Daylight and Sunlight Amenity Within The Site

Templar House

Project No: 7988

11 May 2017

Client	Platform
Architect	Astudio
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1. EXECUTIVE SUMMARY

The purpose of this report is to ascertain whether the proposed Templar House development by Astudio will provide residential accommodation considered acceptable in terms of daylight and sunlight.

The expectation of daylight within a dense urban environment such as Central London is typically limited, as the daylight is often obstructed by neighbouring buildings of similar height and in close proximity. This effect is especially noticeable at the base of most buildings where the view of the sky is restricted and low levels of daylight and sunlight are commonly seen.

It should also be noted that to address thermal comfort, triple glazing has been specified for all windows. Triple glazing has a lower light transmittance and as such to reach a balance between daylight ingress and heat loss, lower daylight levels within some rooms was necessary.

With the aim of maximising the levels of daylight within the building, the architects have worked alongside GIA to provide high quality residential accommodation within a dense urban environment. Within this context, one of the main challenges for the designers was to balance the optimisation of daylight ingress, while protecting the privacy of occupants.

As a result of this process, the design has responded to the above constraints through specific features for each façade and unit typology tailored for maximising the daylight levels.

All habitable rooms with an expectation of daylight have been assessed for Average Daylight Factor (ADF), No Sky Line (NSL) and Room Depth Criterion (RDC).

The results of the assessment show that the proposed development makes the most of the available daylight to site with 86% of all habitable rooms meeting or exceeding the levels of daylight recommended by BRE. Of those rooms nearly 80% of the main living areas receive levels of ADF that meet or exceed BRE's recommendations. This can be considered a very good result for a scheme of this size located in an urban dense environment such as Central London.

All habitable rooms falling short of the BRE guidance are located on the lowest four floors of the building and the great majority of these are facing into the lightwells created by the juxtaposition of the proposed and neighbouring buildings. As expected daylight potential is more challenging in those areas.

Three rooms falling short are generous open plan living spaces located within flats where all bedrooms are meeting or exceeding recommendations for daylight. Therefore these flats are considered to perform acceptably in terms of daylight on balance.

The majority of rooms have good levels of sky visibility. Lower levels of sky visibility are seen on the lower floors which have the largest amount of obstruction from neighbouring buildings. All rooms have been designed in accordance with the RDC criterion where applicable.

All living areas with a main window facing within 90 degrees of due south have been assessed for Annual Probable Sunlight Hours (APSH). The results generally show good levels of APSH on the upper floors either on the windows or on the balconies in front of them, with the exception of the bottom floors overlooking the southwestern and southeastern courtyard, where the access to sunlight is limited by the proximity of neighbouring buildings, as it is typical of urban environments.

All factors considered, we believe the design makes the most of the daylight and sunlight available at site, carefully balancing the necessity for daylight, privacy and private amenity. As such we also believe that future occupants will be able to enjoy levels of daylight and sunlight commensurate with the expectations for a building of this nature and performing equally well if not better than its neighbours.

2. INTRODUCTION AND OBJECTIVE

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

- To create a 3D computer model of the proposal based upon drawings prepared by Astudio.
- Carry out a daylight assessment using the methodologies set out in the BRE guidelines for Average Daylight Factor, No-Sky Line and Room Depth Criterion.
- Carry out a sunlight assessment using the methodologies set out in the BRE guidelines for Annual Probable Sunlight Hours (APSH) to the fenestration facing within 90 degrees of due south.
- 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. This document states that it is also intended to be used in conjunction with the interior daylight recommendations found within the *British Standard BS8206-2:2008* and *The Applications Manual on Window Design* of the Chartered Institution of Building Services Engineers (CIBSE).

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 whose stated 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 acknowledges also 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. The summary of this, given at the end of section 2.1 of the guide, states as follows:

> *"In general, a building will retain the potential for good interior diffused daylighting provided that on all its main faces:*
>
> *A. No obstruction, measured in a vertical section perpendicular to the main face, from a point two metres above ground level, subtends an angle of more than 25 degrees to the horizontal;*
>
> *Or*
>
> *B. If (A) is not satisfied, then all points on the main face on a line two metres above ground level are within four metres (measured sideways) of a point which has a vertical sky line component of 27% or more."*

3.1.1. 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.

Paragraph 2.1.21 of the BRE states that:

"Obstructions can limit access to light from the sky. This can be checked by measuring or calculating the angle of visible sky 'theta' , angle of obstruction or Vertical Sky Component (VSC) at the centre of the lowest window where daylight is required. If VSC is:

- *at least 27% ('theta' is greater than 65 degrees, obstruction angle less than 25 degrees) conventional window design will usually give reasonable results.*
- *between 15% and 27 % ('theta' is between 45 degrees and 65 degrees, obstruction angle between 25 degrees and 45 degrees) special measures (larger windows, changes to room layout) are usually needed to provide adequate daylight.*
- *between 5% and 15% ('theta' is between 25 degrees and 45 degrees, obstruction angle between 45 degrees and 65 degrees) it is very difficult to provide adequate daylight unless very large windows are used.*
- *less than 5% ('theta' less than 25 degrees, obstruction angle more than 65 degrees) it is often impossible to achieve reasonable daylight, even if the whole window wall is glazed."*

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

> *"The British Standard for daylighting, and the CIBSE Applications manual: window design, contain advice and guidance on interior daylighting. This guide to good practice is intended to be used in conjunction with them, and its guidance is intended to fit in with their recommendations.*
>
> *For skylight, the British Standard and the CIBSE manual put forward three main criteria, based on the average daylight factor, room depth, and the position of the no skyline."*

3.1.2. AVERAGE DAYLIGHT FACTOR (ADF)

> *"If a predominantly daylit appearance is required, then 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 last are minimum values of Average Daylight Factor, and should be attained even if a predominantly daylit appearance is not required."*

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.

3.1.3. 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.

3.1.4. 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 lies beyond the no skyline (i.e., 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.

3.1.5. 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".*

4. METHODOLOGY

In order to undertake the daylight and sunlight assessments set out above, 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 Astudio. 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. A medium veneer has been assumed for the reflectance value of the internal floor.

Translucent glazing was modelled as clear triple glazing with a 25% translucent frit pattern, this results in a 10% reduction in light transmittance when compared to standard clear triple glazing.

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:	
Triple glazing:	
Pilkington K Glass 4/12/4/12/4 Argon filled 90%	Tv= 0.63
Double glazing:	
Pilkington K Glass 4/16/4 Argon filled 90%	Tv= 0.75
Single glazing:	
Pilkington Optifloat Clear, Annealed, 4mm	Tv=0.90
Translucent glazing:	
Pilkington Optifloat Opal - 4mm K /16/4mm Opal	Tv= 0.74

Maintenance factors:	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)	0.75	8	1	1	0.8	0.55
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
Double Translucent Low-E (frames modelled)	0.74	8	1	1	1	0.68
Double Translucent Low-E (frames not modelled)	0.74	8	1	1	0.8	0.54
Double Translucent Low-E (inclined, frames modelled)	0.74	8	2	1	1	0.62
Double Translucent Low-E (inclined, frames not modelled)	0.74	8	2	1	0.8	0.50
Double Translucent Low-E (horizontal, frames modelled)	0.74	8	3	1	1	0.56
Double Translucent Low-E (horizontal, frames not modelled)	0.74	8	3	1	0.8	0.45

Table 1: Typical reflectance, transmittance and maintenance factors

5. CONCLUSIONS

The expectation of daylight within a dense urban environment such as Central London is typically limited, as the daylight is often obstructed by neighbouring buildings of similar height and in close proximity. This effect is especially noticeable at the base of most buildings, where low levels of daylight and sunlight are commonly seen.

The site is located within Central London, and is currently occupied by an existing building. The proposal includes replacing the existing building with an office block to the south, facing the main street, and a residential building to the north.

Design implies finding an adequate balance between conflicting requirements. Daylight levels, for instance, will be affected by the provision of private amenity in the form of balconies and winter gardens as well as the adoption of triple glazed units to enhance the energy performance of the proposed building.

To this end, GIA has worked alongside Astudio in order to maximise the daylight ingress considering all aspects of the design, and especially those mentioned above. As a result of this process the following features have been adopted:

- The internal layouts have prioritised the internal daylight ingress to main living areas, where it is generally regarded as more important. The corners of the building have been reserved for dual aspect living rooms where possible, which also improves the daylight spread as the windows are more evenly distributed;
- The glazing area has been maximised in all areas where the daylight potential is limited by the external obstructions;
- The apartments facing the eastern and western light wells have been provided with large fenestration and sawtooth pop-outs in order to enhance the daylight ingress in those areas where it is less available;
- Wintergardens have been provided in order to allow future occupants to enjoy good levels of internal daylight and sunlight whilst ensuring they can enjoy a private amenity space throughout the year;
- Lightwells have been introduced to allow for good daylight distribution within the generous living spaces on the upper floors;
- Light coloured finishes have been specified for the external courtyard as well as for the internal floors. This allows for more daylight being reflected into the lowest floors and towards the back of the rooms;
- Where there was a concern for privacy, a translucent frit with 75% clear glazing has been selected to allow as much light through as possible while maintaining a screening effect.

All habitable rooms within the proposed residential scheme have been analysed with regards to internal daylight and sunlight levels. Internal kitchen areas borrowing light from the living area have been excluded from the assessments, as per BRE's guidance.

5.1. CONCLUSION ON DAYLIGHT

All habitable rooms served by an external window have been assessed for Average Daylight Factor (ADF), No-Sky Line (NSL) and Room Depth Criterion (RDC). Results are presented on pages 9 - 15 of this report.

The results have shown good levels of light within the proposed scheme with 86% of the tested rooms (124 out of the total 144 rooms) seeing levels of ADF that either meet or exceed the BRE recommendations. Taking into account all the constraints above we consider these results to be equally as good as if not better than any of the residential surrounding buildings.

As a result of the design optimisation, all rooms above fourth floor are compliant with the daylight quantum recommendations. The rooms seeing levels of ADF lower than those suggested are located in the most obstructed areas on the lowest floors, as is typical of dense urban environment.

In order to maximise the daylight ingress within the living areas looking into the lightwell, these have been designed as double height open spaces with a set-back mezzanine above. This design strategy makes the best use of the double height glazed area available allowing for the maximum daylight ingress and sky visibility within the main living space on lower floor of the duplexes. Therefore these rooms have been considered as a unique space and the averages calculated across the two levels. This means that, even when average levels of daylight lower than those suggested are experienced, the rear of the room and the mezzanine will have a visual connection to the main bright living space. It should also be noted that, to address thermal comfort and privacy concerns, solid and translucent glass respectively have been included in the window wall façade which has contributed to reducing the daylight levels within some rooms.

Five living spaces falling short of recommendations (nos. 7, 12, 4, 24 and 39) are very generous rooms located in the most obstructed areas of the development. This means light will be mostly concentrated at the front of the room, whilst the back may require some supplementary artificial lighting. This is typical of open plan rooms in contemporary developments throughout London. Furthermore, as they are located within units where all bedrooms and kitchens meet or exceed recommendations, we can consider that these flats will perform acceptably in terms of daylight.

Three south facing kitchens (nos. 20, 35, 50) fall short of ADF recommendation due to their location where daylight is less available. This has been undertaken in order to prioritise the daylight ingress within the north facing living areas. As a result, future occupants of these flats will be able to enjoy good levels of daylight within their living space whilst the kitchen area will be more reliant on artificial lighting.

Only 5 out of the 81 bedrooms (6%) see levels of daylight lower than those recommended. These are south and east facing rooms looking into the light well, where the daylight availability is restricted. The fenestration serving these rooms has been maximised to cover the entire window wall façade in order to make the most of the daylight available in this location. Also, future occupants of these two bedrooms flats will be able to enjoy good levels of daylight in the main bedrooms.

Following a similar trend to daylight quantum, the majority of rooms exceed the recommended level of sky visibility with lower levels than those recommended seen in the lowest five floors of the development where the obstruction of the neighbouring buildings limits the view of sky. This is typical of urban developments and as such in line with expectations for a scheme of this nature.

All the habitable rooms tested are compliant with the Room Depth Criterion where this is applicable.

We can therefore conclude that the proposed development makes the most efficient use of its land in terms of daylight with the vast majority of units provided with good daylight levels, especially within all habitable rooms on the upper floors.

5.2. CONCLUSION ON SUNLIGHT

In order to ascertain the levels of sunlight which will be enjoyed within the proposed Templar House development, all living room windows within 90 degrees of due south have been assessed for Annual Probable Sunlight Hours (APSH), as recommended by BRE.

The results (pages 16-17) generally show good levels of APSH on the upper floors, therefore the occupants are likely to enjoy good sunlight in their living rooms.

Lower levels of sunlight will be observed in living spaces on levels 1-6 and in the south-western corner of the building during the winter months only due to overshadowing by surrounding buildings.

We believe that the design makes the most of the daylight and sunlight available and that the proposed accommodation will provide future occupants with good levels of light which are commensurate to their expectation given the central urban location of the proposed building.

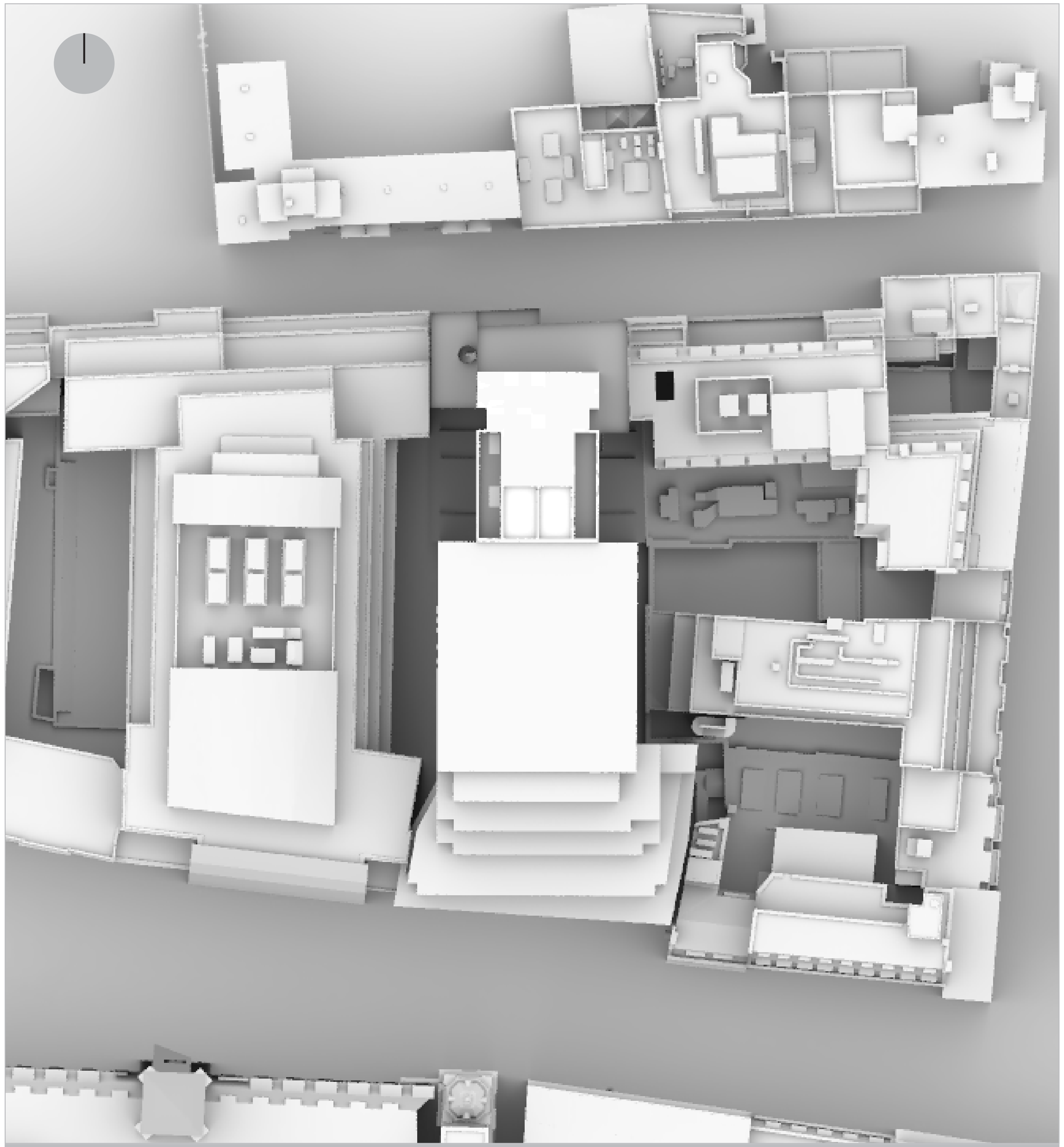


Figure 1: Top View

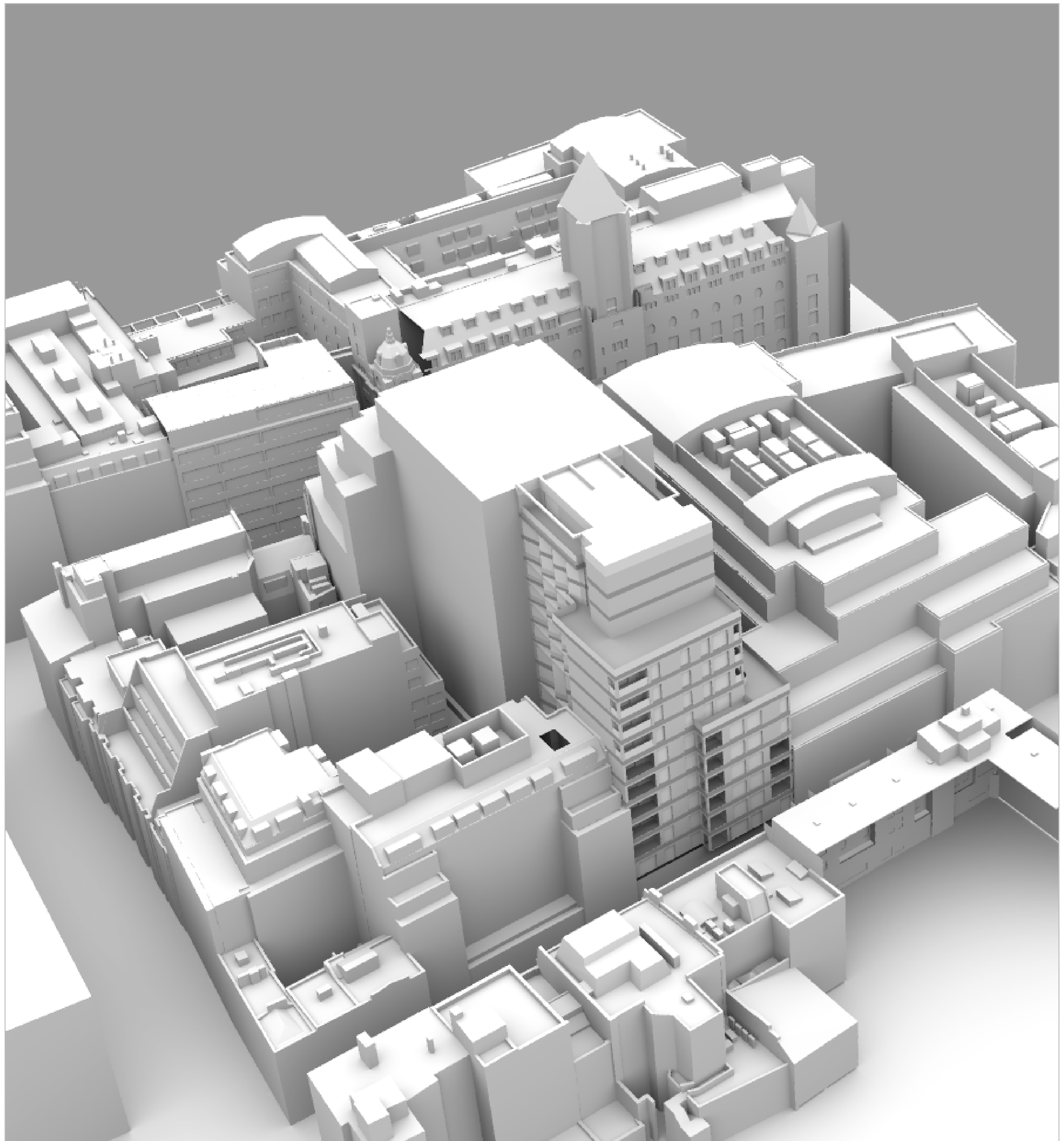


Figure 2: Perspective View

		Daylight Quantum	Distribution of Daylight	
Room Ref.	Room Use	ADF (%)	NSL (%)	RDC
First Floor				
1	L/K/D Duplex	0.8	36	N/A
2	Bedroom	1.0	46	N/A
3	L/K/D Duplex	0.9	37	N/A
4	L/K/D	0.6	48	Met
5	Bedroom	1.0	35	Met
6	Bedroom	1.0	42	Met
7	Living Room	1.4	44	Met
8	Bedroom	3.2	50	N/A
9	Bedroom	1.1	45	Met
10	Bedroom	1.4	53	Met
11	Kitchen	2.4	70	Met
12	Living Room	0.7	51	Met
13	L/K/D Duplex	1.3	66	N/A
14	Bedroom	2.3	98	N/A
15	L/K/D Duplex	1.8	84	N/A
Second Floor				
16	Bedroom	0.5	19	N/A
17	Bedroom	0.7	23	N/A
18	Bedroom	0.6	50	Met
19	Bedroom	3.2	46	Met
20	Kitchen	0.7	64	N/A
21	Living Room	1.5	59	N/A
22	Living Room	1.8	74	Met
23	Bedroom	4.1	75	N/A
24	L/K/D	1.4	83	Met
25	Bedroom	4.6	80	Met
26	Bedroom	1.0	89	Met
27	Bedroom	1.7	97	N/A
28	Bedroom	1.5	91	N/A

Table 2: Assessment Data

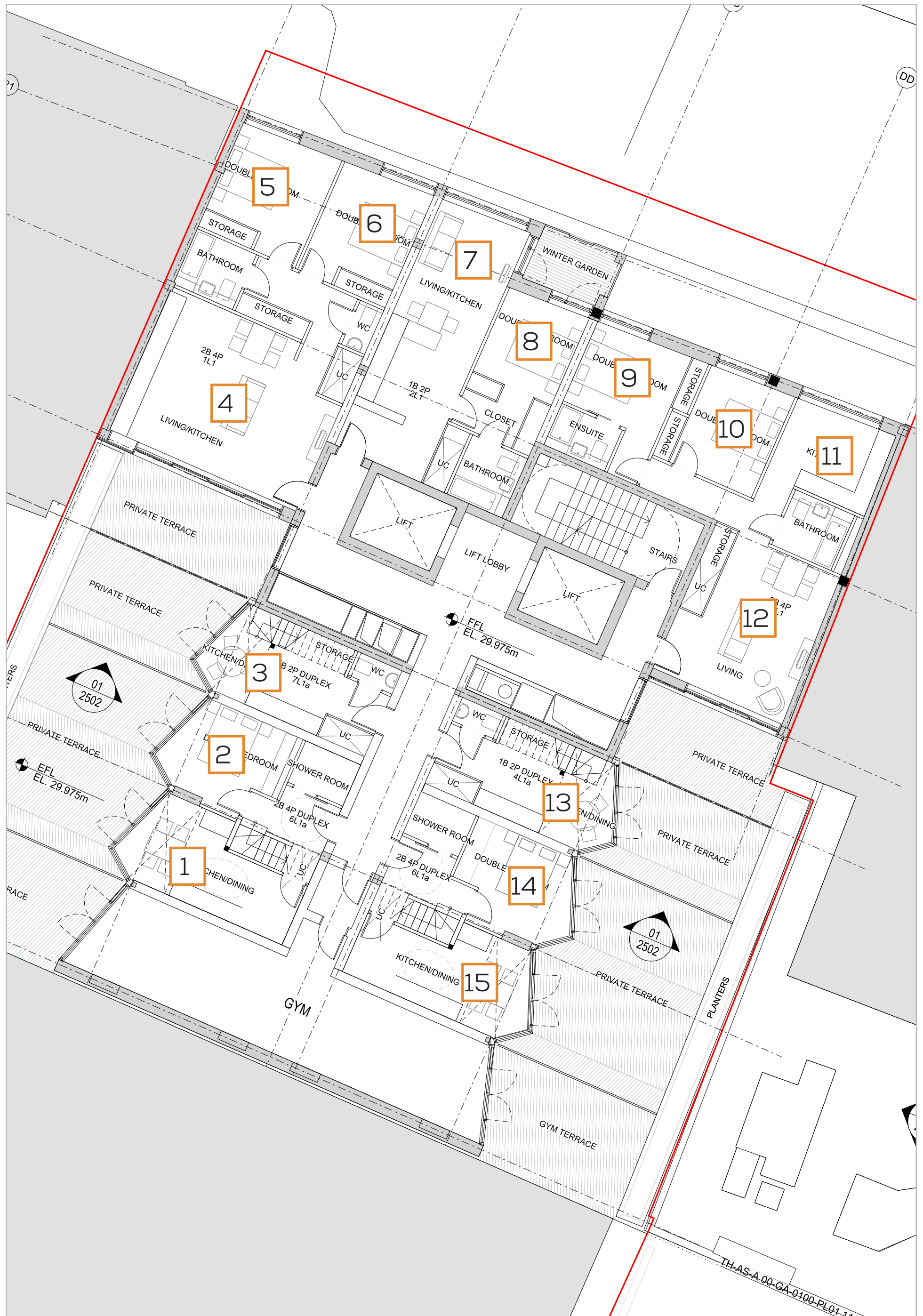


Figure 4: Floor Plan - 1st Floor

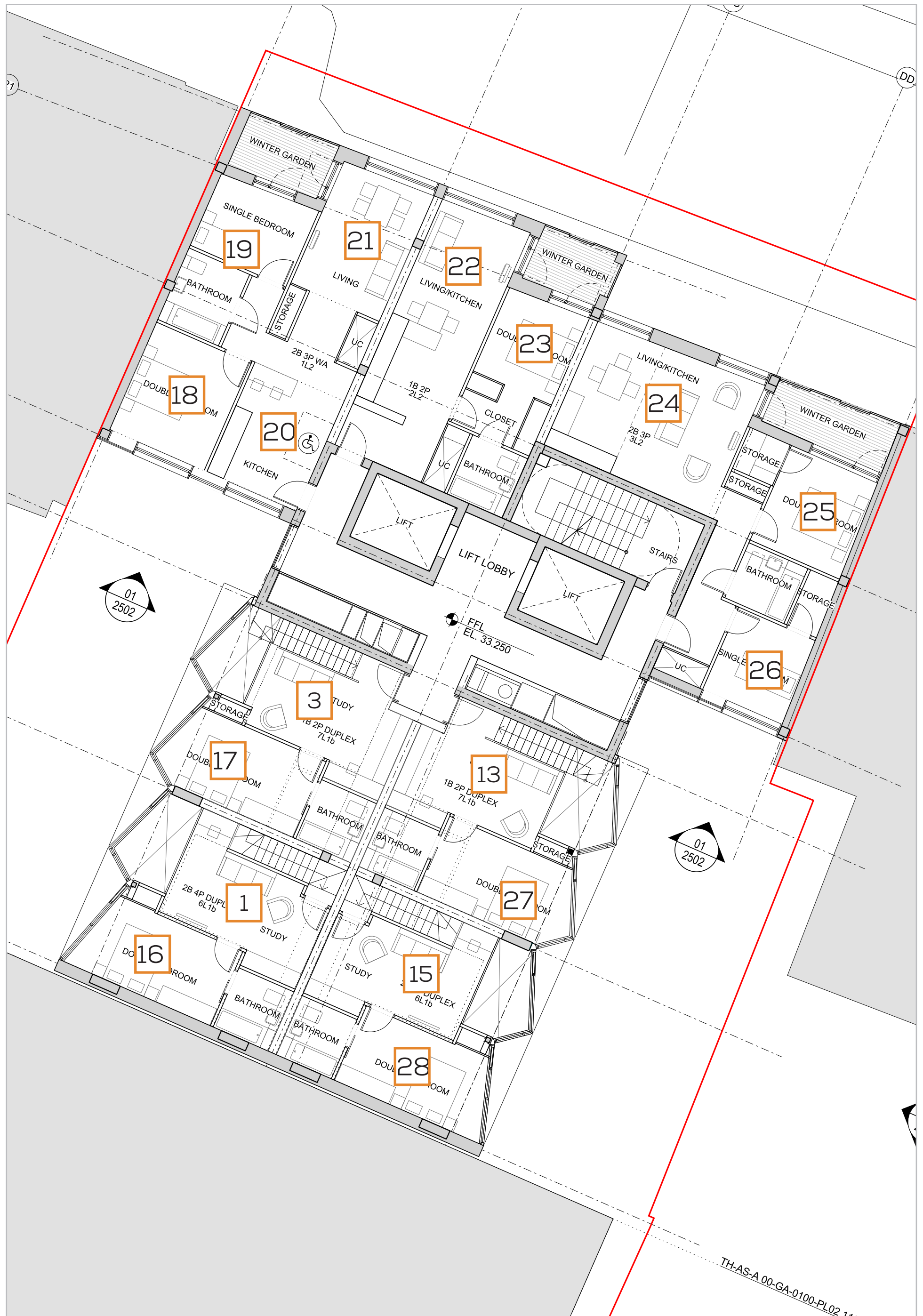


Figure 3: Floor Plan - 2nd Floor

Room Ref.	Room Use	Daylight Quantum ADF (%)	Distribution of Daylight NSL (%)	RDC
Third Floor				
29	Bedroom	1.3	50	N/A
30	L/K/D Duplex	1.4	44	N/A
31	Bedroom	1.6	65	N/A
32	L/K/D Duplex	1.6	47	N/A
33	Bedroom	0.7	62	Met
34	Bedroom	4.1	82	Met
35	Kitchen	0.8	76	N/A
36	L/K/D	2.2	93	N/A
37	Living Room	2.5	99	Met
38	Bedroom	5.0	96	N/A
39	L/K/D	1.9	98	Met
40	Bedroom	5.5	99	Met
41	Bedroom	1.2	91	Met
42	L/K/D Duplex	1.8	75	N/A
43	Bedroom	2.8	99	N/A
44	L/K/D Duplex	2.3	96	N/A
45	Living Room	1.9	98	N/A
Fourth Floor				
46	Bedroom	1.1	38	N/A
47	Bedroom	1.1	35	N/A
48	Bedroom	0.8	68	Met
49	Bedroom	5.0	93	Met
50	Kitchen	1.0	100	N/A
51	Living Room	2.8	99	N/A
52	Living Room	3.2	100	Met
53	Bedroom	5.3	96	N/A
54	L/K/D	2.1	98	Met
55	Bedroom	5.9	99	Met
56	Bedroom	1.4	92	Met
57	Bedroom	1.9	100	N/A
58	Bedroom	2.0	99	N/A

Table 3: Assessment Data

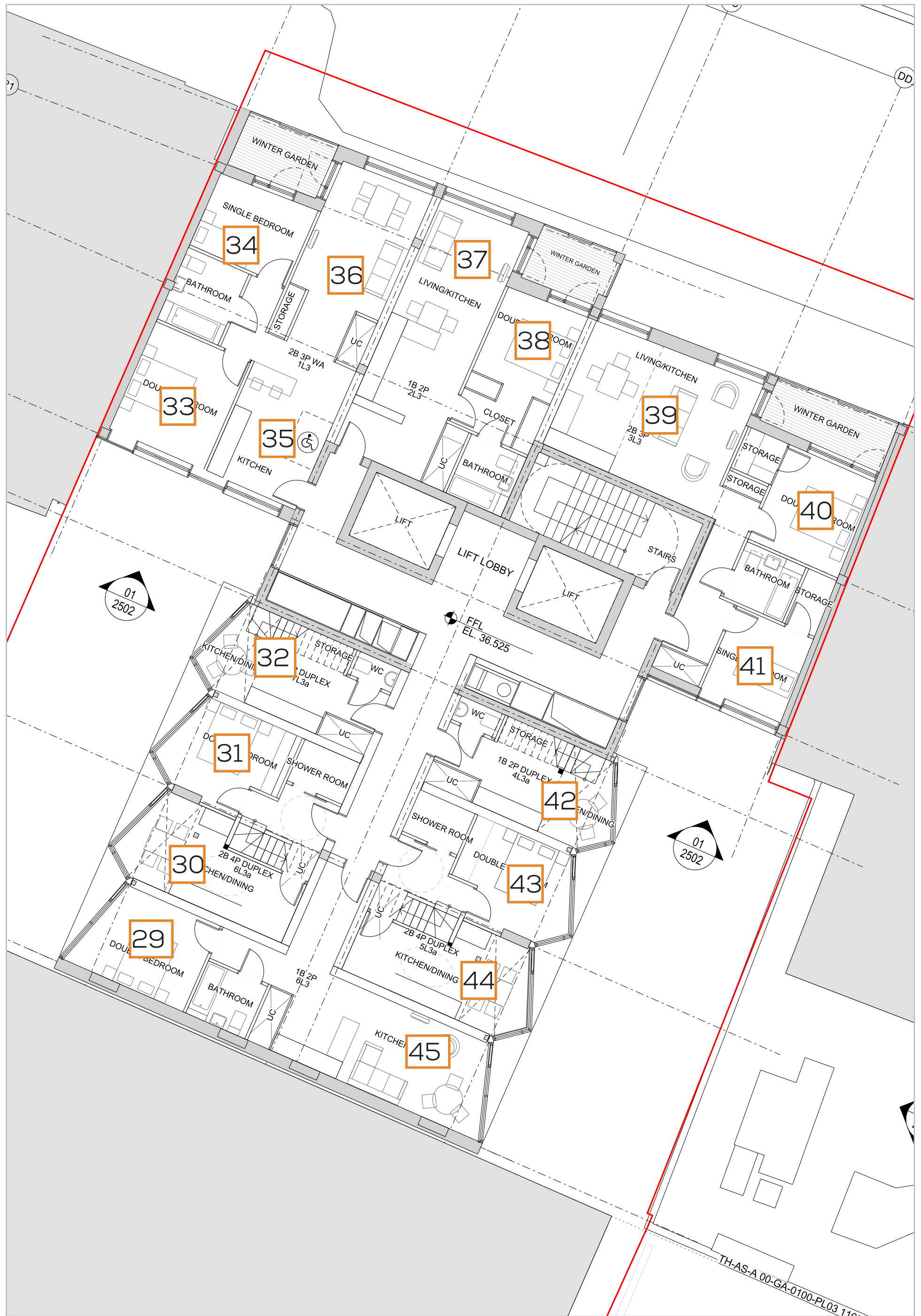


Figure 6: Floor Plan -3rd Floor

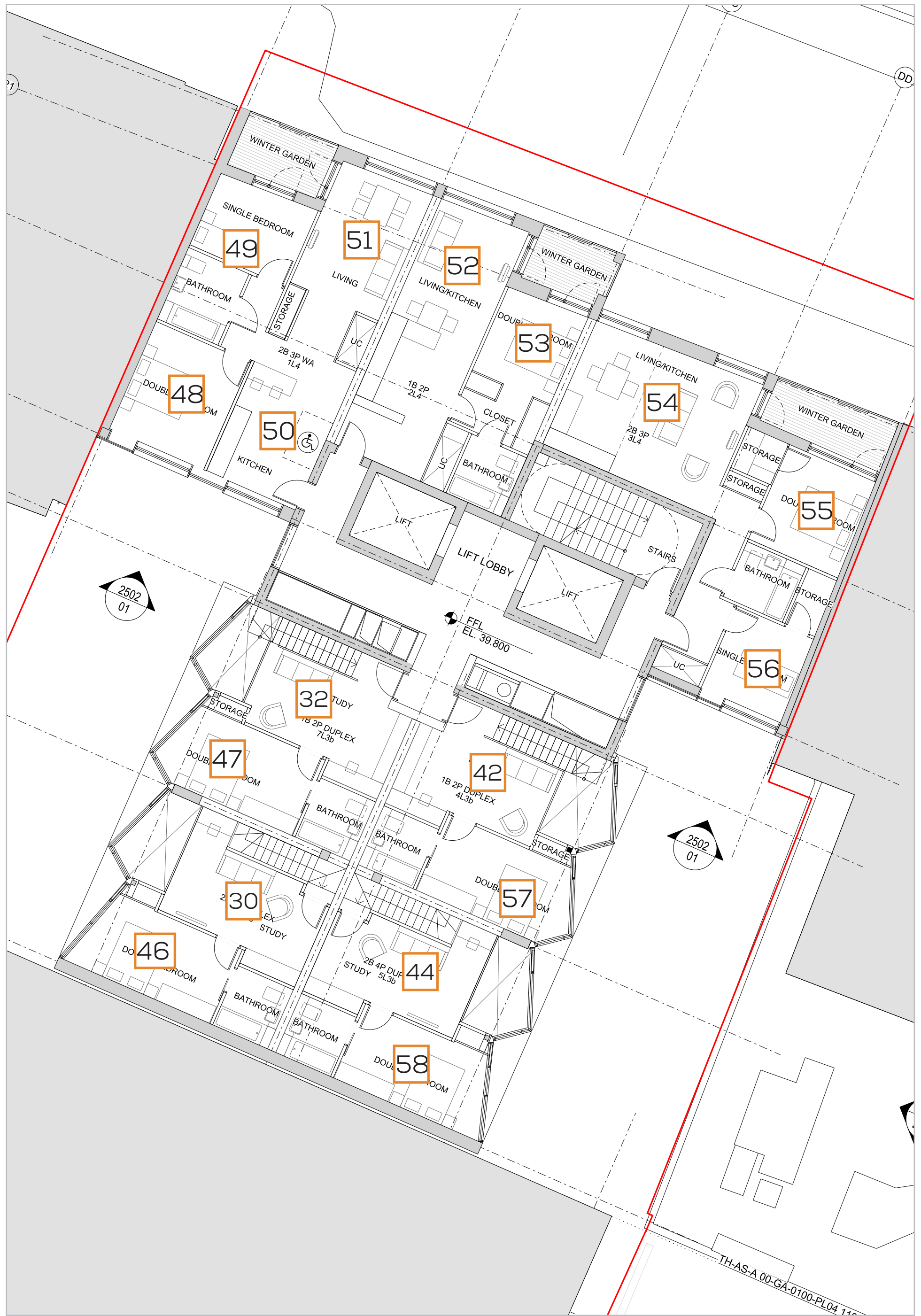


Figure 5: Floor Plan - 4th Floor

		Daylight Quantum	Distribution of Daylight	
Room Ref.	Room Use	ADF (%)	NSL (%)	RDC
Fifth Floor				
59	Bedroom	2.3	73	N/A
60	L/K/D Duplex	2.2	65	N/A
61	Bedroom	3.0	89	N/A
62	L/K/D Duplex	3.0	86	N/A
63	Bedroom	1.2	69	Met
64	Bedroom	2.8	100	Met
65	L/K/D	3.1	100	N/A
66	Living Room	3.4	100	Met
67	Bedroom	5.8	96	N/A
68	L/K/D	2.3	98	Met
69	Bedroom	6.2	99	Met
70	Bedroom	1.6	94	Met
71	L/K/D Duplex	2.9	92	N/A
72	Bedroom	3.8	100	N/A
73	L/K/D Duplex	3.0	100	N/A
74	Living Room	2.6	97	N/A
Sixth Floor				
75	Bedroom	2.0	64	N/A
76	Bedroom	2.9	93	N/A
77	Study	1.8	85	N/A
78	Bedroom	3.2	100	Met
79	Living Room	3.7	100	Met
80	Bedroom	5.9	96	N/A
81	L/K/D	2.5	98	Met
82	Bedroom	6.4	99	Met
83	Bedroom	2.0	95	Met
84	Bedroom	3.9	100	N/A
85	Bedroom	2.7	99	N/A

Table 4: Assessment Data

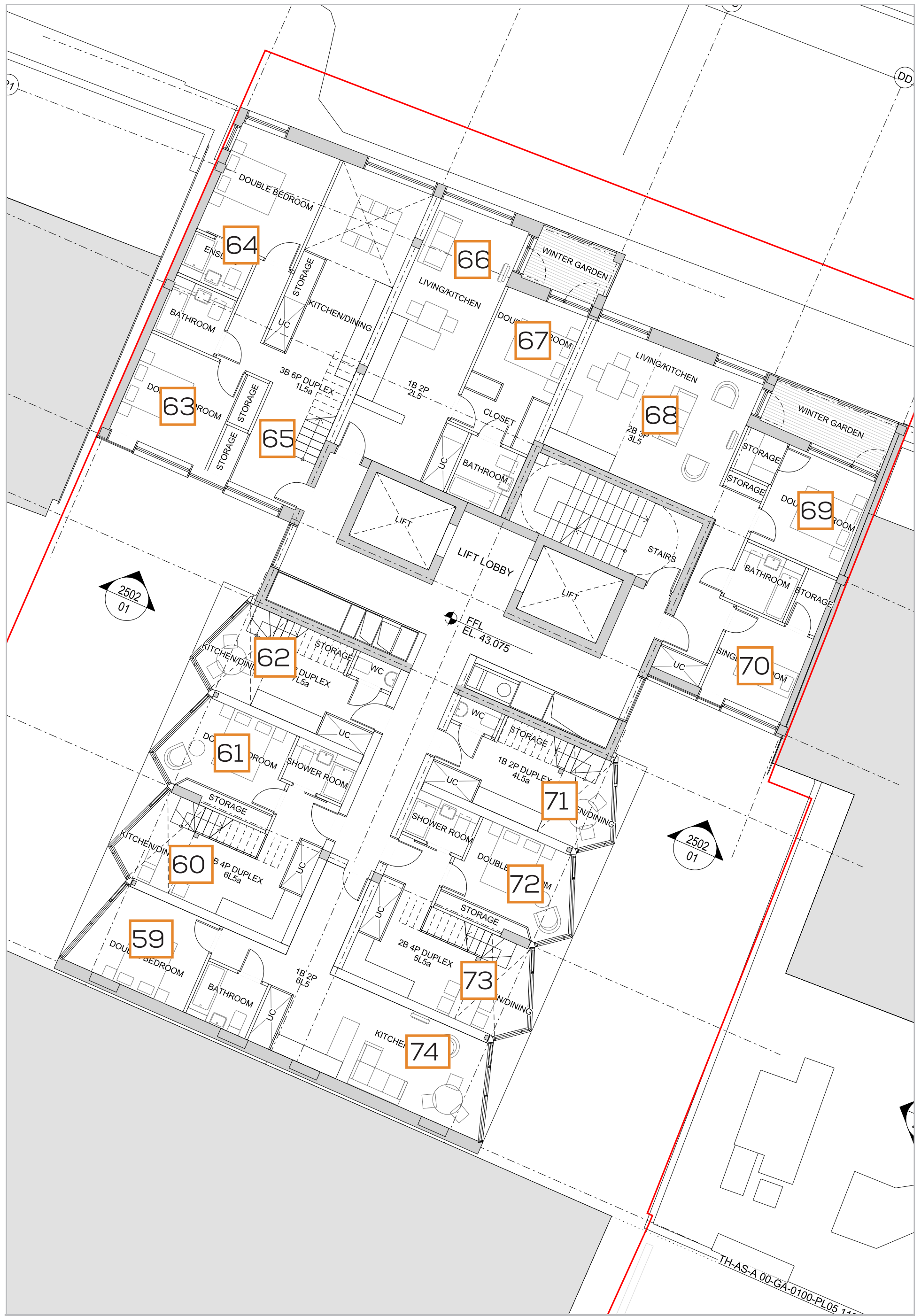


Figure 8: Floor Plan - 5th Floor

Figure 7: Floor Plan -6th Floor

		Daylight Quantum	Distribution of Daylight	
Room Ref.	Room Use	ADF (%)	NSL (%)	RDC
Seventh Floor				
86	Bedroom	2.3	97	N/A
87	Living Room	2.4	99	N/A
88	Studio	2.6	99	N/A
89	L/K/D	2.7	99	N/A
90	Bedroom	3.1	97	Met
91	L/K/D	2.4	100	N/A
92	Bedroom	2.5	100	Met
93	Bedroom	2.8	96	Met
94	Studio	2.9	100	N/A
95	Bedroom	4.2	100	N/A
96	Bedroom	2.4	99	N/A
Eighth Floor				
97	Bedroom	2.7	98	N/A
98	Living Room	2.7	100	N/A
99	Studio	3.0	100	N/A
100	L/K/D	4.4	100	N/A
101	Bedroom	2.9	98	Met
102	L/K/D	2.5	100	N/A
103	Bedroom	2.6	100	Met
104	Bedroom	3.0	96	Met
105	Studio	3.1	100	N/A
106	Bedroom	4.3	100	N/A
107	Bedroom	2.5	97	N/A

Table 5: Assessment Data

Figure 10: Floor Plan - 7th Floor

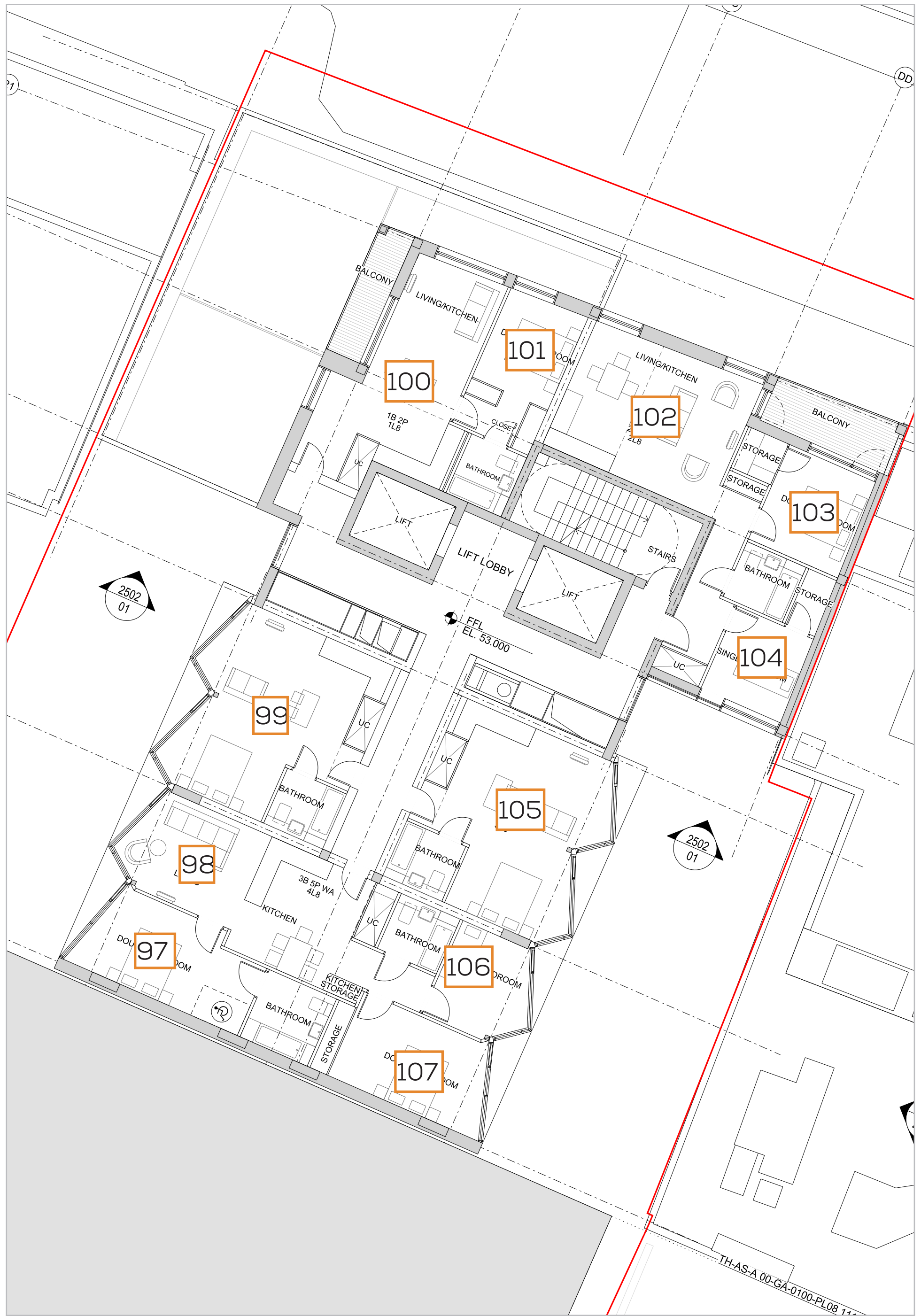


Figure 9: Floor Plan -8th Floor

		Daylight Quantum	Distribution of Daylight	
Room Ref.	Room Use	ADF (%)	NSL (%)	RDC
NInth Floor				
108	Bedroom	3.0	98	N/A
109	Living Room	2.9	100	N/A
110	Studio	3.2	100	N/A
111	L/K/D	4.4	100	N/A
112	Bedroom	2.9	98	Met
113	L/K/D	2.5	100	N/A
114	Bedroom	2.6	100	Met
115	Bedroom	3.0	97	Met
116	Studio	3.1	100	N/A
117	Bedroom	4.5	100	N/A
118	Bedroom	2.6	99	N/A
Tenth Floor				
119	Bedroom	3.1	98	N/A
120	Living Room	3.0	100	N/A
121	Studio	3.4	100	N/A
122	L/K/D	5.2	100	N/A
123	Bedroom	2.6	97	Met
124	Bedroom	2.5	100	N/A
125	Living Room	2.4	100	Met
126	Bedroom	1.8	94	Met
127	Studio	3.1	100	N/A
128	Bedroom	4.6	100	N/A
129	Bedroom	2.7	98	N/A

Table 6: Assessment Data

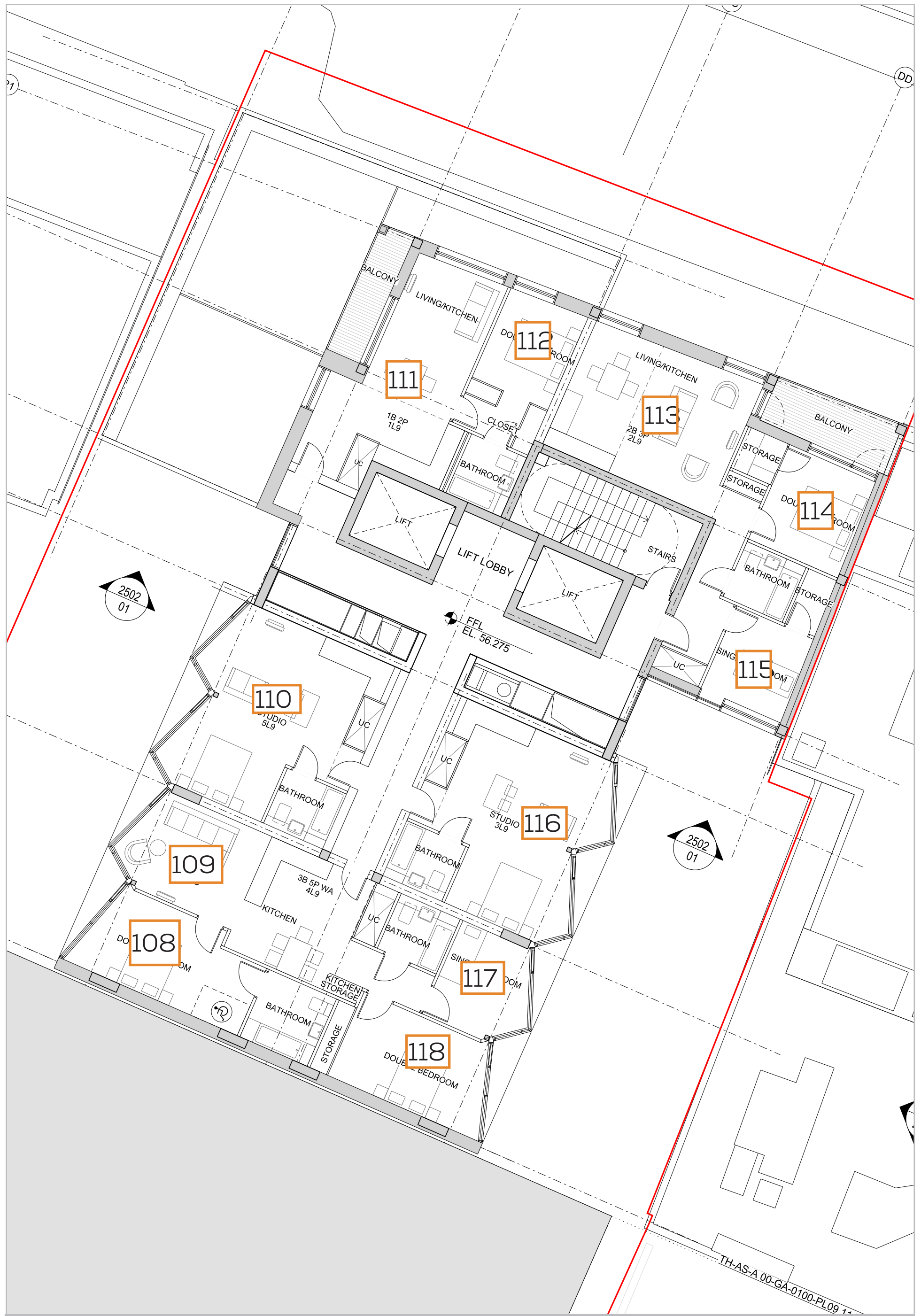


Figure 12: Floor Plan - 9th Floor

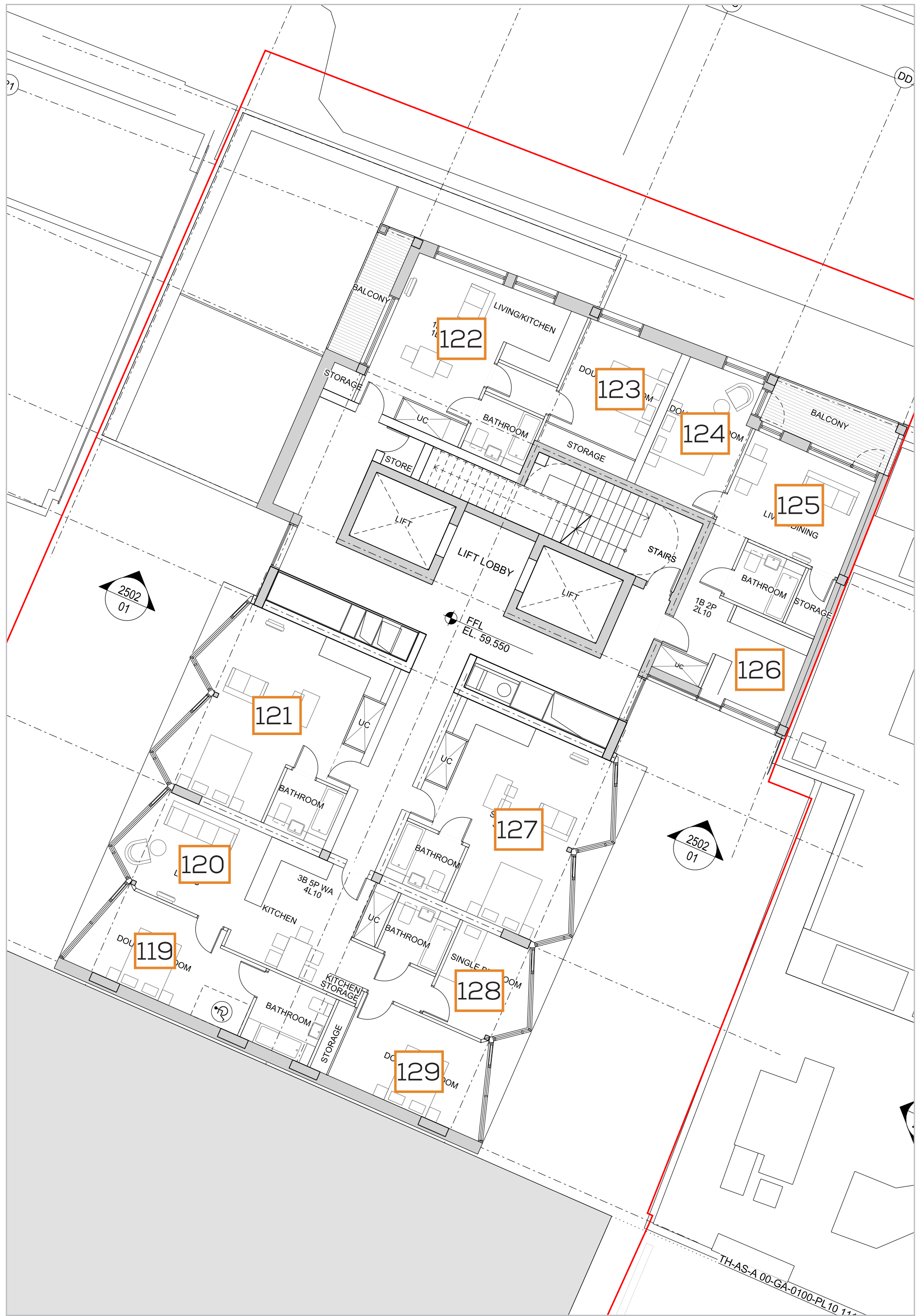


Figure 11: Floor Plan -10th Floor

Room Ref.	Room Use	Daylight Quantum ADF (%)	Distribution of Daylight NSL (%)	RDC
Eleventh Floor				
130	Bedroom	4.8	100	N/A
131	L/K/D	7.1	100	N/A
132	Study	6.8	100	N/A
133	Bedroom	6.0	100	N/A
134	Living Room	6.2	100	N/A
135	Bedroom	4.9	100	N/A
136	Bedroom	4.3	97	
Twelfth Floor				
137	Living Room	3.1	100	N/A
138	Living Room	8.5	100	N/A
139	Bedroom	4.9	100	N/A
140	Bedroom	4.7	100	N/A
141	Bedroom	4.5	100	N/A
142	Bedroom	3.5	98	N/A

Table 7: Assessment Data

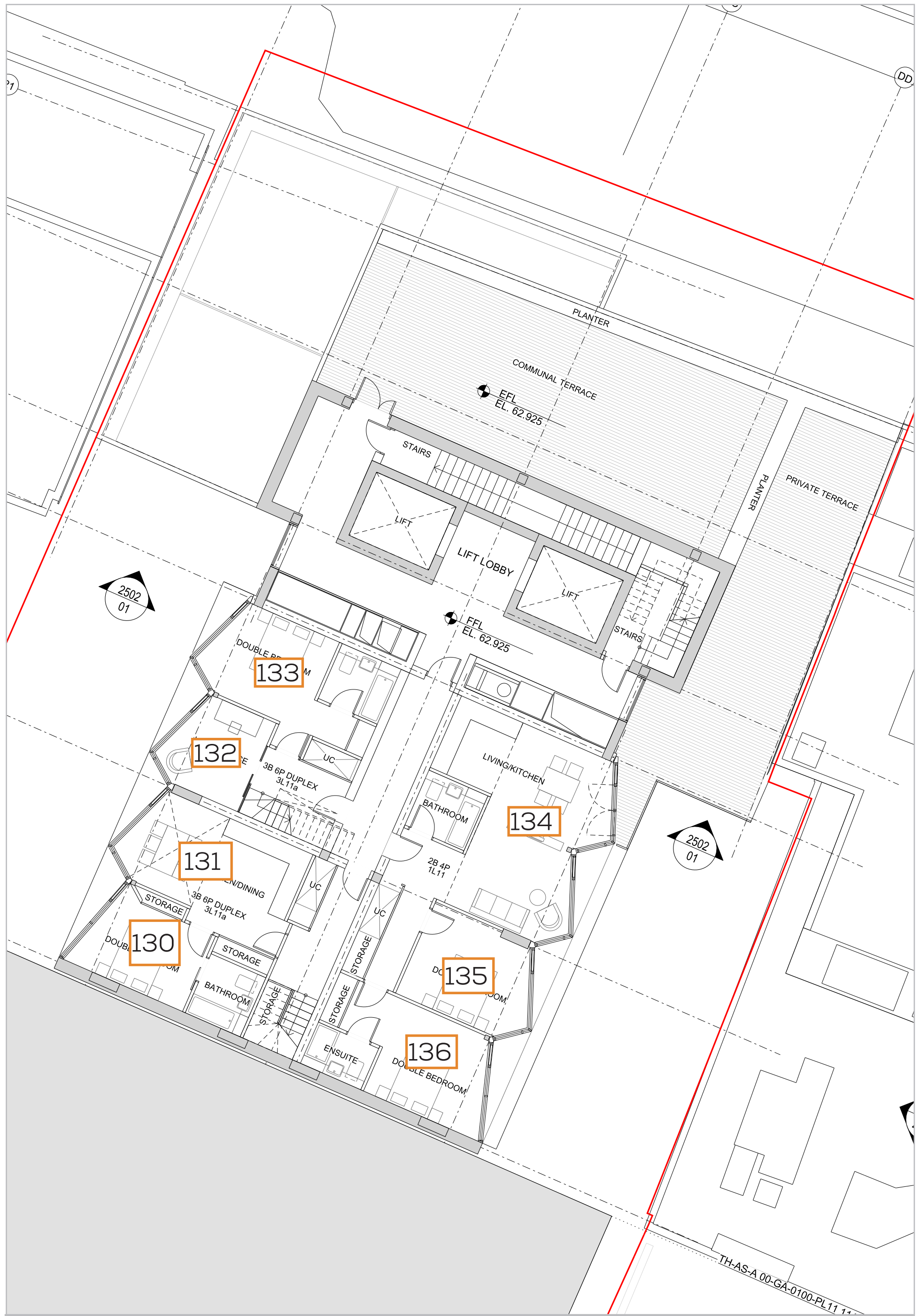


Figure 14: Floor Plan - 11th Floor

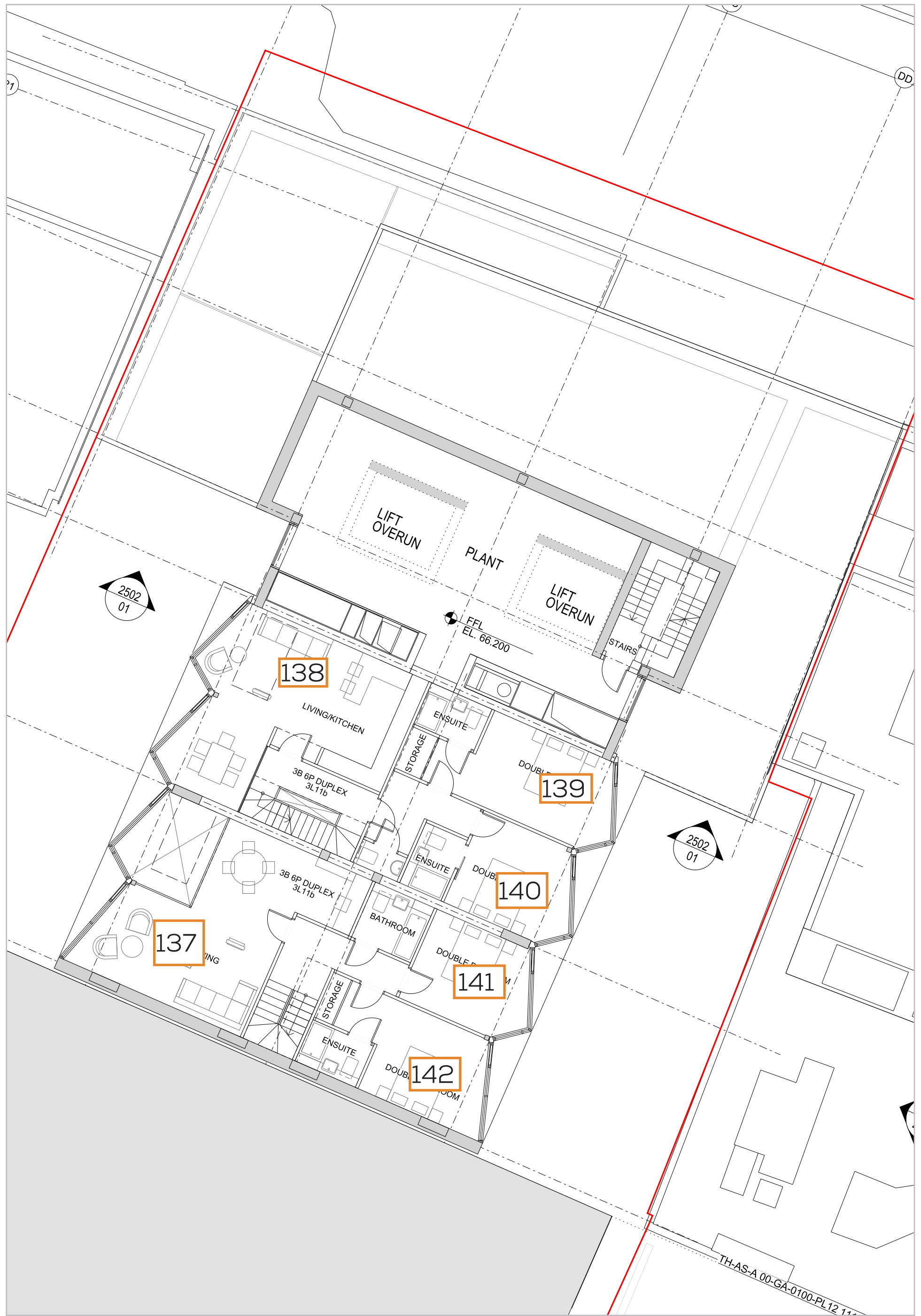


Figure 13: Floor Plan -12th Floor

Room Ref.	Room Use	Daylight Quantum ADF (%)	Distribution of Daylight NSL (%)	RDC
Thirtheenth Floor				
143	Living Room	21.3	100	N/A
144	Living Room	28.1	100	N/A

Table 8: Assessment Data

Figure 15: Floor Plan - 13th Floor

Figure 16: Annual Probable Sunlight Hours - Total

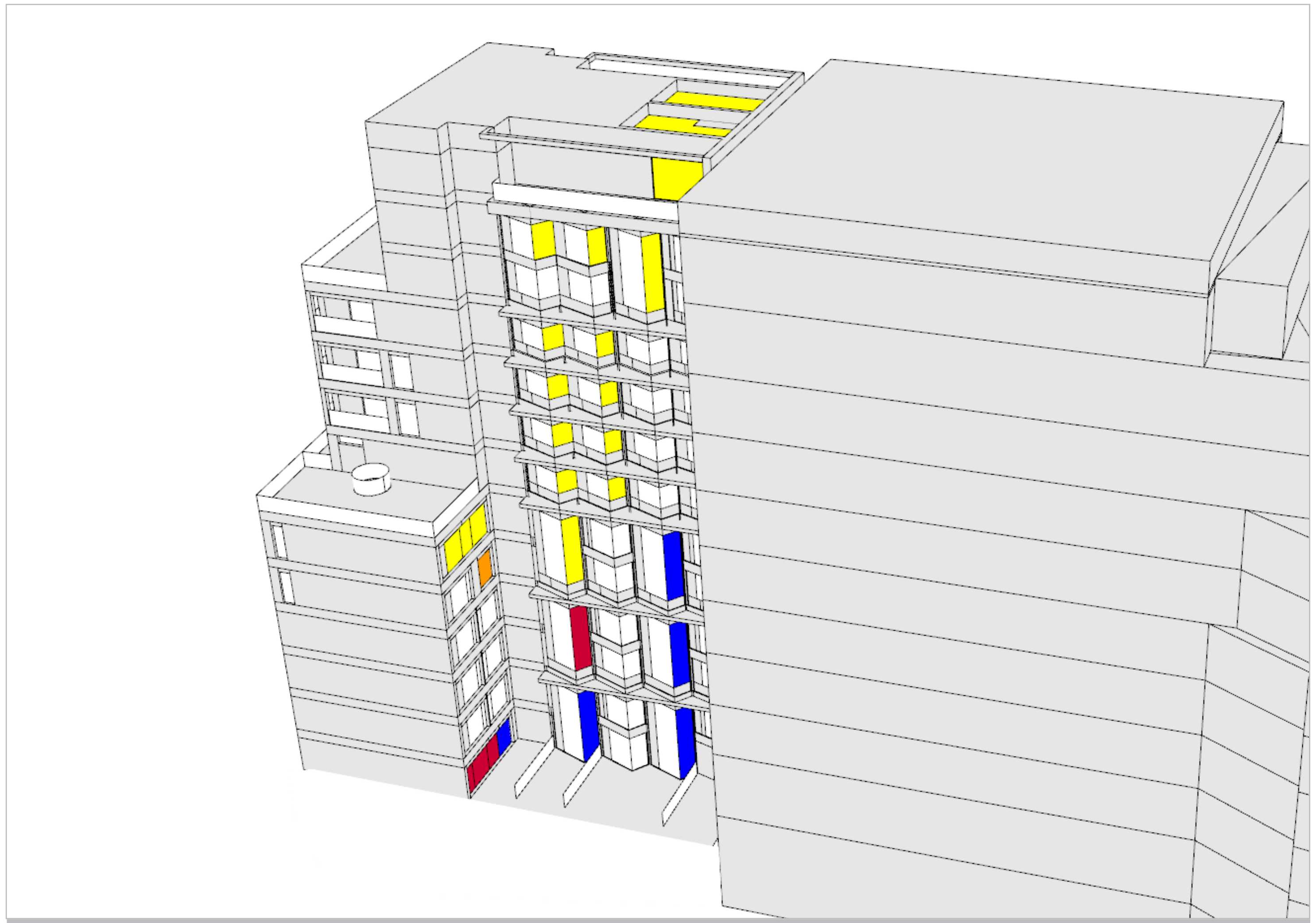
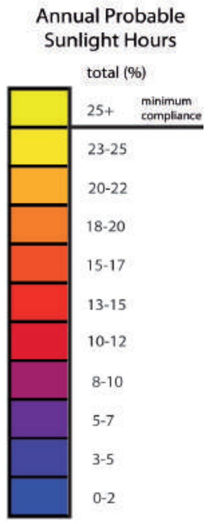
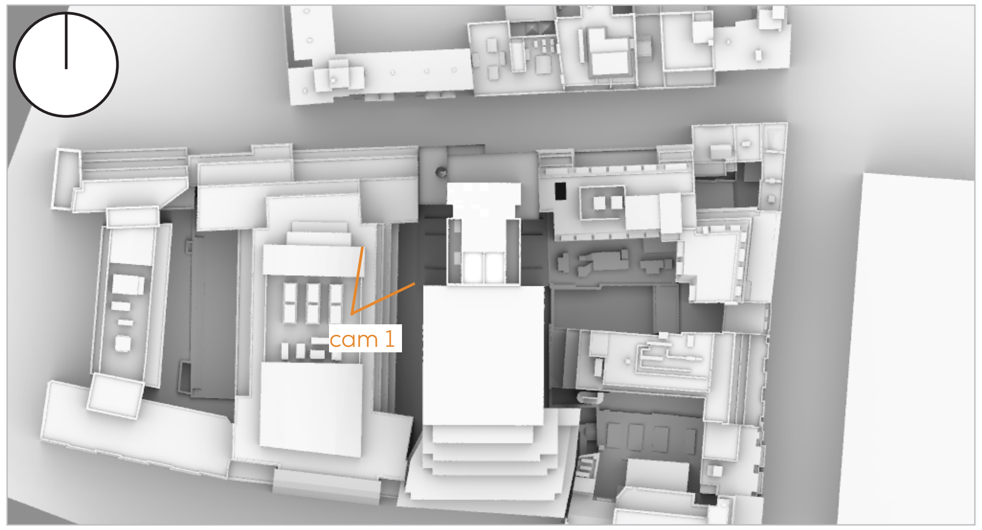
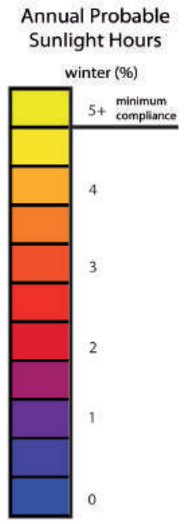


Figure 17: Annual Probable Sunlight Hours - Winter







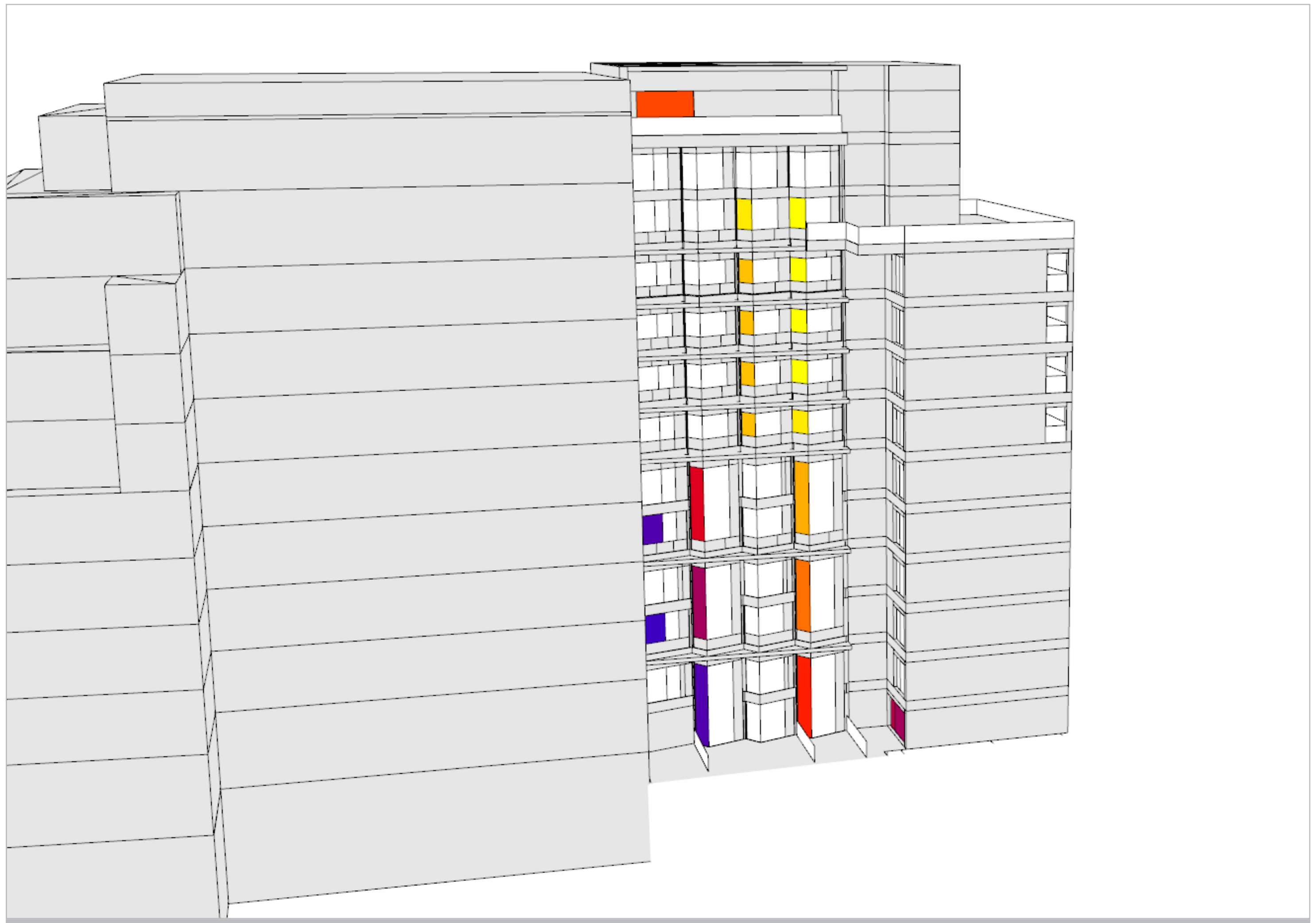


Figure 18: Annual Probable Sunlight Hours - Total

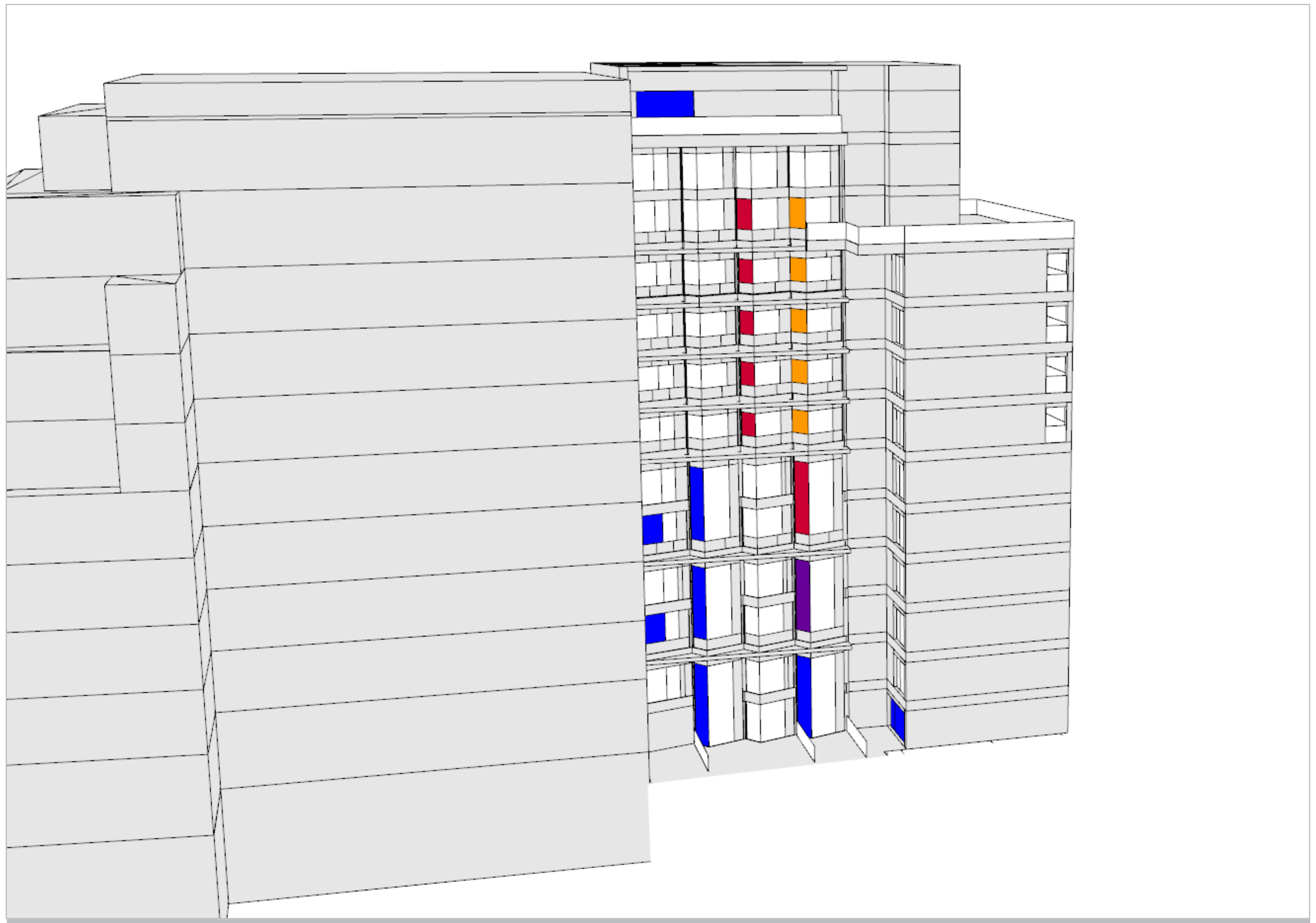
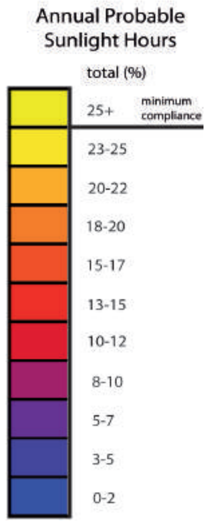
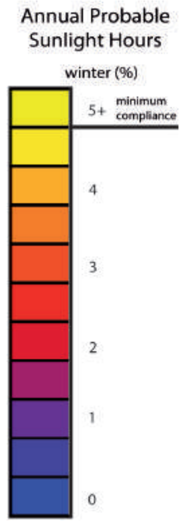


Figure 19: Annual Probable Sunlight Hours - Winter





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