Environmental Sustainability Report

Building S1

King's Cross Central General Partner Ltd

August 2017

King's Cross

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Environmental Sustainability Plan

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Contents

1. INTRODUCTION

This Environmental Sustainability Plan (Plan) describes the strategies that have been included within the design of Building S1, including the Building S1 basement, within Development Zone S, at King's Cross Central (KXC) in response to the planning conditions of the 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, 46 and 48 of that permission, giving details of the strategies adopted and demonstrating that the building achieves a very high standard of sustainability. The plan also details how relevant obligations contained within sections AA, Y and Z of the S106 Agreement will be met.

This Plan should be read in the context of the other plans and documents forming the submission of Reserved Matters in respect of Building S1, including the Urban Design Report and the Planning Compliance Report. This document includes a BREEAM Pre-Assessment at Section 3.5 and Appendix B.

2. EXECUTIVE SUMMARY

Building S1 is located in Development Zone S of King's Cross Central. It comprises of approximately 18,230m² of net internal area for office space usage and 496m² NIA of retail spaces.

The King's Cross Central masterplan is a mixed use development, consisting mainly residential, educational, office and retail uses and first granted outline planning approval in 2006.

Figure 1: *Location of Building S1 within the King's Cross Central masterplan area*

Building S1 consists of ground floor plus ten levels of office space (Class B1) above; retail (Class A1 and A3/A4) units, cyclist parking servicing and welfare facilities at ground level, and plant areas at basement and roof level. Several massing setbacks are introduced at various levels in the façade forming accessible terrace at Level 7, 10 and 11.

The project team for Building S1 has worked closely with King's Cross Central General Partner Limited to realise a very high standard of sustainability and a high-quality internal environment for its staff and visitors. The combination of passive design, very energy efficient measures and the sourcing of heat and power from the low-carbon district energy system result in a very high overall annual carbon reduction of 22.75% relative to the current 2013 Part L2A 'Target Emission Rate'.

Other key environmental sustainability measures include greywater recycling, low flow water fittings, greenery and amenity rooftop facilities for staff, thorough energy and water metering and monitoring and use of materials with a low environmental impact.

Building S1 has been registered under BREEAM 2014 New Construction since concept design stage, allowing a complete analysis of its environmental credentials as the design has progressed. The project team is committed to achieving a minimum BREEAM 'Excellent' rating for the office element. The shell only retail element of Building S1 is targeting a minimum BREEAM 'Very Good' rating.

In summary, the main environmental and sustainability measures that are proposed include, but are not limited to:

2.1. Condition 17(A) Design and Technology Energy efficiency measures

The façade design, particularly the overall area of glazing and the fenestration composition, was informed by early dynamic thermal modelling and detailed sectional analysis. The building fabric is optimised to control heat losses and solar gains while maintaining good levels of natural light. Insulation of the external building elements is improved with respect to Part L2A's limiting U-values.

The office mechanical ventilation system will be fitted with Variable Air Volume (VAV) boxes on each riser branch, which will be controlled by the building management system (BMS), to:

- Enable each office floor to be commissioned and isolated independently from other floors
- Provide a means to allow operation of individual floors for partial occupancy/tenancy or out of hour's operation
- Provide the functionality for introducing "demand driven" control.

The base building ventilation will not be "demand driven", but it will include the ability for future tenants to introduce CO_2 control of the supply and extract air volumes to and from their tenancy. This solution could provide energy savings as the supply and extract volumes to each tenant zone could be controlled and reduced when levels or zones have periods of low occupancy.

Approximately 70% of the heat present in the return air from offices will be recovered, therefore reducing energy consumption.

The building services will be automatically monitored by a Building Management System (BMS), which will facilitate efficient operation of HVAC and lighting systems. In addition, an Energy Management System (EMS) will enable finer monitoring of energy consumption and can be utilised for billing purposes.

To ensure the correct, stable and efficient operation of the building services seasonal commissioning will be undertaken.

2.2. Condition 17(B) Reduction in carbon emissions

Excluding the contribution of the low-carbon district energy system and PV, the achievement of carbon emissions is 15.58% lower than Part L2A of the Building Regulations 2013 through the use of good passive building design, energy efficient system selection and intelligent control methodologies. Roof-mounted photovoltaic panels alone will reduce CO_2 emissions by a further 0.16%.

2.3. Condition 17(C) and 46: Provision of Green / Brown roofs

Buildings S1 sits within a Green/Brown Roof Priority Zone under Parameter Plan KXC021. A proportion of the level 10 and 11 terraces and roof level is provided as landscaped and green roofs respectively. This consists of:

An indication of the proposed landscaping, without species identified, indicates the provision of the following opportunities for ecological enhancement:

- 403.2m^2 of landscaping on the 10th floor terrace including the provision of trees, perennials, grasses, shrubs, ground cover and bulb species with a total of 21 species of known biodiversity value;
- 364.2m^2 of landscaping on the 11th floor terrace including the provision of trees and a minimum of 16 species of known biodiversity values; and
- 53.1m^2 of green roof at roof level, with a sedum variety containing a minimum of 8 species of known biodiversity value.

The green habitat at roof level is likely to comprise sedum species or brownfield habitat species, which will grow in suitable areas adjacent to the photovoltaic infrastructure, with additional habitat features such as stone piles and deadwood habitats.

The combination of the green roof area and the soft landscaping achieves at least 15% of the roofs.

2.4. Condition 17(D) and 48: Energy supply and Combined Heat and Power

The connection of Building S1 to the low carbon district energy system will allow it to take advantage of the low carbon benefits associated with combined heat and power. The district heating network will meet all of the heating and hot water demand of the building and the district cooling network will provide cooling.

The use of a low-carbon energy supply and the aforementioned passive design measures, energy efficient systems selection and intelligent controls result in Building S1 achieving an overall reduction in CO_2 of 22.75% beyond the Part L2A 2013 TER.

Photovoltaic panels will be integrated with a green roof on the available area at roof level and will meet a percentage of the electrical energy demand of the building.

2.5. Condition 17(E): BREEAM Rating

A BREEAM pre-assessment has been carried out for the office element of Building S1 and has identified that the design has an indicative score of 75.1%, equating to a secure 'Excellent' BREEAM 2014 New Construction rating.

The retail element pre-assessment has identified an indicative score of 61.7% to secure a 'Very Good' BREEAM 2014 New Construction rating.

2.6. Condition 45: Drainage

The drainage infrastructure networks around the King's Cross Central development are being designed on SUDS principles providing an overall peak flow rate reduction of 10% (based on a 1 in 30 year storm).

Thames Water has approved in principle surface water discharges for four direct connections. The approved surface water discharge for Building S1 is 158 l/s, based on assumed peak flows, with a further assumed foul water flow of 13 l/s for Building S1. The figures in tables 6 and 7 do not include for any public realm areas.

2.7. S106 - Section AA: Water

Sanitary fittings will comprise low flow dual flush WC's, low flush PIR controlled urinals and flow restricted taps and showers, solenoid shut off devices on all supplies to each toilet block and BMS monitored meters to major water using equipment, retail and functional space areas. The preliminary BREEAM assessment indicates a total reduction of at least 40% relative to a baseline performance.

A greywater recycling system will be treated and distributed throughout the building to serve WC flushing.

2.8. S106 - Section Y: Construction materials and waste

The principal contractor (design and build contract) will prepare a Site Waste Management Plan (SWMP) that includes target benchmarks for resource efficiency and procedures for minimising, measuring and reporting hazardous and non-hazardous waste and for sorting, reusing and recycling construction waste.

In addition to Section 106 requirements, the Development Manager has its own corporate construction targets which will be applied to the proposed development.

The targeting of credits under the BREEAM 2014's construction issues will ensure a higher standard of resources and waste control during construction. 'Man 3 - Construction site impacts' includes monitoring and reducing resource use and its waste production. 'Wst 1 – Construction waste' awards credits for construction waste efficiency and diversion of resources from landfill and requires the development of best practice procedures, monitoring and reporting.

2.9. S106 - Section Z: Waste

A simple Building User Guide will be produced and circulated to future occupants, and will include information on waste and recycling.

The allocation of a sizeable waste store for the Building S1 in the basement service area will allow for the future separation of waste and recyclable materials. The project will incorporate planning and BREEAM requirements for space allocation, accessibility and labelling.

3. RESPONSE TO PLANNING CONDITIONS

3.1. Condition 17(A): Design and Technology 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 S1 has been designed from the outset with energy efficiency as a key driver.

Whilst heating and hot water supplies to the building will be provided via the low carbon district heating system, the project team recognises the need to reduce the energy demand of the building through the application of the following design methodologies:

- **Passive Design** - The building form and highly efficient façade systems are designed and specified to minimise cooling loads and artificial lighting energy demand.
- **Active Design** - The specification of energy efficient equipment and controls (for example energy efficient lighting, daylight and presence sensors, efficient fans, etc.) to reduce energy consumption when the building is in use.

By embracing efficient passive and active design, Building S1 will also be 'future-proofed' to enable adaptation to climate change and the future operational needs of the tenant.

3.1.2. Passive Design

Physical Form of the Building

Building S1 is situated in the north-west part of the KXC development site. It is located on a rectangular plot on the corner of Handyside Street and Canal Reach. To the East, Building S1 fronts onto a street and plot S2 and to the North a pedestrian route separates it from the neighbouring plot S3.

Building S1 comprises flexible open plan B1 office space set on and over the ground floor plus ten main occupied floors. A centralised core incorporating stairs, lifts, WCs and the vertical services distribution. The ground floor comprises the main entrance and lobby area, cycle stores, loading area, refuse and an office area to the west, as well as two A1-A3/ A4 retail units to the north. A single-level basement provides support and plant space for the building, and plant areas are allocated at roof level 11 and 12.

The building form has evolved as a single mass, sculpted and shaped in response to a variety of design parameters set by the Outline Planning Permission and informed by the immediate physical site context. Set-backs have been created at street-level to create a pedestrian colonnade along Handyside Street to the south, and to signal the main entrance to the building; while at roof level the massing steps back to reduce the scale of the building, responding to its immediate proximity to building S2 the east. Further set-backs along the South elevation fronting Handyside Street and along the West elevation on Canal Reach have been created in response to daylighting cones (Figure 2 and Figure 3 below), with the widths and lengths of the terraces varied to create a diverse language within the developing townscape form.

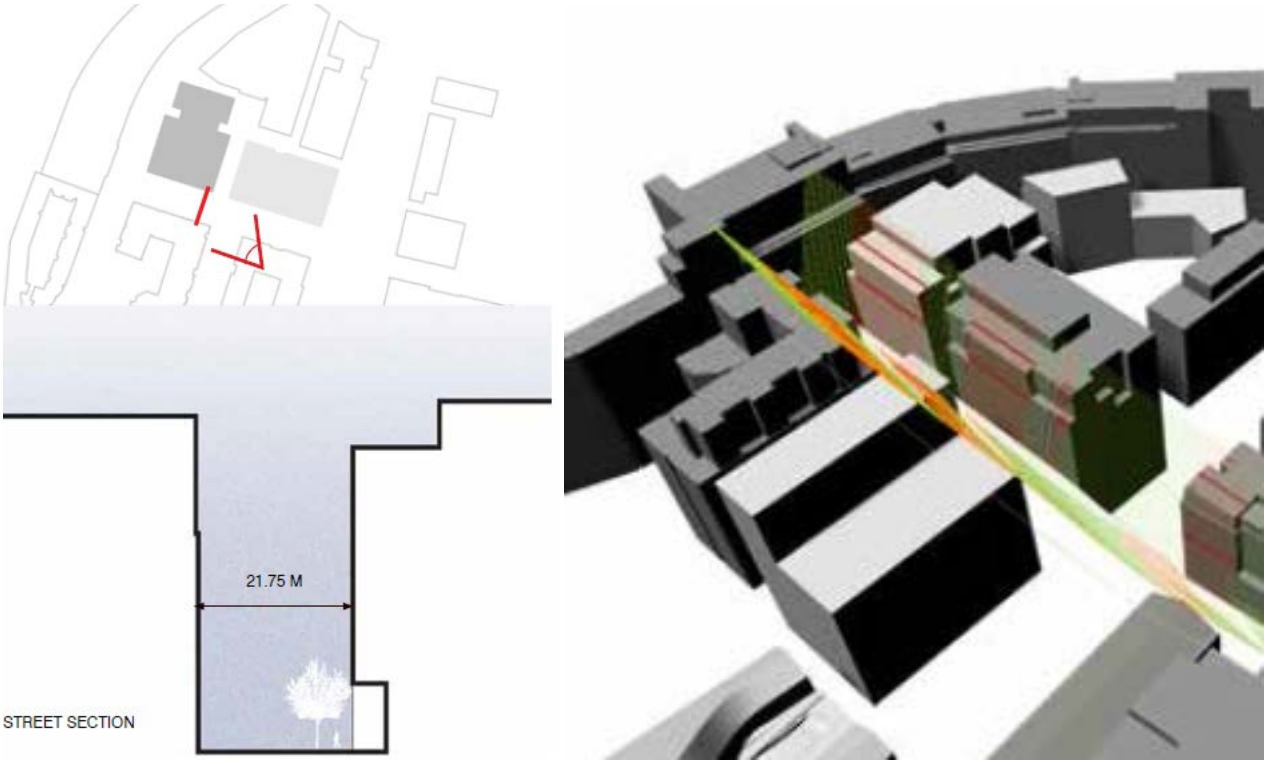


Figure 2: *Daylight cone study for Handyside Street*

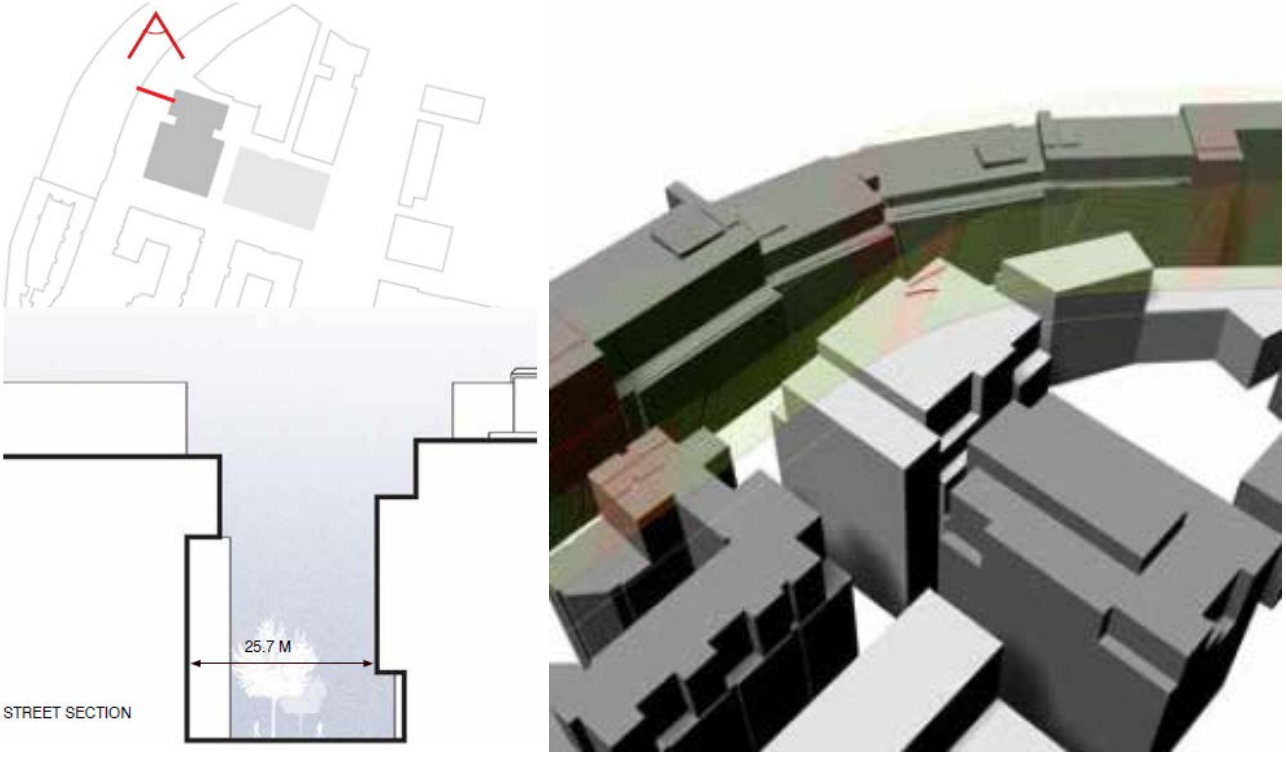


Figure 3: *Daylight cone study for Canal Reach*

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.

During the design stages the building's façade has been developed through dynamic thermal modelling simulations using industry-recognised dynamic analysis software. This has been employed to optimise the percentage of glazing, together with solar and light transmittance performance, to ensure good levels of natural daylight penetration whilst limiting solar gain and heat loss.

High performance building fabric with low U-values and the specification of low air-leakage rates will be used to minimise uncontrolled heat losses and gains. Computational analysis was applied to optimise the benefits from the high levels of insulation, selection of thermal and solar-control glass, the depth of reveals, as well as the proportions of glazing and opaque façade elements.

Figure 4: *The location and orientation of Building S1 (red arrow) in the context of the North West corner of the KXC development site, which includes Development Zones S and T.*

The results of the dynamic simulation analysis demonstrated that a g-value of 0.33 for the clear glass at typical office floors is likely to mitigate thermal discomfort. The Building S1 façade performance figures will comply with or exceed the Part-L Limiting Fabric Parameters as stated within the Building Regulations Part-L2 2013. It should be noted that the basement does not include any external facades.

The percentage of and the solar performance of the glazing on the upper levels has been specified to maximise the opportunity for very good levels of natural light. These indicative results were carefully considered during RIBA Stages 2 and 3. The building elevations are demonstrated below.

The façade of Building S1 comprises the following types:

- Wall type 1: Unitised cladding system, stone clad with punched glazing, with 4 different window sizes;
- Wall type 2: Aluminium curtain walling, consisting of 4 panels types, i.e. clear glazing, fritted glazing, corrugated anodized shadowbox (insulated), and anodised aluminium panel (insulated); and
- Retail façade: Aluminium curtain walling.

The specified glass performances are listed in Table 1 below.

Application	Centre Pane U-Value (W/m².K)	Specified g-value	Light Transmittance[1]
1. All clear glazing in Office floors (Wall type 1 and clear panels in Wall type 2)	1.02	0.33	60%
2. Fritted panels in Wall type 2	1.02	0.25	51%
3. Reception	1.60	0.54	78%
4. Retail façades	1.82	0.59	78%

Table 1 *Glazing properties used for Part L2A assessment*

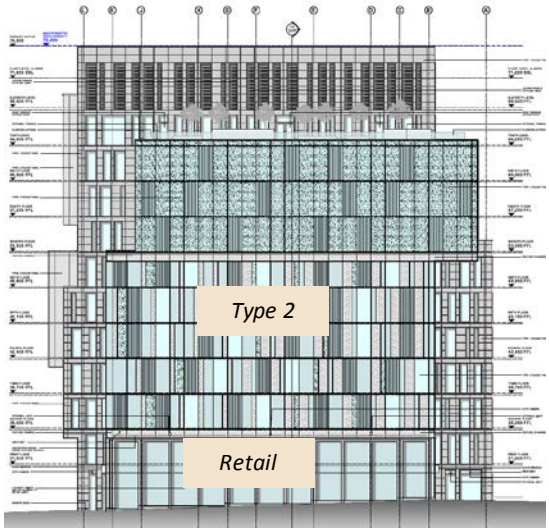


Figure 5: *North elevation*

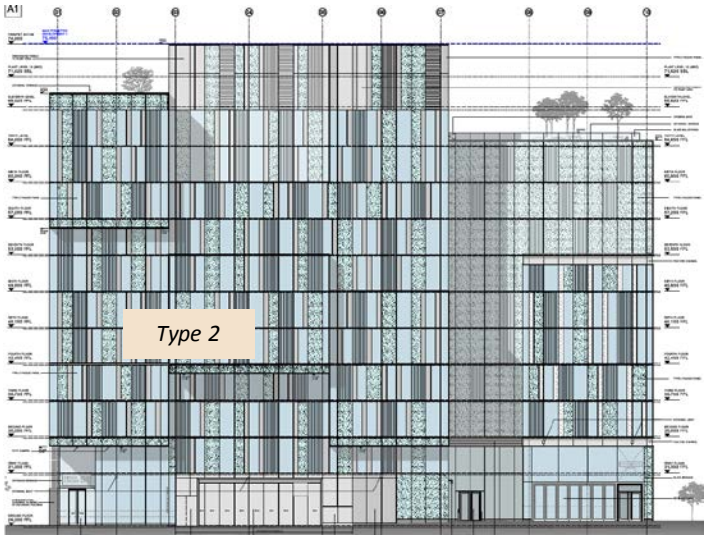


Figure 6: *East elevation*

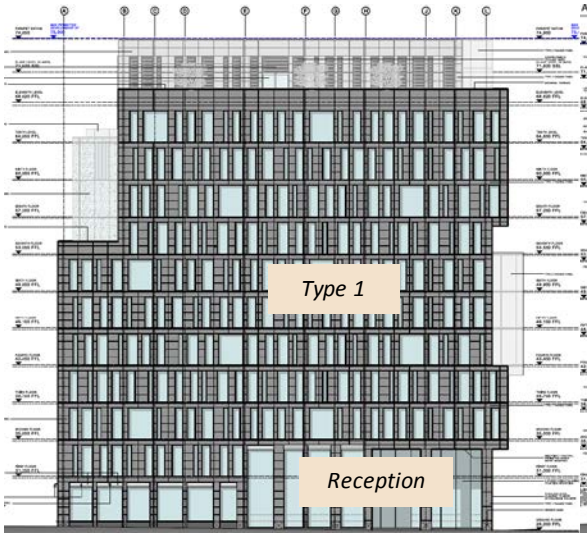


Figure 7: *South elevation*

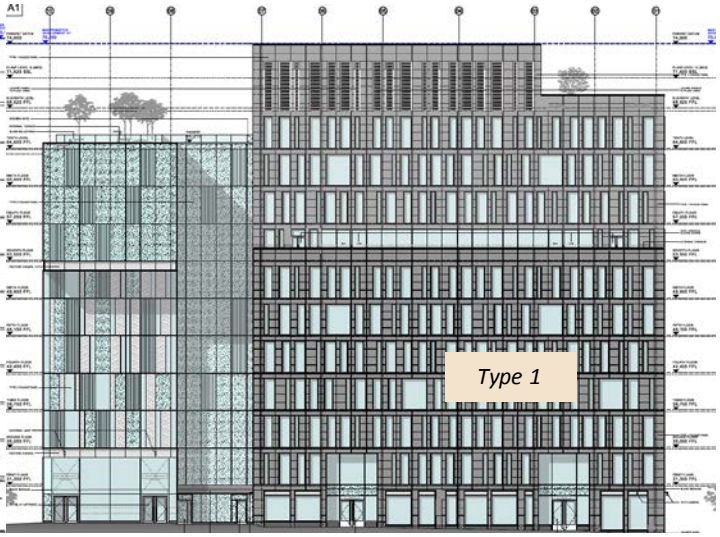


Figure 8: *West elevation*

[1] Note that the glazing light transmission values that are listed here are only indicative and vary for different products. As the performance between different glass manufacturers varies slightly, before final selection the 'preferred' glass should be tested to ensure it can meet the thermal comfort targets.

The results of the daylight analysis for Building S1 show a daylight factor of 2% achieved between 20% (on floor 2) and 50% (on floor 10) of the floor area. The façade has been optimised for access to daylight, with full height windows. In addition, the majority of the first 6m perimeter achieves the recommended daylight levels.

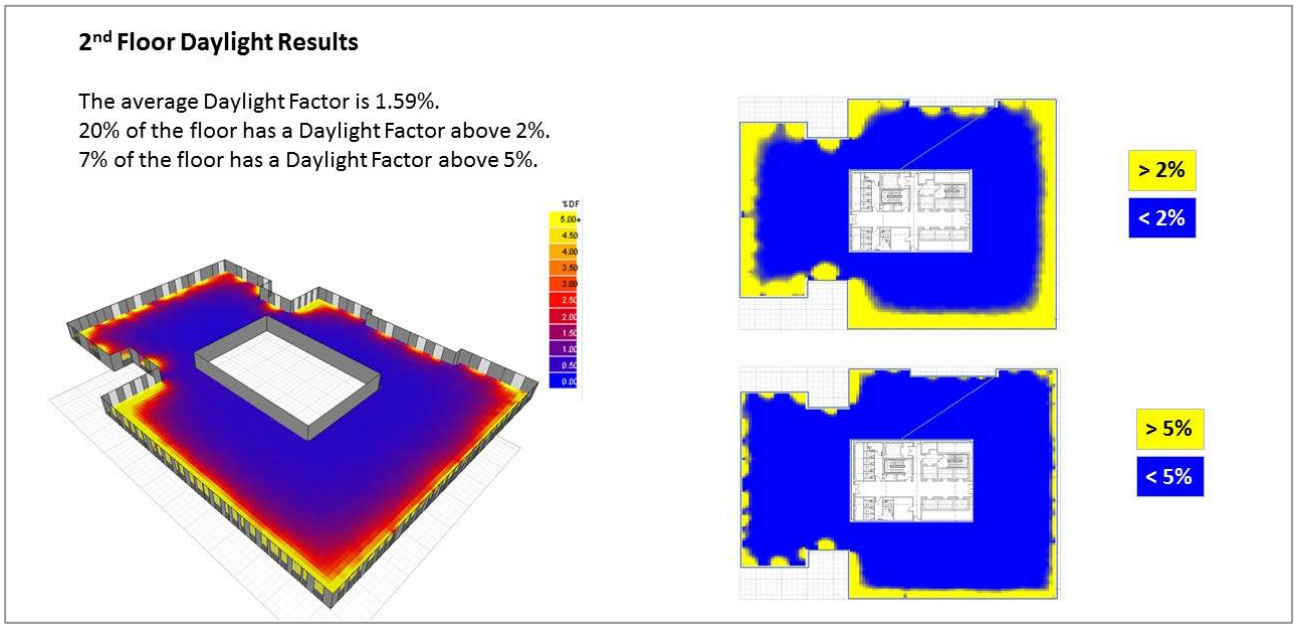


Figure 9: *Results from the daylight analysis for Level 2*

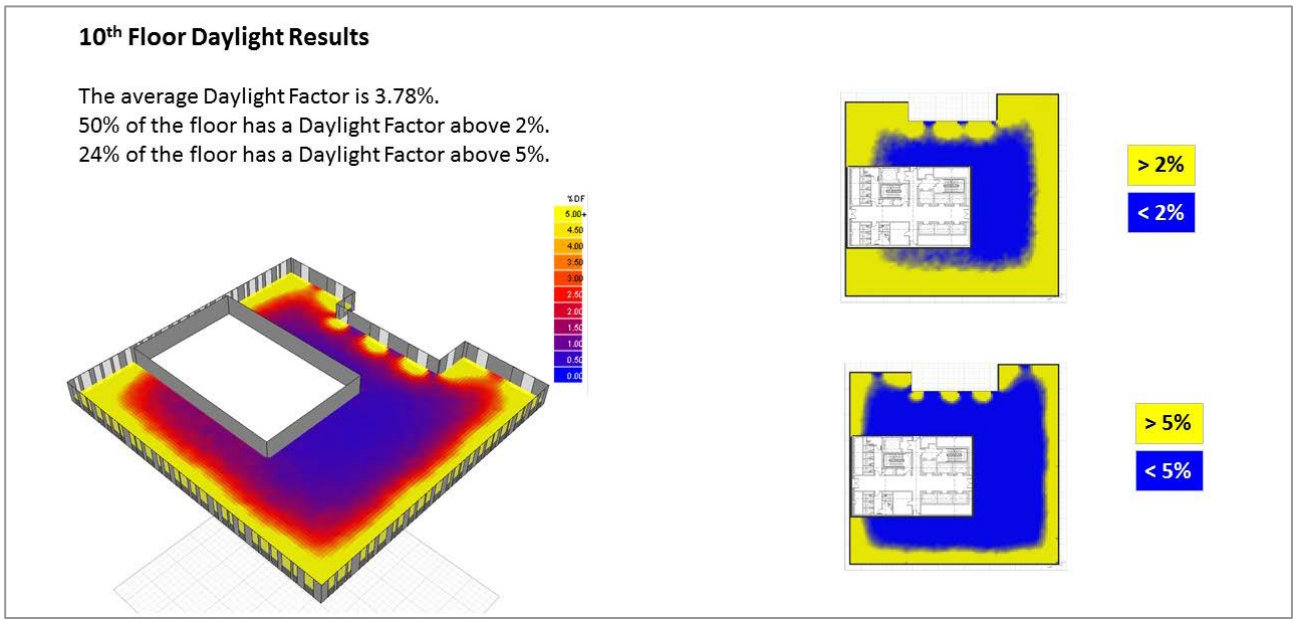


Figure 10: *Results from the daylight analysis for Level 10*

A comparison between the fabric parameters set out in Part L2A and those proposed for Building S1 are set out in Table 2.

Element	Part L2A Limiting Fabric Parameters U-value (W/m².K)	Building S1 Fabric Parameters U-value (W/m².K)
Curtain Walling Retail (overall, including insulation of the mullions)	2.20	2.20
Curtain Walling Wall type 2 (overall, including insulation of the mullions)	2.20	1.44
External Walls	0.35	0.35
Basement Walls	0.35	0.35
Ground and exposed floors	0.25	0.25
Roof and terraces	0.25	0.25
Air Permeability	10.00m^3/hr.m^2 @50Pa	5.00m^3/hr.m^2 @ 50Pa

Table 2: *Building Regulations Part L2A Limiting Fabric Parameters & Building S1 comparative figures*

The external façades have been optimised to minimise direct solar gains whilst maximising daylight provision into the occupied areas. The set-backs and terraces have enhanced the levels of daylight penetration into the office floors. As well as improving occupant comfort by increasing natural daylight provision, this will reduce the dependency on artificial lighting, thus resulting in significant energy savings.

Whilst the lower floors will predominantly be shaded by the proposed surrounding buildings, the design team has sought to limit the extent of solid building mass present at ground floor level. This is achieved by introducing a double-height colonnade externally, which is mimicked by the large reception lobby void internally to enable both the public realm and internal environment to benefit from increased levels of natural light.

The design also allows tenants to install internal blinds as part of their fit-out for glare control which will be more important during the winter months due to the inherent low sun angles.

Energy efficient mechanical ventilation systems have been specified to maintain desired internal comfort conditions. The efficient mechanical ventilation system will be zoned and controlled to reflect internal and perimeter variations and will operate during peak conditions.

Scope of Using Thermal Mass

Fan coil units will air condition the general office space due to their flexibility, good temperature control and fast response time to changing heat gains. The fan coil units will be selected to achieve a low specific fan power, thereby increasing the energy efficiency benefits.

This air conditioning system has been developed in conjunction with a steel frame super structure, which does limit the thermal mass of the building (in comparison to a concrete structure).

The proposed scheme does not include internal ceilings in the majority of the office open spaces, which will allow the concrete structural slab to be exposed, and therefore, maximise the use of the available thermal mass surfaces. However, if the incoming tenant's selects to install ceiling as part of their CAT B fit out design, the benefits of utilising the thermal mass of the floor slab(s) will not be fully realised.

3.1.3. Active Design

Building Energy Management System and Metering

A Building Management System (BMS) will be installed and will comprise of a dedicated network of intelligent controllers performing control and monitoring functions for mechanical and electrical plant serving the building. These will also report on the performance of services to the building operator via a dedicated PC interface system.

The BMS will monitor all the main building services plant, to record their performance over a period of time. The BMS will raise alarms upon plant failure or on an abnormal condition, such as exceedance of predetermined limits. It will have the capability to provide optimum control of the mechanical plant to achieve efficient running of plant and associated services. The BMS will be utilised to schedule plant to minimise unnecessary operation and extend plant life. These functionalities enable the reduction of energy consumption throughout the lifetime of the building.

Building S1 will also be equipped with a Landlord's Energy Management & Billing System, which will collect and continuously archive all the metered data from all of the mechanical, electrical, water and gas services within the building. The system will highlight any abnormal consumption readings, allowing a preventative approach through interrogation and resolution of potential problems.

Utility energy meters will be provided on all the main utility services serving the building. Base building meters will also be provided to monitor heating, cooling, ventilation, (cold & domestic hot) water and electrical use throughout the building

Sub-metering of energy usage at the main plant, retail units, landlord's areas and each office tenancy (namely, at each floor / riser) allows building owners and occupiers to view and interrogate where potential energy savings can be made throughout the building.

Mechanical Ventilation Systems

Centralised roof mounted air handling plant will provide outside air to the building. The air handling units (AHU) will incorporate filters, cooling & heating coils, a thermal wheel and supply and extract fans. Outside air will be drawn through the AHU via louvres within the roof plant room enclosure. The air will be filtered, heated or cooled, depending on the ambient conditions, and then distributed throughout the building (Figure 11). The external and riser primary air supply ductwork will be insulated to minimise heat loss or unwanted heat gains, which would otherwise result in increased energy usage. The external general office extract ductwork will also be insulated to maximise the heat recovery achievable from the extracted air.

Any useful thermal energy from extracted air will be harnessed by the thermal wheel. Thermal wheels continuously rotate allowing heat from the return air path to transfer to the incoming air stream. In winter, the warmer return air will raise the temperature of the cooler outdoor / supply air, thus reducing the amount of energy required to heat the incoming air to the required design conditions. In summer, the opposite will occur, with the incoming / supply 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 mechanically cool the air to design conditions.

At the office levels air will be supplied via fan coil units. A dedicated centralised toilet extract system will be provided to serve the toilets and cleaners cupboards on each level of the building. A toilet extract ductwork riser will be routed to extract fan located within the roof plant area. Make up air to the toilet areas will be drawn from the adjacent office accommodation and supplied to the space by fan coil units. Suitable attenuation will be provided between the toilet and office areas.

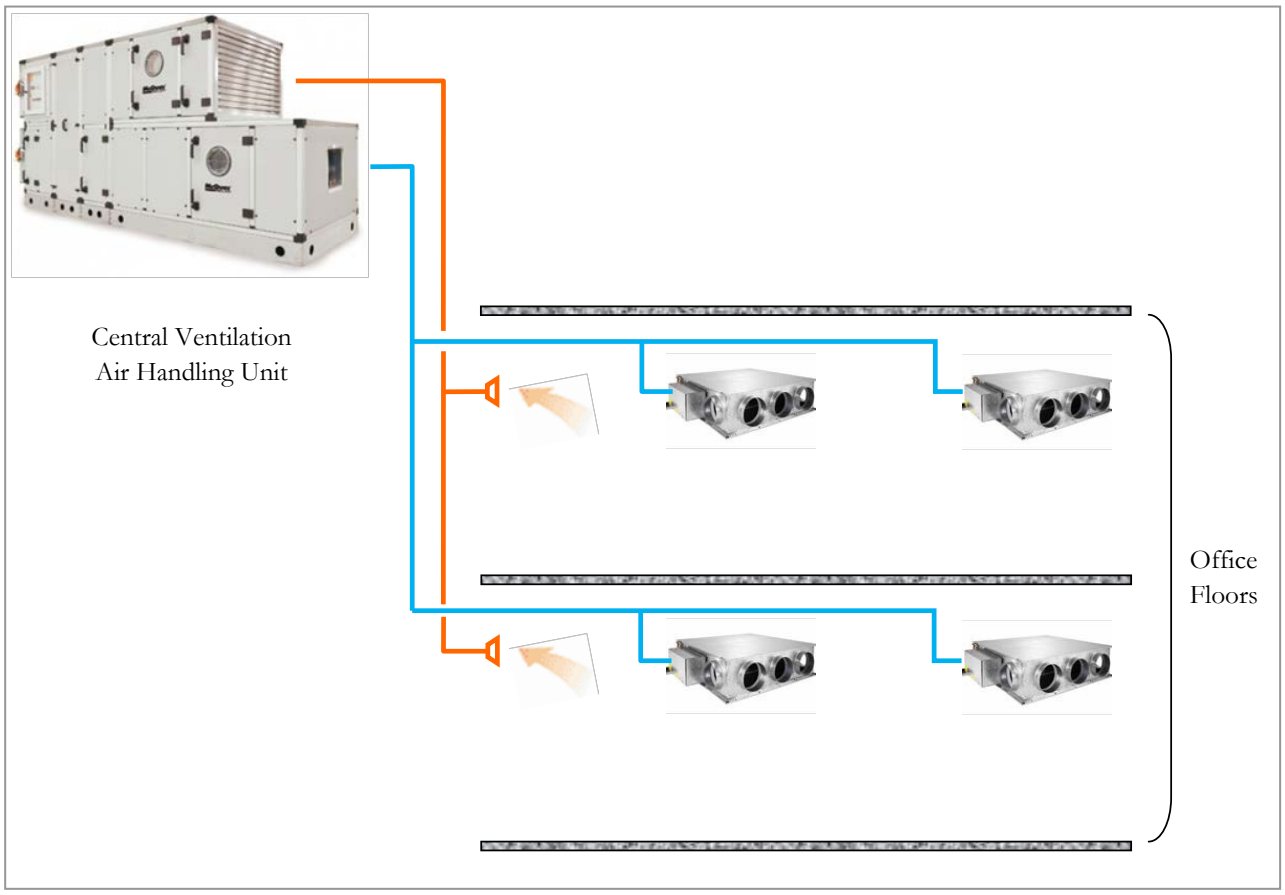


Figure 11: *Mechanical ventilation schematic for Building S1*

One of the Building's options for providing enhanced tenant services is the allowance for the installation of two dedicated kitchen ventilation systems. Plant and riser space (located on either side of the central core) will be provided to facilitate the future installation of tenant's kitchen facilities on the office floors.

Packaged air handling units will provide ventilation to the basement and ground floor areas. Each of the following areas will be served by an independent system;

- General basement / plant rooms
- Cycle store and cyclist facilities, and general back of house areas
- Refuse store
- Driver accommodation and welfare facilities

Generally, outside air will be drawn in via louvres and will be filtered, tempered and then distributed to each respective via a supply air ductwork system. Extract air will be drawn from each space via a ductwork system and duct/ceiling mounted grilles. The extracted air will be drawn through the AHU and any useful thermal energy will be harnessed by a plate heat exchanger, before it will be discharged to atmosphere via louvres.

The system serving the "*cyclist store and facilities, and general back of house areas*" will also incorporate Variable Air Volume (VAV) boxes on each main supply and extract duct branch to provide individual control of the ventilation of each of the separate spaces.

Scope for Intelligent and High Efficiency Lighting Systems

The lighting installation will aim to maximise energy efficiency and occupier comfort through the use of innovative technology such as LED luminaires and advanced lighting control techniques.

A lighting control system will provide flexibility and optimise the building's energy consumption whilst maximising occupant comfort and control in line with the best practice guidance given in the BCO Guide to Lighting. The control system will provide lighting when it is required, and switch off lighting when the areas are vacated. Dimming control will provide the correct light levels required for the associated task, maximise the use of daylight and to guard against the risk of light pollution. Perimeter office areas will be provided with photocell sensors to provide a degree of intelligent dimming that monitors daylight and adjusts the lighting intensity accordingly

Lighting will also comply with the following requirements:

- All fluorescent and compact fluorescent lamps will be fitted with high frequency ballasts to prevent flicker and visual discomfort to occupants.
- Lighting for all occupied internal building areas is specified in accordance with the SLL Code for Lighting 2012.
- Areas with computer screens are specified in accordance with SLL Lighting Guide 7 sections 2.4, 2.20 and 6.10 to 6.20.
- Illuminance levels for lighting in all external areas within the construction zone are specified in accordance with BS 5489-1:2013 Lighting of roads and public amenity areas and BS EN 12464-2:2014 Light and lighting - Lighting of work places - Part 2: Outdoor work places.
- Internal office lighting system is specified with the flexibility to be zoned to accommodate the future tenant's fit out and BREEAM requirements.

Power Correction Factor

Power factor correction to 0.95 or greater will be provided through the installation of correction equipment to improve the efficiency of the electrical supply.

Many items of equipment within a building cause a lagging power factor, a good example being a motor. This lagging power factor is inefficient because it means more energy is required to produce the power consumed.

For example a motor consumes 1kW of electrical power whilst running, at unity power factor (PF=1) this requires 1kVA of apparent power to be supplied to it. If the power factor is reduced to 0.8 then 1.25kVA needs to be supplied to get the required output.

Heating

Heating demand for Building S1 will be supplied by the low carbon energy network serving King's Cross Central. A heating plant room will be located within the basement to accommodate the utility provided plate heat exchanger assemblies, and the building's LTHW distribution pumps and ancillary plant. Connections from the district heating system will be extended into the plant room to supply (heat) energy to the building, via metered plate heat exchanger arrangements (Figure 12). The building will make use of

the low carbon heat to serve the whole building's space heating and domestic hot water, including the retail units.

The building's heating distribution system will be based on a primary and series of secondary variable volume circuits, namely;

- Landlord's circuit(s) serving;
  - the retail units, office air handling plant, landlord's air handling plant, landlord's fan coil units, under floor heating, trench heating, radiators, radiant panels, fan convectors, door air curtains and the like.
  - Landlord's Domestic Hot Water (DHW) generating equipment serving the base building WCs, WHBs and shower facilities.
- Tenant's circuit serving the tenant's fan coil units and will include allowance to serve the future office tenant catering facilities.

All pumps will be provided with inverters to maximise energy savings.

Figure 12: *Example of prefabricated plate heat exchanger installation*

Cooling

Cooling demand for Building S1 will be supplied by the district cooling network serving King's Cross Central. A cooling plant room will be located within the basement to accommodate the utility provided plate heat exchanger assemblies, and the building's CHW distribution pumps and ancillary plant. Connections from the district cooling system will be extended into the plant room to supply energy to the building, including the retail units, via metered plate heat exchanger arrangements (Figure 12). The building's CHW distribution systems will comprise of a primary and a series of secondary variable volume, constant temperature circuits, namely;

- Landlord's circuit serving the office air handling plant, landlord's fan coil units, under floor cooling, ground floor lobby cooling units and retail units.
- Tenant's circuit serving the tenant's fan coil units and will include allowance to serve the future tenant's kitchen ventilation supply air plant.

All pumps will be provided with inverters to maximise energy savings.

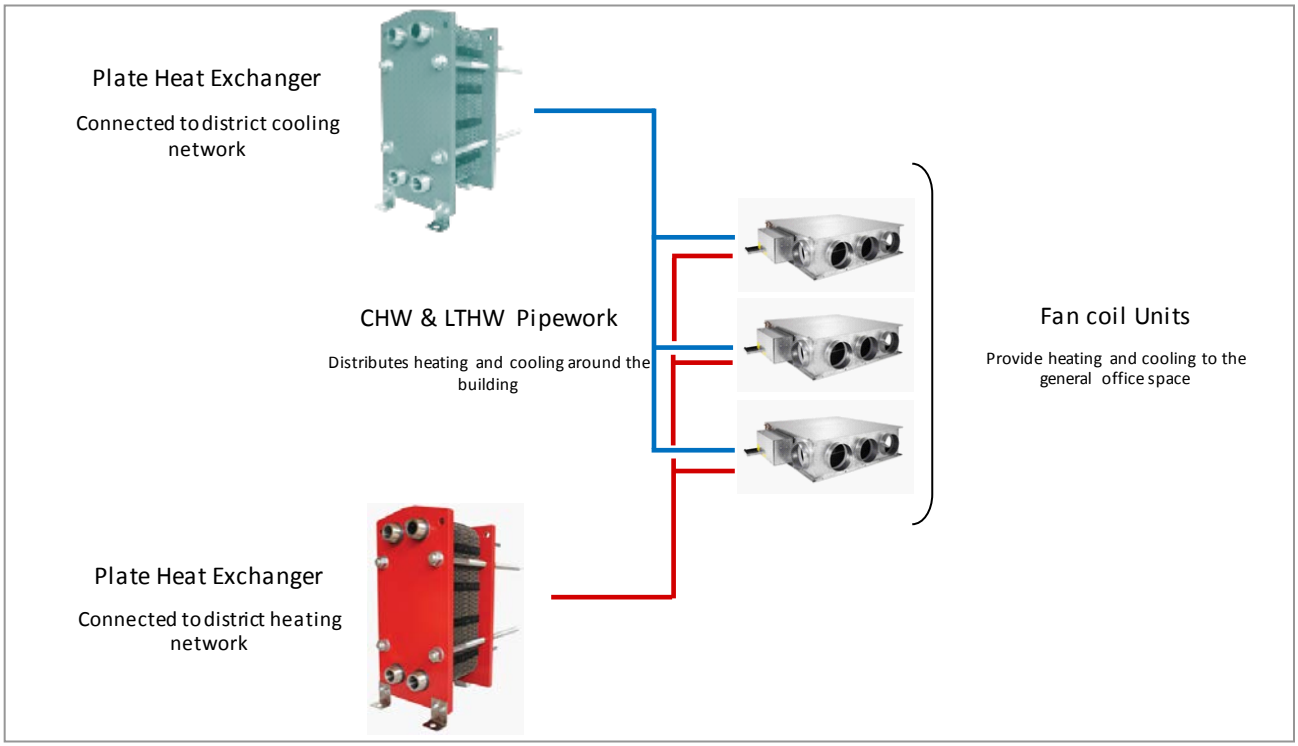


Figure 13: *Fan coil unit air conditioning schematic*

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."

Building S1 is primarily an office building, with retail, food and drink (A1-A3 and A4) uses at ground floor level. As such, it 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 the Department for Communities and Local Government, has been used under the supervision of a licensed energy assessor (LCEA) to assess regulated carbon dioxide emissions of the building (the Building Emission Rate or 'BER') against the Target Emission Rate (TER) set by Part L2A of the Building Regulations. Appendix A of this Plan sets out the assumptions and methodology of the TER and BER calculations for the building in more detail.

The Building Regulations Part-L2 compliance is demonstrated by utilising these models and inputting the Part-L limiting values for building fabric U-values, plant efficiencies and operational parameters to determine a notional (or benchmark) building emission. To comply, each building will have to show carbon emissions which are lower than the notional building figure. This notional building figure is known as the 'Target Emission Rate' (TER). Once calculated, the actual emission rate of the building and its systems is referred to as the 'Building Emission Rate' (BER).

The ADL2A notional (or benchmark) building emission for this project is 23.56 kg CO_2/m^2. The BER must be below this figure. Under the new Part L2A of the Building Regulations 2013, the notional building emissions will also be the TER.

The KXC S106 Agreement requires each new building to achieve carbon emissions by at least 5% lower than Part L2A 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. On the basis of these measures alone (i.e. disregarding the carbon savings that will be achieved by utilising the low carbon district heating system and the PV panels), the carbon emissions for the building are expected to be 19.89kg CO_2/m^2 (Figure 14). This represents a 15.58% reduction over the Part L2A TER. Consequently the building significantly exceeds the target 5% reduction set by the S106 Agreement.

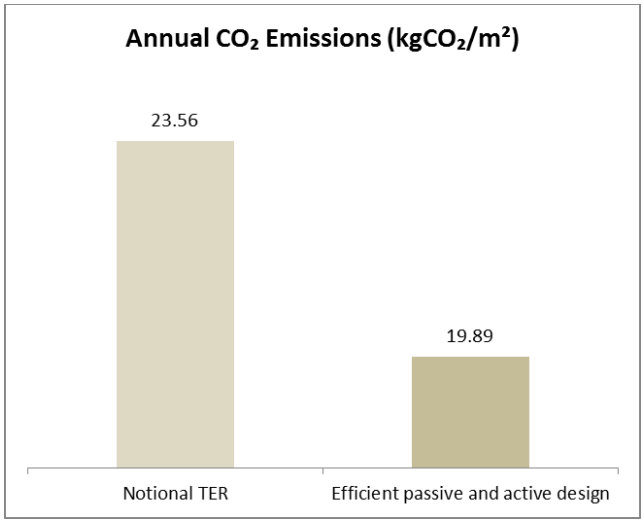


Figure 14: *Part L2A Assessment of proposed passive and active design measures for Building S1, excluding the benefits of the low-carbon district heating system*

Similarly, taking into account building design and technology measures only, a comparison with 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 33.82% (Figure 15).

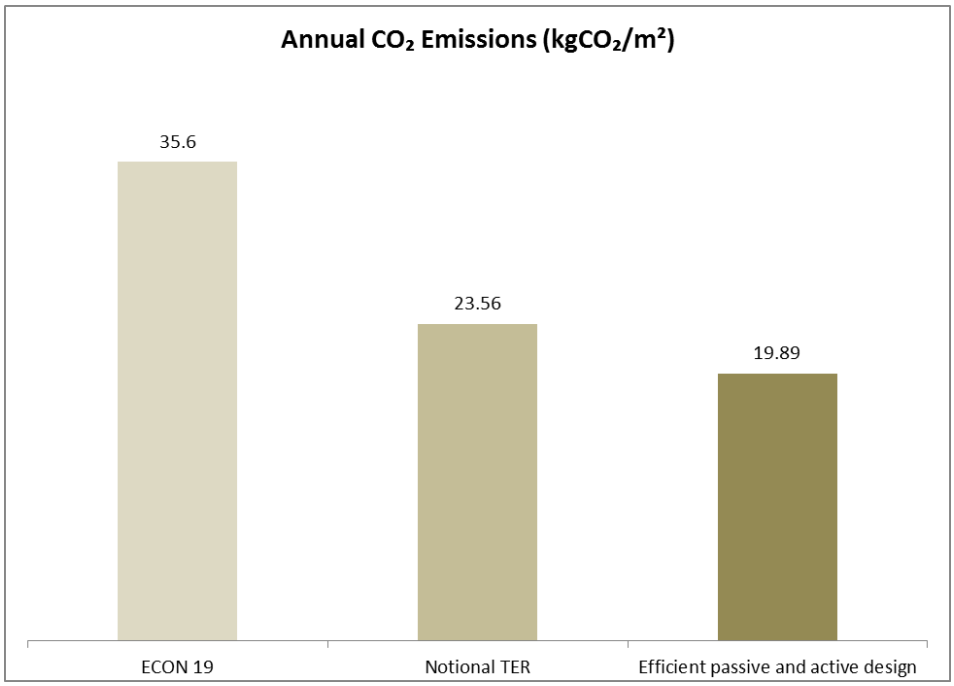


Figure 15: *Part L2A Assessment of proposed passive and active design measures for Building S1, excluding the benefits of the low-carbon district heating system, compared with the Econ 19 'Business as Usual' benchmark*

Business as Usual Benchmark (ECON 19)

Section X of 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 the Energy Assessment which supported the outline planning application (2005). For office buildings, the relevant benchmark is ECON19, which includes process loads such as catering facilities, data rooms etc. consumed within the building. This contrasts with Part L2A of the Building Regulations which excludes small power. The impact of small power is dependent on the fit-out of the building and the occupier's own requirements.

Since the completion of the Section 106 Agreement in 2006, Part L2A 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 L2A (2013), the building will be achieving a reduction in carbon emissions that meets (and indeed exceeds), the ECON19 Business as Usual Benchmark set out in the original KXC Energy Assessment, thus making a contribution to the achievement of the 32% target set out in the Section 106 Agreement.

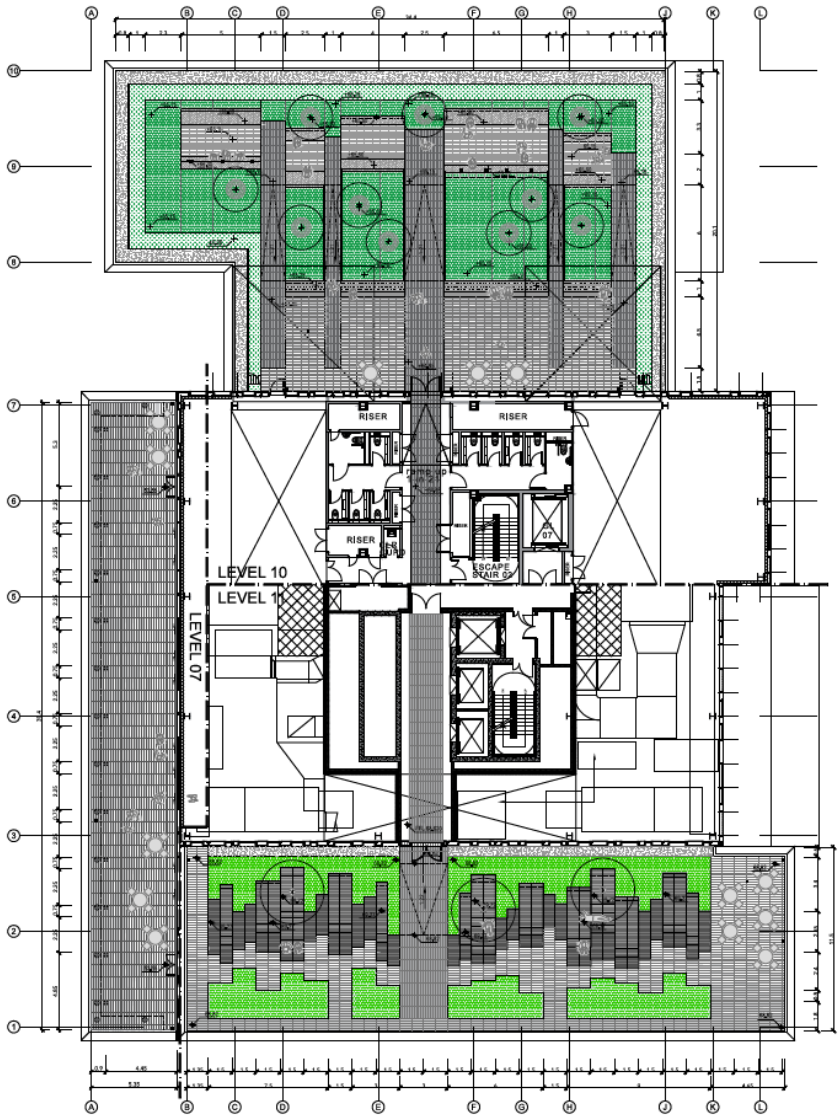
3.3. Condition 17(C) and 46: Provision for Green and/or Brown Roofs

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

"At least 15% of the roofs of new buildings constructed […] shall be green and/or brown roofs."

Buildings S1 sits within a Priority Zone for Green/Brown Roofs under Parameter Plan KXC021[2]. The ecological value of the site has also been assessed and this has influenced the choice of planting on the roof and terrace.

The development includes the provision of a landscaped terrace on level 10 and 11 and a green sedum roof at the roof level above the core.



[2] The term 'green roof' is defined in the Revised Development Specification (2005) as both intensive ornamental roof gardens and extensive roofs with more naturalistic plantings or self-established vegetation. The term 'brown roof' refers to roof areas where ruderal vegetation (vegetation associated with disturbed sites) is allowed to colonise low fertility substrates like those found in the rubble of demolished buildings.

Figure 16: *Proposed landscaping and amenity spaces at level 10 and 11 terraces*

An ecological appraisal has been completed on the basis of ecological assessments carried out by RPS of the wider Kings Cross masterplan site in 2007 for the Environmental Impact Assessment, with further surveys completed by Hilson Moran in September 2014 and January 2017 to ensure the findings are up to date and continue to reflect conditions on the site. The assessments have also been supported by a desk based study, drawing on readily available information on protected sites and species and those obtained from the local biological records centre (Greenspace Information for Greater London).

The habitats present on the site throughout the ecological assessments have been identified as being of low ecological value, from RPS's assessment in 2007 through to Hilson Moran's assessment in 2017.

An indication of the proposed landscaping, without species identified, indicates the provision of the following opportunities for ecological enhancement:

- 403.2m^2 of landscaping on the 10th floor terrace including the provision of trees, perennials, grasses, shrubs, ground cover and bulb species with a total of 21 species of known biodiversity value;
- 364.2m^2 of landscaping on the 11th floor terrace including the provision of trees and a minimum of 16 species of known biodiversity values; and
- 53.1m^2 of green roof at roof level, with a sedum variety containing a minimum of 8 species of known biodiversity value.

The green habitat at roof level is likely to comprise sedum species or brownfield habitat species, which will grow in suitable areas adjacent to the photovoltaic infrastructure, with additional habitat features such as stone piles and deadwood habitats.

Inclusion of the enhancement measures as part of the development will have a benefit to local biodiversity and contribute towards targets contained within the London Plan and London Borough of Camden BAPs.

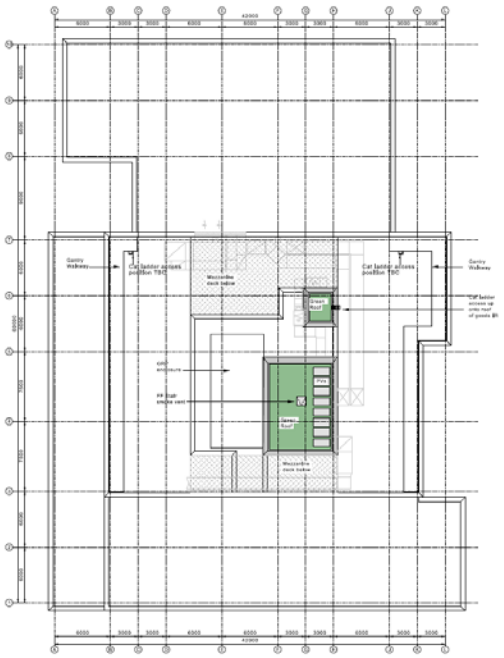


Figure 17*: Proposed green roof at roof level (in green)*

3.4. Condition 17(D): Reduction in Carbon Emissions

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

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

3.4.1. Overview

The Energy Centre, which forms part of Building T1 at Kings Cross Central, has already been constructed and partially commissioned to meet the heat and hot water demands of the first occupiers at KXC, including the University of the Arts London and other commercial tenants in the Granary Complex/ Western Transit Shed, residents of Building R4 and R5 North, and the B zone offices.

The necessary heat, cooling and power distribution infrastructure has been and is being installed across the KXC site to enable the connection of each new building to the site-wide district energy system. The thermal energy supplied to Building S1 will be used to provide all of its space heating, cooling and hot water demands. The combined heat and power (CHP) engines within the Energy Centre will also generate electrical power (to be sold to a third party), which will offset a significant percentage of the buildings demand. Building S1 will be able to benefit from the domestic hot water load generated by the cyclist showers and office wash hand basin hot water demand.

The showers and wash hand basin heating demand is supplied via the low carbon district energy system. The notional building used within the Part-L2 to compare the Building S1 design efficiencies, would typically utilise localised electric heating to serve these showers and wash hand basins. Plant will be installed and commissioned on a phased basis in order to meet demand as buildings are completed and to optimise efficiency. When fully fitted, it is anticipated that the T1 Energy Centre will include the following principal items:

- 3 x No. 1.8MWth gas fired CHP
- A thermal store, integral to the CHP operating hours strategy
- 3 x No. 9MWth gas boilers
- Absorption chillers on waste heat produced by the 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.

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.

3.4.2. CO_2 Savings Arising From the KXC Energy Centre

Taking into account the passive design and energy efficiency measure set out in Section 3.1 of this Plan, combined with the contribution made by the connection of Building S1 to the low carbon district energy system, the BER is reduced further from 19.89kg CO_2/year to 18.23kg CO_2/year, representing an overall reduction of 22.75% in emissions against the TER under Part L2A 2013.

Figure 18 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.

Without the KXC district heating network, the CO_2 emissions for heating and hot water would derive from the use of gas which has a carbon factor of 0.216kgCO_2/kWh, as established by the current Standard Assessment Procedure (SAP) 2012. The low carbon technology used in the Heating Energy Centre reduces this figure to 0.12kgCO_2/kWh. Since the heating and hot water only accounts for a small part of regulated energy consumption (Table 3), in part as a result of the nature of use of the building but also because of a commendable design effort in reducing heating demand by passive means, the emissions reduction that is attributable to the district heating is relatively small, albeit environmentally significant.

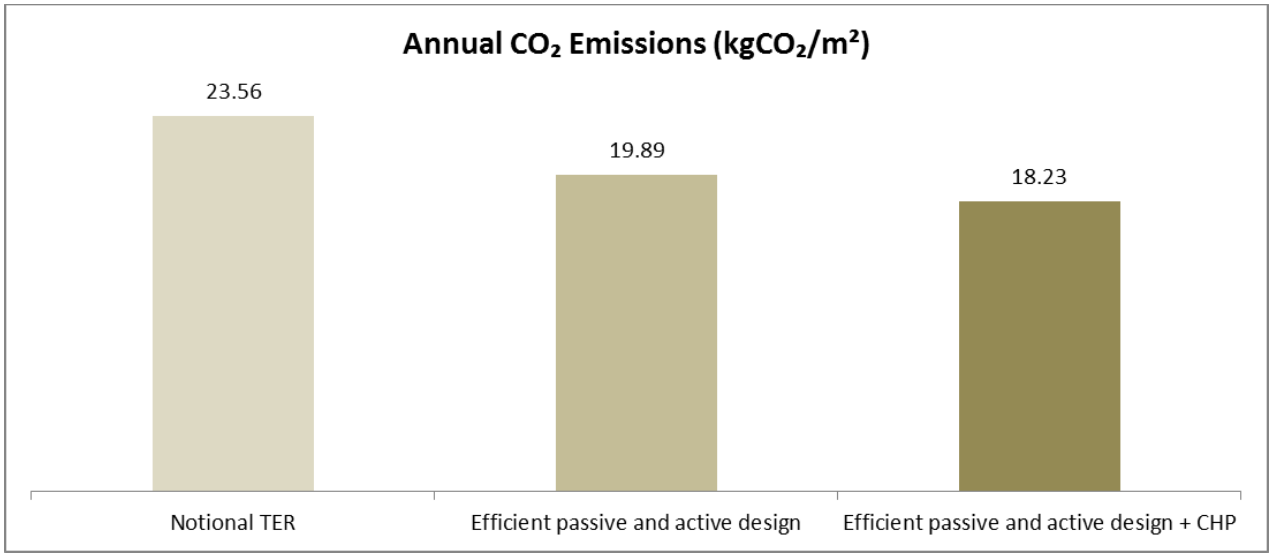


Figure 18: *Building S1 CO_2 emissions resulting from passive design and energy efficiency measures and the contribution of the low-carbon district heating network*

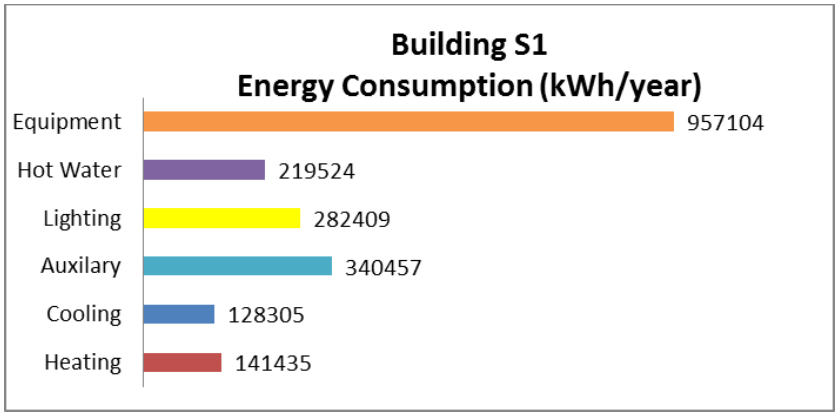


Table 3 *Breakdown of primary energy consumption in Part L2A assessment for Building S1*

3.4.3. Renewable Energy Options

The September 2005 Energy Assessment and Parameter Plan KXC021 does not highlight Zone S as a priority location for wind turbines or photovoltaic (PV) panels. Nonetheless, the incorporation of renewable technologies into Building S1, specifically the preferred on-site renewable technologies (Photovoltaic cells, wind turbines, solar water heating and ground source heat pumps) described in the 2005 Energy Assessment, has been explored extensively during design development.

Balancing the likely level of carbon emission reductions against other factors, including provision of roof top plant, amenity space for occupants and planning height restrictions, it is considered that an array of PV panels would be the most suitable for Building S1. The review by technology is summarised below.

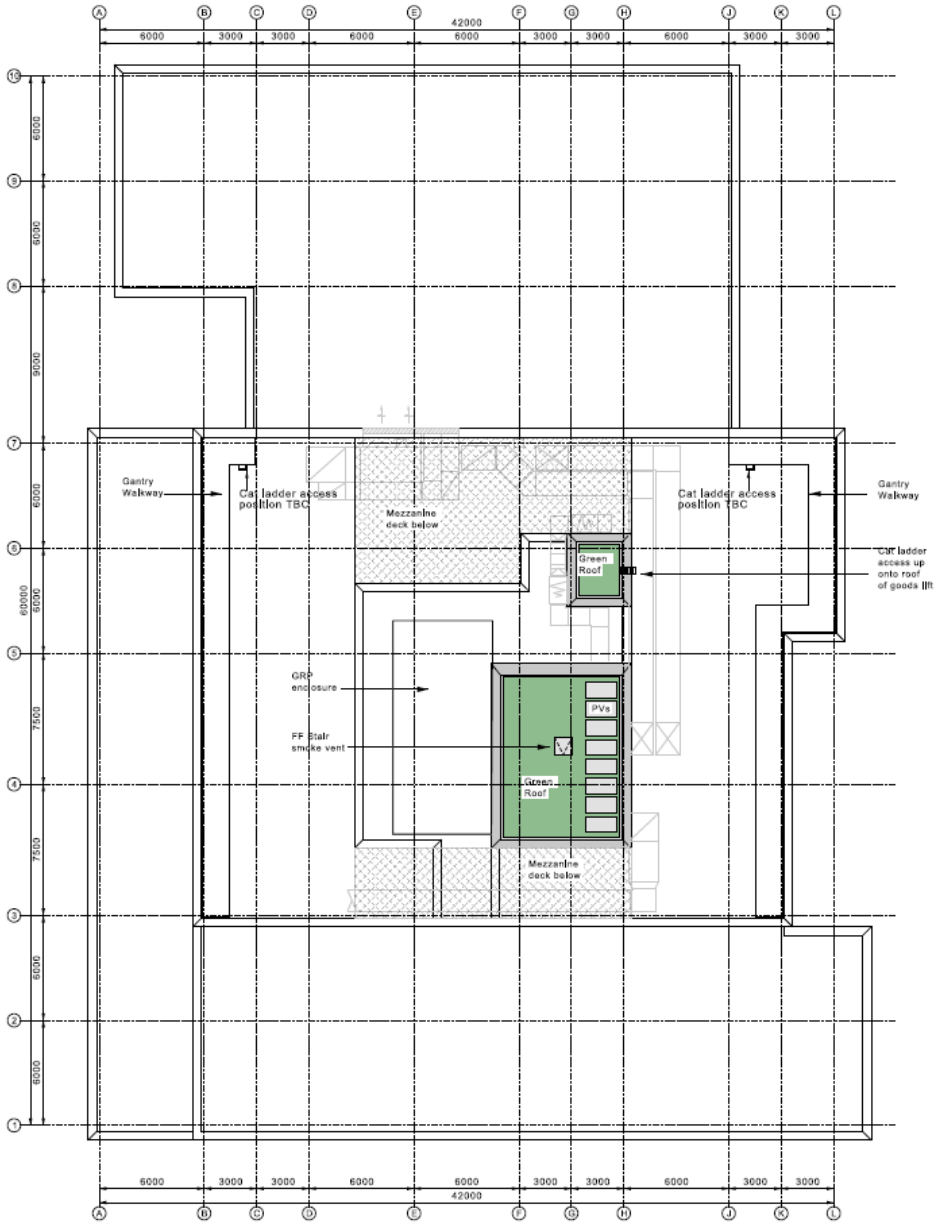


Figure 19: *Indicative location of PV array at upper roof level*

Photovoltaic cells (PVs) – The design approach for the Building S1 is to prioritise 'be Lean' and 'be Clean' measures to reduce CO_2 emissions and to utilise available roof area for soft and hard landscaped amenity

space for the building users. In this way the proposed development project has succeeded in reducing carbon emissions by 22.75% and has maximised the use of available roof space in favour of the health and well-being of building users and local biodiversity.

Nevertheless, a net (active) area of circa 12m² is integrated with the green roof at the upper roof level (Figure 19). The array will be set at a tilt of 6° to the horizontal and is estimated to result in an annual saving of 0.69 tonnes of CO_2 emissions, equivalent to 0.16% reduction relative to the Part L2A TER.

Wind turbines – Turbines sized for the urban environment are likely to produce very modest power outputs and corresponding reduction in the sites total CO_2 emissions. Turbulent air is likely to increase turbine wear and noise. Wind turbines may also appear incongruous in long and short range views, particularly in the immediate context of the Grade I listed King's Cross Station and the wider context of the similarly listed St. Pancras Station and the King's Cross Conservation Area. In addition, the proposed use of the roof for amenity space, plant and leisure facilities limits the availability of suitable areas for their installation. King's Cross Central has moved away from wind turbines in other locations previously considered suitable/ a priority (for example Building T1) and installed PVs instead.

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 design for the proposed building and the basement has been progressed to make full use of the heating from the low carbon district energy system. The use of solar hot water would reduce (albeit marginally) the efficiency of that system. In addition, amenity uses, biodiversity improvements and electricity generation have been prioritised for available roof space.

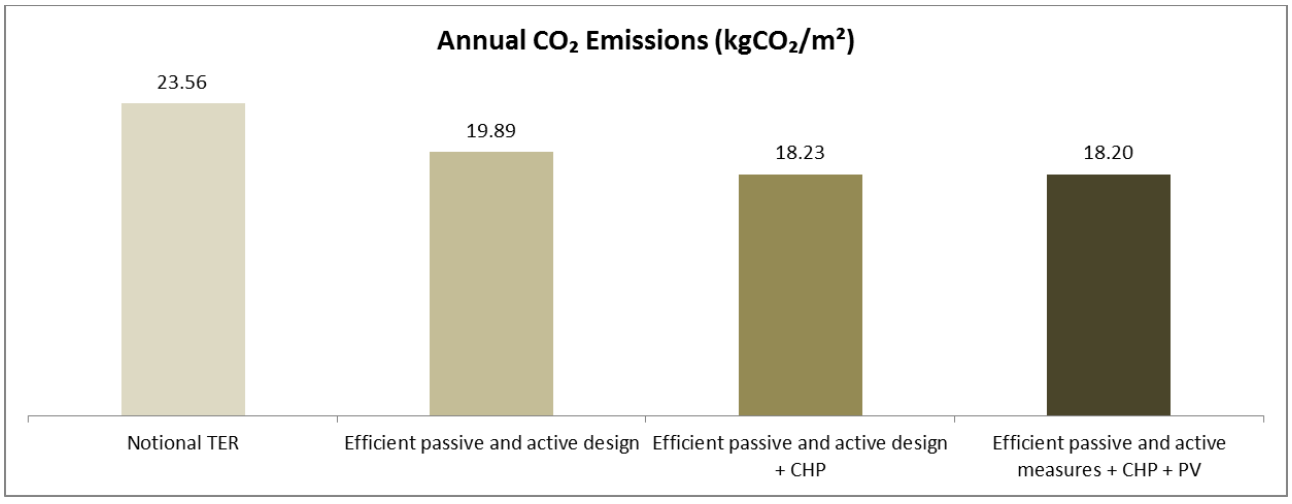


Figure 20: *Building S1 CO_2 emissions resulting from passive design and energy efficiency measures, the contribution of the low-carbon district heating network and the PV array*

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. Typically they can serve air-conditioned buildings up to around 4 storeys from the ground floor. Given the height of the proposed building (up to 12 storeys), it is considered that the size of the building is not conducive to GSHP. Further, the use of heat from the low-carbon district energy system means that the buildings and the basement will not be able to offer a balanced heating and cooling application and therefore GSHP would not be able to achieve the carbon savings that will be achieved by using that system. Hence the ground source scheme has not been pursued.

Overall, the building design focuses on passive and active design and energy efficiency measures, to reduce energy demand. Thereafter, the use of the district heating system to provide all of the building's space heating and hot water, combined with high efficiency chillers, is the lowest carbon solution for providing the energy that is required.

In conclusion, the PV array's contribution to annual CO_2 emission savings is demonstrated in ***Figure 20***.

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. BREEAM 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.

Building S1 has been registered since concept design stage under BREEAM New Construction 2014. The office and retail uses have been registered and assessed separately. The project team is committed to going beyond the requirements of the condition and achieving a minimum rating of BREEAM 'Excellent' for the office floors.

The offices pre-assessment undertaken by the BREEAM assessor, attached as Appendix B, indicates a current score of 75.1% (i.e. an 'Excellent' rating), as shown in Table 4.

The team has taken a holistic approach to every aspect of the building's 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.

	Credits Available	Targeted	Possible
Management	18	18	0
Health & Wellbeing	10	6	2
Energy	21	16	4
Transport	9	9	0
Water	9	6	3
Materials	13	6	2
Waste	9	6	1
Land Use & Ecology	10	8	1
Pollution	13	9	0
Exemplar Performance	10	2	2
	Final Weighted Score	**75.1%**	**88.9%**
	Predicted BREEAM Rating	**Excellent**	**Outstanding**

Table 4 *BREEAM pre-assessment overview (offices)*

The retail element pre-assessment has identified an indicative score of 61.7% to secure a 'Very Good' BREEAM 2014 New Construction rating under a Shell Only assessment.

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. Full evidence will be gathered in due course at the detailed design stages as the projects progress.

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."

Although the presence of protected species on-site is limited, due to the levels of activity and an absence of semi-natural habitat, the diverse nature of the surrounding habitats have the potential to support a range of legally protected and ecologically significant species, notably breeding birds, bats and invertebrate species. Of particular note is the presence of Regent's Canal to the south-west of the site, which will provide important habitat connectivity with the wider environment and other green spaces in London.

A number of specially protected bird species were identified in the study area, with potential for their presence in the undeveloped or developed habitat surrounding the site. It is recommended that a breeding bird survey is conducted prior to the commencement of construction activities to ensure no specially protected species are breeding in close vicinity to the site, and therefore likely to be affected by the development.

In the event that nesting birds are identified on site during works, an appropriate 'standoff period' will be enforced around the nest until the young have fledged, as all birds, active nests and eggs are protected by law. In the event that a specially protected species is identified as present within or adjacent to the site, then work should stop immediately and further advice sought. The exclusion area for a specially protected species will be much greater than that of other bird species, as the additional legislative protection prevents disturbance of the nest and dependent young.

No other protected species are considered likely to be present on the site, although bat and invertebrate species are likely to utilise surrounding habitats. The construction of the development is unlikely to significantly influence habitat use off-site, however best practice measures will be incorporated to reduce potential impacts, for example from light spillage, which will be addressed by designing the external lighting for this area to be sympathetic to the wildlife populations.

Building S1 will enhance the ecology of the site, through the inclusion of nesting/overwintering aids for invertebrates and artificial habitats for bird species. A range of artificial faunal habitat opportunities is recommended by the ecological appraisal, including boxes targeted at providing opportunities for house sparrow, swift and general opportunities for common birds, bats and invertebrates.

Inclusion of the enhancement measures as part of the development will have a benefit to local biodiversity and contribute towards targets contained within the London and London Borough of Camden BAPs.

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 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).

This response seeks to explain how the discharges from S1 relate to the 2,992l/s limit in Condition 45, the wider KXC drainage strategy, London Plan 2015 policies 5.13 and 5.14, Camden policies CS13 and DP23 and CPG3.

The cumulative peak discharge from the many building plots and areas of infrastructure will exceed 2,292l/s under certain weather conditions. In these instances, the site wide drainage infrastructure, including online and offline attenuation, will attenuate peak flows discharging from individual plots, highways and public realm, enabling cumulative peak flows to be reduced to 2,292 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 where available, 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's.
- To discharge at various locations into the sewerage network.
- To design the above infrastructure such that combined surface and foul water flows do not exceed 2,292 l/s during a 1 in 30 storm event.

The site wide drainage infrastructure at King's Cross Central can be described in terms of three drainage infrastructure areas, incorporating both building plots and infrastructure/public realm. These are described in Table 5.

Table 6 identifies the assumed peak foul and surface water flows from each of the building plots in the Eastern Goods Yard area. 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.

Drainage Infrastructure Area	Plot Developments	Infrastructure / Public Realm
Eastern Goods Yard	The Granary Complex, Q1, Q2, R1, R3, R4, R5, R6, R7, R8, 50% of T1, T2, J1, H1, K1, K2, K3, K4 and 50% of I1.	Stable Street, Wharf Road, Handyside Street, Granary Square, Cubitt Park and Handyside Gardens
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	50% of I1, M1, M2, M3, N1, P1, P2, S1, S2, S3, S4, S5, 50% of T1, T3, T4, T5, T6 and W1	Canal Reach and Cubitt Square

Table 5 *KXC Sitewide Drainage Infrastructure Areas*

	Assumed Peak Flows (l/s) for Plots in the Eastern Goods Yard Area	
Plot Reference	**Surface Water (1 in 30 year event)**	**Foul Water**
I1	10	3.3
M1	107	16.2
M2	142	1.7
M3	Nil (Considered as public realm)	<0.1
N1	252	5.5
P1	255	7.9
P2	210	11.5
S1	**158**	**13.0**
S2	162	13.0
S3	156	5.3
S4	175	7.5
S5	149	5.5
T3 (inclT4)	239	17.6
T5	78	4.8
T6	133	10.9
W1	308	7.3
TOTALS	**2,534**	**131.1**

Table 6 *KXC Plot Peak Surface and Foul Water Flows in the Eastern Goods Yard Area*

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 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 (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 7 *Assumed Foul Water Discharges from Various Land Uses*

3.7.2. Building S1 Drainage Infrastructure

The drainage infrastructure networks around the King's Cross Central development are being designed on SUDS principles providing an overall peak flow rate reduction of 10% (based on a 1 in 30 year storm).

Thames Water has approved in principle surface water discharges for four direct connections. The approved surface water discharge for Building S1 is 158 l/s, based on assumed peak flows, with a further assumed foul water flow of 13 l/s for Building S1. The figures in Table 6 and Table 7 do not include for any public realm areas.

The Building S1 design team is working closely with the teams responsible for the surrounding infrastructure and adjacent zones, to ensure compatibility with the sitewide infrastructure and compliance with the sitewide drainage strategy.

4. RESPONSE TO S106 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; and*
- *To ensure that the design for the treatment of storm water run-off incorporates, where practicable, filtration, attenuation and other techniques that is consistent with current best practice on SUDS, to control the timing and volume of flows.*

4.1.1. Water Efficiency

The design team has used the BREEAM criteria as their benchmark in driving down potable water consumption for each building.

Building S1 will achieve high standards of water efficiency through the specification of low flow dual flush WC's, low flush PIR controlled urinals and flow restricted taps and showers, solenoid shut-off devices on all supplies to each toilet block, and BMS monitored meters to appliances and zones that use potable water. A greywater recycling from showers and taps (see 4.1.2 below) will be used for WC flushing to reduce water consumption further.

The above measures are expected to reduce the annual water consumption for the building from the BREEAM baseline figure by at least 40%, which would result in at least 3 out of 5 credits for this issue being awarded.

4.1.2. Alternative Water Supplies

4.1.2.1. Condensate Drainage System

Dedicated condensate waste stacks will be installed within the main core and localised columns as necessary, with trapped branch connections provided for future connection by the incoming tenants and direct connections for landlord's plant/systems, where practicable.

These stacks will be routed to basement level and will discharge to the grey water recovery system to increase the amount of the buildings flushing demand met by the recovery system.

4.1.2.2. Grey water recycling System

The grey water recovery system will be installed to collect waste water from all the showers within the cyclist shower area and landlord commercial wash basins throughout the building.

The grey water will be collected, handled & stored within the basement plant room, the product of the grey water recovery system will be pumped to a reclaimed water tank for onward distribution for WC flushing up to the 7th floor. This will minimise the amount of mains water required for WC flushing, as the potable water back-up to this system will only be utilised in periods where the collected grey water cannot meet the WC flushing demand.

The grey water recovery system will also receive water from condensate drainage, collected from the HVAC system. An emergency overflow is to be provided discharging into an adjacent below slab sump with

associated pumps with interconnecting pipework connecting to the suspended drainage system at high level basement.

Figure 21: *Above Ground Grey Water Plant*

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.

SUDS principles have been integrated wherever possible into the design of Building S1 to affect source control and storm water retention/ infiltration, provide permeable surfaces and encourage evapo-transpiration.

The substrate on roof areas that are vegetated will attenuate a portion of rainwater that falls on these parts.

4.2. Section Y: Construction materials and waste

London Plan 2016 policy 5.16 and Camden policy CS18, require developments to minimise waste and material use, during construction and post-completion. The design of Building S1 will minimise waste in line with the waste hierarchy outlined in the Supplementary Planning Guidance documents produced by the London Mayor. The five stages of the hierarchy are:

- Reduce;
- Reuse (prioritise on-site reuse of demolition materials, followed by off-site reuse);
- Recycle (prioritise on-site recycling, then off-site recycling);
- Resource recovery (for energy generation processes – fuels, heat and power);
- Disposal

Section Y of the Section 106 Agreement includes 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:

- To minimise packaging waste associated with the delivery of construction materials.
- To produce topsoil and subsoil that uses subsoil and crushed rubble from the site combined with organic material for use in areas of landscaping.
- To achieve the Construction Targets

4.2.1. Construction Materials and Purchasing Strategy

The project teams intend that best practice will be followed and surpassed wherever practicable, in order to maximise resource efficiency. The Construction Materials and Purchasing Strategy in the S106 Agreement will be adopted, while careful planning and effective control will ensure that waste during the construction phase is minimised.

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. The principal contractor is committed to a waste target of <7.5m³ per 100m² gross floor area and to reduce non-hazardous construction waste by at least 70% by volume (80% by weight) from being diverted to landfill.

Strategies to meet these targets are likely to include working with the supply chain to reduce packaging and participating in take-back schemes with suppliers.

Soil

London Plan 2016 Policy 5.18 'Construction, Excavation and Demolition Waste' requires Construction, Excavation and Demolition (CE&D) waste to be recycled on site wherever practicable. However, in line with Policy 5.18 and Camden Policy CS18, the contractor will be required to identify any opportunities to reuse material prior to construction, for example, re-using crushed concrete as a fill material.

As much as is practicable of the covering material will be sourced from the arisings generated by the site clearance and preparation of levels, with the addition of appropriate organic material. The submitted

Earthworks and Remediation Plan addresses the nature and quantity of arisings and the arrangements for their re-use or disposal as appropriate.

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 planted beds/tree pits. As such, it is recommended that imported organic material is used in these areas.

Construction & Recycling Targets

Achieving a BREEAM rating of at least 'Excellent' for the office element of Building S1 has been the principal driver for the project team's endeavours to achieve the best possible performance against the Construction Targets. BREEAM credits cover the Green Guide rating of the major building elements, the environmental impacts of paints and varnishes, the responsible sourcing of materials and the global warming potential of insulants, all matters addressed by the Construction Targets.

Waste-related environmental certification targets include:

- BREEAM 'Man 3 – Responsible construction practice' awards monitoring and reduction of material resource use and waste generation.
- BREEAM 'Wst 1 – Construction waste management' awards credits for construction waste efficiency and diversion of resources from landfill and requires the development of best practice procedures, monitoring and reporting.

The principal contractor is committed to a waste target of <7.5m³ per 100m² gross floor area and to reduce non-hazardous construction waste by at least 70% by volume (80% by weight) from being diverted to landfill.

The project team is committed to using sustainably-sourced timber products for Building S1 (through an auditable supply chain), including temporary timbers used for site works at the construction phase. Ozone-depleting substances will not be used.

Given the limited space on site, waste is likely to be segregated and recycled off site by a waste management contractor.

Secondary aggregates will be used to replace virgin materials in concrete where possible.

The site is not expected to generate any materials suitable for recovery in energy generation processes. Waste which cannot be recycled will be dealt with safely by approved contractors as set out in the submitted Earthworks and Remediation Strategy.

4.3. Section Z: Waste

Section Z of the Section 106 Agreement includes obligations to:

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

Waste Information Packs

To encourage recycling in the building's operational phase and in line with Camden's Policy CS18, waste storage space has been provided within the building which is sufficient to allow separation and storage of recyclable waste prior to collection. Waste Information Packs will be provided to occupiers, and arrangements will be made to monitor their effectiveness in encouraging waste minimisation. Further details on the recycling arrangements, servicing and refuse strategy are provided in the specialist report

Design Solutions

Dedicated and sufficiently sized facilities will be provided within the basement service areas for the separation, storage and easy handling of waste. The facilities will be available with direct lift connections being provided from the upper levels of the building to the basement to allow convenient access to the storage areas and the service yard from which collections will be made. Waste separation bins will be placed in strategic locations in office clusters, to be collected and taken down to the main storage facilities by building management.

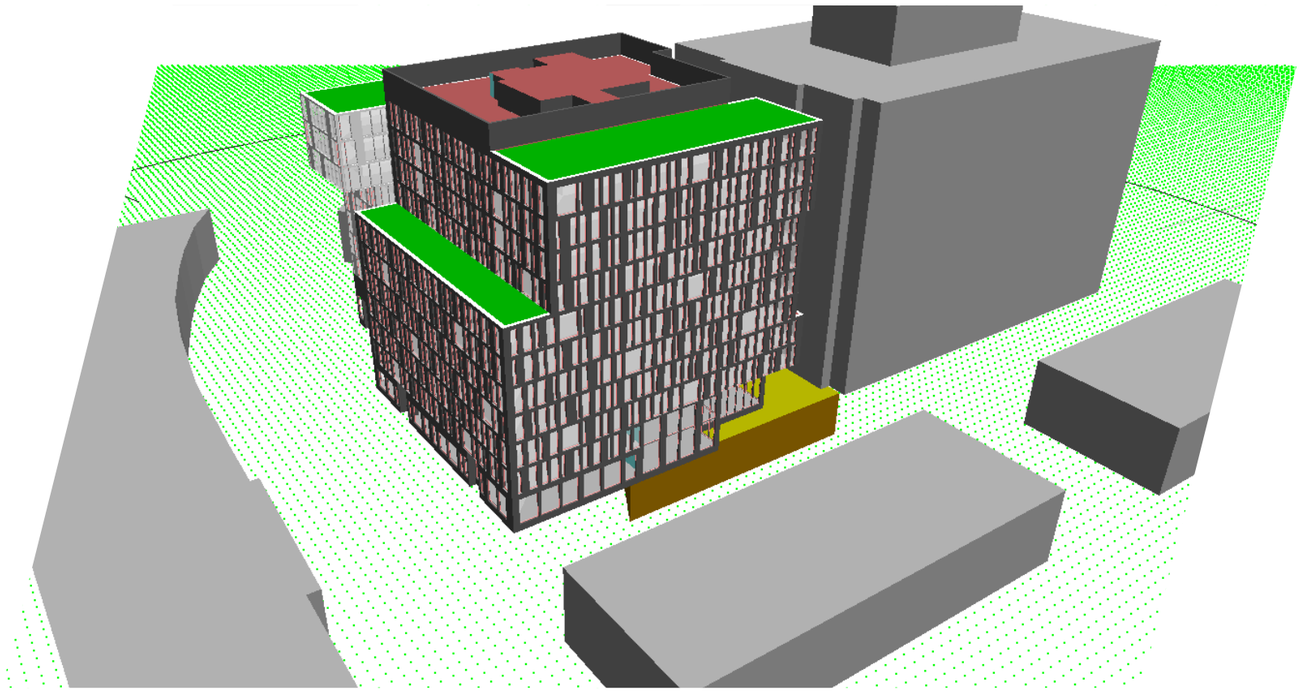
The target BREEAM ratings for the building will ensure that current best practice is followed.

APPENDIX A – Building Regulation Part L2A Analysis

HILSON MORAN

Part L2A: 2013 Assessment
Employer's requirements report

DATE OF ISSUE: 30 JUNE 2017
REVISION NUMBER: 01
HM REFERENCE: 20905/S/ADL/RP01/01



PROJECT:

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King's Cross
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PROJECT NAME: **King's Cross Central - Building S1**

REPORT NAME: **Part L2A: 2013 Assessment**
Employer's requirements report

ISSUE STATUS: **EMPLOYER'S REQUIREMENTS**

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Contents

Executive Summary

This assessment has been produced for Argent to demonstrate that the proposed design for Building S1 at King's Cross Central has the potential to comply with the requirements of Building Regulations Approved Document Part L2A:2013: 'Conservation of Fuel and Power in new Buildings other than Dwellings' (ADL2A:2013 incorporating 2016 amendments).

The results contained in this report demonstrate a route to comply with Criterion 1 of the Approved Document Part L2A:2013, achieving a 22.75% reduction in CO_2 emissions as required by planning and the BREEAM energy targets.

Additionally, the vast majority of the modelled zones comply with Criterion 3 of ADL2A:2013 'Limiting the effects of heat gains in summer.'

In the Office areas, the zones that are not compliant with the criterion are located in the reception foyer, on the south east corner – note that Criterion 3 is a recommendation and not a statutory requirement. On two other buildings in King's Cross Central, an area-weighted approach was applied to the Criterion 3 results and this was discussed with and accepted by the Building Control Officer. This item will therefore need to be discussed with the Building Control Officer at detailed design. In addition, a thermal comfort assessment has been carried out and all spaces achieve compliance with thermal comfort and CIBSE Guide A overheating criteria.

Similarly, the retail units do not comply with Criterion 3. This is due to the higher g-value applied in these areas for higher transparency and will have to be discussed with the Building Control Officer.

The building is registered under BREEAM 2014 New Construction. The Office element achieves an Energy Performance Ration (EPRNC) of 0.828, which equates to 11 credits under credit Ene 1 'Reduction of energy use and carbon emissions', and exceeds the minimum standards for an 'Outstanding' certification rating. This result will need to be confirmed as the design of Building S1 progresses.

The building design and systems are based on the RIBA Stage 3 information, including the design drawings issued on 12th April 2017 and 25th April 2017 by Mossessian Architecture and Weedon Architects. At this stage, design and system assumptions have been made for these assessments, so the current results may be affected when the design is finalised, the procurement plan is in place and system specifications are provided by manufacturers, etc.

1. Introduction

1.1. Background

The design for Building S1 was developed by design architect Mossessian Architecture and Weedon Architects and Structural Engineers Ramboll. Along with the Part L analysis Hilson Moran are also responsible for the base build MEP design. The proposed development will provide an entrance lobby and retail space at ground level, office space at levels 1 to 10 with plant space at levels B1 and 11. The building will provide approximately 18,230m² of net internal area (NIA) for office space usage and 496m² NIA of retail spaces.

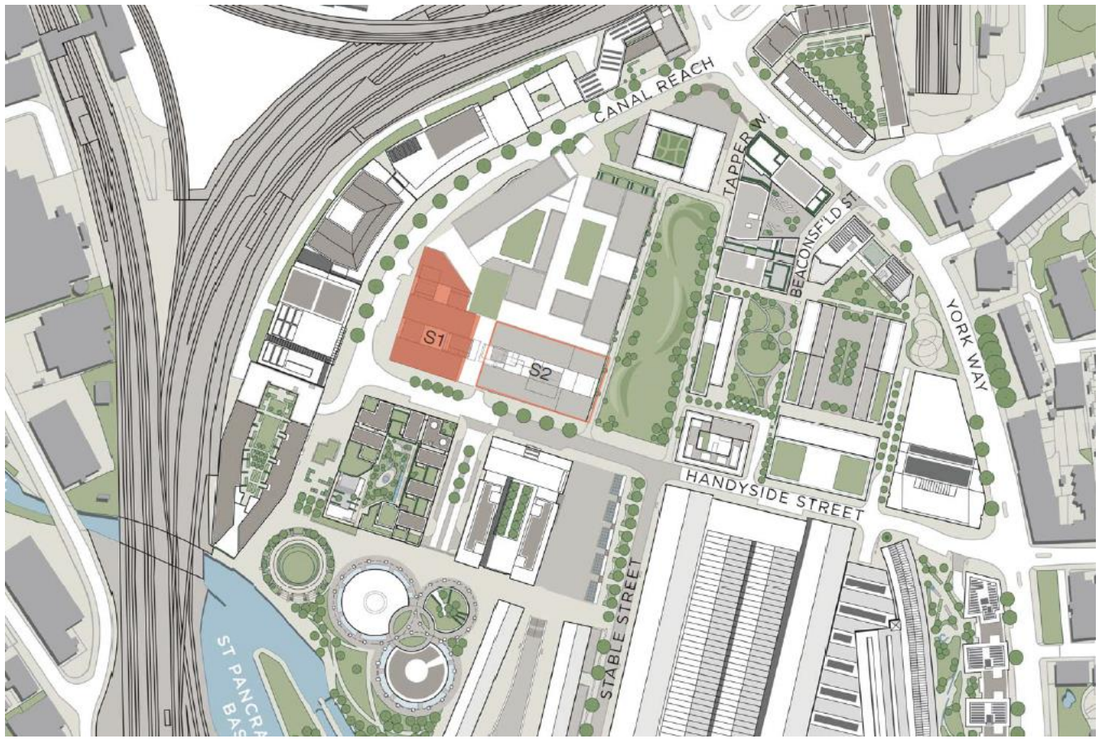


Figure 1: *Site location of Building S1 with the King's Cross Central masterplan area*

The King's Cross Central masterplan is a mixed use development, consisting mainly of residential, educational, office and retail uses and was first granted outline planning approval in 2006.

The project is targeting a BREEAM 2014 'Outstanding' for the Office element, which requires a minimum Energy Performance Ratio (EPR_{NC}) of 0.6.

1.2. Purpose

The aim of this report is to demonstrate a route to achieving a CO_2 reduction relative to the Part L target for the proposed development of Building S1 in the context of the current regulatory and policy requirements.

1.3. Structure

The following section describes the methodology applied to assess the buildings against ADL2A:2013 criteria. This is followed by a description of assumptions and the data input of the simulation model. Section 4 presents the results and these are summarised in the conclusion.

2. Approved Document L2A:2013 (incorporating 2016 amendments)

Approved Document L2A 2013 (ADL2A:2013) was released on April 2014. It compromises of 5 criteria which new non-domestic buildings must comply with. The 2016 amendments withdraw Regulations 29 to 33 of Building Regulations 2010 and are replaced by Regulation 7A of the Energy Performance of Buildings Regulations 2012 and incorporate changes in wording of Regulations 24, 25, 26, 27 and 27A. There are no technical changes.

2.1. Criterion 1: Achieving the TER

This assessment applies the guidance of ADL2A:2013 to calculate the CO_2 Target Emission Rate (TER), which is the minimum energy performance requirement specified in Regulation 25, as well as the CO_2 Building Emission Rate (BER), which is required to be less than or equal to the TER in order comply with Criterion 1 of ADL2A:2013.

The TER is calculated from a notional building with specified properties as described in paragraphs 2.7 to 2.36 of ADL2A:2013 and the NCM Modelling Guide (2013 Edition).

Both TER and the BER are calculated using the same tool. The tool must be included in the methodology for calculating the energy performance of buildings and approved by the Department of Communities and Local Government. Approved tools are listed in the National Calculation Methodology (NCM) Modelling Guide (2013 Edition) and include:

- Simplified Building Energy Model (SBEM) for those buildings whose design features are capable of being adequately modelled by SBEM; or
- Other approved software tools. The procedures for approving such software and lists of approved software are set out online (http://www.gov.uk/).

The analysis for the proposed development was carried out using the accredited software EDSL TAS version 9.4.1, which is an approved DTM package. Regulations 26 and 27 of the Building Regulations state that separate assessments of the BER should be provided to Building Control at the following two stages:

- Before building work commences (as designed) and;
- After work has been completed (as built).

CO_2 emission factors are specified in Table 12 of the Government's Standard Assessment Procedure for energy rating of dwellings, SAP 2012.

Criterion 1 is a Regulation and is therefore mandatory, whereas the limits of design flexibility for Criterion 2 are statutory guidance. The calculations required as part of the procedures used to show compliance with this criterion can also provide information needed to prepare the Energy Performance Certificate required by Regulation 7A of the Building (England and Wales) Regulations 2012.

2.1.1. Internal Heat Gains

In accordance with ADL2A:2013, all internal gains and temperature set-points for the CO_2 analysis must be selected from the predefined SBEM database and based upon the building type and intended usage (office, circulation, WC, etc.). The temperature set-points and internal loads, with the exception of the lighting, cannot be adjusted. The lighting loads and illuminance levels of the proposed building model can be adjusted to account for efficient lighting design and/or daylighting, providing that certain requirements are adhered to.

The National Calculation Method (NCM) activity database for offices specifies a notional lighting efficacy of 60 luminaire lumens per circuit-watt for all zones, and the resulting power density varies depending on the geometry of the modelled zone. This variation is determined by Equation 7 in the NCM Modelling Guide 2013.

2.2. Criterion 2: 'Limits on design flexibility'

The performance of the individual fabric elements and the fixed building services of the building should achieve reasonable overall standards of energy efficiency following the procedures set out in paragraphs 2.37 to 2.49 of ADL2A:2013.

2.2.1. U-values

The performance values specified for this assessment comply with the area-weighted limiting values in table 3 of ADL2A:2013 and the guidance in paragraphs 2.39 to 2.41. The proposed constructions are described in section 3 of this report.

2.2.2. Design limits for building services

The building services systems have been selected in accordance with the limiting performance requirements set out in paragraphs 2.42 through to 2.49 of the ADL2A:2013 document and the Non-Domestic Building Service Compliance Guide 2013. The description and criteria of the proposed system design are described in section 3 of this report.

2.2.3. Additional Studies

A number of additional studies are required to verify compliance with ADL2A:2013 after completion of the building. They include:

- Detailed U-value calculations;
- Condensation risk assessment;
- Detailed plant and controls information;
- Metering;
- Insulation of ducts, pipes and vessels; and
- Detailed lighting design.

2.3. Criterion 3: 'Limiting the effects of heat gains in summer'

Criterion 3 requires one to demonstrate that the building has appropriate passive control measures to limit solar gains. The guidance given in paragraphs 2.50 to 2.53 of ADL2A:2013 provides a way of demonstrating that suitable provision has been made.

Paragraph 2.51 of ADL2A:2013 states that Criterion 3, "applies to all buildings, irrespective of whether they are air-conditioned or not. The intention is to limit solar gains during the summer period to either:

- Reduce the need for air-conditioning; or
- Reduce the installed capacity of any air-conditioning system that is installed."

For compliance with Criterion 3, in each occupied or mechanically cooled space in the building the solar gains through the glazing aggregated over the period from April to September can be no greater than would occur through the relevant reference glazing system. The reference glazing system has a defined total solar energy transmittance (g-value) depending on how the space is defined in the NCM database.

The solar gain limit can be assessed using the same methodology and tools as that utilised to obtain the BER.

2.4. Criterion 4: 'Building Performance Consistent With BER'

Compliance with this criterion is demonstrated by the provision of information, reports and certificates detailing how the requirements of ADL2A:2013 concerning the continuity of insulation, air permeability and commissioning have been satisfied.

In order to ensure consistency between the building performance in operation and the BER, paragraph 3.7 of ADL2A:2013 offers 2 options for specifying construction details which achieve required standards of consistency:

- To use construction joint details that have been calculated by a person with suitable expertise and experience following the guidelines set out in BR 497 and following a process flow sequence that has been provided to the BCB indicating the way in which the detail should be constructed. The calculated value can then be used in the BER calculation; and
- To use construction joints with no specific quantification of the thermal bridge values. In such cases, the generic linear thermal bridge values as given in IP1/06 increased by 0.04W/m.K or 50%, whichever is greater, must be used in the BER calculation.

For the results contained within this report, it has been assumed that the majority of the construction details will be unaccredited in order to represent the worst possible case. As the project moves forward, it is expected that some details will become accredited. A review of the level of accredited details will be made to see if it is possible to further reduce the level of heat loss or heat gain.

Additional information will also be provided at a later stage. The commissioning will be carried out in accordance with CIBSE Code M and the outcomes will be applied in the carbon dioxide emissions calculations to obtain the 'as-built' ADL2A:2013 compliance result.

2.5. Criterion 5: 'Provisions for energy-efficient operation'

Criterion 5 requires that the owner of the building should be provided with sufficient information about the building, the fixed building services and their maintenance requirements so that building can be operated in such a manner as to use no more fuel and power than in reasonable in the circumstances.

Hence, a log book complying with the requirements of 'CIBSE TM 31 Building log book toolkit' will need to be completed by an appropriately competent person. In addition, the data used to calculate the TER and BER should be included with the look book, while the occupier should be provided with the recommendations report generated with the 'on-construction' Energy Performance Certificate (EPC).

2.6. Consideration of high-efficiency alternative systems

Provided the building satisfies the limits on design flexibility as set out in Criterion 2, the compliance procedure allows the designer full flexibility to achieve the TER utilising fabric and system measures and low and zero carbon (LZC) technologies (including local renewable and low-carbon schemes driven by the National Planning Policy Framework) in whatever mix is appropriate to the scheme.

Regulation 25A requires that, before the work starts, an analysis is carried out that considers and takes into account the technical, environmental and economic feasibility of using high-efficiency alternative systems in the building design. The following high efficiency alternative systems may be considered if available, but other LZC systems may also be considered:

- **Energy from renewable sources**, i.e. energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases;
- **Cogeneration**, i.e. simultaneous generation in one process of thermal energy and one or both of electrical and mechanical energy;
  district or block heating or cooling, i.e. the distribution of thermal energy in the form of steam, hot water or chilled liquids, from a central source of production through a network of multiple buildings or sites, for the use of space or process heating or cooling; and
- **Heat pumps**, i.e. a machine, a device or installation that transfers heat from natural surroundings such as air, water or ground to buildings or industrial applications by reversing the natural flow of heat such that it flows from a lower to a higher temperature.

The analysis should state whether high-efficiency alternative systems have or have not been included in the building design. The requirement relates to considering, taking into account, documenting and making available for verification purposes the analysis of high-efficiency alternative systems.

2.7. Energy Performance Certificate

Although not part of the ADL2A analysis, the EPC is a further indication on the building's energy performance and is a requirement before the building can be let or sold.

3. Simulation Inputs

3.1. Model Inputs

Dynamic Thermal Modelling (DTM) software tracks the thermal state of the building on an hourly basis using real weather data, resulting in a detailed picture of the building's performance.

DTM combines several mechanisms to calculate the building response:

- Conduction;
- Convection;
- Long wave radiation;
- Short wave radiation – absorbed, reflected and transmitted;
- Internal conditions – gains from lights, equipment and occupants along with plant operating hours and natural infiltration rates; and
- Ventilation and air movement from internal natural convection.

The accredited software EDSL TAS version 9.4.1 was used for thermal comfort analysis and Part L assessments.

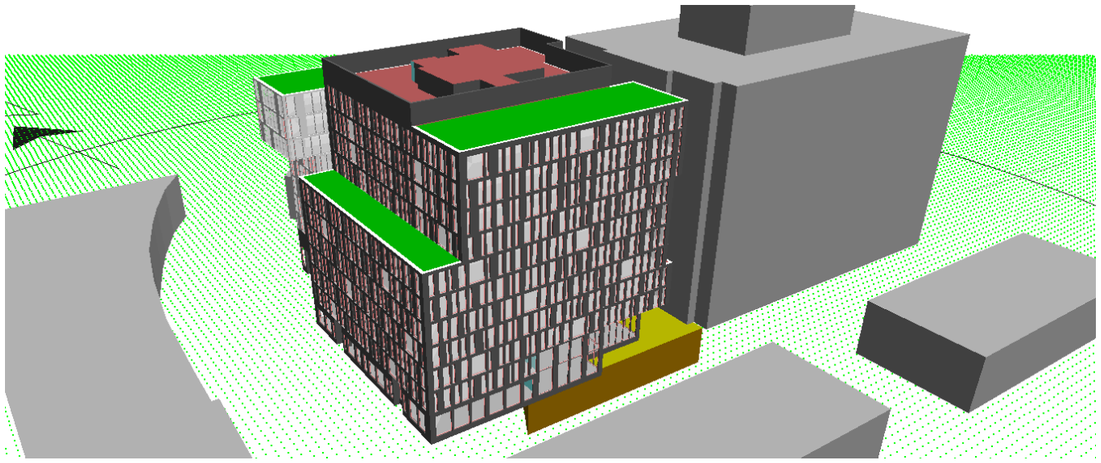


Figure 2: *TAS 3D model of Building S1, South West view*

3.2. Weather Data

In accordance with CIBSE TM 32:2003 and the NCM Modelling Guide (2013 Edition), the weather data applied to the ADL2A:2013 computational Carbon Emissions Calculation Method (CECM) assessments is a CIBSE test reference year (TRY), which is based on an average of approximately 20 years. The weather file 'London TRY' is chosen for its proximity to the project site.

3.3. CAT A fit-out with exposed slabs

The proposed building S1 is developed to CAT A fit-out, excluding the internal suspended ceilings (exposed slabs). The tenant will decide on whether finished ceilings voids will be installed. For Part L purposes, the exclusion of the internal suspended ceilings represents the worst case scenario as more cooling or heating is likely to be required due to the bigger occupied volume[1].

3.4. Building Fabric

The Part L2A 2013 assessment described in this report is based on the RIBA Stage 3 design drawings issued on 12th April 2017 and 25th April 2017 by Mossessian Architecture and Weedon Architects.

The façade of Building S1 comprises the following types:

- Wall type 1: Unitised cladding system, tuff stone clad with punched glazing, including 4 different window sizes;
- Wall type 2: Aluminium curtain walling, consisting of 4 panels types, i.e. clear glazing, fritted glazing, corrugated anodized shadowbox (insulated), and anodised aluminium panel (insulated); and
- Retail façade: Aluminium curtain walling.

3.4.1. Glazing

The glazing properties shown in Table 1 below have been used in the model to achieve compliance with thermal comfort criteria (see Thermal Comfort report) and ADL2A:2013 Criterion 3.

Application	Part L2A Limiting U-value* (W/m².K)	Centre Pane U-Value (W/m².K)	g-value	Light Transmittance
1. All clear glazing in Office floors (Wall type 1 and clear panels in Wall type 2)	2.20	1.02	0.33	60%
2. Fritted panels in Wall type 2	2.20	1.02	0.25	51%
3. Reception	2.20	1.60	0.54	78%
4. Retail facades	2.20	1.82	0.59	78%

** This U-value should be derived as a combination of frame and centre pane U-values.*
Table 1: *Glazing properties used for Part L2A assessment for Building S1*

As part of the curtain walling system, a frame U-value of 5.0 W/m².K was applied for all windows so as to account for linear and point losses and the effects of thermal bridging.

Note that this analysis is concerned with the thermal properties of the glass. The light transmissions listed here are only indicative and vary for different products. Additionally, the performance between different glass manufacturers varies slightly. Therefore, before final selection the 'preferred' glass should be tested to ensure it can meet thermal comfort criteria and targets. It is important to note that the surrounding buildings of the area were included in the 3D model for overshadowing purposes, implying a real case scenario with respect to solar exposure.

[1] The exposed high thermal mass ceilings are likely to reduce cooling loads if coupled with night cooling to purge the heat sink in preparation for the following day of occupancy.

3.4.2. Opaque Constructions

The proposed fabric constructions are compliant with the limiting fabric parameters set out in ADL2A:2013 as follows:

Application	Limiting U-value (W/m².K)	Actual Building (W/m².K)
Curtain Walling Retail (overall, including insulation of the mullions)	2.20	2.20
Curtain Walling Wall Type 2 (overall, including insulation of the mullions)	2.20	1.44
External Walls	0.35	0.35
Basement Walls	0.35	0.35
Ground and exposed floors	0.25	0.25
Roof and terraces	0.25	0.25

Table 3.2 *Construction element U-Values for Building S1*

3.4.3. Air Tightness

The air permeability for Building S1 is assumed to be 5.0 m³/h.m² @50pa.

3.5. Internal Conditions

The internal conditions used within the DTM model for the purposes of ADL2A:2013 compliance are specified in the Simplified Building Energy Model (SBEM) database as proposed by the Energy Performance of Buildings Directive (EPBD) 2002/91/EC of the European Parliament and Council.

3.6. Lighting

The following systems were specified for the different uses in Building S1:

Lighting					
Zone	**Power density** (W/m²)	**Power density** (lumens/circuit Watt)	**Illuminance** (lux)	**Auto presence detection**	**Daylight control**
S1 Offices (perimeter)	5	-	400	Auto on/Auto off	Photocell
S1 Offices (internal)	5.26	-	400	Auto on/Auto off	*None*
Entrance lobbies	7	-	200	Manual on/Dimmed	*None*
Lift lobbies	5	-	200	*None*	*None*
Stairwells	11	-	200	Auto on/auto off	*None*
Circulation in cores	4.5	-	200	Auto on/auto off	*None*
WC & shower area	4.5	-	200	Auto on/auto off	*None*
Refuse stores	3	-	200	Auto on/auto off	*None*
Basement store (and sprinkler tank)	3.5	-	200	Manual on / Auto off	*None*
Basement plant stores	3.5	-	200	Auto on/Dimmed	*None*
Bike store	3.5	-	200	Auto on/Auto off	*None*
On-floor cleaners' stores	4.5	-	200	Manual on / Auto off	*None*
A1 retail	-	60/22	600	*None*	*None*
A3 retail	-	60/22	150	*None*	*None*

Table 3: *Lighting performance for Building S1*

3.7. Mechanical Services

The King's Cross Central masterplan includes a site-wide energy network, which provides heating and cooling through a Combined Heat and Power system (CHP), and absorption chillers on waste heat. The office spaces are cooled by Fan Coil Units (FCU) with very efficient terminal Specific Fan Powers (SFP) that incorporate variable speed fans. The average area-weighted equivalent terminal SFP have been estimated and presented in Appendix A.

Heating and domestic hot water (DHW) for office and retail spaces are provided from the district heating (carbon factor 0.12kg/kWh) via heat exchangers (99% efficiency), whilst cooling is provided by district cooling (carbon factor 0.13kg/kWh). The carbon factors were provided by Argent during RIBA Stage 3.

HVAC							
Zone	**System**	**Heat source & HEX efficiency (%)**	**Heat recovery**	**Cooling source & HEX efficiency (%)**	**Ventilation plant SFP** (W/(l/s))		
					SP	**EX**	**TR**
S1 Offices (perimeter)	FCU	District heating (99%)	Thermal Wheel (Assumed 70%)	District Cooling (99%)	1.54	0.92	0.23
S1 Offices (internal)	FCU						
Entrance lobby + Main reception	Underfloor and trench heating and cooling + Trench heating and local AHU	District heating (99%)	-	District Cooling (99%)	0.89	-	-

HVAC							
Zone	System	Heat source & HEX efficiency (%)	Heat recovery	Cooling source & HEX efficiency (%)	Ventilation plant SFP (W/(l/s))		
					SP	EX	TR
Lift lobbies	Comfort cooling / heating via fan coil unit	-	-	District Cooling (99%)	-	-	0.23
Circulation (Corridors & Staircases)	Heating only (via radiators or similar)	District heating (99%)	-	-	-	-	-
Office WCs	Central extract and local fan coil unit (cooling)	-	-	District Cooling (99%)	-	0.5 (10 ach)	0.23
Cycle Stores	Mechanical Ventilation (and background heating)	District heating (99%)	Plate HEX (Assumed 67%)	District Cooling (99%)	1.0	0.9	0.23
Refuse Stores	Mechanical Ventilation (and background heating)	District heating (99%)	Plate HEX (Assumed 67%)	District Cooling (99%)	0.9	0.9	0.23
Basement plantroom and services areas	Mechanical Ventilation (and background heating for frost protection only)	District heating (99%)	Plate HEX (Assumed 67%)	-	1.0	0.9	0.23
Cycle showers and changing facilities	Comfort cooling / heating and Mechanical Ventilation via AHU	District heating (99%)	Plate HEX (Assumed 67%)	District Cooling (99%)	1.0	0.9	-
Welfare, Security and Fire command rooms	FCUs (variable speed)	District heating (99%)	Plate HEX (Assumed 67%)	District Cooling (99%)	1.0	0.9	0.23
Drivers rooms	Comfort cooling / heating and Mechanical Ventilation via AHU	District heating (99%)	Plate HEX (Assumed 67%)	District Cooling (99%)	0.8	0.8	-
Dock masters room	Ventilation & Heating only (via radiators)	District heating (99%)	Plate HEX (Assumed 67%)	-	1.0	0.9	0.23

HVAC							
Zone	System	Heat source & HEX efficiency (%)	Heat recovery	Cooling source & HEX efficiency (%)	Ventilation plant SFP (W/(l/s))		
					SP	EX	TR
A1 retail	Connects to central plant; Assumed FCU (constant speed)	District heating (99%)	Plate HEX (Assumed 67%)	District Cooling (99%)	1.3	0.7	0.23
A3 retail	Connects to central plant; Assumed FCU (constant speed)						

Table 3.4 *HVAC performance input for Building S1*

3.8. Low and Zero Carbon (LZC) technologies

A high level feasibility study has been carried out that considered and took into account the technical, environmental and economic feasibility of using of LZC technologies on a building level. Since Building S1is connected to the site-wide district heating and cooling network, the most applicable and feasible technology available is photovoltaic panels. Approximately 12m^2 of PV (active area) is currently proposed to be installed on the roof of Building S1. An efficiency of 15% and a tilt angle of 7° were assumed, due to restrictive planning height. Efficiency and tilt angle must be confirmed at detailed design.

3.9. Other System Design Information

A power factor correction greater than 0.95 is included to improve the electric stability and efficiency of the transmission network. In addition, all lighting and HVAC systems are linked to a system capable of Automatic meter reading and data collection to comply with the requirements of Part L2A:2013 and CIBSE guide TM39. This is a complete system that measures, records, transmits, analyses, reports and communicates meaningful energy management information to enable the operator to manage operational energy . The metering system should be capable of alerting the building operator of energy usage that exceeds predetermined limits (‘out of range’ values).

4. Results

The analysis for the proposed development has been carried out using EDSL TAS version 9.4.1 accredited software, which is an approved DTM software tool.

4.1. Criterion 1 – Achieving the TER

The results contained in this report demonstrate that the proposed design for the buildings has the potential to comply with Criterion 1 of the Approved Document Part L2A:2013, provided that the advice contained within this document is adhered to or improved upon.

The Building Emission Rate (BER) for Building S1 is 22.75% better than the Target Emissions Rate (TER). This demonstrates that the proposed building's CO_2 emissions are no greater than the notional building's and comply with the requirements of ADL2A:2013 Criterion 1.

BER (Whole building)	TER (Whole building)
18.20 $kgCO_2/m^2$	23.56 $kgCO_2/m^2$
22.75%	

Table 4.1 *Summary of Part L2A 2013 Carbon Dioxide emissions assessment results for Building S1*

4.2. Criterion 3 – Limiting the effects of heat gains in summer

The vast majority of the modelled zones comply with Criterion 3 of ADL2A:2013.

In the Office areas, the zones that are not compliant with the Criterion are located in the reception foyer, on the south east corner. The failure can be attributed to the calculation methodology and limitations of the software used. A thermal comfort assessment has been carried out and all spaces achieve compliance with thermal comfort and CIBSE Guide A overheating requirements – note that Criterion 3 is a recommendation and not a statutory requirement.

On two other buildings in King's Cross Central, an area-weighted approach was applied to the Criterion 3 results and this was discussed with and accepted by the Building Control Officer. This item will therefore need to be discussed with the Building Control Officer at detailed design.

Similarly, the retail units do not comply with Criterion 3. This is due to the higher g-value applied in these areas for higher transparency and will have to be discussed with the Building Control Officer.

4.3. Energy Performance Certificate

Although not part of the ADL2A analysis, the EPC is a further indication of the building's energy performance and is a requirement before the building can be let or sold.

Rating (Whole building)	Benchmark
B	26

Table 4.2 *EPC rating for Building S1 (whole building)*

Rating (Office only)	Benchmark
A	25

Table 4.3 *EPC rating for the Office element of Building S1*

4.4. BREEAM New Construction 2014 Assessment – Office only

The development is registered for a BREEAM New Construction 2014 assessment. The Office elements is and targeting an 'Outstanding' rating, whilst the Retail units are targeting a 'Very Good' rating.

In order to achieve a BREEAM 'Outstanding' rating, the office spaces of the building EPR_{NC} (Energy Performance Ratio) needs to be 0.6 or greater.

The EPR_{NC} rating for the Office element is set out in the table below:

Results summary of BREEAM 2011 New Construction Ene01 credit – Building S1		
Office use only		
EPR_{NC}	Ene 1 Credits	Part L Pass Margin
0.828	11	25.9%

Table 4.4 *Results summary of BREEAM 2014 New Construction Ene 01 credit for Building S1 (Offices)*

When assessed under ADL2A:2013, the EPR_{NC} rating for the BREEAM assessment achieves 11 credits for the office use, which exceeds the minimum standards for an 'Outstanding' rating. Note that Post Construction EPR_{NC} values based on the as-built energy assessment must be undertaken to confirm compliance with ADL2A:2013 criteria.

4.5. Retail units only results

The retail units will be built as shell only with the possibility to connect to the masterplan district network heating. In the absence of building services information, Part L backstop values have been assumed for all retail building services efficiencies (ventilation terminal SFPs, lighting efficiencies etc.). The retail units in isolation do not achieve sufficient CO_2 reduction to comply with Criterion 1 of Part L2A 2013. This is mainly due to the double height spaces with glazed facades, resulting in a high ratio of glazed façade to floor area.

The retail units are not required to comply with Part L at shell only stage and this is the tenant's responsibility when installing their fit-out items. However, this must be discussed with building control or the approved inspector, highlighting the fact that as a whole, the building largely complies with Criterion 1.

Additionally, it is recommended that assumptions are made for the tenant fit-out design in order to provide a route for Part L compliance. This shall be discussed with Argent at RIBA Stage 4.

5. Conclusion

The report concludes that Building S1 achieves a 22.75% improvement over the Part L2A:2013 Target Emission Rate (TER) for the 'as-designed' submission.

Additionally, the vast majority of the modelled zones also comply with Criterion 3 of ADL2A:2013 'Limiting the effects of heat gains in summer'.

In the Office areas, the zones that are not compliant with the criterion are located in the reception foyer, on the south east corner – note that Criterion 3 is a recommendation and not a statutory requirement. On two other buildings in King's Cross Central, an area-weighted approach was applied to the Criterion 3 results and this was discussed with and accepted by the Building Control Officer. This item will therefore need to be discussed with the Building Control Officer at detailed design. In addition, a thermal comfort assessment has been carried out and all spaces achieve compliance with thermal comfort and CIBSE Guide A overheating criteria.

Similarly, the retail units do not comply with Criterion 3. This is due to the higher g-value applied in these areas for higher transparency and will have to be discussed with the Building Control Officer.

The building is registered under BREEAM 2014 New Construction. The Office element achieves 11 credits under credit Ene 01 'Reduction of energy use and carbon emissions', which exceeds the minimum standards for an ''Outstanding' certification rating.

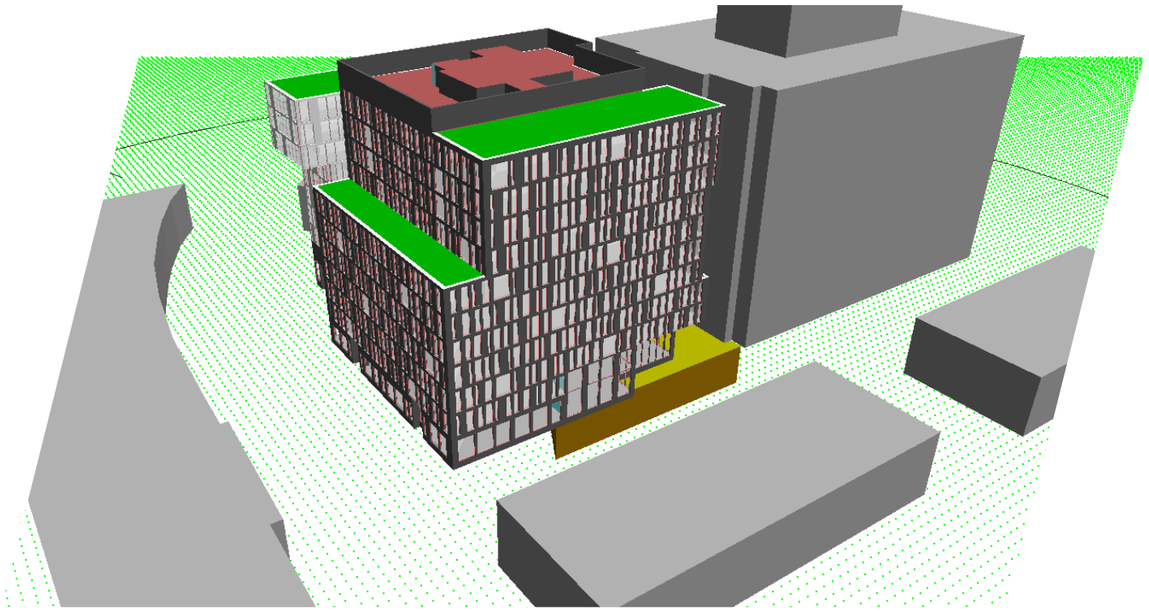
The building design and systems are based on the RIBA Stage 3 information provided. The results contained in this report demonstrate a route to comply with Criterion 1 of the Approved Document Part L2A:2013, achieving a 22.75% reduction in CO_2 emissions as required by planning and the BREEAM energy targets.

The 'as-built' submission must be based on the actual installed equipment and building fabric.

APPENDIX B – BREEAM Pre-Assessment for offices element

HILSON MORAN

BREEAM New Construction 2014 – Office
Employer's requirements report



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King's Cross
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PROJECT NAME: **King's Cross Central - Building S1**

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Employer's requirements report

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Contents

1. Executive Summary

Hilson Moran has been commissioned by Argent to undertake the BREEAM New Construction 2014 Pre-Assessment for Building S1 as part of the King's Cross Central development in London. This report forms the basis of a strategy for the office element to achieve an 'Outstanding' rating under the SD5076 BREEAM 2014 New Construction scheme using the Shell and Core approach. The targeted rating has been set by Argent.

A retail assessment has also been carried out separately for the A1/A3 retail elements of the proposed Building S1. The retail elements are targeting a BREEAM 'Very Good' rating.

Hilson Moran Sustainability met with the project team at RIBA Stage 2 to undertake the initial BREEAM Pre-Assessment. The appointed BREEAM AP and BREEAM Assessor have regularly reviewed and reported progress on the pre-assessment throughout RIBA Stage 3. The targeted score for the office element of Building S1 is **88.9%** which equates to an **Outstanding** rating with all mandatory rating criteria targeted by design.

Hilson Moran recommends that the development has a 4-6% margin above the minimum score required (85% for Outstanding) to provide a reasonable buffer during the construction process.

The BREEAM 2014 scheme only allows for fully fitted out buildings to be fully certified. As the building will not be fully fitted out by the developer, and based on guidance in Appendix D of the final BREEAM 2014 New Construction manual, the buildings is being assessed as a Shell and Core development.

It is the design team's responsibility to ensure that the evidence is provided for all relevant BREEAM credits to meet the BRE's criteria, in the specific format required for the assessor to submit for third party quality assurance (QA) prior to issue of the certificate.

The following table provides the current predicted BREEAM 2014 Offices New Construction Shell and Core scores:

	Targeted[1]		Difficult
Expected BREEAM Score	75.1%	88.9%	94.7%
Expected BREEAM Rating	Excellent	Outstanding	Outstanding

Table 1: BREEAM Pre-assessment score and rating for Building S1 Office

	Credits	Targeted[1]		Difficult	Unachievable
MANAGEMENT	18	18	0	0	0
HEALTH & WELLBEING	10	6	2	0	2
ENERGY	21	16	4	1	0
TRANSPORT	9	9	0	0	0
WATER	9	6	3	0	0
MATERIALS	13	6	2	2	3
WASTE	9	6	1	1	1
LAND USE AND ECOLOGY	10	8	1	0	1
POLLUTION	13	9	0	1	3
EXEMPLARY PERFORMANCE	10	2	2	1	5
Total	122	86	15	6	15
Final Weighted Score		75.1%	88.9%	94.7%	
Predicted BREEAM Rating		Excellent	Outstanding	Outstanding	

Note: 22 innovation credits are available in total, however only a maximum of 10 can be awarded.

Table 2: BREEAM Assessment results for Building S1 Office

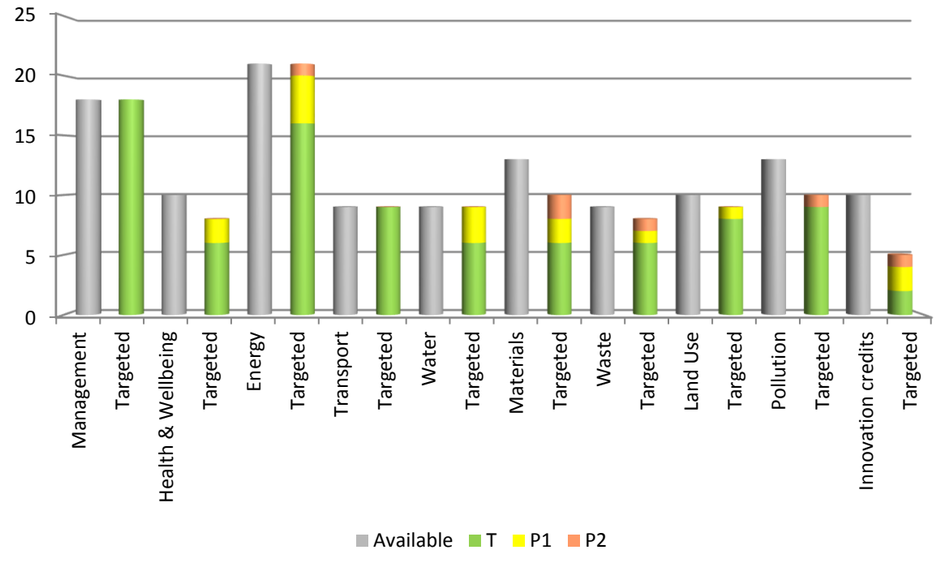


Figure 1: BREEAM Pre-assessment results breakdown for Building S1, Office element

[1] All credits in the 'Green' and 'Yellow' column are targeted and are included into the RIBA Stage 3 design. The credits in the 'Yellow' column will need to be monitored closely as they could be affected by decisions during RIBA Stage 4 design.

2. Introduction

2.1. Background

Hilson Moran has been commissioned by Argent to provide sustainability consultancy and advice to the project team responsible for the construction of Building S1 at King's Cross.

As part of this role, Hilson Moran has prepared a strategy to enable the proposed Office to achieve an **Outstanding** rating based on the 2014 New Construction Scheme.

The proposed building includes:

- A basement level with plant associated rooms;
- A ground floor providing access directly from the street, with the office reception, loading bay, cycle storage, office provision and A1/A3 commercial units;
- The first floor includes shower facilities for the office staff, a mezzanine level for the A1/A3 commercial units and office floor provisions;
- Floors 2 to 11 includes office provisions and access to outdoor terraces; and
- The highest level of the building includes plant rooms, with the provision of PV panels.

The proposed building will be connected to the masterplan energy network, which provides both heating and cooling.

2.2. Purpose

This document is intended to inform, and provide the basis for, detailed discussions regarding the current design proposals and the credits to be targeted to achieve the desired BREEAM rating for the building. All information contained within this document is based on the finalised BREEAM 2014 New Construction scheme released on the 27th May 2014.

This document is not intended to provide detailed guidance to achieve particular credits. Hilson Moran can provide copies of the relevant BREEAM Scheme manual and provide design advice on request for specific credits. A credit summary is listed in section 4.2 for initial guidance. It is the responsibility of the design team to provide the assessor with the appropriate evidence to demonstrate compliance with the credit criteria.

2.3. BREEAM 2014

The BREEAM UK New Construction 2014 scheme can be used to assess the environmental life cycle impacts of new non-domestic buildings at the design and construction stages. 'New Construction' is defined as development that results in a new standalone structure, or new extension to an existing structure, which will come into operation or use for the first time upon completion of the works.

This BREEAM UK New Construction 2014 scheme version is applicable to new non-domestic buildings in the United Kingdom only.

Buildings that are not fully fitted-out, are referred to as shell only (generally no services installed as part of base build) or shell and core (generally with services installed as part of the base build) buildings under BREEAM 2014, and can be assessed using the BREEAM UK New Construction scheme. Full Cat A projects, where areas of the development are not fully-fitted, must demonstrate performance of the building and compliance with BREEAM criteria based on the developer's scope of works. However to allow for comparable buildings where CAT A works are undertaken (ceilings, HVAC, floors etc.), for the purpose of BREEAM, issues not included within the chosen option (shell only or shell and core) will be excluded from the assessment, even where they are within the developer's scope of works.

A shell and core building project is defined as one where the developer's scope of works is the design and construction of the base building only, leaving a range of construction and fit out works to be completed before the building is able to be occupied. This may include some or all of the following elements: the structure, building envelope, core building systems including building servicing strategy and installations (such as HVAC) or plant support for installation of such systems and where present, fit-out of common areas. Upon completion, the whole building or space within the building is sold or let to be fitted out as appropriate for occupation. The new owner(s) or tenant(s) will fit-out the building's accommodation in accordance with their corporate and operational needs which could include designing and installing fit out works to BREEAM Non-domestic Refurbishment 2014 standards.

In projects where areas of the development are not fully-fitted, performance of the building and compliance with BREEAM is verified based on the developer's scope of works only. This performance is measured using two standard project type options (shell only or shell and core) that in turn define appropriate assessment criteria applicable to that project type. Whilst some projects will differ to some extent from the scope of these standard options, for the purpose of BREEAM, issues not included within the chosen option will be excluded from the assessment, even where they are within the Developer's scope of works. This approach is necessary to ensure clarity, consistency and comparability within the property market.

The BREEAM 2014 Scheme has removed the criteria for a Green Lease Agreement and Green Building Guide under shell only and shell and core assessments with the exception of Ene 01. Ene 01 has the option for a contractually agreed Green Fit-out Agreement to allow the required energy rating for Outstanding to be achieved. Without it the minimum standards in the Part L 2013 design guide must be used, thus making achieving the minimum energy standards for Outstanding difficult.

To obtain full certification the tenants would have to undertake a BREEAM 2014 Non Domestic Fit out assessment. BRE are intending to provide details of how a full certification route can be applied for in shell and core buildings in due course.

This report is based on the Shell and Core scheme. The design team should be aware this is subject to change.

2.4. Recent Workshops

Hilson Moran Sustainability initially met with the project team during RIBA Stage 2 on 12.12.2016 to review the current design and to set out a strategy to achieve the BREEAM 2014 New Construction targeted rating. The workshop was attended by:

Name	Company	Job Role
Mark Swinburne	Argent (AR)	Project manager
Lucinda Rudge	Mossessian Architecture (MO)	Concept Architect
Mel Whild	Weedon Architects (WE)	Architect
Kyle Hutchinson	G&T (GT)	Cost Consultant
Alexander Drysdale	Sweco	Sustainability Consultant
Snigdha Jain	Hilson Moran (HM)	BREEAM AP
Fanny Duret	Hilson Moran	Sustainability Consultant

Table 3: Initial BREEAM Workshop attendees

Hilson Moran Sustainability met with the project team on a regular basis to monitor progress, to review the design development and to enhance and update the BREEAM 2014 New Construction rating. The following table lists the meetings and attendees throughout RIBA Stage 2 and Stage 3.

Meeting	Date	Attendance
Stage 2 workshop	12.12.2016	AR, MO, WE, GT, HM
BREEAM Review	07.02.2017	AR, MO, WE, Carillion (CCL), HM
BREEAM Review	21.03.2017	AR, MO, WE, CCL, HM
BREEAM Review	04.04.2017	AR, MO, WE, CCL, HM
BREEAM Review	21.04.2017	AR, MO, WE, CCL, HM

Table 4: List of BREEAM meetings

Note: Key design team meetings and an early stage workshop with the architects have been attended by the BREEAM AP.

3. BREEAM 2014 Early Stage Credits

The table below summarises the credits in BREEAM 2014 that have an early stage requirement. The design team should ensure the requirements at the relevant stage are met to ensure credits are not lost as the design progresses.

Credit Title	No. of Credits	RIBA Work Stage	Action By / Status
Management			
Man 01 Project brief and design			
Stakeholder consultation (project delivery) (new credit criteria)	1	**RIBA 2 (equivalent to Stage C)**	Targeted
Stakeholder consultation (third party) (new credit criteria)	1	**RIBA 2 (equivalent to Stage C). Feedback no later than RIBA 4 (Stage E)**	Targeted
Sustainability Champion (design)(new credit)	1	**RIBA 1 (equivalent to Stage B).**	Targeted
Sustainability Champion (monitoring progress) (new credit)	1	**RIBA 2 (equivalent to Stage C) - RIBA 4 (Stage E)**	Targeted (Appointed)
Man 02 Life cycle cost and service life planning			
Elemental life cycle cost (LCC) (new credit criteria)	2	**RIBA 2 (equivalent to Stage C)**	Targeted
Component level LCC Plan (new credit criteria)	1	**RIBA 4 (equivalent to Stage E)**	Targeted (Appointed)
Man 03 Responsible construction practices			
Sustainability Champion (construction) (new credit criteria)	1	**BREEAM target in contractor's contract. Appointment at RIBA 6**	Targeted
Man 04 Commissioning and handover			
Commissioning building services	1	**During design stage (appropriate stage for reviews of proposed systems**)	Targeted
Health and Wellbeing			
Hea 06 Safety and security			
Security of site and building (1 credit) (new credit criteria)	1	**RIBA 2 (equivalent to Stage C or later providing all recommendations are implemented)**	Targeted
Energy			
Ene 04 Low and zero carbon technologies			
Passive Design (new credit)	1	**RIBA 2 or equivalent (equivalent to Stage C)**	Targeted (Appointed)
Low zero carbon (LZC) feasibility study	1	**RIBA 2 or equivalent (equivalent to Stage C)**	Targeted (Appointed)
Transport			
Tra 05 Travel plan			
Travel plan	1	**Feasibility and design stages RIBA 2 (equivalent to Stage C) onwards**	Targeted
Materials			
Mat 06 Material efficiency			
Material efficiency (new credit)	1	**RIBA 1, RIBA 2, RIBA 3,** RIBA 4, RIBA 6	Targeted
Waste			

Credit Title	No. of Credits	RIBA Work Stage	Action By / Status
Wst 05 Adaptation to climate change			
Adaptation to climate change – structural and fabric resilience (new credit)	1	**RIBA 2 or equivalent (equivalent to Stage C)**	Targeted (Appointed)
Wst 06Functional adaptability			
Functional adaptability (new credit)	1	**RIBA 2 or equivalent (equivalent to Stage C)**	Targeted
Land use and Ecology			
Le 02 Ecological value of site and protection of ecological features			
Le 02 Ecological value of site	1	Prior to the commencement of works on site	Targeted (Appointed)
Le 04 Enhancing site ecology			
Le 04 Ecologist's report and recommendations (new credit criteria)	1	**RIBA 1 or equivalent (equivalent to Stage B)**	Targeted (Appointed)
LE 05 Long term impact on biodiversity			
Mandatory criteria (new credit criteria)	1	Prior to the commencement of works on site	Targeted

Table 3.1: BREEAM 2014 New Construction RIBA Stage Credits

4. Initial Assessment against BREEAM New Construction 2014 Criteria

4.1. BREEAM 2014 New Construction Minimum Standards

BREEAM Credit	Percentage required and number credits required to meet minimum standards					Status
	Pass ≥30 - <45%	Good ≥45 - <55%	Very Good ≥55 - <70%	Excellent ≥70 - <85%	Outstanding ≥85%	
Man 03 - Responsible construction practices	-	-	-	One credit (Considerate construction)	One credit (Considerate construction)	Targeted. This will be included in the Main Contractor's requirements.
Man 04 - Commissioning and handover	-	-	-	1 credit Building User Guide	1 credit Building User Guide	Targeted.
Ene 01 - Reduction in CO_2 Emissions	-	-	-	5 credits	8 credits	Targeted.
Ene 02 - Energy Monitoring (first credit)	-	-	1 credit	1 credit First sub-metering credit	1 credit First sub-metering credit	Targeted.
Wat 01 - Water Consumption	-	1 credit	1 credit	1 credit	2 credit	Targeted.
Wat 02 - Water Monitoring	-	Criterion 1 Mains water meter	Criterion 1 Mains water meter	Criterion 1 Mains water meter	Criterion 1 Mains water meter	Targeted.
Mat 03 - Responsible Sourcing	Criterion 1 Legally harvested and traded timber	Criterion 1 Legally harvested and traded timber	Criterion 1 Legally harvested and traded timber	Criterion 1 Legally harvested and traded timber	Criterion 1 Legally harvested and traded timber	Targeted. This will be included in the Main Contractor's requirements.
Wst 01 - Construction Waste Management	-	-	-	-	1 credit	Targeted. This will be included in the Main Contractor's requirements.
Wst 03 - Operational Waste	-	-	-	1 credit	1 credit	Targeted.
LE 03 - Minimising impact on existing site ecology	-	-	1 credit	1 credit	1 credit	Targeted.

Table 3.2: BREEAM 2014 New Construction Minimum Standards (note some credits are not applicable to the Shell and Core scheme)

4.2. Pre-assessment: Summary credit list

The following table summarises the status of each credit and provides the RIBA Stage 3+ assessment score and rating.

More details on credit criteria and proposed design are provided in Section 4.3 of this report.

All credits in the 'Green' and 'Yellow' column are targeted and are included into the Stage 3 design. The credits in the 'Yellow' column will need to be monitored closely as they could be affected by the RIBA Stage 4 design.

Targeted
Targeted - requires attention
Difficult
Unachievable
Mandatory credits for the targeted rating

EXE - Exemplary credit worth 1%

Credit Code	Credit Title	Credits Available	Targeted		D	U	Action Lead
MANAGEMENT		**credit weight =**	**0.61%**				
MAN 01 - Credit 1	Stakeholder consultation (project delivery)	1	1	0	0	0	AR
MAN 01 - Credit 2	Stakeholder consultation (third party)	1	1	0	0	0	AR
MAN 01 - Credit 3	Sustainability Champion (design)	1	1	0	0	0	HM Sus
MAN 01 - Credit 4	Sustainability Champion (monitoring progress)	1	1	0	0	0	HM Sus
MAN 02 - Credits 1-2	Elemental life cycle cost (LCC)	2	2	0	0	0	G&T
MAN 02 - Credit 3	Component level LCC Plan	1	1	0	0	0	G&T
MAN 02 - Credit 4	Capital cost reporting	1	1	0	0	0	G&T
MAN 03	Timber: Pre-requisite	-	Yes				CCL
MAN 03 - Credit 1	Environmental management	1	1	0	0	0	CCL
MAN 03 - Credit 2	Sustainability Champion (construction)	1	1	0	0	0	CCL
MAN 03 - Credit 3-4	Considerate construction	**2**	2	0	0	0	**CCL**
MAN 03	Monitoring of construction site impacts: Pre-requisite	-	Yes				CCL
MAN 03 - Credit 5	Utility consumption - Energy and Water	1	1	0	0	0	CCL
MAN 03 - Credit 6	Transport of construction materials and waste	1	1	0	0	0	CCL
Man 03 -EXE Credit	**Considerate construction - Exemplary level**	1	1	0	0	0	CCL
MAN 04 - Credit 1	Commissioning schedule and responsibilities	1	1	0	0	0	HM MEP
MAN 04 - Credit 2	Commissioning building services	1	1	0	0	0	HM MEP
MAN 04 - Credit 3	Commissioning building fabric	1	1	0	0	0	CCL
MAN 04 - Credit 4	Handover - Building User Guide and Training	1	1	0	0	0	AR
HEALTH & WELLBEING		**credit weight =**	**1.05%**				
HEA 01 - Credit 2	Daylighting	1	0	0	0	1	-
HEA 01 - Credit 3	View out	1	1	0	0	0	MO / WEE
HEA 01 - Credit 4	Internal and external lighting levels, zoning and control	1	1	0	0	0	HM MEP
HEA 01 - EXE Credit	**Daylighting - Exemplary level**	1	0	0	0	1	-
HEA 02 - Credit 2	Ventilation	1	0	1	0	0	HM MEP
HEA 02 - Credit 5	Adaptability - Potential for natural ventilation	1	0	0	0	1	-
HEA 04 - Credit 1	Thermal modelling	1	1	0	0	0	HM Sus
HEA 04 - Credit 2	Adaptability - for a projected climate change scenario	1	1	0	0	0	HM Sus
Hea 05 - Credit 2	Internal indoor ambient noise levels	1	1	0	0	0	Ramboll (RA) / CCL
Hea 06 - Credit 1	Safe access	1	0	1	0	0	MO / WEE
Hea 06 - Credit 2	Security of site and building	1	1	0	0	0	QCIC
ENERGY		**credit weight =**	**0.71%**				
ENE 01	Energy performance	12	8	3	1	0	HM Sus
ENE 01 - EXE Credit	**Exemplary Performance for Carbon Negative Buildings**	5	0	0	0	5	-
ENE 02 - Credit 1	Sub-metering of major energy consuming systems	1	1	0	0	0	HM MEP
ENE 02 - Credit 2	Sub-metering of high energy load and tenancy areas	1	1	0	0	0	HM MEP
ENE 03 - Credit 1	External Lighting	1	1	0	0	0	HM MEP
ENE 04 - Credit 1	Passive design	1	1	0	0	0	HM Sus
ENE 04 - Credit 2	Free Cooling	1	0	1	0	0	HM Sus
ENE 04 - Credit 3	Low zero carbon (LZC) feasibility study	1	1	0	0	0	HM Sus
ENE 06 - Credit 1	Lift - Energy consumption	1	1	0	0	0	HM VT
ENE 06 - Credit 2-3	Lift - Energy efficient features and Regenerative drives	2	2	0	0	0	HM VT
TRANSPORT			**1.11%**				
TRA 01	Public transport accessibility	3	3	0	0	0	HM Sus
TRA 02	Proximity to amenities	1	1	0	0	0	MO / WEE
TRA 03 - Credit 1	Cycle storage	1	1	0	0	0	MO / WEE
TRA 03 - Credit 2	Cyclist Facilities	1	1	0	0	0	MO / WEE

TRA 04 - Credit 1	Maximum car parking capacity	2	2	0	0	0	MO / WEE
TRA 05	Travel plan	1	1	0	0	0	AR
WATER			**0.83%**				
WAT 01	Water consumption	5	3	2	0	0	MO / WEE
WAT 01 EXE Credit	**Water consumption 65% reduction - Exemplary level**	1	0	0	0	1	-
WAT 02	Water monitoring Pre-requisite	-	Yes				HM MEP
WAT 02	Water Sub-metering	1	1	0	0	0	HM MEP
WAT 03 - Credit 1	Leak detection system	1	1	0	0	0	HM MEP
WAT 03 - Credit 2	Flow control devices	1	1	0	0	0	HM MEP
WAT 04	Water efficient equipment	1	0	1	0	0	HM MEP
MATERIALS		**credit weight =**	**1.12%**				
MAT 01	Life cycle impacts	5	2	0	1	2	MO / WEE
MAT 01 - EXE Credit	**Exemplary performance for life cycle impacts**	3	0	2	0	1	HM Sus
MAT 02	Hard landscaping and boundary protection	1	0	1	0	0	MO / WEE
MAT 03 - Pre-	Sustainable timber procurement Pre-requisite	-	Yes				CCL
MAT 03 - Credit 1	Sustainable procurement plan	1	0	1	0	0	CCL
MAT 03 - Credits 2-4	Responsible sourcing of materials	3	1	0	1	1	CCL
MAT 3 - EXE Credit	**Exemplary Performance for Responsible Sourcing**	1	0	0	0	1	-
MAT 04	Insulation Embodied impact	1	1	0	0	0	MO / WEE
MAT 05	Protecting vulnerable parts of the building from damage	1	1	0	0	0	MO / WEE
MAT 06	Material efficiency	1	1	0	0	0	MO / WE / AR/ RA
WASTE		**credit weight =**	**1.06%**				
WST 01 - Credit 1	Construction resource efficiency	3	2	0	0	1	CCL
WST 01 - Credit 2	Diversion of resources from landfill	1	1	0	0	0	CCL
WST 01 - EXE credit	**Exemplary Performance for Construction Waste**	1	0	0	0	1	-
WST 02	Recycled aggregates	1	0	0	1	0	RA
WST 02 - EXE Credit	**Exemplary Performance for Recycled Aggregates**	1	0	0	0	1	-
WST 03	Operational waste	1	1	0	0	0	MO / WEE
WST 04	Speculative Floor and Ceiling Finishes	1	0	1	0	0	MO / WEE
WST 05	Adaptation to climate change - Structural and fabric	1	1	0	0	0	HM Sus
WST 05 - EXE Credit	**Responding to adaptation to climate change**	1	1	0	0	0	HM Sus
WST 06	Functional adaptability	1	1	0	0	0	MO / WEE / HM
LAND USE AND ECOLOGY		**credit weight =**	**1.10%**				
LE 01 - Credit 1	Previously occupied land	1	1	0	0	0	MO / WEE
LE 01 - Credit 2	Contaminated land	1	0	0	0	1	Ramboll
LE 02 - Credit 1	Ecological value of site	1	1	0	0	0	HM Sus
LE 02 - Credit 2	Protection of ecological features	1	1	0	0	0	HM Sus
LE 03 - Credit 1	Change in ecological value 1	1	1	0	0	0	HM Sus
LE 03 - Credit 2	Change in ecological value 2	1	1	0	0	0	HM Sus / Urban
LE 04 - Credit 1	Ecologist's report and recommendations	1	1	0	0	0	HM Sus
LE 04 - Credit 2	Increase in ecological value	1	0	1	0	0	HM Sus
LE 05 - Pre- requisite	SQE appointment and management plan	-	Yes				HM Sus
LE 05	Long term impact on biodiversity - 2 additional	1	1	0	0	0	HM Sus
LE 05	Long term impact on biodiversity - 4 additional	1	1	0	0	0	CCL
POLLUTION		**credit weight =**	**0.85%**				
POL 01	Impact of refrigerants	3	1	0	1	1	AR
POL 02	NOx Emissions	3	2	0	0	1	AR
POL 03 - Credit 1	Flood risk	2	2	0	0	0	PBA
POL 03 - Credit 2	Surface water run off	1	1	0	0	0	PBA
POL 03 - Credit 3	Prevention of flooding	1	1	0	0	0	PBA
POL 03 - Credit 4	Minimising watercourse pollution	1	0	0	0	1	-
POL 04	Reduction of night time light pollution	1	1	0	0	0	HM MEP
POL 05	Noise attenuation	1	1	0	0	0	RA ' CCL
AI Approved Innovation		**credit weight =**	**1.00%**				
AI	Approved Innovation	1	0	0	1	0	HM Sus
		Score	**75.1%**	**88.9%**	**94.7%**		
		Rating	Excellent	Outstanding	Outstanding		

4.3. Pre-Assessment: BREEAM 2014 New Construction Criteria

Complete credit criteria and requirements are contained within the BREEAM New Construction 2014 manual available online at http://www.breeam.org/BREEAMUK2014SchemeDocument/ . The credits have been categorised as follows:

- **Targeted** (green column): Credits targeted and integrated into RIBA Stage 3 design.
- **Targeted** (yellow column): Credits targeted and integrated into Stage 3 design. The credits in the 'Yellow' column will need to be monitored closely as they could be affected by the RIBA Stage 4 design.
- **Difficult** (orange column): Credits are those that the design team and assessor considers to be uncertain for this project, either because they have a cost or design choice attached that is unlikely to have been anticipated by the project team.
- Credits in the Unachievable column (U) (light grey column) are inaccessible to this project, either because of its location, the fundamental design of the building, high additional costs, or because some other influence prevents this design from targeting those credits.

Table 5: BREEAM 2014 Credit Matrix

Highlighted	Credits with minimum standards to achieve the targeted rating

Credit Code	Credit Title	Credits Available	Targeted	Targeted	Difficult	Unachievable	Action Lead	Action Support	Headline Requirements	Project Specific Notes
MANAGEMENT			**credit weight =**	**0.61%**						
Man 01 Project brief and design:										
MAN 01 - Credit 1	Stakeholder consultation (project delivery)	1	1	0	0	0	AR		1) Provide meeting minutes/ responsibilities schedules/ employers requirements (clearly highlighting) the project delivery stakeholders (client, building occupier (if known), design team, including Principal Contractor) have met to identify and define their roles, responsibilities and contributions for each of the key phases of project delivery. 2) Provide a copies of the project execution plan, project brief or role and responsibilities schedule for each key phase (RIBA Stage) of the project, clearly highlighting the following has been considered: a. End user requirements b. Aims of the design and design strategy c. Particular installation and construction requirements/limitations d. Occupiers' budget and technical expertise in maintaining any proposed systems e. Maintainability and adaptability of the proposals f. Requirements for the production of project and end user documentation g. Requirements for commissioning, training and aftercare support. 3)Provide an updated project brief and concept design documents to show how the project team stakeholder contributions and the outcomes of the consultation process have influenced or changed the Initial Project Brief, including if appropriate, the Project Execution Plan, Communication Strategy, and the Concept Design documents.	An extensive consultation has been undertaken for the masterplan. This credit is targeted on the basis that the evidence items provided for Building S2 were acceptable.
MAN 01 - Credit 2	Stakeholder consultation (third party)	1	1	0	0	0	AR		4) Provide meeting minutes and a consultation plan demonstrating that all third party stakeholders have been consulted with prior to completion of the Concept Design stage (Riba Stage 2). The consultation information provided must clearly highlight the following items have been considered: a. Functionality, build quality and impact (including aesthetics).	An extensive consultation has been undertaken for the masterplan. This credit is targeted on the basis that the evidence

									b. Provision of appropriate internal and external facilities (for future building occupants and visitors/users). c. Management and operational implications. d. Maintenance resources implications. e. Impacts on the local community, e.g. local traffic/transport impact. f. Opportunities for shared use of facilities and infrastructure with the community/appropriate stakeholders, if relevant/appropriate to building type. g. Compliance with statutory (national/local) consultation requirements. h. Inclusive and accessible design. 5) Provide evidence such as an updated project brief clearly highlighting how the stakeholder contributions and outcomes of the consultation exercise have influenced or changed the Initial Project Brief and Concept Design. 6) Provide evidence such as leaflet drops, mailing lists, website information, of how feedback has been made to all stakeholders prior to completion of the detailed design (RIBA Stage 4, Technical Design or equivalent). Feedback must focus on the stakeholder suggestions, comments, recommendations and the consultation outcomes. This includes how the suggestions and outcomes influenced, or resulted in modifications to, the proposed design and building operation/use	items provided for Building S2 were acceptable.
MAN 01 - Credit 3	Sustainability Champion (design)	1	1	0	0	0	HM Sus		8) Provide an appointment letter to demonstrate the BREEAM AP Involvement during RIBA Stage 1 / Preparation and Brief and that the Sustainability Champion (e.g. BREEAM AP) has facilitated the setting of BREEAM performance targets for the project. 9) Provide a copy of a formal agreement (contract/letters of appointment) between the client and the project team members confirming the Sustainability Champions set target (Excellent) will be achieved at RIBA stage 2. *(Although the target rating is Outstanding for this project – only the planning target will be reported here, i.e. 'Excellent', to reduce risks on the credit)* 10) Note: The design stage assessment must be completed for these credits to be awarded	Credit targeted. The first BREEAM AP meeting was undertaken on 12/12/2016 and the BREEAM AP notes were issued to the team. The target rating was also set. *(Although the target rating is Outstanding for this project – only the planning target will be reported here, i.e. 'Excellent', to reduce risks on the credit)*
MAN 01 - Credit 4	Sustainability Champion (monitoring progress)	1	1	0	0	0	HM Sus		11) The Sustainability Champion (Design) credit must be achieved12) Provide confirmation the formal agreement (contract/letters of appointment) confirms the Sustainability Champion will attend key design team meetings and provide BREEAM update reports for each key RIBA stage up to and including RIBA Stage 4.The Sustainability Champion must provide reports for each stage and attend key project/design team meetings.To achieve this credit at the interim design stage assessment, the agreed BREEAM performance target(s) must be demonstrably achieved by the project design. This must be demonstrated via the BREEAM Assessor's design stage assessment report.	Credit targeted subject to appointment.
Man 02 Life cycle cost and service life planning:										
MAN 02 - Credits 1-2	Elemental life cycle cost (LCC)	2	2	0	0	0	G&T		1) Provide a copy of an outline, entire asset elemental life cycle cost plan undertaken at RIBA Stage 2 and a design option appraisal in line with 'Standardised method of life cycle costing for construction procurement' PD 156865:2008. This is commonly used for developing solutions at project level during option appraisals. Costs are normally at building elemental level on the entire asset. Information may be a mix of typical benchmark costs for key elements, comparative cost modelling or approximate estimates. It is expressed as cost/m2 of gross internal floor area (GIFA) and presented for elemental analysis, aligned to the level of capital cost plans. 2) The elemental LCC plan must: a) Provide an indication of future replacement costs over a period of analysis as required by the client (e.g. 20, 30, 50 or 60 years);	The LCC report was produced as part of the Stage 2 report.

									b) Includes service life, maintenance and operation cost estimates. 3) Demonstrate, using appropriate examples provided by the design team, how the elemental LCC plan has been used to influence building and systems design/specification to minimise life cycle costs and maximise critical value.	
MAN 02 - Credit 3	Component level LCC Plan	1	1	0	0	0	G&T	AR	4) Provide a Component level LCC option appraisal developed by end of Stage 4/Technical Design in line with PD 156865:2008 and that includes the following component types; a. Envelope, e.g. cladding, windows, and/or roofing b. Services, e.g. heat source cooling source, and/or controls c. Finishes, e.g. walls, floors and/or ceilings d. External spaces, e.g. alternative hard landscaping, boundary protection. 5) Demonstrate, using appropriate examples provided by the design team, how the component level LCC cycle appraisal has been used to influence building and systems design/specification to minimise life cycle costs and maximise critical value.	G&T has confirmed this credit can be targeted.
MAN 02 - Credit 4	Capital cost reporting	1	1	0	0	0	G&T	AR	6) Provide the capital cost for the building in pounds per square metre (£k/m2)	G&T has confirmed the capital cost figure will be reported.
Man 03 Responsible construction practices:										
MAN 03	Timber: Pre-requisite	-	Yes				CCL	AR	1) Provide confirmation (e.g. FSC/PEFC certification) that all timber and timber-based products used on the project is 'Legally harvested and traded timber' as outlined in the Central Point of Expertise on Timber (CPET) 5th Edition report on the UK Government Timber Procurement Policy:, see: https://www.gov.uk/timber-procurement-policy-tpp-prove-legality-and-sustainablity	Criteria to be included in the Principal Contractor's requirements.
MAN 03 - Credit 1	Environmental management	1	1	0	0	0	CCL	AR	2) Provide a copy of the Principle Contractors ISO14001 certification. 3) Provide confirmation the principal contractor implements best practice pollution prevention policies and procedures on-site in accordance with Pollution Prevention Guidelines, Working at construction and demolition-sites: PPG6	Criteria to be included in the Principal Contractor's requirements.
MAN 03 - Credit 2	Sustainability Champion (construction)	1	1	0	0	0	CCL	AR	4) Provide confirmation and a scope of appointment for a construction site sustainability champion. Members of the following schemes satisfy the requirement of a Sustainability Champion (Construction) - BREEAM Accredited Professional (AP) Membership Scheme - BRE Site Sustainability Manager Membership Scheme. Provide progress reports required during RIBA Stages 5-6 (Construction, Handover and Close out Stages) at key stages including where: -works can be observed before they are covered up or new works or trades start; - where significant risks of conflicts or errors could occur; - where timing is critical to demonstrating compliance; - where key evidence is required to be produced at specific times including, but not limited to photographic, delivery notes and other documentary evidence; and - where different trades and systems come together and one could harm the integrity or compliance of another system's performance against BREEAM requirements. 5) Provide a contract clause or appointment letter to confirming the defined BREEAM performance targets from part of the principal contractor's contract 6) The performance target **Excellent** must be achieved for the credit to be awarded. *(Although the target*	Criteria to be included in the Principal Contractor's requirements.

									rating is Outstanding for this project – only the planning target will be reported here, i.e. 'Excellent', to reduce risks on the credit)	
MAN 03 - Credit 3-4	Considerate construction	2	2	0	0	0	CCL	AR	7) Provide confirmation the Principal Contractor will use a 'compliant' organisational, local or national considerate construction scheme (e.g. CCS) and confirm the targeted score a) One credit: a CCS score between 25 and 34 with a score of 5 in each of the 5 sections is required under the CCS scheme. This is based on the final site inspection b) Two credits: A score of 35-39 is required with a score of 7 in each of the 5 sections is required under the CCS scheme. This is based on the final site inspection	Criteria to be included in the Principal Contractor's requirements.
MAN 03	Monitoring of construction site impacts: Pre-requisite	-	Yes				CCL	AR	8) Confirm an appropriate person is assigned to monitor, record and report energy and water consumption from the use of construction plant, equipment (mobile and fixed) and site accommodation. This is applicable to both principal contractor and subcontractor.	Criteria to be included in the Principal Contractor's requirements.
MAN 03 - Credit 5	Utility consumption - Energy and Water	1	1	0	0	0	CCL	AR	9-14) Provide eKPI sheets / formal letter confirming monitoring, recording and reporting of energy and water consumption from the use of construction plant, equipment (mobile and fixed) and site accommodation. Energy emissions must be reported in terms of total kgCO2/project value. Water use must be reported in m3. Note: This is applicable to both principal contractor and subcontractor operations	Criteria to be included in the Principal Contractor's requirements.
MAN 03 - Credit 6	Transport of construction materials and waste	1	1	0	0	0	CCL	AR	15) Confirm an appropriate person is assigned to monitor, record and report energy and water consumption from the use of construction plant, equipment (mobile and fixed) and site accommodation. This is applicable to both principal contractor and subcontractor. 16-17) Provide eKPI sheets / formal letter confirming monitoring, recording and reporting of transport of construction materials and waste accommodation. Reporting must be separate for materials and waste, the total fuel consumption (litres) and total carbon dioxide emissions (kgCO2 eq), plus total distance travelled (km) must be included. This is applicable to both principal contractor and subcontractor.	Criteria to be included in the Principal Contractor's requirements.
Man 03 -EXE Credit	**Considerate construction - Exemplary level**	**1**	**1**	**0**	**0**	**0**	CCL	AR	18) To achieve the exemplary credits, a score of 40 with a score of 7 in each of the 5 sections is required under the CCS scheme.	Criteria to be included in the Principal Contractor's requirements. Building S2 has achieved a score of 40.
Man 04 Commissioning and handover:										
MAN 04 - Credit 1	Commissioning schedule and responsibilities	1	1	0	0	0	HM MEP	AR / CCL	1) Provide a schedule of commissioning and testing that identifies and includes a suitable timescale for commissioning and re-commissioning of all complex and non-complex building services and control systems and testing and inspecting building fabric. 2) The schedule provided must identify the appropriate standards that all commissioning activities will be conducted in accordance with, such as current Building Regulations, BSRIA and CIBSE guidelines and/or other appropriate standards, where applicable. BMS commissioning procedures must be undertaken in line with BREEAM. 3) Provide an appointment letter confirming an appropriate project team member(s) is appointed to monitor and programme, pre-commissioning, commissioning, testing and, where necessary, re-commissioning activities on behalf of the client. 4) Provide confirmation the principal contractor accounts for the commissioning and testing programme, responsibilities and criteria within their budget and main programme of works, allowing for the required time to complete all commissioning and testing activities prior to handover.	Credit targeted. The criteria will be included in the MEP specification. An appropriate team member is to be appointed as a commissioning manager. Criteria to be included in the Principal Contractor's requirements.
MAN 04 - Credit 2	Commissioning building services	1	1	0	0	0	HM MEP	AR / CCL	5) The Commissioning and Testing Schedule credit must be achieved. 6) Provide an appointment letter containing the scope of services for a specialist commissioning manager	Credit targeted. The criteria will be included in the MEP specification. An

									during the design stage (by either the client or the principal contractor) with responsibility for: a. Undertaking design reviews and giving advice on suitability for ease of commissioning. b. Providing commissioning management input to construction programming and during installation stages. c. Management of commissioning, performance testing and handover/post-handover stages. Where there are simple building services, this role can be carried out by an appropriate project team member (see criterion 3), provided they are not involved in the general installation works for the building services system(s).	appropriate team member is to be appointed as a commissioning manager
MAN 04 - Credit 3	Commissioning building fabric	1	1	0	0	0	CCL	HM	7) The Commissioning and Testing Schedule credit must be achieved. 8) Provide an appointment letter or a formal commitment letter confirming that A thermographic survey of the building fabric will be undertaken by a level 2 thermographer. The integrity of the building fabric, including continuity of insulation, avoidance of thermal bridging and air leakage paths is quality must be assured through completion of post construction testing and inspection. 9) Any identified defects must be remediated rectified prior to building handover and close out Thermographic survey of large complex buildings: In the case of large and complex buildings, it may be impractical for the thermographic survey and air-tightness testing to cover 100% of the building. Where a complete thermographic survey is deemed impractical by a Level 2 qualified thermographic surveyor, the guidance in air tightness standard TSL23 should be followed on the extent of the survey and testing. This could include airports, large hospitals and high-rise buildings.	Credit targeted. Criteria to be included in the Principal Contractor's requirements
MAN 04 - Credit 4	Handover - Building User Guide and Training	1	1	0	0	0	AR	Design Team	10) A non-technical Building User Guide (BUG) must be produced to meet the BREEAM requirements prior handover for distribution to the building occupiers and premises managers. This should include: a) Overview of the building and its environmental strategy, e.g. energy/water/waste efficiency policy/strategy and how users should engage with/deliver the policy/strategy. b) Building services overview and access to controls, e.g. where to find them, what they control, how to operate effectively and efficiently etc. c) Pre-arrival information for visitors, e.g. access and security procedures/provisions d) Provision of, and access to, shared facilities e) Safety and emergency information/instructions f) Building related operational procedures specific to building type/operation, e.g. laboratories g) Building related incident reporting/feedback arrangements h) Building related training information/links i) Provision of, and access to, transport facilities, e.g. public transport, cyclist facilities, pedestrian routes etc. j) Provision of, and access to, local amenities k) Re-fit, refurbishment and maintenance arrangements/considerations l) Links, references and relevant contact details m) There is no requirement on the format the Building User Guide should take. **Criterion 11 not applicable to Shell and Core projects, however on completion of works the building owner/agent/user hands it over to the fit-out contractor, who can then complete the relevant sections based on the fit-out strategy.** 11) Provide a copy of the BREEAM training schedule prepared for building occupiers/premises managers, timed appropriately around handover and proposed occupation plans. This should include a. The building's design intent b. The available aftercare provision and aftercare team main contact(s), including any scheduled seasonal commissioning and post occupancy evaluation c. Introduction to, and demonstration of, installed systems and key features, particularly building management systems, controls and their interfaces	Credit targeted. A Building User Guide will be produced and handed over to the building's users.

									d. Introduction to the Building User Guide and other relevant building documentation, e.g. design data, technical guides, maintenance strategy, operations and maintenance (O&M) manual, commissioning records, log book etc. e. Maintenance requirements, including any maintenance contracts and regimes in place.	
HEALTH & WELLBEING		**credit weight**	**1.05%**							
Hea 01 Visual comfort:										
HEA 01 - Credit 2	Daylighting	1	0	0	0	1	-	-	3) Provide calculations to demonstrate the average daylight factor criteria are achieved: a) Average daylight factor requires 2% over 80% of the occupied spaces.Or3) Provide calculations demonstrating the relevant building areas meet the good practice average and minimum point daylight illuminance criteria: b) Average daylight illuminance (averaged over entire space) of at least 300 lux for 2000 hours per year with a minimum of at least 90 Lux for 2000 hours per year for over 80% of the floor area.	A modelling test has been carried and the daylight criteria cannot be achieved due to deep plan office.
HEA 01 - Credit 3	View out	1	1	0	0	0	WEE / MO		4-6) Provide marked up drawings showing 95% of the relevant building areas (i.e. workstations or desks), is within 7m of a wall which has a window or permanent opening that provides an adequate view out. The window opening must be of 20% or more where the room depth is 7m or less. Where the depth is greater than the 7m requirement, compliance is only possible where the % of window is greater than the values in Table 1 of BS 8206: Depth of room from outside wall (metres) % of window wall as seen from the inside <8 20 ≥ 8 ≤ 11 25 >11 ≤ 14 30 > 14 35 An adequate view out is a view of landscape or buildings at seated eye level within all relevant building areas and ideally through an external window.	Credit targeted. The architect is to provide compliant evidence of the percentage of view out.
HEA 01 - Credit 4	Internal and external lighting levels, zoning and control	1	1	0	0	0	HM MEP		7-9) Provide a specification clause and manufactures details confirming All florescent and compact florescent lamps are to be fitted with high frequency ballasts/ control gear. 10) Provide a specification clause and drawings demonstrating all external lighting located within the construction zone is designed to meet: BS 5489-1:2013 Lighting of roads and public amenity areas AND BS EN 12464-2:2014 Light and lighting - Lighting of work places - Part 2: Outdoor work places.	Credit targeted. The criteria will be included in the Electrical specifications.
HEA 01 - EXE Credit	**Daylighting - Exemplary level**	**1**	**0**	**0**	**0**	**1**	-	Dayligh ting Speciali st	3) Provide calculations to demonstrate the average daylight factor criteria are achieved: a) Average daylight factor requires 3% over 80% of the occupied spaces. Or 3) Provide calculations demonstrating the relevant building areas meet the good practice average and minimum point daylight illuminance criteria: Average daylight illuminance (averaged over entire space) of at least 300 lux for 3000 hours per year with a minimum of at least 90 Lux for 2650 hours per year for over 80% of the floor area.	Credit unachievable due to the depth of the floor plans.

Hea 02 Indoor air quality:										
HEA 02 - Credit 2	Ventilation	1	0	1	0	0	HM MEP		2) Provide a specification confirming fresh air rates into the building will be in accordance with the criteria of the relevant standard for ventilation, for offices this is the top of the range recommendation in the British Council for Offices Guide to Best Practice in the Specification of Offices i.e. 12 litres per second per person/ 3) Provide a specification and design drawings showing the building's air intakes and exhausts are over 10m apart and intakes are over 20m from sources of external pollution (i.e. car parks, roads, loading /waiting bays) or Provide drawings and a specification clause confirming the location of the building's air intakes and exhausts, in relation to each other and external sources of pollution, is designed in accordance with BS EN 13779:2007 Annex A2. 4) Where present, provide a specification confirming HVAC systems must incorporate suitable filtration to minimise external air pollution, as defined in BS EN 13779:2007 Annex A3.	**Meeting 08.02.2017:** Argent/ Mossessian confirmed the road between S1 and S2 will not be used regularly and therefore does not constitute a source of pollution. The credit is targeted.
HEA 02 - Credit 5	Adaptability - Potential for natural ventilation	1	0	0	0	1	-		13) The building ventilation strategy is designed to be flexible and adaptable to potential building occupant needs and climatic scenarios. The occupied spaces of the building must be designed to be capable of providing fresh air entirely via a natural ventilation strategy. I.e. meet the room depth criteria in CIBSE AM 10 and have a 5% openable window area in proportion to the floor area or provide adequate cross flow of air, demonstrated by using ventilation design tool that meet the requirements of CIBSE AM10 14) The natural ventilation strategy should be capable of providing at least two levels of user-control on the supply of fresh air to the occupied space.	Credit not achievable (windows not expected to be openable).
Hea 04 Thermal comfort:										
HEA 04 - Credit 1	Thermal modelling	1	1	0	0	0	HM Sus	MO	1) Provide a copy of a CIBSE AM 11 compliant thermal model/report 2) Provide formal confirmation the software used provides full dynamic thermal analysis 3) Provide a copy of a the thermal model confirming summer and winter operative temperature ranges in occupied spaces are in accordance with the criteria set out in CIBSE Guide A Environmental design, Table 1.5. 4) Provide a copy of the thermal model confirming the PMV (predicted mean vote) and PPD (predicted percentage of dissatisfied) indices for the building.	Credit targeted.
HEA 04 - Credit 2	Adaptability - for a projected climate change scenario	1	1	0	0	0	HM Sus	MO	5) Hea 04 credit 1 must be achieved 6) Provide a copy of the thermal model / report confirming criterion 3 of the first credit will be achieved for a projected climate change environment 7) Where thermal comfort criteria are not met for the projected climate change environment, the project team demonstrates how the building has been adapted, or designed to be easily adapted in future using passive design solutions in order to subsequently meet the requirements under criterion 6 of the first credit. Design drawings and adaptability strategy may be required to demonstrate the criteria. 8) Provide a copy of the thermal model / report (for the climate change scenario) confirming the PMV (predicted mean vote) and PPD (predicted percentage of dissatisfied) indices for the building	Credit targeted.

Hea 05 Acoustic performance:										
Hea 05 - Credit 2	Internal indoor ambient noise levels	1	1	0	0	0	Rambol l		1) Provide confirmation of the appointment of a Suitably Qualified Acoustician (SQA) and their accreditation. a) Provide the SQA report confirming the Indoor ambient noise levels achieved the design ranges provided in Section 7 of BS 8233: 2014. Note: The SQA must confirm that given a typical arrangement and fit-out specification for then building type, the development is likely to meet the levels required to demonstrate compliance with the BREEAM criteria. Where the specific room functions and areas within the building are yet to be defined, the acoustician must base their assessment on the most sensitive room type likely to be present in the building, as a worst case. For example in a retail assessment, where there are likely to be offices the acoustician should make an assessment based on this scenario b) Provide a copy of, or written confirmation of, the programme of pre completion acoustic testing to be carried out by the SQA. Note: If testing is to be carried out where the office is not yet furnished, then section 7.5 of BS 8233:2014 should be referred to when determining the performance criteria. Where the office is to be furnished at the time testing is carried out, then refer to section 7.7.6 of BS 8233:2014 for the relevant performance criteria **Note: for Shell and Core projects, the SQA must confirm that the developer's works will enable a future tenant utilising a typical fit-out and specification to meet the levels required to demonstrate compliance with the BREEAM criteria (Compliance Note CN 1.1).**	Sandy Brown is appointed as the SQA. Credit targeted.
Hea 06 Safety and security:										
Hea 06 - Credit 1	Safe access	1	0	1	0	0	WEE / MO		1-10) Provide external drawings showing the vehicular, pedestrian and cyclist routes on site. The drawings must clearly show is achieved: -Dedicated cycle paths provide direct access from the site entrance(s) to any cycle storage provided, without the need to deviate from the cycle path and, if relevant, connect to off-site cycle paths. -Footpaths on-site provide direct access from the site entrance(s) to the building entrance(s) and connect to public footpaths off-site (where existing). -Drop-off areas are designed off/adjoining to the access road and provide direct access to pedestrian footpaths, therefore avoiding the need for the pedestrian to cross vehicle access routes. -Dedicated pedestrian crossings are provided where pedestrian routes cross vehicle access routes, and appropriate traffic calming measures are in place to slow traffic down at these crossing points. -For large developments with a high number of public users or visitors, pedestrian footpaths must be signposted to other local amenities and public transport nodes off-site (where existing). -The lighting for access roads, pedestrian routes and cycle lanes is compliant with the external lighting criteria defined in Hea 01 Visual comfort, i.e. in accordance with BS 5489-1:2013 lighting of roads and public amenity areas. -Delivery areas are not directly accessed through general parking areas and do not cross or share pedestrian and cyclist routes and other outside amenity areas accessible to building users and general public. -There is a dedicated parking/waiting area for goods vehicles with appropriate separation from the manoeuvring area and staff and visitor car parking.	**Meeting 08.02.17:** Credit targeted. Clear mark up of loading bay and accessible car space have been provided.

									-Parking and turning areas are designed for simple manoeuvring according to the type of delivery vehicle likely to access the site, thus avoiding the need for repeated shunting. -There is a dedicated space for the storage of refuse skips and pallets away from the delivery vehicle manoeuvring area and staff/visitor car parking (if appropriate given the building type/function).	
Hea 06 - Credit 2	Security of site and building	1	1	0	0	0	QCIC	MO	11) Provide a copy of the Security Needs Assessment undertaken at RIBA stage 2 by the Suitably Qualified Security Specialist (SQSS). 12) Provide details of the SQSS's recommendations or solutions during or prior to Concept Design (RIBA Stage 2). The recommendations or solutions must aim to ensure that the design of buildings, public and private car parks and public or amenity space are planned, designed and specified to address the issues identified in the preceding SNA. 13) Provide confirmation (formal letter and highlighted examples in design drawings) that the recommendations or solutions proposed by the SQSS are implemented. Any deviation from those recommendations or solutions will need to be justified, documented and agreed in advance with a suitably qualified security specialist.	Credit targeted. QCIC appointed.
ENERGY		**credit weight =**	**0.71%**							
Ene 01 Reduction of energy use and carbon emissions										
ENE 01	Energy performance	12	**8**	**3**	**1**	**0**	HM Sus		1) Provide a copy of the Part L model and outputs (BRUKL) and .inp file for the Energy Performance Ratio for New Constructions (EPR NC) to be calculated. Provide the accredited energy assessors qualification details. Provide a copy of the green fit-out agreement detailing the performance specification to be undertaken in line with the base build to ensure the EPR is maintained during fit out. **Note: An 'Excellent' rating requires an EPR of at least 0.375 which equates to 5 credits. An 'Outstanding' rating required an EPR of at least 0.60 which equates to 8 credits.**	The RIBA Stage 3 design results in 11 credits achieved.
ENE 01 - EXE Credit	Exemplary Performance for Carbon Negative Buildings	**5**	**0**	**0**	**0**	**5**	-	GT	2-4) Provide a copy of the Part L model and outputs (BRUKL) and .inp file for the Energy Performance Ratio for New Constructions (EPR NC). The exemplary credits can be awarded as follows: Four Credits : The building achieves an EPRNC ≥0.9 and zero net regulated CO2 emissions An equivalent % of the buildings modelled 'regulated' operational energy consumption as stipulated in table 26of the manual, is generated by carbon neutral on-site or near-site sources and used to meet energy demand from 'unregulated' building systems or processes. Five Credits: The building is 'carbon negative' in terms of its total modelled operational consumption, including regulated and unregulated energy.	**Not achievable.**
Ene 02 Energy monitoring:										
ENE 02 - Credit 1	Sub-metering of major energy consuming systems	1	1	0	0	0	HM MEP		1) Provide a specification clause and design schematics showing that energy sub metering is provided for at least 90% of the estimated annual energy consumption of each fuel to be assigned to the following energy consuming systems:- - Space heating - Domestic hot water-	Credit targeted. Criteria to be included in the MEP specifications and schematics.

									Humidification - Cooling - Pumps - Lighting- Small Power - Renewable or low carbon systems (each system separately) - Controls - Other major energy consuming systems (e.g. kitchen plant/catering equipment/transportation systems/dedicated computer rooms/covered car parks/floodlighting sports and leisure facilities) Provide a specification clause and drawings confirming the meters will be connected to a building energy management systems (BEMS) or automatic meter reading systems (AMR) Provide confirmation end energy consuming uses are identifiable to the building users, for example through labelling or data outputs (photographic /BMS screenshot evidence must be provided at PCR).	
ENE 02 - Credit 2	Sub-metering of high energy load and tenancy areas	1	1	0	0	0	HM MEP		5) Provide a specification clause and drawings confirming submetering will be undertaken covering the energy supply (including electricity, gas, fuel or other form of energy/fuel) to tenanted areas. **Meters must be installed on the energy supply to each separate tenanted unit/ floor plate. This includes office areas (metering by floor plate) and catering facilities if present.** Provide a specification clause and drawings confirming the meters will be connected to a building energy management systems (BEMS) or automatic meter reading systems (AMR).	Credit targeted. Criteria to be included in the MEP specifications and schematics.
Ene 03 External lighting										
ENE 03 - Credit 1	External Lighting	1	1	0	0	0	HM MEP		1-3) Provide a specification clause and drawings confirming the luminous efficacy of external light fittings ≥ 60 lamp lumen/circuit watt Provide a specification clause and drawings confirming external light fittings controlled for daylight and presence detection in areas of intermittent pedestrian traffic.	Credit targeted. Criteria to be included in the Electrical specifications.
Ene 04 Low carbon design:										
ENE 04 - Credit 1	Passive design	1	1	0	0	0	HM Sus	HM MEP	1) Provide confirmation the first Credit within issue Hea04 Thermal Comfort is achieved. 2) Provide a passive design analysis carried out at RIBA Stage 2/Concept Design. As a minimum, this must cover: - Site Location - Site Weather - Microclimate - Building Layout - Building Orientation - Building Form - Building Fabric - Thermal Mass/Other Fabric Thermal Storage - Building Occupancy type - Daylighting strategy - Ventilation Strategy - Adaptation to climate change	Credit targeted.

									3) The analysis should show passive design measures reduce the total heating, cooling, mechanical ventilation and lighting loads. Measures to contribute ≥ 5% of overall building energy demand.	
ENE 04 - Credit 2	Free Cooling	1	0	1	0	0	HM Sus	MO	4) Provide confirmation the passive design analysis is achieved 5) The passive design analysis carried out under criterion 2 (above) includes an analysis of free cooling and identifies opportunities for the implementation of free cooling solutions. 6) Provide evidence of the building free cooling strategy (e.g. a specification) used to reduce the cooling demand.	Cooling will be provided via the site wide district cooling, which comprises absorption chillers. The credit is therefore in targeted. Argent to provide details of the cooling production.
ENE 04 - Credit 3	Low zero carbon (LZC) feasibility study	1	1	0	0	0	HM Sus	GT	7-8) Provide a copy of the BREEAM compliant LZC Feasibility Study required at RIBA Stage 2/Concept Design. An LZC installation should be specified and should contribute ≥ 5% of overall CO2 emissions Note: If the LZC study clearly demonstrates not technologies are feasible at stage 2 the credit can still be awarded.	LZC study was carried out at Stage 1. CCHP and PV are provided. More than 5% reduction through LZC is expected. Credit targeted.
Ene 06 Energy efficient transportation systems:										
ENE 06 - Credit 1	Lift - Energy consumption	1	1	0	0	0	HM VT	CCL	1 a) Provide an analysis of the transportation demand and usage patterns of the building carried out to determine the optimum number and size of lifts, escalators and moving walkways. b) Provide a copy of an energy consumption calculation, calculated in accordance with BS EN ISO 25745 Parts 2 and 3 for one of the following: - At least two types of system - Arrangement of systems - System strategy which is fit for purpose c) The use of regenerative drives to be considered where it produces an energy saving greater than the additional standby energy used to support the drives d) The transportation system with the lowest energy consumption to be specified.	Credit targeted. Criteria to be included in the VT specifications.
ENE 06 - Credit 2-3	Lift - Energy efficient features and Regenerative drives	2	2	0	0	0	HM VT	CCL	Criterion 1 is achieved. 3) Provide a copy of a calculation of energy saving for the regenerative drive , specification and manufacturers details confirming the following energy efficient features are specified:-lifts operate in a standby condition during off peak periods-lift car lighting and display lighting provides an average lamp efficacy (across all fittings) of > 55 lamp lumen/ circuit watt- lift uses a drive controller capable of VVVF control of the drive motor 4) Regenerative drives to be specified where they have been demonstrated to save energy (i.e. where it produces an energy saving greater than the additional standby energy used to support the drives)Energy Efficient Features: Escalators and/or moving walkways: 5-6) Provide a copy of a specification and manufacturers details (when available) confirming the escalator or moving walkway is fitted with either a load-sensing device that synchronises motor output to passenger demand through a variable speed drive OR a passenger-sensing device for automated operation (auto walk), so the escalator operates in standby mode when there is no passenger demand	Credit targeted. Criteria to be included in the VT specifications.

TRANSPORT										
Tra 01 Public transport accessibility:										
TRA 01	Public transport accessibility	3	3	0	0	0	HM Sus	HM MEP	**Provide a copy of the Buildings PTAL rating summary report from : www.webptals.org.uk**	Credit targeted.
Tra 02 Proximity to amenities:										
TRA 02	Proximity to amenities	1	1	0	0	0	WEE / MO		1-2) Provide a copy of a scale map highlighting the 3 local amenities via safe pedestrian routes within 500m from the building entrance to the amenity entrance. At least 2 (3 of these would also be compliant) of the following core facilities must be provided: - Appropriate food outlet - Access to cash - Access to a recreation/leisure facility for fitness/sports Any 1 of the following amenities can be provided: - Access to an outdoor open space (public or private, provided suitably sized and accessible to building users) - Publicly available postal facility - Community facility - Over the counter services associated with a pharmacy - Child care facility or school	Credit targeted.
Tra 03 Cyclist facilities:										
TRA 03 - Credit 1	Cycle storage	1	1	0	0	0	WEE / MO	AR	1) Provide confirmation of the number of anticipated building users or use the default occupancy density for office areas (including reception areas) 0.111. Based on a total net internal area of **17000 m2**, the following cycle spaces and facilities are required. Occupancy = **17000 x 0.111=1887** Cycle storage facilities: 1-200 users@ 1 space per 10 users = **20 spaces** 201-300 users @ 1 space per 15 users = 7 **spaces** 301-400 users@ 1 space per 20 users = **5 spaces** > 401 users @ 1 space per 25 users = **60 spaces** Total cycle storage spaces = 92 **spaces** 50% reduction due to high AI = 46 **spaces** Provide a marked up drawing confirming the location and number of BREEAM compliant racks to be provided.	Preliminary calculations indicate that 46 cycle spaces are required to meet the BREEAM criteria. Credit targeted. Showers, lockers and changing rooms are also provided.
TRA 03 - Credit 2	Cyclist Facilities	1	1	0	0	0	WEE / MO	AR	2) Criterion 1 above is achieved 3) Provide drawing to shows that at least 2 of the BREEAM compliant cyclist facilities will be installed: a. Showers (Any building providing 8 showers or more will comply. Both male and female users must be catered for) b. Changing facilities (Drawing should show it is appropriately sized and include adequate space and	

									facilities to hang/store clothing and equipment. (e.g. bench seats/hooks)) c. Lockers (must equal the number of required racks and Lockers should be adjacent to compliant changing	
Tra 04 Maximum car parking capacity										
TRA 04 - Credit 1	Maximum car parking capacity	2	2	0	0	0	WEE / MO	AR	1) Provide the building occupancy numbers and number of car parking spaces for the building so the credit can be calculated Provide a drawing showing the number of building user spaces.	Credit targeted. No parking spaces are provided.
Tra 05 Travel plan										
TRA 05	Travel plan	1	1	0	0	0	AR		1) Provide a copy of the BREEAM compliant Travel plan developed as part of the feasibility and design stages. The plan must include a package of measures to encourage the use of sustainable modes of transport and movement of people and goods during the building's operation and use. Drawings are also required to show the implementation of base build recommendations. 2) Provide a copy of the site specific travel assessment/statement produce to inform the plan. This must cover (where relevant: a) Existing travel patterns and opinions of existing building or site users towards cycling and walking so that constraints and opportunities can be identified. b) Travel patterns and transport impact of future building users. c) Current local environment for walkers and cyclists (accounting for visitors who may be accompanied by young children). d) Disabled access (accounting for varying levels of disability and visual impairment). e) Public transport links serving the site. f) Current facilities for cyclists. 3) The developer must provide formal confirmation that they will hand over a copy of the travel plan to the building's future tenant(s)/owner-occupier, so that it may inform their own travel plan/strategy. OR 4) If the tenant is known they must be involved in the development of the travel plan and they must confirm that the travel plan will be implemented post construction and be supported by the building's management in operation.	Credit targeted. A Masterplan travel plan was produced. A building specific travel plan is to be produced.
WATER		**credit weight =**	**0.83%**							
Wat 01 Water consumption:										
WAT 01	Water consumption	5	3	2	0	0	WEE / MO	HM MEP	1-3) Provide a copy of a sanitaryware schedule clearly highlighting the number and type of all water consuming fittings within the building. The efficiency of the following domestic scale water consuming components must be included (where present): - WCs - Urinals - Taps (including kitchenette taps) - Showers - Baths - Dishwashers - Washing Machines Provide a copy of the specification confirming the flow rate / flush volume of each water consuming fitting in the building (manufacturers details are require at PCR clearly highlighting the flow rate /flush volumes) in line with the BREEAM requirements	Rainwater and Greywater recycling is being considered for the project. Preliminary test calculations have shown that collecting greywater from both the taps and showers will allow for all 5 credits to be achieved. This will be further investigated at the detailed design stage.

									4) Provide the yield details of the greywater or rainwater harvesting system (if present). 5) Provide a specification confirming any greywater systems must be specified and installed in compliance with BS 8525-1:2010 Greywater Systems - Part 1 Code of Practice. Any rainwater systems must be specified and installed in compliance with BS 8515:2009+A1:2013 Rainwater Harvesting Systems - Code of practice	
WAT 01 EXE Credit	Water consumption 65% reduction - Exemplary level	**1**	0	0	0	1	-		1) A 65% improvement over baseline building water consumption needs to be achieved.	Credit not achievable.
Wat 02 Water monitoring:										
WAT 02	Water monitoring Pre-requisite	-	Yes				HM MEP		1) Provide a specification and drawing confirming a pulsed water meter will be installed on the mains water supply to each building	Credit targeted.
WAT 02	Water Sub-metering	1	1	0	0	0	HM MEP		2) Provide a calculation and where relevant drawing and specification confirming water consuming plant/building areas, consuming 10% or more of the building's total water demand will have accessible sub-meters/ water monitoring equipment integral to the plant/area. 3-4) Provide a specification confirming all water meters will have a pulsed output or other open protocol communication output to enable connection to an appropriate utility monitoring and management system, e.g. a building management system (BMS).	Credit targeted. Criteria to be included in the MEP specifications.
Wat 03 Water leak detection:										
WAT 03 - Credit 1	Leak detection system	1	1	0	0	0	HM MEP		1) Provide a specification (and a drawing if possible) confirming a leak detection system which is capable of detecting a major water leak on the mains water supply within the building and between the building and the utilities water meter is installed. The specification must confirm the leak detection is: a. A permanent automated water leak detection system that alerts the building occupants to the leak OR an inbuilt automated diagnostic procedure for detecting leaks is installed. b. Activated when the flow of water passing through the water meter/data logger is at a flow rate above a pre-set maximum for a pre-set period of time. c. Able to identify different flow and therefore leakage rates, e.g. continuous, high and/or low level, over set time periods. d. Programmable to suit the owner/occupiers' water consumption criteria. e. Where applicable, designed to avoid false alarms caused by normal operation of large water-consuming plant such as chillers.	Credit targeted. Criteria to be included in the MEP specifications.
WAT 03 - Credit 2	Flow control devices	1	1	0	0	0	HM MEP		2) Provide a specification and drawings confirming flow control devices that regulate the supply of water to each WC area/facility according to demand are installed (and therefore minimise water leaks and wastage from sanitary fittings). Acceptable devices include: a) A time controller, i.e. an automatic time switch device to switch off the water supply after a predetermined interval b) A programmed time controller, i.e. an automatic time switch device to switch water on and/or off at predetermined times. c) A volume controller, i.e. an automatic control device to turn off the water supply once the maximum pre-set volume is reached A presence detector and controller, i.e. an automatic device detecting occupancy or movement in an area to switch water on and turn it off when the presence is removed d) A central control unit, i.e. a dedicated computer-based control unit for an overall managed water control system, utilising some or all of the types of control elements listed above. **Note**: BREEAM compliant control devices can be fitted to the CWS only however systems must be designed to prevent scalding.	Credit targeted. Criteria to be included in the MEP specifications.

Wat 04 Water efficient equipment:										
WAT 04	Water efficient equipment	1	0	1	0	0	HM MEP	Urban	1-2) Provide confirmation that all unregulated water demands have been identified that could be realistically mitigated or reduced. Examples include equipment for irrigation, vehicle wash plant/ equipment. Provide clearly highlighted specification documents showing the system(s) or processes have been identified to reduce the unregulated water demand, and demonstrate, through either good practice design or specification, a meaningful reduction in the total water demand of the building. Examples of solutions include: i. Drip-fed subsurface irrigation incorporating soil moisture sensors. The irrigation control should be zoned to permit variable irrigation to different planting assemblages. ii. ii. Reclaimed/recovered water from a rainwater collection or waste water recovery system, with appropriate storage, i.e. greywater collection from building functions or processes that use potable water, e.g. vehicle wash, training water in fire stations, sanitary facilities, irrigation etc. This should take into account the Government Buying Standards where appropriate to the building type. iii. iii. External landscaping and planting that relies solely on precipitation, during all seasons of the year. iv. iv. All planting specified is restricted to contextually appropriate species that thrive without irrigation and will continue to do so in those conditions likely as a result of climate change, i.e. typically warmer and drier conditions.	Drip-fed surface irrigation with soil moisture sensors/ rainstat. Currently included in the Stage 3 design This credit in targeted.
MATERIALS		**credit weight =**	**1.12%**							
Mat 01 Life cycle impacts:										
MAT 01	Life cycle impacts	5	**2**	**0**	**1**	**2**	WEE / MO	RA	1-3) Provide specification clauses, detail drawings and a materials schedule clearly highlighting the materials to be used in the building. This must include m2 area of each element as follows; - External Walls - Windows - Roof - Upper Floor Slabs - Floor finishes/coverings Provide the Green Guide specifications, element numbers and ratings which can be reviewed at: www.thegreenguide.org.uk.	2 credits targeted based on Building S2. Credit details to be developed at detailed design by WEE/RA in collaboration with the Assessor.
MAT 01 - EXE Credit	Exemplary performance for life cycle impacts	**3**	**0**	**2**	**0**	**1**	HM Sus	WEE/ MO	Where IMPACT will not be undertaken route 1 applies. 4-5) Route 1) Using the Green Guide Specification: Where assessing four or more applicable building elements, the building achieves at least 2 points in addition to the total. Where assessing fewer than four applicable elements, the building achieves at least one point in addition to the total Where IMPACT is undertaken route 2 applies 6-8) Route 2) Using compliant life cycle assessment software tools e.g. IMPACT Where the design team has used an IMPACT compliant software tool to measure the environmental impact of the building.	To achieve 2 of these credits, a LCA analysis is required to be undertaken. The impact on the design is not likely to be significant and the credit will be mainly achieved by undertaking the study. Credit is targeted. Study to be carried out at RIBA Stage 4.

									Where the design team can demonstrate how the use of an IMPACT compliant software has benefited the building in terms of measuring and reducing its environmental impact Where the design team submit the building information model (BIM) from the IMPACT compliant tool for the assessed building to BRE.	
Mat 02 Hard landscaping and boundary protection:										
MAT 02	Hard landscaping and boundary protection	1	0	1	0	0	WEE / MO		1) Provide a marked up drawing and specification clearly showing at least 80% of all external hard landscaping and boundary protection (by area) must achieve an A or A+ Green Guide rating. Drawings should contain the following information: -A detailed description of each applicable element and its constituent materials; -Locations and area (m2) of each applicable element; -Green Guide element numbers for the applicable materials. Green Guide specifications, element numbers and ratings can be reviewed at: www.thegreenguide.org.uk.	WEE has provided a footprint drawing indicating no hard landscaping as part of the S1 build contract.
Mat 03 Responsible sourcing of materials:										
MAT 03 - Pre-requisite	Sustainable timber procurement Pre-requisite	-	Yes				CCL		Pre-Requisite (Mandatory credit element): 1) All timber AND timber based products used on the project is 'Legally harvested and traded timber'.	Criteria to be included in the Principal Contractor's requirements
MAT 03 - Credit 1	Sustainable procurement plan	1	0	1	0	0	CCL	AR	2) Provide a copy of the BREEAM compliant sustainable procurement plan. A plan that sets out a clear framework for the responsible sourcing of materials to guide procurement throughout a project and by all involved in the specification and procurement of construction materials. The plan may be prepared and adopted at an organisational level or be site/project specific and for the purposes of BREEAM compliance, will cover the following as a minimum: - Risks and opportunities are identified against a broad range of social, environmental and economic issues. BS 8902:2009 Responsible sourcing sector certification schemes for construction products-Specification can be used as a guide to identify these issues. - Aims, objectives and targets to guide sustainable procurement activities. - The strategic assessment of sustainably sourced materials available locally and nationally. There should be a policy to procure materials locally where possible. - Procedures are in place to check and verify that the sustainable procurement plan is being implemented/adhered to on individual projects. These could include setting out measurement criteria, methodology and performance indicators to assess progress and demonstrate success	**Criteria to be confirmed by contractor. Likely to be achieved.**
MAT 03 - Credits 2-4	Responsible sourcing of materials	3	1	0	1	1	CCL	AR	3-4) Provide a materials schedule and full list of suppliers and manufacturers of the materials in the following building elements. At least 70% of the materials that makeup that element must be responsibly sourced (i.e. classified by Responsible Sourcing Certification Schemes points levels) with full third party certification: a. Ceiling (including ceiling finishes) b. Door/window c. Floor (including floor finishes) d. Insulation e. Internal partition/internal walls (including finishes) f. Roof (including roof finishes) g. Structure, primary and secondary h. External wall (e.g. cladding, lining, render, including finishes)	1 credit targeted. Criteria to be included in the Principal Contractor's requirements.

									i. Building service j. Hard landscaping k. OtherProvide design drawings showing the building elements and written confirmation of the breakdown of each material in m^3 or %.	
MAT 3 - EXE Credit	Exemplary Performance for Responsible Sourcing	**1**	**0**	**0**	**0**	**1**	-	AR	Where 70% of available RSM are achieved.	Criteria not considered achievable.
Mat 04 Insulation:										
MAT 04	Insulation Embodied impact	1	1	0	0	0	WEE / MO	M&E Engineer / Principal Contractor	Provide a specification, drawings and manufacturers' literature of the insulation specified for the following areas: -External walls; -Ground floor; -Roof; -Building services For the building fabric, provide the following for each specific insulation: -Area of insulation (m^2); -Thickness (mm); -Density (kg/m^3); -Thermal conductivity (W/mK). For the building services, provide the following: -Volume of insulation (m^3); -Density (kg/m^3); -Thermal conductivity (W/mK). Green Guide specifications, element numbers and ratings can be reviewed at: www.thegreenguide.org.uk. Insulation Index for the building fabric and services insulation is the same as or greater than 2.5	Credit targeted.
Mat 05 Designing for robustness:										
MAT 05	Protecting vulnerable parts of the building from damage & Protecting exposed parts of the building from material degradation	1	1	0	0	0	WEE / MO		1) Provide drawings and a highlighted specification to confirm suitable durability and protection measures or designed features/solutions to prevent damage to vulnerable parts of the internal and external building and landscaping elements: a. Protection from the effects of high pedestrian traffic in main entrances, public areas and thoroughfares (corridors, lifts, stairs, doors etc.). b. Protection against any internal vehicular/trolley movement within 1m of the internal building fabric in storage, delivery, corridor and kitchen areas. c. Protection against, or prevention from, any potential vehicular collision where vehicular parking and manoeuvring occurs within 1m of the external building façade for all car parking areas and within 2m for all delivery areas. **2) Exposed elements:** The relevant building elements incorporate appropriate design and specification measures to limit material degradation due to environmental factors. Provide a specification and/or material pallet confirming how each of the items below is addressed.	Credit targeted.

									Applicable Building Elements a. Foundation/substructure/lowest floor/retaining walls b. External walls Roof/balconies c. Glazing: windows, skylight d. External doors e. Railings/balusters (where exposed to external environment) f. Cladding (where exposed to external environment) g. Staircase/ramps (where exposed to external environment) h. Hard landscaping **Material Degradation Effects** a. Corrosion, b. Dimensional change, e.g. swelling or shrinkage, c. Fading/discolouration, d. Rotting, e. Leaching, f. Blistering, g. Melting, h. Salt crystallisation, i. Abrasion	
Mat 06 Material efficiency										
MAT 06	Material efficiency	1	1	0	0	0	WEE / MO / Rambol l / AR	AR	1) Provide details of all materials efficiency strategies undertaken on the project. 2) Provide reports, drawings, building integrated models, calculations required (as appropriate) at each stage to demonstrate ideas discussed, analysis done and decisions taken at : - RIBA Stage 1/ Preparation and Brief - RIBA Stage 2/ Concept Design - RIBA Stage 3/ Developed Design - RIBA Stage 4/ Technical Design - RIBA Stage 5/ Construction Provide details of specific workshops (such as WRAP designing out waste workshop) or discussions with - Client/developer - Cost consultant - Architect - Structural/civil engineers - Building services engineers - mechanical, electrical - Principal contractor - Demolition/strip-out contractor - Environmental consultant - Project management consultant - Materials/component manufacturers/suppliers Provide evidence that process for material efficiency in BS 8895 Designing for material efficiency in buildings projects - Part 1: Code of practice for Strategic Definition and Preparation and Brief has been implemented.	To achieve this credit, the team should provide evidence of material efficiency strategy at each stage of the project. Evidence could be reports, minutes, sketch, drawings, models and calculations, at each stage (RIBA Stage 1 to 6) to demonstrate ideas discussed, analysis done and decisions taken in a view of optimising the use of materials. The team has confirmed that this credit should be targeted. It is recommended the team review BS8895.
WASTE		**Credit weight =**	**1.06%**							
Wst 01 Construction waste management:										
WST 01 - Credit 1	Construction resource efficiency	3	2	0	0	1	CCL	AR	1-2) Provide a copy of a BREEAM compliant Resource Management Plan (RMP) or a commitment letter with all targets and the RMP contents included.The RMP must contain the following waste minimisation target and details of waste minimisation actions: - Set and report against waste reduction targets. The target set is currently 7.5m^3 / 100m^2 of floor area. - Design for standardisation of components	2 credits targeted. Criteria to be included into the contractor's requirements.

									- Avoid waste from excavation/groundworks and consider opportunities for zero cut and fill- Return packaging for reuse - Consider community reuse of surplus/off-cuts - Include waste minimisation initiatives and targets in tenders/contracts and engage with the supply chain - Consider use of BIM (Building Information Modelling) - Design for off-site/modular build- Design for flexibility, adaptability and future deconstruction - Design to use fewer materials- Use of reusable temporary elements such as shuttering and protection. -Procedures for estimating, monitoring, measuring and reporting hazardous and non-hazardous site waste. If waste data is obtained from licensed external waste contractors, the data needs to be reliable and verifiable, e.g. by using data from EA/SEPA/EA Wales/NIEA Waste Return Forms. 3) Provide a copy of the BREEAM compliant Pre demolition audit (if demolition has been undertaken by the developer). This must cover; a. Identification of the key refurbishment/demolition materials. b. Potential applications and any related issues for the reuse and recycling of the key refurbishment and demolition materials in accordance with the waste hierarchy.	
WST 01 - Credit 2	Diversion of resources from landfill	1	1	0	0	0	CCL		4) Provide confirmation in the RMP that 80% (by volume) of demolition waste and 70% (by volume) of non-demolition waste diverted from landfill. Includes on site and off site manufacture/fabrication in a dedicated facility.	Credit targeted. Criteria to be included in the Principal Contractor's requirements.
WST 01 - EXE credit	Exemplary Performance for Construction Waste Management	**1**	**0**	**0**	**0**	**1**	-		5-8) Non-hazardous construction waste generated by the building is no greater than the exemplary level resource efficiency benchmark. The % of non-hazardous construction waste diverted from landfill is no greater than the exemplary level resource efficiency benchmark in tables 51 and 52 of the manual. All waste groups are identified for diversion.	Criteria not considered achievable.
Wst 02 Recycled aggregates:										
WST 02	Recycled aggregates	1	0	0	1	0	Ramboll	CCL	1) Provide the percentage of recycled aggregate to contribute to the total use by complying with the minimum levels of high grade aggregate specified - Structural Frame - 15% -Bitumen/hydraulically bound base, binder and surface courses for paved areas and roads - 30% -Building Foundations - 20% -Concrete Road Surfaces - 15% -Pipe bedding – 100% -Granular fill and capping – 100% 2) Provide the total recycled/secondary aggregate which must be ≥ 25% of total high grade aggregate specified. This should form part of the Principal Contractors specification. 3) The recycled or secondary aggregates are EITHER: a. Construction, demolition and excavation waste obtained on-site or off-site; OR b. Secondary aggregates obtained from a non-construction post-consumer industrial by product source (see Relevant definitions section).	**Meeting 08.02.2017:** Ramboll, G&T and Contractor to investigate this credit.
WST 02 - EXE Credit	Exemplary Performance for Recycled Aggregates	**1**	**0**	**0**	**0**	**1**	-	CCL	4-5) The % of the high grade aggregate that is recycled or secondary must meet the exemplary minimum levels. Provide the total recycled/secondary aggregate which must be ≥ 35% of total high grade aggregate specified. This should form part of the Principal Contractors specification. 6) The contributing recycled or secondary aggregate must not be transported more than 30 km by road transport.	Criteria not considered achievable.

Wst 03 Operational waste										
WST 03	Operational waste	1	1	0	0	0	WEE / MO	AR	1) Provide marked up drawings (highlighting the m2 and labelling for recyclable waste) clearly showing the dedicated space for segregation and operation of recyclable waste streams. The design team demonstrates that the provision of waste management facilities for the assessed building is adequate given the building type, occupier (if known), operational function and likely waste streams and volumes to be generated. Where it is not possible to determine what provision should be made, the following guide for minimum storage space provision should be used: a. At least 2m^2 per 1000m^2 of net floor area for building <5000m^2; b. A minimum of 10m^2 for buildings >5000m^2; c. An additional 2m^2 per 1000m^2 of net floor area where catering is provided (with an additional minimum of 10m^2 for buildings >5000m^2). 2) Where the consistent generation in volume of the appropriate operational waste streams is likely to exist Provide drawings showing; a. Static waste compactor(s) or baler(s); situated in a service area or dedicated waste management space. b. Vessel(s) for composting suitable organic waste resulting from the building's daily operation and use; OR adequate space(s) for storing segregated food waste and compostable organic material prior to collection and delivery to an alternative composting facility. c. Where organic waste is to be stored/composted on-site, a water outlet is provided adjacent to or within the facility for cleaning and hygiene purposes. Note: If the end- occupier is not known but the function/area of the assessed building suggests that large amount of packaging/ compostable waste is likely to be generated, then appropriately sized space and services/infrastructure to accommodate relevant facilities must be provided. Facilities themselves do not need to be installed for a Shell & Core Assessment.	Credit targeted. To be include into the design.
Wst 04 Speculative floor and ceiling finishes										
WST 04	Speculative Floor and Ceiling Finishes	1	0	1	0	0	WEE / MO	AR	1) If the future occupier of the building is unknown provide design drawings and/or relevant specification or contract clauses confirming carpets and other floor and ceiling finishes have been installed in a show area only (no more than 25% of the buildings net lettable floor area). OR 2) If the future building occupier is known, provide confirmation (formal letter) the occupier has selected or agreed to the specified floor and ceiling finishes.	Ceiling and floor finishes should not be installed in more than 25% of the tenanted floor areas. Credit targeted.
Wst 05 Adaptation to climate change:										
WST 05	Adaptation to climate change - Structural and fabric resilience	1	1	0	0	0	HM Sus	AR	1) Provide a copy of the Conduct a climate change adaptation strategy appraisal for structural and fabric resilience by the end of Concept Design (RIBA Stage 2). The assessment must cover:-Hazard identification-Hazard assessment -Risk estimation -Risk evaluation -Risk management.Provide specifications / drawings to demonstrate how any identified risks have been mitigated as far as practically feasible.	The appraisal has been carried out by Hilson Moran Sustainability team.
WST 05 - EXE Credit	Responding to adaptation to climate change	**1**	1	0	0	0	HM Sus	AR	Provide evidence the following credits/criteria will be achieved Responding to adaptation to Climate Change: Hea 04 – Thermal Comfort (linked to Wst 05 issue: - preventing increasing risks of overheating). Criterion 6 in the second credit of the Hea 04 issue has been achieved	**Credit targeted.**

									Ene 01 Reduction of energy use and carbon emissions (linked to Wst 05 issue: to maximise energy efficiency contributing to low carbon emissions resulting from increasing energy demands. At least 8 credits in this issue have been achieved. Ene 04 Low carbon design (link to Wst 05 issue: to maximise opportunities to avoid unnecessary carbon emissions. The passive design analysis credit in this issue has been achieved. Wat 01 Water consumption (link to Wst 05: to minimise water demands in periods of drought). A minimum of 3 credit in this issue have been achieved Mat 05 Designing for durability and resilience (link to Wst 05 issue: to minimise the risks of deterioration and higher maintenance demands) Criterion 2 relating to material degradation in this issue has been achieved. Pol 03 Surface water run-off (link to Wst 05 to minimise the risks of increased flood risk and surface water run-off affecting the site or others). Flood risk – a minimum of one credit has been achieved. Surface water run-off - two credits have been achieved	
Wst 06 Functional adaptability:										
WST 06	Functional adaptability	1	1	0	0	0	WEE / MO / HM MEP	M&E Engineer	1) Provide a copy of the building specific functional adaptation strategy by Concept Design/RIBA Stage 2 with recommendations for measures. This should consider: a. The potential for major refurbishment, including replacing the façade. b. Design aspects that facilitate the replacement of all major plant within the life of the building e.g. panels in floors/walls that can be removed without affecting the structure, providing lifting beams and hoists. c. The degree of adaptability of the internal environment to accommodate changes in working practices. d. The degree of adaptability of the internal physical space and external shell to accommodate change in-use. e. The extent of accessibility to local services, such as local power, data infrastructure etc. 2) Provide marked up drawings and specification showing how the functional adaptation measures have been adopted in the design by Technical Design/Stage 4: a. The feasibility for multiple/alternative building uses and area functions e.g. related to structural design of the building b. Options for multiple building uses and area functions based on design details e.g. modularity c. Routes and methods for major plant replacement e.g. networks and connections have flexibility and capacity for expansion d. Accessibility for local plant and service distribution routes e.g. detailed information on building conduits and connections infrastructure e. The potential for the building to be extended, horizontally and/or vertically.	Credit targeted.

LAND USE AND ECOLOGY		credit weight = 1.10%								
LE 01 Site selection:										
LE 01 - Credit 1	Previously occupied land	1	1	0	0	0	WEE / MO		1) Provide marked up design drawings (including existing site plan), report or site photographs confirming the type and duration of previous land use. Drawings must include -Area (m2) of previous land use. -Proposed site plan showing location and footprint (m2) of proposed development and temporary works. It must be confirmed that 75% of the proposed development's footprint is on land which has previously been occupied by industrial, commercial or domestic buildings or fixed surface infrastructure.	Credit targeted, based on Building S2 evidence.
LE 01 - Credit 2	Contaminated land	1	0	0	0	1	Rambol l		2) Provide a copy of the specialist's contaminated land report and drawings showing the location of contamination and the areas to be remediated in relation to the proposed development. The specialists report should be based on site investigation, risk assessment and appraisal which confirms: -The degree of contamination; -The contaminant sources/types; -The options for remediating sources of pollution which present an unacceptable risk to the site. 3) Provide formal written confirmation from the client or Principal Contractor that remediation of the site will be carried out in accordance with the remediation strategy and its implementation plan. Note: Asbestos can only be considered as a contaminant if it is found within the ground.	Land is not contaminated to a level where it requires remediation measures.
LE 02 Ecological value of site and protection of ecological features:										
LE 02 - Credit 1	Ecological value of site	1	1	0	0	0	HM Sus	CCL	Provide a completed and signed copy of the BREEAM checklist for defining land of low ecological value (table 55 of the BREEAM 2014 manual) Or Provide a Suitably Qualified Ecologist's (SQE) report confirming land within the construction zone is defined as 'land of low ecological value'.	Credit targeted. A Suitably Qualified Ecologist has carried out a site survey and has concluded that the site is of low ecological value.
LE 02 - Credit 2	Protection of ecological features	1	1	0	0	0	HM Sus	CCL	Provide confirmation (e.g. marked up drawings) the, the principal contractor has installed the ecological protection recommended by the SQE, prior to any preliminary site construction or preparation works (e.g. clearing of the site or erection of temporary site facilities). All existing features of ecological value within and surrounding the construction zone and site boundary area must be adequately protected from damage during clearance, site preparation and construction activities in line with BS42020: 2013 In all cases, the principal contractor is required to construct ecological protection recommended by the SQE, prior to any preliminary site construction or preparation works (e.g. clearing of the site or erection of temporary site facilities).	
LE 03 Minimising impact on existing site ecology:										
LE 03 - Credit 1	Change in ecological value 1	1	1	0	0	0	HM Sus	CCL	1) Provide scaled existing and proposed site plans confirming landscape and vegetation plot types, area (m2) of vegetation plot types.	A Suitably Qualified Ecologist has undertaken an assessment and has

									OR Provide a copy of the Suitably qualified Ecologist's report (signed and dated) including all information detailed in Appendix F and calculations of the change in ecological value before and after development using these figures to determine the number of credits achieved. The report could use BREEAM-UK-NC-2014-Guidance-Note-GN13-Relating-ecologists-reports-to-BREEAM-Nov-2014 1 credit is achieved where there is a minimal effect on the ecological value of the site i.e. less than 0 but greater than -9 species.	concluded that the anticipated landscape planting across terrace areas will ensure no net loss of biodiversity overall as a result of the development. Consequently, the project is expected to achieve full credits (2) within BREEAM LE03.
LE 03 - Credit 2	Change in ecological value 2	1	1	0	0	0	HM Sus / Urban	CCL	Evidence as above 2) 2nd credit is achieved where there is a minimal effect on the ecological value of the site i.e. equal to or greater than 0.	
LE 04 Enhancing site ecology:										
LE 04 - Credit 1	Ecologist's report and recommendations	1	1	0	0	0	HM Sus	CCL	1) Provide confirmation of the Suitably Qualified Ecologist's (SQE) appointment at RIBA stage 1. 2-3) Provide a copy of the SQE report (no later than RIBA stage 2) based on a site survey and calculations highlighting all of the information required by BREEAM. This must be include the change in ecological value from before and after development using these figures to determine the number of credits achieved. The report could use BREEAM-UK-NC-2014-Guidance-Note-GN13-Relating-ecologists-reports-to-BREEAM-Nov-2014 Provide scaled existing and proposed site plans confirming landscape and vegetation plot types, area (m2) of vegetation plot types. Provide formal written confirmation that the general recommendations put forward in the ecology report for enhancement and protection of site ecology have been, or will be, implemented.	A Suitably Qualified Ecologist has undertaken an assessment and provided recommendations. If the recommendations are incorporated and depending on the final landscaping proposals for the development, it is anticipated that the project could achieve full credits (2) within BREEAM LE04. RIBA Stage 3 design results in 2 credits achieved, to be monitored closely.
LE 04 - Credit 2	Increase in ecological value	1	0	1	0	0	HM Sus	CCL	4) The first credit is achieved 5-6)Provide confirmation from the SQE the implementation of all recommendations will result in an increase of six plant species or greater	
LE05 Long term impact on biodiversity:										
LE 05 - Pre-requisite	SQE appointment and management plan	-	Yes				HM Sus	CCL	1) Provide confirmation (formal appointment letter) that the Suitably Qualified Ecologist (SQE) is appointed prior to commencement of activities on-site and they confirm that all relevant UK and EU legislation relating to the protection and enhancement of ecology has been complied with during the design and construction process. 2) Provide a copy of the landscape and habitat management plan, appropriate to the site, is produced covering at least the first five years after project completion in accordance with BS 42020:2013 Section 11.1. 3) Provide confirmation of the additional measures to improve the assessed site's long term biodiversity are adopted (see table 58 of the Manual)	Credit targeted, based on Building S2 evidence. Subject to appointment. Landscape and habitat management to be produced.
LE 05	Long term impact on biodiversity - 2 additional measures	1	1	0	0	0	HM Sus		Up to 2 additional measures have been included, credits detailed in Table 58 of the Manual	Credit targeted. Criteria to be included into contractor's requirements.
LE 05	Long term impact on biodiversity - 4 additional measures	1	1	0	0	0	CCL	HM Sus	Up to 4 additional measures have been included, credits detailed in Table 58 of the Manual.	

POLLUTION

credit weight = 0.85%

Pol 01 Impact of refrigerants

POL 01	Impact of refrigerants	3	1	0	1	1	AR		2) Provide a specification clause confirming all systems (with electric compressors) comply with the requirements of BS EN 378:2008 (parts 2 and 3) and where refrigeration systems containing ammonia are installed, confirm they comply with the Institute of Refrigeration Ammonia Refrigeration Systems Code of Practice. 3-5) Provide a specification clause confirming the details of the refrigeration systems to be installed. Information must contain: a. Refrigerant type b. Global Warming Potential (GWP) of the specified system refrigerant(s); c. Total refrigerant charge (kg); d. Cooling capacity of the systems(s) (kW); e. Sectoral release factors: • Annual refrigerant leakage rate (% of refrigerant charge); • Annual purge release factor (% of refrigerant charge); • Annual service release factor for catastrophic system failure (%); • Recovery efficiency (% of refrigerant charge). One is available where credit where systems using refrigerants have Direct Effect Life Cycle CO_2 equivalent emissions (DELC CO_2e) of ≤ 1000 $kgCO_2e/kW$ cooling/heating capacity. Two credits are available for a (DELC CO_2e) of ≤ 100 $kgCO_2e/kW$ cooling/heating capacity 6) Provide a specification confirming systems using refrigerants have a permanent automated refrigerant leak detection system installed; OR an inbuilt automated diagnostic procedure for detecting leakage is installed. In all instances a robust and tested refrigerant leak detection system must be installed and must be capable of continuously monitoring for leaks. 7) The system must be capable of automatically isolating and containing the remaining refrigerant(s) charge in response to a leak detection incident.	The district cooling information provided at RIBA Stage 3 demonstrates that 1 credit can be achieved.

Pol 02 NOx emissions										
POL 02	NOx Emissions	3	2	0	0	1	AR		1) Provide a specification clauses from the building specification or contract confirming the NOx emissions of the boilers specified Provide the manufacturers' product information to confirm the NOx emissions. Credits are awarded for dry NOx emissions at 0% O2 for space and water heating as follows: **NOx emissions Credits achieved** **100 mg/kWh (space heating, hot water & cooling) 1** **70 mg/kWh (space heating, hot water & cooling) 2** **40 mg/kWh (space heating, hot water & cooling) 3** Note: Heat pumps powered by grid electricity are likely to indirectly produce emission rates higher than those required by BREEAM and are therefore typically unable to achieve credits under this issue. District heating systems that incinerate waste usually have NOx emission rates higher than the levels set to achieve any BREEAM credits. Biomass systems are recognised as reducing the impact of fossil fuel depletion, by employing a renewable fuel source (provided it is sustainably sourced). However, biomass can produce a significant amount of NOx and so may not achieve this credit. Note: Although not assessed BRE also require the reporting of NOx emissions from cooling.	Two credits were achieved for Building S2 on the basis that the heating district were CHP and gas boilers. The heating district system is now anticipated to integrate hydrogen fuel cells, although this is not confirmed within the Utility Designer Guide and has been queried by HM. Two credits are targeted and 1 credit are targeted. Argent to provide details of the hydrogen fuel cells.
Pol 03 Surface water runoff:										
POL 03 - Credit 1	Flood risk	2	2	0	0	0	PBA		1-3) Provide a site specific Flood Risk Assessment to determine the flood zone of the site and detail the flood risk from: -Fluvial; -Tidal; -Surface water: Sheet run-off from adjacent land (urban and rural); -Groundwater: Most common in low-lying areas underlain by permeable rock (aquifers); -Sewers: Combined, foul or surface water sewers; -Reservoirs, canals and other artificial sources. The site specific Floor Risk Assessment confirms the site as having a low annual probability of flooding. If the site is defined as having a medium or high annual probability of flooding and is not in a functional floodplain (in accordance with current best practice national planning guidance) to increase the resilience and resistance of the development to flooding, one of the following must be achieved: a. The ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600mm above the design flood level of the flood zone in which the assessed development is located; OR b. The final design of the building and the wider site reflects the recommendations made by an appropriate consultant in accordance with the hierarchy approach outlined in section 5 of BS 8533:2011	FRA provided by PBA. Climate allowance to be confirmed.

POL 03 - Credit 2	Surface water run off	1	1	0	0	0	PBA		4) Provide a statement from the appropriate consultant confirming that they are qualified in line with the following definition A consultant with qualifications and experience relevant to designing SUDS and flood prevention measures and completing peak rate of run-off calculations, Where complex flooding calculations and prevention measures are required, this must be a specialist hydrological engineer. 5-7) Provide drawings, report and calculations confirming that the specified drainage measures to ensure that the peak rate of run-off from the site to the watercourses (natural or municipal) is no greater for the developed site than it was for the pre-development site. This should comply with the 1 year and 100 year return period events. The report must contain all information necessary to demonstrate compliance including. -Type and storage volume (l) of the drainage measures; -Total area of hard surfaces (m2); -Peak/Volume flow rates (l/s) pre and post development for the return period events; -Additional allowance for climate change designed in to the system. The calculations must include an allowance for climate change; this should be made in accordance with current best practice planning guidance. Note: If there is no change in impermeable area post development, the peak and volume rate of run-off requirements for the surface water run-off credits will be met by default. Flow rate calculations will not need to be provided. Instead, drawings clearly showing the impermeable areas of the site draining to the watercourse should be provided for the pre- and post-development scenarios. Figures must also be given (ideally on the drawings) to show a comparison between the areas of drained impermeable surfaces pre- and post-development	FRA provided by PBA. Climate allowance to be confirmed.
POL 03 - Credit 3	Prevention of flooding	1	1	0	0	0	PBA		8) Provide written confirmation (from the appropriate consultant) that flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance); **And** 9-14) Provide confirmation there is no change in impermeable area. Flow rate calculations will not need to be provided. Instead, drawings clearly showing the impermeable areas of the site draining to the watercourse should be provided for the pre- and post-development scenarios. Figures must also be given (ideally on the drawings) to show a comparison between the areas of drained impermeable surfaces pre- and post-development. **Or** 8) Provide written confirmation (from the appropriate consultant) that flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance); **AND** 9) Provide a drainage design report or specification confirming the drainage design measures are specified to ensure that the post development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development for the 100-year 6-hour event, including an allowance for climate change. 10) Provide a drainage design report or specification confirming any additional predicted volume of run-off for this event is prevented from leaving the site by using infiltration or other Sustainable Drainage System (SuDS) techniques. **Or if 9 and 10 are not possible** 8) Provide written confirmation (from the appropriate consultant) that flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance); **AND** 11) Provide Justification from the Appropriate Consultant indicating why the above criteria cannot be achieved, i.e. where infiltration or other SuDS techniques are not technically viable options. 12) Provide calculations confirming the design measures are in place to reduce the limiting discharge,	FRA provided by PBA. Climate allowance to be confirmed.

									which is defined as the highest flow rate from the following options a. The pre development 1 year peak flow rate; OR b. The mean annual flow rate Qbar; OR c. 2l/s/ha. Note: For the 1 year peak flow rate, the 1 year return period event criterion applies (as described in the peak run-off criteria above). 13) Provide confirmation and copies of maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS are in place. 14) The calculation must account for an allowance for climate change, this should be made in accordance with current best practice planning guidance.	
POL 03 - Credit 4	Minimising watercourse pollution	1	0	0	0	1	-		Provide specification clauses, drainage plans and calculations to demonstrate: 15) There is no discharge from the developed site for rainfall up to 5mm (confirmed by the Appropriate Consultant). 16) In areas with a low risk source of watercourse pollution, an appropriate level of pollution prevention treatment is provided, using appropriate SuDS techniques. 17) Where there is a high risk of contamination or spillage of substances such as petrol and oil (see Compliance notes for a list of areas), separators (or an equivalent system) are installed in surface water drainage systems. 18) Where the building has chemical/liquid gas storage areas, a means of containment is fitted to the site drainage system (i.e. shut-off valves) to prevent the escape of chemicals to natural watercourses (in the event of a spillage or bunding failure). 19)All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as Pollution Prevention Guideline 3 (PPG 3) and/or where applicable the SuDS manual. For areas where vehicle washing will be taking place, pollution prevention systems must be in accordance with Pollution Prevention Guidelines 13 20) A comprehensive and up to date drainage plan of the site will be made available for the building/site occupiers. 21) Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS must be in place. 22) Where present, all external storage and delivery areas designed and detailed in accordance with the current best practice planning guidance (	To achieve this credit, there should be no discharge from the developed site for rainfall up to 5mm. This is generally unachievable in London.
Pol 04 Reduction of night time light pollution										
POL 04	Reduction of night time light pollution	1	1	0	0	0	HM MEP		Provide specification clauses and drawings confirming the external lighting (and timers) meet the following requirements: 2-3) The external lighting strategy has been designed in compliance with Table 1 (and its accompanying notes) of the ILP Guidance notes for the reduction of obtrusive light, 2011. This can be demonstrated via completion of the checklists in Annexes B and C of the guidance note by a relevant member of the design team. 4) All external lighting (except for safety and security lighting) can be automatically switched off between 2300hrs and 0700hrs. This can be achieved by providing a timer for all external lighting set to the appropriate hours. 5) If safety or security lighting is provided and will be used between 2300hrs and 0700hrs, this part of the lighting system must comply with the lower levels of lighting recommended during these hours in Table 2 of the ILP's Guidance notes, for example by using an automatic switch to reduce the lighting levels at 2300 or earlier.	Credit targeted. Criteria to be included in the Electrical specifications.

									6) Where specified, illuminated advertisements, must be designed in accordance with PLG 05 The Brightness of Illuminated Advertisements 2015 Note: The ILP Guidance notes for the Reduction of Obtrusive Light, 2011 are available free of charge from the ILE website www.ilp.org.uk.	
Pol 05 Reduction of noise pollution:										
POL 05	Noise attenuation	1	1	0	0	0	Rambol l	CCL	1-5) Provide confirmation of the Suitably Qualified Acousticians accreditation details (i.e. a consultant holding a recognised acoustic qualification and membership of an appropriate professional body) Provide a copy of the SQA's noise impact assessment in compliance with BS 7445, with the following noise levels measured/determined: i. Existing background noise levels must be at the nearest or most exposed noise-sensitive development to the proposed development or at a location where background conditions can be argued to be similar. ii. The rating noise level resulting from the new noise-source . The noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (0700hrs to 2300hrs) and +3dB at night (2300hrs to 0700hrs) compared to the background noise level. Where the noise source(s) from the proposed site/building is greater than the levels described above, provide written confirmation that appropriate measures will be installed to attenuate the noise at its source to a level where it will comply with the noise levels listed above. Provide drawings showing the noise sensitive buildings within 800m radius of the assessed building. Drawings must include scale and distance from the nearest noise sensitive buildings to the assessed building in metres. Note: Post completion testing and a report or calculations based on as built information confirming compliance with the above standards will be required based on the installed and operational plant	Credit targeted. Sandy Brown appointed as the Suitably Qualified Acousticians.
AI Approved Innovation		**credit weight =**	**1.00%**							
AI	**Approved Innovation**	**1**	0	0	1	0	HM Sus		One innovation credit can be awarded for each innovation approved by BRE Global, where the building complies with the criteria defined within an Approved Innovation application form	Innovation opportunities to be reviewed (District cooling).

APPENDIX I – GENERAL BREEAM GUIDANCE

BREEAM aims to assess many aspects of a project, from the initial decisions taken by clients and architects, through the detail of engineering design, to the policies and agreements reached by prospective tenants and building owners.

Minimum standards have been set for various credits that must be achieved if certain rating levels are to be achieved. Significant minimum standards need to be met to achieve an 'Outstanding' rating. These will be identified throughout the report and will be shown in bold red text. Formal certification cannot be achieved until this assessment is completed and submitted to BREEAM for approval.

BREEAM 2014 allows additional credits outside of the core BREEAM credits to be achieved by demonstrating innovation within the building. This may be by exceeding a current credit requirement, or by developing a new credit and demonstrating that the innovation proposed by the design team will make a positive contribution to one of 20 criteria determined by BREEAM. Innovation credits that are available for exceeding the standard credit requirements will be described in bold blue text.

The BREEAM assessment is carried out by awarding credits for environmental improvement on each of the issues. Each credit awarded must be supported by full evidence in the form of details documented in the design drawings and specification. There are now additional Innovation Credits available as recognition for buildings that either meet exemplary performance standards for an existing BREEAM credit or for a particular building feature, system or process that is exemplary. This is determined by the BRE on a case by case basis. An additional 1% can be awarded for each innovation credit achieved, up to a maximum of 10%.

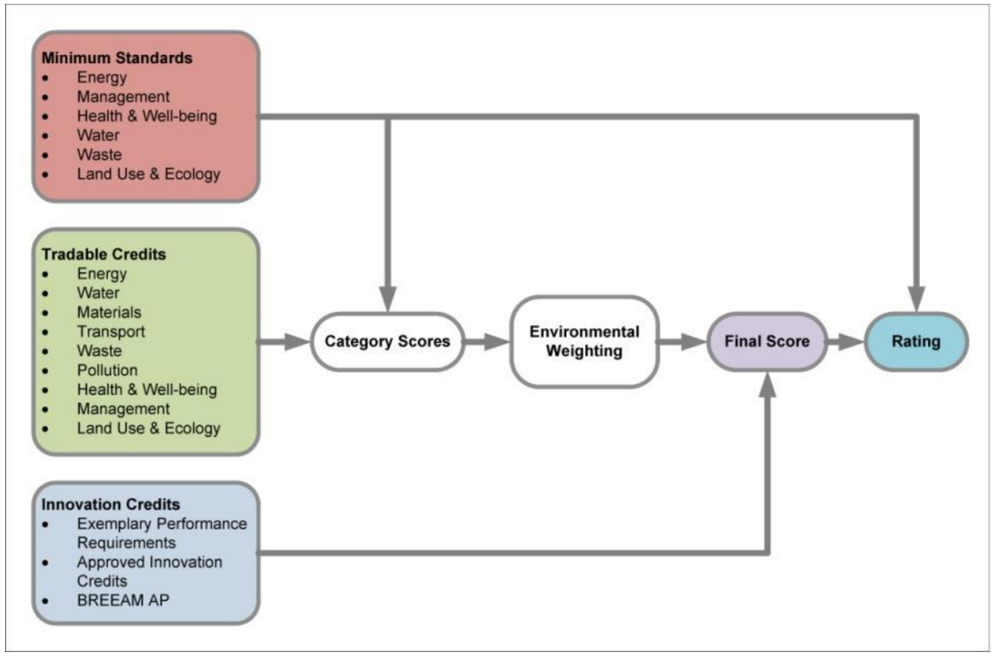
On submission and successful QA of the Design Stage Assessment, an interim BREEAM rating is awarded to the development. The development is then assessed again at Post Construction stage upon successful submissions and QA of this report, the final BREEAM rating is awarded by the BRE.

Hilson Moran can make no warranty in respect of BREEAM predictions, as all credits are dependent on supporting evidence being provided to the BREEAM assessor at the time of the formal BREEAM assessment. Until a formal BREEAM assessment takes place, with supporting evidence provided to a certified BREEAM Assessor and the BRE complete their quality assurance process, no building can claim to hold a BREEAM rating.

BREEAM Assessment Process

The BREEAM assessment process awards a number of credits depending upon whether or not sufficient evidence can be provided to demonstrate that the BREEAM requirements have been fulfilled. One of the strengths of the BREEAM Assessment process is that it examines the performance of a development over a wide range of issues (Figure 2.1). These issues are weighted according to their perceived importance, with the credits in some sections being more valuable than others. In order to standardise the BREEAM Assessment process there are a number of issues that are common to all building types. Within these common credits there are a number of mandatory minimum performance requirements that all building types need to achieve in order to secure a particular rating. Please refer to Table 3.2 for details of the minimum performance standards for the BREEAM New Construction 2014 scheme. The remaining credits are tradable and give the design team the flexibility to choose which credits to target in order to achieve a particular rating. The requirements of individual credits vary considerably, both between credits and between schemes.

Figure 2.1 – BREEAM Scoring Process



The BREEAM Assessment process is split into three main stages; Pre-Assessment, Design Stage Assessment and Post Construction Review. The Pre-Assessment stage allows the design team to ascertain the likely BREEAM score and rating a development can achieve and to provide a strategy for the credits to be targeted and to support the later stages of the assessment process. The Design Stage Assessment builds on the Pre-Assessment strategy and is undertaken just before tender and or work begins on site. At this stage the design should be sufficiently detailed to demonstrate that all of the targeted credit requirements have been fulfilled. Following completion of the design stage the assessment can be submitted to the BRE for interim certification.

The Post Construction Review is intended to verify that the commitments made at the design stage have been implemented. The performance of the development in the post construction review will dictate the final score and rating the building achieves. At all times throughout the assessment process the assessor is reliant upon receiving accurate and comprehensive evidence from the design team in a timely manner. When preparing evidence the design team should bear in mind that the QA personnel at the BRE are not necessarily technically minded and have no knowledge of the project. The evidence provided by the design team should clearly show (through annotation, sketches, calculations etc.) to a non-technical individual that the credit requirements have been met. Where necessary any confirmation statements should quote relevant credit criteria to demonstrate that the requirements have been met.

BREEAM THRESHOLDS

BREEAM ratings range between 'Pass' and 'Outstanding'. The rating achieved is dependent on the percentage score achieved and achieving the required minimum standards appropriate to each rating level. Percentage thresholds and minimum standards (number of credits to be achieved within the specified minimum standard credits) are given below:

Table 3.1: BREEAM 2014 New Construction Ratings

BREEAM Rating	% Score	BREEAM Rating	% Score
Unclassified	<30	Very Good	≥55
Pass	≥30	Excellent	≥70
Good	≥45	Outstanding	≥85

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