Environmental Sustainability Report

Gas Holder Triplets

King's Cross Central General Partner Ltd

October 2014

King's Cross

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Audit Sheet

Rev.	Description	Prepared and checked by	Reviewed by	Date
A - DRAFT	First draft for team review – EXEC SUMMARY ONLY	R. Murray	J. Godefroy	04.07.2014
B	Revised DRAFT to incorporate comments from NLP on Exec Summary + first full draft	J. Godefroy	-	05.08.2014
C	Revised DRAFT: • Comments from NLP, Argent, Arup (waste), PBA (drainage), Carillion, (construction waste), Dan Pearson (landscaping); • Updated energy calculations to take account of revised floor layouts • Revised approach to future energy centre with biomass, in line with approach in submission for Fish and Coal	R. Murray	J. Godefroy	20.08.2014
D	Revised DRAFT: - Comments from NLP, Carillion, and Townshend - New scheme description and figures to match UDR v5 - Updated daylight report.	J. Godefroy	-	05.09.2014
E	Revised Exec Summary only, to incorporate Argent's comments	J. Godefroy	-	25.09.2014
F	Revised with comments from Argent, incl. agreement on overall 45% improvement on Part L 2010 – **Exec Summary only**	J. Godefroy	-	26.09.2014
G	Final issue: • Previous agreed changes to the exec summary applied throughout the report; • Modified wording of BREEAM target, as requested by Argent • Updated images from UDR Final Draft (dated 22nd Sept 2014)	J. Godefroy	-	29.09.2014
H	Revised with comments from NLP and Argent	J. Godefroy	-	01.10.2014

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Contents

1.0 Executive Summary

This Environmental Sustainability Plan (ESP) has been prepared to describe the contribution that the Gas Holder Triplets development will make to delivering sustainable development on the King's Cross Central site. Specifically this document details how the project team has responded to the relevant planning conditions of the King's Cross Central Outline Planning Permission (ref. 2004/2307/P) dated 22 December 2006, namely Conditions 17 and 45, and the associated Section 106 Agreement obligations relating to sustainability.

The Gas Holder Triplets will provide an 8-12-storey residential-led scheme over 3 buildings comprising of residential accommodation located above some commercial floorspace and residential amenity facilities. Car and cycle parking and back of house functions are provided at basement level. The new buildings will be located within the re-erected circular Grade II listed linked guide frames. The scheme also incorporates substantial ground level landscaping to the south and south west up to the Regent's Canal, referred to as Gas Holder Gardens.

The scheme is committed to delivering a genuinely sustainable development in the context of the original King's Cross Central masterplan and the Outline Planning Permission. In particular, a combination of passive design features and highly efficient building services is being proposed, in addition to connection to the King's Cross district heating network incorporating Combined Heat and Power (CHP) and to the future district cooling network.

The proposals have been developed within the parameters of the Outline Planning Permission, including the conservation and refurbishment of the listed Gas Holder guide frames. These have to a large part dictated the shape of the buildings and their construction methodology, and the buildings' high environmental performance has been achieved within these constraints, incorporating a best practice thermal envelope and maximising views within the given building's shape and layout.

In the residences, these measures are expected to deliver an area-weighted average carbon saving of 2% on Part L1A 2010 Building Regulations prior to taking into account Combined Heat and Power (CHP) or other low carbon technology, and an average 45% carbon saving against Part L1A 2010 with the inclusion of savings from the district heating scheme, including CHP.

The residences will be assessed under the Code for Sustainable Homes 2010 (the Code). Code Level 3 is generally considered to be more challenging than an EcoHomes 'Very Good' rating targeted under the Section 106 Agreement. A preliminary assessment has been carried out and is included in this report, which shows that the residences are expected to achieve and exceed this target, with a predicted Code for Sustainable Homes Level 4 rating.

The commercial units will achieve a BREEAM Retail rating of 'Very Good', subject to the tenant fit-out. Furthermore there is an aspiration to achieve an 'Excellent' rating where possible. A pre-assessment has been carried out which is included in this report.

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

Condition 17(a) Energy Efficiency Measures

The approach to reducing energy consumption and carbon emissions has followed the energy hierarchy, from passive design, energy efficiency, and incorporation of low-carbon district energy, which will result in significant regulated CO_2 emissions reductions relative to Building Regulations Part L 2010 compliance levels.

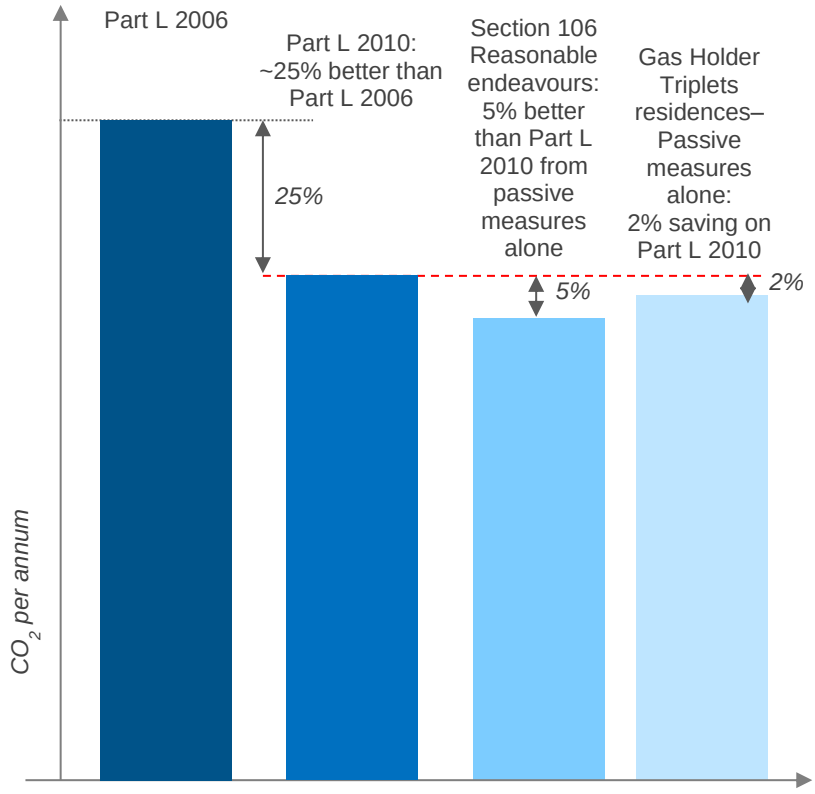
- The scheme utilises the building fabric to deliver low-energy buildings: passive design measures include recessed balconies to the South to protect dwellings from summer solar gains and protruding balconies to the North to optimise daylight and views, movable external shading for control of solar gains and privacy, and optimised proportions of glazed and opaque areas to allow beneficial winter solar gains, avoid excessive summer solar gains, and maximise daylight levels.
- High envelope performance will be achieved through the use of high specification glazing, high levels of insulation, and very good airtightness levels, all of which reflect best practice whilst addressing the construction methodology constraints imposed by building within the listed guide frames.
- The central atria in each building will benefit from a tempered environment (without actual mechanical heating or cooling), allowing reduced winter heat losses from the apartments compared to those that would occur adjacent to an external space.
- The residential apartments will be provided with an efficient whole house ventilation system with heat recovery and summer bypass, ensuring efficient and adequate ventilation levels. All apartments will also benefit from openable windows for additional occupant control over the internal environment.
- All areas, including the dwellings, residential amenity facilities, and commercial areas, will be served by the district heating scheme. In the apartments, this will be delivered via Heat Interface Units (HIU), and individual storage cylinders where required.
- Intelligent low energy lighting will be specified throughout the residences.
- Apartments and commercial units will be separately metered for heat and electricity to encourage energy efficiency in operation. The apartments will also be provided with energy display devices, recording energy consumption and promoting efficient behaviour.
- The residential units will have programmable controls to maintain comfort conditions.

Condition 17(b) Reduction in carbon emissions

The Gas Holder Triplets is subject to Building Regulations Part L 2010 alongside the heritage and other parameters encapsulated on Parameter Plan KXC 020. Previous schemes have been assessed under Part L 2006 and therefore subject to less onerous carbon reduction targets.

The residential units will comply with Part L1A 2010 from passive design and energy efficiency alone (i.e. prior to the contribution of the low-carbon supply and renewable energy measures). Currently, preliminary Part L 2010 calculations carried out on a large sample of residential units predict that this could be achieved, with an improvement of 2%. This would equate to at least 27% compared to Part L 2006, which is significant, particularly for a scheme of this type subject to the constraints of the Gas Holder frames, which place limits on the buildings' shape and construction methodology.

The delivery of considerable carbon emissions savings is illustrated in the following figure. The team have applied all reasonable endeavours to meet the Section 106 target of a 5% saving, with measures detailed in this report. It has not been possible to achieve 5% on this occasion because of the particular building constraints and because Part L 2010 is much more onerous than the Building Regulations in place when the S106 was drafted.



The scheme is largely (95%) residential-led and this is therefore the focus of this report. The residential amenity facilities and commercial areas will however benefit from the highly-efficient building envelope. Services in the residential amenities will be highly efficient, and services in the commercial areas will be fitted out by the retail tenants, but with heat and hot water from the low-carbon district heating scheme and cooling from the future district cooling scheme.

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

The proposals seek to significantly increase the ecological value of the site through the incorporation of large landscaped areas. These include the Gas Holder Gardens at ground level, and green roofs on each of the Gas Holder buildings, of which Gas Holders GH10 and GH12 are identified as Priority Zones for Green / Brown Roofs on Parameter Plan KXC 021.

An Ecologist from RPS has been involved to carry out site surveys and advise on design proposals and protection measures at the construction stage, and their advice has been incorporated into the scheme. The current planting proposals are described in more detail in the main body of this report and in the Urban Design Report, and summarised here. The new planting will include native species. The variety of planting will encourage biodiversity and benefit wildlife by providing shelter and nesting sites for a range of birds and nectar/seed sources at different times of the year.

- The roof garden on top of Gas Holder (GH) 12 is a communal garden for residents of the development with social seating areas within a seasonally rich semi-extensive green roof planting scheme. The planting will incorporate a diverse mix of herbaceous perennials, grasses and bulbs, designed to have high visual quality throughout the year, to be robust and tolerant of dry, warm, exposed conditions, and to bring biodiversity benefits, including through the selection of pollinator-friendly species. In addition, the roof garden design includes raised

planters, with generous soil depths containing shrubs and grasses which will be selected to be tolerant to exposed conditions.

- Private roof gardens will be provided on GH10 and GH11. Each garden will feature raised planter beds.
- The public Gas Holder Gardens at ground level, which will extend from the new buildings to the Regent's Canal to the south, will incorporate new trees and shrub planting. The gardens will be heavily planted, with meadow clearings providing open space. The design incorporates rich planting including evergreens, berry bearing trees, perennials and bulbs. This will offer seasonal interest and a tree and shrub layer throughout the year, as well as creating an important green link to the Camley Street Natural Park, providing protection for fauna during the winter and a source of food for birds.

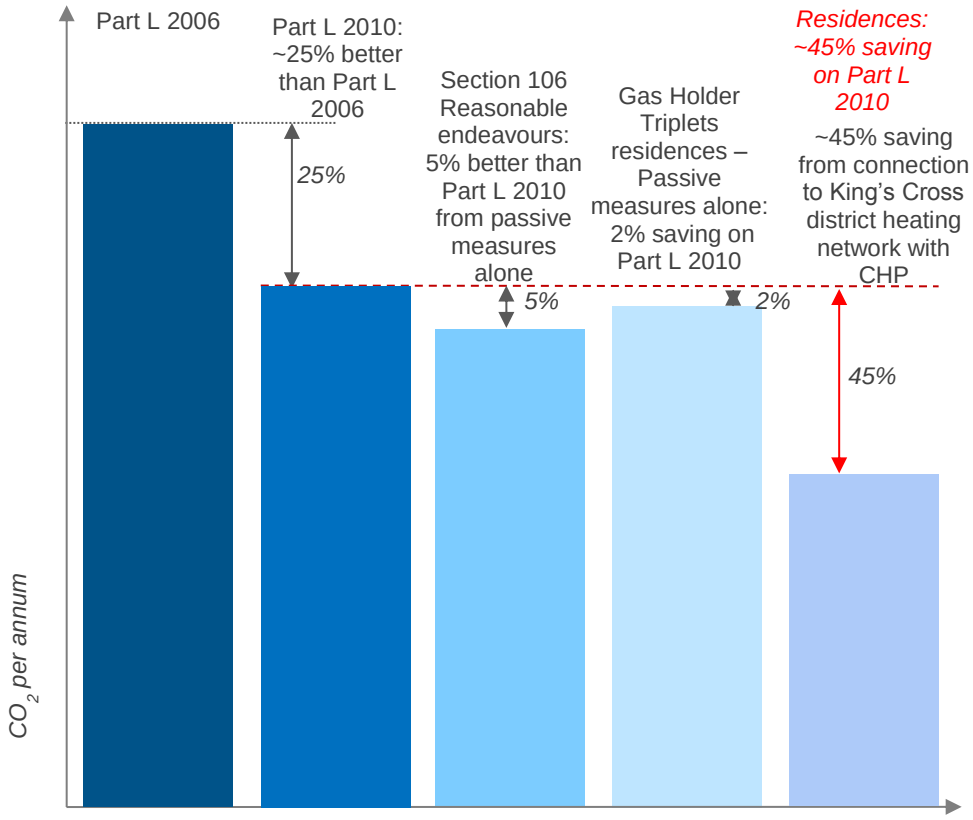
Condition 17 (d): Energy supply

All areas will be connected to the site's district energy scheme for space heating and hot water. The dwellings will be connected via Heat Interface Units (HIU), as well as individual cylinders where required, and the residential amenity facilities and commercial units will be connected via plate heat exchangers.

This will allow the Gas Holder Triplets to take advantage of the low-carbon benefits associated with Combined Heat and Power (CHP), with the electrical power generated offsetting a significant percentage of the building's demand.

Cooling will also be provided centrally from a future district cooling scheme as part of the wider KXC development, and calculations have been based on good-practice chiller efficiencies. In addition, Combined Cooling Heat and Power (CCHP), i.e. CHP and absorption chillers, is being investigated; the potential additional carbon savings associated with this system have not been taken into account in the current calculations, but a further improvement could be expected as a result.

Overall, the combination of passive design features, highly efficient building services and low-carbon energy supply is expected to result in the residential units achieving an average 45% carbon saving against Part L1A 2010. This is based on a range of design assumptions, indeed it may be possible to achieve a higher saving depending on detailed design and specifications.



The residential amenity facilities and commercial units will benefit from the highly-efficient building envelope. Services in the residential amenity facilities will be highly efficient and services in the commercial areas will be fitted out by the retail tenants, but with heat and hot water from the low-carbon district heating scheme and cooling from the future district cooling scheme.

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

The Outline Planning Permission and Parameter Plan KXC021 do not highlight the Gas Holder Triplets as a priority location for renewable energy generation. A number of technologies, including solar photovoltaic (PV), wind turbines, ground source heat pumps and solar hot water, were considered for suitability but discounted during early stage design because of performance limitations and restricted space as a result of the guide frames. Attention was instead focused on fabric efficiency and passive solar control.

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

The residential units will achieve Code for Sustainable Homes (2010) Level 4. A Code level 3 rating is usually regarded as broadly equivalent to an Ecohomes 'Very Good' rating, and the current target therefore represents a significant improvement on the S106 targets. A Code for Sustainable Homes pre-assessment has been carried out which highlights a route for all residences to achieve a Level 4 rating, with a number of 'potential' additional credits as a safety margin.

A preliminary BREEAM New Construction 2011 Retail pre-assessment has been carried out on the commercial units, which is included in this report. These units will achieve a BREEAM Retail rating of 'Very Good', subject to the tenant fit-out. Furthermore there is an aspiration to achieve an 'Excellent' rating where possible.

Condition 17(f): Wildlife Features

Following discussion with English Heritage and LB Camden during the pre-application stage no bird or bat boxes have been incorporated into the design of the buildings in order to prevent encouraging opportunities for roosting which may compromise the long-term maintenance of both the Gas Holder Triplets guide frames and the adjacent Gas Holder No.8.

Planting proposals have been informed by the advice from the Ecologist (RPS) and will result in significant improvements in biodiversity, creating habitats for wildlife and green links to neighbouring areas, including the canal and Camley Street Natural Park - Please refer to response to Condition 17 (c) for details of the advice provided and proposed design measures.

Condition 45: Drainage

The site-wide drainage infrastructure at King's Cross Central can be described in terms of three areas, including the North West Drainage Area which the Gas Holder Triplets site is part of.

The Gas Holder Triplets scheme has been designed so that the maximum discharge rates (252 l/s and 7.5 l/s for surface water and foul water, respectively) will not be exceeded and that the site-wide maximum discharge to the existing combined sewer will not exceed 2,292 l/s, as agreed as part of the Outline Planning Permission. The site-wide drainage networks have been designed on this basis, using Sustainable Urban Drainage principles to provide an overall peak flow reduction of 10% (based on a 1-in-30 year storm).

S106 - Section AA: Water

Water efficiency:

All residences will be equipped with water-efficient fittings and appliances to enable water consumption levels in line with Code for Sustainable Homes Level 4 (105 litres/person/day), a substantial improvement compared to Building Regulations Part G requirements and resulting in over 40% of the potable water consumption credits available under the Code for Sustainable Homes methodology.

The commercial units will be individually metered for water consumption, which will encourage water savings. Tenants in these areas will also be encouraged to fit low-water appliances.

Water meters, controls and detection systems will be installed in order to effectively manage water consumption.

Alternative water supplies for non-potable water needs:

Due to constraints related to the built form, enshrined in the Outline Planning Permission, as well as the provision of extensive green roofs, hard-landscaped roof areas available for rainwater collection are limited and these technologies are therefore not proposed at the Gas Holder Triplets.

Run-off treatment and incorporation of SUDS:

The Gas Holder Triplets' and surrounding public realm has been designed on Sustainable Urban Drainage Systems (SuDS) principles as part of a site-wide strategy to affect source control and storm water retention/infiltration.

Attenuation will be provided by the landscaped areas of the Gas Holder Gardens and the planted green roofs, as well as online and offline storage within the proposed surface water network upstream of the Camden Sewer. Permeable paving which allows natural infiltration to the ground is not considered appropriate for the public realm across the KXC site as the land generally consists of made-ground over impermeable London Clay and so there is not a suitable pathway to a porous drainage layer or aquifer.

S106 - Section Y: Construction materials and waste

Contractors will be expected to follow best practice procedures on site, including registration with Considerate Constructors (or equivalent), pollution prevention, site waste management, and monitoring of activities. The reduction of site impacts including noise, dust and water pollution will be incorporated into construction procedures.

The main contractor Carillion Construction Ltd has its own corporate policy. They will implement the Construction Materials and Purchasing Strategy, and the team will apply reasonable endeavours to achieve the Section 106 Construction targets.

A site waste management plan will be implemented, including targets for reducing waste and diverting it from landfill.

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

When producing topsoil and subsoil for the development, opportunities will be sought to crush and re-use suitable materials such as rubble or other excavated material.

Responsible sourcing of materials including site timber is proposed.

S106 - Section Z: Waste

A simple 'home user guide' and a 'building user guide' will be prepared which will include information on waste and recycling for both the residential and commercial occupants. Feedback will be sought on the success of the initiatives described in the guides.

Dedicated storage space and containers will be provided to encourage building users to recycle, including space in individual apartments as well as sufficient communal refuse storage space in compliance with Camden Council's waste collection policy:

- For the residential areas, chutes to a central storage and collection point will be provided, with three waste streams: compostable food waste, recyclable and non-recyclable.
- The commercial areas will have their own dedicated waste and recycling collection and storage area in the basement, via chutes for three waste steams (compostable food waste, recyclable and non-recyclable). The commercial waste will be serviced through the lower level of the Coal Drops Yard to reduce impacts on the surrounding ground level public realm.
- Waste containers will be provided in the public realm, with consideration to the segregation of recyclable waste, as per the containers already used along King's Boulevard, in Granary Square, and other areas of the KXC site.

2.0 Introduction

2.1 The Purpose of this Plan

This Environmental Sustainability Plan (ESP) has been prepared to explain the contribution that the Gas Holder Triplets will make to delivering sustainable development on the King's Cross Central (KXC) site. Specifically, this document responds to the relevant planning conditions of the King's Cross Central Outline Planning Permission (ref. 2004/2307/P) dated 22 December 2006, namely, Conditions 17 and 45. It provides details of the strategies adopted to demonstrate that the building achieves an advanced sustainability performance against the standard design for a building of this scale and mixed-use function in a central urban environment and given the constraints of the Grade II listed guide frames. The plan also details how obligations contained within sections AA, Y and Z of the Section 106 Agreement will be met, and it includes summaries of the Code for Sustainable Homes (the Code) and BREEAM pre-assessments.

This document should be read in the context of other plans and documents forming the Gas Holder Triplets planning submission, including the Planning Compliance Report and the Urban Design Report.

2.2 Description of Gas Holder Triplets

The listed Gas Holder Triplets were originally located to the west side of Goods Way where they were built as part of Pancras Gasworks between 1879 and 1880. They are considered to be unique both in terms of their linked structure and their height and illustrate the mature development of the 'High Victorian' manner of gas holder construction. The gas holders were decommissioned in 2000 with their guide frames dismantled in 2001-2002 as part of the Channel Tunnel Rail Link (CTRL) works and temporarily stored on the east side of Goods Way. Listed Building Consent (Ref: 2008/5825/L) was granted in 2009 to relocate the dismantled Gas Holder Triplets guide frames from their temporary storage location to South Yorkshire under the care of Shepley Engineers Ltd where they are under refurbishment further to the submission and approval of satisfactory details pursuant to Condition 54(c) of the Outline Planning Permission (Refs: 2013/5611/P and 2013/7079/P).

The name 'Gas Holder Triplets' originally referred to the Grade II listed gas holder guide frames themselves but it has become commonplace, through the development and implementation of the approved masterplan, to use the term more broadly. In the masterplan (and this report) 'Gas Holder Triplets' will be used to describe the whole residential building which the guide frames will form part of. Furthermore, the names of the linked gas holders – Gas Holder No. 10, No. 11 and No. 12 (commonly referred to as GH10, GH11 and GH12) – will also be used to define the blocks of residential accommodation proposed in each guide frame.

The Gas Holder Triplets will offer living accommodation in 144 apartments with a range of ancillary residential facilities (including a screening room, lounge, business suite, gym and spa), an area of commercial floor space (use classes A1 / A3 / A4 / A5) and a significant new area of public realm (Gas Holder Gardens).

The overall form of the proposed development is driven by the geometry of the gas holder frames themselves and is set out in terms of both footprint and height in the Outline Planning Permission. Residential accommodation is proposed in three, separate buildings that are arranged around a circular courtyard designed to show-case the unique 'Siamese' columns of the guide frames. Whilst the buildings only share common space at ground floor, they are connected at three levels by an external bridge link that runs around the perimeter of the central courtyard. As established as part of the Outline Planning Permission, each building has a different height which references (but deliberately does not replicate) the original gas holder 'bells'.

The ground floor of GH12 include the proposal's main residential entrance which addresses both Lewis Cubitt Square to the northeast and Holder Street to the north. An area of commercial units is located to the south and west of GH10 and GH11 to create active street frontages to Gas Holder Gardens, the canal towpath and the new public amenity of Gas Holder No. 8 (Gas Holder Park) which is also located in Development Zone N, to the west of the Gas Holder Triplets, and for which Reserved Matters was recently approved (Ref: 2014/3681/P).

The residential accommodation will be arranged above this active ground floor level over seven storeys on GH12, eight storeys on GH10, and eleven storeys on GH11.

The perimeter of the development is open at the south and west to allow long views out across the Regent's Canal and to allow as much daylight and sunlight as possible to be brought into the heart of the site. The Gas Holder Gardens will form a key segment of the masterplanned gardens that form green ribbon around the north of the bank of the Regent's Canal. Communal amenity space (available to the residents only) can be found on the ground floor in the central courtyard, on the first floor at the base of the atria in GH10 and GH11 and on the rooftop of GH12 (level 8). Private gardens for some residents are provided on top of GH10 and GH11.

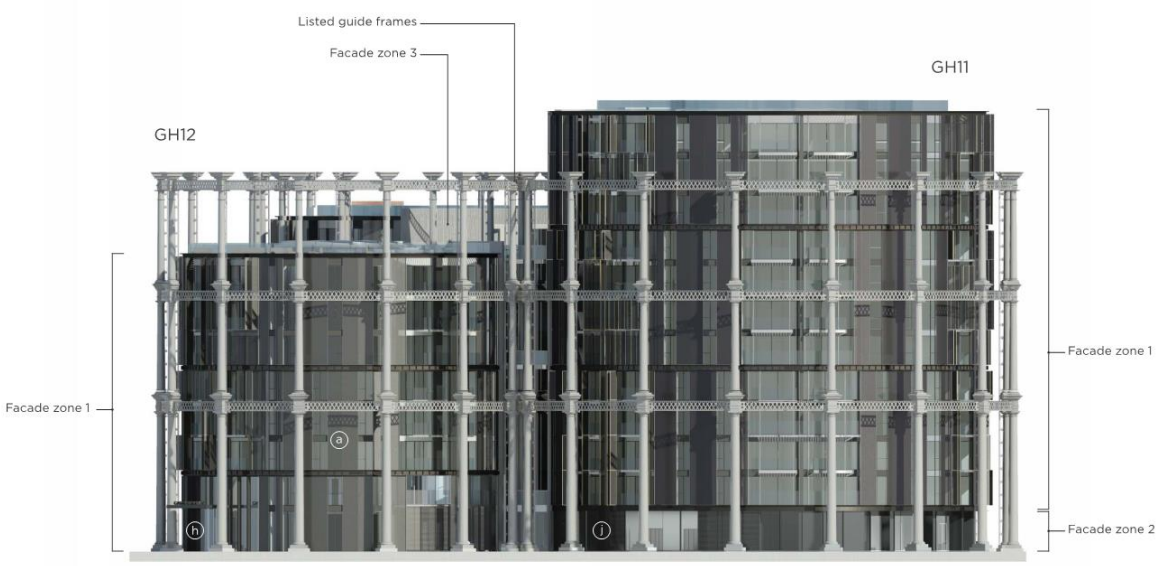
The rooftops of the Gas Holder Triplets are visible from the neighbouring developments and have been considered carefully in terms of their overall aesthetic impact. They offer great amenity space - both private and communal - to the residents of the gas holders, and landscaped gardens are provided on all available roof space. In addition, roof lights located on rooftops enable natural light penetration to the circulation spaces of the deep plan residences below.

Figure 2.1: Site plan showing the location of Gas Holder Triplets in the context of the northern King's Cross Central masterplan.

The façade treatment on each building is consistent but varies according to aspect and orientation. The circular nature of the building form means that there is no clear distinction between the north, east, west and south elevations but through the use of a panellised system, the façade is modulated in response to aspect, key views and daylighting.

The proposal for the Gas Holder Triplets is to deliver an exceptional and sustainable urban scheme which meets the environmental, social and economic needs of the local community. It has been designed in close co-operation with LBC Planning Officers and heritage experts to address the relevant conditions and associated obligations from the Outline Planning Permission and to achieve the desired Code and BREEAM ratings.

This ESP outlines the key measures taken to ensure the proposed development is in keeping with the high sustainability standards set for the wider KXC site.



Figures 2.2 and 2.3: South West and North elevations.

3.0 Response to Planning Conditions

3.1 Condition 17 (A): Energy efficiency Measures

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

3.1.1 Overview

The Gas Holder Triplets will provide an 8-12-storey residential-led scheme over 3 buildings comprising of residential accommodation located above some commercial floorspace and residential amenity facilities at ground and first floor level, and car and cycle parking and back of house functions at basement level. The measures described in this section relate to the scheme's energy performance as a whole, with a description of measures specific to each element where appropriate.

The buildings have been designed from the outset with energy efficiency as a key driver. Whilst power, heating and hot water supplies will be provided via the low-carbon district energy system, expected energy demand has been reduced through the application of the energy hierarchy:

- **Passive Design** – design of the building façade and specification of a high-performance envelope, achieved within the constraints imposed by building within the listed guide frames. A well-designed external envelope can significantly reduce energy demand, and the need to reduce space heating demand, optimise daylight, and control summer solar gains has had a strong influence upon the design of the buildings and their facades.
- **Active Design** - energy efficient equipment and controls to reduce energy consumption.

This passive approach also helps 'future-proof' the building and provide resilience to climate change impacts to continue meeting the future operational needs of the occupants.

3.1.2 Physical form of the building

A full description of the Gas Holder Triplets scheme is provided in the Urban Design Report.

The physical form of the buildings is essentially led by the gas holder guide frames, with little flexibility within this. Efforts have however been made, such as on the articulation of the façade, to optimise views, daylight penetration, and shading – see section 3.1.4 for more details.

The development's orientation helps facilitate daylight penetration from the South West to the heart of the scheme and take advantage of the sun path and environmental conditions for the plot.

Within the overall shape of the buildings, dictated by the listed frames, efforts have been made to optimise the buildings' articulation, with extruded balconies to the North for views and daylight penetration, and enclosed balconies to the South for summer solar protection.

Figure 3.1: Illustrative view of King's Cross Central, with the Gas Holder Triplets highlighted in orange

3.1.3 Passive Design

The provision of natural daylighting is an important consideration in passive solar design, and has been achieved within the constraints of the site footprint, the dense urban context, and the buildings shape dictated by the listed gas holder frames.

Design options have been explored to optimise daylighting to the development, within the inherent constraints from the gas holder frames (i.e. building shape and shading effect) and the need to balance critical issues related to space and internal layout.

For the dwellings, Table 3.1 below indicates the recommended dwelling daylight factors from the BRE 'Site Layout for Daylight and Sunlight: A Guide to Good Practice 1991', for which a 2nd edition was published in 2011 and which is replicated in the 'Code for Sustainable Homes – Technical Guide 2010'.

Table 3.1: Summary of dwelling recommended daylight factors from Code for Sustainable Homes

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

The way in which the Gas Holder Triplets development relates to the above recommended daylight factors and BRE Guide for residential units is addressed within the separate Daylight and Sunlight Report prepared by Hoare Lea and included in the Reserved Matters submission.

The above BRE guide has been a key reference within the architectural design process of the Gas Holder Triplets, which has culminated in 79% of the residential units meeting/exceeding the BRE guidance for the daylight assessment of living rooms and bedrooms. This figure denotes very good performance, and would improve to a very high rate (~89%) without the shading effect of the gas holder guide frames.

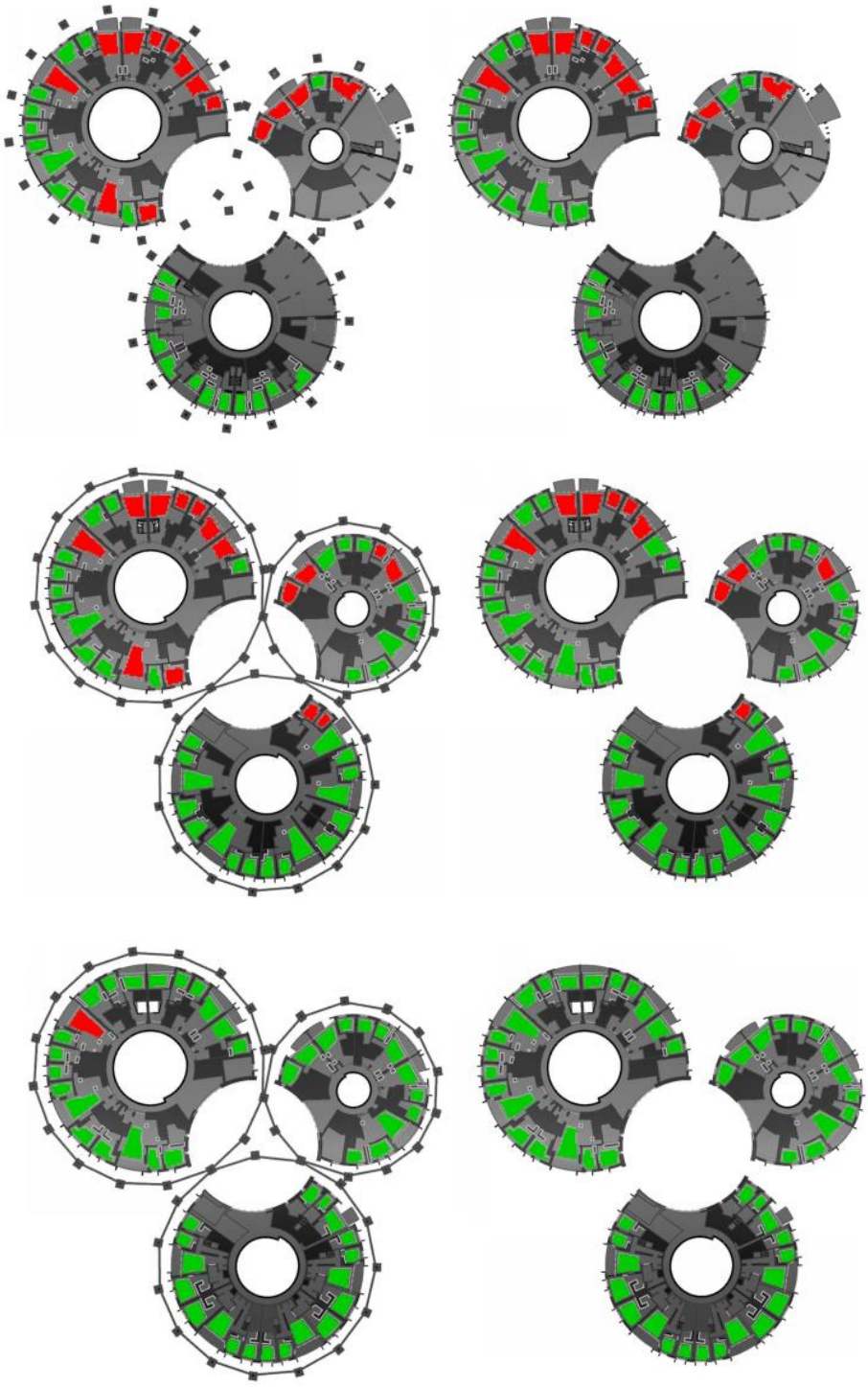


Figure 3.2: Illustration of daylight factors against BRE targets on levels 1 (top), 4 (mid), and 7 (bottom), with (left) and without (right) the guide frames

As well as the daylight considerations, the potential impact of summertime overheating has also been considered. The correct balance between daylight, sunlight and heat gain is achieved by optimised proportions of opaque and glazed areas (~60% of the facade, as seen from the inside), subtly shifting the composition of panel types around the building according to orientation, and providing recessed balconies to the South, where more protection is needed, but protruding balconies to the North, to enhance views. In addition, movable external shading will allow user control of privacy and shading.

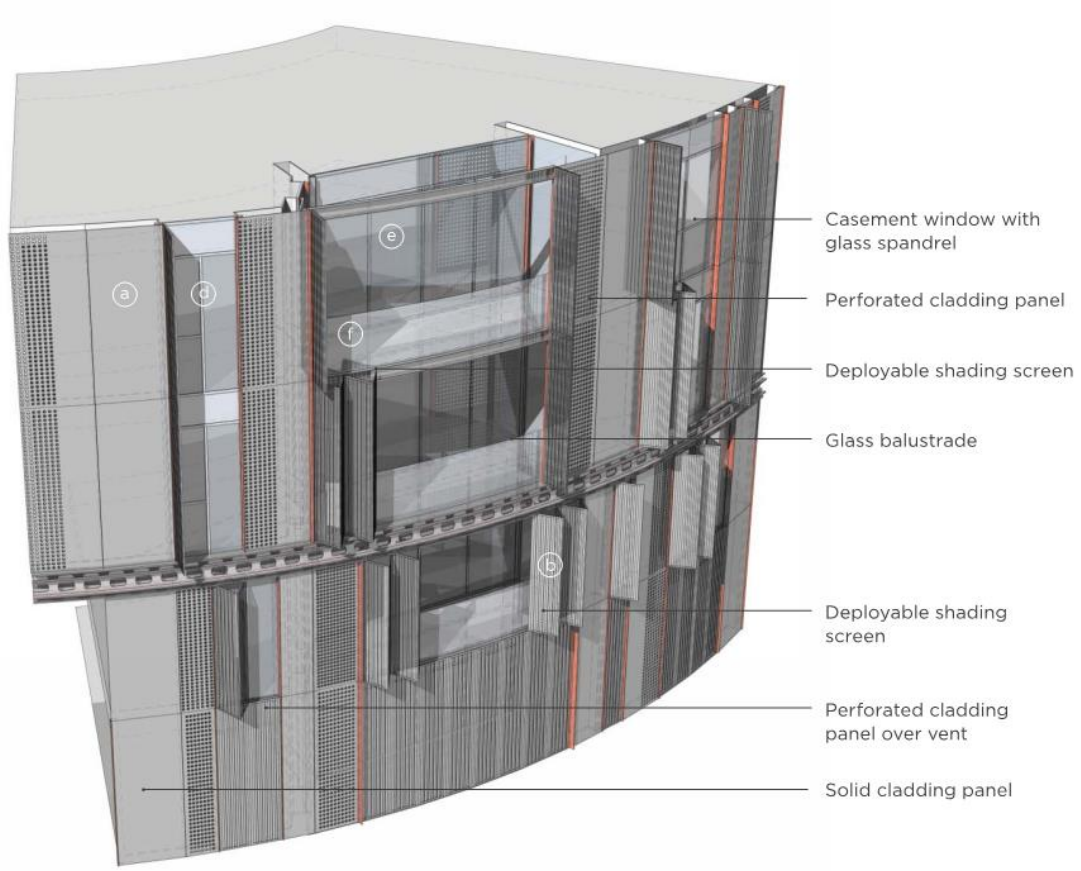


Figure 3.3: Illustration of the façade proposals showing solid and transparent elements

As a result, Part L1A 2010 SAP (Standard Assessment Procedure) calculations carried out on sample apartments indicate that the units would comply with Criterion 3 Limit Summertime Solar Gains for Overheating.

The design also seeks to make the best use of the central atria, which will allow natural daylight into the circulation areas. A tempered environment will be achieved inside the atria without actual mechanical heating or cooling, allowing reduced winter heat losses from the apartments compared to those that would occur onto an external space.

3.1.4 Building envelope, specification and thermal performance

High building envelope performance will be achieved through the use of high specification glazing, high levels of insulation and airtight construction methods that reflect best practice whilst addressing the construction methodology constraints imposed by building within the listed guide frames. The façade design and target performance parameters have been defined in close collaboration with the architect, façade consultant, and sustainability consultant, informed initial Part L calculations. Insulation levels in the opaque areas have been maximised for this type of systems. In addition, the use of a curtain walling system will allow very good airtightness levels.

As a result, the fabric thermal performance is currently targeted to be significantly better than the minimum requirements of Part L of the Building Regulations 2010, as shown in Table 3.2 below. These will assist in significantly reducing the energy required to heat the spaces.

Table 3.2: Indicative building fabric performance for the Gas Holder Triplets against Building Regulations Part L 2010

Building Element			Current Assumptions	Part L 2010 Limiting Factors
Thermal mass			Low i.e. 100	-
Air permeability			3 $m^3/hr/m^2$	10 $m^3/hr/m^2$
Thermal bridging, Y value			0.15 W/m^2K	-
U-values	Curtain wall	Opaque area	0.33 W/m^2K	2.00 W/m^2K
		Glazing (inc. frame)	1.2 W/m^2K	2.00 W/m^2K
	External wall to atrium	Opaque area	0.15 W/m^2K	0.30 W/m^2K
		Glazing (inc. frame)	1.2 W/m^2K	2.00 W/m^2K
	Party wall		0.00 W/m^2K	-
	External wall onto courtyard		0.15 W/m^2K	0.30 W/m^2K
	Floor		0.25 W/m^2K	0.25 W/m^2K
	Roof		0.20 W/m^2K	0.20 W/m^2K
	Door to corridor		1.2 W/m^2K	2.00 W/m^2K
	Roof light (inc. frame)		1.2 W/m^2K	-
	Fraction glazed		0.8	-
	g-value		0.56	-

3.1.5 Scope for using thermal mass

Utilising the thermal mass of a building can in theory reduce peak heating and cooling loads and thus reduce annual energy consumption. To that purpose, the thermal mass needs to be exposed to cooler air flow, typically at night, in order to cool down and be able to absorb heat during the day. Given that much of the buildings are for residential uses, there is a limited opportunity to expose the thermal mass directly and to utilise night-time cooling by leaving windows open at night when occupants are sleeping, in the site's urban location. The extensive use of thermal mass is therefore not proposed here.

3.1.6 Choice and design of building services

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

Residential areas:

Each dwelling will be fitted with a Heat Interface Unit (HIU) to provide hot water and space heating, supplemented where required by individual cylinders in the larger dwellings. Each dwelling will also have a heat meter to facilitate individual billing according to use. All pumps and drives will be inverter-driven, allowing them to match the energy requirements of the building. Space heating will be provided by underfloor heating allowing a degree of user control within each room and the ability to reduce further energy requirements on a room by room basis.

The proposed passive and energy efficient design measures set out in this section are designed to provide a comfortable internal environment without the need for mechanical cooling. However, due to market expectations, comfort cooling will be provided in a selection of apartments, with the cooled areas representing approximately 60% of total Net Internal Area (NIA) of the residential units. The 'Home User Guide' provided to occupants of any relevant units will include a section on the efficient use of the comfort cooling system in order to encourage minimised use.

Cooling will be provided by the district scheme, and there are therefore no local cooling systems from which waste heat recovery could be considered. These options typically offer only limited carbon saving benefits, as heat is of low grade compared to that required for space heating and hot water.

Commercial and residential amenity facilities areas:

The commercial units and residential amenity facilities will be connected to the district heating and cooling scheme, with metered supplies, for all of the heat for hot water and space heating and all of the chilled water for space cooling, except the possible use of small air-conditioning units for comms rooms.

All pumps and drives will be inverter-driven, allowing them to match the energy requirements of the building.

Controlling the building services:

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

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

b. Secondary heating pumps

c. Cold water storage high and low water level alarms

d. Cold water booster systems

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

f. Heating consumption within the apartments

g. Water consumption within the apartments.

The use of a BMS will enable automatic system control to ensure correct operation of the building, and monitoring to maintain optimum energy consumption through data interrogation and resolution of potential problems.

It is expected that the BMS will also monitor and control building services in the residential amenity facilities.

3.1.7 Ventilation strategy

The residential dwellings will benefit from highly efficient 'whole house' mechanical ventilation with heat recovery units (MVHR). The MVHR units recover heat from the exhaust air and use it to raise the temperature of the intake air, reducing the ventilation heat loss and thus reducing the energy required to heat the apartments. The units will also be provided with a summer bypass.

All dwellings will also be provided with openable windows, for purge ventilation and to allow user control, particularly for summer ventilation.

Mechanical ventilation will be installed in the residential amenity facilities, and is expected to be fitted-out by tenants in the commercial units.

3.1.8 Scope for intelligent lighting

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

- The lighting installation will employ low-energy, high efficiency light fittings. In addition to reducing energy use associated with lighting, this strategy will help to limit unwanted heat gains.
- Controls will be installed as appropriate in the external areas, service corridors, car park, and communal areas in order to reduce energy consumption, e.g. daylight sensors, timers, and passive infra-red (PIR) movement detectors

3.1.9 Plant sizing

Plant sizing has been designed to optimise the efficiency of the systems, by matching installed capacity to building demand. The district energy centre and electrical sub-stations have been designed to provide thermal energy (i.e. heat and hot water) and electrical power for the Gas Holder Triplets.

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

3.2 Condition 17 (B): Reduction in carbon emissions

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

The Gas Holder Triplets is a mixed-use scheme comprising a residential development, which falls under the control of Building Regulation Approved Document Part L1A (ADL1A), and non-residential areas including residential amenity facilities (such as a spa/gym) and a number of commercial units, which falls under Building Regulation Approved Document Part L2A (ADL2A). The scheme has been registered under Part L 2010, and will be assessed as such.

Residential areas

The residential areas of the development have been subject to a preliminary assessment using SAP (Standard Assessment Procedure) on a large sample of representative apartments to guide the design development and maximise the carbon emissions savings achievable by the proposals. Results on these apartments were then area-weighted to assess the overall average performance of the residential areas.

The Section 106 Agreement, Section X, targets each new KXC building to achieve a 5% carbon emissions reduction against Part L of the prevailing Building Regulations based on the use of energy efficient and passive design measures, and any low-carbon energy supply not already accounted for in the Outline Planning submission.

The scheme is being submitted at a Stage D level of design and the prevailing Building Regulations for most of the design stages so far were the 2010 version, under which the scheme has been registered.

On the basis of the passive design measures set out in Section 3.1, the area-weighted carbon emissions (derived from the Dwelling Emissions Rate – DER in kg $CO_2/m_2/yr$ calculated for the example apartments above) from the residential areas of the Gas Holder Triplets are currently predicted to be 210 tonnes CO_2/year, i.e. a 2% improvement on expected Part L1A 2010 carbon emissions compliance levels of 220 tonnes CO_2/year, as derived from the Target Emissions Rate (TER).

This would equate to at least 27% compared to Part L 2006, which is significant, particularly for a scheme of this type subject to the constraints of the Gas Holder frame and resulting construction methodology. It should also be noted that the Gas Holder Triplets is the first residential scheme with heritage constraints submitted at KXC under Part L 2010, while previous schemes were assessed under Part L 2006 and therefore subject to less onerous carbon reduction targets.

The delivery of considerable carbon emissions savings is illustrated in the following figure, which illustrates the overall improvement on Part L 2006, Part L 2010 and Section 106 for the proposed residential areas of the Gas Holder Triplets, prior to the incorporation of Combined Heat and Power (CHP) or other low carbon technology.

It is therefore considered that the team have applied all reasonable endeavours to meet Section 106 targets. It has not been possible to achieve 5% on this occasion because of the particular building constraints and because Part L 2010 is much more onerous than the Building Regulations in place when the S106 was drafted.

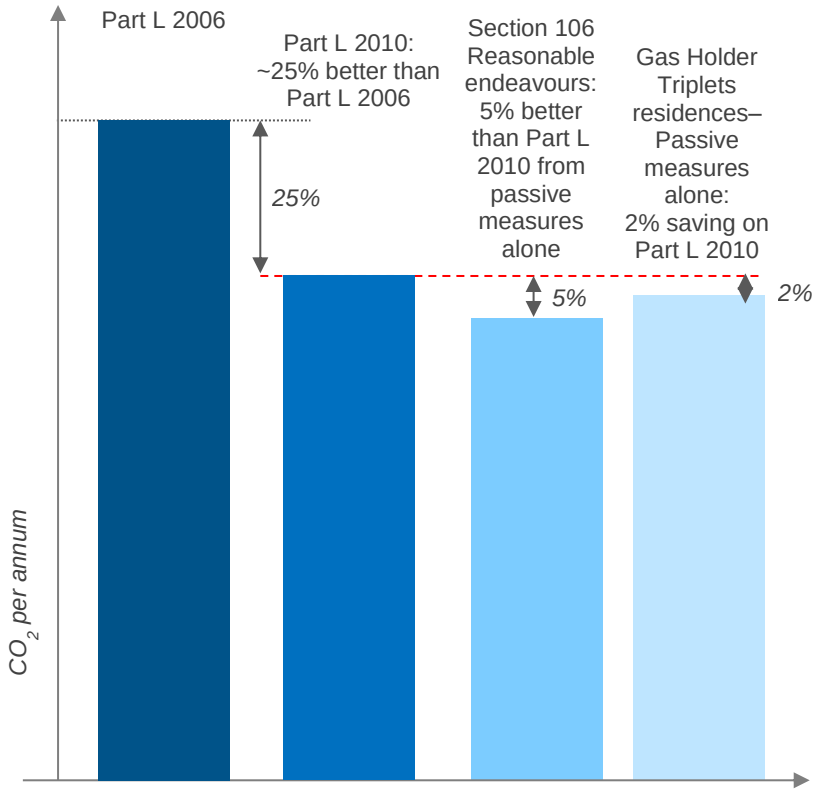


Figure 3.4: Estimated Regulated Carbon Emissions Reductions for the residential areas (excluding contributions from CHP and renewables)

The team is continuing to seek further improvements, such as optimising the performance of the Heat Interface Units (HIU) and hot water cylinders, and improving U-values and thermal bridging from apartments to atria.

Residential amenity facilities and commercial areas

The scheme is largely (95%) residential-led and this is therefore the focus of this report. The non-residential areas will however benefit from the highly-efficient building envelope. Services in the residential amenity facilities will be highly efficient, and services in the commercial areas will be fitted out by the retail tenants, but with heat and hot water from the low-carbon district heating scheme and cooling from the future district cooling scheme.

Initial Part L2A 2010 Criterion 3 modelling has been carried out on the ground floor elevations to inform design development and ensure compliance of the commercial units.

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

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

Ecological enhancements are being sought as part of the landscaping strategy to significantly increase the ecological value of the site. The Gas Holders GH10 and GH12 are identified as Priority Zones for Green / Brown Roofs on Parameter Plan KXC 021 and they, as well as GH11, will be provided with green roofs. In addition, the scheme includes substantial new ground level landscaping, referred to as the Gas Holder Gardens.

An Ecologist (from RPS) has been involved to carry out site surveys and advise on design proposals and protection measures during construction. Their advice has informed the landscaping strategy, and the planting species mix takes account of the local Biodiversity Action Plan (BAP). The majority of the new planting will include native species. The variety of planting will encourage biodiversity and benefit wildlife by providing shelter and nesting sites for a range of birds and nectar/seed sources at different times of the year.

It is anticipated that this green infrastructure will act as a wildlife corridor or 'ribbon', providing connectivity between other green spaces and wildlife areas within the King's Cross Central footprint and beyond, including the Camley Street Natural Park.

This strategy will also offer social benefits, including ample recreational outdoor garden space for use by occupants and, in the case of the Gas Holder Gardens, by the wider public.

Green and / or brown roofs

The roof garden on top of GH12 is a communal garden for residents of the development which will incorporate social seating areas within a seasonally rich semi-extensive green roof planting scheme. The green roof planting will be a diverse mix of herbaceous perennials, grasses and bulbs, designed to have high visual quality throughout the year, to be robust and tolerant of dry, warm, exposed conditions, and to bring biodiversity benefits. In particular, planting proposals will including pollinator-friendly species. Native species will be used, such as Cowslip, Pasque Flower, Great Knapweed, and Sea Campion, possibly along with additional species to extend the flowering season at both ends. In addition, the garden is proposed to include raised planters with generous soil depths containing shrubs and grasses, selected where possible for their tolerance to exposed conditions e.g. Tamarix tetrandra or Thamnochortus insignis.

Private roof gardens will be provided on GH10 and GH11. Each garden will feature raised planter beds, in order to encourage planting of the private areas by future residents.

Ground Level

In addition to roof level landscaping, extensive areas of soft landscaping are provided at ground level. The public Gas Holder Gardens, which will extend from the new buildings to the Regent's Canal to the south, will incorporate new trees and shrub planting and create an important green link to Camley Street Natural Park.

The Gas Holder Gardens will be heavily planted, with meadow clearings providing open space. The design incorporates rich planting including evergreens, berry bearing trees, perennials and bulbs. This will offer seasonal interest and a tree and shrub layer throughout the year, as well as providing protection for fauna during the winter and a source of food for birds.

Figure 3.5 Illustrative view of landscaping, including Gas Holder Gardens and green roofs

3.4 Condition 17 (D): Energy Supply

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

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

3.4.1 Building energy supply and relationship with low-carbon district energy system

KXC low-carbon district energy system

The Gas Holder Triplets will be served for all its space heating and hot water demand from the T1 Energy Centre, which has already been approved, 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, commercial tenants in the Western Transit Shed and buildings in Zone B, and residents of Buildings T6, J, R4 and R5 North.

KCCLGP and its partners have established the Energy Services Company ('ESCo') to run the district heating, and the necessary heat and power distribution infrastructure has been and is being installed across the KXC site to enable the connection of each new building, and where appropriate retained buildings, to the district energy network. The Combined Heat and Power ('CHP') engines within the T1 Energy Centre will also generate electrical power, which will offset a significant percentage of the demand from this and other buildings.

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

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

These items will be installed on a phased basis as the scheme reaches critical mass, in order to meet peak demands and optimise efficiency.

The Gas Holder Triplets will also be served by a future district cooling scheme as part of the wider KXC development. Combined Cooling Heat and Power (CCHP), i.e. CHP and absorption chillers, is being investigated.

Biofuel boilers

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

3.4.2 CO_2 savings arising from the District Energy System

The carbon emission calculations used within this report have assumed that, in total, 66% of the space heating and hot water used across the KXC site will be produced by CHP with the remainder provided by gas fired boilers. The CHP efficiency was taken from data provided by the ESCo, i.e. approximately 38% thermal efficiency and 38% electrical efficiency.

At this stage and as conservative assumption for the purpose of the initial calculations, cooling has been assumed to be provided by traditional chillers.

Residential areas

Taking into account the passive design and energy efficiency measures set out in Section 3.1 of this plan and the contribution made by the building's connection to the low-carbon district heating system, the area weighted carbon emissions of the residential areas are expected to be further reduced from approximately 210 tonnes CO_2/year (with passive design and energy efficiency alone) to 105 tonnes CO_2/year, representing an average 45% reduction in emissions compared to Part L1A 2010 compliance levels (approximately 220 tonnes CO_2/year). This is based on a range of design assumptions, indeed it may be possible to achieve a higher saving depending on detailed design and specifications.

Figure 3.6 below provides the overall improvement on Part L 2006, Part L 2010 and Section 106 for the proposed design, including the CO_2 emissions reductions made as a result of the connection to the low-carbon heating supply.

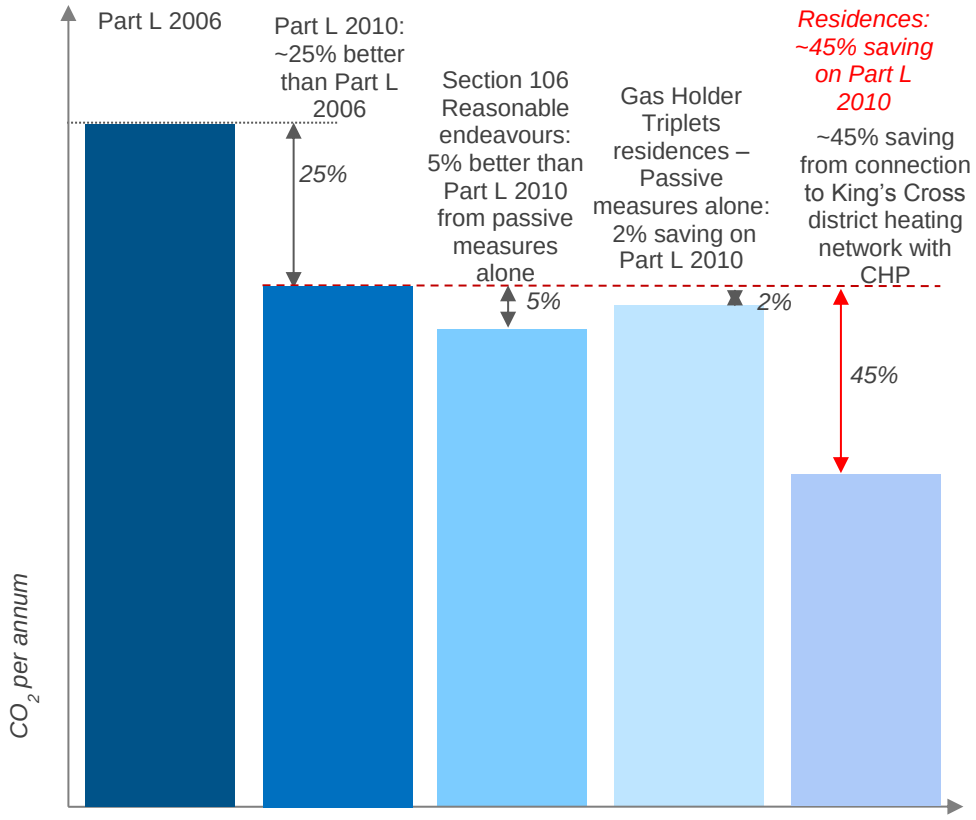


Figure 3.6 Estimated Gas Holder Triplets regulated CO_2 Emissions for the residential areas, with contribution from CHP

Commercial and residential amenity facilities areas

The district heating and cooling scheme will provide further carbon savings on the non-residential areas, after passive design and energy efficiency services.

3.4.3 Renewable energy options

The Outline Planning Permission and Parameter Plan KXC021 do not highlight the Gas Holder Triplets as a priority location for renewable energy generation. A number of technologies were however considered for suitability but are not considered appropriate to the scheme due to a number of factors:

- Solar Photovoltaic (PV) - The contribution from PV on the Gas Holder Triplets would be limited. The roof areas have been designed to maximise opportunities for biodiversity and outdoor space and gardens for the buildings' occupants, thus providing significant both social and environmental sustainability benefits that are considered here to take precedence over the limited carbon saving potential of PVs.
- Wind turbines – The building location and proximity to other constructed/planned buildings would be likely to affect the local wind patterns and therefore the performance of building integrated turbines, meaning any contribution to overall generation would be limited. Proximity to other buildings could also lead to issues associated with noise and flicker for neighbouring residents. Other limiting factors include the impact on views of the listed guide frames, and site location in the Regent's Canal Conservation Area and St Paul's viewing corridor.
- Ground source heat pumps (GSHP) - Typically this type of system is best suited to a building where heating and cooling loads are relatively balanced. Due to the presence of tunnels which run beneath and alongside the building, the numbers of boreholes to supply a GSHP would be restricted, thus limiting the size and contribution that any GSHP system could offer. Cooling is instead proposed to be met efficiently by the district cooling scheme.
- Solar hot water – Similarly to PV, the proposed uses of the roofs mean there is no available area to locate solar hot water panels. Furthermore the building has been designed to make full use of the heating supplied by the King's Cross Central low carbon district energy system for hot water provision, and supply from solar would be competing for the hot water demand.

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

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

3.5.1 The Code for Sustainable Homes

The BRE EcoHomes assessment system, referred to in Condition 17(E), was effectively superseded in April 2007 for all new residential projects by the Government's Code for Sustainable Homes ('Code') scheme. The Code is therefore an equivalent system of assessment for the purposes of this Condition.

Although most credits under the Code are 'tradable' (i.e. chosen at the discretion of the design team) there are a number of mandatory credits associated with each Code Level rating; the most significant of these fall within the energy and the water sections.

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

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

The Gas Holder Triplets has been registered against the latest version of the Code Technical Guidance (November 2010) and a preliminary assessment has been carried out by the project team. This pre-assessment highlights a possible route for all residences to achieve a Level 4 rating, with a number of 'potential' additional credits as safety margin.

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

Table 3.3 on the following page summarises the performance in each of the Code sections as a result of the credits currently targeted at this stage

Table 3.3: Current target performance under The Code for Sustainable Homes 2010

Category	Issue	Available Credits	Targeted (base case)	Credits Targeted (Apt type 8)	Potential
Energy and CO_2 Emissions	Ene 1: Dwelling Emission Rate **(M)**	10	5	5	
	Ene 2: Fabric Energy Efficiency **(M)**	9	6	6	
	Ene 3: Display Energy Devices	2	2	2	
	Ene 4: Drying Space	1	1	1	
	Ene 5: Energy-labelled White Goods	2	2	2	
	Ene 6: External Lighting	2	2	2	
	Ene 7: Low and Zero Carbon Technologies	2	2	2	
	Ene 8: Cycle Storage	2	1	2	
	Ene 9: Home Office	1	0	1	
Water	Wat 1: Indoor Water Use **(M)**	5	3	3	
	Wat 2: External Water Use	1	0	0	
Materials	Mat 1: Environmental Impact of Materials **(M)**	15	6	6	
	Mat 2: Responsible Sourcing of Materials (Building Elements)	6	3	3	
	Mat 3: Responsible Sourcing of Materials (Finishing Elements)	3	1	1	
Surface Water Run-off	Sur 1: Management of Surface Water Runoff **(M)**	2	2	2	
	Sur 2: Flood Risk	2	2	2	
Waste	Was 1: Storage of Non-Recyclable Waste and Recyclable Waste **(M)**	4	4	4	
	Was 2: Construction Site Waste Management	3	3	3	
	Was 3: Composting	1	1	1	
Pollution	Pol 1: Global Warming Potential (GWP) of Insulants	1	1	1	
	Pol 2: NO_x Emissions	3	3	3	
Health & Wellbeing	Hea 1: Daylighting	3	0	0	+1 (some dwellings)
	Hea 2: Sound Insulation	4	3	3	+1
	Hea 3: Private Space	1	1	1	
	Hea 4: Lifetime Homes **(M)**	4	4	0	
Management	Man 1: Home User Guide	3	3	3	
	Man 2: Considerate Constructors Scheme	2	2	2	
	Man 3: Construction Site Impacts	2	2	2	
	Man 4: Security	2	0	0	
Ecology	Eco 1: Ecological Value of the Site	1	1	1	
	Eco 2: Ecological Enhancement	1	1	1	
	Eco 3: Protection of Ecological Features	1	1	1	
	Eco 4: Change in Ecological Value of the Site	4	3	3	+1
	Eco 5: Building Footprint	2	2	2	
	Weighted Score: **CfSH Pre-Assessment Rating:**		71.31 **'Level 4'**	69.81 **'Level 4'**	

3.5.2 BREEAM Rating

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

A preliminary BREEAM New Construction 2011 Retail pre-assessment has been carried out for the commercial units, which is included in this report. The units will be provided as shells by the developer, with connection to the district heating and cooling network. They will achieve a BREEAM Retail rating of 'Very Good', subject to the tenant fit-out. Furthermore there is an aspiration to achieve an 'Excellent' rating where possible.

A summary of the approach and scores is provided in table 3.4 below.

Table 3.4: BREEAM 2011 pre-assessment summary table for the commercial spaces

Building Performance by Section – Targeted Score					
	Environmental weighting	Credits available	Credits targeted	% Achieved	Weighted Score
Management	12.0%	22	10	63.64%	7.64
Health & Wellbeing	15.0%	15	10	20.00%	3.00
Energy	19.0%	27	13	37.04%	7.04
Transport	8.0%	9	9	77.78%	6.22
Water	6.0%	9	4	61.11%	3.67
Materials	12.5%	12	11	50.00%	6.25
Waste	7.5%	6	4	100.00%	7.50
Land Use & Ecology	10.0%	8	8	80.00%	8.00
Pollution	10.0%	8.5	9	65.38%	6.54
Innovation	10.0%	0	3	0.00%	0.00
Total BREEAM Targeted Score					**55.85 (Very Good)**

3.6 Condition 17 (F): Wildlife Features

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

The landscape strategy (as described in our response to condition 17(C) in Section 3.3) offers opportunities for ecological enhancement and increased biodiversity, helping the Gas Holder Triplets to make a contribution towards fulfilling objectives within the London Biodiversity Action Plan.

The project Ecologist (from RPS) has carried out an assessment of the Gas Holder Triplets and provided a number of ecological enhancement recommendations for the development. These have been considered as part of the overall landscaping strategy for the scheme and implemented where practical to do so. In summary, the enhancement measures under consideration include:

- The Gas Holder Gardens at ground level will incorporate new tree and shrub planting. The new landscape planting will act as stepping stone habitat and create an important green link to Camley Street Natural Park. The Gardens are expected to be heavily planted, with rich planting including evergreens, berry bearing trees, perennials and bulbs. This will offer a tree and shrub layer throughout the year, providing protection for fauna during the winter and a source of food for birds.
- New planting will include native species (in accordance with Parameter Plan KXC 006). The variety of planting will encourage biodiversity and benefit wildlife by providing shelter and nesting sites for a range of birds (native house sparrow and black redstart) and nectar/seed sources at different times of the year.
- Following discussion with English Heritage and LB Camden during the pre-application stage no bird or bat boxes have been incorporated into the design of the buildings in order to prevent encouraging opportunities for roosting which may compromise the long-term maintenance of the both the Gas Holder Triplets guide frames and the adjacent Gas Holder No.8.
- Green roofs will be provided on each Gas Holder, including a large communal one on top of GH12 for residents of the development (see Condition 17(c) for more details).

The ecology assessment concludes that implementation of the recommendations will significantly enhance the ecological value of the Gas Holder Triplets site and support an increase in the local site biodiversity.

3.7 Condition 45: Drainage

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

3.7.1 Site Wide Drainage Infrastructure

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

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

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

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

The site wide drainage infrastructure at King's Cross Central can be described in terms of three drainage infrastructure areas, incorporating both building plots and infrastructure/public realm. These are described in Table 3.5 below.

The Gas Holder Triplets site (plot N1) is within the North West Drainage Area, within the 'Remainder of the Northern Area'.

Table 3.5: Drainage Infrastructure Areas

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

Table 3.6 identifies the assumed peak foul and surface water flows from each of the building plots which underpins the design of the site-wide infrastructure. The foul water figures are based on CIRIA 177 Variable Peaking Factor and the assumed foul water discharges from various land uses are identified in Table 3.7. The surface water peak flows are based on a 1 in 30 year storm. It should be noted that it is most unlikely that the foul and surface water peak discharges from each individual plot will coincide with each other.

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

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

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

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

Table 3.6: Peak Surface and Foul Water Flows for the North West Area

	Assumed Peak Flows (l/s)	
Plot reference	Surface Water (1 in 30 year event)	Foul Water
Remainder of Northern Area	Plot developments	Infrastructure / Public Realm
M1	61	4.6
M2	82	7.1
N1	252	7.5
N2	57	-
P1	139	8
P2	122	19.4
S3	95	4.2
S4	106	7.2
S5	90	6.5
T3	83	4.3
T4	63	11.8
T5	49	106.7
T6	39	7.2
W1	67	6.5
Totals	1204	4.3

Table 3.7: Foul water discharges from various land uses

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

3.7.2 Drainage Infrastructure Relating to Gas Holder Triplets

Building N1 is serviced by the North West Area drainage systems, which discharges via restricted discharges in to the combined Thames Water Camden Sewer. The drainage networks have been designed on SUDS principles providing an overall peak flow reduction of 10% (based on a 1 in 30 year storm).

Thames Water has approved the surface water discharges into the Camden Sewer for the network serving Plot N1. The design discharges for N1 are 252 l/s and 7.5 l/s peak for surface water and foul water, respectively.

It should be noted that the figures in Table 3.6 do not specifically include public realm areas. However, the North West Area public realm was included in the hydraulic model used during the design of the infrastructure to ensure that each of the drainage sub catchments (buildings and public realm) are attenuated and the flows into the combined Thames Sewer restricted so that the permissible discharges set out in the Outline Planning Permission are not exceeded.

4.0 Section 106 Agreements

4.1 Section AA: Water

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

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

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

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

4.1.1 Domestic water use

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

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

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

A priority objective for the project team is to significantly enhance the ecological value of the Gas Holder Triplets site, including through the promotion of the Local Biodiversity Action Plan. The proposals therefore include green roofs, soft landscaping and planting features, as described in Sections 3.3 and 3.6. It will be critical to maintain these features and protect against drought risks if the ecological value is to be retained. The planting of native species will help to some extent since these species tend to be resilient to the current UK climate and can readily go for periods of time without precipitation. During the growing season and summer months it will be necessary to provide some level of irrigation to ensure continued, healthy growth, however, this system will only be used when necessary.

4.1.2 Non-domestic water use

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

Based on initial calculations, it is anticipated that a 20-30% reduction against typical water consumption could be achieved through implementation of these water efficiency measures. A minimum of 2 credits are currently targeted in the water usage section of the BREEAM pre-assessment, in line with the Section 106 agreement.

It should be noted that these credits are dependent on the tenant fit-out choice, addressed through green lease agreements, green building guides or developer/tenant collaboration.

4.1.3 Water recycling

Water reuse has been investigated for the Gas Holder Triplets to further reduce the demand for mains-supplied water for WC flushing. Although rainwater harvesting is the most common system for using recycled water, the opportunities for collection from roof areas are reduced by the structural form of the building and the large areas of green roof, such that the additional collection and distribution infrastructure required would be challenging, with high capital costs and limited benefits.

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

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

4.1.4 Sustainable drainage

Surface water drainage methods that take account of quantity (flooding), quality (pollution) and amenity issues are collectively referred to as Sustainable Urban Drainage Systems (SUDS). Due to the way that SuDS manage flow rates from hard surfaces, protect natural flow regimes in existing watercourses, and can protect and even enhance water quality, they are considered more sustainable than traditional drainage methods.

The Gas Holder Triplets' and surrounding public realm has been designed on SuDS principles as part of a site-wide strategy:

Attenuation will be provided by the landscaped areas of the Gas Holder Gardens and the planted green roofs, as well as online and offline storage within the proposed surface water network upstream of the Camden Sewer. Planted roofs will help reduce the peak flow and the total volume discharged from the roofs by attenuating or detaining rainfall and, on warmer days, by encouraging evapotranspiration.

Permeable paving which allows natural infiltration to the ground is not considered appropriate for the public realm across the KXC site as the land generally consists of made-ground over impermeable London Clay and so there is not a suitable pathway to a porous drainage layer or aquifer.

Storage measures for surface water runoff will allow a controlled discharge to the existing surrounding infrastructure.

4.2 Section X: Energy

Please refer to the previous sections which detail the response to energy and carbon reduction.

4.3 Section Y: Construction materials and waste

Section Y of the Section 106 Agreement imposes obligations to:

Implement the Construction Materials and Purchasing Strategy.

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

Use reasonable endeavours:

IV. To minimise packaging waste associated with the delivery of construction materials.

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

VI. To achieve the Construction Targets.

4.3.1 Construction Materials and Purchasing Strategy

The project team intends that best practice will be applied to the Gas Holder Triplets development and surpassed wherever practicable, in order to maximise resource efficiency.

Contractors will be expected to follow best practice procedures on site, including registration with Considerate Constructors (or equivalent), pollution prevention, site waste management, and monitoring of activities. The reduction of site impacts including noise, dust and water pollution will be incorporated into construction procedures.

The Construction Materials and Purchasing Strategy set out in the S106 Agreement will be adopted, while careful planning and effective control will ensure that waste during the construction phase is minimised.

4.3.2 Packaging waste

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

4.3.3 Soil

When producing topsoil and subsoil for the development, opportunities will be sought to crush and re-use suitable materials such as rubble or other excavated material. Where possible, the covering material for the brown roofs will be sourced from the arisings generated by the site clearance and preparation of levels, with the addition of appropriate organic material.

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

4.3.4 Construction Targets

The team will apply reasonable endeavours to achieve the Section 106 Construction targets.

A site waste management plan will be implemented, including targets for reducing waste and diverting it from landfill.

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

The aspiration to achieve a Code for Sustainable Homes Level 4 rating will be the principal driver for the team's endeavours to achieve the best possible performance against the Construction Targets. Code for Sustainable Homes 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.

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

- Monitor, report, and set targets for CO_2 production or energy use arising from site activities;
- Monitor and report CO_2 or energy use arising from commercial transport to and from site;
- Monitor, report and set targets for water consumption from site activities;
- Adopt best practice policies in respect of air (dust) pollution arising from site activities;
- Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site;
- 80% of site timber is reclaimed, reused or responsibly sourced.
- In addition, the contractor has its own corporate policy, including construction targets which will be applied to the proposed development.

In addition, the contractor Carillion Construction Ltd has its own corporate policy.

4.4 Section Z: Waste

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

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

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

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

4.4.1 Waste Information Packs

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

4.4.2 Design Proposals

Details regarding the Waste and Refuse Strategy are included in the Urban Design Report. Communal refuse chutes for residents will be provided directing both non-recyclable, recyclable waste and food waste to a central storage and collection point. The commercial areas will have their own dedicated waste and recycling collection and storage area in the basement, via chutes for three waste steams (compostable food waste, recyclable and non-recyclable). The commercial waste will be serviced through the lower level of the Coal Drops Yard to reduce impacts on the surrounding ground level public realm.

Sufficient communal refuse storage areas will be provided in compliance with the London Borough of Camden's waste collection policy and with the Code for Sustainable Homes criteria, with the following to be incorporated in the design:

- Storage of non-recyclable waste

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

- Storage of recyclable household waste

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

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

The commercial areas are currently targeting the BREEAM criteria for storage of non-recyclable and recyclable waste.

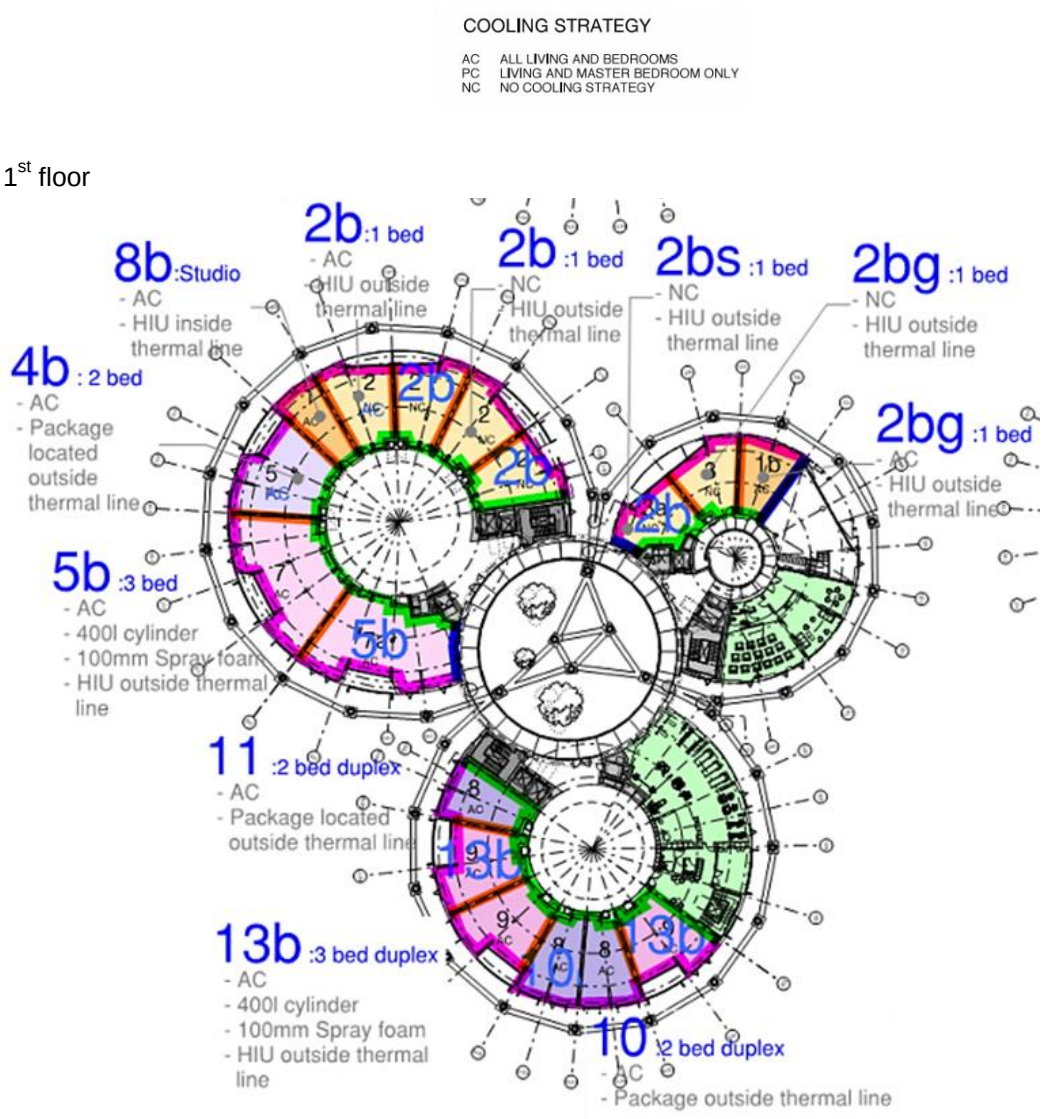
- Composting

Credits will be achieved for promoting the provision of compost facilities to reduce the amount of household waste sent to landfill. The proposal allows residents to choose from one of three waste streams at a chute door. Food waste drops into the 'central chute' to avoid breakages of the food compost bag. The food waste chute tapers into a 240l waste bin which will be used for this waste stream in other parts of Kings Cross (including the Coal Drops Yard). A waste chute cleaner system can be fitted that works by lowering a brush sweep from the top of the chute whilst injecting a disinfectant solution.

- Public Realm

Waste containers will be provided in the public realm, with consideration to the segregation of recyclable waste, as per the containers already used along King's Boulevard, in Granary Square, and other areas of the KXC site.

5.0 Appendix 1 – Dwellings tested under preliminary Part L 2010 calculations



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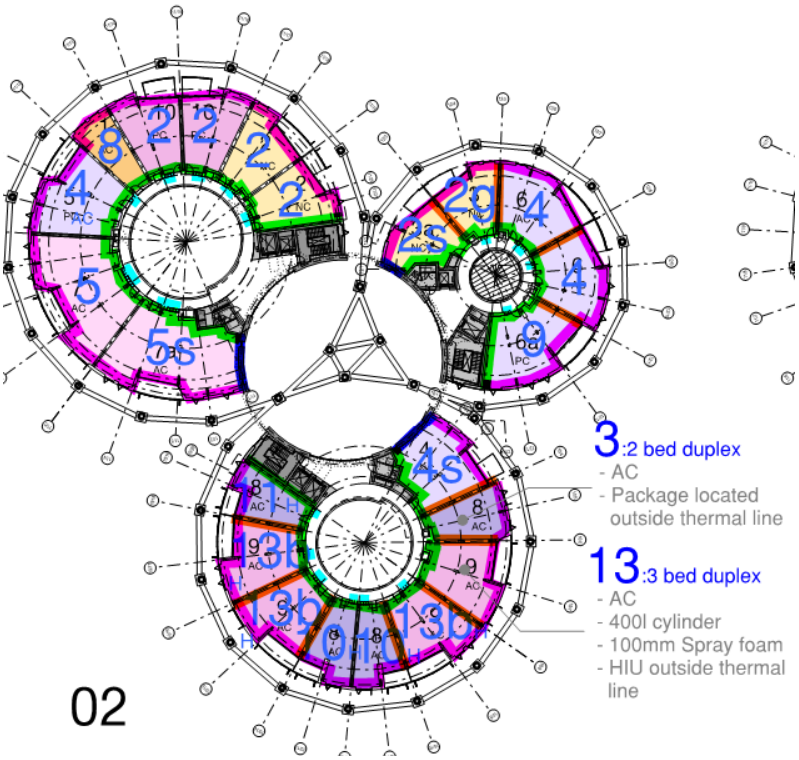

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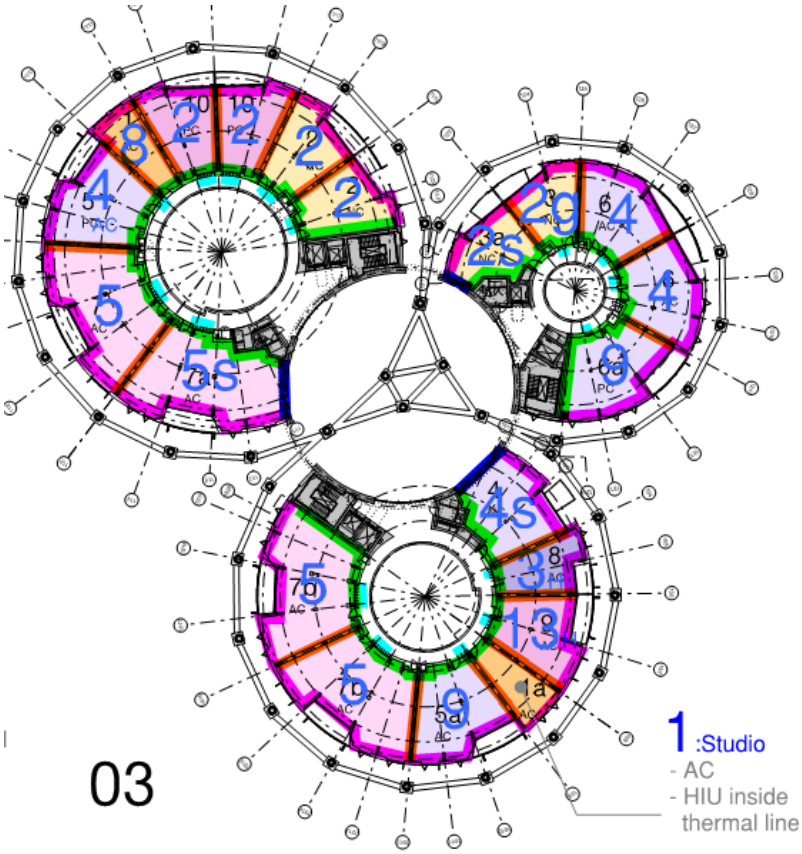
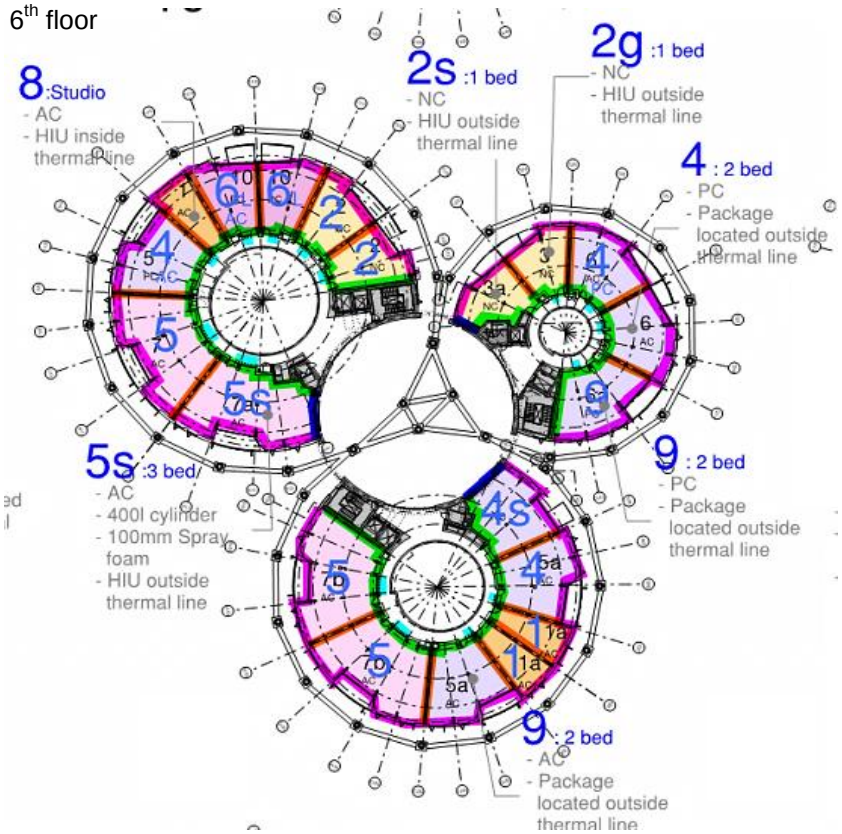
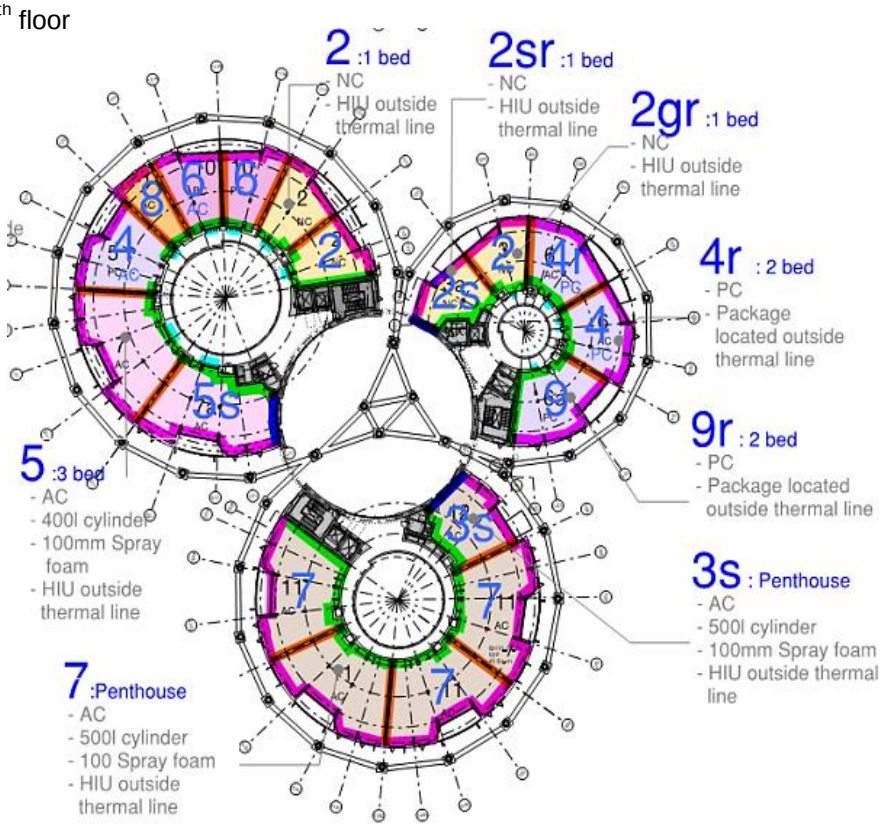


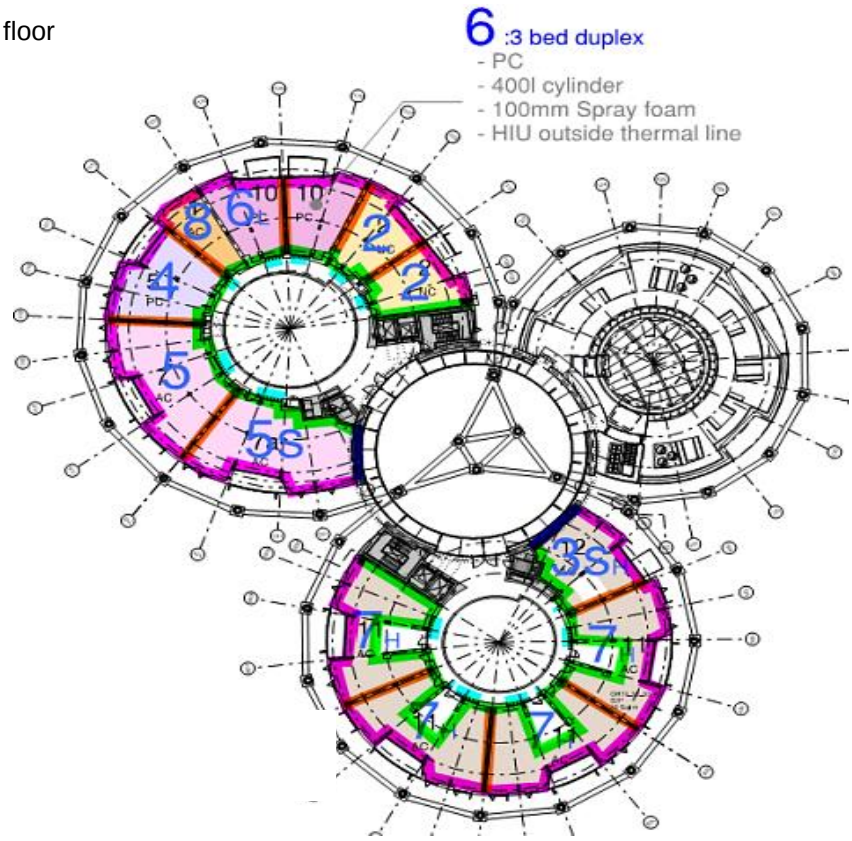
6th floor



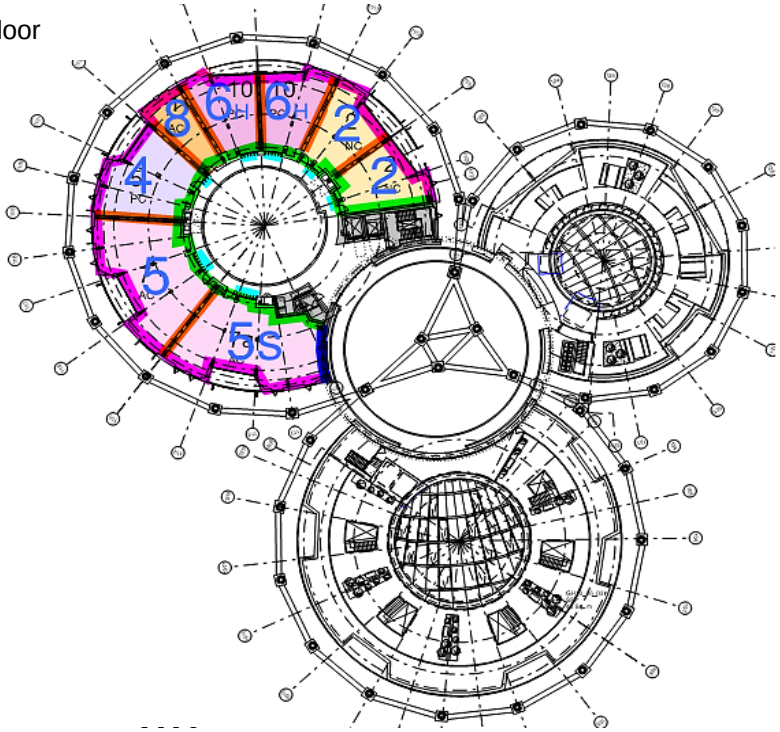
7th floor



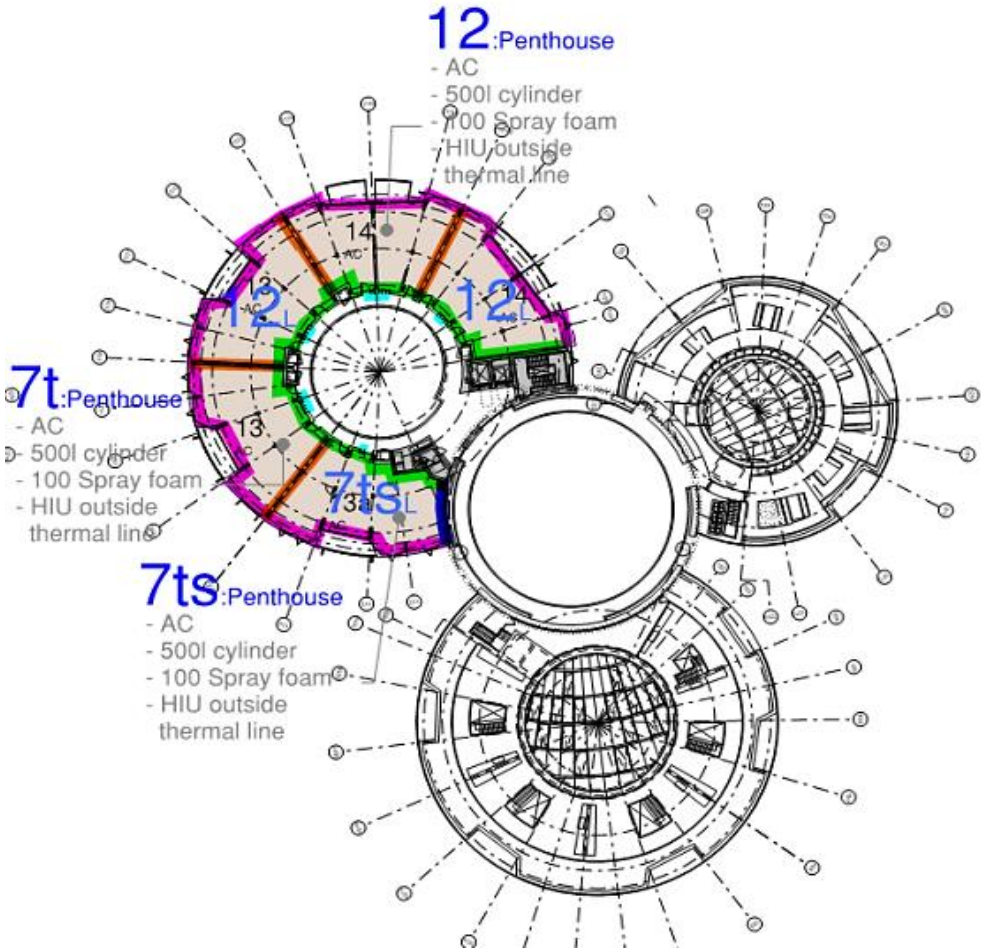
8th floor



9th floor



10th floor


12 :Penthouse
- AC
- 500l cylinder
- 100 Spray foam
- HIU outside
thermal line
7t :Penthouse
- AC
- 500l cylinder
- 100 Spray foam
- HIU outside
thermal line
7ts :Penthouse
- AC
- 500l cylinder
- 100 Spray foam
- HIU outside
thermal line

6.0 Appendix 2– SAP output from assessment of an average performing sample dwelling

L1A 2010 - Regulations Compliance Report
Design - Draft

NHER

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

Assessor name	Ms Roisin Murray	Assessor number	3
Client		Last modified	30/05/2014
Address	11 Kings Cross Triplets, London		

Check	Evidence	Produced by	OK?
Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target			
TER (kg $CO_2/m^2.a$)	Fuel = Mains gas Fuel factor = 1.00 TER = 15.65	Authorised SAP Assessor	
DER for dwelling as designed (kg $CO_2/m^2.a$)	DER = 15.13	Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 15.13 < TER 15.65	Authorised SAP Assessor	Passed
Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits			
Fabric U-values			
Are all U-values better than the design limits in Table 2?	**Element** / **Weighted average** / **Highest** Wall: 0.14 (max 0.30) / 0.14 (max 0.70) Party wall: 0.00 (max 0.20) / N/A Floor: 0.25 (max 0.25) / 0.25 (max 0.70) Roof: (no roof) Openings and curtain wall: 0.87 (max 2.00) / 1.20 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridging			
How has the loss from thermal bridges been calculated?	Thermal bridging calculated using default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems			
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Community heating scheme Secondary heating system: None	Authorised SAP Assessor	N/A
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	No hot water cylinder in the dwelling	Authorised SAP Assessor	
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	Space heating control: Charging system linked to use, programmer and TRVs No hot water cylinder in the dwelling	Authorised SAP Assessor	Passed
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 1 Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed

URN: Dwelling 11 version 2
NHER Plan Assessor version 5.5.4
SAP version 9.90

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Check	Evidence	Produced by	OK?
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Slight Overheating risk (July) = Medium Overheating risk (August) = Medium Region = Thames Thermal mass parameter = 100.00 Ventilation rate in hot weather = 2.50 ach Blinds/curtains = Dark-coloured external shutter, window fully open	Authorised SAP Assessor	**Passed**
Criterion 4: the performance of the dwelling, as designed, is consistent with the DER			
Design air permeability ($m^3/(h.m^2)$ at 50Pa)	Design air permeability = 3.00 Max air permeability = 10.00	Authorised SAP Assessor	**Passed**
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery: SFP = 0.60 W/(litre/sec) Max SFP = 1.5 W/(litre/sec) Heat recovery efficiency = 90.00 % Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	**Passed**
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than $0.2W/m^2K$: • Lower wall - party (0.00) • Lower wall 3 - Inner (0.14) • Upper wall - party (0.00) • Upper wall3 - Inner (0.14) The following openings have a U-value less than $1.5W/m^2K$: • Window reference 1 (1.20) • Window reference 2 (1.20) • Solid door reference 3 (1.20) • Window reference 5 (1.20) • Window reference 6 (1.20) • Window reference 4 (0.80) Design air permeability of 3 $m^3/(h.m^2)$ is less than 5 $m^3/(h.m^2)$ at 50 Pa Space cooling is specified	Authorised SAP Assessor	

URN: Dwelling 11 version 2
NHER Plan Assessor version 5.5.4
SAP version 9.90

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