Environmental Sustainability Plan

Building P2

King's Cross Central
General Partner Ltd

May 2018

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KXC Building P2

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King's Cross Central General Partner Ltd

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Glossary

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)
CO2	Carbon Dioxide
DE	District Energy
DHW	Domestic Hot Water
ESCO	Energy Service Company
GREEN GUIDE	The 'Building Research Establishments Green Guide to Specification (3rd Edition)
GLA	Greater London Authority
LTHW	Low Temperature, Hot Water
MSCB	Multi Service Chilled Beams
PV	Photovoltaic Cells/Panels
S106	Deed of Planning Obligations Pursuant to Section 106 of the Town and Country Planning Act 1990
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.)

This plan should be read in the context of the other plans and documents forming the Building P2 submissions, including the Urban Design Report, the Planning Compliance Report and the BREEAM Pre-assessment, the latter being included within Appendix B of this document.

Executive Summary

Introduction

This Environmental Sustainability Plan describes the strategies that have been included within the design of Building P2 in response to the planning conditions of the King's Cross Central ('KXC') outline planning permissions (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 60 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 AA, Y and Z of the KXC Section 106 Agreement will be met.

This Plan should be read in the context of the other plans and documents forming the Building P2 submissions, including the Urban Design Report, the Planning Compliance Report and BREEAM pre-assessment, the latter being included within this document in the Appendix.

Executive Summary

Building P2 is located within Development Zone P within the King's Cross Central (KXC) development. Plot P2 is located in the north of the King's Cross Central ('KXC') development site. It is bounded by Lewis Cubitt Square and the Western Transit Shed to the east, Building S2, Lewis Cubitt Park and Building R1 to the north and north east, Building P1 to the west, and the heritage Coal Drops Yard ('CDY') and Gasholder Triplets buildings to the south and south west.

The proposed Building P2 is a ten-storey office building with retail and theatre at ground levels. It is formed of a unifying light pre-cast concrete frame, with inset glazing surrounded by contrasting midnight blue frames and spandrels at upper levels, and glazed oriel bays interspersed with concrete ribbed panels with benches and various entrances at ground floor. A large, wrap around terrace is proposed at Level 5, whilst inset terraces (loggias) punctuate a facade with strong horizontal and vertical emphasis, to respond to the surrounding buildings and in particular to the adjacent Lewis Cubitt Square.

The proposed Building P2 will target a high standard of sustainability. As the predominant usage of the building is as an office, it will be registered under the BREEAM New Construction Offices 2014 scheme, and will aim to achieve a minimum rating of 'Excellent', with an aspirational target of 'Outstanding'.

The design of the development could result in an annual carbon reduction of 37% over the Part L Target Emission Rate through a combination of passive design measures, energy efficient systems and the use of low carbon heating and cooling from the King's Cross district networks.

In summary, the main environmental and sustainability measures that are provided in this report to address the requirements of Condition 17 of the Outline Planning Permission for the site, and the relevant obligations of the associated S106 Agreement with reference to 2004/2307/P. These include, but are not limited to the following:

Condition 17(A) Energy efficiency measures

- Passive design features will be prioritised to reduce the energy demand on associated systems. These features will include high performance glazing, enhanced building fabric and improved air tightness.
- Full thermal analysis has been performed on the building's façade to optimise the performance of the shading device to reduce solar heat gains to the perimeter zones. This reduces the dependence on the air conditioning in the space and ensures that the occupants experience thermal comfort.
- A Building Management System will be specified to efficiently control all building systems.
- The installation of energy efficient fan coil units with variable speed and responsive fans, with heating and cooling being provided by the KXC district energy systems.
- The installation of energy efficient lighting with a high efficacy and intelligent controls, including presence detection and daylight dimming to greatly reduce the electrical consumption of the artificial lighting installation. The atria will help daylight penetrate the office cores, reducing dependence on artificial light.

Condition 17(B) Reduction in carbon emissions

Excluding the contribution of the low-carbon district energy system, the development could achieve a 22% improvement over the target emission rate under the Part L2a 2013 Target Emission Rate (TER) through the combination of passive design features and energy efficient systems.

Condition 17(C): Provision of Green / Brown roofs

The Building P2 is located within a Priority Zone for green/brown roofs and will include approximately 802m^2 of green roof. The green roof will incorporate a mix of species sympathetic to the local environment aimed at maximising biodiversity. Planting will include ornamental grasses, wildflower meadows, groundcover planting, small native trees and shrubs.

The inclusion of a combination of terraces on the east, west and south facades at levels 1, 2, 3, 4, 5 and 9 enables multiple planters to be provided as part of the base-build work or by the tenants at fit-out stage.

Condition 17(D): Energy supply

The connection of the Building P2 to the KXC district energy supply system will allow it to take advantage of the low-carbon benefits associated with the installed combined heat and power. The district energy system will meet all the chilled water, heating and hot water demand for the building. It will also generate electrical power which will be fed into the National Grid, thereby offsetting a significant percentage of the buildings' demand.

Condition 17(E): BREEAM Rating

As stated above, an initial BREEAM pre-assessment has been carried out and has identified that the building design has an indicative score of 71.82%, representing an 'Excellent' BREEAM rating. The project team has also identified those credits which will be targeted with an aspiration to achieve an 'Outstanding' BREEAM rating.

Condition 17(F): Wildlife

The provision of significant areas of green and brown roofs will be provide valuable habitats for wildlife including insects, invertebrates and birds. Bird and bat boxes will be incorporated during construction of the building to provide nesting habitats and shelter.

Condition 45: Drainage

The site-wide drainage networks and overall strategy has been designed using SUDS principles to provide an overall peak flow reduction of 10% (based on a 1 in 30-year storm). The site-wide drainage strategy has set maximum peak flow limits to each plot to ensure that the site-wide maximum discharge to the existing combined sewer will not exceed 2292 l/s. The Building P2 will be designed so that the foul and surface water discharges will not exceed these set limits.

S106 - Section AA: Water

The Building P2 will target rainwater harvesting for the flushing of WC's and sanitary supply shut-off valves to reduce demand for mains water.

The installation of low water usage sanitary ware fittings in conjunction with the rainwater harvesting systems will be provided to reduce the potable water use. A minimum of 40% of the available BREEAM water credits will be achieved resulting in a total consumption figure approximately twenty to thirty percent lower than typical water consumption for a building of this type.

S106 - Section Y: Construction materials and waste

The minimisation of packaging used to protect construction materials and assemblies in transportation. Any packaging will be returned wherever possible to be re-used. In addition, to minimise site wastage at the construction phase, prefabrication off-site will be utilised whenever possible.

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

The targeting of maximum credits under the BREEAM for Offices 2014 assessment for 'Man 3 - Responsible construction practices, which includes monitoring and reducing resource use and its waste production.

An early appraisal of the likely construction materials and their carbon footprint has been undertaken. Materials with low levels of environmental impact will be specified wherever practicable. In addition, to minimise site wastage at the construction phase, prefabrication will be utilised whenever possible.

S106 - Section Z: Waste

The circulation of a simple Environmental Sustainability ‘user’ guide to occupants, including information on waste and recycling. The allocation of a sizeable waste store for the Building P2 at basement level will enable the future separation of waste and recyclable materials.

Contents

1.0

Introduction

1.0 Introduction

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2.0

Response to Planning Conditions

2.0 Response to Planning Conditions

2.1 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."

2.1.1 Overview

The Building P2 has been designed to minimise its annual energy consumption with the purpose of reducing the development's environmental impact. Whilst the offsetting of electrical energy and heating supplies to the building will be provided by the connection to low-carbon KXC district heating and cooling networks, the design team realises the importance to reduce the primary energy demand in the first instance. This will be achieved through the following design methodologies:

Passive Design – The design of the building façade and specification of a high-performance envelope. A well-designed external envelope can significantly reduce energy demand, and the need to reduce space heating demand, optimise daylight, and control summer solar gains has had a strong influence upon the design of the building and its facades.

Active Design - The specification of energy efficient equipment (for example, intelligent and high efficacy lighting systems, variable speed pumping etc.) all linked and monitored via the Building Energy Management System, to reduce energy consumption when the building is in use.

By embracing passive and active design, the Building P2 will also be 'future-proofed' to ensure it is adaptable to climate change and the future operational needs of the tenant and is capable of accommodating future low/zero carbon technologies.

2.1.2 Passive Design

Building P2 aims for the highest standards of environmental sustainability for a major office development with mixed usage through a combination of complementary passive design features to obtain low carbon emissions.

Passive features include:

- High levels of thermal insulation and an air tight structure precluded through the maximisation of prefabrication of envelope components off-site;
- Optimal proportioning of glazing and solid panels within the façade to minimise heat gains in summer months, with louvres, transoms and mullions used to mitigate direct solar gain whilst still maintaining maximum visual transparency and guaranteeing a view out;
- Projections to control direct solar gain and glare into perimeter zones; and
- Good internal daylight levels due to medium depth floorplates and maximised floor to ceiling heights;

2.1.3 Façade Design

The proposed Building P2 façade has been optimised to make use of the bold projecting grid consisting of mullions and transoms which create natural balconies and overhangs. This gives the development its distinctive look but also acts as a passive design feature, shading the windows from peak overhead sun in summer months. The windows have been placed as close to the underside of the soffits as possible, to permit maximum daylight penetration into the floor plate whilst also shading it.

At level 9, the mezzanine floor design has a raised section of façade to promote daylight infiltration, reducing the reliance on artificial lighting and limiting the electrical consumption. At ground floor, the façade has been optimised to host retail units, with large single glazed display windows with high visible light transmission.

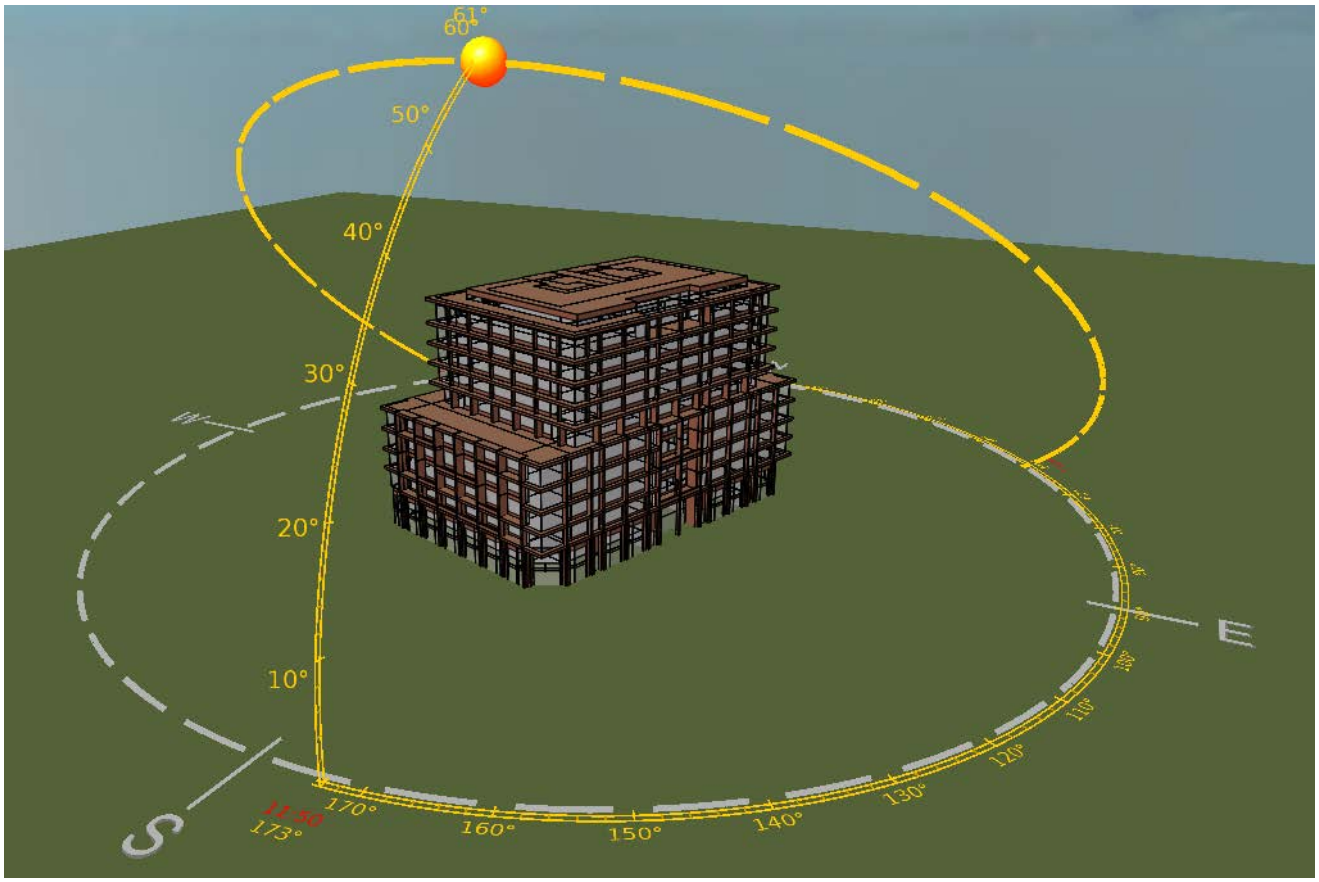


Figure 1 - Orientation of building with reference to sun path

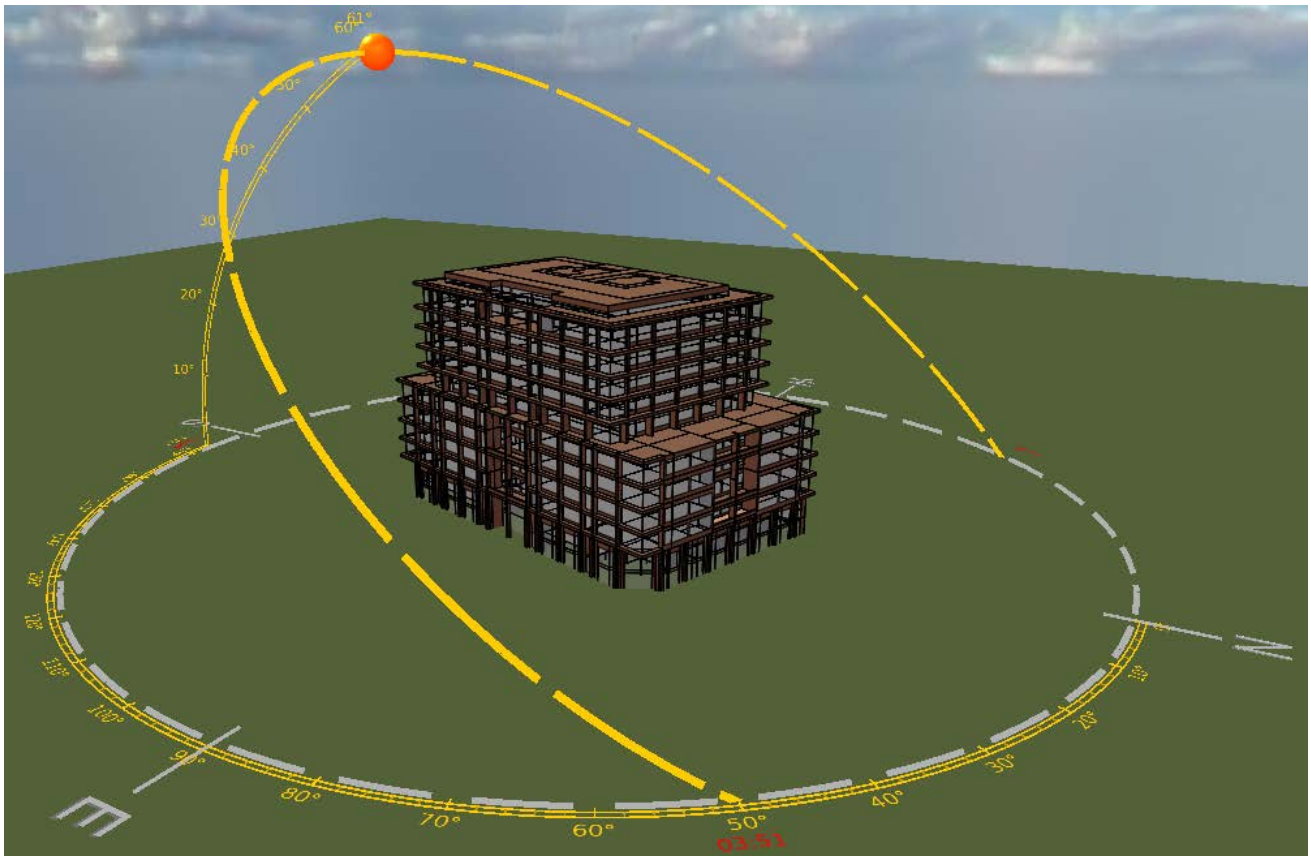


Figure 2 - Orientation of building with reference to sun path

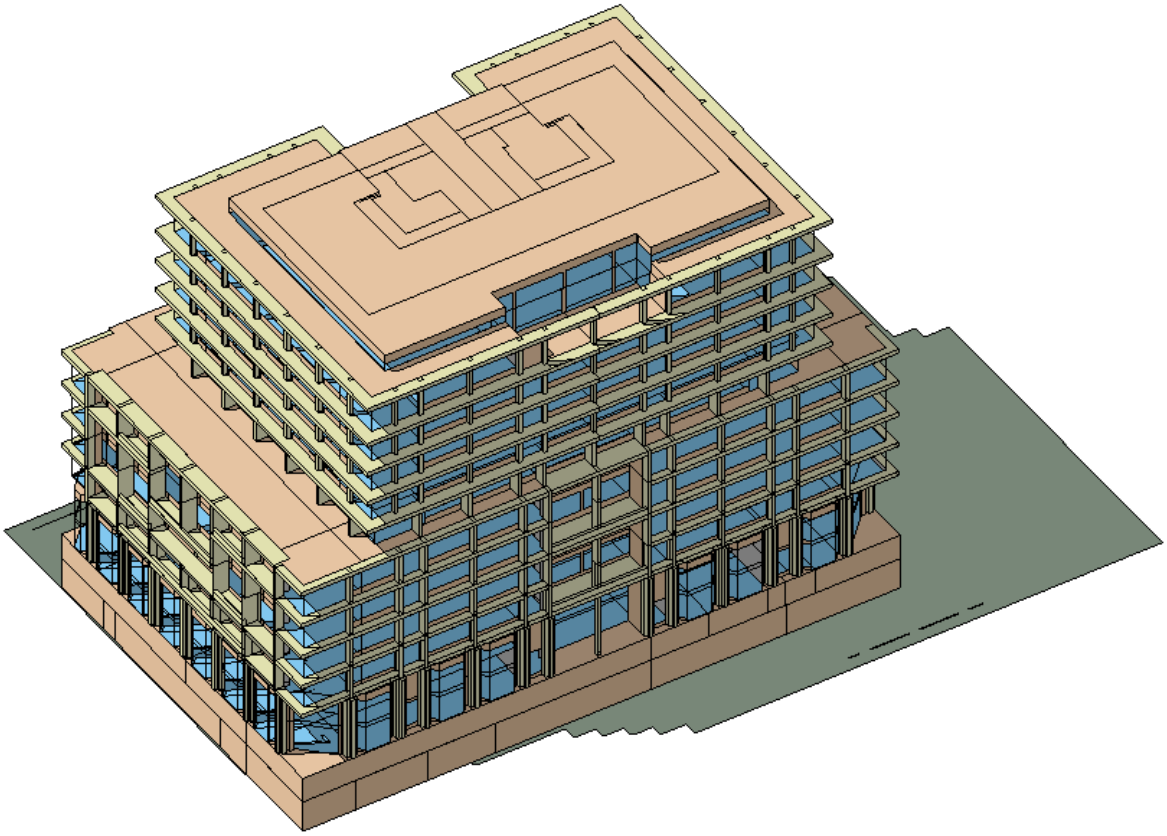


Figure 3 - Shading July 14:00

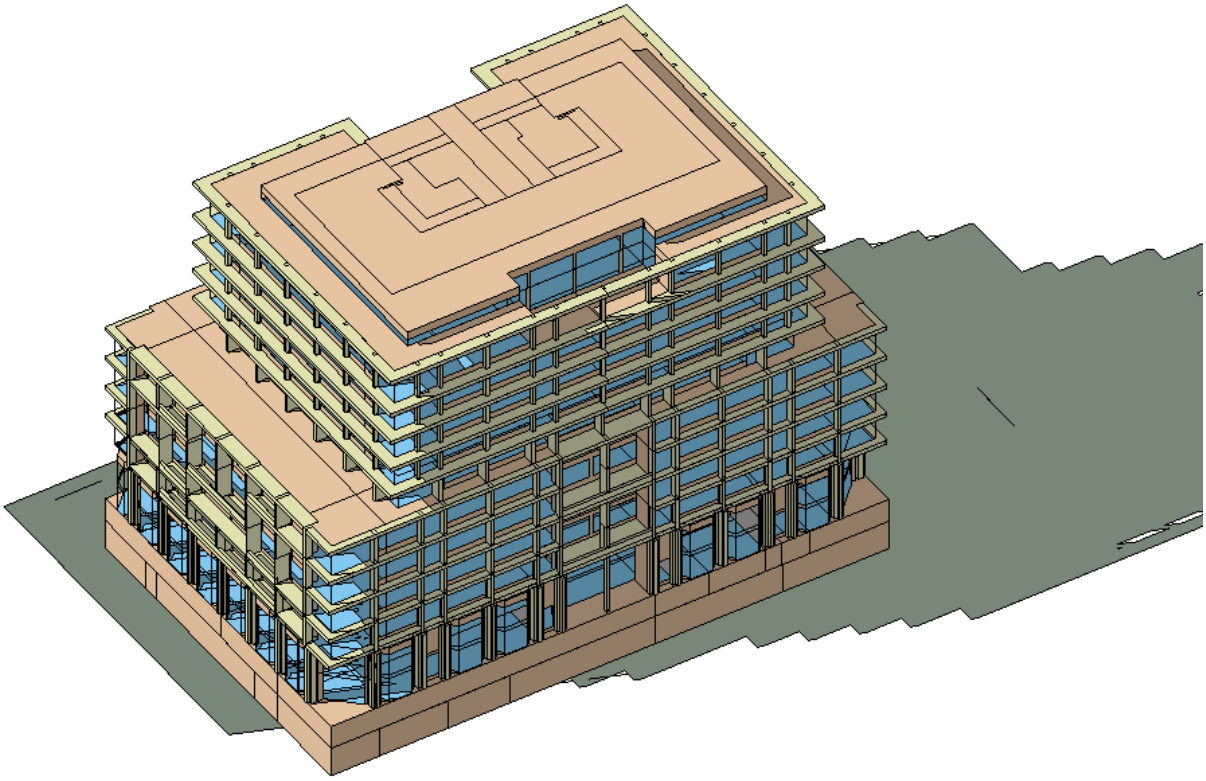


Figure 4 - Shading September 14:00

2.1.4 Natural Daylight

As stated previously the external facades have been optimised to minimise direct solar gains, whilst maximising daylight provision into the occupied areas. The shading provided by the facade will prevent direct solar gain from striking the glazing when the sun is at its peak on summer days and limit the incidence of glare on the windows.

The proposed high-performance glazing will have a high visible light transmittance to ensure that the useful light from the surrounding environment, both direct and diffuse, can infiltrate the perimeter zones, creating a well-lit environment that will benefit the health and wellbeing of the occupants. This will reduce dependence on artificial lighting which, when coupled with photoelectric sensors and a dimming protocol, will reduce energy consumption associated with lighting.

2.1.5 Scope for using thermal mass

The building has been designed to utilise a lightweight curtain walling system that reduces loading on the slab and structure, thereby reducing the volume of material needed within the building. This reduces the embodied carbon associated with all building materials. Additional thermal mass to store coolth has not been specified, as this would require additional operation of the central air handling units outside of occupied hours.

2.2 Active Design

2.2.1 Building Energy Management System and Metering

A comprehensive Building Energy Management System ('BEMS') will be installed to monitor and report overall 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 on all floors allows building owners / occupiers to view and interrogate where potential energy savings can be made throughout the building.

2.2.2 Ventilation

A centralised mechanical ventilation system will provide tempered fresh air into all aspects of the development. To minimise energy consumption associated with tempering the fresh air, heat recovery will be provided on the return air path to extract the sensible heat from the air stream and use it to prewarm incoming fresh air, thus reducing the heating load by up to 80%. This heat recovery will be compliant with the latest Energy Related Products (ErP) directive that stipulates minimum recovery efficiency.

The air handling equipment will be fitted with a bypass on the heat recovery for use in summer months. During shoulder months, there is potential to supply fresh air without any requirement to cool the incoming air. As the internal office condition will require cooling even when external conditions do not preclude it due to the high levels of internal gain, this will allow free cooling to meet a proportion of the central cooling demand.

The heating and cooling coils on the ventilation plant will be served by the district heating and cooling networks, and therefore any energy usage will result in low associated carbon emissions.

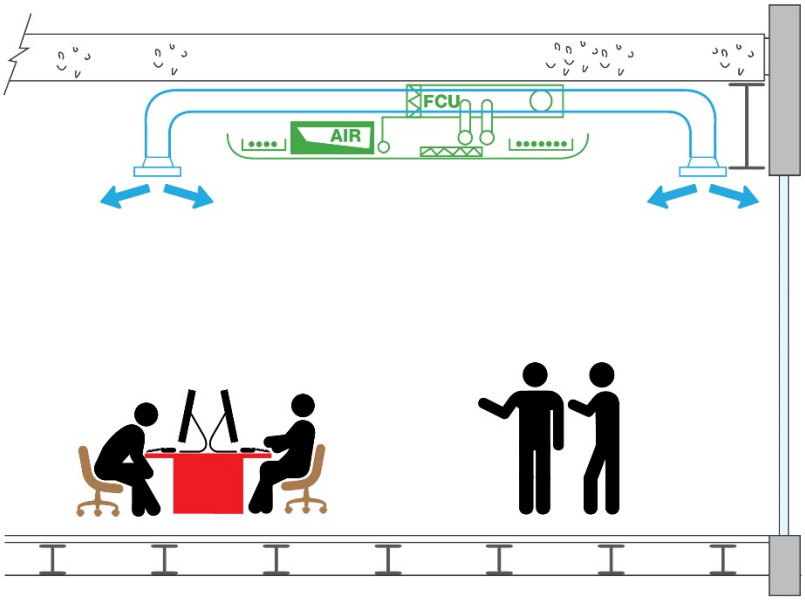


Figure 5 - Cross section of fan coil servicing

2.2.3 Variable Air Volume

There is potential for significant variation in cooling load during the day as the sun tracks from east to west. To minimise energy consumption associated with the requirement for cooling, the fan coils in each perimeter zone will be equipped with infinitely variable electronically commutated direct current (EC/DC) motors that will allow them to adjust the air flow over the cooling coils to match the cooling demand.

The central air handling units will also be equipped with variable speed fans to ensure that energy consumption matches the demand.

2.2.4 Lighting Systems

The building will be designed to include intelligent and efficient operation of lighting systems. The office lighting specification predominantly comprises of five different area types, offices, core facilities – toilets, stairs etc., lift lobbies, receptions, and back of house areas – plant, stores, and cycle stores. Each area type's light fittings will be limited to the required lux level intensity set out by LG7 and BS standards for the function of that space. The largest area, open plan offices for example; will generally be limited to provide an intensity of 300-400lux at working plane and will be lit using high efficacy lamps. The selection and specification of lights will therefore limit the energy consumption and cooling requirement to offset the lighting heat gain. All areas will be provided with high frequency ballasts to improve the energy efficiency and occupant wellbeing by preventing flickering. The tenant will be provided with a fit-out guide which will detail the potential benefits; including the payback potential, if they were to install LED lighting when they carry out modifications for their tenancy.

All lighting in the offices, cores and back of house will be controlled by infrared presence detectors, which will monitor occupancy and switch off lighting when the area has been vacant for a set length of time. In addition, lighting provided within the office perimeter will be controlled by intelligent dimming that will adjust the lighting intensity according to the measured level of daylight detected. Lighting within the stairs, lift lobbies and other circulation areas will be on time control to ensure that excess electricity is not used illuminating the areas out of office hours.

2.2.5 Electrical Systems

Power factor correction will be provided to 0.95 or higher to improve the efficiency of the electrical supply. A lagging power factor will cause inefficiencies as it means that a greater amount of energy is required to produce the power that is consumed.

A motor is one example of the many items of equipment within a building which will cause a lagging power factor. Ensuring that the power factor correction is at 0.95 or higher will keep inefficiencies to a minimum. For example, for a 1kVA requirement; if the power factor was reduced to 0.8, 1.25kVA would be required to meet the 1kVA demand.

2.2.6 Heating

The entirety of the building's heating and hot water demand will be met through the connection to the KXC District Heating network. On this basis, no boilers will be installed within the building, resulting in no negative impact on local air quality.

Through a plate heat exchanger, heating will be distributed to centralised air handling units and branching off each floor via metered plate heat exchangers to serve the 4-pipe fan coil units to meet the heating demand.

Heat will also be supplied to calorifiers to generate hot water for the changing areas. Hot water within each core at each level will be generated instantaneously through electric point of use heaters, to reduce the losses associated with distribution and storage.

2.2.7 Chilled Water

All the cooling demand will be met by the low carbon KXC District Cooling network, negating the requirement for local chillers within the development. The cooling plant that drives the district cooling network utilises a combination of high efficiency electrical chillers and absorption chillers that utilise the district heating system to generate chilled water whilst minimising energy consumption and associated emissions.

2.2.8 High Efficiency Variable Speed Pumps

Both the chilled and heating water systems will utilise variable speed pumps to circulate water throughout the building. The buildings control system will include sensors throughout each system to monitor demand of each zone and subsystem and allow pumps to operate at the minimum possible speed allowing for significant reductions in annual energy consumption.

2.2.9 Climate Change Adaptability and Future Flexibility

The plate heat exchangers for the chilled water connection will be designed with future flexibility in mind, accounting for possible increases in external wet and dry bulb temperature increases. Fan coil units will be designed with a margin to account for zonal load increases and any future changes to the floorplate usage.

2.3 CONDITION 17(B) – REDUCTION IN CARBON EMISSIONS

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

2.3.1 Overview

The proposed P2 Building development comprises primarily of office space, with theatre and retail at ground levels. All usages qualify as non-domestic and therefore are liable for assessment under Part L2a of the 2013 Building Regulations.

A dynamic simulation model (DSM) was created using the approved software IES Virtual Environment 2016 and the energy assessment was undertaken using the VE Compliance module under the 2013 Building Regulations. All prescribed passive design measures and energy efficient systems were modelled, and the development was assessed with the connections to the heating and cooling district networks.

To comply with Part L of the Building Regulations, the P2 Building must achieve 5 criteria, of which 3 can be assessed at design stage, with the remaining 2 dependents on contractual works, commissioning and post occupancy evaluation. A full explanation of the criteria is provided in Appendix A. The requirement for the development to achieve a Building Emissions Rate (BER) lower than the notional carbon dioxide emissions, otherwise known as the Target Emissions Rate (TER), is Criterion 1 of the Part L requirements.

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 2013) using good passive design and energy efficiency measures only such as those set out in Section 3.1.2 & Section 3.1.3. Based on 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 the P2 Building are expected to be 19.3kgCO_2/m^2. This represents a 22% reduction over the Part L2a 2013 Target Emission Rate (TER). Consequently, the building exceeds the target 5% reduction set by the S106 Agreement.

2.3.2 Business as Usual Benchmark (ECON 19)

The KXC Section 106 Agreement includes an obligation to carry out the development with the objective of achieving a site-wide 32% reduction in carbon emissions compared to the 'Business as Usual Benchmark', as identified in Appendix 2 of the Energy Assessment which supported the outline planning application (2005).

Since the completion of the Section 106 Agreement in 2006, Part L of the Building Regulations has been updated to include more stringent requirements in terms of the energy efficiency of a building and is now considered the primary method of assessment for a building's performance. By meeting the requirements of the current Part L (2013), the building will be achieving a reduction in carbon emissions that meets (and indeed exceeds), the Business as Usual Benchmarks set out in the original KXC Energy Assessment, thus contributing to the achievement of the 32% target set out in the Section 106 Agreement.

2.4 CONDITION 17(C) – PROVISION FOR GREEN/BROWN ROOFS

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

2.4.1 Overview

The KXC Outline Planning Permission defines Development Zone P as a priority zone for green or brown roofs. As such, it is proposed that 802m^2 of green roof will be provided for Building P2. This makes up approximately 25% of the total roof area of the Building.

The large wrap around terrace at the Level 5 will also provide opportunities for with intensive planting. The plant species will be considered to specifically incorporate a high degree of native planting and species which offer high ecological value including ornamental grasses, wildflower meadows, groundcover planting, small native trees and shrubs. Inset terraces will also be provided at Levels 1, 2, 3, 4, 5 and 9.

A suitably qualified ecologist has provided ecology advice on the types of species which will be planted within the allocated zones. The ecologist will also write a five-year bio-diversity action plan. In addition to the aforementioned planting provisions, the paved terrace areas are provided as amenity space for occupants. These areas provide the opportunity for additional container planting by the tenants.

2.5 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."

2.5.1 Overview

The proposed P2 Building will be served by the existing King's Cross district heating system operated by Metropolitan. This system is fed by a conventional gas-fired CHP plant located in the T1 Building energy centre, with gas-fired boilers to meet peak heating demands. A fuel cell is also scheduled to connect into the network and further decarbonise the delivered heat by cogeneration of electricity.

A 'Cooling Pod' consisting of six chillers with a combined cooling capacity of 9MW was approved and has been commissioned at KXC. There are three types of chiller present within the Cooling Pod: absorption, electric and air-cooled chillers. The absorption chillers use hot water to generate chilled water, meaning that they can act as a base heat load for the CHP units during summer months. The Cooling Pod has been sized to meet the cooling demand of 15 of the buildings within KXC.

All heating and cooling for Building P2 will be met through these connections, with plate heat exchangers at ground level to provide a hydraulic separation from the respective networks. The main energy centre with CHP units produces simultaneous low carbon electricity that decarbonises the delivered heat, with a quoted intensity of 0.0719kgCO_2/kWh of heat energy. The district cooling network has been calculated to have an associated carbon intensity of approximately 0.1039kgCO_2/kWh of cooling energy.

As outlined in previously submitted (and approved) Environmental Sustainability Plans, the position regarding the inclusion of biomass continues to be actively monitored by KCCLP. However, at this time, a robust commercial case to support biomass cannot yet be made. There remain concerns on air and fuel quality, particularly as the KXC site (together with the vast majority of London), is situated within an Air Quality Management Area. NOx levels are already high in this area and this is expected to be exacerbated in the King's Cross locality by biomass emissions and increased lorry movements to deliver the fuel. There are also concerns regarding supply, with expected limitations on biomass growth in the UK (driven, for example, by air quality) affecting the harvesting rates and potentially increasing the cost of fuel. Large amounts of biomass would also need to be delivered and stored, as the burning of biomass is not as efficient as fossil fuels via CHP.

The carbon emission calculations used within this report have assumed that, in total, 65% of the thermal energy used across the KXC site will be produced by CHP with the remainder provided by gas-fired boilers.

2.5.2 CO_2 Savings arising from connection to the KXC Energy Centre

The figure below illustrates the CO_2 savings made possible through connection to the district heating and cooling networks. This equates to a further 14.8% reduction in CO_2 emissions over the base case, with a total reduction in CO_2 emissions of 37.0% over the Target Emission Rate.

System	Part L2A 2013	
$kgCO_2/m^2$	TER	BER (Be Clean)
Heating	0.69	1.24
DHW	1.14	0.55
Cooling	3.67	2.37
Auxiliary	7.03	6.39
Lighting	11.31	4.47
Renewables	0.00	0.00
Total	**23.83**	**15.02**
Improvement		**37.0%**
Part L Status (BER<TER)		**Pass**
Planning Status (>35%)		**Pass**

Table 1 - CO2 Emissions following connection to KXC Energy Centre

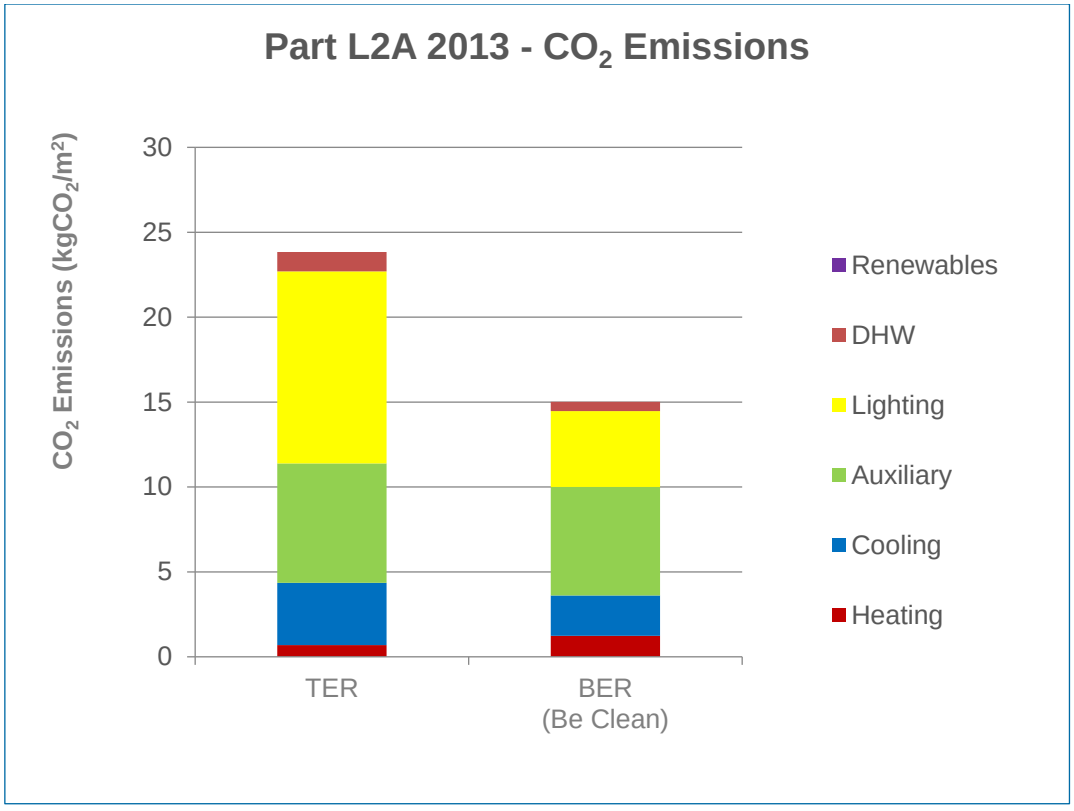


Figure 6 - Breakdown of CO2 Emissions

2.5.3 Renewables

A range of low and zero carbon (LZC) energy technologies were investigated to assess whether they could further reduce the proposed building's CO_2 emissions. Each technology has been assessed to regard the potential contribution each could make to supply a proportion of the building's delivered energy requirement, whilst considering the technical, planning, land use and financial issues.

In summary, the review had the following outcomes:

- **Wind Turbines** – The output from wind turbines is highly sensitive to wind speed. Hence, it is essential that wind turbines are sited away from obstructions, with a clear exposure or fetch for the prevailing wind. In urban

environments such as the King's Cross area it is difficult to achieve the high and consistent wind speeds that would make the operation of these turbines viable, unless they could be located where there is a locally high wind speed or located on the roof of the P2 Building, where obstructions and other surrounding buildings would not interfere with the wind flow. As the building is located within the St. Paul's viewing corridor and within the King's Cross St. Pancras Conservation Area, the turbines could not be sited without disruption to the skyline that would not be considered appropriate. Further, Building P2 was not identified as an area for wind turbines in the Parameter Plan. Mounting turbines on the roof of Building P2 would also compromise the preferred design feature of green/brown roofs. For these reasons, turbines were not incorporated into the design.

- **Solar hot water** – Solar thermal collectors utilise solar radiation to heat water for use in buildings. They are complex to integrate with domestic hot water systems and require several safety systems to prevent over pressurisation. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30º to the horizontal. Solar collectors are typically designed to meet a development's base heat load for domestic hot water requirement. For a building of this nature, domestic hot water usage is a minor component of the energy consumption and the district heating provides a perfectly adequate amount of sustainable hot water that the building is already connected to. Solar hot water is not considered to be viable for this development.
- **Ground source heat pumps** – Ground source heat pumps differ from air source heat pumps in that they extract heat from the ground and pump it into a building to provide space heating and to pre-heat domestic hot water, resulting in an increase Seasonal Energy Efficiency Ratio (SEER). In the summer months the process can be reversed, and heat can be rejected into the ground, improving the SEER of the cooling system. Ground source heat pumps require relatively balanced heating and cooling demands to work effectively, as otherwise as heat is extracted or rejected to the ground in unbalanced amounts, the ground can cool down or warm up, reducing the efficiency of the system until it becomes less efficient than a traditional arrangement. The large size of the development means that extensive piles or trenches would need to be excavated for the site, with an associated capital cost. Much of the KXC development is covered by infrastructure and services, minimising the areas in which it could be installed. The proposed district heating and cooling network offers a lower carbon heating and cooling alternative future, and as such, ground source heat pumps are not considered viable for this scheme.
- **Photovoltaics** – Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon with a separating chemical layer. The incoming solar energy charges the electrons held within the chemical. The energised electrons move through the cell into a wire creating an electrical current. A study into the feasibility of onsite electrical generation using south facing photovoltaic panels orientated at 30º to the horizontal on the roof of the development to meet a proportion of the development's electrical demand has been undertaken. Proposals include accessible terraces and green/brown roofs and so photovoltaic panels could not be installed in areas large enough to deliver more than a token contribution to electrical generation. A life cycle cost analysis over 20 years indicates that this is not a cost-effective method of reducing CO_2 emissions. Therefore, photovoltaic panels are not considered a viable technology for this scheme.
- **Biomass** – Biomass boilers utilise low carbon sources of fuel to generate heat. The carbon that is emitted by the burning of organic matter was removed from the atmosphere as the fuel grew, therefore the process is almost carbon neutral. Biomass boilers require deliveries of solid fuel and high levels of maintenance to maintain effective operation. Furthermore, biomass boilers produce higher levels of particulates that conventional gas boilers. As central London is already susceptible to poor air quality, there is resistance towards biomass boilers, as they can further degrade the air quality. It is also difficult in sourcing fuel in an inner city urban location. As such, biomass boilers are not considered appropriate for Building P2.

In conclusion, Building P2 will maximise usage of the low carbon district networks, and, in conjunction with the aforementioned passive design measures and energy efficient systems, will deliver CO_2 emission reductions in excess of 35% against the Target Emission Rate.

2.6 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, or an equivalent assessment method and rating."

2.6.1 Overview

BREEAM is a recognised methodology to drive improvement in the sustainability performance of buildings. The standards set by BREEAM are used to maximise the effectiveness of the issue-specific strategies, including energy, water and waste, as addressed in this Plan. The project team is fully committed to going beyond the planning objective of 'Very Good', to 'Excellent', with an aspiration to achieve 'Outstanding' for Building P2.

The team has taken a holistic approach to every aspect of the buildings' design utilising passive and active design methodologies to ensure that 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.

A BREEAM Pre-Assessment has been carried out using the BREEAM New Construction 2014 scheme, which can be found in Appendix B of this report.

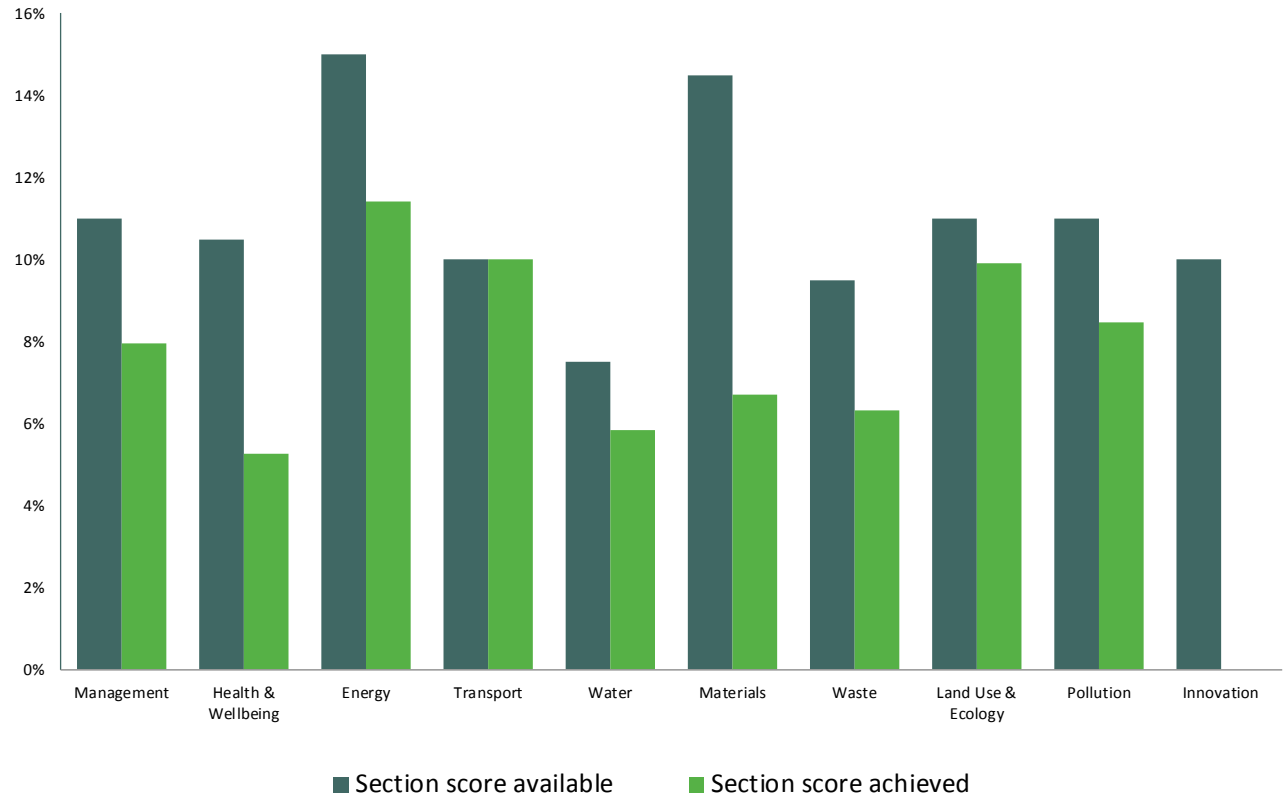
The Pre-Assessments predict that an 'Excellent' rating (minimum BREEAM score of 70%) will be achieved under BREEAM New Construction Offices 2014 scheme. The project team have also assigned target credits to strive for the 'Outstanding' rating, but this will also rely on how the building is used by incoming tenants. 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 Figure below.

BREEAM UK New Construction 2014 Assessment Report: Rating & Key Performance Indicators

Overall Building Performance

Building name	P2
BREEAM rating	Excellent
Total Score	71.82%
Min. standards level achieved	Outstanding level

Building Performance by Environment Section



Environmental Section	No. credits available	No. credits Achieved	% credits achieved	Section Weighting	Section Score
Management	18	13	72.22%	11.00%	7.94%
Health & Wellbeing	10	5	50.00%	10.50%	5.25%
Energy	21	16	76.19%	15.00%	11.42%
Transport	9	9	100.00%	10.00%	10.00%
Water	9	7	77.78%	7.50%	5.83%
Materials	13	6	46.15%	14.50%	6.69%
Waste	9	6	66.67%	9.50%	6.33%
Land Use & Ecology	10	9	90.00%	11.00%	9.90%
Pollution	13	10	76.92%	11.00%	8.46%
Innovation	10	0	0.00%	10.00%	0.00%

Figure 7 - BREEAM Pre-assessment

It should be noted that the assessments are provisional on the basis that all the documentary evidence required for a formal assessment (in the form of tender documents and drawings etc) is not yet available at this planning stage. Full evidence will be gathered in due course at the detailed design stages as the project progresses.

2.6.2 Building P2 BREEAM Pre-assessment

The provisional assessment tool for the BREEAM New Construction Offices 2014 scheme predicts an overall score of 71.82% for Building P2, which equates to an 'Excellent' rating. The assessment highlights the credits sought.

2.7 CONDITION 17(F) – AREAS FOR WILDLIFE

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

2.7.1 Overview

Building P2 includes roof spaces at various levels. 802m^2 of green roof is proposed at roof level, whilst a wraparound terrace at Level 5 has a high level of plant coverage as described in relation to condition 17(c) (approximately 25% of buildable roof area). Proposals include predominantly native plants in the form of shrubs and trees, as well as green roof planting which will encourage biodiversity and wildlife habitat creation, insects, invertebrates and birds, including species such as the Black Redstart and swallows.

Bird and bat boxes will be incorporated during construction of the building to provide nesting habitats and shelter. The specification and exact location of these boxes will be decided in liaison with the project's ecologist and architects to ensure they respond to species found in the vicinity and are installed in suitable positions. However, the general approach to siting and type is set out in the paragraph below.

Built-in bird boxes or external bird boxes will be considered on the building to provide additional nesting areas for the birds currently utilising the wider King's Cross site. Nest boxes of varying kinds will be considered which are suitable for different bird species including some of the protected species above. 'Open' boxes for starlings and sparrows, along with 'closed' boxes for tit species will be considered, these could be affixed to the new building. Nest boxes are a very effective but simple enhancement measure. Bird boxes will be mounted facing between south-east and north, to avoid strong direct sunlight and the heaviest rain.

In addition to the planting provision on the roofs and roof terraces, the paved usable terrace areas on Levels 1, 2, 3, 4, 5 and 9 shall enable future tenants to locate additional features such as raised containers for shrub planting. The inclusion of such features will be encouraged within the 'Building User Guide' documentation issued to each incoming tenant.

A five-year bio-diversity action plan will be prepared by a suitably qualified ecologist. The report will make recommendations to further enhance diversity of wildlife as well as plant species. KCCLP will adhere to these recommendations and appoint a facilities manager to manage and maintain the ecology on-site.

2.8 CONDITION 45

"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."

2.8.1 Overview

The figure of 2292 l/s in the wording to Condition 45 describes the maximum peak (storm and foul) discharge which is permissible for the site as a whole to discharge to the existing combined sewers. The peak discharge will be split between the Camden Sewer and 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 2292 l/s under certain weather conditions. In these instances, the site wide drainage infrastructure, including online and offline attenuation (see below), will attenuate peak flows discharging from individual plots, adopted highway and public realm, enabling cumulative peak flows to be reduced to 2292 l/s or less.

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

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

The site wide drainage infrastructure at King's Cross Central can be described in terms of three drainage infrastructure areas, incorporating both building plots and infrastructure/public realm. These are described below. Although Building P2 was originally assigned to as part of the northern area system the new development will direct all foul discharge to the Remainder of the Northern area system as shown in Tables 2 and 3.

Drainage Infrastructure Area	**Plot developments**	**Infrastructure / Public Realm**
Eastern Goods Yard	The Granary Complex, Q1, Q2, R1, R3, R4, R5, R7 & R8, S1, S2, T1, T2, J1, H1, K1, K2, K3, K4 and 50% of I1	Transit Street, Wharf Road, Goods Street, Granary Square, Lewis 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 Reach and Lewis Cubitt Square

Table 2 - Drainage Infrastructure Key

Table 3 identifies the assumed peak foul and surface water flows from the building plot in the Remainder of the Northern 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 4. The surface water peak flows are based on a 1 in 30 year storm. It should be noted that it is most unlikely that the foul and surface water peak discharges from each individual plot will coincide with each other.

Generally, foul water discharges represent small but consistent flows subject to diurnal patterns. For example, residential properties will exhibit two peaks within their diurnal flow pattern, one in the morning and one in the early evening. Surface water discharges, on the other hand exhibit extreme variations in flow, directly related to rainfall intensity.

The surface water discharge from each plot development will have its own unique hydrograph (identifying the variation between flow and time – the peak of which only lasting for a few minutes in most cases). Each one of these peaks (within the hydrographs) 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 2292l/s. Where the plot development discharges combine to produce flows in excess of the maximum allowable discharge, water will be held within the drainage infrastructure which has been specifically sized to accommodate these flows.

	Assumed Peak Flows (l/s) for plots in the Northern Area including the Triangle Site	
Plot reference	**Surface Water (1 in 30 year event)**	**Foul Water**
M1	107	16.2
M2	142	1.7
N1	252	5.5
N2	-	-
P1	255	7.9
P2	210	11.5
S3	156	5.3
S4	175	7.5
S5	149	5.5
T3	138	-
T4	101	-
T5	78	4.8
T6	133	10.9
W1	308	7.3
Total:	2204	83.8

Table 3 - Peak Surface and Foul Water Flows for the Northern Area

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

Table 4 - Foul Water discharges from various land usages

2.8.2 Drainage Infrastructure

Plot P2 is serviced by the North West Area drainage system which discharges via a restricted discharge in to the combined Thames Water Camden Sewer. The drainage networks have been designed on SUDS principles providing an overall peak flow reduction of 10% (based on a 1 in 30-year storm).

Thames Water has approved the surface and foul water discharges into the Camden Sewer for the network serving Plot P2. The peak flows for P2 are 210 l/s and 11.5 l/s for surface water and foul water respectively.

It should be noted that the figures in Tables 2 and 3 do not specifically include public realm areas. However, the North West Area 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.

3.0

Response to S106 Agreement Obligations

3.0 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 practice on SUDS, to control the timing and volume of flows.

3.1 Water Efficiency

Building P2 will achieve very high standards of water efficiency through an approach that combines alternative supply via reclaimed water and internal water efficiency through design. The design teams have used the BREEAM criteria as their benchmark in driving down potable water consumption for the proposed building.

The aim is to minimise internal and external potable water use within the development. Good water management can contribute to reducing the overall level of water consumption maintaining a vital resource and having environmental as well as cost benefits in the life-cycle of the building. The following water saving measures are being considered:

Dual Flush Cisterns on WC's - These units can provide a single flush of 4L and/or a full flush of 6L.

Flow Restrictors to Taps - Flow restrictors reduce the volume of water discharging from the tap. Spray taps have a similar effect.

Low Flow Showers - The average shower uses 15 litres of water a minute, by restricting the output of the showers in the development to a maximum of 8 litres/ min a 40% water saving can be achieved. Flow rate can be reduced to less than 6 litres/ min without compromising on water pressure and hence should be considered.

Water Meters - In 1995 approximately 33,200 million litres of water a day were extracted in England and Wales, this increased to 44,130 supplies. To reduce this figure, accurate information on usage is required for management of a building's consumption. Water meters will be specified on the main supply to each tenanted area.

Water efficiency measures will include 'auto shut-off' on all toilet areas and dual flush WCs. Together with reclaimed water, the incorporation of this sanitary ware will reduce the water consumption from the BREEAM baseline figure of 7.0m^3 per person per year, down to below 4.2m^3 per person per year. This indicates a ≥40% improvement on the BREEAM baseline figure.

3.2 Alternative Water Supplies

Rainwater harvesting is to be installed to provide an alternative water source for the building. Rainwater will be collected from roof areas (excluding green roof areas) and stored in rainwater tanks in the basement. The water will be filtered prior to entering the tanks. A booster pump will be used to deliver the water for the flushing of water closets and urinals. It is estimated that potable water consumption for flushing will be reduced by about 25% because of these water recycling measures.

3.3 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 provide a natural approach to managing drainage by lowering flow rates, increasing water storage capacity and reducing the transport of pollution to the water environment. SUDS aim to reduce surface water flooding, improve water quality and enhance the amenity and biodiversity value of the environment and are thus considered to be more sustainable than conventional methods.

Typical SUDS techniques include the use of:

- green/brown roofs;
- permeable surfaces;
- infiltration trenches filter drains and filter strips;
- swales - shallow drainage channels; and
- detention basins, purpose-built ponds and wetlands.

Not all these systems are suited to dense urban environments such as King's Cross Central. However, the sitewide drainage and attenuation strategy (explained previously) has been designed holistically on SUDS principles and additional opportunities for incorporating SUDS are considered on a plot-by-plot basis, usually through soft landscaping and/or the provision of green/brown roofs.

In this case, the Reserved Matters submission for Building P2 includes only a limited area of public realm. Save for the green roof and the planted beds on the terrace at Level 5, which will provide some attenuation to storm water run-off, the proposed landscaping is largely hard landscaped.

4.0 Construction Materials and Waste

As 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; and*
- *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; and

III. to achieve the Construction Targets.

4.1 Construction Materials and Purchasing Strategy

During the construction phase a large amount of waste material will be generated through construction, demolition and land clearing procedures. In building construction, the primary waste products in descending percentages are: wood, asphalt/concrete/masonry, drywall, roofing, metals, and paper products.

Prior to commencement on site a Site Waste Management Plan (SWMP) that complies with the requirements of current legislation and CSH will be prepared. This plan will identify the local waste haulers and recyclers, determine the local salvage material market, identify and clearly label site spaces for various waste material storage and require a reporting system that will quantify the results and set targets. As a minimum the SWMP will contain:

- The target benchmark for resource efficiency e.g. m^3 of waste per $100m^2$ or tonnes of waste per $100m^2$;
- Procedures and commitments for minimising non-hazardous waste in line with the benchmark;
- Procedures for minimising hazardous waste;
- Procedures for monitoring, measuring and reporting hazardous and non-hazardous site waste;
- Procedures for sorting, reusing and recycling construction waste into defined waste groups either on site or through a licensed external contractor;
- The name or job title of the individual responsible for implementing the above.

4.2 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. Volumes or weights of the packaging returned or recycled will be recorded as part of the SWMP and used to fulfil the relevant BREEAM criteria.

4.3 Soil

Earthworks and Remediation Plan for the P2 Building has been prepared to accompany the Reserved Matters Application to address Condition 18 of the KXC Outline Planning Permission dated 22nd December 2006 (ref. 2004/2307/P) and deliver appropriate site levels and ground conditions for the development and demonstrate compliance with Conditions 64 and 65. The plan addresses the nature and quantity of arising 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. Given the findings of a previous study undertaken to assess the suitability of site-won clay fill from the KXC site as a constituent of manufactured topsoil, it is not proposed to utilise the cut material. This is primarily due to the density, plasticity and poor drainage qualities associated with clay fill and therefore, manufactured topsoil derived from this material would not be suitable for use in permanent landscaping schemes such as brown or green roofs (which require a light weight substrate) or planted beds or tree pits. As such, it is recommended that imported organic material is used in these areas.

4.3.1 Construction Targets

A BREEAM rating of 'Excellent', with aspirations for 'Outstanding', 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.

Under EU legislation the UK will have to ensure that less than a third of its waste is sent for burial in landfill sites by 2020 and the figure at present is about 80%. To achieve this UK-applicable target, a number of measures are implemented, including landfill tax, aiming to discourage disposal of waste to landfill. Good waste management is a key component of sustainable development. Reducing waste is an important means of:

- Reducing unnecessary expenditure;
- Reducing the amount of natural resources used for production of new materials;
- Reducing energy for waste disposal;
- Reducing levels of contamination and pollution arising from waste disposal.

The proposed development will minimise the impact of waste in the environment where possible.

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.

5.0 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.*

5.1.1 Waste Management

The detailed design phases will identify the potential waste streams that the development will produce. As a minimum, plans will be formulated to handle the separation, collection, and storage of common recyclable materials such as paper, glass, plastics, and metals. The collection points will be easily accessible to all users. As the development is intended to be used as an office, the focus will be on common office material such as paper and plastics rather than food waste.

The main aim will be to recycle as much waste as possible; this will be achieved by making sure that waste recycling facilities are strategically placed in convenient locations. A ventilated bin store located at the ground level will be provided to the P2 Building.

5.1.2 Waste Information Packs

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

5.1.3 Design Solutions

A waste store will be provided for office users and a separate waste store will serve the retail units. A separate waste store will also be provided for the theatre operators. The waste stores will be sized to store segregated waste streams (refuse, dry mix recyclables, glass and food waste). Waste containers will be clearly identified through signage and colour coded bins to prevent contamination of recyclable and non-recyclable waste streams.

A centralised waste presentation area for refuse vehicle collection within the loading bay will act as the destination for all waste streams. Please refer to section 1.6 of the Urban Design Report for further details.

Appendices

Appendix A - Part L Report Summary

A preliminary assessment of the proposed P2 building within the King's Cross development area has been undertaken using the approved software IES Virtual Environment 2016, to show compliance with the requirements of Part L2a (2013) of the Building Regulations. This assessment covers the multiple uses proposes within the building.

The results of the annual CO_2 emissions analysis indicate that the proposed design is performing better than the minimum requirements of the Building Regulations with an overall improvement of **37.0%** below the Part L2A 2013 Target Emission Rate.

Part L2a 2013 CO_2 Emissions Results		Asset Rating
TER	23.83 $kgCO_2/m^2$	**A**
BER	15.02 $kgCO_2/m^2$	
Pass Rate	37.0%	
Status	**Pass**	

A preliminary EPC rating of **'A'** was also generated for the development.

Appendices D to F of this report detail the performance parameters assumed for this analysis, all of which meet or are better than the minimum requirements for Part L2A of the Building Regulations (2013) and the Non-Domestic Building Services Compliance Guide (2013 Edition). The design therefore demonstrates compliance with Criterion 2 of Part L2A, as confirmed by the BRUKL document in Appendix A.

The analysis indicates that most of the current façade design complies with Criterion 3: Limiting the effects of solar gains, assuming a maximum glazing total solar transmission (g-value) of 0.32. However, the double height reception and foyer areas as well as several of the south facing retail fronts are exceeding the solar gains limit. Mitigation measures are listed in the report and with a little design development all areas should be able to comply.

Please note that results and recommendations are based on the assumptions described in this report. If any of the inputs change, results are likely to change, and the recommendations might not be appropriate.

Appendix B - BREEAM Matrix

Introduction

Cundall have prepared a BREEAM pre-assessment that outlines how the development can achieve an 'Excellent' rating under the BREEAM New Construction 2014 Shell and Core assessment and highlighted the potential credits that could push the assessment to an 'Outstanding' rating.

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

Pre-assessment

Minimum Standards

In addition performance against the minimum standards (required for the specified target rating) is summarised below;

Issue	Awarded	Maximum Rating	Met
Man 03 - Responsible construction practices	0	Very Good	✗
Man 04 - Commissioning and handover	0	Very Good	✗
Ene 01 - Reduction of energy use and carbon emissions	0	Very Good	✗
Ene 02 - Energy Monitoring	0	Good	✗
Wat 01 - Water Consumption	0	Pass	✗
Wat 02 - Water Monitoring	0	Pass	✗
Mat 03 - Responsible Sourcing of Materials	0	Unclassified	✗
Wst 01 - Construction Waste Management	0	Excellent	✓
Wst 03 - Operational Waste	0	Very Good	✗
LE 03 - Minimising impact on existing site ecology	0	Good	✗

If the required minimum standards are not met then the target rating will not be achieved regardless of overall score.

	Available	Targeted	Potential	Awarded	Responsibility
Management					
Man 01 Project brief and design	4	2	4	0	Client, Project Manager
Man 02 Life cycle cost and service life planning	4	1	4	0	Quantity Surveyor
Man 03 Responsible construction practices	6	6	6	0	Project Manager
Man 04 Commissioning and handover	4	4	4	0	Project Manager
	18	13	18	0	
Health & Wellbeing					
Hea 01 Visual Comfort	3	0	1	0	Electrical Engineer
Hea 02 Indoor Air Quality	2	1	2	0	Mechanical Engineer
Hea 04 Thermal comfort	2	2	2	0	Mechanical Engineer
Hea 05 Acoustic Performance	1	1	1	0	Acoustician
Hea 06 Safety and Security	2	1	2	0	Architect, Project Manager, Client
	10	5	8	0	
Energy					
Ene 01 Reduction of energy use and carbon emissions	12	8	11	0	Mechanical Engineer
Ene 02 Energy Monitoring	2	2	2	0	Mechanical Engineer, Electrical Engineer
Ene 03 External Lighting	1	1	1	0	Electrical Engineer
Ene 04 Low carbon design	3	2	2	0	Mechanical Engineer
Ene 06 Energy Efficient Transportation Systems	3	3	3	0	Lift Engineer
	21	16	19	0	
Transport					
Tra 01 Public Transport Accessibility	3	3	3	0	Architect
Tra 02 Proximity to amenities	1	1	1	0	Architect
Tra 03 Cyclist facilities	2	2	2	0	Architect
Tra 04 Maximum Car Parking Capacity	2	2	2	0	Architect
Tra 05 Travel Plan	1	1	1	0	Client
	9	9	9	0	
Water					
Wat 01 Water Consumption	5	3	4	0	Architect, Public Health Engineer
Wat 02 Water Monitoring	1	1	1	0	Mechanical Engineer, Public Health Engineer
Wat 03 Leak Detection	2	2	2	0	Mechanical Engineer, Public Health Engineer
Wat 04 Water Efficient Equipment	1	1	1	0	Mechanical Engineer, Public Health Engineer
	9	7	8	0	
Materials					
Mat 01 Life Cycle Impacts	5	2	5	0	Architect
Mat 02 Hard Landscaping and Boundary Protection	1	0	1	0	Landscape Architect, Architect
Mat 03 Responsible Sourcing of Materials	4	1	3	0	Architect, Project Manager
Mat 04 Insulation	1	1	1	0	Architect, Mechanical Engineer

Mat 05	Designing for durability and resilience	1	1	1	0	Architect
Mat 06	Material efficiency	1	1	1	0	Architect
		13	6	12	0	
Waste						
Wst 01	Construction Waste Management	4	3	4	0	Project Manager
Wst 02	Recycled Aggregates	1	0	0	0	
Wst 03	Operational Waste	1	1	1	0	Architect
Wst 04	Speculative Floor and Ceiling Finishes	1	0	0	0	Client
Wst 05	Adaptation to climate change	1	1	1	0	Architect, Structural Engineer
Wst 06	Functional adaptability	1	1	1	0	Architect, Mechanical Engineer
		9	6	7	0	
Land Use & Ecology						
LE 01	Site Selection	2	2	2	0	Project Manager, Client
LE 02	Ecological Value of Site and Protection of Ecological Features	2	2	2	0	Ecologist
LE 03	Minimising impact on existing site ecology	2	2	2	0	Ecologist
LE 04	Enhancing site ecology	2	1	2	0	Ecologist
LE 05	Long Term Impact on Biodiversity	2	2	2	0	Ecologist
		10	9	10	0	
Pollution						
Pol 01	Impact of Refrigerants	3	1	0	0	
Pol 02	NOx emissions	3	3	0	0	
Pol 03	Surface Water Run Off	5	4	4	0	Civil Engineer
Pol 04	Reduction of Night Time Light Pollution	1	1	1	0	Electrical Engineer
Pol 05	Noise Attenuation	1	1	1	0	Acoustician
		13	10	6	0	
Innovation						
Man 03	Responsible construction practices	1	0	0	0	
Hea 01	Visual Comfort	1	0	0	0	
Ene 01	Reduction of energy use and carbon emissions	5	0	0	0	
Wat 01	Water Consumption	1	0	0	0	
Mat 01	Life Cycle Impacts	3	0	0	0	
Mat 03	Responsible Sourcing of Materials	1	0	0	0	
Wst 01	Construction Waste Management	1	0	0	0	
Wst 02	Recycled Aggregates	1	0	0	0	
Wst 05	Adaptation to climate change	1	0	0	0	
AI	Approved Innovation	1	0	0	0	
		16	0	0	0	

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