NORCUTT ROAD, TWICKENHAM

Overheating Report

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Overheating Report
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EXECUTIVE SUMMARY

RPS Consulting Services Limited (RPS) was commissioned to produce an Overheating Risk Assessment based upon Dynamic Simulation Modelling (DSM) for the proposed development at 75 Norcutt Road, Twickenham, London, TW2 6SR. The proposed development includes the construction of a five-storey building to provide residential accommodation. This report will form part of the planning submission to the London Borough of Richmond Upon Thames and relates to a full planning application.

The risk of overheating has been investigated for all occupied areas within each of the dwelling types and communal corridors, against the CIBSE's Technical Memorandum (TM) 49 and 59, which focus on predicting the risk of overheating for buildings using location specific data and future climate projections.

The overheating analysis has followed the London Plan Cooling Hierarchy and the requirements detailed in the Local Plan Policy LP20 of the London Borough of Richmond Upon Thames. As a result, a number of passive and active measures have been implemented into design to reduce the risk of overheating without relying on comfort cooling.

The overheating modelling using LHR_DSY1, 2020s, high emissions, 50% percentile scenario, demonstrates that all living rooms, kitchens and bedrooms within the assessed dwellings pass the CIBSE TM59 criteria.

Further analysis was carried out to communal corridors, even though compliance for these is not a mandatory requirement under TM59. It was established that all assessed communal corridors are at a low risk of overheating.

Additional testing was undertaken using the 2020 weather files for more extreme design weather years (LHR_DSY2, 2020s, high emissions, 50% percentile scenario and LHR_DSY3, 2020s, high emissions, 50% percentile scenario). The analysis shows that 50% and 25% of the assessed dwellings/rooms under the DSY2 and DSY3 simulations respectively, comply with TM59 requirements. It can be confirmed that the risk of overheating has been reduced as far as practical by passive measures. Full compliance with for these extreme weather files is not mandatory under GLA guidance on preparing energy assessments (October 2018).

Finally, the overheating modelling also reviewed the impact of potential warmer and future weather scenarios, in line with CIBSE TM49; even though compliance with these weather data is not mandatory in CIBSE TM59. It was established that the risk of overheating is increasing, when warmer summers and climate change adjusted weather years are used.

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1 INTRODUCTION

1.1.1 RPS Consulting Services Ltd (RPS) was commissioned by *Leek Real Estate (No.1) Ltd* to produce an Overheating Risk Assessment based upon Dynamic Simulation Modelling for the proposed development at 75 Norcutt Road, Twickenham, London, TW2 6SR.

1.1.2 This report reviews the risk of overheating in all occupied dwelling areas (bedrooms and dinning/kitchen/living rooms) of each dwelling type and communal corridors. Many factors influence overheating in homes, including the intensity of heat gains, occupancy patterns, orientation, dwelling layout, shading strategy and ventilation method. Therefore, dynamic thermal modelling has been used to simulate the internal temperature conditions and establish whether threshold conditions of discomfort will be reached.

1.2 Scheme Overview

1.2.1 The scheme consists of the demolition of the light industrial building and the replacement with a residential development comprising of 15 dwellings.

Figure 1: South elevation of the proposed development

1.2.2 This report supports the full planning application for the London Borough of Richmond Upon Thames.

1.3 Purpose of the Overheating Assessment

1.3.1 The purpose of this report is to address sections 3.2.2 - 3.2.5 of the Sustainable Design and Construction supplementary planning guidance (SPG) and as well as Chapter 5 of the London Climate Change Adaptation Strategy. These guidelines are referenced by the Greater London Authority (GLA) guidance on preparing energy assessments (March 2016), where dynamic thermal modelling is expected to be carried out to assess the overheating risk in support of the energy assessment. A separate Energy Report which has been carried out by RPS also forms part of this planning application.

1.3.2 The risk of overheating has been investigated for all occupied areas within each of the dwelling types. The occupied areas were assessed against the CIBSE's Technical Memorandum (TM) 49 and 59, which focus on predicting overheating for buildings using location specific data.

1.3.3 The report provides in Sections 2 and 3 a summary of the requirements and standards relevant to overheating. Section 4 notes the specification and input data entered into the simulation. Section 5 details the steps taken to establish the risk of overheating and the results of the calculations. Finally, a summary of findings is presented in Section 6.

2 REGULATIONS & POLICIES

2.1.1 The relevant authority for this site is Richmond Council. The requirements of this Council and other relevant planning authorities have been taken into account within this feasibility study. The key policy framework applicable to the overheating aspects of the development is outlined below.

2.2 National Level Policies

National Planning Policy Framework

2.2.1 The National Planning Policy Framework (NPPF) was published in February 2019, and replaced the first NPPF published in March 2012. The NPPF set out the Government's planning policies for England and how these are expected to be applied. The NPPF is designed to make the planning system less complex and more accessible; to protect the environment and promote sustainable growth. It provides a framework within which local people and their respective councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

2.2.2 At the heart of the NPPF is a presumption in favour of sustainable development (paragraph 11). The three dimensions of sustainable development can be defined as the economic, social and environmental.

2.2.3 Within the planning policies outlined in the NPPF, there is a strong support for the transition to a low carbon future in a climate change context, taking full account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures.

2.2.4 The NPPF (paragraph 150) states that new development should be planned for in ways that avoid increased vulnerability to the range of impacts arising from climate change; and help to reduce greenhouse gas emissions. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

2.2.5 Finally, the NPPF (paragraph 16) also highlights that plans should be prepared with the objective of contributing to the achievement of sustainable development and in a way that is aspirational but deliverable.

Building Regulations Part L

2.2.6 Building Regulations are statutory instruments that seek to ensure that the policies set out within any relevant UK legislation are carried out. Building regulations approval is required for the majority of building work carried out in the United Kingdom.

2.2.7 Part L 2013 of Building Regulations covers the requirements with respect to the conservation of fuel and power in all building types. It controls the insulation values of building fabric elements and openings, the air permeability of the structure, the heating efficiency of heating, ventilation and air conditioning systems together with hot water storage and lighting efficiency.

2.2.8 Assessing overheating risk in buildings is a complex issue and not adequately assessed by Building Regulations. Indeed, Criterion 3 of Part L 2013 of the Building Regulations relates to limiting the effects of heat gains in summer. However, the regulations explicitly recognise that, as Criterion 3 does not cover all factors influencing overheating, hence there is no guarantee that buildings will not overheat and developers should carry out additional design assessments.

2.3 Regional Level Policies

London Plan

2.3.1 Planning policy for London is set out in the Mayor's London Plan 2016; this sets out an integrated social, economic and environmental framework for future development of Greater London. The London Plan contains a number of policies relating to energy; those most relevant to the energy assessment of new developments are detailed below.

Policy 5.9 Overheating and Cooling

2.3.2 Major development proposals should reduce potential overheating and reliance on air conditioning systems through consideration of principles of the following cooling hierarchy:

- Minimise internal heat generation through energy efficient design.
- Reduce the amount of heat entering a building during summer months through orientation, shading, albedo, fenestration, insulation and green roofs and walls.
- Manage the heat within the building through exposed internal thermal mass and high ceilings.
- Use passive ventilation.
- Use mechanical ventilation.
- Use active cooling systems (ensuring they are the lowest carbon options).

2.3.3 Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible.

Greater London Authority guidance on preparing energy assessments

2.3.4 On October 2018 GLA issued a guidance on preparing energy assessments. This guidance note provides further detail on how to prepare an overheating assessment to accompany strategic planning applications as set out in London Plan Policy 5.9. The purpose of an overheating assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the cooling hierarchy.

2.3.5 The overheating assessment must fully address requirements in Policy 5.9, CIBSE TM49, CIBSE TM52 and CIBSE TM59. Overheating modelling for both domestic and non-domestic developments should be conducted using the following design weather file:

- DSY1 (Design Summer Year) for the 2020s, high emissions, 50% percentile scenario

2.3.6 It is expected that the CIBSE compliance criteria is met for the DSY1 weather scenario.

2.4 Local Level Policies – Richmond Council

2.4.1 The London Borough of Richmond Upon Thames requirements regarding energy are, in the main, reflecting those highlighted in the London Plan. The Council adopted the Local Plan on 3rd July 2018 and sets out policies and guidance for the development of the borough over the next 15 years. The policies as set out in this Local Plan follow the approach of the presumption in favour of sustainable development. The relevant proposed policies are outlined below.

Local Plan (adopted July 2018)

Policy LP 20

Climate Change Adaptation

2.4.2 The Council will promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property.

2.4.3 New development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy:

- minimise internal heat generation through energy efficient design
- reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls
- manage the heat within the building through exposed internal thermal mass and high ceilings
- passive ventilation
- mechanical ventilation
- active cooling systems (ensuring they are the lowest carbon options).

3 OVERHEATING CONTEXT

3.1.1 In order to address the GLA requirement of the risk of operational overheating, dynamic thermal modelling has been carried out in accordance with the guidance provided within CIBSE TM49. However, TM49 doesn't specify any specific performance criteria. CIBSE TM59 is the recognised standard for assessing the risk of overheating in residential buildings.

3.2 CIBSE TM49 – Design Summer Years for London

3.2.1 CIBSE TM49 was released in 2014 to address the question of whether the current CIBSE Design Summer Year (DSY) for London is the most appropriate year of weather data to assess the summertime cooling needs of buildings in London. TM49 enables the analysis of summer performance of buildings and investigate the impact of urban macroclimatic factors and climate change when carrying out overheating risk assessments for buildings in London.

3.2.2 Specifically, instead of having a single DSY (using observed data from Heathrow), three DSYs are now available capturing the local climate in three different London sites (urban, semi-urban and rural). To address London's urban heat island the following 3 different weather files have been created:

- LHR: Current London weather file based on Heathrow airport. To be used for most developments in London.
- LWC: Weather file based on London Weather Centre. To be used for sites in Central Activities Zone.
- GTW: Weather file based on Gatwick airport. To be used for rural sites.

3.2.3 As it is impossible to prejudge the impact of warm weather conditions on a building in a general sense, the modelling has been conducted using three design weather years from London Heathrow airport data:

- DSY1 - 1989: a moderately warm summer (current weather file used);
- DSY2 - 2003: a year with a very intense single warm spell; and
- DSY3 - 1976: a year with a prolonged period of sustained warmth.

3.2.4 DSY1-1989 is the current DSY and represents a moderately warm summer, as is interpreted in current CIBSE guidance. The years 1976 and 2003 were chosen as more extreme years with different types of summer: the former is a year with a long period of persistent warmth, whereas the latter has a more intense single warm spell.

3.2.5 Future DSYs for London are also available to reflect the UK Climate Projections (DEFRA, 2009) (UKCP09) and allow designers to increase the resilience of their buildings to future changes in climate.

3.2.6 The time periods considered within TM49 are the 2020s, 2050s and 2080s (each a 30-year period centred on the stated decade). In addition for each period, different emission scenarios (low, medium and high) have been taken into account with different probabilities (10^{th}, 50^{th} and 90^{th} percentile). The 50^{th} are viewed to be the 'best guess' level of change.

3.2.7 CIBSE TM49 doesn't specify any specific performance criteria but rather a certain methodology by ensuring that for sites within London the most appropriate weather data is used depending upon the location and time period.

3.3 CIBSE TM59 – Design Methodology for the Assessment of Overheating Risk in Homes

3.3.1 Given the complexity of the factors (i.e. intensity of heat gains, occupancy patterns, orientation, dwelling layout, shading strategy and ventilation method) influencing overheating, it is important that a standardised methodology is used to assess risk and hence the need for this technical memorandum. TM59 proposes the following steps for all overhearing assessments for all residential building types:

- A suitable sample of units within a development should be selected.
- Zoning: all sample units should be zoned into the separate rooms including kitchens, living rooms, bedrooms, bathrooms and halls.
- Building constructions should be modelled as proposed, accurately reflecting thermal properties such as thermal mass, insulation and solar transmittance for glazing.
- Standard profiles should be applied for occupancy, lighting and equipment gains.
- Guidance on the treatment of communal corridors should be followed.
- Pipework and equipment (e.g. heat interface unit gains from community heating systems) should be included in the model.
- Operable windows should be included in the model.
- Any internal or external shading provision should be included in the model.
- Additional mechanical ventilation including mechanical ventilation with heat recovery (MVHR) or extract systems should be included in the model.
- Air speed assumptions should be based on the guidance.
- The weather file used for the methodology should be the DSY1 (design summer year) file most appropriate for the site location for the 2020s, high emissions, 50% percentile scenario.
- The assessment should be undertaken using hourly dynamic simulation modelling, which includes all the relevant features of the building.

3.3.2 Homes that are predominantly naturally ventilated, including homes that have MVHR, with good opportunities for natural ventilation in the summer should assess overheating using the adaptive method based on CIBSE TM52 (2013). Compliance is based on passing both of the following two criteria:

- For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

- For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26oC for more than 1% of annual hours.

3.3.3 Finally, the overheating test for corridors should be based on the number of annual hours for which an operative temperature of 28^{o}C is exceeded. Whilst there is no mandatory target, if an operative temperature of 28^{o}C is exceeded for more than 3% of the total annual hours, this will be flagged as a significant risk within the report.

4 BUILDING INPUT DATA

4.1.1 The thermal model has been generated based upon the architect's floor plans and elevations, issued on 17th May 2019, and the specifications agreed with the design team.

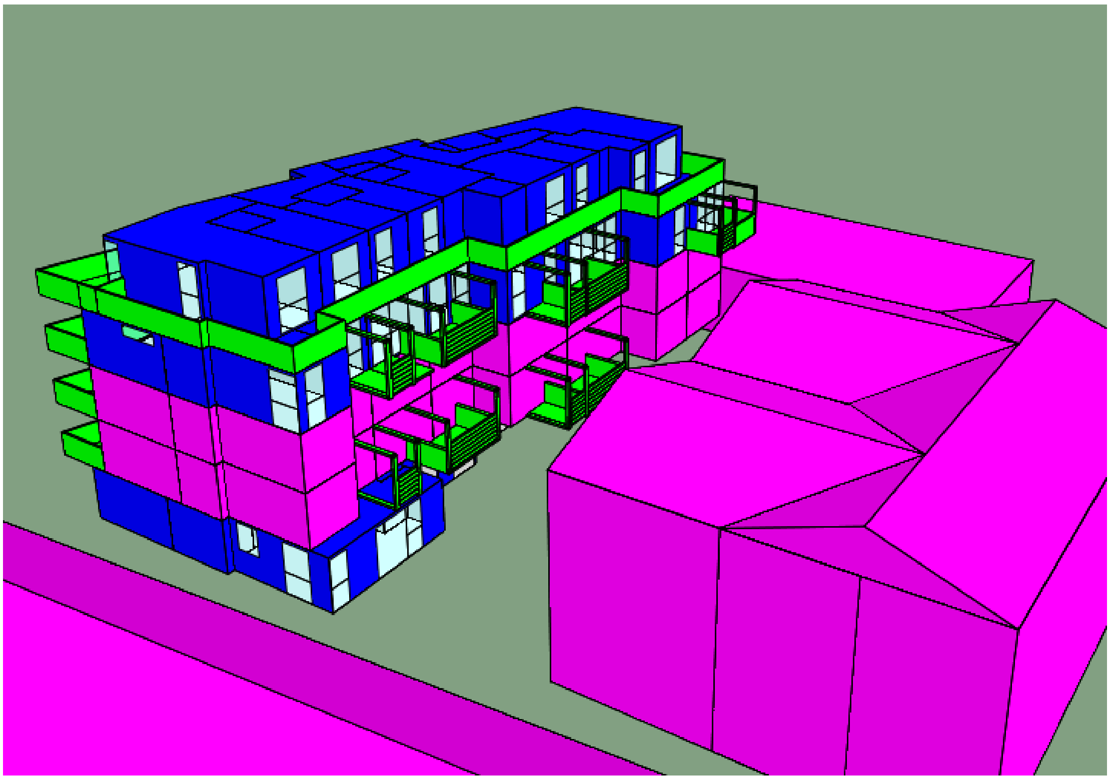

Figure 2: IES model developed based on the architectural drawings provided (south elevation)

4.2 Assessed Areas

4.2.1 This report reviews the risk of overheating in all occupied rooms within the flats. Occupied areas are considered all areas within the assessed building that are likely to be occupied for at least 30 minutes by a building user. For this project, occupied areas are the bedrooms and kitchen/living rooms within the dwellings. The ancillary spaces within the dwellings (corridors, bathrooms, WCs and cupboards) have been excluded from the analysis as they do not fall under the occupied spaces definition.

4.2.2 Table 1 shows the activity types that were assigned to each zone of the proposed development based upon the room labelling on the drawings provided.

Room Type	Room Activity
Bedroom	Dwelling: Bedroom
WC	Dwelling: Bathroom
Living Room/ kitchen	Dwelling: Lounge
Corridors within flats	Dwelling: Circulation area
Communal corridor/ Lift / Staircase	Dwelling: Common circulation area
Cupboard	Hotel: Cupboard
Bedroom	Dwelling: Bedroom

Table 1: Allocated activity type for residential spaces

4.2.3 The overheating analysis has assessed all dwellings but only a sample as per CIBSE TM59 methodology. This assessment has identified all the dwellings that are at risk of overheating. These are likely to be those (a) with large glazing areas, (b) on the top floor, (c) having less shading, (d) having large, sun-facing windows, (e) having a single aspect, or (f) having limited opening windows. As a result, the following units have been selected and analysed:

- Ground Floor: Flat 1
- Third Floor: Flat 10, 11, 12, 13
- Fourth Floor: Flat 14, Flat 15

4.2.4 In addition and in accordance to CIBSE TM59, communal corridors are also at risk of overheating as they contain community heating distribution pipework. A sample of communal corridors has been assessed and these were selected as the most highly to overheat due to (a) presence of community pipework, (b) absence of windows, (c) large glazing on single aspect wall, or (d) long lengths. As a result, the following units have been selected and analysed:

- Ground Floor Lobby
- Third Floor Communal Corridor
- Fourth Floor Communal Corridor

4.2.5 Overall, 7 living rooms/kitchens, 15 bedrooms and 3 communal corridors have been analysed.

4.3 Weather Files

4.3.1 The Design Summer Year (DSY) weather file was introduced in 2002 (CIBSE, 2002) in recognition of the need to have a sequence of warm weather data for use with dynamic thermal simulation programs for the assessment of overheating risk in naturally ventilated and passively cooled (‘free running’) buildings. The DSY represents a warmer than typical summer. The measure of summer warmth used to select the DSY is the average temperature over the six-month period from April to September. Although in meteorological terms summer is normally defined as the three-month period June, July and August, the longer April–September period was used as overheating problems are also sometimes experienced in spring and early autumn.

4.3.2 With the increasing demand for more sustainable and energy efficient buildings and services to combat climate change, weather data has now become an essential component of virtually every new building design and major refurbishment. As a result, CIBSE published an updated version of weather files on 2016.

4.3.3 According to CIBSE TM49 and the probabilistic design summer years, overheating events with three characteristics can be defined and used to select weather data:

- DSY 1 – moderately warm summer. Represent a moderately warm summer year.
- DSY 2 – short intense warm spell. Represents an intense extreme year, which is chosen as the year with the event which is about the same length as the moderate summer year but has a higher intensity than the moderate summer.
- DSY 3 – long, less intense warm spell. The long extreme year is determined by the year with a less intense extreme than the high intensity year, more intense extreme than the moderate summer year but also has a longer duration than the moderate summer year.

4.3.4 CIBSE TM49 suggests that based on UK Climate Projections (UKCP09 - managed by the Environment Agency working with the Met Office) projections indicated that the more extreme historical summers would become average summers by the middle of the century, which is mainly because of the global warming and carbon dioxide emissions. Therefore, for buildings with long service lives or where overheating impacts are more critical, it is important that the risk of overheating is also analysed against future weather conditions. Hence, the use of climate change adjusted weather years is introduced to evaluate overheating risk on these longer timescales. The greenhouse gas emissions scenarios considered were the Low, Medium and High scenarios; the time periods were the 2020s, 2050s and 2080s (each a 30-year period centred on the stated decade); and the percentile changes considered were the 10%, 50% and 90% percentiles.

4.3.5 There are significant climate variations across London associated with the urban heat island. To enable the impact of these differences to be investigated, CIBSE TM49 suggests the use of weather files for three locations: London Weather Centre (LWC), Heathrow Airport (LHR) and Gatwick Airport (GTW). The most representative weather station site for the project location should be used. It is recommended that LWC data be used for development within the Greater London Authority Central Activity Zone (CAZ); LHR data be used for development in urban and suburban areas outside the CAZ; and GTW data can be used for development in rural and peri-urban areas around the edge of London. – delete if not in London

4.3.6 The following parameters were used for the building simulation in accordance with CIBSE TM49 and TM59:

- Weather Location: Heathrow Airport (LHR)
- Weather files:
    - DSY1, for 2020, high emissions, 50% percentile scenario

- DSY1, DSY2 and DSY3, for 2050, medium and high emissions, 50% percentile scenario
- DSY1, DSY2 and DSY3, for 2080, low, medium and high emissions, 50% percentile scenario

4.4 Building Construction Data

4.4.1 The thermal transmittance values (U-values) adopted in the model, based on specifications agreed with the design team, are presented in Table 3.

Element	Proposed U-values
External Walls	0.16 W/m^{2}K
Ground Floor	0.12 W/m^{2}K
Roof	0.12 W/m^{2}K
Windows	0.9 W/m^{2}K
Doors	1.1 W/m^{2}K

Table 2: Thermal specifications for building elements

4.4.2 The thermal mass of the building was assumed as medium weight, in accordance to Appendix 5 of the current EPC Conventions. A g-value of 0.55 has been specified to all south, west and east facing glazing areas, while 0.45 for the north facing. Finally, the designed air permeability for the development is 3 m^3/hm^2@50Pa.

4.5 Window and Door Openings

4.5.1 To enable passive ventilation operable windows and doors have been assessed as part of this analysis. In more detail, the following options have been analysed:

- All openable windows (including lobby windows) have been allowed to half open (30 degrees angle) and balcony doors fully open (90 degrees angle) when the internal dry bulb temperature exceeds 22ºC and it is higher than the external temperature (between 07:30-23:00). In addition, windows will be openable by 20% during the sleeping hours (23:00 – 07:30) as they can be locked securely open.
- North facing windows are modelled as closed during the day and night due to noise pollution from the trainline.
- Internal doors are left 100% open in the daytime with an angle of 90º, but are assumed closed when the occupants are sleeping.

- Blinds have been included in the modelling only in the bedrooms in Flat 1 but they do not interfere with the opening of windows.

4.5.2 The assumed opening areas have taken into account any security, acoustic or air quality issues that limit opening area (e.g. on ground floors).

4.5.3 Openings depending on their exposure to wind pressures, can have different impact on the thermal comfort of the room they serve. To accurately reflect the exposure type for the site location and orientation, the following parameters have been used based on software's (IES) definitions:

- For openings on buildings of more than 12.5m in height, exposure types with names beginning 'High-rise' have been selected.
- Where the Opening Type is to be used for internal openings only, it has been assigned as 'Internal'.

4.6 Building Services

4.6.1 Thermal comfort in a room is greatly affected by heat produced from the building services that serve the area. The building services specification in Table 3 was accounted for within the analysis.

Feature	Description	Notes
Ventilation	MVHR – SFP: 0.5W/(litre/sec) Heat exchanger efficiency η= 90%	Extract in WC, bathroom and kitchens; supply to bedrooms and living rooms. Flow rates are in accordance with Part F due to limited ventilation design at the time of the assessment.
Heating System	Combi Gas Boilers (90% efficiency)	
Hot Water System	From main heating system	
Lighting	2 W/m^2 (6pm – 11pm)	As specified in Section 5.2 of CIBSE TM59

Table 3: Performance specifications for building services

4.7 Internal Gains

4.7.1 Further to heat gains from lighting, which are presented in Table 3, buildings can also have significant internal heat gains from people and equipment. Table 4 presents the heat gains from occupancy within this assessment.

Room	Peak Load (W/person)
Single bedroom	8:00-23:00: 75W/p sensible – 55W/p latent gains For the rest of the day: 52.5W/p sensible – 38.5W/p latent gains
Double bedroom	8:00-9:00 and 22:00-23:00: 75W/p sensible – 55W/p latent gains 9:00-22:00: 37.5W/p sensible – 27.5W/p latent gains For the rest of the day: 52.5W/p sensible – 38.5W/p latent gains
1bed: living room/kitchen	9:00-22:00: 37.5W/p sensible – 27.5W/p latent gains
2bed: living room/kitchen	9:00-22:00: 75W/p sensible – 55W/p latent gains
3+bed: living room/kitchen	9:00-22:00: 75W/p sensible – 55W/p latent gains

Table 4: Heat gains from occupancy

4.7.2 Similarly, Table 5 presents the heat gains from equipment included within this assessment.

Room	Peak Load (W)
Single and Double bedroom	80 W from 8 am to 11 pm 10 W during the sleeping hours
Living room/kitchen	450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm 85 W for the rest of the day
1bed: living room/kitchen	9:00-22:00: 37.5W/p sensible – 27.5W/p latent gains

2bed: living room/kitchen	9:00-22:00: 75W/p sensible – 55W/p latent gains
3+bed: living room/kitchen	9:00-22:00: 75W/p sensible – 55W/p latent gains

Table 5: Heat gains from equipment

4.8 Passive and Active Measures

4.8.1 The section below details how the different measures implemented have followed the London Plan Cooling Hierarchy developed in Policy 5.9: 'Overheating and Cooling' and the requirements detailed in the adopted Local Plan of the London Borough of Richmond Upon Thames (Policy LP20).

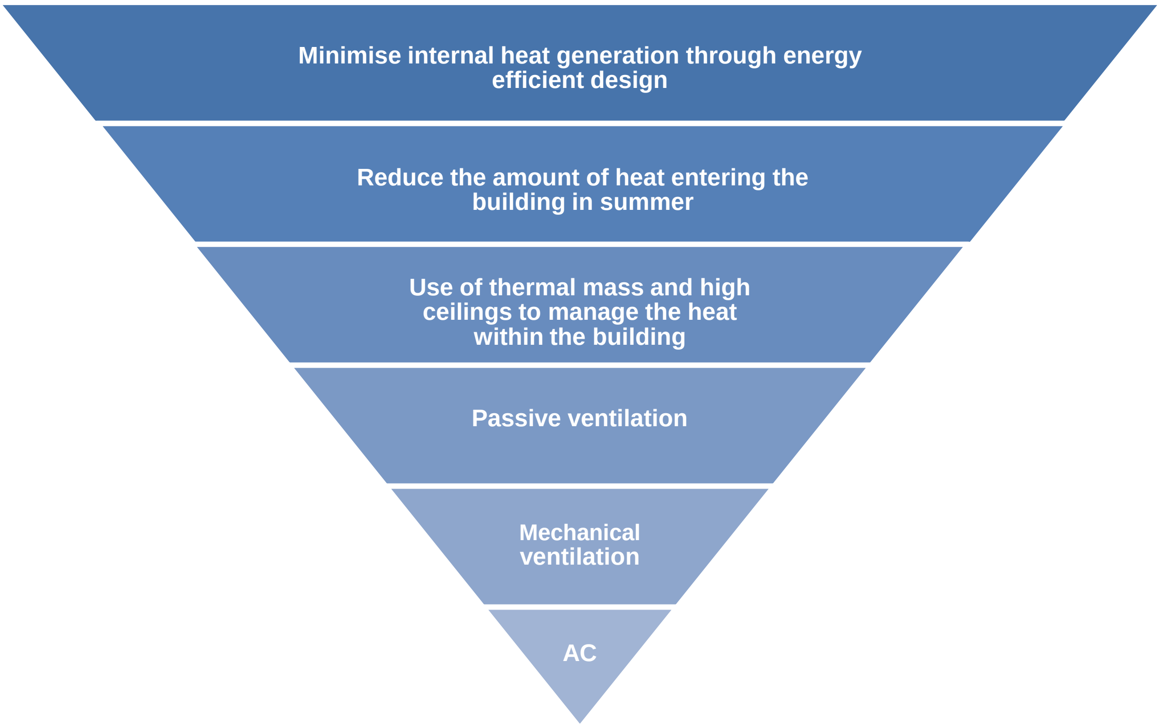

Figure 3: Cooling Hierarchy

4.8.2 New development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. Therefore, all new developments should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Taking this into account the flowing measures have been implemented into design:

- Passive Design

    - Avoid designing large rooms with small openings.
    - Use materials with high surface reflectivity to the sun's radiation.
    - Use windows with low g-value glazing to reduce solar gains.
    - Use carefully designed shading measures, including balconies, vertical external panels on the south elevation and internal blinds.
    - Allow for high insulation standards, exceeding Building Regulations requirements, for all building fabric elements and openings
    - Minimise internal heat gains by using low energy equipment, including energy efficient lighting.
    - Specify High efficiency appliances.
- Passive ventilation
    - Design the building and its internal layout to enable passive ventilation, including openable windows.
    - Allow for cross ventilation, where possible.
- Mechanical ventilation
    - High efficiency Mechanical Ventilation with Heat Recovery (MVHR) will be provided for the dwellings.
    - Extract fans for the kitchens & bathrooms.

5 ANALYSIS AND RESULTS

5.1.1 According to CIBSE TM59, all developments are required to pass the overheating criteria using the DSY1 file most appropriate to the site location, for the 2020s, high emissions, 50% percentile scenario. Other files including the more extreme DSY2 and DSY3 files, as well as future files (i.e. 2050s or 2080s), should be used to further test designs of particular concern, but a pass is not mandatory for the purposes of the simpler test presented in this document.

5.1.2 Using the specification and proposed measures to combat any potential overheating, a dynamic simulation using the Government approved software was carried out.

5.2 Primary Results – DSY1, 2020s, high emissions, 50% percentile scenario

5.2.1 The overheating modelling using LHR_DSY1, 2020s, high emissions, 50% percentile scenario, demonstrates that all occupied areas within the dwellings pass the CIBSE TM59 criteria. In more detail:

- In all living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive are not more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).
- In all bedrooms, the operative temperature, from 10:00 pm to 07:00 am, does not exceed 26^{o}C for more than 1% of annual hours.

5.2.2 Moreover, an overheating test for corridors was carried out in order to calculate the number of annual hours for which an operative temperature of 28^{o}C is exceeded. In all the assessed corridors, the operative temperature of 28^{o}C is not exceeded for more than 3% of total annual hours.

5.2.3 A full breakdown of the results can be found in Appendix A. This shows that for a moderately warm summer the significant majority of occupied areas have no risk of overheating. According to CIBSE TM59 compliance for all rooms is mandatory only when they are assessed under DSY1, 2020s, high emissions, 50% percentile scenario.

5.3 Varied profiles of current weather data

5.3.1 Further to assessing the overheating risk for a moderately warm summer for 2020 weather data, CIBSE TM49 and 59 require the overheating modelling to be also conducted using future weather data, with different heat intensity and carbon emissions, even though a pass is not mandatory for the warmer or future weather files. Therefore, an overheating analysis was carried out for the following scenarios:

- DSY2 for the 2020s, high emissions, 50% percentile scenario
- DSY3 for the 2020s, high emissions, 50% percentile scenario

5.3.2 Table 6 presents the number of rooms passing each criterion under TM59. The last column presents the percentage of rooms that meet all TM59 criteria compared to the total rooms assessed for the purpose of this analysis.

Weather data	Rooms passing Criterion 1: Hours of exceedance of CIBSE TM52 (22 rooms assessed)	Bedrooms passing comfort during the sleeping hours criterion (15 rooms assessed)	Corridors passing operative temperature criterion (3 rooms assessed)
DSY2 - 2020, high emissions	16	1	3
DSY3 - 2020, high emissions	8	0	2

Table 6: TM59 results of 2020 extreme weather profiles for 50% percentile scenario

5.3.3 As can be seen from the results in Table 6, when the overheating analysis has been run against more extreme weather profiles for 2020, the risk of overheating is still limited. Nevertheless, a number of rooms will be at risk of overheating, even though all practical considerations have been taken into account. In more detail:

- Dual aspect flats have been incorporated as far possible, to maximise the benefits of cross ventilation, however a small number of single aspect flats is still present due to design limitations;
- High insulation standards, exceeding Building Regulations requirements, for all building fabric elements and openings have been specified, as presented in Table 2.
- Use smaller windows where possible. However, the size of windows cannot be reduced any further as this will have a negative impact on daylight levels of the proposed development, in accordance to the Daylight Report produced by *Lumina London Limited* and submitted as part of this planning application.
- Shading measures, including balconies and external vertical panels on the south elevation have been included in the design.

5.3.4 The proposed design aims to reduce the risk of overheating as far as practical; hence all passive measures as mentioned in Section 4 have been explored and it is believed that no further improvements are possible.

5.3.5 According to GLA guidance on preparing energy reports and CIBSE TM59, a pass is not mandatory for the warmer weather files for 2020 (DSY2 and DSY3).

5.4 Future Weather Data

5.4.1 Further to assessing the overheating risk for a moderately warm summer for 2020 weather data, CIBSE TM49 and 59 require the overheating modelling to be also conducted using future weather data, with different heat intensity and carbon emissions, even though a pass is not mandatory for the warmer or future weather files. Therefore, an overheating analysis was carried out for the following scenarios, in accordance to CIBSE TM49:

- DSY1, DSY2 and DSY3 for the 2050s, medium and high emissions, 50% percentile scenario

- DSY1, DSY2 and DSY3 for the 2050s, low, medium and high emissions, 50% percentile scenario

5.4.2 In Table 7, the number of rooms that pass each criterion under TM59 are presented.

Weather data	Rooms passing Criterion 1: Hours of exceedance of CIBSE TM52 (22 rooms assessed)	Bedrooms passing comfort during the sleeping hours criterion (15 rooms assessed)	Corridors passing operative temperature criterion (3 rooms assessed)
DSY1: - 2050, medium emissions	15	1	2
DSY2 - 2050, medium emissions	7	0	2
DSY3 - 2050, medium emissions	3	0	2
DSY1: - 2050, high emissions	13	0	3
DSY2 - 2050, high emissions	6	0	2
DSY3 - 2050, high emissions	1	0	1
DSY1: - 2080, low emissions	14	0	2
DSY2 - 2080, low emissions	7	0	2
DSY3 - 2080, low emissions	3	0	1
DSY1: - 2080, medium emissions	7	0	1
DSY2 - 2080, medium emissions	3	0	1

DSY3 - 2080, medium emissions	1	0	0
DSY1: - 2080, high emissions	3	0	0
DSY2 - 2080, high emissions	1	0	0
DSY3 - 2080, high emissions	0	0	0

Table 7: TM59 results of future weather profiles for 50% percentile scenario

5.4.3 As can be seen from the results in Table 7, when the overheating analysis has been run against future, warmer weather profiles for 2050 and 2080, the risk of overheating increases, as more intensive weather data are used, when the climate change is taken into account. However, this is to be expected with the future weather files having a significantly higher average and peak temperatures and CO_2 emissions.

5.4.4 According to CIBSE TM59, a pass is not mandatory for the warmer or future weather files. Detailed results showing the performance of all assessed rooms against TM59 criteria for the future weather data can be provided upon request.

6 CONCLUSIONS

6.1.1 The dynamic overheating modelling analysis using the Government's approved computer software has been carried out for all types of occupied residential areas to address the requirement under the London Plan. This modelling has been carried out in accordance with CIBSE TM49 and TM59, in accordance with the GLA guidance on preparing energy assessments. To minimise the risk of overheating in these areas, passive and active measures have been introduced in the building design. In more detail, the following passive and active measures have been proposed to reduce the risk of overheating:

- High levels of insulation have been specified to all building fabric elements, improving on Part L1A 2013 standards;
- High specification glazing, improving on Part L1A 2013 standards;
- Low solar transmittance factor (g-value) in all glazing areas, to reduce the maximum amount of solar energy passing through;
- Incorporation of thermal mass in the building fabric to naturally attenuate heat gain during hot weather;
- Incorporation of as many dual aspect flats as possible, to maximise the benefits of cross ventilation;
- The incorporation of balconies and vertical panels provide local shade to limit solar gain;
- Efficient mechanical ventilation with heat recovery in all dwellings with extract ventilation in the kitchens and bathrooms;
- Energy efficient light fittings to all areas to reduce latent heat gains;
- Promotion of natural ventilation to reduce internal temperature in the rooms by opening all openable windows (30 degrees angle) and balcony doors fully open (90 degrees angle) within the flats (of their openable area, except for the north facing), when the internal temperature within the areas reaches 22ºC and it is higher than the external. In addition, windows will be openable by 20% during the sleeping hours when the internal temperature reaches 22°C and is higher than the external temperature.

6.1.2 Based upon the specification as detailed in Section 4, the results of the primary weather data simulation confirmed that all occupied rooms pass Criterion 1 of CIBSE TM52 and all bedrooms pass passing comfort during the sleeping hours criterion, when they are assessed against LHR DSY1, 2020, high emissions, 50% percentile weather file. Hence all living rooms, kitchens and bedrooms meet CIBSE TM59 mandatory criteria.

6.1.3 An additional analysis was carried out for all communal corridors to establish if the operative temperature of 28ºC is exceeded for more than 3% of total annual hours. It was concluded that all corridors meet the CIBSE TM59 Criterion, when they are assessed against LHR DSY1, 2020, high emissions, 50% percentile weather file.

6.1.4 The overheating modelling also reviewed the impact of potential warmer and future weather scenarios; even though compliance with these weather data is not mandatory in CIBSE TM59. It was established that the risk of overheating is increasing, when warmer summers and climate change adjusted weather years are used, however the risk of overheating has been reduced as far as practical through a combination of passive measures.

6.1.5 Overall, the design proposal has also been assessed against the London Plan and Policy LP20 of the Richmond Council's Local Plan requirements and it has been confirmed that compliance is achieved.

Appendix A Primary TM59 Results

CIBSE TM59: DSY1, 2020, high emissions, 50% percentile scenario			
Room Name	**Living rooms, kitchens and bedrooms TM52 Criterion 1**	**Bedrooms Comfort during the sleeping hours criterion**	**Corridors Operative temperature criterion**
3F - Flat 10 - 2B3P - LKD	1.2	n/a	n/a
3F - Flat 10 - 2B3P - Single Bed 2	1.9	20	n/a
3F - Flat 10 - 2B3P - Double Bed 1	2.0	15	n/a
3F - Flat 11 - 1B2P - LKD	1.7	n/a	n/a
3F - Flat 11 - 1B2P - Double Bed 1	0.8	22	n/a
3F - Flat 12 - 1B2P - LKD	2.0	n/a	n/a
3F - Flat 12 - 1B2P - Double Bed 1	0.6	21	n/a
3F - Flat 13 - 2B3P - Single Bed 2	0.9	21	n/a
3F - Flat 13 - 2B3P - Double Bed 1	1.1	16	n/a
3F - Flat 13 - 2B3P - LKD	1.8	n/a	n/a
4F - Flat 14 - 3B4P - LKD	2.9	n/a	n/a
4F - Flat 14 - 3B4P - Double Bed 1	1.0	27	n/a
4F - Flat 14 - 3B4P - Single Bed 2	0.5	23	n/a

4F - Flat 14 - 3B4P - Single Bed 3	1.0	24	n/a
4F - Flat 15 - 3B4P - Single Bed 2	0.7	20	n/a
4F - Flat 15 - 3B4P - Single Bed 3	0.8	21	n/a
4F - Flat 15 - 3B4P - LKD	1.1	n/a	n/a
4F - Flat 15 - 3B4P - Double Bed 1	0.3	21	n/a
GF - Flat 1 - 3B5P - LKD	1.7	n/a	n/a
GF - Flat 1 - 3B5P - Double Bed 1	0	24	n/a
GF - Flat 1 - 3B5P - Double Bed 2	0.1	32	n/a
GF - Flat 1 - 3B5P - Single Bed 3	0.1	22	n/a
GF - Lobby	n/a	n/a	0.3
4F - Communal Corridor	n/a	n/a	0.6
3F - Communal Corridor	n/a	n/a	1.7

Table A1 Primary results under CIBSE TM59: DSY1, 2020, high emissions, 50% percentile scenario