25 Oakhill Avenue

Overheating Report

Sustainability Services

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Audit Sheet

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Contents

1.0 Executive Summary

This report has been prepared by Cooper Homewood Ltd (CHL) to present the results from the Dynamic Simulation Model (DSM) assessment, which considers if the proposed development is at risk of overheating and if active cooling should be proposed as a strategy to control internal temperatures.

CHS have adopted CIBSE Technical Memorandum TM59 – 'Design Methodology for the Assessment of Overheating Risk in Homes' to assess the risk of overheating in habitable rooms. The results are based on the output from the IES software and are to be taken as an indication of the expected internal conditions.

CIBSE TM59 is based on guidance from CIBSE TM52 (2013) and CIBSE Guide A (2015a) to provide a standardised approach to predicting overheating risk in both naturally and mechanically ventilated residential buildings.

Design measures have been incorporated, where feasible, to optimise thermal comfort conditions and minimise the overheating risks in line with the cooling hierarchy, as required by the London Borough of Camden core strategy. The measures adopted are a combination of mechanical ventilation, efficient lighting and openable windows to promote good natural airflow.

The DSM modelled 10 occupied rooms throughout the dwelling to confirm internal conditions. Each room has been assigned a specific set of design parameters which cover the anticipated heat gains from occupants and equipment, expressed in a variation profile.

Simulation results indicate that 8 out of the 10 occupied rooms fail the relevant criteria outlined in CIBSE TM59 guidance under current weather conditions and therefore the overheating risk is categorised as high under the CIBSE 2020 London DSY 1 local weather file. With a majority of the occupied spaces failing the criteria, summertime overheating is likely to arise and building users will generally feel uncomfortable in summer periods, based on the predicated data from the current weather file.

It has therefore been considered necessary to provide comfort cooling due to the anticipated overheating risk as confirmed by the DSM assessment with high internal gains recorded. In line with the local policy requirements, the cooling strategy will be implemented in an energy efficient way by using low carbon VRF (Variable Refrigerant Flow) heat pump system to meet the cooling and heating requirements. This system will be specified with a high COP and will utilise the same equipment as the anticipated space heating system serving the development.

2.0 Introduction

This Overheating Report has been prepared by Cooper Homewood Ltd (CHL) on behalf of Mrs Lauren Shamoon (the Client) to determine the risk of overheating within the proposed residential development at 25 Oakhill Avenue.

This report has been produced to show compliance with the relevant policies of the London Borough of Camden Core Strategy, relating to overheating risk in planning decisions. The document outlines the design measures that need to be incorporated in line with the cooling hierarchy, before active cooling can be considered.

CHL have used CIBSE Technical Memorandum TM59 (Design methodology for the assessment of overheating risk in homes) methodology to determine if bedrooms, and kitchen/living areas are at risk of overheating. This is considered across the industry as the adaptive approach for assessing overheating.

Dynamic Simulation Modelling (DSM) has been undertaken using IES VE 2022 software.

The results from this thermal model will determine the predicted risk of overheating for the occupied rooms within the development based on the orientation and internal layout. The DSM model is fully compliant with the Core Strategy, and the CIBSE Applications Manual AM11, and is considered a fair representation of the current design intentions.

There are assumptions and approximations that have been made. As far as possible, details of all assumptions made, and approximations used are supplied as part of the report.

2.1 Description of Development

25 Oakhill Avenue is located in Hamstead and comprises the extension and major refurbishment of an existing listed residential property.

The Proposed Development consists of the refurbishment and extension of an existing dwelling which is currently partitioned into 2 no. apartments. The proposals are for this building to be re-instated as a single dwelling and extended to meet the needs and requirements of the Client.

Figure 1 – Proposed Front Elevation

2.2 Local Policy – London Borough of Camden

The Council requires that developments should adopt appropriate climate change adaptation measures to reduce the impact of dwelling overheating, including application of the cooling hierarchy.

The Council will discourage the use of active cooling (air conditioning) unless the development can demonstrate exceptional circumstances where opportunities for cooling are unable to be controlled through passive measures alone. A dynamic thermal modelling assessment will be required to demonstrate there is a clear need after all of the potential design measures are incorporated in line with the cooling hierarchy.

All developments should follow the cooling hierarchy outlined below, to reduce the risk of overheating and subsequent reliance on active cooling:

Minimise internal heat generation through energy efficient design, considering the following:

- Layout and uses: locate any spaces that need to be kept cool or that generate heat on cooler sides of developments.
- Reducing heat gains e.g. including low energy lighting.
- Seal/ insulate heat generating processes.
- Reduce the distance heat needs to travel and insulate pipework.
- Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.
- Consider evaporation cooling which cools air through the evaporation of water.
- Consider 'free cooling' or 'night cooling', which uses the cooling capacity of ambient air to directly cool the space.

Reduce the amount of heat entering a building in summer:

- Consider the angle of the sun and optimum daylight and solar gain balance.
- Orientate and recess windows and openings to avoid excessive solar gain.
- Consider low g-values and the proportion, size and location of windows.
- Make use of shadowing from other buildings.
- Include adequate insulation.

Comfort cooling (air conditioning) should not be specified in developments where it has been demonstrated that passive or other measures proposed have successfully addressed the risk of overheating.

Whilst a minor development in the context of local and regional policy, the Mayor of London's Cooling Hierarchy has still been used to maximise reduction in overheating throughout the development with the prioritisation of passive design measures.

Due to being an existing building and listed in nature some design measures cannot be achieved with the existing building layout and orientation. However, the proposed rear extension to the south has been designed to incorporate large openings to maximise internal daylighting levels and natural ventilation.

This development will minimise the adverse impacts of overheating through the use of the above passive design measures where practical, before considering the use of comfort cooling.

2.3 Cooling Hierarchy

Following the requirements of the Core Strategy a 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. Low energy lighting throughout with minimal heat output.
Reducing the amount of heat entering the building in summer	Internal blinds are to be provided to minimize solar gain.
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 habitable rooms. Cross ventilation possible via windows on both facades and roof lights.
Mechanical Ventilation	The dwelling shall be provided with a continuous mechanical extract system with background ventilators via window trickle vents in line with Part F of the Building Regulations.

Table 1 - Design measures following the cooling hierarchy

The above passive measures will be taken into account within the dynamic simulation model before active cooling is proposed. This is to identify the risk of overheating within the development, whilst reducing any potentially cooling load required.

As this building is categorised as Grade 2 Listed, other potential design measures such as external shading (brise soleil) have been discounted.

3.0 Assessment Methodology

The dynamic thermal modelling is used to identify the risk of overheating which has been undertaken in accordance with the guidance and design parameters specified in CIBSE TM59.

Methodology advice of CIBSE Guide A and CIBSE TM59 methodology has been used for assumed internal heat gains and profiles.

3.1 Weather Files

CIBSE provide weather files based on the sites location which should be used for all relevant modelling. Files are available for a number of varying future scenarios based on estimated climate change predictions, and the temperature increases predicted as a result.

In this instance, simulations have been tested using CIBSE DSY (Design Summer Year) weather files. More specifically, CIBSE DSY1 2020, weather data for London has been used as to show compliance with CIBSE TM59.

Where relevant, future weather files (ie. 2050 Extreme Scenario) can be used to further test designs for potential temperature rises. However, this is not a mandatory test for compliance with TM59 requirements, and a pass is not required. This assessment has not been undertaken.

3.2 Overheating Criteria

This section outlines the assessment criteria used to determine the risk of overheating in the spaces modelled.

Due to the issue of comfort and overheating being highly subjective and dependant on multiple factors, some of which vary from person to person, guidelines have to be used to assess the appropriateness of the internal temperatures predicted.

CIBSE provide 2 no. guides which assist in benchmarking internal temperatures which are considered uncomfortable, and these guides form the basis for this report and associated modelling.

CIBSE TM52 (2013) – The Limits of Thermal Comfort: Avoiding Overheating in European Buildings

TM52 provides the following 3 no. criteria for determining whether internal temperatures are excessive:

- **Criterion 1: Hours of Exceedance (H_e):** Sets a limit of 3% on the number of occupied hours that the operative temperature can exceed the threshold comfort temperature (26°C in bedrooms and 28°C in all other rooms), T_{max}, by 1°K or more during the occupied hours of a typical non-heating season – 1 May to 30 September.

- **Criteria 2: Daily Weighted Exceedance (W_e):** Deals with the severity of overheating within any one day, which can be as important as its frequency. This is a function of both temperatures above T_{max} (ΔT) and its duration. This criterion sets a daily limit for acceptability. If each hour (or part-hour) in which the temperature exceeds Tmax by at least 1°K is multiplied by the number of degrees by which it is exceeded (ΔT), then this 'excess' should not be more than six degree-hours (for example, it can exceed T_{max} by 1°C for six hours or 2°C by three hours, and so on).

- **Criteria 3: Upper Limit Temperature (T_{upp}):** Sets an absolute maximum temperature of (Tmax + 4) for a room, beyond which the level of overheating is unacceptable.

CIBSE TM59 (2017) – Design Methodology for the Assessment of Overheating Risk in Homes

CIBSE TM59 is based on guidance from CIBSE TM52 (2013) and CIBSE Guide A (2015a) to provide a standardised approach to predicting overheating risk in both naturally and mechanically ventilated residential buildings.

TM59 introduces two sets of compliance criteria for assessing overheating based upon the ventilation type of the dwelling.

Criteria for homes predominantly naturally ventilated:

a. *For Living rooms, kitchens and bedrooms:* The number of hours during which ΔT (difference between actual operative temperature and limiting maximum acceptable temperature) is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours (TM52 criterion 1).

b. *For bedrooms only:* To guarantee comfort during the sleeping hours, the operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of occupied hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours will be recorded as a fail)

The above two criteria must be met for all relevant rooms to comply with CIBSE TM59. It is not necessary for Criteria 2 and 3 of CIBSE TM52 to be met.

Criteria for homes predominantly mechanically ventilated:

a. The CIBSE Guide A fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied hours.

25 Oakhill Avenue is considered to be predominantly naturally ventilated and therefore has been assessed against the relevant CIBSE TM59 criteria.

4.0 Dynamic Modelling

The thermal modelling has been carried out using IES-VE 2022. IES-VE is a fully dynamic analysis tool which is compliant with CIBSE Applications Manual AM11. A 3D thermal model of the Proposed Development has been created based on the architectural drawings to provide an accurate representation of the dwellings' layout, orientation, opening sizes and aspect.

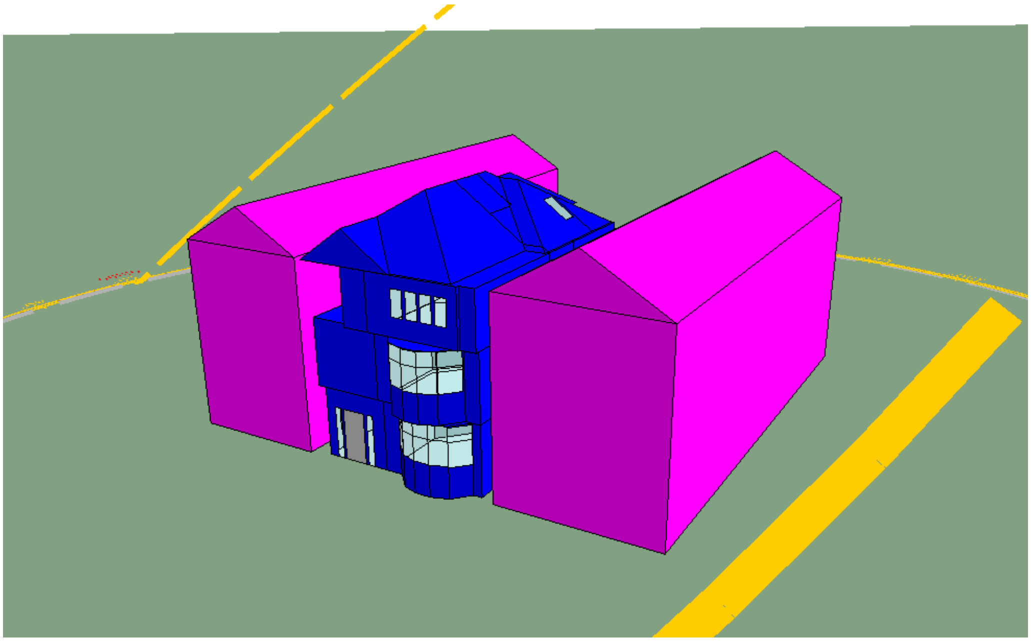

Figure 1: IES 3D Thermal Model

The model has been divided into different zones in relation to use. Appropriate profiles and internal gains have been assigned in all different areas, as per the CIBSE criteria outlined in this report. Only the results of the main occupied spaces have been assessed in this study. Secondary spaces occupied only briefly (less than 30 minutes), such as toilets, bathrooms, and cupboards are outside the scope of this study. The coloured spaces indicate the different thermal and occupancy profiles applied.

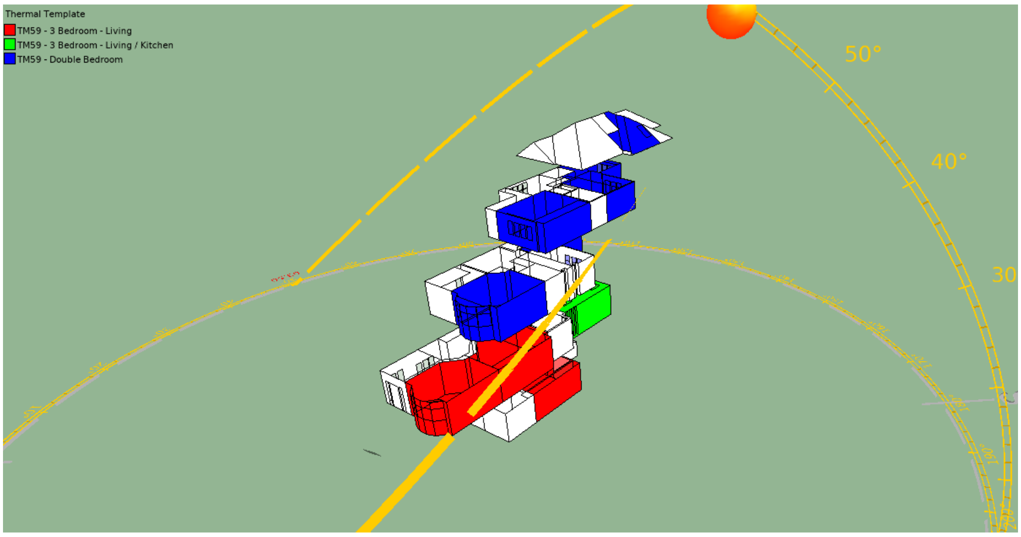

Figure 2: IES 3D Thermal Zones

5.0 Input Criteria and Parameters

This section details the design criteria which is applied in the DSM for the bedrooms and kitchens/living rooms. Load profiles and occupancy patterns are based on CIBSE TM59 methodology and CIBSE Guide A Guidance.

5.1 Assessed spaces

For the purpose of this assessment, all living spaces (occupied lower than 30 minutes) have been modelled as this most likely to suffer from overheating and selected for detailed analysis.

Level/Floor	Type
Lower ground	Flexible Space
Ground	Family Room
Ground	Kitchen/Dining
Ground	Study
First	Bedroom 1
First	Bedroom 2
Second	Bedroom 3
Second	Bedroom 4
Second	Bedroom 5/Study
Third	Bedroom 6

Table 3: Sampled rooms assessed in DSM.

5.2 Occupancy Levels

The following occupancy levels as stipulated in CIBSE TM59 have been used for the purpose of the overheating assessment. Occupancy is a key factor in the assessment of overheating as the presence of people within the room represent a large heat gain and therefore the number of people, and their activity level within a space will impact internal temperatures.

For the purposes of this assessment, the occupancy heat gain profile per person is set to 75W sensible and 55W latent.

Room	Occupancy Level
Double Bedroom	2 people
Living Area	6 person
Kitchen/ dining Area	6 person

Table 4: Assumed Occupancy Levels in Assessed Rooms.

5.3 Occupied Hours

In addition to the number of occupants of each space, the frequency of this occupation is also required so that the gains from this can be quantified. This is also taken from CIBSE TM59, and the profiles allocated to each of the spaces is shown below.

Room Type	Occupancy
Living/Dining/Kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day
Double Bedroom	2 people at 70% from 11 pm to 8 am 2 people at full gains from 8 am to 9am and from 10 pm to 11 pm 1 person at full gain in the bedroom from 9 am to 10 pm

Table 5: Assumed Occupancy Profiles Applied to Assessed Rooms.

5.4 Additional Heat Gains

The following heat gains as stipulated in CIBSE TM59 have been included to detail an accurate representation of the dwellings and inform the overheating analysis for the assessed areas. These are summarised within Table 6 below.

Item	Heat Gains	Times Applicable
Bedroom equipment gains (small power)	80	8:00-23:00
Bedroom Lighting	4	18:00-23:00
Kitchen Cooking Equipment	450	18:00-21:00
Kitchen/ Living Area Lighting	4	18:00-23:00
Building Infiltration	0.25	Continuous

Table 6: Assumed heat gains modelled in DSM

5.5 Mechanical Ventilation Proposals

The following ventilation strategy has been assigned to the assessed areas based on the proposed ventilation philosophy.

The development will be provided with a continuous mechanical extract system serving the bathrooms, and ensuites, with background ventilators via window trickle vents in line with Part F of the Building Regulations.

The extract fans shall be boosted by PIR sensors located in bathrooms and other moisture generating rooms.

Room	Flow Rates	System
Kitchen	13 l/s	Kitchen extract fan
Bathroom	8 l/s	Continuous Mechanical Extract Ventilation

Table 7: Mechanical Ventilation Strategy

5.6 Natural Ventilation Openings

It has been considered that occupants can use the openings for intermittent natural ventilation as and when additional ventilation is required to control internal temperatures.

Profiles are added to the model to identify the opening types with regards to the openable areas and the times/conditions when these will be opened by occupants.

The opening types are illustrated on the images below, with an explanation within Table 8.

Opening Type	Openable Area	Max Opening Angle (deg)	Key
Openable Windows Sign Hung	100%	20	
Openable Windows. Top hung	100%	20	
Openable Rooflight	100%	20	
Bi folding Glazed Doors	100%	50	
Windows Fixed Shut	0%	-	

Table 8: Window Opening Types

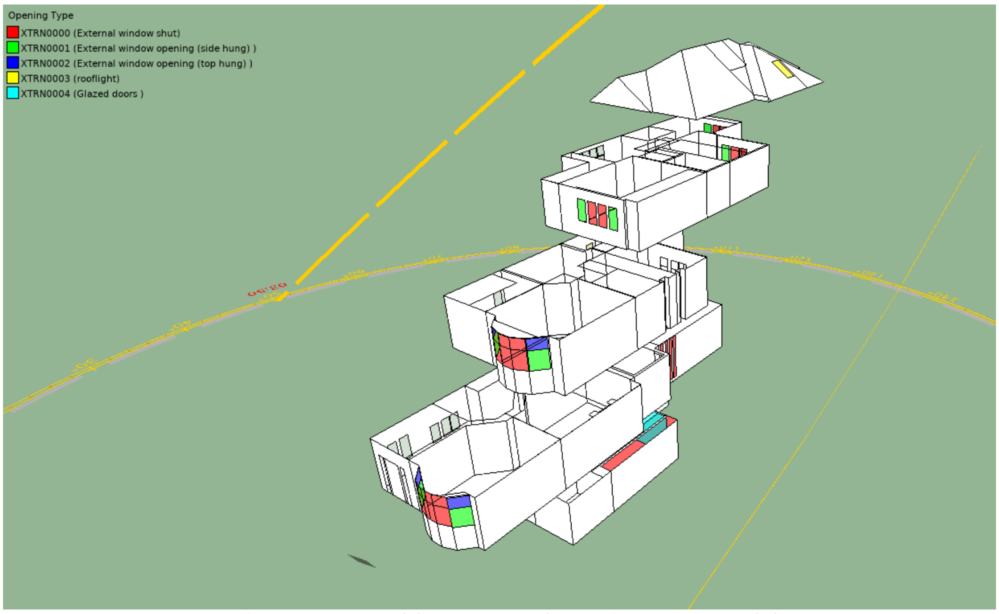

Figure 3: Openable Areas as shown in IES VE Model

5.7 Building Fabric

Thermal build ups for the existing property have been selected from the government approved RdSAP document Appendix S, which provides assumed U-values based on the age of property and construction type.

The proposed new build elements for the extension and refurbishment, have been based on notional Part L compliance u-values.

The thermal properties of the building fabric as confirmed in the Stage 2 report have been summarised in the Table 7 below:

Detail	U-Values	G-Values
Existing External Walls	1.6 W/m²k	-
Proposed External Walls	0.26 W/m2k	
Existing Ground floor	1.2 W/m²k	-
Proposed Basement floor	0.18 W/m²k	-
Existing refurbished Roof	0.16 W/m²k	-
Proposed Roof	0.16 W/m²k	-
Existing Glazing	4.8 W/m²k	0.86
Proposed Glazing	3.1 W/m²k	0.76
Roof window	3.4 W/m2k	0.76

Table 1: Building Fabric details

5.8 Model Geometry and External/Internal Shading

Surrounding buildings and structures have been included within the calculation model to allow for any shading potential provided by these surrounding structures. It should also be noted that for the initial iteration of the calculations contained within this report, external shading devices – brise soleil etc. – have not been proposed for this development due its Listed status.

6.0 Overheating Analysis

In accordance with CIBSE TM59, the overheating assessment has been undertaken for the summer period only - 1st May to 30th September. The air speed is set at 0.1 m/s to generate operative temperature, and the thermal comfort category has been set to 'Category II' (new building) in the assessment.

Using the CIBSE 2020 London DSY 1 weather data file to assess the parameters outlined in this report, all occupied rooms have been assessed for compliance with CIBSE TM59 criteria. The results from the DSM conclude that all rooms pass the CIBSE TM59 assessment. These results are summarised below:

Room	Criteria 1: %Hrs Top-Tmax >= 1°K (Limit = 3)	Criterion 2 (hours operative temp. >26°C Bedroom space)	Pass?
Flexible Space	2.4	N/A	✓
Family Room	1.9	N/A	✓
Kitchen/Dining	8.7	N/A	×
Study	8.4	N/A	×
Bedroom 1	3	65	×
Bedroom 2	1.3	45	×
Bedroom 3	1.4	64	×
Bedroom 4	0.9	78	×
Bedroom 5/Study	1.1	49	×
Bedroom 6	1.3	270	×

Table 2: Summary of CIBSE TM59 Results for Assessed Dwelling

7.0 Conclusion

Design measures have been incorporated, where feasible, to optimise thermal comfort conditions and minimise the overheating risks in line with the cooling hierarchy, as required by the London Borough of Camden Core strategy. These measures are through a combination of mechanical ventilation, efficient lighting and openable windows to promote good natural airflow.

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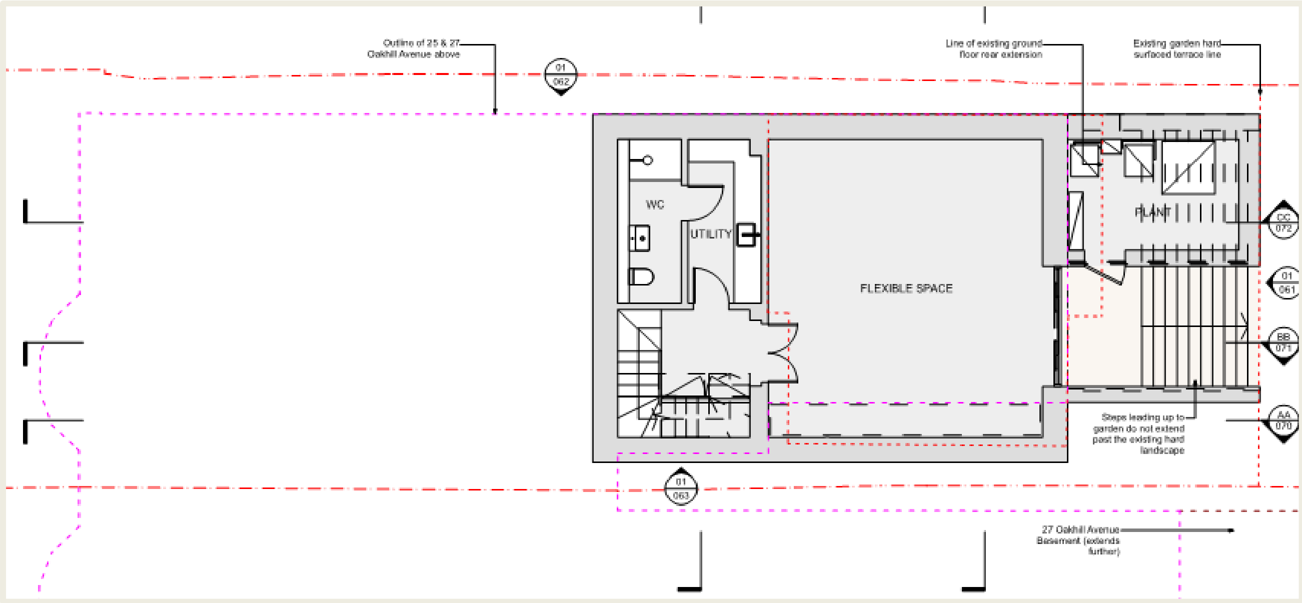
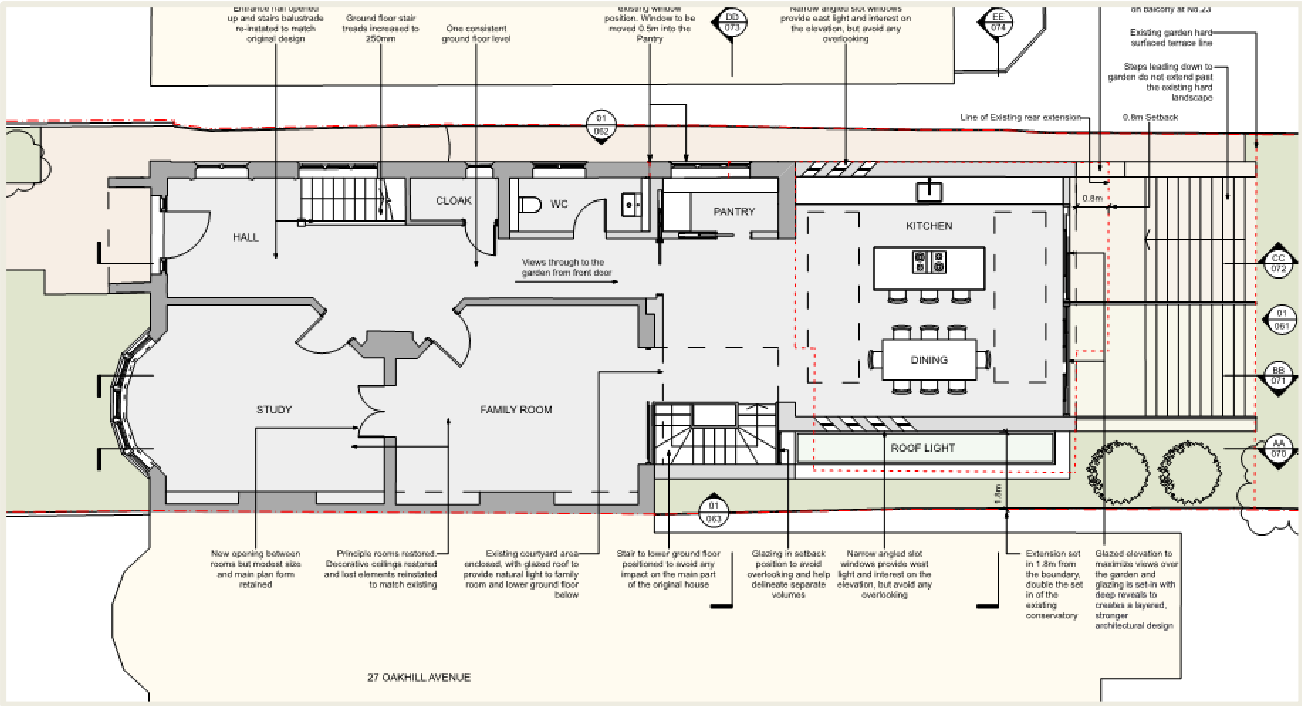
Appendix A – Floor Plans

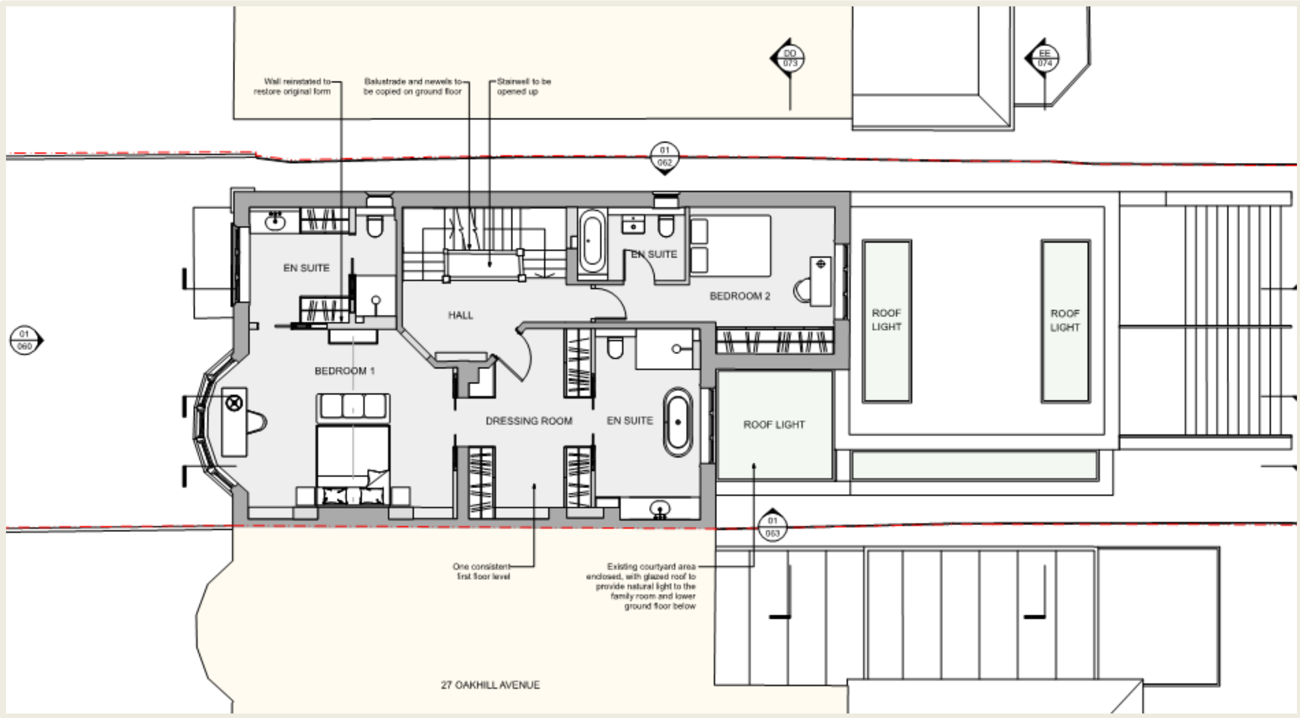
Lower Ground Floor:



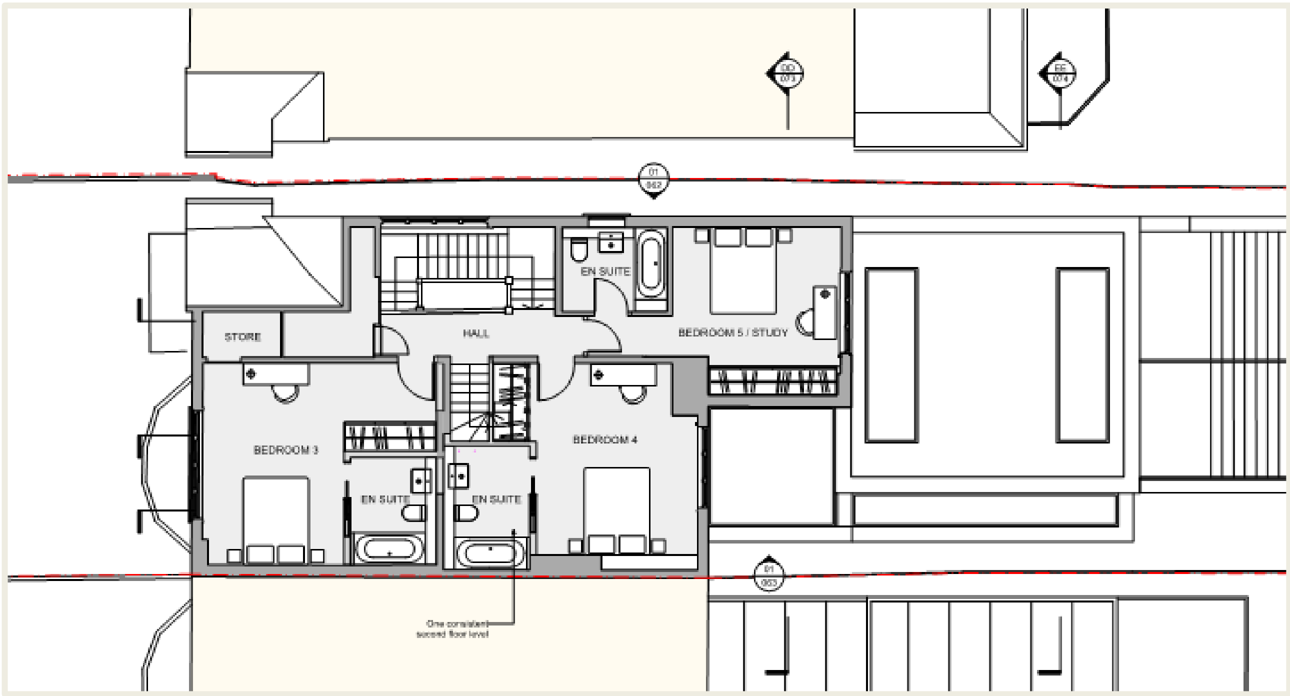
Ground Floor:



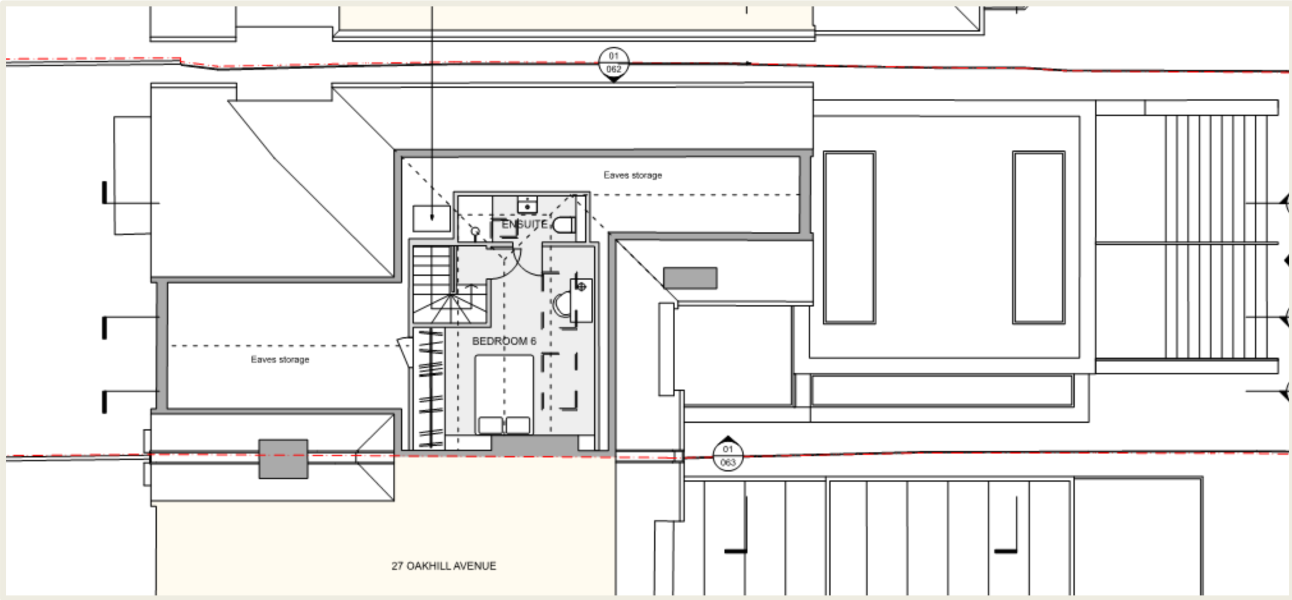
First Floor:



Second Floor:



Loft Plan:



Eaves storage
ENSUITE
BEDROOM 6
Eaves storage
27 OAKHILL AVENUE
01
062
01
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