DAYLIGHT & SUNLIGHT

INTERNAL DAYLIGHT, SUNLIGHT AND OVERSHADOWING ASSESSMENT

St John's Wood Park

28 September 2018

GIA No: **13025**

PROJECT DATA:

Client	**Almax Group**
Architect	**Maccreanor Lavington**
Project Title	**St John's Wood Park**
Project Number	**13025**

REPORT DATA:

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GIA Department	**Daylight & Sunlight**
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Map data

CONTENTS

1 EXECUTIVE SUMMARY

1.1 EXECUTIVE SUMMARY

The purpose of this report is to ascertain whether the proposed St John's Wood Park development will provide residential accommodation considered acceptable in terms of daylight, sunlight and overshadowing.

GIA has worked alongside the design team throughout the design process to maximise the daylight and sunlight amenity within the development. To this end, a continuous review of the scheme has been undertaken and design strategies incorporated to enhance the quality of light within the proposed accommodation. Further details can be found in section 5.

This report contains the final assessments undertaken for all the proposed habitable rooms. The winter-gardens have been excluded from the tests to present the results in the worst-case scenario.

Daylight

The assessments show that the proposed development will provide future occupants with excellent levels of daylight, with all the habitable rooms (100%) meeting or exceeding the levels of Average Daylight Factor (ADF) and No-Sky Line (NSL) recommended by BRE. All rooms have been designed in accordance with the Room Depth Criterion (RDC) where applicable. Further details can be found in section 5.1.

Sunlight

All the living areas suitable for testing (100%) see good levels of sunlight in winter and throughout the year, exceeding the recommendations by BRE. Further details can be found in section 5.2.

Overshadowing

With regards to overshadowing, 75% of the proposed garden at ground floor will see more than two hours of direct sunlight on 21st March, exceeding the BRE recommendation. Further details can be found in section 5.3.

In conclusion, the proposed development will offer future residents excellent daylight and sunlight amenity.

2 INTRODUCTION

1.1 INTRODUCTION AND OBJECTIVE

GIA has been instructed to provide a report upon the availability of Daylight and Sunlight to the proposed accommodation within the residential scheme prepared by Maccreanor Lavington. GIA was specifically instructed to carry out the following:

- To create a 3D computer model of the proposal based upon drawings prepared by Maccreanor Lavington.
- Carry out a daylight assessment using the methodologies set out in the BRE guidance for Average Daylight Factor, No-Sky Line and Room Depth Criterion.
- Carry out a sunlight assessment using the methodologies set out in the BRE guidance for Annual Probable Sunlight Hours (APSH) to the fenestration facing within 90° of due south.
- Carry out an overshadowing assessment using the methodology set out in the BRE guidance for Sun Hours On Ground (SHOG) for all relevant amenity areas.
- Prepare a report setting out the analysis and our findings.

3 BRE GUIDELINES

The Building Research Establishment (BRE) have set out in their handbook 'Site Layout Planning for Daylight and Sunlight a Guide to Good Practice (2011)', guidelines and methodology for the measurement and assessment of daylight and sunlight within proposed buildings.

The guide also provides advice on site layout planning to determine the quality of daylight and sunlight within open spaces between buildings.

It is important to note, however, that this document is a guide and states that its aim *"is to help rather than constrain the designer"*.

The document provides advice, but also clearly states that it *"is not mandatory and this document should not be seen as an instrument of planning policy."* The report also acknowledges in its introduction that *"in special circumstances the developer or planning authority may wish to use different target values. For example, in a historic city centre a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings."*

It is an inevitable consequence of the built up urban environment that daylight and sunlight will be more limited in these areas. It is well acknowledged that in such situations there may be many other conflicting and potentially more important planning and urban design matters to consider other than just the provision of ideal levels of daylight and sunlight.

3.1 DAYLIGHT

The BRE set out various methods for assessing the daylight within a proposed building within section 2.1 and Appendix C of the handbook. These are summarised below.

Vertical Sky Component (VSC)

This method of assessment can be undertaken using a skylight indicator or a Waldram diagram. It measures from a single point, at the centre of the window (if known at the early design stage), the quantum of sky visible taking into account all external obstructions. Whilst these obstructions can be either other buildings or the general landscape, trees are usually ignored unless they form a continuous or dense belt of obstruction.

The VSC method is a useful 'rule of thumb' but has some significant limitations in determining the true quality of daylight within a proposed building. It does not take into account the size of the window, any reflected light off external obstructions, any reflected light within the room, or the use to which that room is put. Appendix C of the guide goes into more detail on these matters and sets forward alternative methods for assessment to overcome these limitations.

Appendix C of the BRE guide: Interior Daylighting Recommendations, states:

"The British Standard Code of practice for daylighting (BS 8206-2) and the CIBSE Lighting Guide LG 10 Daylighting and window design contain advice and guidance on interior daylighting. The guidance contained in this publication (BR 209) is intended to be used with BS 8206-2 and LG 10. Both these publications refer to BR 209.

For skylight BS 8206-2 and LG 10 put forward three main criteria, based on average daylight factor (ADF); room depth; and the position of the no sky line."

These assessments are set out below.

Average Daylight Factor (ADF)

"If a predominantly daylit appearance is required, then the ADF should be 5% or more if there is no supplementary electric lighting, or 2% or more if supplementary electric lighting is provided. There are additional recommendations for dwellings of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms.

These additional recommendations are minimum values of ADF which should be attained even if a predominantly daylit appearance is not achievable."

This method of assessment takes into account the total glazed area to the room, the transmittance quality of the glazing proposed, the total area of the room surfaces including ceilings and floors, and the internal average reflectance for the room being assessed. The method also takes into account the Vertical Sky Component and the quantum of reflected light off external surfaces.

This is, therefore, a significantly more detailed method of assessment than the Vertical Sky Component method set out above.

Room Depth Criterion (RDC)

Where it has access to daylight from windows in one wall only, the depth of a room can become a factor in determining the quantity of light within it. The BRE guidance provides a simple method for examining the ratio of room depth to window area. However, whilst it does take into account internal surface reflections, this method also has significant limitations in that it does not take into account any obstructions outside the window and therefore draws no input from the quantity of light entering the room.

No Sky Line (NSL)

This third method of assessment is a simple test to establish where within the proposed room the sky will be visible through the windows, taking into account external obstructions. The assessment is undertaken at working plane height (850mm above floor level) and the method of calculation is set out in Appendix D of the BRE handbook.

Appendix C of the BRE handbook states *"If a significant area of the working plane (normally more than 20%) lies beyond the no sky line (ie it receives no direct skylight) then the distribution of daylight in the room will look poor and supplementary electric lighting will be required."* To guarantee a satisfactory daylight uniformity, the area which does not receive direct skylight should not exceed 20% of the floor area, as quantified in the BS 8206 Part2 2008.

Summary

The Average Daylight Factor gives a more detailed assessment of the daylight within a room and takes into account the highest number of factors in establishing a quantitative output.

However, the conclusion of Appendix C of the BRE guide states:

"[All three of] the criteria need to be satisfied if the whole of the room is to look adequately daylit. Even if the amount of daylight in a room (given by the Average Daylight Factor) is sufficient, the overall daylight appearance will be impaired if its distribution is poor."

In most urban areas it is important to recognise that the distribution of daylight within a room may be difficult to achieve, given the built up nature of the environment. Consequently, most local authorities seek to ensure that there is sufficient daylight within the room as determined by the Average Daylight Factor calculation. However, the additional recommendations of the BRE and British Standard for residential accommodation, set out above, ought not to be overlooked.

3.2 SUNLIGHT

The BRE provide guidance in respect of sunlight quality for new developments within section 3.1 of the handbook. It is generally acknowledged that the presence of sunlight is more significant in residential accommodation than it is in commercial properties, and this is reflected in the BRE document.

It states, *"in housing, the main requirement for sunlight is in living rooms, where it is valued at any time of the day, but especially in the afternoon. Sunlight is also required in conservatories. It is viewed as less important in bedrooms and in kitchens where people prefer it in the morning rather than the afternoon."*

The BRE guide considers the critical aspects of orientation and overshadowing in determining the availability of sunlight at a proposed development site.

The guide proposes minimizing the number of dwellings whose living room face solely north unless there is some compensating factor such as an appealing view to the north, and it suggests a number of techniques to do so. Further more, it discusses massing solutions with a sensitive approach to overshadowing, so as to maximize access to sunlight.

At the same time it acknowledges that the site's existing urban environment may impose orientation or overshadowing constraints which may not be possible to overcome.

To quantify sunlight access for interiors where sunlight is expected, it refers to the BS 82606-2 criterion of Annual Probable Sunlight Hours. APSH is defined as *"the total number of hours in the year that the sun is expected to shine on unobstructed ground, allowing for average levels of cloudiness at the location in question."* In line with the recommendation, APSH is measured from a point on the inside face of the window, should the locations have been decided. If these are unknown, sunlight availability is checked at points 1.6m above the ground or the lowest storey level on each main window wall, and no more than 5m apart. If a room has multiple windows on the same wall or on adjacent walls, the highest value of APSH should be taken into account. If a room has two windows on opposite walls, the APSH for each can be added together.

The summary of section 3.1 of the guide states as follows:

"In general, a dwelling or non-domestic building which has a particular requirement for sunlight, will appear reasonably sunlit provided that:

- *At least one main window faces within 90 degrees of due south, and*
- *The centre of at least one window to a main living room can receive 25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter months between 21 September and 21 March. "*

In paragraph 3.1.11 the BRE guidance suggests that if a room faces significantly North of due East or West it is unlikely to meet the recommended levels proposed by the BS 8206-2. As such, it is clear that only windows facing within 90 degrees of due South can be assessed using this methodology.

It is also worth noting how paragraph 5.3 of the BS 8206-2 suggests that with regards to sunlight duration *"the degree of satisfaction is related to the expectation of sunlight. If a room is necessarily north facing or if the building is in a densely-built urban area, the absence of sunlight is more acceptable than when its exclusion seems arbitrary"*.

3.3 OVERSHADOWING

The BRE guidance in respect of overshadowing of amenity spaces is set out in section 3.3 of the handbook. Here it states as follows:

"Sunlight in the spaces between buildings has an important impact on the overall appearance and ambiance of a development. It is valuable for a number of reasons, to:

- *provide attractive sunlit views (all year)*
- *make outdoor activities, like sitting out and children's play more pleasant (mainly warmer months)*
- *encourage plant growth (mainly spring and summer)*
- *dry out the ground, reducing moss and slime (mainly in colder months)*
- *melt frost, ice and snow (in winter)*
- *dry clothes (all year)"*

Again, it must be acknowledged that in urban areas the availability of sunlight on the ground is a factor which is significantly controlled by the existing urban fabric around the site in question and so may have very little to do with the form of the development itself. Likewise there may be many other urban design, planning and site constraints which determine and run contrary to the best form, siting and location of a proposed development in terms of availability of sun on the ground.

The summary of section 3.3 of the guide states as follows:

"3. 3 .17 It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March. If as a result of new development an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable. If a detailed calculation cannot be carried out, it is recommended that the centre of the area should receive at least two hours of sunlight on 21 March."

3.4 FURTHER RELEVANT INFORMATION

Further information can be found in The Daylight in Urban Areas Design Guide (Energy Saving Trust CE257, 2007) which provides the following recommendation with regards to VSC levels in urban areas:

"If 'theta' (Visible sky angle) is greater than 65° (obstruction angle less than 25° or VSC at least 27 percent) conventional window design will usually give reasonable results.

If 'theta' is between 45° and 65° (obstruction angle between 25° and 45°, VSC between 15 and 27 percent), special measures such as larger windows and changes to room layout are usually needed to provide adequate daylight.

If 'theta' is between 25° and 45° (obstruction angle between 45° and 65°, VSC from 5 to 15 percent), it is very difficult to provide adequate daylight unless very large windows are used.

If 'theta' is less than 25° (obstruction angle more than 65°, VSC less than 5 percent) it is often impossible to achieve reasonable daylight, even if the whole window wall is glazed."

4 METHODOLOGY

In order to undertake the daylight and sunlight assessments set out in the previous pages, we have prepared a three dimensional computer model and used specialist lighting simulation software.

The three dimensional representation of the proposed development has been modelled using the scheme drawings provided to us by Maccreanor Lavington. This has been placed in the context of its surrounding buildings which have been modelled from survey information, photogrammetry, OS and site photographs. This allows for a precise model, which in turn ensures that analysis accurately represents the amount of daylight and sunlight available to the building facades, internal and external spaces, considering all of the surrounding obstructions and orientation.

4.1 SIMULATION ASSUMPTIONS

Where no values for reflectance, transmittance and maintenance factor were specified by the designer the following values from *BS 8206-2:2008, Annex A, tables A.1-A.6* were used for the calculation of Average Daylight Factor values. These values are shown in Table 1.

All the windows are assumed being standard triple glazed, with the exception of the basement level where a light transmittance value typical of a double glazing has been applied in agreement with the design team.

REFLECTANCE VALUES:	
Surrounding	0.2
Pavement	0.2
Grass	0.1
Water	0.1
Yellow brick	0.3
Red brick	0.2
Portland Stone	0.6
Concrete	0.4
Internal walls (light grey)	0.68
Internal ceiling (white paint)	0.85
Internal floor (medium veneer)	0.3
Internal floor (light veneer)	0.4

TRANSMITTANCE VALUES	TV
Triple glazing (Low-E): Pilkington K Glass 4/12/4/12/4 Argon filled 90%	0.63
Double glazing (Low-E): Pilkington K Glass 4/16/4 Argon filled 90%	0.73
Single glazing: Pilkington Optifloat Clear 4mm Annealed	0.90
Translucent glazing (Low-E): Pilkington Optifloat Opal - 4mm K /16/4mm Opal	0.74

MAINTENANCE FACTORS: GLAZING TYPE	TV (Normal)	A.3	A.4	A.5	A.6	TV (Total)
Triple Low-E (frames modelled)	0.63	8	1	1	1	0.58
Triple Low-E (frames not modelled)	0.63	8	1	1	0.8	0.46
Triple Low-E (inclined, frames modelled)	0.63	8	2	1	1	0.53
Triple Low-E (inclined, frames not modelled)	0.63	8	2	1	0.8	0.42
Triple Low-E (horizontal, frames modelled)	0.63	8	3	1	1	0.48
Triple Low-E (horizontal, frames not modelled)	0.63	8	3	1	0.8	0.38
Double Low-E (frames modelled)	0.75	8	1	1	1	0.69
Double Low-E (frames not modelled)	0.73	8	1	1	0.8	0.53
Double Low-E (inclined, frames modelled)	0.75	8	2	1	1	0.63
Double Low-E (inclined, frames not modelled)	0.75	8	2	1	0.8	0.50
Double Low-E (horizontal, frames modelled)	0.75	8	3	1	1	0.57
Double Low-E (horizontal, frames not modelled)	0.75	8	3	1	0.8	0.46
Single (frames modelled)	0.9	8	1	1	1	0.83
Single (frames not modelled)	0.9	8	1	1	0.8	0.66
Single (inclined, frames modelled)	0.9	8	2	1	1	0.76
Single (inclined, frames not modelled)	0.9	8	2	1	0.8	0.60
Single (horizontal, frames modelled)	0.9	8	3	1	1	0.68
Single (horizontal, frames not modelled)	0.9	8	3	1	0.8	0.55

Table 01: Typical reflectance, transmittance and maintenance factors

5 CONCLUSIONS

In order to ascertain the levels of daylight, sunlight and overshadowing within the proposed St John's Wood Park development, technical assessments have been undertaken within all the proposed habitable rooms (i.e. living rooms, L/K/Ds, kitchens, dining rooms and bedrooms) and the proposed garden.

The internal daylight and sunlight assessments can be found respectively on pages 12 and 19 of this report. The overshadowing assessment results for the garden are presented at page 26.

GIA has worked alongside Maccreanor Lavington Architects to deliver a scheme that will provide future occupants with high levels of daylight and sunlight amenity. The scheme has been reviewed continuously throughout the design process, and advice has been provided to optimise daylight in the most challenging areas, i.e. in the rooms in the basement and ground floor. This included recommendations for internal arrangements, room layouts, window positioning, materials and finishing.

5.1 CONCLUSIONS ON DAYLIGHT

All the proposed habitable rooms have been assessed for Average Daylight Factor (ADF), No-Sky Line (NSL) and Room Depth Criterion (RDC).

The scheme includes amenity areas in the form of winter-gardens for most of the proposed units. These areas are excellently daylit and can be enjoyed by future residents throughout the year, however, they have been discounted from the calculations to represent a worst-case scenario where the winter-gardens are used as balconies.

The results of the assessments show that all of the proposed habitable rooms meet or exceed the recommended levels of daylight (ADF) and light distribution (NSL) set by the BRE guidance. All the rooms have also been designed in accordance to RDC, where applicable.

In addition, it is worth mentioning that the vast majority of the rooms are very well daylit, far exceeding the levels set by BRE.

Therefore, the provision of daylight amenity for the proposed development is excellent.

5.2 CONCLUSIONS ON SUNLIGHT

In order to ascertain the levels of sunlight within the proposed residential accommodation, all the living areas with a main window facing within 90 degrees of due south have been assessed for Annual Probable Sunlight Hours (APSH).

The results show that all of the tested rooms see good levels of sunlight throughout the year (APSH) and also in winter (WPSH), far exceeding the recommendations by BRE.

The scheme will provide future occupants with very good levels of sunlight.

5.3 CONCLUSIONS ON OVERSHADOWING

The proposed garden at the rear of the building has been assessed for Sun Hours on Ground (SHOG).

The results show that 75% of the open space see two or more hours of direct sunlight on 21st March, where 50% represents the recommended target set by the BRE.

The Sun Exposure diagrams show the number of hours of sunlight availability in the garden at the equinox and in the summer solstice.

Overall, the scheme delivers good levels of sunlight amenity for the proposed garden, which will be well sunlit throughout the year.

6 SITE OVERVIEW

Fig. 01: Top view

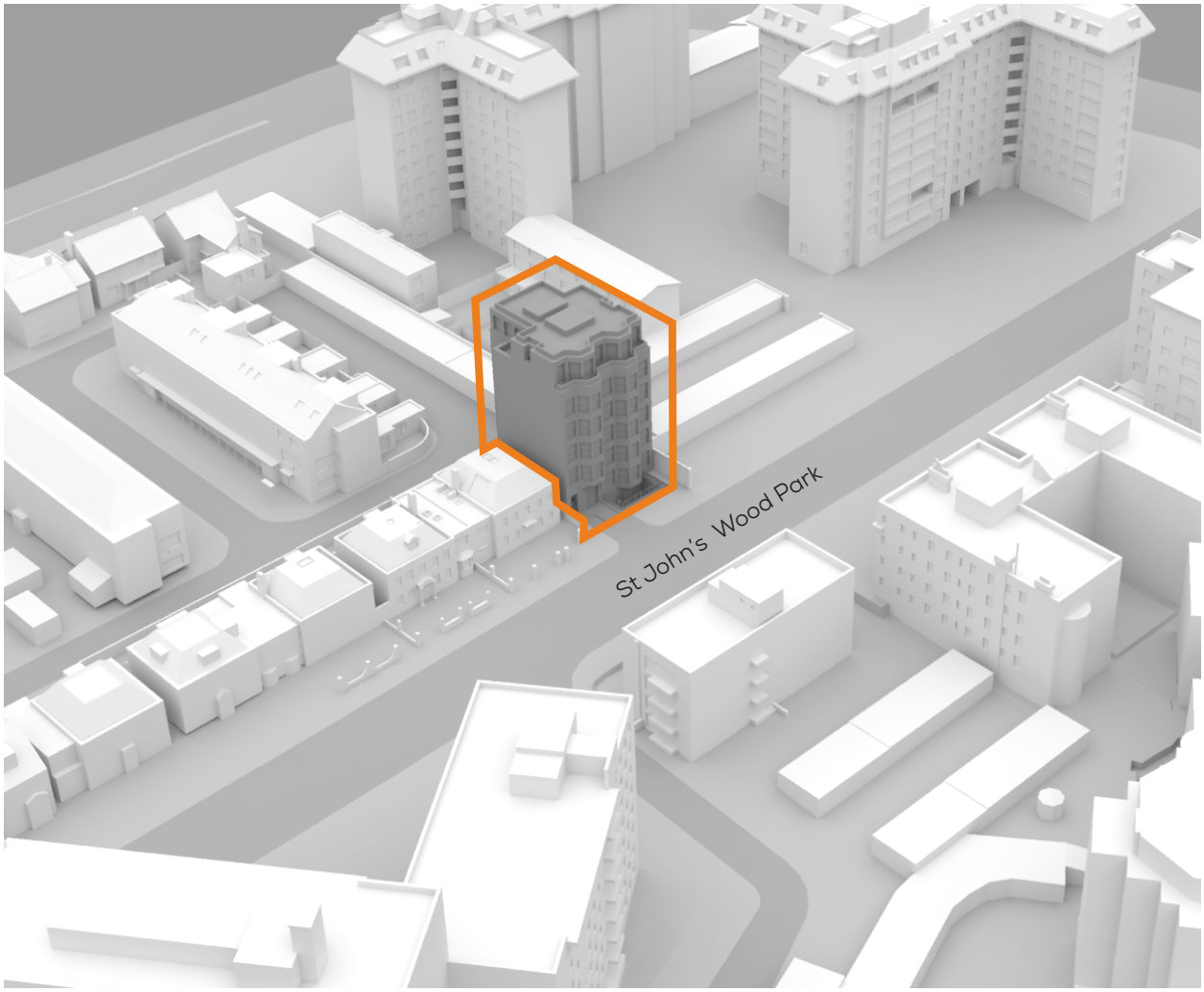


Fig. 02: Perspective view

7 INTERNAL DAYLIGHT ASSESSMENTS

Basement

		DAYLIGHT QUANTUM	DAYLIGHT DISTRIBUTION	
ROOM REF.	ROOM USE	ADF (%)	NSL (%)	RDC
BASEMENT				
1	Bedroom	1.4	84	MET
2	Bedroom	1.6	82	MET
3	Bedroom	1	82	MET

Table 02: Assessment Data

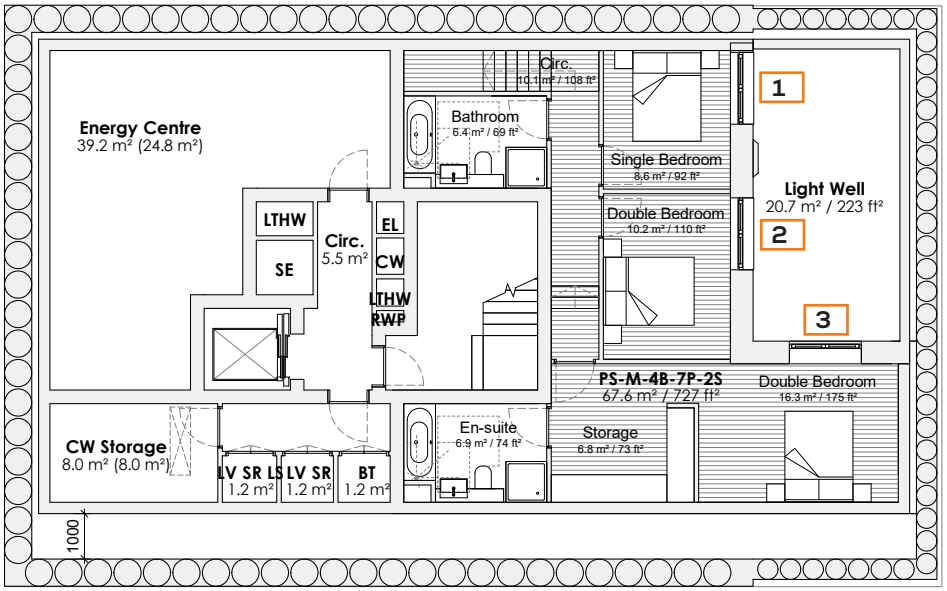


Fig. 03: Floor Plan

Ground Floor

		DAYLIGHT QUANTUM	DAYLIGHT DISTRIBUTION	
ROOM REF.	ROOM USE	ADF (%)	NSL (%)	RDC
GROUND FLOOR				
4	Living Room	3.9	100	N/A
5	Kitchen	2.7	99	MET
6	Bedroom	1.9	99	MET

Table 03: Assessment Data

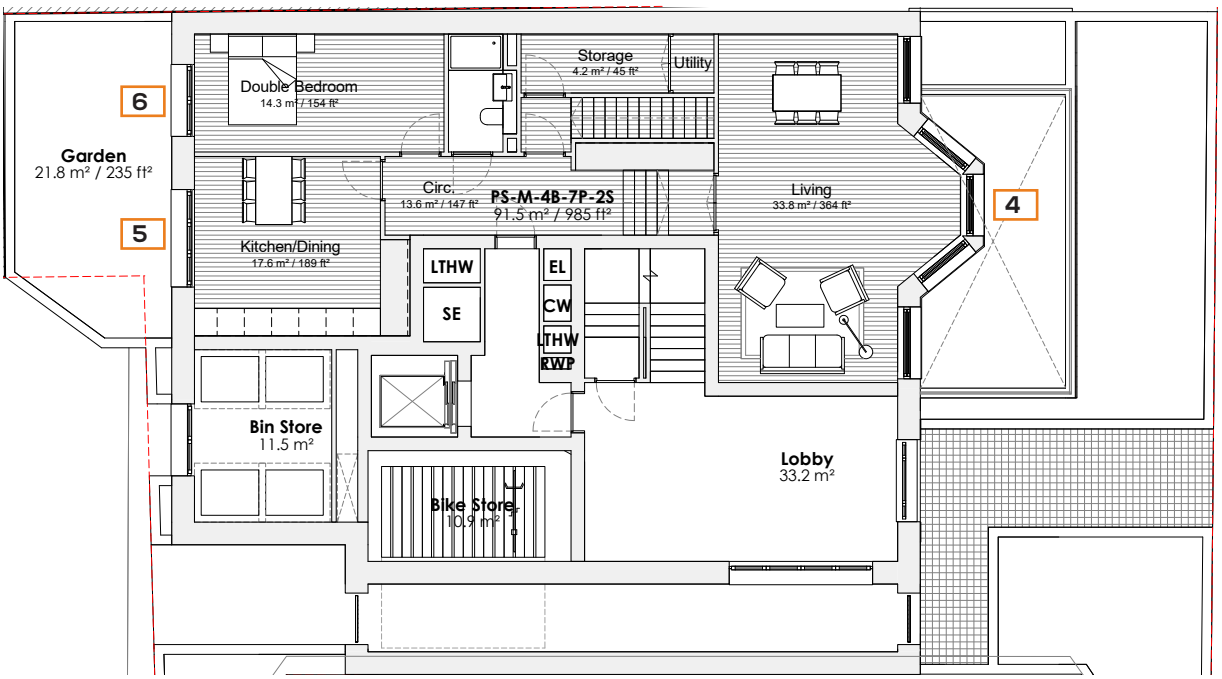


Fig. 04: Floor Plan

First Floor

		DAYLIGHT QUANTUM	DAYLIGHT DISTRIBUTION	
ROOM REF.	ROOM USE	ADF (%)	NSL (%)	RDC
1ST FLOOR				
7	Living Room	2.7	100	N/A
8	L/K/D	2.3	99	N/A
9	Bedroom	1.9	98	MET
10	Bedroom	4.8	100	N/A
11	Bedroom	2.6	100	MET
12	Bedroom	2.7	100	MET
13	Bedroom	2.1	94	MET

Table 04: Assessment Data

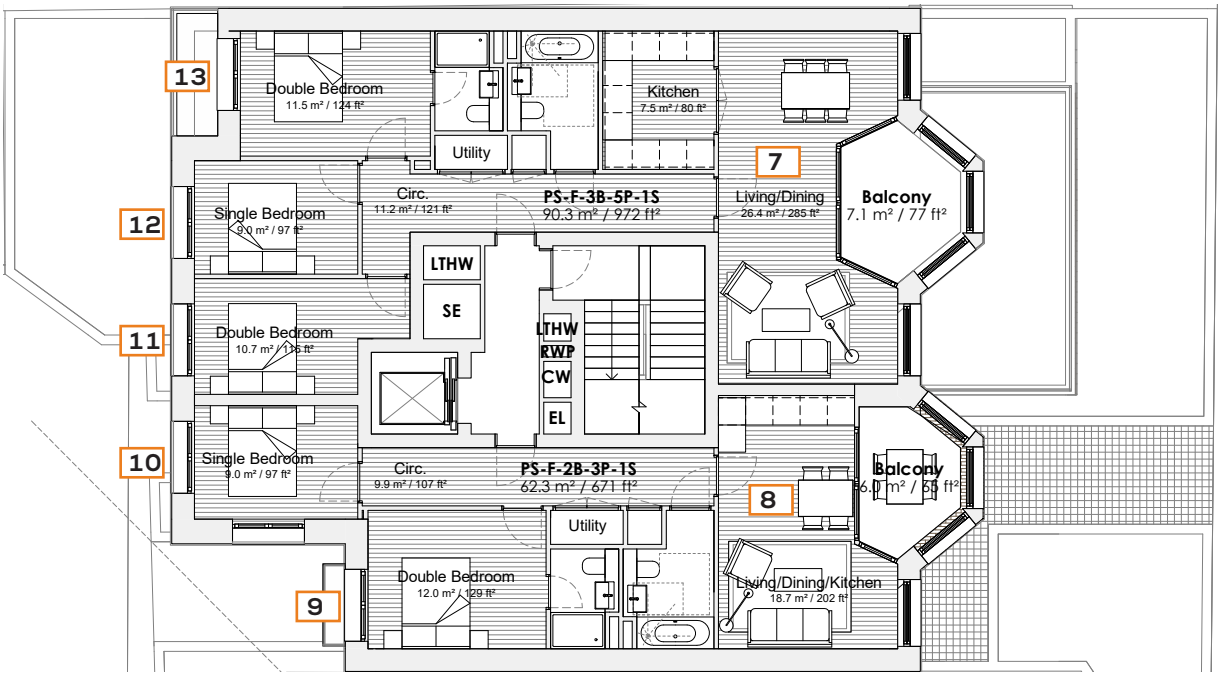


Fig. 05: Floor Plan

Second Floor

		DAYLIGHT QUANTUM	DAYLIGHT DISTRIBUTION	
ROOM REF.	ROOM USE	ADF (%)	NSL (%)	RDC
2ND FLOOR				
14	Living Room	2.8	100	N/A
15	L/K/D	2.4	99	N/A
16	Bedroom	2	98	MET
17	Bedroom	5.1	100	N/A
18	Bedroom	2.7	100	MET
19	Bedroom	2.8	100	MET
20	Bedroom	2.1	96	MET

Table 05: Assessment Data

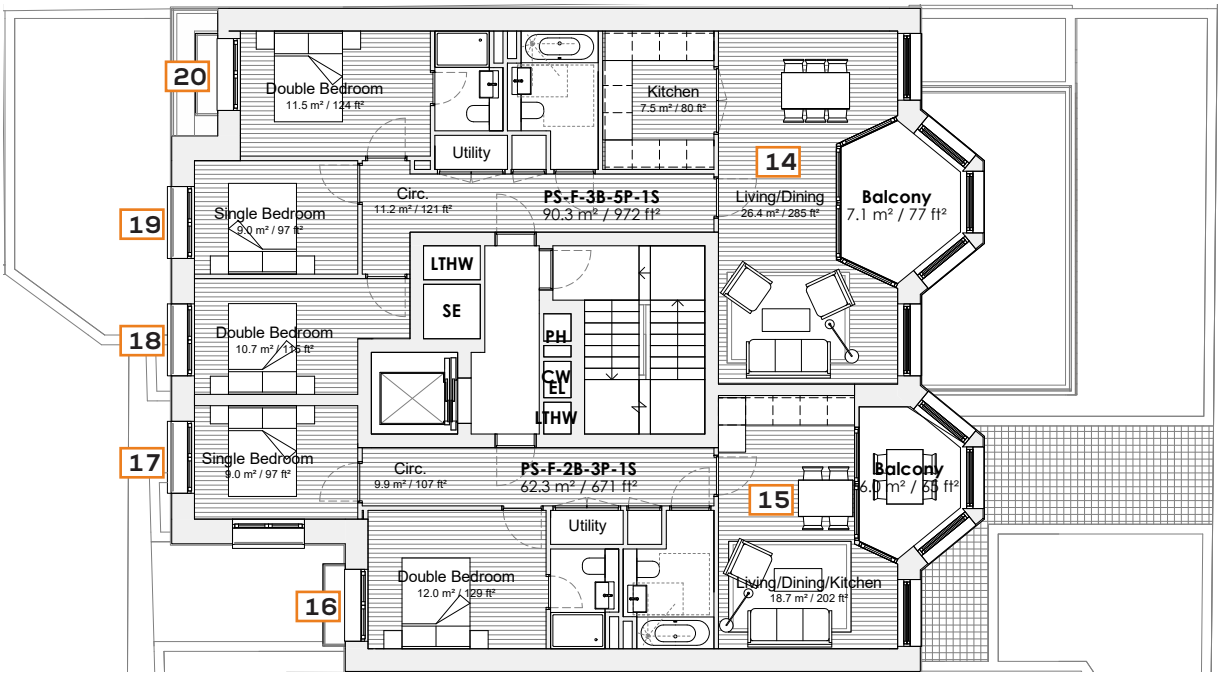


Fig. 06: Floor Plan

Third Floor

		DAYLIGHT QUANTUM	DAYLIGHT DISTRIBUTION	
ROOM REF.	ROOM USE	ADF (%)	NSL (%)	RDC
3RD FLOOR				
21	Living Room	2.9	100	N/A
22	L/K/D	2.5	99	N/A
23	Bedroom	2	98	MET
24	Bedroom	5.2	100	N/A
25	Bedroom	2.8	100	MET
26	Bedroom	2.9	100	MET
27	Bedroom	2.2	98	MET

Table 06: Assessment Data

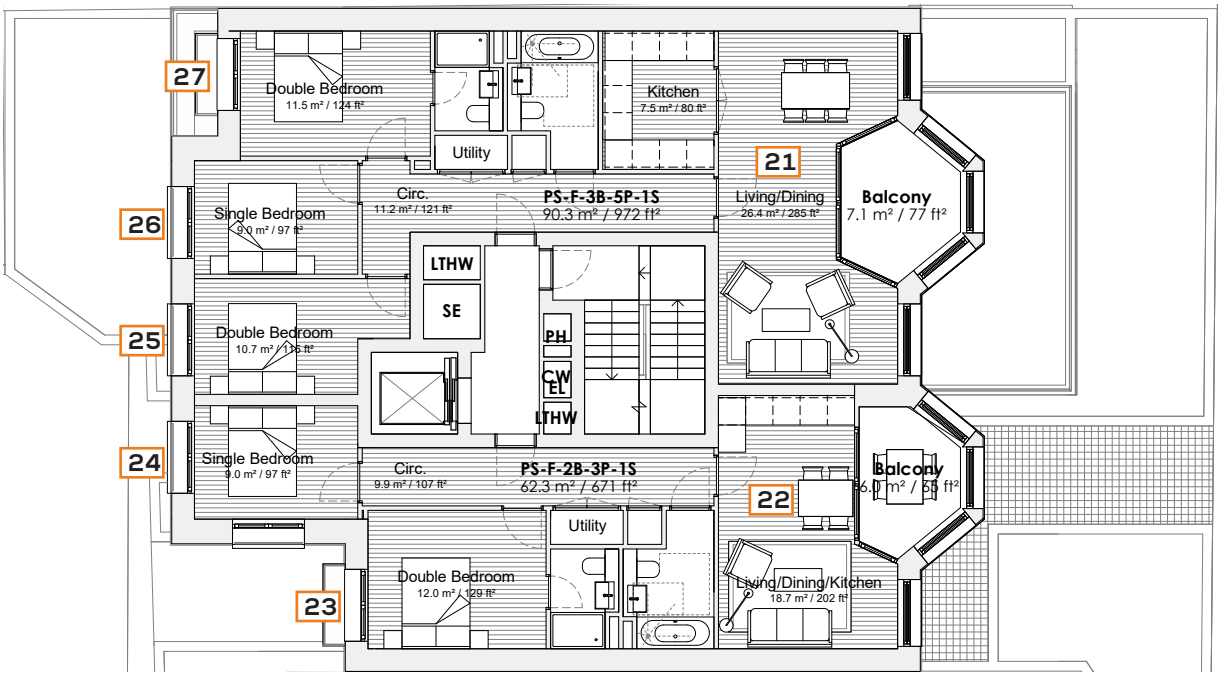


Fig. 07: Floor Plan

Fourth Floor

		DAYLIGHT QUANTUM	DAYLIGHT DISTRIBUTION	
ROOM REF.	ROOM USE	ADF (%)	NSL (%)	RDC
4TH FLOOR				
28	Bedroom	2.5	100	N/A
29	Bedroom	2.7	100	N/A
30	Bedroom	2.5	100	N/A
31	Bedroom	2.6	97	MET
32	Bedroom	5.4	100	N/A
33	Bedroom	2.8	100	MET
34	Bedroom	2.9	100	MET
35	Bedroom	2.3	99	MET

Table 07: Assessment Data

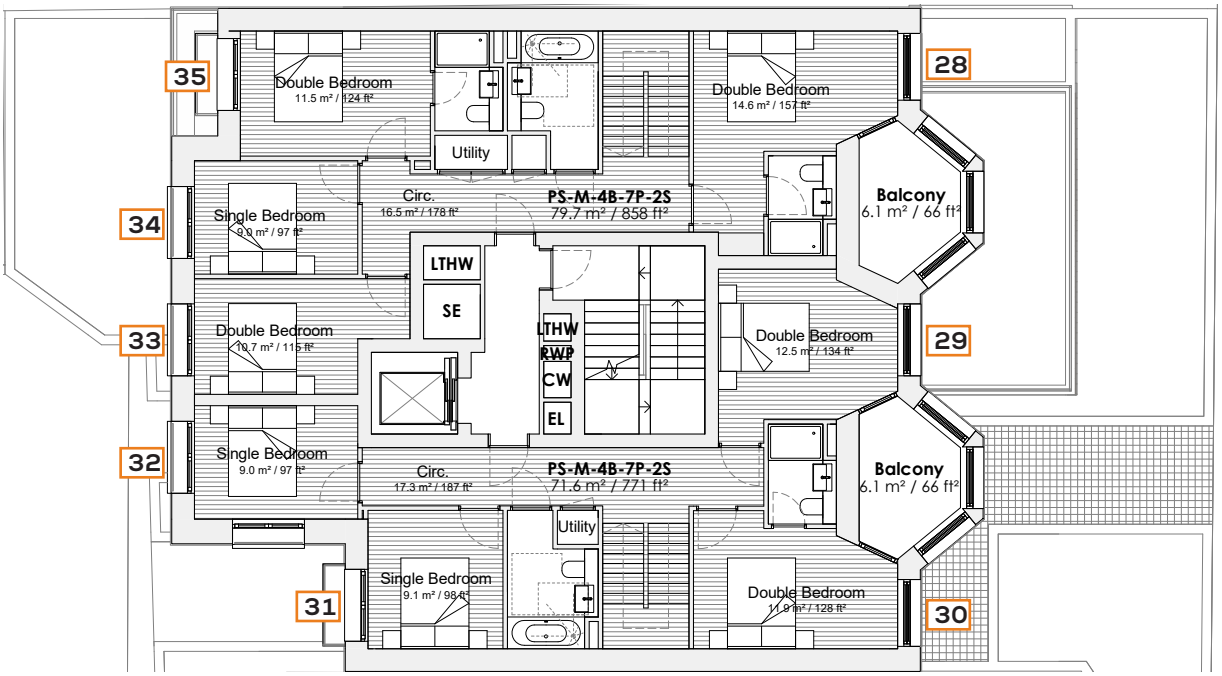


Fig. 08: Floor Plan

Fifth Floor

		DAYLIGHT QUANTUM	DAYLIGHT DISTRIBUTION	
ROOM REF.	ROOM USE	ADF (%)	NSL (%)	RDC
5TH FLOOR				
36	Living Room	4.6	100	N/A
37	Living Room	4.7	100	N/A
38	Kitchen	7.6	100	N/A
39	Kitchen	5.7	100	N/A
40	Dining Room	1.9	92	MET

Table 08: Assessment Data

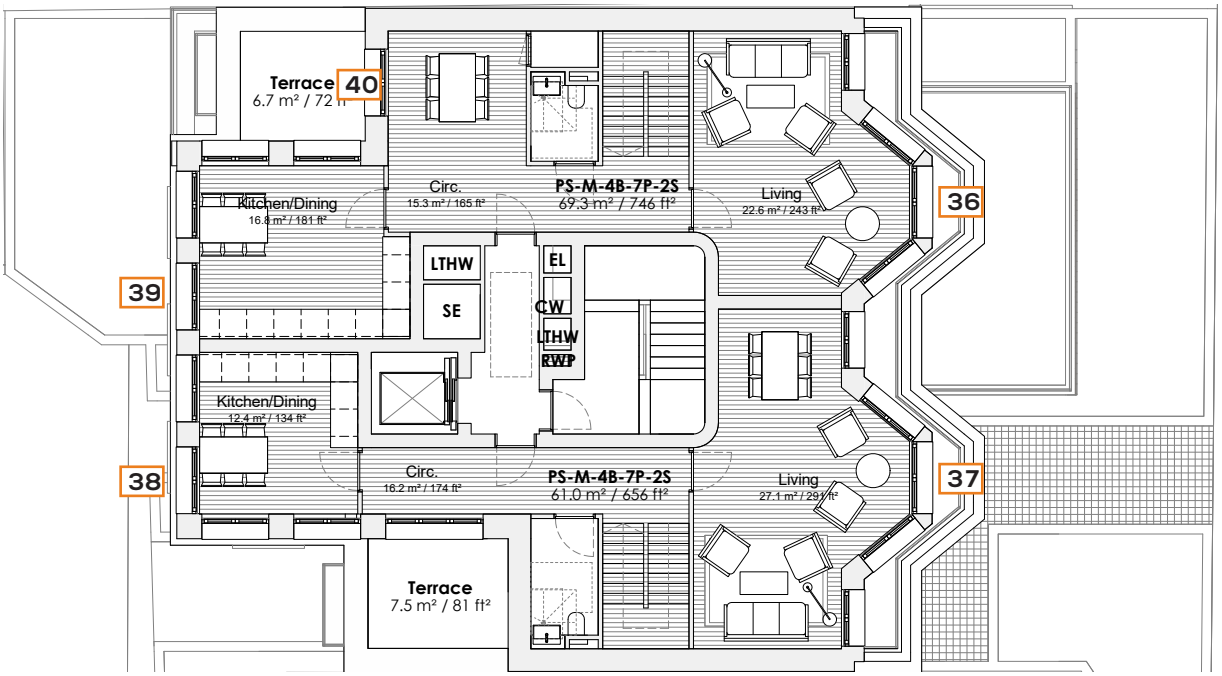


Fig. 09: Floor Plan

8 INTERNAL SUNLIGHT ASSESSMENTS

Basement

		SUNLIGHT QUANTUM (PROBABLE SUNLIGHT HOURS)	
ROOM REF.	ROOM USE	ANNUAL	WINTER
BASEMENT			
1	Bedroom		
2	Bedroom		
3	Bedroom		

Table 09: Assessment Data

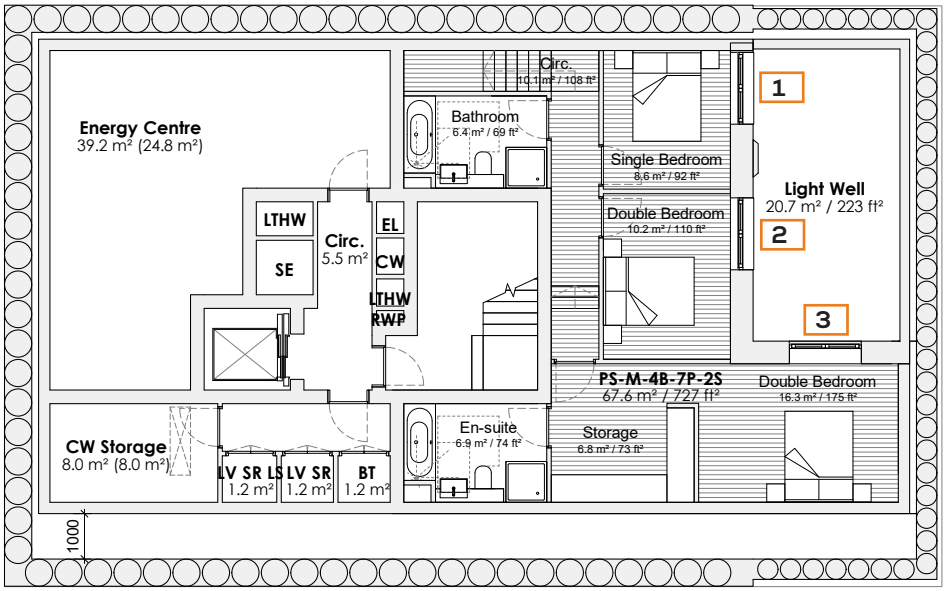


Fig. 10: Floor Plan

Ground Floor

		SUNLIGHT QUANTUM (PROBABLE SUNLIGHT HOURS)	
ROOM REF.	ROOM USE	ANNUAL	WINTER
GROUND FLOOR			
4	Living Room	43	11
5	Kitchen		
6	Bedroom		

Table 10: Assessment Data

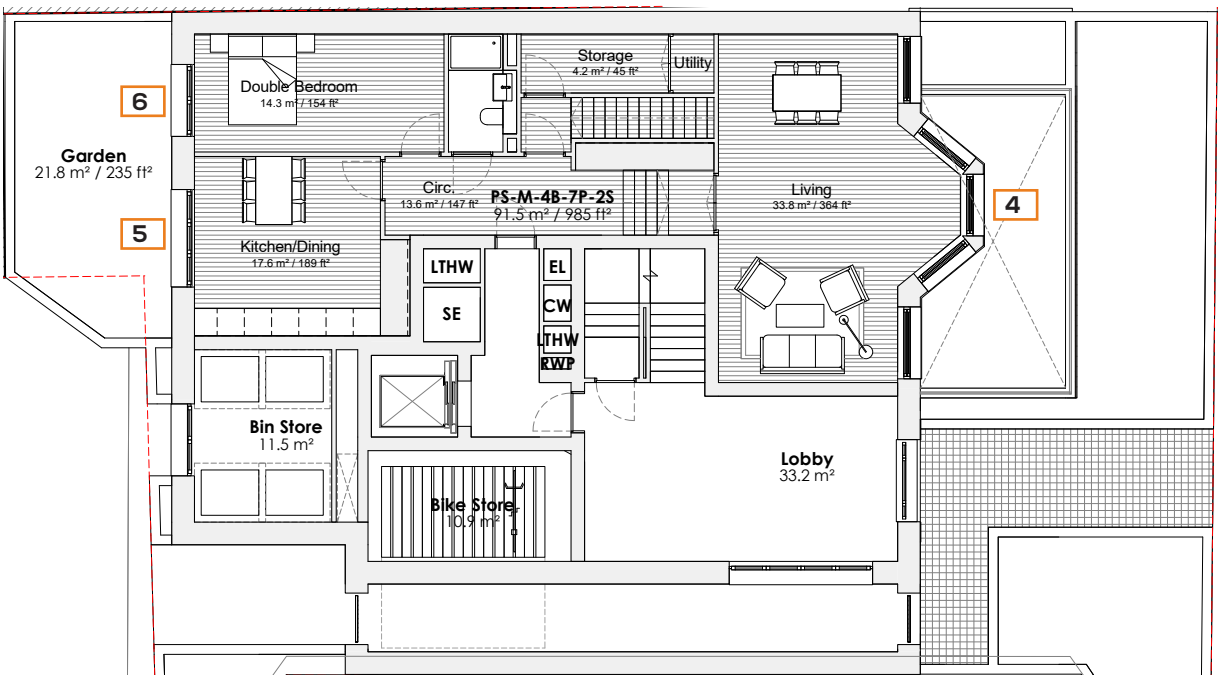


Fig. 11: Floor Plan

First Floor

		SUNLIGHT QUANTUM (PROBABLE SUNLIGHT HOURS)	
ROOM REF.	ROOM USE	ANNUAL	WINTER
1ST FLOOR			
7	Living Room	33	7
8	L/K/D	41	9
9	Bedroom		
10	Bedroom		
11	Bedroom		
12	Bedroom		
13	Bedroom		

Table 11: Assessment Data

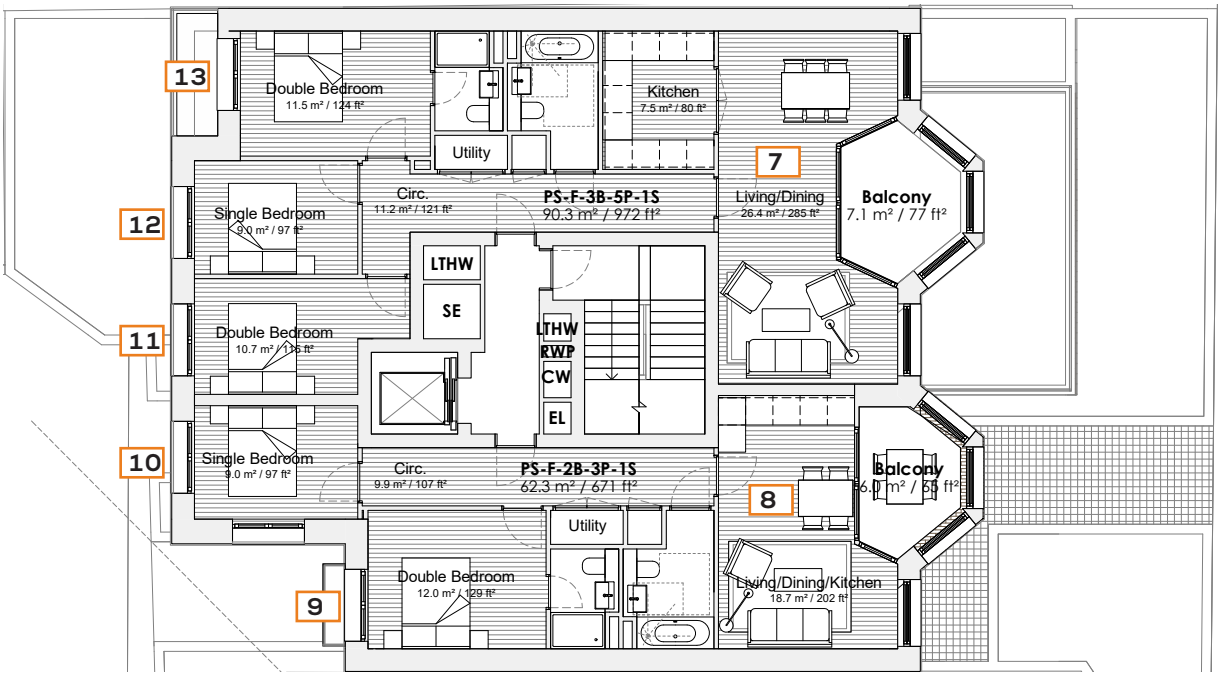


Fig. 12: Floor Plan

Second Floor

		SUNLIGHT QUANTUM (PROBABLE SUNLIGHT HOURS)	
ROOM REF.	ROOM USE	ANNUAL	WINTER
2ND FLOOR			
14	Living Room	34	8
15	L/K/D	44	11
16	Bedroom		
17	Bedroom		
18	Bedroom		
19	Bedroom		
20	Bedroom		

Table 12: Assessment Data

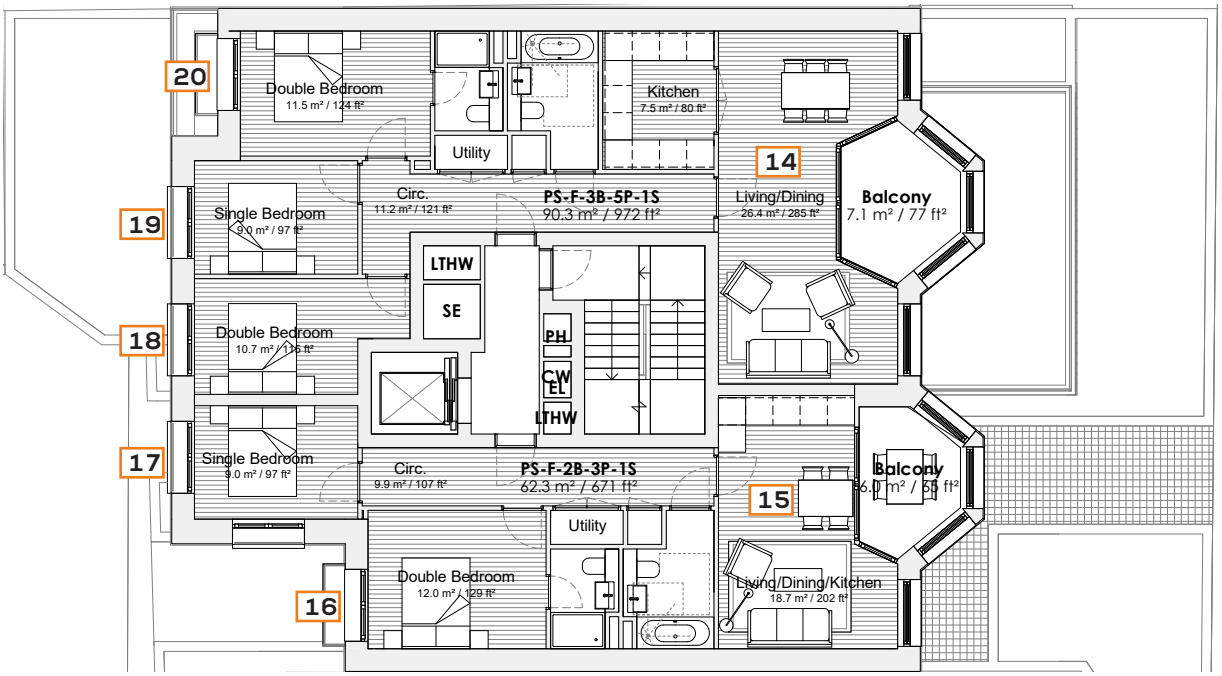


Fig. 13: Floor Plan

Third Floor

		SUNLIGHT QUANTUM (PROBABLE SUNLIGHT HOURS)	
ROOM REF.	ROOM USE	ANNUAL	WINTER
3RD FLOOR			
21	Living Room	35	8
22	L/K/D	44	11
23	Bedroom		
24	Bedroom		
25	Bedroom		
26	Bedroom		
27	Bedroom		

Table 13: Assessment Data

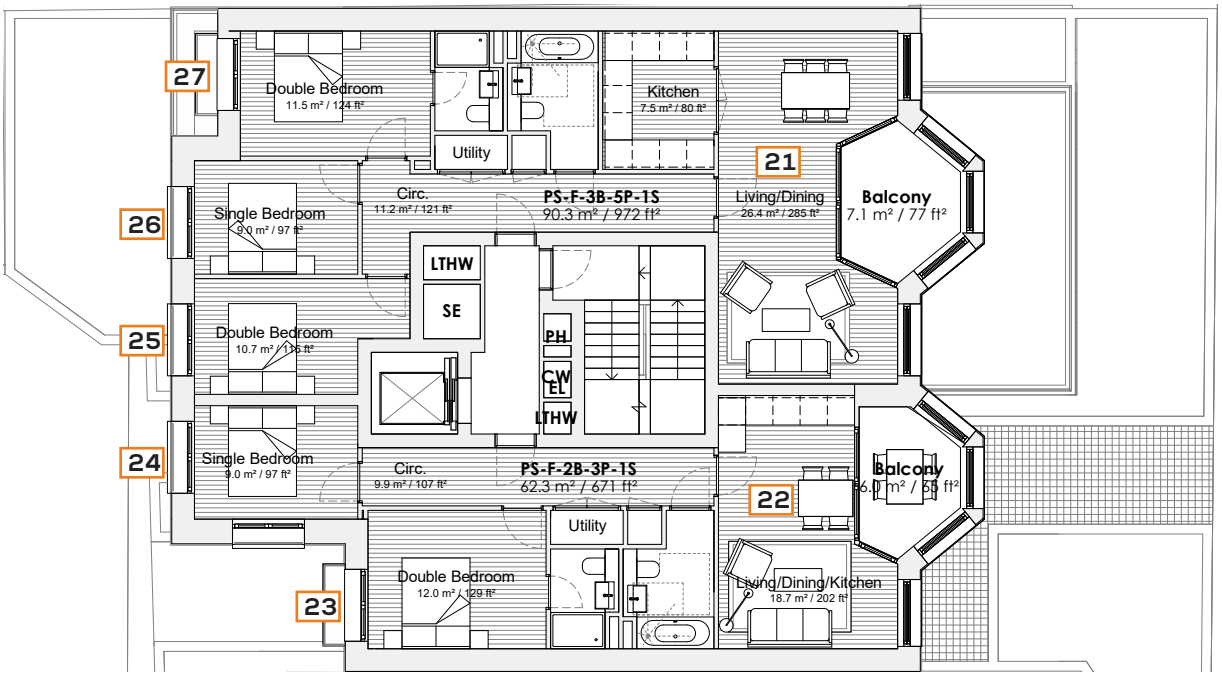


Fig. 14: Floor Plan

Fourth Floor

		SUNLIGHT QUANTUM (PROBABLE SUNLIGHT HOURS)	
ROOM REF.	ROOM USE	ANNUAL	WINTER
4TH FLOOR			
28	Bedroom		
29	Bedroom		
30	Bedroom		
31	Bedroom		
32	Bedroom		
33	Bedroom		
34	Bedroom		
35	Bedroom		

Table 14: Assessment Data

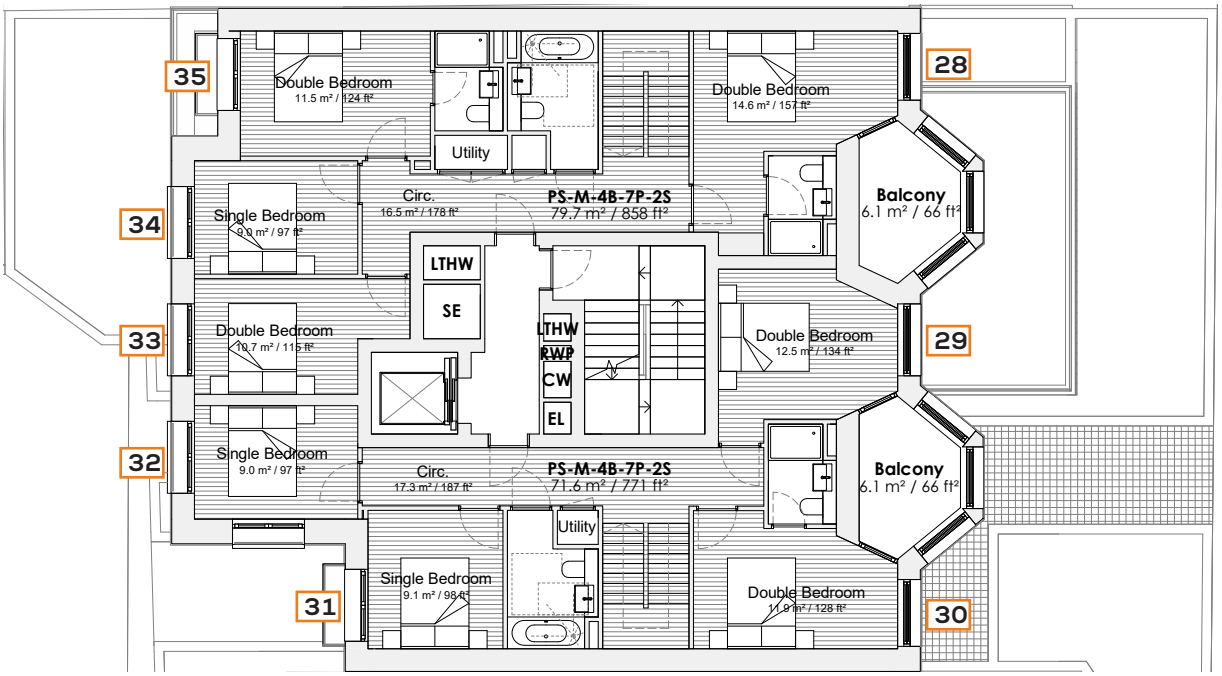


Fig. 15: Floor Plan

Fifth Floor

		SUNLIGHT QUANTUM (PROBABLE SUNLIGHT HOURS)	
ROOM REF.	ROOM USE	ANNUAL	WINTER
5TH FLOOR			
36	Living Room	54	13
37	Living Room	62	20
38	Kitchen		
39	Kitchen		
40	Dining Room		

Table 15: Assessment Data

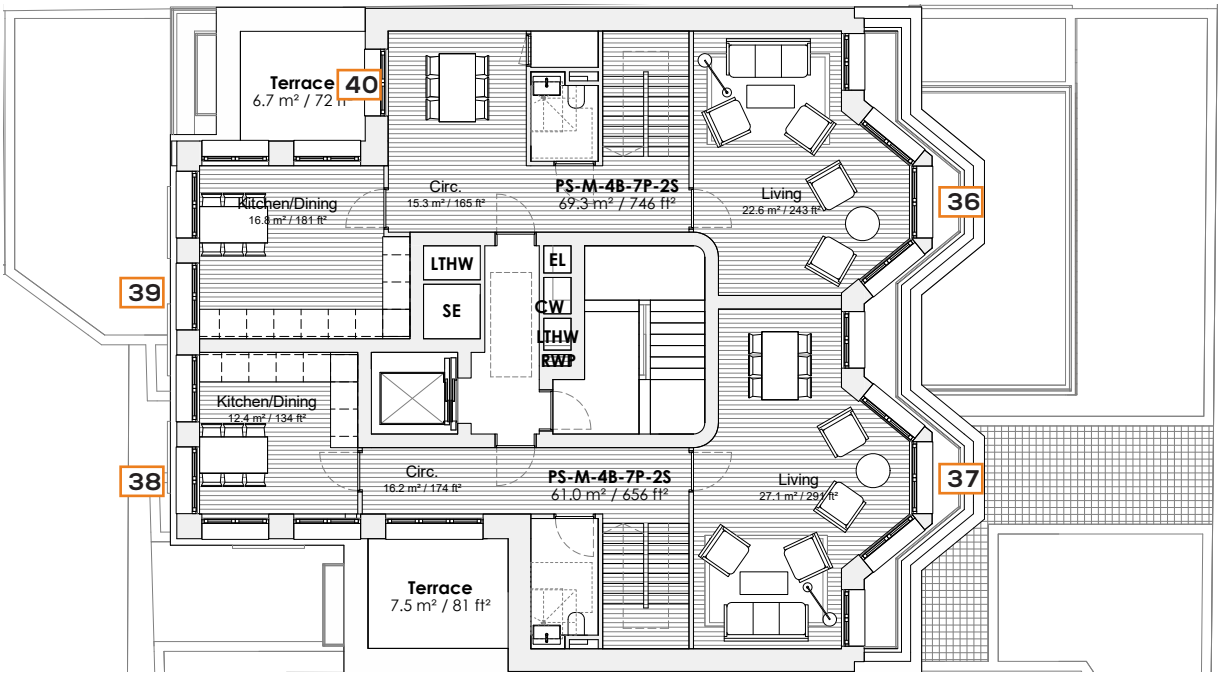
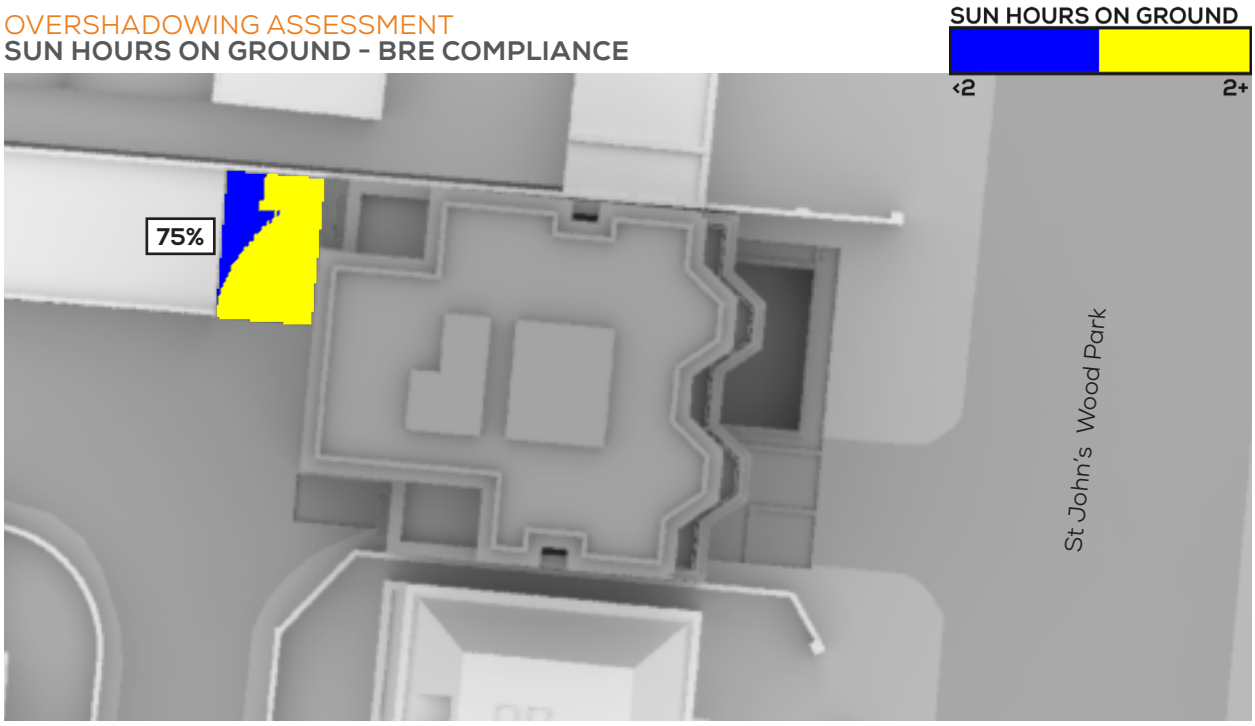


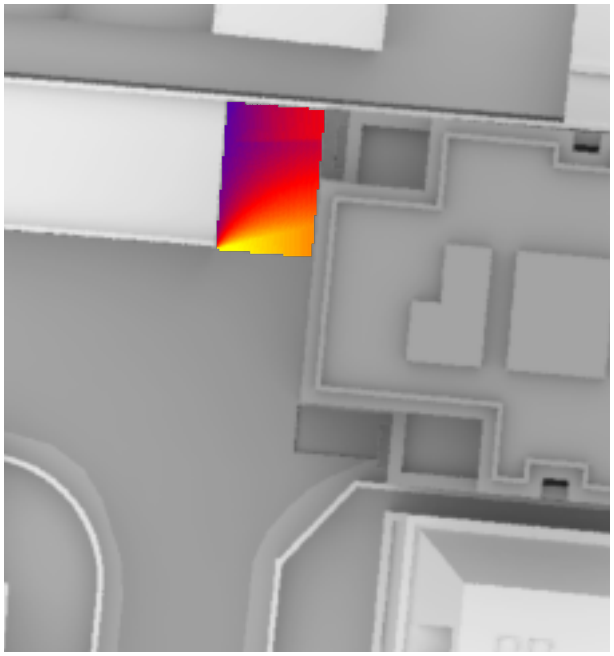
Fig. 16: Floor Plan

9 OVERSHADOWING ASSESSMENTS

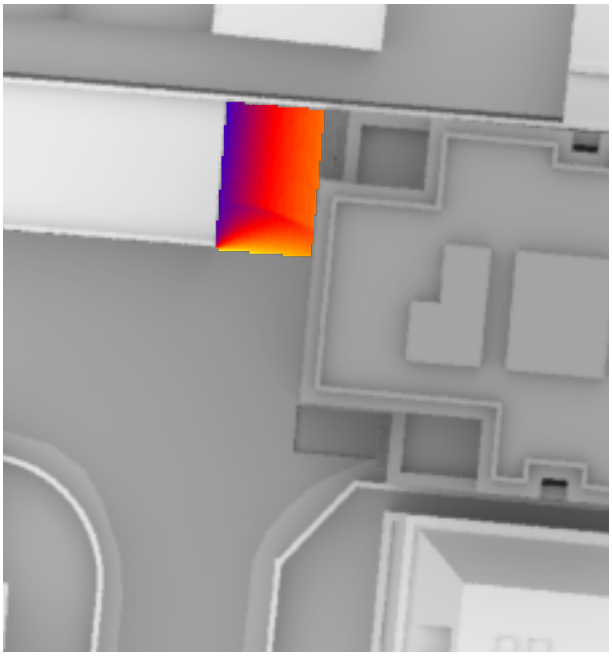
OVERSHADOWING ASSESSMENT
SUN HOURS ON GROUND - BRE COMPLIANCE



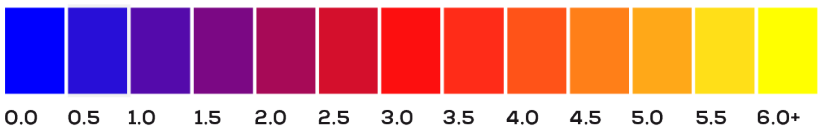
OVERSHADOWING ASSESSMENT
SUN EXPOSURE - 21ST MARCH



OVERSHADOWING ASSESSMENT
SUN EXPOSURE - 21ST JUNE



SUN EXPOSURE
TOTAL HOURS



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