Energy and Sustainability Statement

(inc. BREEAM LZC Feasibility and LBRuT SCC)

Paragon Asra (PA) Housing

Strathmore Centre
Strathmore Road
Teddington
TW11 8UH

SRE

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	29.11.2019	Sam Paine	Sarah Beasley	Sam Paine
1	B	11.02.2020	Iain Turrell	Sarah Beasley	Sarah Beasley

The figures within this report may be based on indicative modelling and an assumed specification outlined within the relevant sections. Therefore, this modelling may not represent the as built emission or energy use of the Proposed Development and further modelling may need to be undertaken at detailed design stage to confirm precise performance figures. Please contact SRE should you have any questions, or should you wish further modelling to be undertaken post planning.

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This Energy and Sustainability Statement (including Passive Design Analysis and BREEAM LZC Feasibility Study) has been written to demonstrate the measures incorporated into the design of residential and non-residential elements of the Proposed Development at the Strathmore Centre, Teddington, which will deliver lower energy and water use, lower carbon emissions and lower operational costs than a Building Regulations compliant design.

The energy strategy has been developed by following the GLA Energy Hierarchy of Lean, Clean, Green and Seen. The chosen energy strategy includes Lean passive and active design measures and Green LZC technologies to achieve a 35% improvement over Baseline CO_2 emissions.

Regulated carbon dioxide savings from each stage of the energy hierarchy for residential buildings		
	Regulated carbon dioxide savings	
	Tonnes per year	%
Lean	4.48	12.1
Clean	0	0.0
Green	9.43	29.0
Cumulative savings	13.91	37.6
Carbon Shortfall	23.08	

Table 1 – Residential - Summary of regulated carbon dioxide savings

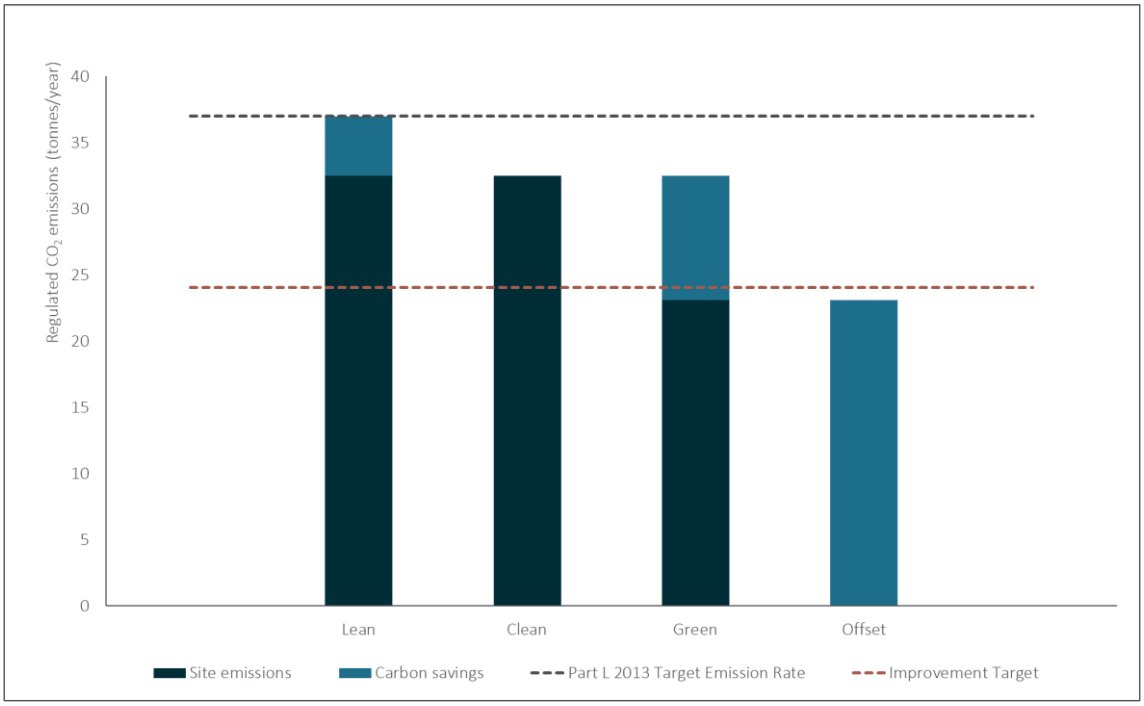


Figure 1 – Residential - Summary of regulated carbon dioxide savings

Regulated carbon dioxide savings from each stage of the energy hierarchy for non-residential buildings		
	Regulated carbon dioxide savings	
	Tonnes per year	%
Lean	1.46	32.7
Clean	0	0.0
Green	0.56	12.6
Cumulative savings	2.02	45.3
Carbon Shortfall	2.44	

Table 2 – Non-residential - Summary of regulated carbon dioxide savings

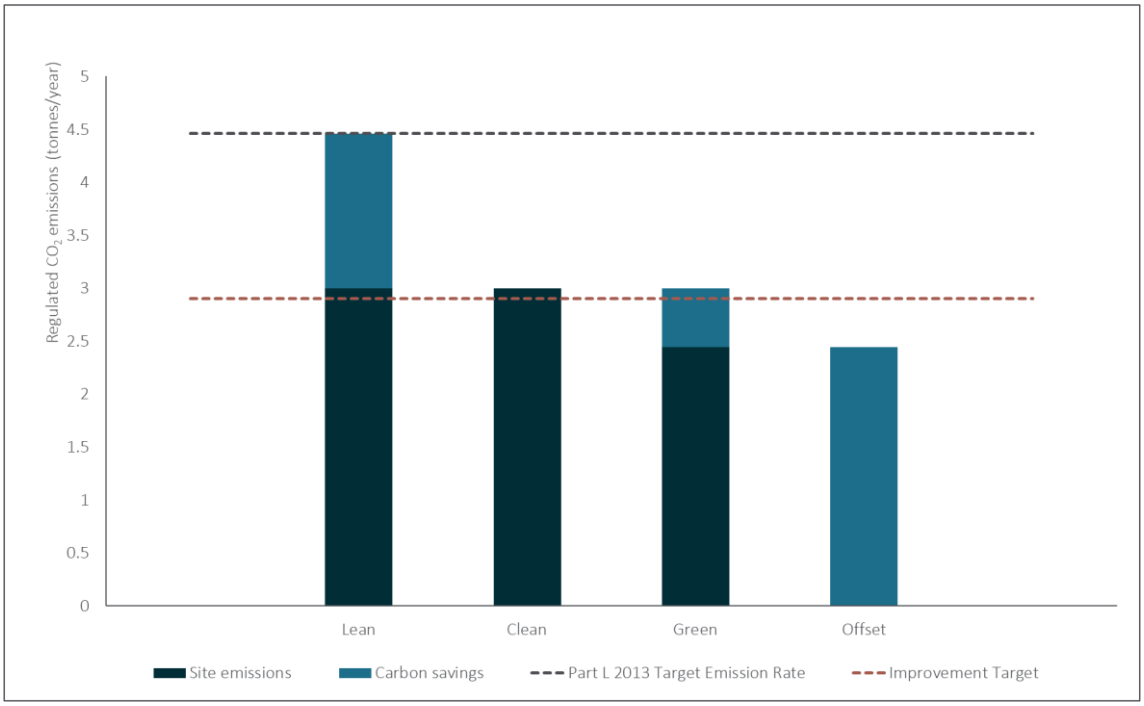


Figure 2- Non-residential - Summary of regulated carbon dioxide savings

Proposed Energy Strategy

- Passive and active design measures including a well-insulated thermal envelope.
- A high-efficiency ASHP system to supply space heating and hot water within the Nursery building.
- Individual high-efficiency gas-fired boilers to supply space heating and hot water within the residential dwellings.
- A 25kWp PV array to provide on-site electrical generation and CO_2 offset for the residential dwellings.

	CO_2 emissions (t/yr)	Improvement over Baseline
Residential	23.08	37.6%
Non-residential	2.44	45.3%

Table 3 - Green on-site emissions summary

The sustainability assessment demonstrates how the Energy Strategy enables the Proposed Development to achieve an 'Excellent level', 6 credits within BREEAM ENE01. The 18.6% reduction of CO_2 emissions using LZC technologies (ASHP and PV) as specified within this BREEAM compliant LZC feasibility study enables 1 credit to be achieved in BREEAM ENE04.

Assessed against the London Borough of Richmond upon Thames (LBRuT) Sustainability Checklist, the Proposed Development scores 52 points, achieving a B rating.

As detailed in Section 2.5, the shortfall in emissions for the residential element (to meet zero carbon standards) of the scheme may be required to be offset through a Carbon Offset Fund set up by the London Borough of Richmond upon Thames.

In addition, the Proposed Development achieves a >35% improvement in overall CO_2 emissions on site, with a 10% and 15% improvement for the residential and non-residential elements respectively, through fabric measures alone.

Introduction

1.0 Introduction

SRE exists to ensure that the built environment enhances life without costing the earth. This Energy and Sustainability Statement has been written by SRE on behalf of Paragon Asra (PA) Housing (the Client) to demonstrate the measures incorporated into the design of The Strathmore Centre, Teddington (the Proposed Development) which will deliver lower energy and water use, lower carbon emissions and lower operational costs than a Building Regulations Compliant design.

The statement compares the predicted actual building energy requirement with a Building Regulations compliant design, outlines passive and active design measures, and assesses the suitability of low and zero carbon (LZC) technologies specific to this site to address the relevant planning policy requirements.

The statement analyses how the Proposed Development will integrate with its surrounding environment within the context of sustainability to ensure it benefits the surrounding area socially, environmentally and economically.

The Proposed Development consists of 2 no. residential blocks, providing a combined total of 30 dwellings with allocated parking for each; a pre-school/nursery amenity with on-site parking and outdoor area; and a communal outside amenity for the site community with associated hard and soft landscaping. The Site is located on Strathmore Road, Teddington, on the existing 'Scamps' site.

Figure 3 – Site plan for the Proposed Development (Living Architects)

As required by the LBRuT Local Plan, the Proposed Development will achieve a BREEAM Excellent rating under the BREEAM New Construction 2018 methodology. Please see the supporting *SRE BREEAM NC 2018 Pre-Assessment* for further details.

The Proposed Development will meet the requirements as set out in the London Plan and the LBRuT Local Plan.

As required by the LBRuT Local Plan, both the residential and non-residential elements of the Proposed Development comply with the Sustainable Construction Checklist SPD, both achieving B ratings.

Carbon Emissions offset has been calculated using SAP 2012 carbon factors as the new version (SAP 10) of Building Regulations has yet to be formally introduced. The output from the GLA SAP 10 conversion tool have been included in Appendix G for reference.

Planning Policy	Requirement
The London Plan (2016)	Policy 5.2 Achieve zero-carbon emissions targets in accordance with the energy hierarchy. Shortfall in on-site reductions should be met through a cash in lieu contribution to the relevant borough.
The (draft) New London Plan (2019) (not yet adopted)	Policy SI2 How the zero-carbon emissions target will be met within the framework of the energy hierarchy.
	Policy SI2 A minimum on-site reduction of 35% with at least 10% (residential) and 15% (non-residential) through energy efficiency (lean) measures alone.
	Policy SI4 Limit internal heat gain through the cooling hierarchy.
	Policy SI5 Achieve mains water consumption of 105 litres or less per head per day (with an additional allowance of 5 litres external water consumption) (residential). BREEAM Excellent level achieved under issue 'Wat 01' – defined as a 12.5% improvement over the defined baseline performance standard (non-residential).
London Borough of Richmond upon Thames Local Plan	Policy LP 22 Comply with the Sustainable Construction Checklist SPD
	Policy LP 22 Achieve mains water consumption of 105 litres or less per head per day (with an additional allowance of 5 litres external water consumption) (residential).
	Policy LP 22 Non-residential buildings over 100m^2 are required to meet BREEAM 'Excellent' Standard.
Further Guidance from LBRuT from: www.richmond.gov.uk /sustainable_construction-checklist	Major residential schemes Every major development proposal should be accompanied by an energy assessment demonstrating how the targets for carbon dioxide emissions reduction will be met within the framework of the energy hierarchy. Zero carbon standards apply to all new major residential development (10 or more housing units) in line with London Plan (2016) policy 5.2 and draft London Plan Policy SI2. This means that at least 35% of regulated CO_2 emission reductions (against a Building Regulations Part L (2013) baseline) must be achieved on-site, with the remaining emissions, up to 100%, to be offset through a contribution to the Council's Carbon Offset Fund. The price for offsetting carbon is regularly reviewed and changes to the GLA's suggested carbon offset price will be updated in future guidance. A nationally recognised non-traded price of £95/tonne has been tested as part of the

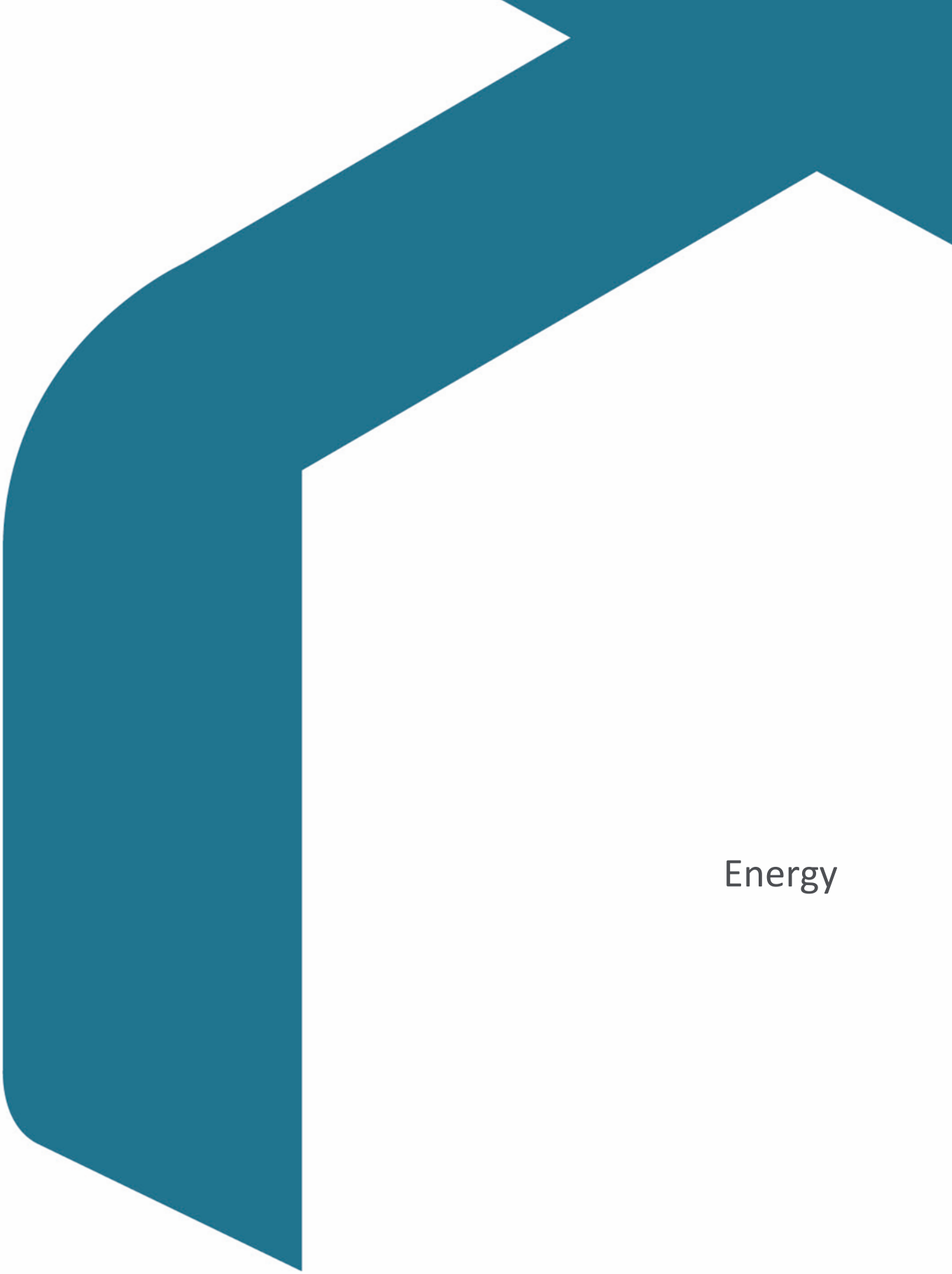
	viability assessment for the London Plan, which this borough will use to collect offset payments. Further detail can be found in the Cabinet Member Decision. Smaller residential and major non-residential schemes Smaller residential schemes (below 10 units) and major non-residential schemes must achieve a 35% reduction in CO_2 emissions (regulated) against a Building Regulations Part L (2013) baseline. If this is not technically feasible and therefore cannot be achieved using on-site measures then applicants will need to demonstrate and justify this as part of a planning application. A cash in lieu contribution to the Council's Carbon Offset fund will be sought in cases where it is not technically feasible.

Table 4 - Summary of local planning policy requirements

Policy Interpretation

Whilst the New London Plan is not yet adopted, it is of material consideration within applications for major development sites. Therefore, based on the policy outlined above, the following standards are targeted:

- Min 35% improvement in CO_2 emissions on site, with 10% (residential) and 15% (non-residential) through energy efficiency (lean) measures alone
- LBRuT Zero Carbon standard for major residential schemes to be met through financial contribution to offset fund
- Non-residential schemes to meet BREEAM 'Excellent' Standards



Energy

2.0 Energy

2.1 Method

The energy strategy design follows national policy guidance[1] and seeks to be:

Lean

minimise the overall environmental impact and energy use through energy efficiency measures

Clean

ensure that energy systems on-site (heat & power) are efficient & produce minimal CO_2 emissions

Green

Implement suitable technologies to provide renewable and emission free energy sources

Seen

incorporate monitoring through SMART metering and accessible displays

As the scheme is classified as a 'Major Development', the CO_2 Conversion Factors (Table 5) have been taken from Building Regulations 2013, rather than the New London Plan updated carbon figures.

	CO_2 Conversion Factor ($kgCO_2/kWh$)
Electricity (mains)	0.519
Electricity (offset)	-0.519
Gas (mains)	0.216
Heating Oil	0.298
Wood Pellets	0.039
Woodchip	0.016

Table 5 - CO_2 conversion factors by energy source

The energy modelling for the Proposed Development has been calculated using SAP (residential) and SBEM (non-residential) software in accordance with Building Regulations 2013 Parts L1A and L2A. The notional building provides the energy baseline and is the exact size and shape of the Proposed Development but is based on existing and notional U-values and heating specifications outlined in Approved Document L and the Non-Domestic Building Services Compliance Guide.

[1]The draft New London Plan https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan

	CO_2 emissions (t/yr)
Residential Baseline	36.99
Non-residential Baseline	4.46

Table 6 – Residential and non-residential Baseline CO_2 emissions

2.2 LEAN – Demand Reduction

The lean scenario implements passive and active design measure to address the minimum reduction in CO_2 emissions required, as set within the London Plan, of 10% for residential and 15% for non-residential developments. The Proposed Development achieves a 12.1% reduction for the residential buildings and a 32.7% reduction for the non-residential buildings through Lean measures.

	CO_2 emissions (t/yr)	Improvement
Baseline	36.99	-
Lean	32.51	12%

Table 7 – Residential – Lean CO_2 emissions and improvement over Baseline

	CO_2 emissions (t/yr)	Improvement
Baseline	4.46	-
Lean	3.00	32.7%

Table 8 – Non-Residential – Lean CO_2 emissions and improvement over Baseline

2.2.1 Passive Design Measures

The residential buildings have been positioned within the site to surround a communal outdoor amenity and provide some privacy. The Nursery building is located on the south side of the site, on the opposite side of the access road/car park. All three buildings have glazing on all elevations, primarily the north and south of Block A, while Block B has glazing primarily on the east and west elevations. This balance of glazing over each elevation enables the buildings to maximise natural light and positive solar gains while limiting potential heat losses. All glazed areas of the buildings will have either shading provided by the building form or internal curtains or blinds. Further solar gains will be further controlled through Low E glazing.

The exact construction method is yet to be determined; however the buildings will be very well insulated through all external elements with a low infiltration rate. Proposed U-values are provided within Table 9 and Table 10. The overall building should have a medium thermal mass as construction will most likely be load-bearing masonry, which will balance providing high energy efficiency and limiting overheating during the summer months.

The Pre-School Nursery will benefit from natural ventilation through openable windows and the relatively open plan nature of the interior will allow adequate cross ventilation.

Element	Notional Compliance (U-value)	Proposed (U-value)
External Walls	0.18	0.15
Ground Floor	0.13	0.12
Roof	0.13	0.15
Windows and rooflights	1.40	1.30
External Doors	1.00	1.40
Air Tightness @ 50 N/m^2	5 ($m^3/hr/m^2$)	4 ($m^3/hr/m^2$)
Thermal Bridge	Standard psi values	Accredited Construction Details (ACDs)

Table 9 – Residential fabric energy efficiencies

Element	Notional Compliance (U-value)	Proposed (U-value)
External Walls	0.26	0.18
Ground Floor	0.22	0.16
Roof	0.18	0.17
Windows and rooflights	1.60	1.40
Air Tightness @ 50 N/m^2	15 ($m^3/hr/m^2$)	5 ($m^3/hr/m^2$)
Thermal Bridge	Not Applicable	Not Applicable

Table 10 – Non-residential fabric energy efficiencies

2.2.2 Active Design Measures

The Proposed Development will utilise 100% low energy/LED lighting in excess of Building Regulation requirements. All external lighting will positioned to avoid excessive light pollution and be supported by PIR/daylight sensor and time controls with a maximum lamp capacity of 150W (equivalent) for essential security lighting.

Time, temperature and optimum start/stop controls will be installed as a minimum to allow the control of individual zones/rooms throughout the building.

In modern air-tight buildings, careful consideration needs to be given to the specification of ventilation systems to ensure moisture is removed and ventilation standards are met to ensure a healthy standard of internal air.

Extract ventilation is provided to all wet-rooms within the nursery building, with passive trickle ventilation and openable windows providing fresh air. The residential dwellings will benefit from Mechanical Ventilation with Heat Recovery and summer by-pass mode. This will enable the dwellings to maintain high levels of fresh air while limiting heat losses.

2.2.3 Cooling

The cooling hierarchy has been used to ensure that passive building design has been optimised to reduce the cooling load for the Proposed Development.

Cooling Hierarchy	Potential Design Measures
Minimising internal heat generation through energy efficient design	All primary pipework to be insulated, therefore low system losses. High specification hot water cylinder installed with low heat loss. Low energy lighting throughout.
Reducing the amount of heat entering the building in summer	Low E glass windows and internal blinds are to be provided to minimize solar gain. All walls are to be well insulated.
Use of thermal mass and high ceilings to manage the heat within the building	Thermal mass is anticipated to be medium with some element of exposed mass.
Passive Ventilation	Openable windows will be provided to all rooms and cross ventilation is possible.
Mechanical Ventilation	Mechanical Ventilation with Heat Recovery is proposed in the residential dwellings, with automatic summer bypass also specified.

Table 11 - Design measures following the cooling hierarchy

2.3 CLEAN – Heating Infrastructure

The Proposed Development will implement a gas-fired heating strategy which will provide space heating and hot water to all areas of the building through a centralised system. Furthermore, while connection to a district heat network is not currently possible, the installation of a 'wet' system would allow the Proposed Development to easily connect to a new network in the future.

	CO_2 emissions (t/yr)	Improvement
Lean	32.51	
Clean	32.51	0%

Table 12 – Residential – Clean CO_2 emissions and improvement over Lean

	CO_2 emissions (t/yr)	Improvement
Lean	3.00	
Clean	3.00	0%

Table 13 – Non-residential – Clean CO_2 emissions and improvement over Lean

District Heat Networks

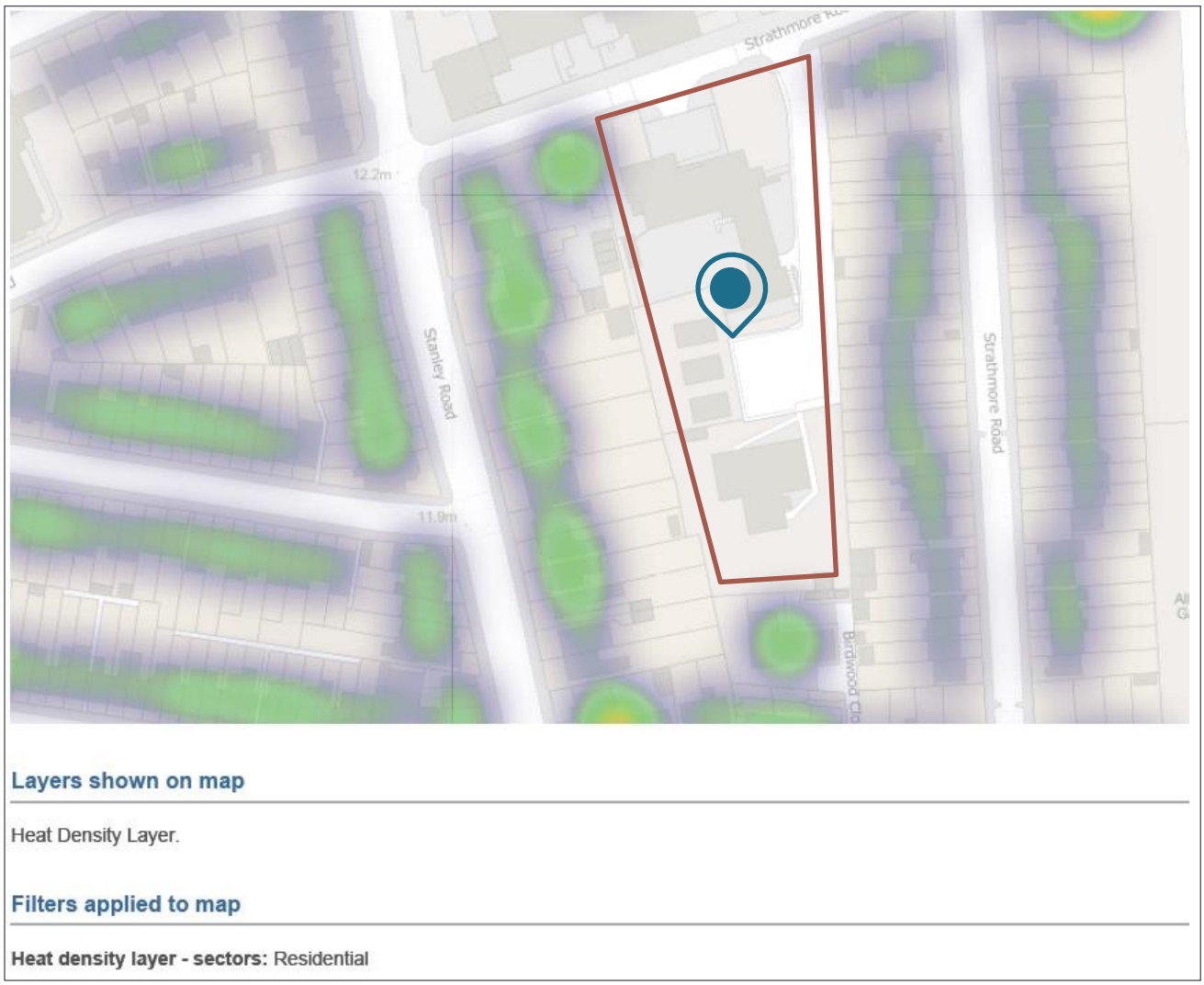


Table 14 - London Heat Map (maps.london.gov.uk/heatmap/)

The London Heat Map shows that the Proposed Development is within an area of reasonable heat density. While the area could benefit from the installation of a district-wide network, there is not yet one installed or planned. Furthermore, with the incoming SAP 10 carbon factors and reduction in modelled standard heat network distribution efficiency, the use of a site-wide heat network would have little benefit in reducing carbon emissions and improving the overall energy efficiency of the site.

Modelling has shown that the Nursery will have little hot water demand, and the demand from the residential blocks should be negligible during the day. There are traits which would prevent the efficient operation of a potential site-based heat network outside of the November to February heating season. Conversely, heat

demand during the day at the Nursery and during the evening in the residential blocks would provide a more balance to a potential heat network demand profile.

As a result of the above investigations, it is determined that the use of a building level centralised 'wet' system in the Nursery building will allow easy adaptation to connect to a future network if it is installed in the area. The residential buildings will implement individual gas boilers to provide an energy and carbon efficient solution, which will also provide affordable heating and hot water for the foreseeable future.

Communal Systems

The Nursery building will install a building level centralised 'wet' system while the residential blocks will use implement individual heating systems.

2.4 GREEN – Low Carbon and Renewable Energy

The addition of 'Green' technologies can provide a significant reduction in CO_2 emissions and enable the Proposed Development to meet the threshold of 35% improvement over Baseline emissions, in addition to the measures already incorporated above.

The residential blocks will implement photovoltaic arrays, while the Nursery building will implement an air source heat pump (ASHP) system to achieve this on-site improvement requirement.

	CO_2 emissions (t/yr)	Improvement
Clean	32.51	
Green	23.08	30%

Table 15 – Residential – Green CO_2 emissions and improvement over Clean

	CO_2 emissions (t/yr)	Improvement
Clean	3.00	
Green	2.44	19%

Table 16 – Non- Residential – Green CO_2 emissions and improvement over Clean

2.4.1 Photovoltaics

Photovoltaic (PV) panels convert energy from daylight into direct (DC) electrical current. These are generally roof mounted and provide electrical generation which can either be utilised directly on-site (or nearby), stored in batteries, or exported back to the National Grid.

The installation of PV could be used to offset electrical demand within the Proposed Development. The PV array would be connected into the electrical system via an inverter or series of inverters, depending on system size and setup.

Noise will not be an issue – A PV system does not feature moving parts and is silent during operation.

An indicative investigation into the roof area of the Proposed Development shows that there is approximately 250m^2 of available roof area, highlighted in red within Figure 4. The PV array is proposed to be installed on the main roof of Block B which is pitched facing east. There is also a suitable area on Block B facing south, and although this is not currently modelled to be utilised, it is available for the final PV array. Modelling shows that

as a worst-case scenario, if only the east facing roof is used, the array could provide adequate generation. The array will be wired back to Block A to offset the emissions of all the dwellings at the Proposed Development.

Based on a 300W monocrystalline module (~1.7m^2 in area) there is the potential for an overall 25kWp PV array to be installed horizontally. However, installation of PV horizontally will not provide optimal performance and would void the manufacturer warranty. As such, panels should would be installed at a minimum 15-degree pitch, which would increase the required spacing to prevent the panels shading each other.

Proposed Array (kWp)	Approximate no. Panels @300W	Active Area (m^2)	Pitch (degrees)	Orientation	Annual Generation (kWh/yr)
25.00	83	141	15	East	18,157

Table 17 - Proposed PV Array Summary

Figure 4 –Roof space at the Proposed Development – area available for PV highlighted in red

2.4.2 Air Source Heat Pump

All Heat Pump systems consume electricity to operate - the Coefficient of Performance (CoP) of the system is the ratio of electrical energy consumed, to heat energy emitted. Generally, a CoP of 3 or 4 can be achieved, meaning 3 or 4 units of thermal energy are produced for each unit of electricity consumed.

Heat pumps will only deliver low grade heat (up to ~50°C) efficiently, and therefore HP systems alone are generally relatively inefficient in providing hot water, as this requires additional electrical input (immersion or increased compressor use).

The capital costs incurred with heat pumps can be offset through installing a system that is eligible for the Renewable Heat Incentive (RHI) scheme, whereby the owner/occupant can receive quarterly payments over seven years. The amount of income received is dependent on the technology installed, metering and the latest tariffs available.

The use of Air Source Heat Pumps (ASHP) has the potential to supply the Nursery building with the heating requirements, subject to the provision of oversized/low temperature radiators or an underfloor heating system (air-to-water systems).

ASHPs tend to generate some noise and therefore the location/space in which the pump is positioned would need to be adequately sound insulated in order to prevent disturbances to the building's occupants and neighbours.

2.4.3 Energy Storage

While the Proposed Development could include battery energy storage, it is believed that the PV generation will not exceed usage at the site, therefore it is unlikely that generation would not be used on-site.

2.5 Carbon Offsetting

The London Plan and the London Borough of Richmond upon Thames Planning policy state that major development schemes may be required to be zero carbon. The calculation for the contribution to the carbon offset fund required for the Proposed Development is taken from the taken from the results of the Building Regulation Part L 2013 modelling as outlined within the London Borough of Richmond upon Thames Sustainable Construction Checklist guidance which states:

"Zero carbon standards apply to all new major residential development (10 or more housing units) in line with London Plan (2016) policy 5.2 and draft London Plan Policy SI2. This means that at least 35% of regulated CO_2 emission reductions (against a Building Regulations Part L (2013) baseline) must be achieved on-site, with the remaining emissions, up to 100%, to be offset through a contribution to the Council's Carbon Offset Fund.

The price for offsetting carbon is regularly reviewed and changes to the GLA's suggested carbon offset price will be updated in future guidance. A nationally recognised non-traded price of £95/tonne has been tested as part of the viability assessment for the London Plan, which this borough will use to collect offset payments."

Therefore, the following formula is used to calculate the Carbon Offset payment which may be required:

Carbon Shortfall (t/year) x 30 (years) x £95

The resultant emissions from the energy modelling undertaken show that the non-residential element of the scheme achieves the required 35% improvement on site and therefore no further offset is required for this element. For the residential aspect of the scheme, a carbon shortfall has been identified of 23.08 tonnesCO_2/year, resulting in the following calculation:

23.08 x 30 x 95

Total potential required contribution = £65,778

2.6 SEEN – In-use monitoring

It is recommended that the Proposed Development will be supplied with Smart Meters (where available from the utility supplier) for all three blocks and a building energy management system (BEMS) along with associated internal energy displays within the Nursery. This will further improve energy efficiency by allowing building managers to observe their energy use in 'real time' and manage it more effectively.

2.7 Conclusions

The Proposed Development will deliver passive and active energy demand reduction measures along with low and zero carbon technologies in order to reduce energy demand and associated CO_2 emissions resulting from the Proposed Development's operation.

	CO_2 emissions (t/yr)	Improvement	Improvement over baseline
Baseline	36.99		
Lean	32.51	12%	12%
Clean	32.51	0%	12%
Green	23.08	30%	38%
Net Zero Carbon	0	100%	100%

Table 18 - Residential - Summary of CO_2 emissions, incremental improvement and improvement over Baseline

	CO_2 emissions (t/yr)	Improvement	Improvement over baseline
Baseline	4.46		
Lean	3.00	33%	33%
Clean	3.00	0%	33%
Green	2.44	19%	45%

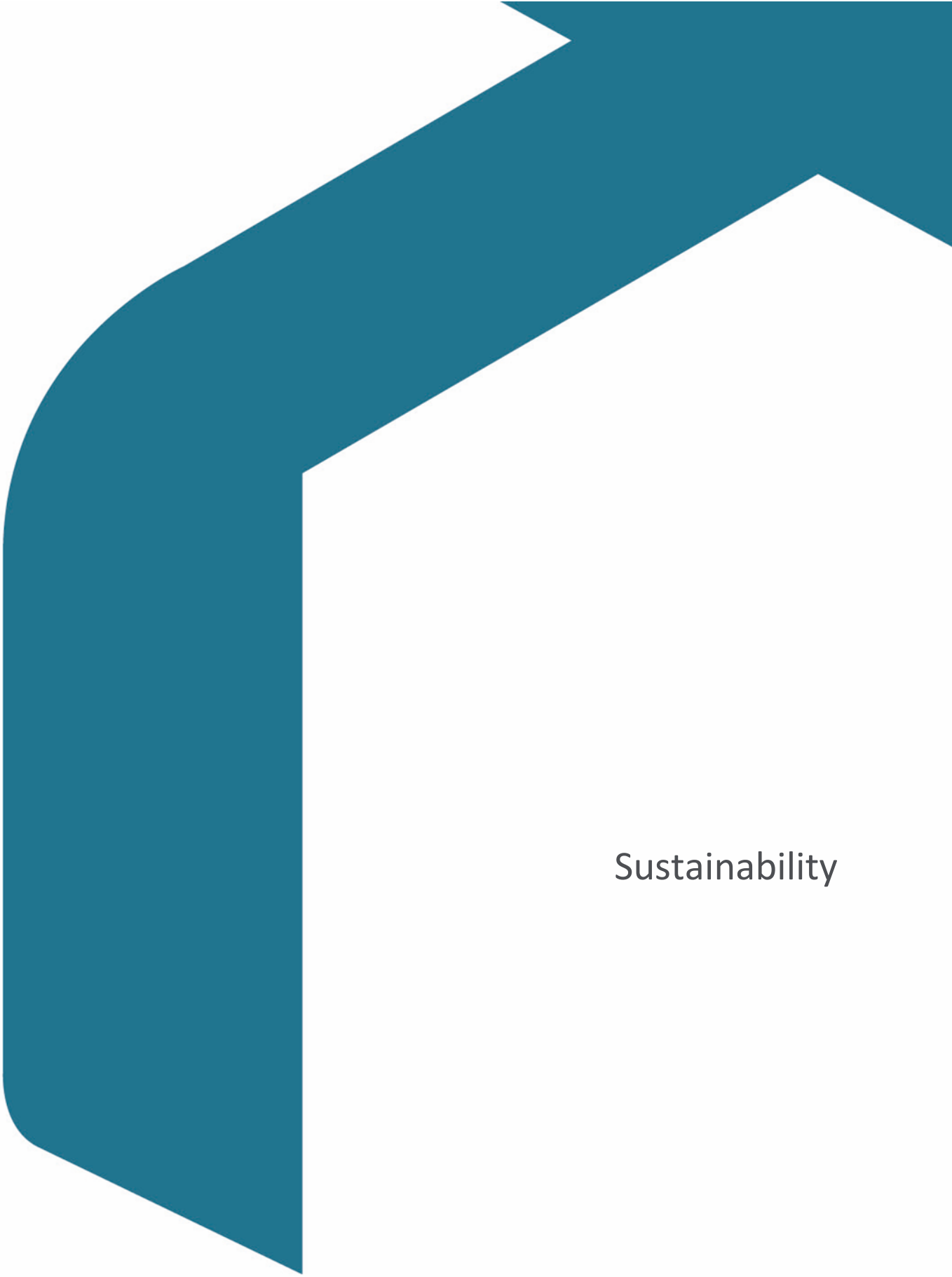
Table 19 – Non-residential - Summary of CO_2 emissions, incremental improvement and improvement over Baseline

The calculations undertaken demonstrate that the Proposed Development will successfully exceed Building Regulations Part L compliance by (i) more than 10% in the residential dwellings and more than 15% in the Nursery building through passive and active ('Lean') measures and, (ii) more than 35% overall in all three buildings, achieving the on-site emissions reductions requirements set by the London Plan. The remaining offset for the residential element of the scheme will be provided through a contribution to the LBRuT carbon offset fund.

The energy performance of the Proposed Development and meaningful reduction in CO_2 emissions allows 6 credits to be achieved under BREEAM NC 2018 issue ENE01 and 1 credit under issue ENE04.

In delivering the Green energy strategy, the Proposed Development provides:

- Passive and active design measures including a well-insulated thermal envelope.
- A high-efficiency ASHP system to supply space heating and hot water within the Nursery building.
- Individual high-efficiency gas boilers to supply space heating and hot water to residential dwellings.
- A 25kWp PV array to provide on-site electrical generation and CO_2 offset for the residential dwellings.



Sustainability

3.0 Sustainability

The World Commission on Environment and Development (WCED) report: Our Common Future, describes Sustainable Development as development that:

"meets the needs of the present without compromising the ability of future generations to meet their own needs."

3.1 Environmental Assessment

BREEAM

The BREEAM family of environmental assessment methods (BRE's Environmental Assessment Method) is a scheme that aims to quantify and reduce the environmental burdens of buildings by rewarding those designs that take positive steps to minimise their environmental impacts.

The scheme will be assessed under the BREEAM New Construction 2018 methodology.

The assessment process results in a report covering the issues assessed together with a formal certification giving a rating on a scale of PASS, GOOD, VERY GOOD, EXCELLENT and OUTSTANDING.

As per the LBRuT Local Plan, the Nursery will achieve an 'Excellent' rating under the BREEAM New Construction 2018 methodology.

This includes an 'Excellent' level under issues ENE01 and WAT01. The achievement of an 'Excellent' level under issue WAT01 is a requirement of the New London Plan.

For full details please see the supporting *SRE BREEAM NC 2018 Pre-Assessment*.

3.2 Pollution

Air

The Proposed Development will aim to limit its contribution to local air pollution by installing low NO_x gas boilers, an ASHP system and PV. The ASHP will emit no onsite NO_x emissions but consumes grid electricity. As the NO_x emissions resulting from the production of electricity decreases at the national scale, the resulting theoretical emissions from the Proposed Development will do also. Furthermore, the use of PV panels will decrease the import of electricity from the national grid and replace it with PV electricity which produces no emissions during operation.

The Proposed Development is located within a high NO_x emissions area as defined by the UK NO_x emissions map, see Figure 5.

Noise

The Proposed Development is located on the site of an educational facility and will not produce any greater noise pollution than was generated during the operation of the previous site. Furthermore, the Proposed Development will be a highly insulated building with excellent air-tightness which should limit any noise leakage from inside the building far below that of the existing site.

The Proposed Development provides minimal car parking for the Nursery building, instead, encouraging visitors to use public transport rather than personal vehicles which may contribute to general noise pollution in the area. Each residential dwelling has one allocated parking place.

An external noise impact assessment will be completed pre and post construction to ensure background ambient noise levels are not impacted through external plant and machinery once the site is operational. This assessment is required as part of the BREEAM assessment.

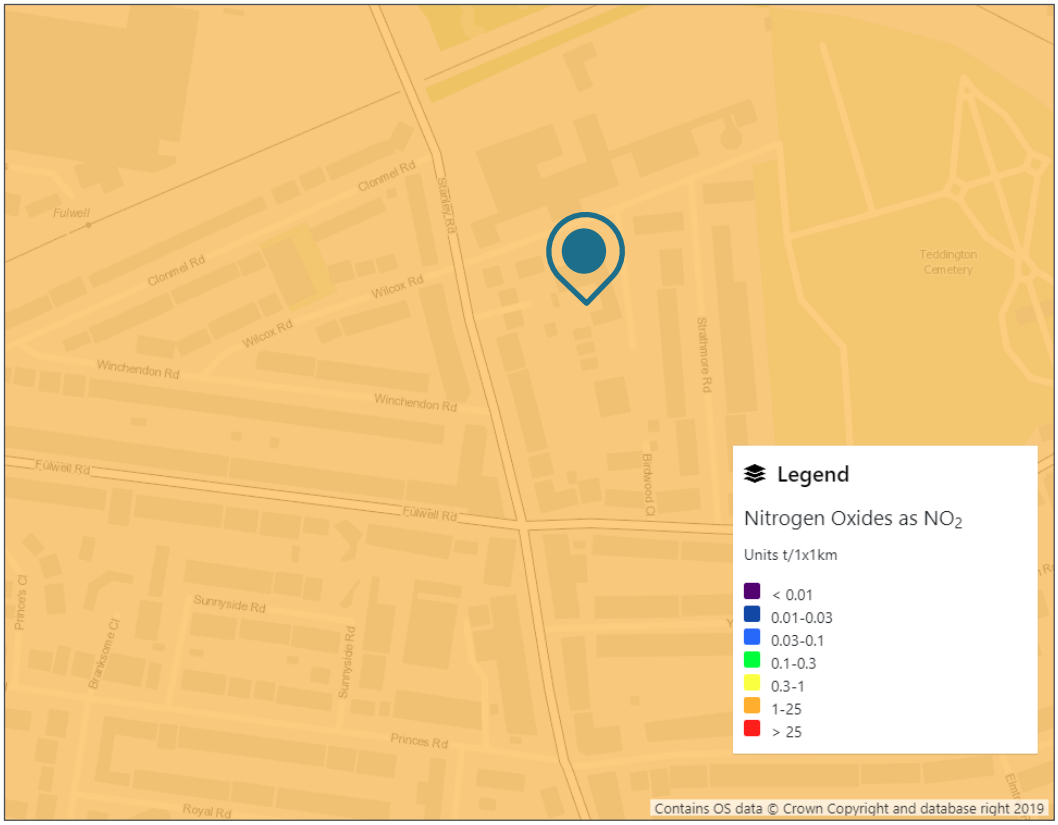


Figure 5 - UK Air Pollution Map showing pollution from Nitrogen Oxides as NO2 (https://naei.beis.gov.uk/emissionsapp/)

Light

The design and layout of the site for practical use has been considered while trying to maximise internal daylight levels. All occupied spaces throughout all three buildings have glazing to provide natural daylight, while light-coloured curtains or roller blinds will be provided to enable glare control and privacy.

Light Pollution will be minimised where possible through the careful specification and positioning of external lighting around the Proposed Development, ensuring minimal light pollution from the site. Special attention will be given to security lighting (where fitted) to ensure it is appropriately focussed and controlled.

All external space lighting around the buildings, where in addition to the standard lighting required for communal walkways, will be provided through low energy fittings, with security lighting being PIR and daylight/timer controlled. Any external signage, where installed and lit, will be installed and controlled in line with best practice and BREEAM requirements.

3.3 Flood Risk

The selected site is at very low risk of flooding from rivers and seas (Figure 6) and while the surrounding area has several roads shown as at low risk of flooding from surface water, the roads adjacent are mainly very low and low risk (Figure 7). The site itself is shown to be at low risk of flooding from surface water, which will be factored into the drainage design of the Proposed Development.

The Proposed Development has undertaken a full flood risk assessment and will include Sustainable urban Drainage System (SuDS) as part of the measures to reduce surface water run-off from the site. This will be assessed under the BREEAM issue Pol03.

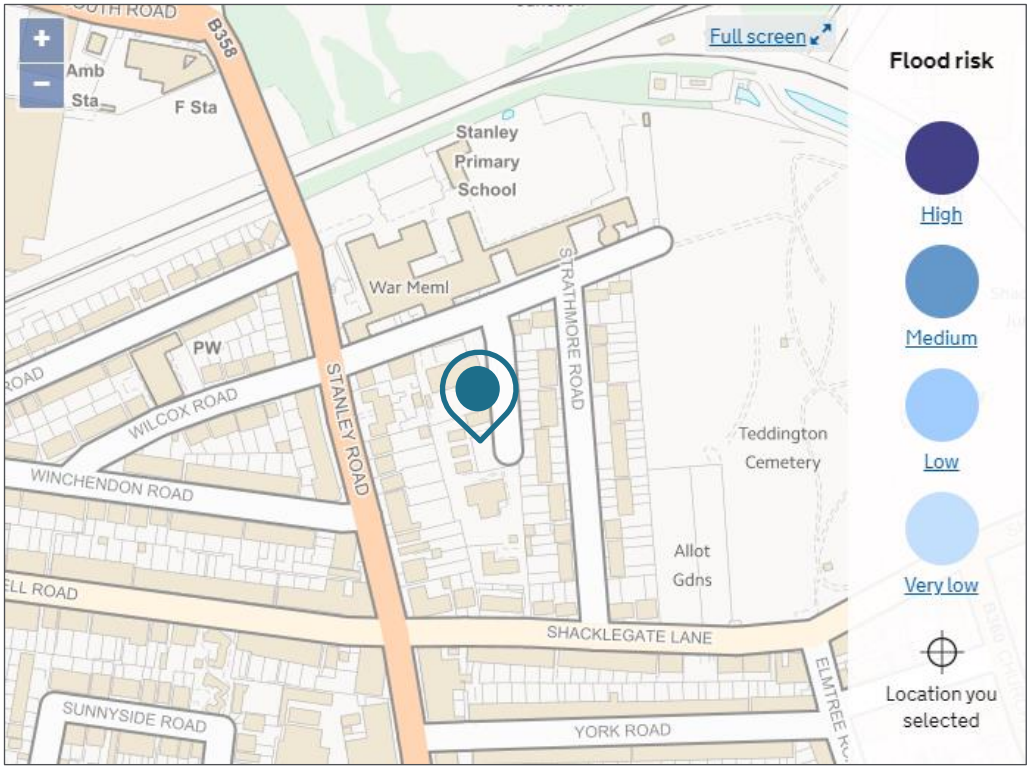


Figure 6 - Flood map showing risk of flooding from rivers or the sea (https://flood-warning-information.service.gov.uk/long-term-flood-risk/map)

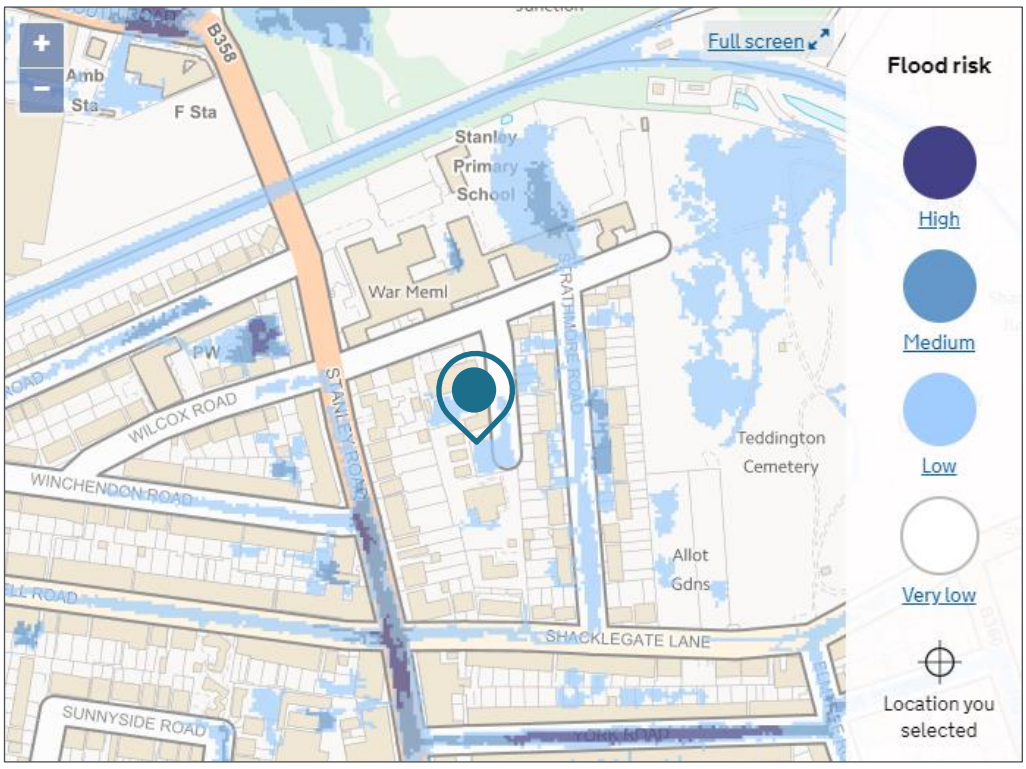


Figure 7 - Flood map showing risk of flooding from surface water (https://flood-warning-information.service.gov.uk/long-term-flood-risk/map)

3.4 Transport

Public Transport

The site has multiple bus stops in the surrounding area, with several on Stanley Road – the nearest being 100m from the site. The nearest train station for overground services is Fulwell, a 5-minute walk to the north-west.

Parking

The Proposed Development will provide 34 parking spaces for the residential dwellings, including 3 disabled and 4 visitor spaces. A further 4 spaces will be allocated for the Nursery, including 2 drop-off and 1 disabled space. The limited on-site parking will promote the use of public transport by residents, visitors and staff.

Electric Vehicle Charging

The one on-site parking space planned to be allocated to the Nursery will include an electric vehicle (EV) charging point. In the instance that one is not provided at the site, or it is in use and another required, the nearest alternative charging station is 600m away at an 'ubitricity Charging Station', on Royal Road, Teddington.

Car-Pooling

There is a car-pooling service provided by Zip Car, located 1.1km away on Claremont Road, Teddington. To use this service, you must be a member of the Zip Car scheme (join online for free). Proximity to a car-pooling service will allow residents access to cars without the need to own one.

Cycle Storage

The Proposed Development has allowed space for 4 cycle spaces allocated to the Nursery and 56 for the residential dwellings, all of which will be suitably covered and lit.

Cycle Rental

The nearest 'Santander Cycle' point is located on the edge of Wandsworth, at Neville Gill Close, 13km away. However, local cycle rental services are available, for example, Moore's cycles just 3km away provides cycle rental on a daily or weekly basis.

3.5 Biodiversity

Biodiversity is generally considered to be the variety of life forms within a certain ecosystem. The Proposed Development currently consists of an educational facility and is therefore expected to be of low ecological value.

A BREEAM compliant full ecological report must be undertaken by a suitably qualified ecologist in order to determine the initial findings of this report and advise if there is any potential of enhancing the biodiversity elements on site.

3.6 Resource efficiency

Construction Phase Waste Management

The Proposed Development will aim to minimise the waste produced from the site during the construction phase.

A comprehensive Construction Management Plan will be implemented from the outset of site works and will meet the BREEAM requirements for waste management and will follow the principles of the waste hierarchy. Targets have been set in relation to volume of construction waste and diversion from landfill, and these can be viewed within the respective Pre-Assessments for each building.

The construction waste generated as part of the redevelopment will be segregated and monitored as per best practice, with suitable materials being recycled as part of this process, either to be reused on site or introduced back into the supply chain through recycling by a Licensed Contractor, therefore minimising the amount of waste being disposed of in landfill sites.

Reusing materials on site will reduce the embodied energy of the development through the reuse of the energy that exists in that material. Transportation of new material to the site will be reduced, reducing the CO_2 emissions associated with transportation and material manufacture.

Where waste will need to be disposed of, this will be done in line with the Waste Hierarchy, with as much as practicable being recycled, and the remainder being dealt with through a specialist waste recycling contractor. Nominal construction waste should be sent to landfill or for incineration unless this is unavoidable due to the materials found on the existing site.

Appropriate targets and benchmarks will be set, and documentation and evidence retained to fulfil the relevant BREEAM requirements.

Resource Management

Policies will be put in place for management of site impacts such as air and water pollution in line with industry best practice. Monitoring and reporting on carbon emissions and water use from site related activities will take place in line with national benchmarks.

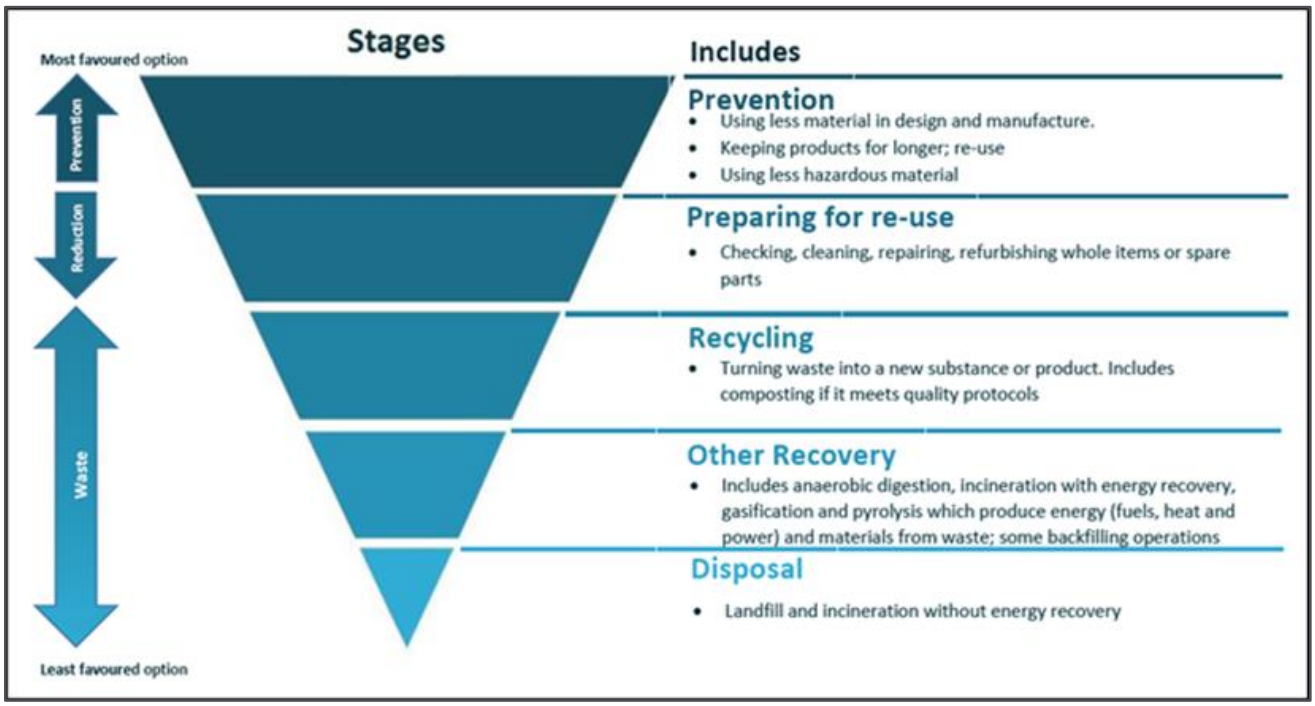


Figure 8 - The waste hierarchy

The overall management of the construction waste will be monitored through the Considerate Constructors Scheme as part of Best Practice Site Management.

Materials

The Proposed Development is to use high quality, low impact materials in order to minimise the overall impact on the environment as far as possible.

The form of construction is anticipated to be of traditional load bearing masonry.

All timber materials for finishing elements will be sourced from FSC and/or PEFC sources and all other materials sourced from suppliers who have an accredited Environmental Management System (EMS) (ISO14001, BS8555 or BES6001) for the extraction and process stages of the material manufacturing, ensuring that any environmental impact caused by the building materials is analysed and mitigated where possible.

All timber and timber-based products use on-site will be legally sourced with appropriate Chain of Custody certification to confirm this.

As standard industry best-practice, all insulation on the site will have an Ozone Depletion Potential (ODP) of zero, and a Global Warming Potential (GWP) of <5, further minimising the Proposed Developments effect on global Climate Change.

Water

Areas of the South East of England have been declared areas of 'serious water stress', particularly Greater London. Water is a vital resource and efficient usage should be encouraged in all new buildings. The Proposed Development aims to significantly reduce mains water use through a combination of efficiency measures, including the use of fittings with a low capacity or flow restrictors to reduce water use and PIR sensors linked to water shut-offs valves to reduce the chances of water waste.

Internal water use will be reduced in line with BREEAM standards and an indicative specification has been given below, but the BREEAM Pre-Assessment should be consulted for definite targets.

- WCs: 3.75 litre effective flush volume
- If 1 urinal only: 2.00 litres/bowl/hour
- If 2 or more urinals at the site: 1.50 litres/bowl/hour
- Hand wash basin taps: 5.00 litres/min
- Kitchenette taps: 6.00 litres/min
- Showers: 6.00 litres/min
- Baths: 140 litres
- Domestic sized dishwashers (if installed) 12.00 litres/cycle
- Domestic sized washing machines (if installed) 40.00 litres/use

3.7 LBRuT Sustainable Construction Checklist

The LBRuT checklist has been completed for the Proposed Development and achieves a score of 52, which equates to a B rating for the non-residential element, and a high B rating for the residential element. This is the minimum score that the Proposed Development can achieve and further points may be awarded through surface water run-off and accessibility sections, the details of which will be confirmed during the detailed design stage.

LBRUT Sustainable Construction Checklist - January 2016

This document forms part of the Sustainable Construction Checklist SPD. This document **must** be filled out as part of the planning application for the following developments: all residential development providing **one or more new residential units (including conversions leading to one or more new units)**, and all other forms of development providing **100sqm or more of non-residential floor space**. Developments including new non-residential development of less than 100sqm floor space, extensions less than 100sqm, and other conversions are strongly encouraged to comply with this checklist. Where further information is requested, please either fill in the relevant section, or refer to the document where this information may be found in detail, e.g. Flood Risk Assessment or similar. **Further guidance** on completing the Checklist may be found in the Justification and Guidance section of this SPD.

Property Name (if relevant):	The Strathmore Centre	Application No. (if known):	
Address (include. postcode)	Strathmore Road, TW11 8UH		
Completed by:	S. Paine - SRE Ltd		
For Non-Residential		*For Residential*	
Size of development (m2)	293.7	Number of dwellings	30

1	**MINIMUM COMPLIANCE (RESIDENTIAL AND NON-RESIDENTIAL)**			
Energy Assessment				
	Has an energy assessment been submitted that demonstrates the expected energy and carbon dioxide emissions saving from energy efficiency and renewable energy measures, including the feasibility of CHP/CCHP and community heating systems? If yes, please tick.			Yes
Carbon Dioxide emissions reduction				
	What is the carbon dioxide emissions reduction against a Building Regulations Part L (2013) baseline			40
	Policy DM SD 1 and London Plan Policy 5.2 (2015) require a 35% reduction in CO_2 emissions beyond Building Regulations 2013.			
	Percentage of **total** site CO2 emissions saved through renewable energy installation?			30
1A	**MINIMUM POLICY COMPLIANCE (NON-RESIDENTIAL AND DOMESTIC REFURBISHMENT)**			
	Please check the Guidance Section of this SPD for the policy requirements			
Environmental Rating of development:				
Non-Residential new-build (100sqm or more)				
	BREEAM Level	Excellent	Have you attached a pre-assessment to support this?	☑
Extensions and conversions for residential dwellings				
	BREEAM Domestic Refurbishment	Please Select	Have you attached a pre-assessment to support this?	☐
Extensions and conversions for non-residential buildings				
	BREEAM Level	Please Select	Have you attached a pre-assessment to support this?	☐
	Score awarded for Environmental Rating:			**Subtotal** 8
	BREEAM:	Good = *0*, Very Good = 4, Excellent = *8,* Outstanding = *16*		
1B	**MINIMUM POLICY COMPLIANCE (RESIDENTIAL)**			
Water Usage				
	Internal water usage limited to 105 litres person per day. (Excluding an allowance 5 litres per person per day for external water consumption). Calculations using the water efficiency calculator for new dwellings have been submitted.			☑ *1*
				Subtotal 1
2. ENERGY USE AND POLLUTION				
2.1 Need for Cooling				***Score***
a.	How does the development incorporate cooling measures? Tick all that apply:			
		Energy efficient design incorporating specific heat demand to less than or equal to 15 kWh/sqm		☐ *6*
		Reduce heat entering a building through providng/improving insulation and living roofs and walls		☑ *2*
		Reduce heat entering a building through shading		☑ *3*
		Exposed thermal mass and high ceilings		☑ *4*
		Passive ventilation		☑ *3*
		Mechanical ventilation with heat recovery		☑ *1*
		Active cooling systems, i.e. Air Conditioning Unit		☐ *0*
2.2 Heat Generation				
b.	How have the heating and cooling systems, with preference to the heating system hierarchy, been selected (defined in London Plan policy **5.6**)? Tick all heating and cooling systems that will be used in the development:			
		Connection to existing heating or cooling networks powered by renewable energy		☐ *6*
		Connection to existing heating or cooling networks powered by gas or electricity		☐ *5*
		Site wide CHP network powered by renewable energy		☐ *4*
		Site wide CHP network powered by gas		☐ *3*
		Communal heating and cooling powered by renewable energy		☐ *2*
		Communal heating and cooling powered by gas or electricity		☐ *1*
		Individual heating and cooling		☑ *0*
2.3 Pollution: Air, Noise and Light				
a.	Does the development plan to implement reduction strategies for dust emissions from construction sites?			☑ *2*
b.	Does the development plan include a biomass boiler?			☐ -
		If yes, please refer to the biomass guidelines for the Borough of Richmond, please see guidance for supplementary information. If the proposed boiler is of a qualifying size, you may need to completed the information request form found on the Richmond website.		☐ -
c.	Please tick only one option below			
		Has the development taken measures to reduce existing noise and enhance the existing soundscape of the site?		☐ *3*
		Has the development taken care to not create any new noise generation/transmission issues in its intended operation?		☑ *1*
d.	Has the development taken measures to reduce light pollution impacts on character, residential amenity and biodiversity?			☑ *3*
e.	Have you attached a Lighting Pollution Report?			☐ -
				Subtotal 19
Please give any additional relevant comments to the Energy Use and Pollution Section below				
Non-residential building to have green roof, exposed thermal mass and high ceilings Residential Buildings to have green roof, well insulated All glazing to have shading provided either through the building form, or via light coloured curtains or roller blinds. All external lighting to be BREEAM compliant.				

3. TRANSPORT

3.1 Provision for the safe efficient and sustainable movement of people and goods

a.	Does your development provide opportunities for occupants to use innovative travel technologies?		
	Please explain:		
b.	Does your development include charging point(s) for electric cars?	☑	2
c.	**For major developments ONLY**: Has a Transport Assessment been produced for your development based on TfL's Best Practice Guidance?		
	If you have provided a Transport Assessment as part of your planning application, please tick here and move to Section 3 of this Checklist.	☑	5
d.	**For smaller developments ONLY**: Have you provided a Transport Statement?	☐	5
e.	Does your development provide cycle storage? (Standard space requirements are set out in the the Council's Parking Standards - DM DPD Appendix 4)	☐	2
	If so, for how many bicycles?		
	Is this shown on the site plans?	☐	-
f.	Will the development create or improve links with local and wider transport networks? If yes, please provide details.	☐	2
		Subtotal	**7**

Please give any additional relevant comments to the Transport Section below

4 BIODIVERSITY

4.1 Minimising the threat to biodiversity from new buildings, lighting, hard surfacing and people

a.	Does your development involve the loss of an ecological feature or habitat, including a loss of garden or other green space? (Indicate if yes)				☐	-2
	If so, please state how much in sqm?					sqm
b.	Does your development involve the removal of any tree(s)? (Indicate if yes)				☐	-
	If so, has a tree report been provided in support of your application? (Indicate if yes)				☐	-
c.	Does your development plan to add (and not remove) any tree(s) on site? (Indicate if yes)				☐	-
d.	Please indicate which features and/or habitats that your development will incorporate to improve on site biodiversity:					
	Pond, reedbed or extensive native planting	6	☐	Area provided:		sqm
	An extensive green roof	5	☑	Area provided:	200	sqm
	An intensive green roof	4	☐	Area provided:		sqm
	Garden space	4	☑	Area provided:	1120	sqm
	Additional native and/or wildlife friendly planting to peripheral areas	3	☐	Area provided:		sqm
	Additional planting to peripheral areas	2	☐	Area provided:		sqm
	A living wall	2	☐	Area provided:		sqm
	Bat boxes	0.5	☑			
	Bird boxes	0.5	☑			
	Other	0.5	☐			
					Subtotal	**10**

Please give any additional relevant comments to the Biodiversity Section below

Non-residential buildings to have green roof
Residential buildings also to have green roofs

5 FLOODING AND DRAINAGE

5.1 Mitigating the risks of flooding and other impacts of climate change in the borough

a.	Is your site located in a high flood risk zone (Zone 3)? (Indicate if yes)	☐	-2
	Have you submitted a Flood Risk Assessment? (Indicate if yes)	☐	-
b.	Which of the following measures of the drainage hierarchy are incorporated onto your site? (tick all that apply)		
	Store rainwater for later use	☐	5
	Use of infiltration techniques such as porous surfacing materials to allow drainage on-site	☑	3
	Attenuate rainwater in ponds or open water features	☐	4
	Store rainwater in tanks for gradual release to a watercourse	☐	3
	Discharge rainwater directly to watercourse	☐	2
	Discharge rainwater to surface water drain	☐	1
	Discharge rainwater to combined sewer	☐	0
c.	Please give the change in area of permeable surfacing which will result from your development proposal:	0	sqm
	Please provide details of the permeable surfacing below	*please represent a loss in permeable area as a negative number*	
		Subtotal	**3**

Please give any additional relevant comments to the Flooding and Drainage Section below

Drainage to be provided to meet all BREEAM Pol03 requirements. 3 points therfore assumed for porous surface amterials, although this score could be higher.

6	**IMPROVING RESOURCE EFFICIENCY**			
6.1 Reduce waste generated and amount disposed of by landfill though increasing level of re-use and recycling				
a.	Will demolition be required on your site prior to construction? *[Points will only be awarded if 10% or greater of demolition waste is reused/recycled]*		☑	*1*
	If so, what percentage of demolition waste will be reused in the new development?	90 %		
	What percentage of demolition waste will be recycled?	90 %		
b.	Does your site have any contaminated land?		☐	*1*
	Have you submitted an assessment of the site contamination?		☐	*2*
	Are plans in place to remediate the contamination?		☐	*2*
	Have you submitted a remediation plan?		☐	*1*
	Are plans in place to include composting on site?		☐	*1*
6.2 Reducing levels of water waste				
a.	Will the following measures of water conservation be incorporated into the development? (Please tick all that apply):			
	Fitting of water efficient taps, shower heads etc		☑	*1*
	Use of water efficient A or B rated appliances		☑	*1*
	Rainwater harvesting for internal use		☐	*4*
	Greywater systems		☐	*4*
	Fit a water meter		☑	*1*
		Subtotal		**4**
Please give any additional relevant comments to the Improving Resource Efficiency Section below				

7	**ACCESSIBILITY**			
7.1	**Ensure flexible adaptable and long-term use of structures**			
a.	**If the development is residential,** will it meet the requirements of the nationally described space standard for internal space and layout?		☐	*1*
	If the standards are not met, in the space below, please provide details of the functionality of the internal space and layout			
AND				
b.	**If the development is residential**, will it meet Building Regulation Requirement M4 (2) 'accessible and adaptable dwellings'?		☐	*2*
	If this is not met, in the space below, please provide details of any accessibility measures included in the development.			
	For major residential developments, are 10% or more of the units in the development to Building Regulation Requirement M4 (3) 'wheelchair user dwellings'?		☐	*1*
OR				
c.	**If the development is non-residential,** does it comply with requirements included in Richmond's Design for Maximum Access SPG		☐	*2*
	Please provide details of the accessibility measures specified in the Maximum Access SPG that will be included in the development			
		Subtotal		**0**
Please give any additional relevant comments to the Design Standards and Accessibility Section below				
Accessibility detials to be confirmed by the Architects at a laer date				

LBRUT Sustainable Construction Checklist- Scoring Matrix for *New Construction* **(Non-Residential and domestic refurb)** ***TOTAL*** **52**

Score	Rating	Significance
80 or more	*A+*	Project strives to achieve highest standard in energy efficient sustainable development
71-79	*A*	Makes a major contribution towards achieving sustainable development in Richmond
51-70	*B*	Helps to significantly improve the Borough's stock of sustainable developments
36-50	*C*	Minimal effort to increase sustainability beyond general compliance
35 or less	*FAIL*	Does not comply with SPD Policy

LBRUT Sustainable Construction Checklist- Scoring Matrix for New Construction **Residential new-build**

Score	Rating	Significance
81 or more	**A++**	Project strives to achieve highest standard in energy efficient sustainable development
64-80	*A+*	Project strives to achieve highest standard in energy efficient sustainable development
55-63	*A*	Makes a major contribution towards achieving sustainable development in Richmond
35-54	*B*	Helps to significantly improve the Borough's stock of sustainable developments
20-34	*C*	Minimal effort to increase sustainability beyond general compliance
19 or less	*FAIL*	Does not comply with SPD Policy

Authorisation:

I herewith declare that I have filled in this form to the best of my knowledge

Signature SP Date 29.11.2019

Appendix A

Appendix A – Site Plan

Appendix B – SBEM Summary Sheet

Scamps Nursery

Building Regulations 2013 L2A

Building Type	Address	As-Designed/As-Built Drawings	SBEM Level	Asset Rating (A-G) (0-150)	BER	TER	BER/TER Improvement (%)
D1: Primary School	Strathmore Road, Teddington	As Designed	5	TBC	3.70	9.90	62.63%

Construction Element	U-Value	Description
External Wall	0.18	Brick outer leaf, 120mm cavity with partial fill solid insulation (0.021 conductivity), Blockwork inner leaf, plasterboard on battens.
Internal Partition	1.79	12.5mm plasterboard / 50mm cavity / 12.5mm plasterboard
Ground Floor	0.16	Insulated ground floor slab
Flat Roof	0.17	Insulated concrete 'green' roof

Construction Element	U-Value	G Value	Frame Factor	Description (manufacturer, make and model)
External Window	1.40	0.43	10%	Light Transmittance 71%. Average value for U and G-Value (U-Value assummed based on SAP Appendix S)
Glazed Doors	1.40	0.43	10%	Light Transmittance 71%. Average value for U and G-Value (U-Value assummed based on SAP Appendix S)
Rooflight	1.40	0.43	10%	Light Transmittance 71%. Average value for U and G-Value (U-Value assummed based on SAP Appendix S)

Construction Notes	Description (manufacturer, make and model)
Construction Details	Standard
Air-permeability	5 (assummed based on construction year and non domestic EPC conventions)

Heating and Cooling	System Details	Emitter	Controls
Heating Sysem	Air Source Heat Pump - SCOP = 4.00 (Variable speed pumps, with differential sensor in system)	Underfloor	Local time temperature control with optimum start/stop.

Hot Water	System Details	Secondary Circulation	Circulation Losses (W/m)	Pump Power (kW)	Loop Length (m)	Storage Tank (l)	Storage Losses (kWh/l.day)
Hot Water System	Air Source Heat Pump - SCOP = 4.00 (Variable speed pumps, with differential sensor in system)	N	n/a	n/a	n/a	300	0.047

Ventilation	System Details	SFP (W/l/s)	Leakage tested ductwork CEN Classification	AHU CEN leakage standards class	Heat Recovery	Heat Recovery Efficiency (%)	Heat Recovery Type	Variable HR
Mechanical Ventilation (extract)	Mechanical extract - Toilets and kitchen	0.25/0.3	n/a	n/a	N	N/a	N/a	n/a

Electrical Flow Control	Description
Power Correction Factor	<0.9
Separate Metering	Lighting, Heating, Air conditioning, Ventilation all on separate meters. BMS warns for 'out of range' values

Renewables	Description
PV	N
Solar Water Heating	N
Wind Turbine	N

Lighting	Description
Lighting	min 100 lm/W - All Rooms
Lighting Controls	Occupancy Auto-on-Off sensors -Corridors, combined PIR and daylight sensors in the offices, kitchen, toilets and teaching areas
Parasitic power	0.1 W/m2

Sign Off of details	Name	Callum Neil	Date	27.11.2019	By signing this document, I declare that the aforementioned details are all correct as per the final "As-Built" specifications:	Name		Date	
						Sign			

Appendix C – Unfeasible Low and Zero Carbon Technologies

Biomass Boiler

Biomass boilers generate heat from the burning of renewable or 'waste' fuels. They require a regular feed of fuel and regular heat demand to operate efficiently. A flue taller than the surrounding buildings must be incorporated into the design to minimise air pollution impacts at ground level from particulate emissions.

The use of a biomass boiler system to supply space heating and DHW has been deemed unsuitable due to the high level of particulates emitted from their use. The use of such a system would negatively impact the air quality of the surrounding area.

Wind Power

Wind power is a developed and productive method of renewable energy generation, however the main limiting factor to its implementation is opposition at a local public and local government level.

To generate a meaningful amount of electricity, large-scale turbines are required which have noise and the visual impacts for the local area. The use of wind turbines has therefore been deemed unsuitable.

Solar Water Heating

Solar Water Heating (SWH) can be used to offset a proportion of the domestic hot water demand (DHW) within a building.

However, due to the low DHW demand at the Proposed Development it is likely to provide minimal CO_2 emissions reductions, while taking up roof-space, better utilised for photovoltaics.

Ground Source Heat Pump

As with ASHP, ground source heat pump (GSHP) systems consume electricity in order to operate.

Beyond 1m below ground level, an average temperature of 15^{o}C is maintained throughout the year. Because of the ground's high thermal mass, it stores heat from the sun during the summer. GSHP can transfer this heat from the ground into a building to provide space heating by a similar process to an air source system.

It is recommended that the ground conditions of the site be assessed in detail (through consultation with a GSHP manufacturer and/or purchase of a Ground Conditions report from the British Geological Survey) before a system is installed – the primary heat source that GSHP relies on is solar derived, and shading can affect the 're-charge' of the ground within which the ground loop is laid. This can affect year-on-year CoPs, steadily increasing running costs and reducing CO_2 offset.

Although GSHP can provide a greater efficiency performance than ASHP, it comes at a significantly higher capital cost, due to the extensive groundworks needed to install either 'slinky' ground loops or 50-100m deep boreholes.

The significantly higher capital costs of installing a GSHP system, it is not considered to be financially viable for the scheme. Alternative additional technologies will be considered for inclusion within the energy strategy at the site.

Appendix D – BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Scamps Nursery — As designed

Date: Wed Nov 27 15:32:05 2019

Administrative information

Building Details

Address: Strathmore Road, Teddington, TW11 8UH

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Callum Neil

Telephone number: 01730 710044

Address: Greenforde Farm, Stoner Hill Road, Froxfield, Petersfield, GU32 1DY

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m².annum	14
Target CO_2 emission rate (TER), kgCO_2/m².annum	14
Building CO_2 emission rate (BER), kgCO_2/m².annum	8.3
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	SP000000:Surf[2]
Floor	0.25	0.16	0.16	SP000000:Surf[0]
Roof	0.25	0.17	0.17	SP000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.35	1.4	SP000006:Surf[2]
Personnel doors	2.2	1.4	1.4	SP000006:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	5

Appendix E – Available Grants and Incentive Schemes

Available Grants

The London Borough of Richmond upon Thames does not have any grants available for a project of this type and size.

Feed-In Tariff

NOTE: The Feed-In-Tariff closed to new applicants on the 1st April 2019, barring some exceptions. See www.ofgem.gov.uk/publications-and-updates/feed-tariffs-essential-guide-closure-scheme for details.

Feed-In Tariffs (FIT) apply to electricity generation from renewable technologies installed at a site. FIT were introduced in the UK in 2010 and were intended to be the main financial incentive to encourage the installation of renewable electricity-generating technologies both domestically and on small commercial buildings.

The Feed-In Tariff scheme is administered by the energy regulator Ofgem, however key decisions regarding FIT are made by the Department of Energy and Climate Change.

The following technologies are included by the scheme:

- Solar Electricity (PV) (roof mounted or stand-alone)
- Wind Turbines
- Hydroelectricity
- Anaerobic Digesters (AD)
- Micro-Combined Heat and Power (CHP)

In order to qualify for the Feed-In Tariff, the installer and the products used must both be certified under the Micro generation Certification Scheme (MCS), except for hydro and anaerobic digestion which have to go through the ROO-FIT process.

The rate received is dependent on the date of installation, has a lifetime of 20 years (micro-CHP only 10) and will increase in-line with inflation. For solar PV, an EPC rating greater than band D is also required in order to achieve the full FIT rate.

Renewable Heat Incentive

The Renewable Heat Incentive (RHI) apply to heat generated through renewable heat technologies at industrial, commercial, public-sector and domestic sites. It is intended to encourage the use of renewable heat technologies by communities, householders and/or businesses.

As with the FIT, the RHI is administered by the energy regulator Ofgem.

The non-domestic scheme is applicable to eligible renewable heat generators and producers of bio methane. Installations may be large-scale industrial heating systems of smaller community heating schemes. The RHI scheme provides financial incentives to installations for up to 20 years.

The following technologies are included by the domestic scheme:

- Heat Pumps (Air-Source and Ground Source)
- Biomass Systems
- Solar Thermal technologies

The domestic scheme provides financial incentives as quarterly payments for up to 7 years, however any public grants previously received are deducted from this amount.

Appendix F – Life Cycle Cost Analysis – simple payback (Nursery Building)

The installation of ASHP does not incur high costs when incorporated into the construction phase of the development as opposed to a retrofit scheme. While it requires 'specialist installers', there are many companies who can supply these services across the South East of England, ensuring that prices remain competitive.

Operation

ASHP have relatively low operational costs. The costs included in this section are: utilities, cleaning and management costs.

Future prices for utilities are extremely difficult to predict, especially over a long period of time such as 60 years. For instance, it would not be unreasonable to assume that due to decreasing global fossil fuel reserves, the cost of gas could increase exponentially over the lifespan of the Proposed Development.

However, for the purposes of this study, the real and discounted costs of the utilities have been calculated using the trends seen since 2007, which have been extended to the year 2079. Although energy prices are never linear, this should give a conservative but fair estimation of the potential future unit costs.

ASHP systems require little day to day management as automatic room thermostats can be set to maintain a constant temperature. Additionally, modern systems have a user-friendly interface, making it easy for members of staff with no training to quickly adjust the settings if desired.

Maintenance

This section includes the costs related to planned maintenance, replacements and repairs.

ASHPs will require an annual service, with the pressures and system performance checked. The costs of this is are likely to be negligible, with the checks and maintenance undertaken as part of the overall management of the site facilities. When considered in the arrangement and compared to overall costs, the price of this is negligible.

According to the Energy Saving Trust, ASHPs will require replacement every 15-20 years.

The sum equivalent to 20% of the total capital costs has been allocated for repairs to the systems during the lifetime of the building.

Calculations assume an average rate of inflation of 1.9% and UK interest rate of 0.75%.

Figure 14 below shows the results from the Life Cycle Cost Analysis for the proposed energy strategy of the nursery building.

	60 year Cost		60 year Savings	
	Real	Discounted	Real	Discounted
Construction				
Capital costs	£ 12,600	£ 12,600		
Installation	£ 2,400	£ 2,400		
Sub-total	**£ 15,000**	**£ 15,000**		
Operation				
Gas Utility	£ -	£ -		
Electric Utility	£ 283,101	£ 280,993		
Electric Generation			£ -	£ -
Cleaning	Negligible			
Management	Negligible			
Sub-total	**£ 283,101**	**£ 280,993**	**£ -**	**£ -**
Maintanance				
Planned Maintanance	Negligible			
Replacements	£ 68,262	£ 67,754		
Repairs	£ 13,652	£ 13,551		
Sub-total	**£ 81,915**	**£ 81,305**		
	Real	Discounted		
Total	**£ 380,015**	**£ 377,298**		

Appendix G –GLA SAP 10 tables

SAP 2012 PERFORMANCE

DOMESTIC

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	37	
After energy demand reduction	33	
After heat network / CHP	33	
After renewable energy	23	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	4	12%
Savings from heat network / CHP	0	0%
Savings from renewable energy	9	25%
Cumulative on site savings	**14**	**38%**
Annual savings from off-set payment	23	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**692**	-
Cash in-lieu contribution (£)	**41,549**	

NON-DOMESTIC

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	5	
After energy demand reduction	3	
After heat network / CHP	3	
After renewable energy	2	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	2	34%
Savings from heat network / CHP	0	0%
Savings from renewable energy	1	13%
Total Cumulative Savings	**2**	**46%**

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO_2)	Cumulative Shortfall (Tonnes CO_2)
Total Target Savings	**2**	-
Shortfall	-1	-16
Cash in-lieu contribution (£)	**-932**	-

SAP10 PERFORMANCE

DOMESTIC

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	33	
After energy demand reduction	27	
After heat network / CHP	27	
After renewable energy	23	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	6	18%
Savings from heat network / CHP	0	0%
Savings from renewable energy	4	13%
Cumulative on site savings	**10**	**31%**
Annual savings from off-set payment	23	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**681**	-
Cash in-lieu contribution (£)	**40,836**	

NON-DOMESTIC

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	3	
After energy demand reduction	2	
After heat network / CHP	2	
After renewable energy	1	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	1	30%
Savings from heat network / CHP	0	0%
Savings from renewable energy	1	33%
Total Cumulative Savings	**2**	**63%**

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO_2)	Cumulative Shortfall (Tonnes CO_2)
Total Target Savings	1	-
Shortfall	-1	-24
Cash in-lieu contribution (£)	**-1,453**	-

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