facilities will be provided within the basement service area of building B1 for the separation, storage and easy handling of waste. The facilities will be available for use by the occupiers of the buildings, with direct lift connections being provided from the building to the basement service area to allow convenient access to the storage areas and from which collections will be made. The desire to achieve an 'Excellent' BREEAM rating for the building will ensure that current best practice is followed.

The detailed arrangements that will be made have been described within the submitted Urban Design Reports and the Compliance Reports for the building and the basement in accordance with Condition 28 covering refuse storage and collection.

Appendix A – Part L2 Analysis

1.0 Overview

The content of this Appendix is governed by the Building Regulations Part-L2, 2010. The Appendix focuses on three of the five criteria (Criteria 1, 2 and 3) required for compliance at the design stage. Criteria 4 and 5 have not been addressed because the project team have committed to adhering to the best practice guidelines with respect to BREEAM. A 'Building Log Book' and 'User Guide' will be provided, thereby satisfying Criterion 5 in any event. In addition, Criterion 4 covering quality of construction and commissioning will be satisfied as the Contractor will commit to achieving best practice certification under the 'Considerate Constructors Scheme'.

- **Criterion 1**: Target CO_2 emissions rate (TER), requires that the Building CO_2 Emissions Rate (BER) is equal or less than the TER when using pre-determined scenarios and weather data.
- **Criterion 2**: Limits to design flexibility ensure that a minimum level of performance is achieved for the fabric, heating, ventilation and air conditioning (HVAC) systems, and lighting for all buildings and designs.
- **Criterion 3**: Limits to solar gains, assessment to highlight compliance with a reference mean solar gain figure determined through April to September onto an 'East' facing façade with fixed glazing dimensions and solar performance. All façades on Building B3 will need to adhere to the equivalent or less mean solar gain figure predetermined.

The building's Part L2 calculations have been carried out by Hoare Lea. A registered TAS assessor used approved TAS Software to carry out the Part L calculation. TAS complies with the requirements of the Chartered Institution of Building Services Engineers (CIBSE) AM11 as required by BREEAM.
A full three-dimensional thermal model for the building was created in TAS from the architects drawings. Numerous simulations were run to understand and optimise the energy demand, solar gain and heating and cooling power, by studying various options for the design of the façade, glazing type, the level of thermal insulation in the fabric, building systems, etc.

Building Model

The 3D geometry and building construction materials have been modelled based on the architectural plans and elevations. The 3D model describes the building:

- Orientation
- Geometry of building form and all associated exposure of surfaces
- Material constructions
- Windows and glazing
- Surrounding structures.

The 3D geometry has been subdivided into generic zone types as per the National Calculation Method (NCM) requirements.

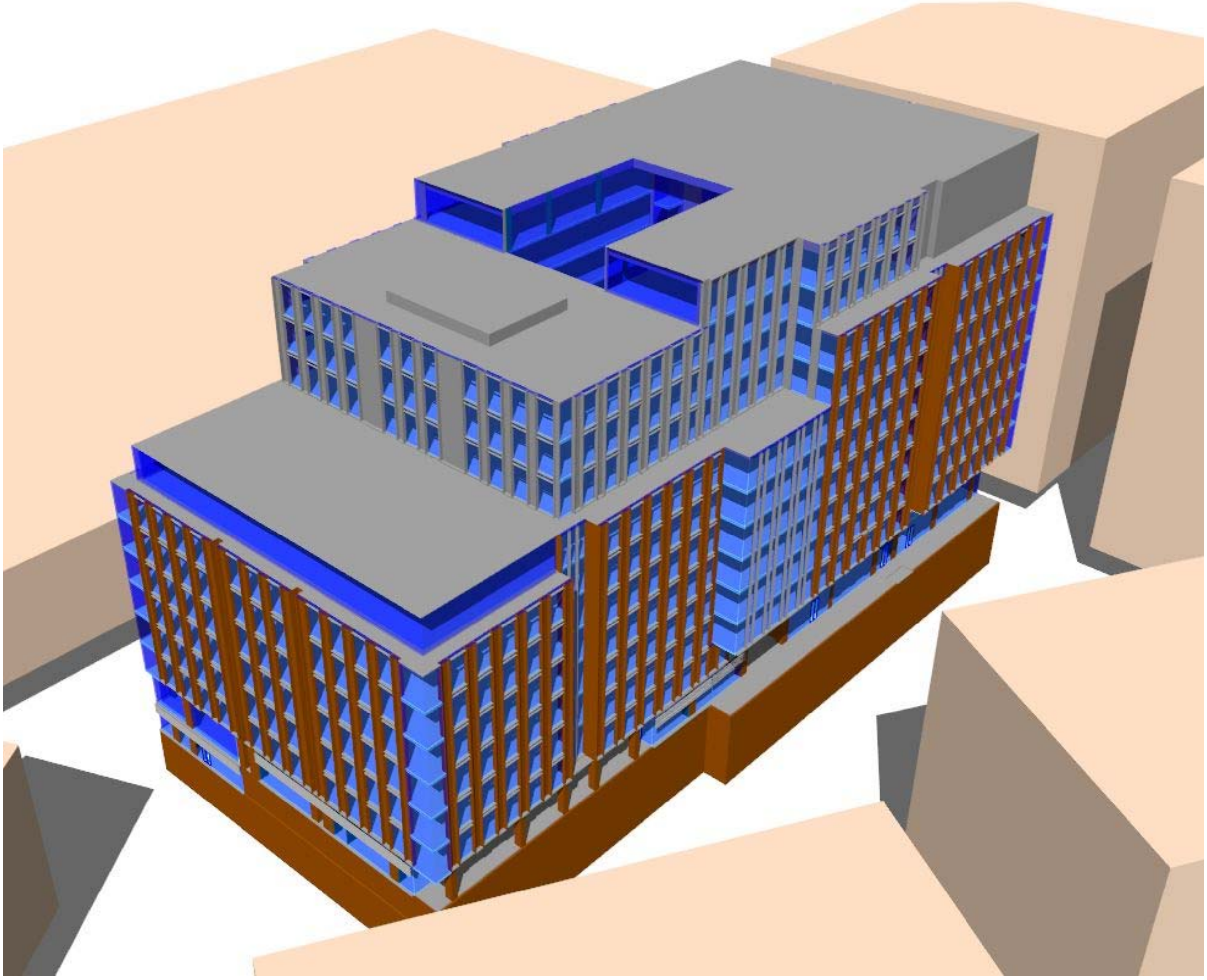


Figure 1: Image of the thermal model from above.

Operational Parameters

Building loads determine the heating and cooling requirements of a building. Generic zone types have been assigned a default NCM Operational Template, taken from the Activity Database, which defines these loads. Each of the NCM Operational Templates applies a fixed set of characteristics including:

- Operational hours and profile
- Occupancy densities and loads
- Minimum ventilation rates
- Small power loads
- Room conditions
- Domestic hot water loads.

Solar loads vary daily and depend on seasonal and weather conditions, and will affect loads which are accounted for in the thermal modelling process, such as solar transmission, conduction and building heat transfer. These are represented in the model by virtue of the weather data file, in this case the CIBSE London Test Reference Year (TRY) data.

Criterion 1 – Achieving the BER

Target CO_2 emissions rate (TER), requires that the Building CO_2 Emissions Rate (BER) is equal or less than the TER when using pre-determined scenarios and weather data.

The carbon emissions of the notional building and subsequent TER were calculated to be 22.7 $kgCO_2/m^2$. The BER for Building B1 was calculated to be 17.8 $kgCO_2/m^2$ per annum. The calculations have assumed the reduced fan power in EC/DC fan coils, as described in section 3.1.3.1 of the Environmental Sustainability Plan and linking to daylight dimming sensors as described in section 3.1.3.6 of the same document, to reflect the daylight levels within the occupied office floor areas.

The building performs better than the TER by approximately 21.5% and complies with the Criterion 1 of the Building Regulations Part L2. Figure 2 below shows this data in graphical form.

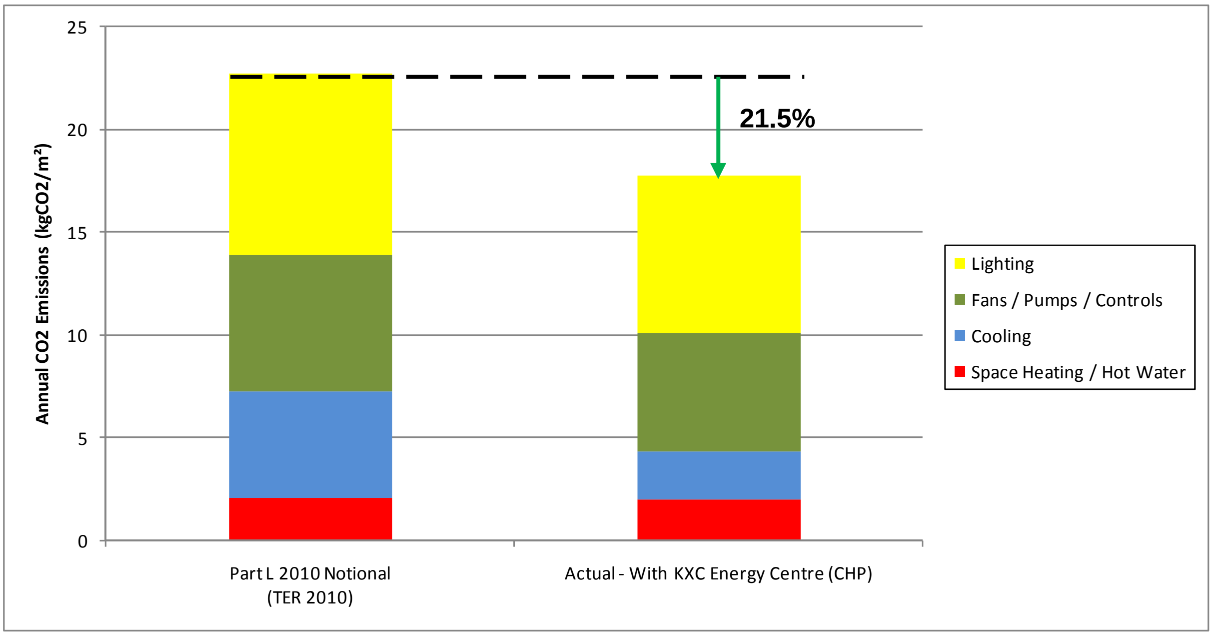


Figure 2:Criterion 1 modelling results for B1 Reduction in CO_2 Below TER

Criterion 2 – Limits on design flexibility

Limits to design flexibility ensure that a minimum level of performance is achieved for fabric, heating, ventilation and air conditioning (HVAC) systems, and lighting for all buildings and designs.

All fabric, fittings, HVAC systems and lighting have been specified with performance better than or equal to the Part-L2 requirements. Building B1 therefore complies with Criterion 2 of the Building Regulations.

Criterion 3 – Limiting the effects of solar gains in the summer

Limits to solar gains, assessment to highlight compliance with a reference mean solar gain figure determined through April to September onto an 'East' facing façade with fixed glazing dimensions and solar performance. All façades on Building B1 will need to adhere to the equivalent or less mean solar gain figure predetermined.

The reference façade is that of a 1m high piece of glazing across the full width of the occupied space. A frame taking up 10% of this window area should also be assumed. The glazing solar performance (g-value) is 0.68. The reference façade is East facing.

Hence, the solar performance of any façade make-up on any orientation of Building B1 will have to better the equivalent mean aggregate solar gain between the months of April and September passing though the reference façade into occupied areas, including retail and display glazing areas.

.
The extensive solar modelling conducted for all of the Building B1 façades, show the resulting mean solar gain to be less than the reference glazing system figure.

Building B1 therefore satisfies Criterion 3 of the Building Regulations Part-L2.

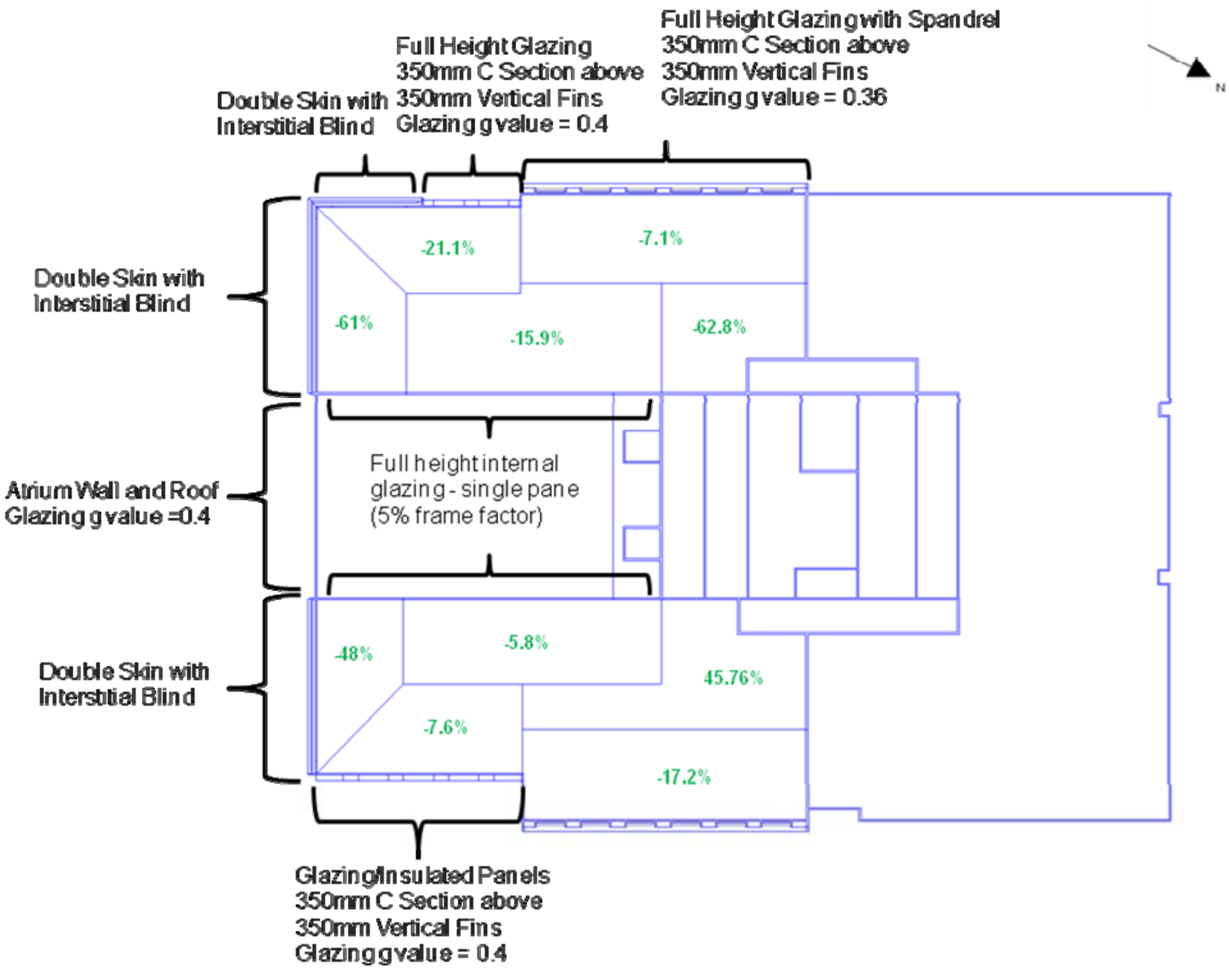


Figure 3: Sample of the B1 solar gain model, showing the typical improvement on criterion 3 for floor level 11 of the building

Appendix B - Building B1 BREEAM pre-assessment

Hoare Lea have prepared this document to highlight those credits which have been sought in order for the King's Cross Central B1 development to achieve an 'Excellent' rating under the BREEAM for Offices 2008 criteria.

The final BREEAM certification report will be produced inline with the credits highlighted within this schedule and sent to the Building Research Establishment for quality assurance checking and accreditation.

BNP PARIBAS REAL ESTATE
PROPERTY DEVELOPMENT UK

KINGS CROSS PLOT B1

BREEAM OFFICES 2008
PRE ASSESSMENT REPORT AND ESTIMATE OF RATING
Rev G

09.09.2011

HOARE LEA
Sustainability

Glen House
200 - 208
Tottenham
Court Road
London W1T 7PL

Tel: 020 7890 2500
Fax: 020 7436 8466

REVISION	DESCRIPTION	DATE	ISSUED BY	REVIEWED BY
A	Issue for comments	23.02.2011	H. Blackwell	T. Lefevre
B	Issue for workshop	07.03.2011	H. Blackwell	T. Lefevre
C	Update from Workshop	10.03.2011	H. Blackwell	T. Lefevre
D	Amended with comments from design team	15.03.2011	H. Blackwell	T. Lefevre
E	Amended with comments from stage C co-ordination meeting	02.06.2011	H. Blackwell	T. Lefevre
F	Amended to account for design changes	18.06.2011	H. Blackwell	T. Lefevre
G	Amended to account for design changes	09.09.2011	H. Blackwell	T. Lefevre

CONTENTS

1.0 BACKGROUND TO BREEAM OFFICES 2008

The aim of BREEAM Offices 2008 is to estimate the sustainability of buildings and to promote a programme of design improvement. BREEAM Offices 2008 is published by the Building Research Establishment (BRE) and information is available at:

http://www.breeam.org/page.jsp?id=109

BREEAM Offices 2008 is based upon several categories. Credits are awarded based upon construction, design and procurement criteria for the assessed area such as:

- MANAGEMENT — Commissioning of building services, Construction site impacts, Building user guide, Security, Considerate contractors;
- HEALTH AND WELLBEING — Daylighting, Glare control, Lighting, Indoor air quality, Thermal zoning, Microbial contamination, Sound insulation;
- ENERGY — Reduction of CO_2 emissions, Metering, Low/zero carbon technologies, Lifts;
- TRANSPORT — Public transport links, Local amenities, Cyclist Facilities, Pedestrian & Cyclist Safety, Travel Plan, Car Parking;
- WATER — Consumption, Metering, Leak detection, Supply shut-off;
- MATERIALS — Responsible sourcing of building materials and environmental impact;
- WASTE — Managing construction and operational waste;
- LAND USE & ECOLOGY — Ecological value, Ecological enhancement, Protection of ecological features, Change in ecological value, Reuse of land;
- POLLUTION — Refrigerant Global Warming Potential (GWP), NO_x emissions, Flood risk, Watercourse pollution;

Mandatory standards apply to the following credits: commissioning, considerate constructors, building user guide, high frequency lighting, microbial contamination, CO_2 emissions, sub-metering of substantial energy uses, low/zero carbon technologies, water consumption, water metering, storage of recycle operational waste and mitigating ecological impact.

This assessment excludes the common access ramp, service tunnel and other areas which form part of the site wide Masterplan and are constructed outside of the client's control by the masterplan developer Argent. Where relevant site wide systems contribute to the assessed area (e.g. the proportion of energy and NOx emissions from the Masterplan energy centre) these are considered for relevant credits.

Failure to meet the mandatory criteria may restrict a development to an UNCLASSIFIED rating, regardless of the overall number of credits achieved.

The mandatory requirements are outlined in Table 1.

Table 1: Minimum score and mandatory requirements for BREEAM Offices 2008 ratings						
BREEAM Rating		**Pass**	**Good**	**Very Good**	**Excellent**	**Outstanding**
MINIMUM SCORE REQUIRED		30%	45%	55%	70%	85%+
Section	**Credit required**					
MANAGEMENT	Commissioning	At completion	At completion	At completion	At completion	At completion AND seasonal
	Considerate Constructors Scheme	-	-	-	Score ≥ 24	Score ≥ 32
	Building User Guide	-	-	-	YES	YES
HEALTH & WELL-BEING	High-frequency lighting	YES	YES	YES	YES	YES
	Minimisation of risk of microbial contamination	YES	YES	YES	YES	YES
ENERGY	CO_2 index and EPC rating	-	-	-	CO_2 index ≤ 40	CO_2 index ≤ 25
	Sub-metering of substantial energy uses	-	-	YES	YES	YES
	Low and zero carbon technologies feasibility study	-	-	-	YES	YES
WATER	Max. water consumption	-	4.5 – 5.5m^3 per person	4.5 – 5.5m^3 per person	4.5 – 5.5m^3 per person	1.5 – 4.4m^3 per person
	Metering (pulsed output meter linked to BMS)	-	YES	YES	YES	YES
WASTE	Storage of recyclable waste	-	-	-	YES	YES
LAND USE & ECOLOGY	Mitigating ecological impact	-	-	Minimal change in the site's existing ecological value	Minimal change in the site's existing ecological value	Minimal change in the site's existing ecological value

Credits obtained in each section (e.g. Waste, Energy etc) have a weighting factor applied to reflect the relative importance of each section. The largest weighting factor is for the ENERGY section, which means that this is the section where the largest number of credits is available. In addition, the value of 1 credit in each section is also important in order to achieve a high BREEAM rating. The weightings and scoring values are in the table below, which shows that credits in the MANAGEMENT section are most valuable in terms of the BREEAM rating, as they have the highest 'Value of 1 credit', while ENERGY credits have the least.

Table 2: Credit weighting and value of 1 credit in each category

SECTION	SECTION WEIGHTING	NO. OF CREDITS AVAILABLE	VALUE OF 1 CREDIT
Management	12%	10	**1.20%**
Health and Wellbeing	15%	13	**1.15%**
Energy	19%	24	**0.79%**
Transport	8%	10	**0.80%**
Water	6%	6	**1.00%**
Materials	13 %	13	**0.96%**
Waste	8%	7	**1.07%**
Land Use and Ecology	10%	10	**1.00%**
Pollution	10%	12	**0.83%**
Innovation	10%	10	**1.00%**

2.0 ASSESSED RATING BREAKDOWN

The credits targeted to achieve a rating of Excellent are shown in the score breakdown below.

Table 3: Credit Allocation

Overall Credit Allocation	Mandatory elements achieved	Value of 1 credit	No. Credits Available	No. CREDITS Targeted	Percentage of Available Credits Targeted	Overall Weighted POINTS score
Management	✓	1.20%	10.00	10.00	100.00%	12.00%
Health and Wellbeing	✓	1.15%	13.00	10.00	76.92%	11.54%
Energy	✓	0.79%	24.00	13.00	54.17%	10.29%
Transport		0.80%	10.00	10.00	100.00%	8.00%
Water	✓	1.00%	6.00	5.00	83.33%	5.00%
Materials		0.96%	13.00	8.00	61.54%	7.69%
Waste	✓	1.07%	7.00	6.00	85.71%	6.43%
Land Use and Ecology	✓	1.00%	10.00	7.00	70.00%	7.00%
Pollution		0.83%	12.00	9.00	75.00%	7.50%
Innovation		1.00%	10.00	3.00	30.00%	3.00%
					Total	**78.45%**

A score of 78.45% and the achievement of the relevant mandatory credits is equivalent to a BREEAM Offices 2008 "Excellent" rating, with a safety margin of 8.45% over the minimum required score of 70%.

3.0 CREDIT ASSESSMENTS

CATEGORY 1 MANAGEMENT				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Man 1 **Mandatory:** **1 at any level** **2 for Excellent** Status of Mandatory Elements	**Commissioning**	**One Credit:** Where evidence provided demonstrates that an appropriate project team member has been appointed to monitor commissioning on behalf of the client to ensure commissioning will be carried out in line with current best practice. **Two Credits:** Where, in addition to the above, evidence provided demonstrates that seasonal commissioning will be carried out during the first year of occupation, post construction (or post fit out).	2	**2**
	Responsible Party: **Gleeds (prelims) / Contractor / Hoare Lea**			
Man 2 **Mandatory Elements** Status of Mandatory Elements	**Considerate Constructors**	**One credit:** Where evidence provided demonstrates that there is a commitment to comply with best practice site management principles (achieving a score of between 24 and 31.5 under the Considerate Constructors Scheme. **Second credit:** Where evidence provided demonstrates that there is a commitment to go beyond best practice site management principles (achieving between 32 and 35.5 under the Scheme),	2	**2**
	Responsible Party: **Gleeds (prelims) / Contractor**			

CATEGORY 1 MANAGEMENT				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Man 3	**Construction Site Impacts**	**One credit:** Where evidence provided demonstrates that 2 or more of items a-g (listed below) are achieved.. **Two credits:** Where evidence provided demonstrates that 4 or more of items a-g (listed below) are achieved. **Three credits:** Where evidence provided demonstrates that 6 or more of items a-g are achieved: a. Monitor, report and set targets for CO_2 or energy arising from site activities b. Monitor, report and set targets for CO_2 or energy arising from transport to and from site c. Monitor, report and set targets for water consumption arising from site activities d. Implement best practice policies in respect of air (dust) pollution arising from the site e. Implement best practice policies in respect of water (ground and surface) pollution occurring on the site f. Main contractor has an environmental materials policy, used for sourcing of construction materials to be utilised on site g. Main contractor operates an Environmental Management System. **One extra credit:** Where evidence provided demonstrates that at least 80% of site timber is responsibly sourced and 100% is legally sourced.	4	**4**
	Responsible Party: **Gleeds (prelims) / Contractor**			

CATEGORY 1 MANAGEMENT

Issue ID	Description	Compliance Status	Credits Available	Assessed Score
Man 4 **Mandatory Elements** Status of Mandatory Elements ✓	**Building User Guide**	Where evidence provided demonstrates the provision of a simple guide that covers information relevant to the tenant/occupants and non-technical building manager on the operation and environmental performance of the building.	1	**1**
	Responsible Party: **Hoare Lea**			
Man 8	**Security**	Where evidence provided demonstrates that an Architectural Liaison Officer (ALO) or Crime Prevention Design Advisor (CPDA) from the local police force has been consulted at the design stage and their recommendations incorporated into the design of the building and its parking facilities (if relevant).	1	**1**
	Responsible Party: **Wilmotte / Adamson**			

CATEGORY 2 HEALTH AND WELLBEING				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Hea 1	**Daylighting**	Where evidence provided demonstrates that at least 80% of floor area in each occupied space is adequately daylit.	1	**0**
	Responsible Party: **Hoare Lea**			
Hea 2	**View Out**	Where evidence provided demonstrates that all relevant building areas have an adequate view out.	1	**1**
	Responsible Party: **Wilmotte**			
Hea 3	**Glare Control**	Where evidence provided demonstrates that an occupant-controlled shading system (e.g. internal or external blinds) is fitted in relevant building areas.	1	**1**
	Responsible Party: **Wilmotte / Adamson**			
Hea 4 **Mandatory Elements** Status of Mandatory Elements ✓	**High Frequency Lighting**	Where evidence provided demonstrates that high frequency ballasts are installed on all fluorescent and compact fluorescent lamps.	1	**1**
	Responsible Party: **Hoare Lea**			
Hea 5	**Internal & External Lighting Levels**	Where evidence provided demonstrates that all internal and external lighting, where relevant, is specified in accordance with the appropriate maintained illuminance levels (in lux) recommended by CIBSE	1	**1**
	Responsible Party: **Hoare Lea**			

CATEGORY 2	**HEALTH AND WELLBEING**			
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Hea 6	**Lighting Zones & Controls**	Where evidence provided demonstrates that, in all relevant building areas, lighting is appropriately zoned and occupant controllable.	1	**0.5**
	Responsible Party: **Hoare Lea / Gleeds (costing)**			
Hea 7	**Potential for Natural Ventilation**	Where evidence provided demonstrates that fresh air is capable of being delivered to the occupied spaces of the building via a natural ventilation strategy, and there is sufficient user-control of the supply of fresh air.	1	**0**
	Responsible Party: **-**			
Hea 8	**Indoor Air Quality**	Where air intakes serving occupied areas avoid major sources of external pollution and recirculation of exhaust air.	1	**1**
	Responsible Party: **Wilmotte / Adamson / Hoare Lea**			
Hea 9	**Volatile Organic Compounds**	Where evidence provided demonstrates that the emissions of VOCs and other substances from key internal finishes and fittings comply with best practice levels.	1	**1**
	Responsible Party: **Wilmotte / Adamson**			
Hea 10	**Thermal Comfort**	Where evidence provided demonstrates that thermal comfort levels in occupied spaces of the building are assessed at the design stage to evaluate appropriate servicing options, ensuring appropriate thermal comfort levels are achieved.	1	**1**
	Responsible Party: **Hoare Lea**			
Hea 11	**Thermal Zoning**	Where evidence provided demonstrates that local occupant control is available for temperature adjustment in each occupied space to reflect differing user demands.	1	**0.5**
	Responsible Party: **Hoare Lea**			

CATEGORY 2 HEALTH AND WELLBEING				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Hea 12 **Mandatory Elements** Status of Mandatory Elements ✓	**Microbial Contamination**	Where evidence provided demonstrates that the risk of waterborne and airborne legionella contamination has been minimised.	1	**1**
	Responsible Party: **Hoare Lea**			
Hea 13	**Acoustic Performance**	Where evidence provided demonstrates that the building achieves appropriate indoor ambient noise levels in offices areas.	1	**1**
	Responsible Party: **Hoare Lea Acoustics**			

CATEGORY 3 ENERGY

Issue ID	Description	Compliance Status	Credits Available	Assessed Score
Ene 1 **Mandatory Elements** Status of Mandatory Elements ✓	**Reduction of CO_2 Emissions**	**Up to 15 credits available:** Where evidence provided demonstrates an improvement in the energy efficiency of the building's fabric and services and therefore achieves lower building operational related CO_2 emissions. The number of credits achieved is determined according to the building's CO_2 Index (which determines the Energy Performance Certificate (EPC) rating). A minimum of 6 credits must be achieved for an "Excellent" rating, and a minimum of 10 for an 'Outstanding' rating. **1 credit:** CO_2 index < 63 **2 credits:** CO_2 index < 53 **3 credits:** CO_2 index < 47 **4 credits:** CO_2 index < 45 **5 credits:** CO_2 index < 43 **6 credits:** CO_2 index < 40 **7 credits:** CO_2 index < 37 **8 credits:** CO_2 index < 31 **9 credits:** CO_2 index < 28 **10 credits:** CO_2 index < 25 **11 credits:** CO_2 index < 23 **12 credits:** CO_2 index < 20 **13 credits:** CO_2 index < 18 **14 credits:** CO_2 index < 10 **15 credits:** CO_2 index < 0	15	**6**
	Responsible Party: **Hoare Lea**			

CATEGORY 3 ENERGY				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Ene 2 **Mandatory Elements** Status of Mandatory Elements ✓	**Sub-metering of Substantial Energy Uses**	Where evidence provided demonstrates the provision of direct sub-metering of energy uses within the building.	1	**1**
	Responsible Party: **Hoare Lea**			
Ene 3	**Sub-metering of High Energy Load & Tenancy Areas**	Where evidence provided demonstrates sub-metering of energy consumption by tenancy/building function area is installed within the building.	1	**1**
	Responsible Party: **Hoare Lea / Gleeds (costing)**			
Ene 4	**External Lighting**	Where energy-efficient external lighting is specified and all light fittings are controlled for the presence of daylight.	1	**1**
	Responsible Party: **Hoare Lea**			

CATEGORY 3 ENERGY				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Ene 5 ⚠ **Mandatory Elements** Status of Mandatory Elements ✓	**Low or Zero Carbon Technologies**	**One credit:** Where evidence provided demonstrates that a feasibility study considering local (on-site and/or near site) low or zero carbon (LZC) technologies has been carried out and the results implemented. **Two credits:** Where evidence provided demonstrates that the first credit has been achieved and there is a 10% reduction in the building's CO_2 emissions as a result of the installation of a feasible local LZC technology. **Three credits:** Where evidence provided demonstrates that the first credit has been achieved and there is a 15% reduction in the building's CO_2 emissions as a result of the installation of a feasible local LZC technology.	3	**1**
	Responsible Party: **Hoare Lea / Gleeds (costing)**			
Ene 8	**Lifts**	**Up to 2 credits can be awarded:** Up to two credits are available where evidence provided demonstrates the installation of energy-efficient lift(s).	2	**2**
	Responsible Party: **Hoare Lea Vertical Transportation**			
Ene 9	**Escalators and Travelling walkways**	Where each escalator and/or horizontal travelling walkway complies with either the following: a) Is fitted with a load sensing device that synchronises motor output to passenger demand through a variable speed drive b) Is fitted with a passenger sensing device for automated operation, so the escalator operates in stand-by mode when there is no passenger demand.	1	**1**
	Responsible Party: **Hoare Lea Vertical Transportation**			

CATEGORY 4 TRANSPORT				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Tra 1	**Provision of Public Transport**	**Up to 3 credits can be awarded:** The credits are awarded on a sliding scale based on the assessed buildings' accessibility to the public transport network.	3	**3**
	Responsible Party: **Argent Group / Wilmotte / Adamson**			
Tra 2	**Proximity to Amenities**	Where evidence provided demonstrates that the building is located within 500m of accessible local amenities appropriate to the building type and its users.	1	**1**
	Responsible Party: **Wilmotte / Adamson**			
Tra 3	**Cyclist Facilities**	**One credit:** Where evidence provided demonstrates that covered, secure and well-lit cycle storage facilities are provided for all building users. **Two credits:** Where, in addition to the above, adequate changing facilities are provided for staff use	2	**2**
	Responsible Party: **Wilmotte / Adamson**			
Tra 4	**Pedestrian and Cyclist Safety**	Where evidence provided demonstrates that the site layout has been designed in accordance with best practice to ensure safe and adequate pedestrian and cycle access.	1	**1**
	Responsible Party: **Wilmotte / Adamson**			
Tra 5	**Travel Plan**	Where evidence provided demonstrates that a travel plan has been developed and tailored to the specific needs of the building users.	1	**1**
	Responsible Party: **Argent Group / Wilmotte / Adamson**			
Tra 6	**Maximum Car Parking Capacity**	**Up to 2 credits can be awarded:** Where evidence provided demonstrates that the number of parking spaces provided for the building has been limited.	2	**2**
	Responsible Party: **Wilmotte / Adamson**			

CATEGORY 5 WATER

Issue ID	Description	Compliance Status	Credits Available	Assessed Score
Wat 1 Mandatory Elements Status of Mandatory Elements ✓	**Water Consumption**	**Up to 3 credits can be awarded:** Where evidence provided demonstrates that the specification includes taps, urinals, WCs and showers that consume less potable water in use than standard specifications for the same type of fittings. The credits are awarded as follows: · 1 credit where consumption is 4.5 - 5.5m^3 per person per year · 2 credits where consumption is 1.5 - 4.4 m^3 per person per year · 3 credits where consumption is <1.5 m^3 per person per year	3	**2**
	Responsible Party: **Hoare Lea / Wilmotte / Adamson / Gleeds (costing)**			
Wat 2 Mandatory Elements Status of Mandatory Elements ✓	**Water Meter**	Where evidence provided demonstrates that a water meter with a pulsed output will be installed on the mains supply to each building/unit.	1	**1**
	Responsible Party: **Hoare Lea / Gleeds (costing)**			
Wat 3	**Major Leak Detection**	Where evidence provided demonstrates that a leak detection system is specified or installed on the buildings water supply.	1	**1**
	Responsible Party: **Hoare Lea**			
Wat 4	**Sanitary Supply Shut-Off**	Where evidence provided demonstrates that proximity detection shut-off is provided to the water supply to all toilet areas.	1	**1**
	Responsible Party: **Hoare Lea**			

CATEGORY 6 MATERIALS				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Mat 1	**Materials Specification (Major Building Elements)**	Up to four credits are available, determined by the Green Guide to Specification ratings for the major building elements. No exemplar credits have been included	4	**2**
	Responsible Party: **Wilmotte / Adamson**			
Mat 2	**Hard Landscaping and Boundary Protection**	Where evidence provided demonstrates that at least 80% of the combined area of external hard landscaping and boundary protection specifications achieve an A or A+ rating, as defined by the Green Guide to Specification.	1	**1**
	Responsible Party: **Wilmotte / Adamson**			
Mat 3	**Reuse of Building Facade**	Where evidence provided demonstrates that at least 50% of the total final façade (by area) is reused in situ and at least 80% of the reused façade (by mass) comprises in-situ reused material.	1	**0**
	Responsible Party: **-**			
Mat 4	**Reuse of Building Structure**	Where evidence provided demonstrates that a design reuses at least 80% of an existing primary structure and, for part refurbishment and part new build, the volume of the reused structure comprises at least 50% of the final structure's volume.	1	**0**
	Responsible Party: **-**			

CATEGORY 6 MATERIALS				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Mat 5	**Responsible Sourcing of Materials**	**Up to 3 credits can be awarded:** where evidence provided demonstrates that 80% of the assessed materials in the following building elements are responsibly sourced: a. Structural Frame b. Ground floor c. Upper floors (including separating floors) d. Roof e. External walls f. Internal walls g. Foundation/substructure h. Staircase Additionally 100% of any timber must be legally sourced	3	**2**
	Responsible Party: **Gleeds (prelims) / Wilmotte / Adamson / AKT / Contractor**			
Mat 6	**Insulation**	**One credit:** Where evidence provided demonstrates that thermal insulation products used in the building have a low embodied impact relative to their thermal properties, determined by the Green Guide to Specification ratings. **One credit:** Where evidence provided demonstrates that thermal insulation products used in the building have been responsibly sourced.	2	**2**
	Responsible Party: **Gleeds (prelims) / Wilmotte / Adamson / Hoare Lea**			
Mat 7	**Designing for Robustness**	Where protection is given to vulnerable parts of the building such as areas exposed to high pedestrian traffic, vehicular and trolley movements.	1	**1**
	Responsible Party: **Wilmotte / Adamson / AKT**			

CATEGORY 7 WASTE				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Wst 1	**Construction Site Waste Management**	Where evidence provided demonstrates that the amount of non-hazardous construction waste ($m^3/100m^2$ or tonnes$100m^2$) generated on site by the development is the same as or better than good or best practice levels: **1 credit:** Amount of waste generated per 100 m^2 gross internal floor area: 13.0 – 16.6 m^3 / 6.6 – 8.5 tonnes **2 credits:** Amount of waste generated per 100 m^2 gross internal floor area: 9.2 – 12.9 m^3 / 4.7 – 6.5 tonnes **3 credits:** Amount of waste generated per 100 m^2 gross internal floor area: < 9.2 m^3 / < 4.7 tonnes **1 additional credit:** Where evidence provided demonstrates that a significant majority of non-hazardous construction waste generated by the development will be diverted from landfill and reused or recycled.	4	**3**
	Responsible Party: **Gleeds (prelims) / Contractor**			
Wst 2	**Recycled Aggregates**	Where evidence provided demonstrates the significant use of recycled or secondary aggregates in 'high-grade' building aggregate uses.	1	**1**
	Responsible Party: **AKT**			

CATEGORY 7 WASTE

Issue ID	Description	Compliance Status	Credits Available	Assessed Score
Wst 3 Mandatory Elements Status of Mandatory Elements ✓	**Recyclable Waste Storage**	Where a central, dedicated space is provided for the storage of the building's recyclable waste streams. The space should be: a. Clearly labelled for recycling b. Placed within accessible reach c. In a location with good vehicular access to facilitate collections. The size of the space allocated must be adequate to store the likely volume of recyclable materials generated by the building's occupants/operation (i.e. at least $2m^2$ per $1000m^2$ of net floor area for buildings < $5000m^2$).	1	**1**
	Responsible Party: **Wilmotte / Adamson**			
Wst 6	**Floor Finishes**	Where carpets and other floor finishes are specified by the future occupant or, in tenanted areas of speculative buildings, where carpets or floor finishes are installed in a limited show area only.	1	**1**
	Responsible Party: **BNP Paribas Real Estate Property Development UK**			

CATEGORY 8 LAND USE AND ECOLOGY				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
LE1	**Reuse of Land**	Where evidence is provided to demonstrate that the majority of the footprint of the proposed development falls within the boundary of previously developed land.	1	**1**
	Responsible Party: **Wilmotte / Adamson**			
LE2	**Contaminated Land**	Where evidence is provided to demonstrate that the land used for the new development has, prior to development, been defined as contaminated and adequate remedial steps have been taken to decontaminate the site prior to construction.	1	**1**
	Responsible Party: **Arcadis (information from Argent Group, BNP Paribas Real Estate Property Development UK to supervise)**			
LE3	**Ecological Value of Land & Protection of Ecological Features**	Where evidence provided demonstrates that the site's construction zone is defined as land of low ecological value and all existing features of ecological value will be fully protected from damage during site preparation and construction works.	1	**1**
	Responsible Party: **RPS (information from Argent Group, BNP Paribas Real Estate Property Development UK to supervise)**			
LE4 ⚠ **Mandatory Elements** Status of Mandatory Elements ✓	**Mitigating Ecological Impact**	**One credit:** Where evidence provided demonstrates that the change in the site's existing ecological value, as a result of development, is minimal. **Two credits:** Where evidence provided demonstrates that there is no negative change in the site's existing ecological value as a result of development.	2	**2**
	Responsible Party: **Ecologist / Willmotte /Adamson**			

CATEGORY 8 LAND USE AND ECOLOGY				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
LE5	**Enhancing Site Ecology**	**One credit:** Where the design team (or client) has appointed a suitably qualified ecologist to advise and report on enhancing and protecting the ecological value of the site; and implemented the professional's recommendations for general enhancement and protection of site ecology works. **Two credits:** Where there is a positive increase in the ecological value of the site of up to (but not including) 6 species. **Three credits:** Where there is a positive increase in the ecological value of the site of 6 species or greater	3	**1**
	Responsible Party: **Ecologist / Willmotte /Adamson**			
LE6	**Long Term Impact on Biodiversity**	**One credit:** The client has committed to achieving the mandatory requirements as listed in the BREEAM guidance and at least two of the additional requirements. **Two credits:** The client has committed to achieving the mandatory requirements and at least four of the additional requirements.	2	**1**
	Responsible Party: **Ecologist / Contractor / Gleeds (Prelims & Costing)**			

CATEGORY 9 POLLUTION

Issue ID	Description	Compliance Status	Credits Available	Assessed Score
Pol 1	**Refrigerant GWP**	Where evidence provided demonstrates the use of refrigerants with a global warming potential (GWP) of less than 5 or where there are no refrigerants specified for use in building services.	1	**0**
	Responsible Party: **-**			
Pol 2	**Preventing Refrigerant Leaks**	**One credit:** Where evidence provided demonstrates that refrigerant leaks can be detected or where there are no refrigerants specified for the development. **Two credits:** Where evidence provided demonstrates that the provision of automatic refrigerant pump down is made to a heat exchanger (or dedicated storage tanks) with isolation valves. OR where there are no refrigerants specified for the development.	2	**1**
	Responsible Party: **Hoare Lea**			
Pol 4	**NOx Emissions from Heating Source**	**One credit:** Where evidence provided demonstrates that the maximum dry NOx emissions from delivered space heating energy are <100 mg/kWh (at 0% excess O_2) OR **Two credits:** for <70 mg/kWh (at 0% excess O_2) OR **Three credits** for <40 mg/kWh (at 0% excess O_2).	3	**3**
	Responsible Party: **Hoare Lea / Argent Group**			

CATEGORY 9 POLLUTION				
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Pol 5	**Flood Risk**	Where evidence provided demonstrates that the assessed development is located in a zone defined as having a low annual probability of flooding. **One credit:** Where evidence provided demonstrates that the assessed development is located in a zone defined as having a medium or high annual probability of flooding AND the ground level of the building, car parking and access is above the design flood level for the site's location **One further credit:** Where evidence provided demonstrates that surface water run-off attenuation measures are specified to minimise the risk of localised flooding, resulting from a loss of flood storage on site due to development.	3	**2**
	Responsible Party: **Argent Group / AKT**			
Pol 6	**Minimising Watercourse Pollution**	Where evidence provided demonstrates that effective on site treatment such as Sustainable Drainage Systems (SUDs) or oil separators have been specified in areas that are or could be a source of watercourse pollution.	1	**1**
	Responsible Party: **AKT / Gleeds (costing)**			
Pol 7	**Reduction of Night Time Light Pollution**	Where evidence provided demonstrates that the external lighting design is in compliance with the guidance in the Institution of Lighting Engineers (ILE) Guidance notes for the reduction of obtrusive light, 2005.	1	**1**
	Responsible Party: **Hoare Lea**			
Pol 8	**Noise Attenuation**	Where evidence provided demonstrates that new sources of noise from the development do not give rise to the likelihood of complaints from existing noise sensitive premises and amenity or wildlife areas that are within the locality of the site.	1	**1**
	Responsible Party: **Hoare Lea**			

CATEGORY 10	**INNOVATION AND EXEMPLARY CREDITS**			
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Inn – Man2	**Considerate Constructors**	Where post construction, a Considerate Constructors Scheme certificate can be provided demonstrating that the site achieved CCS Code of Considerate Practice with a score of at least 36. OR Where post construction, the site has complied in full with the alternative, independently assessed scheme, and the alternative scheme addresses all the mandatory and optional items in Checklist A2.	1	**1**
	Responsible Party: **Gleeds (prelims) This credit is to be targeted by the principal contractor**			
Inn – Hea1	**Daylighting**	At least 80% of the floor area (for the building spaces/room identified above in the standard requirements) has an average daylight factor of 3% in multi-storey buildings and 4% in single-storey buildings.	1	**0**
	Responsible Party: **-**			
Inn – Ene1	**Reduction of CO2 emissions**	One additional innovation credit can be awarded where evidence provided demonstrates the building is designed to be a carbon neutral building as defined by the NCM (i.e. in terms of building services energy demand). Two additional innovation credits can be awarded where evidence provided demonstrates the building is designed to be a True zero carbon building (in terms of building services and operational energy demand).	3	**0**
	Responsible Party: **-**			
Inn – Ene5	**Ene 5: Low or Zero Carbon Technologies**	A local LZC energy technology has been installed in line with the recommendations of a compliant feasibility study and this method of supply results in a 20% reduction in the building's CO_2 emissions.	1	**0** **(+1 potential)**
	Responsible Party: **Hoare Lea / Gleeds (costing)**			

CATEGORY 10	INNOVATION AND EXEMPLARY CREDITS			
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Inn – Wat2	**Water Meter**	Where sub meters are fitted to allow individual water-consuming plant or building areas to be monitored such as cooling towers, car washes, catering areas, etc. If the building does not have any major water consuming plant this exemplar credit is not available. Each sub meter has a pulsed output to enable connection to a Building Management System (BMS) for the monitoring of water consumption. ***Note: If there are only small water consuming units used within the building such as singular toilets, small kitchen etc, the exemplary credit is not available.***	1	**0** **(+1 potential)**
	Responsible Party: **Hoare Lea / Gleeds (costing)**			
Inn – Mat1	**Materials Specification**	One exemplary BREEAM credit can be awarded as follows: a. Where assessing four or more applicable building elements, the building achieves at least two points additional to the total points required to achieve maximum credits under the standard BREEAM requirements. OR b. Where assessing fewer than four applicable building elements, the building achieves at least one point additional to the total points required to achieve maximum credits under the standard BREEAM requirements.	1	**0**
	Responsible Party: **-**			
Inn – Mat5	**Responsible Sourcing of Materials**	Where, in addition to the standard BREEAM requirements, 95% of the applicable materials, comprised within the applicable building elements, have been responsibly sourced.	1	**0**
	Responsible Party: **-**			

CATEGORY 10	INNOVATION AND EXEMPLARY CREDITS			
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Inn – Wst1	**Construction Site Waste Management**	Where non-hazardous construction waste generated by the building's development meets or exceeds the resource efficiency benchmark required to achieve three credits (as outlined in the guidance). Where at least 90% by weight (80% by volume) of non-hazardous construction waste and 95% of demolition waste by weight (85% by volume) (if applicable) generated by the build has been diverted from landfill and either: a. Reused on site (in-situ or for new applications) b. Reused on other sites c. Salvaged/reclaimed for reuse d. Returned to the supplier via a 'take-back' scheme e. Recovered from site by an approved waste management contractor and recycled. Where all key waste groups are identified for diversion from landfill at pre-construction stage SWMP.	1	**0**
	Responsible Party: **-**			
Inn – BREEAM AP	**BREEAM Accredited Professional / Suitably Qualified Assessor**	Up to two credits are available for the comprehensive use of a BREEAM Accredited Professional (AP) or Suitably Qualified BREEAM Assessor (SQA) throughout project work stages: **First credit** 1. BREEAM performance objectives are agreed, (and must be achieved at final certification) no later than the end of the design brief stage (e.g. RIBA Stage B or equivalent procurement stage). 2. The appointed BREEAM Accredited Professional or SQA is given the opportunity to attend key design team meetings held from the start of RIBA Stage B (Design Brief) up to and including Stage E (Technical Design) or equivalent, and is to be included on the circulation list for minutes from all meetings. 3. A Design stage assessment report is submitted to BRE for interim certification. **Second credit** 4. The first credit is achieved. 5. The project is reviewed against BREEAM performance objectives by the appointed BREEAM AP or SQA no later than the end of the Pre-Construction stage (e.g. RIBA Stage H (Tender Action) or equivalent procurement stage). 6. The appointed BREEAM AP or SQA is given the opportunity to attend key design team meetings held from the start of RIBA Stage F (Production Information) up to and including Stage K (Construction to Practical Completion) or equivalent, and is to be included on the circulation list for minutes from all meetings. 7. A Post Construction stage assessment report is submitted to BRE for final certification.	2	**2**
	Responsible Party: **Hoare Lea**			

CATEGORY 10	INNOVATION AND EXEMPLARY CREDITS			
Issue ID	**Description**	**Compliance Status**	**Credits Available**	**Assessed Score**
Inn	**Innovation Credits**	Where the design team identifies or develops a particular feature, system or process recognised which is "innovative", and this is registered with BRE as an additional credit. There is an administrative fee of £1000 for this, payable to BRE. Note that the maximum number of "exemplary" plus "approved" innovation credits that can be awarded is 10, so if all 9 exemplary credits are achieved, there is only scope to achieve one additional "approved" credit. Measures are eligible for approved innovation credits where the feature, system or process aims to reduce the building's impact on one of the following overarching environmental/social issues: ▪ Mineral Resource Depletion ▪ Fossil Fuel Depletion ▪ Acidification ▪ Climate Change ▪ Nuclear Waste ▪ Stratospheric Ozone Depletion ▪ Eco-toxicity ▪ Eutrophication ▪ Human Toxicity ▪ Photochemical Ozone Creation (Summer Smog) ▪ Waste Disposal ▪ Water Use ▪ Deforestation ▪ Urban Sprawl ▪ Reduction of Biodiversity ▪ Noise and Nuisance ▪ Loss of Heritage ▪ Indoor comfort ▪ Health and Safety ▪ Access and Inclusion	10	**0**
	Responsible Party: **(ALL)**			

BNP PARIBAS REAL ESTATE | Real Estate for a changing world

BNP Paribas Real Estate Property Development
5 Aldermanbury Square
London EC2V 7BP
Tel : +44 (0) 207 338 4840
PA: +44 (0) 207 430 4136
Mob : +44(0) 7909 004652
realestate.bnpparibas.co.uk