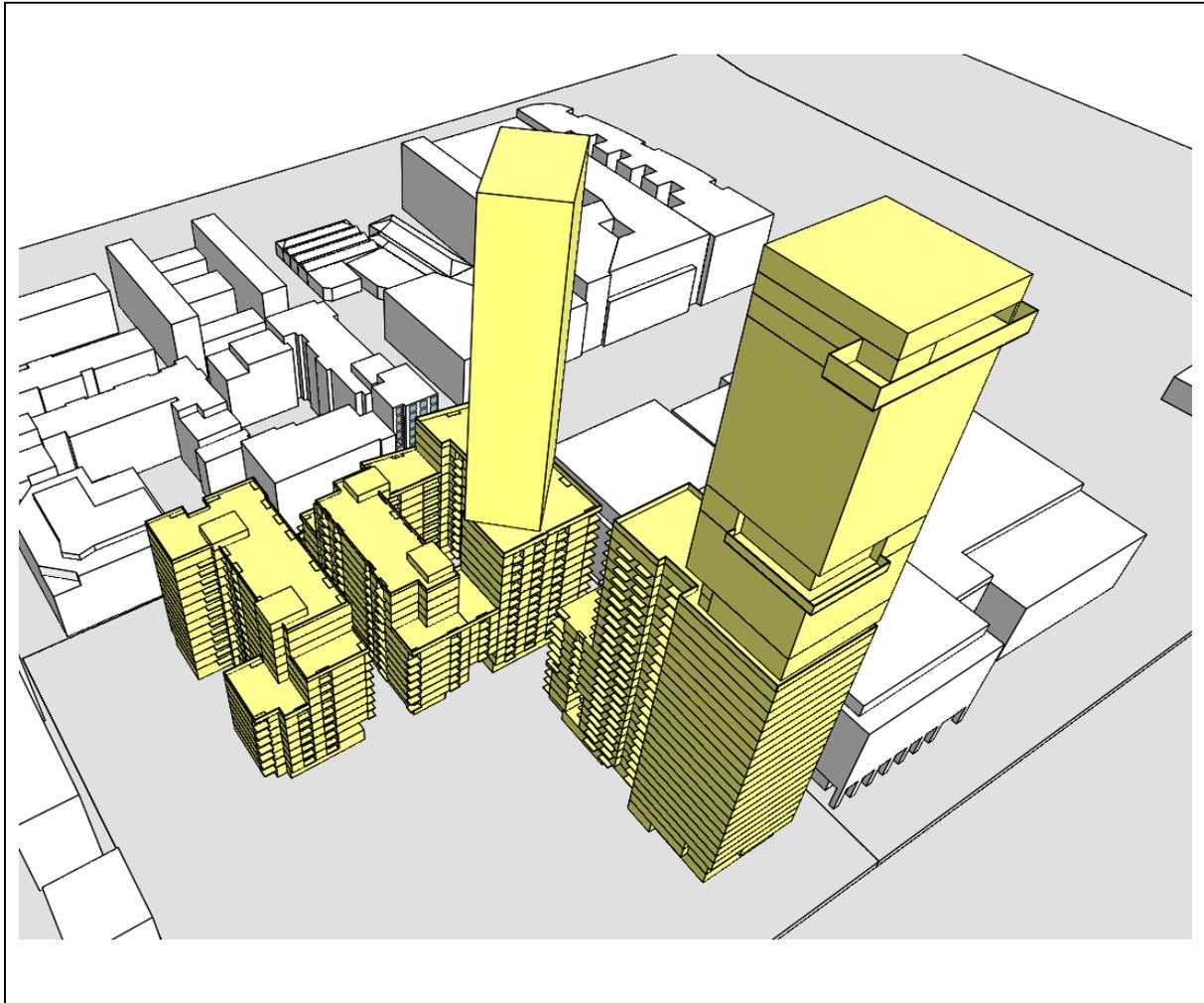


Report for: Waterfront Block 9 Developments Limited

Project No.: 14441

# City Block 9, Project Waterfront – SHD Planning Application

*Daylight, Sunlight and Overshadowing Analysis*





**Document created by:**

Integrated Environmental Solutions Limited

International Sustainability Consulting Developers of the IES <Virtual Environment>

Date:	Issued For:	Prepared by:	Checked by:
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## **1 Executive Summary**

This report is completed to quantify the daylight, sunlight and overshadowing performance of the proposed development Project Waterfront at City Block 9 on the North Docks, Dublin.

The following can be concluded based on the studies undertaken.

### **1.1 Shadow Analysis**

The Shadow analysis shows different shadows being cast at specific times of the year for the proposed scheme in comparison to the heights and block layouts of the Strategic Development Zone (SDZ) indicative scheme.

When compared to the SDZ compliant scheme there is minor additional shading noted throughout the periods considered.

### **1.2 Annual Probable Sunlight Hours of Proposed Building Amenity Spaces**

As mentioned under Section 3.3.17 of BRE's Site Layout Planning for Daylight and Sunlight states that for a space to appear adequately sunlit throughout the year, at least half of the garden or amenity area should receive at least 2 hours of sunlight on the 21st of March.

While the proposed pocket park is located in a central location within the proposed development it does not receive two hours of Sunlight on March 21<sup>st</sup>. However, the pocket park within the SDZ scheme did not receive 2 hours of sunlight on March 21<sup>st</sup>.

The proposed scheme provides a generous amount of shared private amenity space which is in excess of the minimum required. The majority of external shared private amenity space is provided via roof gardens. All of the shared private amenity spaces within the proposed development exceed the BRE's recommendation of over half of their respective areas receiving at least 2 hours of sunlight on March 21<sup>st</sup>.

### **1.3 Daylight Analysis of Existing Adjacent buildings**

Daylight analysis for the neighbouring existing dwellings i.e. Castleforbes Road and Mayor Street upper was completed via Vertical Sky Component (VSC) calculations. Overall the results show the balance of protecting daylight to existing buildings while providing a scale to allow the redevelopment of the proposed building has been achieved.

## 1.4 Average Daylight Factors

The results show 90% of the rooms exceed the BRE recommendations when only the SHD planning application is analysed. When the adjacent commercial scheme is accounted for 85% of the rooms exceed the BRE recommendations for average daylight factors.

We have reviewed what is accepted as best practice internationally on high-rise high-density schemes. We have found some very high-quality schemes for example, Thirty Casson Square located South Bank London which would have 66-70% units exceeding BRE recommendations for ADF's.

Overall, we believe the percentage of rooms that exceed the BRE guidelines for ADF's on Project Waterfront to be best practise for a high-density development.

## 1.5 Discussion

It should be noted that the guidance in 'Site layout planning for daylight and sunlight: a guide to good practice' is not mandatory and the Report itself states 'although it gives numerical guidelines these should be interpreted flexibly because natural lighting is only one of many factors in site layout design.

Overall, the results demonstrate that the proposed development performance achieves best practise for a high-density development and exceeds many of the BRE recommendations in the BRE 'Site Layout Planning for Daylight and Sunlight' guide, sometimes referred to as BRE Digest 209.

## 2 Introduction

This report was completed to quantify the Sunlight / Daylight performance of the proposed development Project Waterfront at City Block 9 on the North Docks, Dublin.

The focus of the study considers the following items with respect to the proposed current scheme development:

- **Shadow Analysis** - A visual representation analysing any potential changes that may arise from the proposed development on to the neighbouring existing developments.
- **Daylight Analysis of Existing surrounding Buildings** - via consideration of Vertical sky component (VSC).
- **Proposed buildings Annual Probable Sunlight Hours** - Clarify the impacts on passive solar gain as per section 3.2 of the BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight.
- **Average daylight factors** – Sampling Internal room light levels for multiple floors in the proposed development with reference to the BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight, Appendix C – Average Daylight Factors.

The assessment is based on recommendations given in BRE – Site Layout Planning for Daylight and Sunlight guide.

The analysis was completed using the IES VE software.

### 3 Development Description

The scheme, totalling 125,388 sq m, provides 22,499 sq m at basement levels, with 102,889 sq m from ground upwards. The development will consist of the:

1. Construction of 1,005 No. residential units (with balconies and winter gardens) arranged in 3 No. blocks ranging in height from 8 No. storeys to 45 No. storeys over a triple-level basement, the former comprising: Block A (8-14 No. storeys (with extended core to access roof level); with an apartment mix of: 116 No. 1-bed; and 92 No. 2-bed; with landscaped terraces at Level 1 (south east elevation), Level 8 (south west elevation), Level 11 (south west elevation) and Level 14 (north east elevation)); Block B (8-41 No. storeys (with extended core to access roof terrace); with an apartment mix of: 172 No. 1-bed; and 247 No. 2-bed; with landscaped terraces at Level 5 (south west elevation), Level 8 (north west elevation and south west elevation), Level 11 (north elevation), Level 12 (west elevation), Level 13 (east elevation), Level 14 (east elevation), and at Level 41 (roof level)); and Block C (11-45 No. storeys (with extended core to access roof level); with an apartment mix of: 207 No. 1-bed; 168 No. 2-bed; and 3 No. 3-bed units; with landscaped terraces at Level 11 (north elevation), Level 24 (south elevation), Level 32 (south elevation), and Level 45 (roof level), incorporating a public viewing deck at Levels 44 and 45).

2. Provision of ancillary residential amenities and support facilities including: live/work suites (321 sq m), a gym/spa reception (52 sq m), a residents' games room (91 sq m), a residents' common room (110 sq m), a residents-only social space (193 sq m), a management office (96 sq m), a security office (50 sq m), concierge spaces (GFA of c. 381 sq m) all located at ground floor level; a residents' games room (90 sq m) located at Level 1 of Block B; a residents' common room (86 sq m) located at Level 14 of Block B; a residents' wellness club and common room (408 sq m) located at Level 24 of Block C;

3. Construction of triple height basement which will comprise double basement with mezzanine plant level (total basement area 22,499 sq m), accommodating: waste storage areas (659 sq m), plant rooms (4,228 sq m), maintenance / management offices (GFA of 92 sq m), residents' courier / parcel rooms (GFA of 210 sq m), residents' laundry rooms (GFA of 138 sq m), ancillary residential storage (GFA of 291 sq m), residents' WCs (65 sq m), a residents' gym / spa (1,529 sq m) and ancillary gym storage room (100 sq m), residents' screening rooms (240 sq m), a residents' indoor plant cultivation room (356 sq m), 176 No. car parking spaces, 10 No. motorcycle parking spaces and 1,693 No. bicycle parking spaces, with vehicular access provided by ramp from North Wall Avenue.

4. Provision of "other uses" as defined by the *Planning and Development (Housing) and Residential Tenancies Act 2016*, comprising: a childcare facility (450 sq m), a restaurant (110 sq m), an indoor Farmer's Market/foodhall (299 sq m), an external market area, a winter garden/seating area (130 sq m), and 3 No. café units (110 sq m, 167 sq m and 261 sq m, respectively), all located at ground floor level; a restaurant (609 sq m) located at Level 32 of Block C; office use (1,894 sq m) from Floor Level 41 to 43 inclusive at Block C; and a public bar / function room (407 sq m) located at Level 44 of Block C. The total area of "other uses" provided is 4,307 sq m.

5. Provision of a pocket park and new pedestrian lanes from North Wall Quay, North Wall Avenue and Mayor Street Upper to the center of the site.

6. All enabling and site development works, landscaping (including living walls), lighting, services and connections, waste management and all other ancillary works above and below ground including the use of existing secant piling permitted under Reg. Ref. DSDZ3779/17 and DSDZ3780/17 (as amended by DSDZ3042/19).

## 4 Methodology

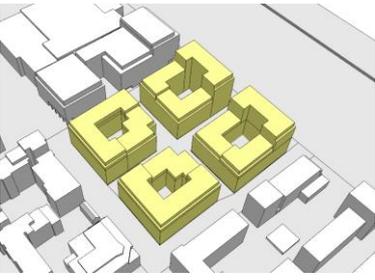
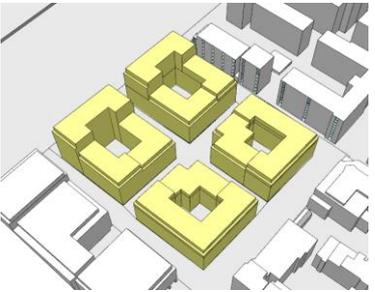
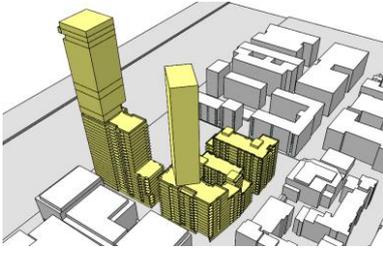
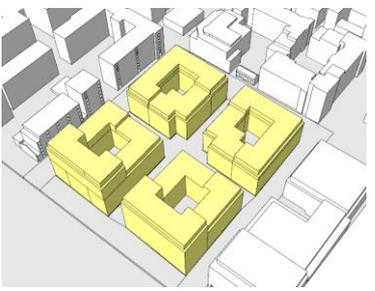
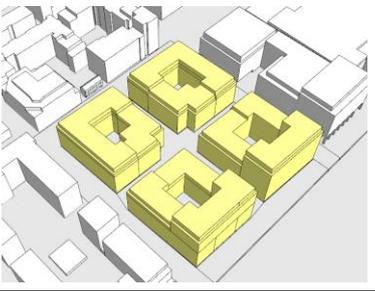
### 4.1 North Angle Orientation

The model orientation has been taken from drawings provided by the Architect and the resulting angle shown below used in the analysis.

Google Maps image	
	
IES <VE> thermal model image – Proposed Residential Development	
	<p>North</p> 

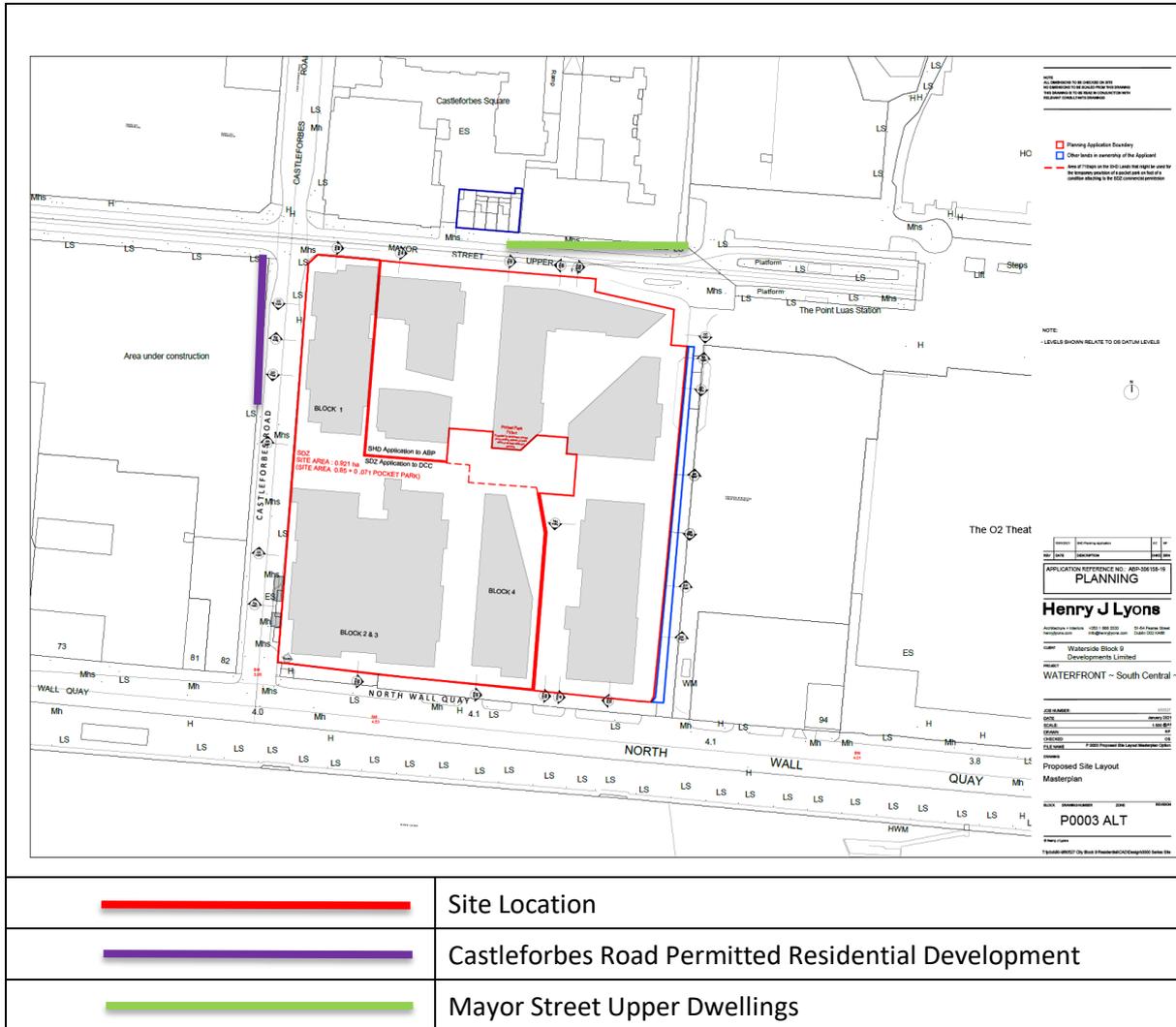
## 4.2 Model Images

The Proposed and SDZ compliant schemes have been created using the Architects information / drawings / 3D SketchUp models provided alongside estimations made from utilising google maps with regards to elevation details of the existing site.

	SDZ Indicative Scheme	Proposed SHD Scheme	Proposed SHD Scheme plus Proposed Commercial
View Looking from North West of Site			
View looking from North East of			
View looking from South East of Site			
View looking from West of Site			

### 4.3 Potential Sensitive Receptors

To help understand the potential impact to surrounding buildings potential sensitive receptors were identified as illustrated below.



## 5 BRE – Site Layout Planning for Daylight and Sunlight (2nd edition)

Access to daylight and sunlight is a vital part of a healthy environment. Sensitive design should provide sufficient daylight and sunlight to new housing while not obstructing light to existing homes nearby.

The BRE Report, Site layout planning for daylight and sunlight: a guide to good practice (BR209), advises on planning developments for good access to daylight and sunlight, and is widely used by local authorities to help determine the impacts of new developments.

### 5.1 Impact classification discussion

BRE guidance in Appendix I – Environmental Impact Assessment suggests impact classifications as minor, moderate and major adverse. It provides further classifications of these impacts with respect to criteria as follows;

<i>Negligible to minor adverse impacts</i>	<i>Fully meets guidelines in BRE report</i>
<i>Negligible adverse impact</i>	<ul style="list-style-type: none"> <li>• <i>Loss of light well within guidelines, or</i></li> <li>• <i>only a small number of windows or limited area of open space losing light (within the guidelines)</i></li> </ul>
<i>Minor adverse impact (a)</i>	<ul style="list-style-type: none"> <li>• <i>Loss of light only just within guidelines, or</i></li> <li>• <i>A large number of windows or large areas of open space areas affected (within the guidelines)</i></li> </ul>
<i>Minor adverse impact (b)</i>	<ul style="list-style-type: none"> <li>• <i>only a small number of windows or limited open space areas are affected</i></li> <li>• <i>the loss of light is only marginally outside the guidelines</i></li> <li>• <i>an affected room has other sources of skylight or sunlight</i></li> <li>• <i>the affected building or open only has a low level requirement for skylight or sunlight</i></li> <li>• <i>there are particular reason why an alternative, less stringent, guideline should be applied</i></li> </ul>
<i>Major adverse impact</i>	<ul style="list-style-type: none"> <li>• <i>large number of windows or large open space areas are affected</i></li> <li>• <i>the loss of light is only substantially outside the guidelines</i></li> <li>• <i>all the windows in a particular property are affected</i></li> <li>• <i>the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight (living rooms / playground)</i></li> </ul>

## 6 Shadow Analysis

The statistics of Met Eireann, the Irish Meteorological Service, show that the sunniest months in Dublin are May and June, based on 1981-2010 averages or latest - <https://www.met.ie/climate/30-year-averages>

The following can also be shown:

- During December, Dublin receives a mean daily duration of 1.7 hours of sunlight out of a potential 7.4 hours sunlight each day (i.e. only 22% of potential sunlight hours).
- During June, Dublin receives a mean daily duration of 6.4 hours of sunlight out of a potential 16.7 hours sunlight each day (i.e. only 38% of potential sunlight hours).

Therefore, impact caused by overshadowing are generally most noticeable during the summer months and least noticeable during the winter months.

This section will consider the shadows cast for both the SDZ compliant scheme and current scheme development for the following dates;

- December 21<sup>st</sup> (Winter Solstice)
- March 21<sup>st</sup> / September 21<sup>st</sup> (Equinox)
- June 21<sup>st</sup> (Summer solstice)

These images will show shadows cast for 'perfect sunny' conditions with no clouds and assumed that the sun is out for every hour shown. Given the discussion above it is important to remember that this is not always going to be the case.

## 6.1 Plan View

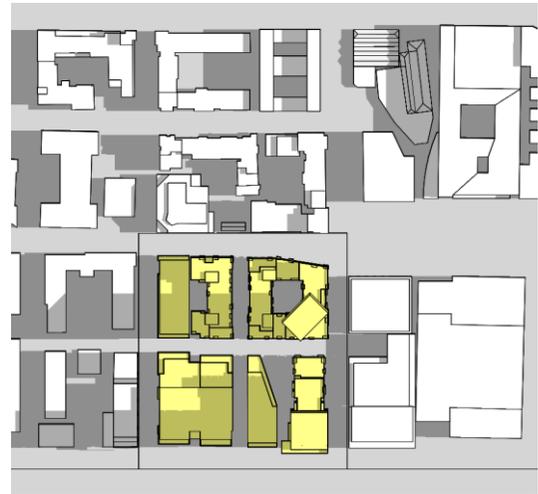
### 6.1.1 March 21st

	SDZ Indicative Scheme	Proposed SHD Scheme	Proposed SHD Scheme plus Proposed Commercial
March 21st - 8:00			





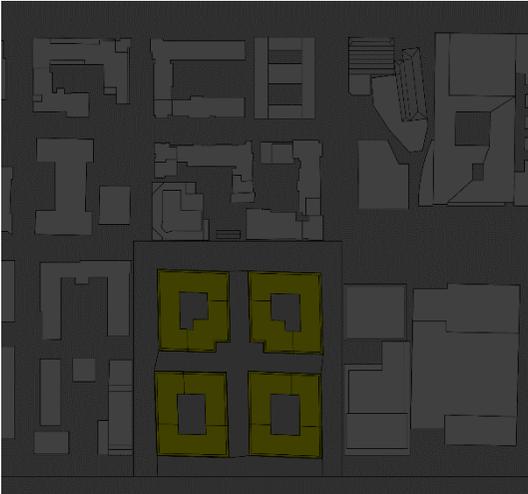
### 6.1.2 June 21st

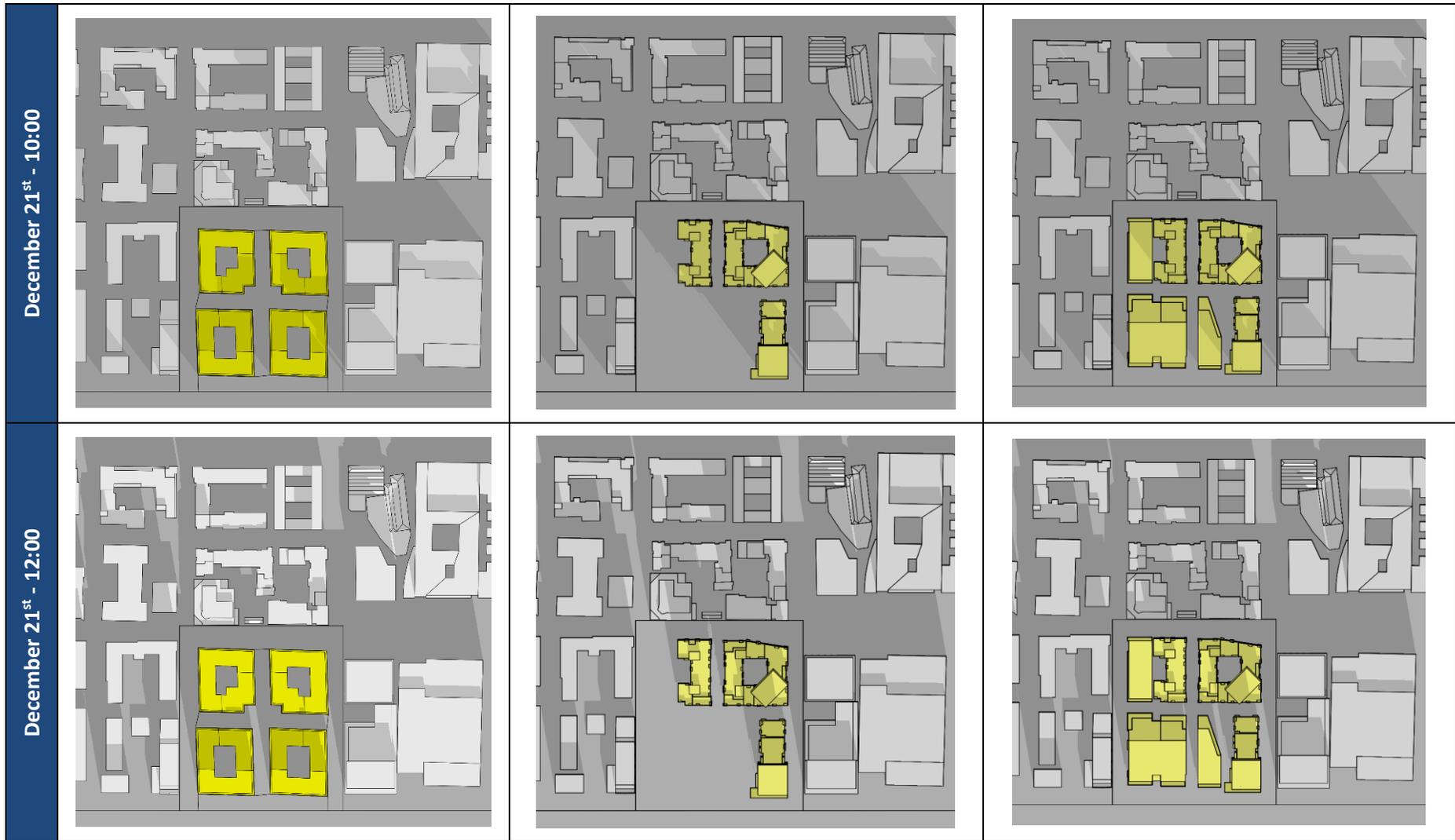
	SDZ Indicative Scheme	Proposed SHD Scheme	Proposed SHD Scheme plus Proposed Commercial
June 21st - 8:00			

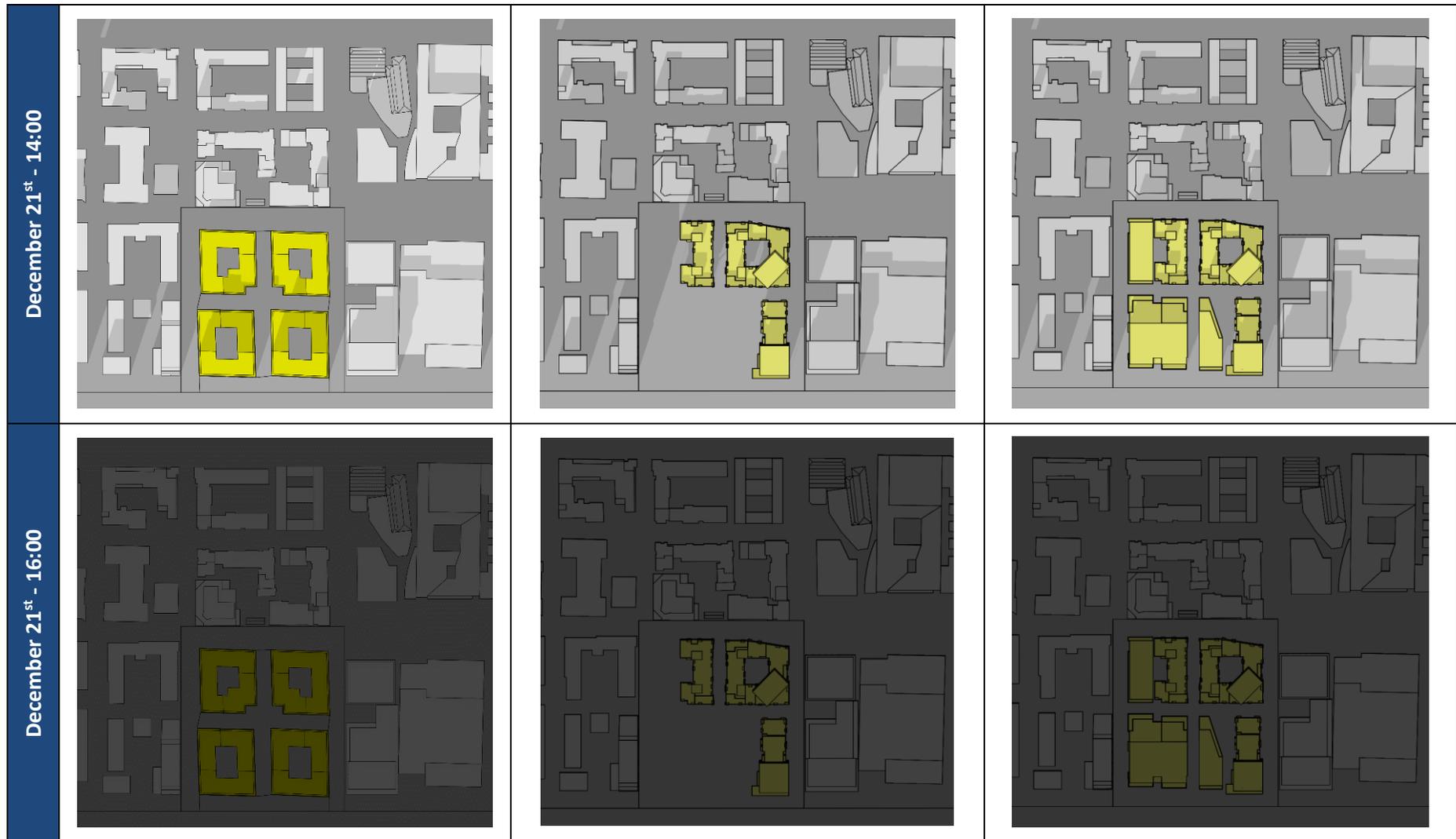




### 6.1.3 December 21st

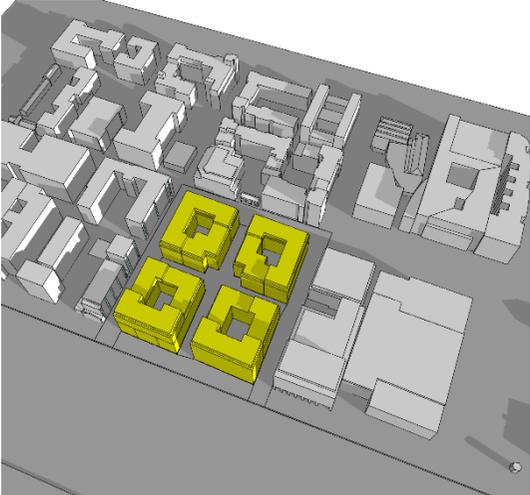
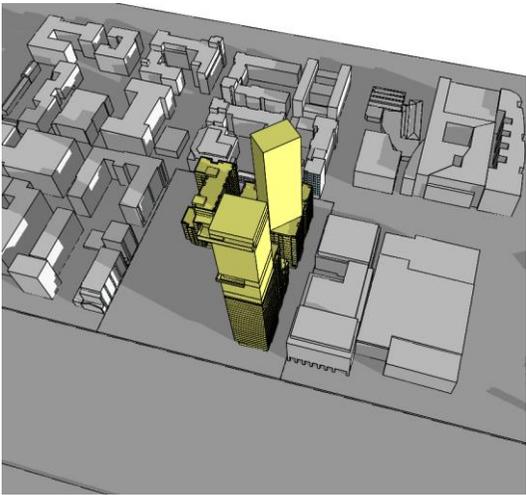
	SDZ Indicative Scheme	Proposed SHD Scheme	Proposed SHD Scheme plus Proposed Commercial
December 21st - 8:00			





## 6.2 3D view

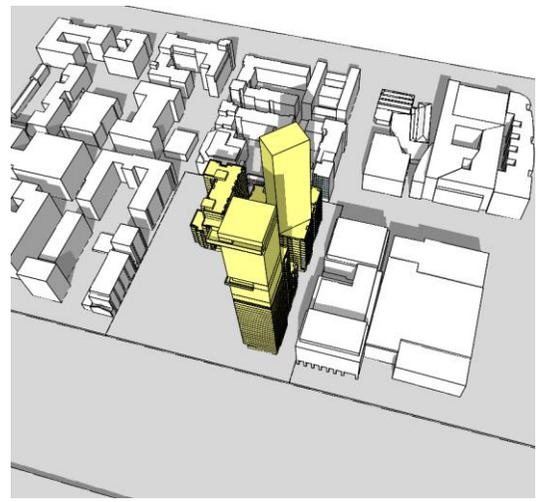
### 6.2.1 March 21st

	SDZ Indicative Scheme	Proposed SHD Scheme	Proposed SHD Scheme plus Proposed Commercial
March 21st - 8:00			

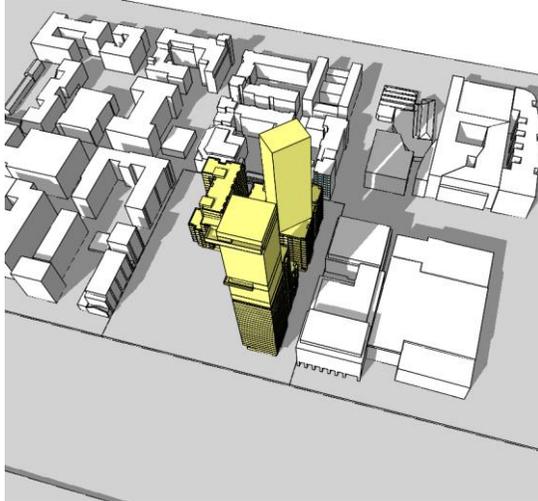
March 21<sup>st</sup> - 10:00



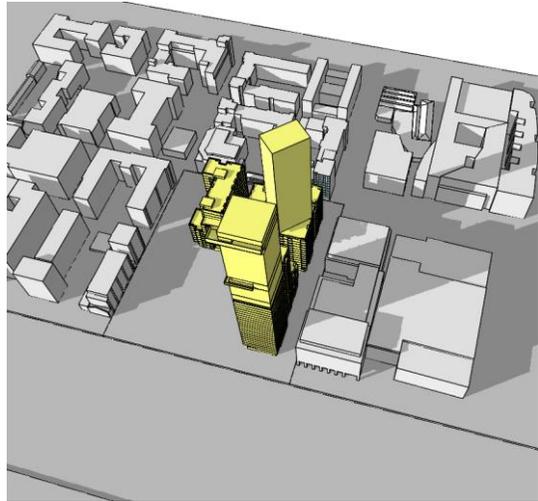
March 21<sup>st</sup> - 12:00



March 21<sup>st</sup> - 14:00



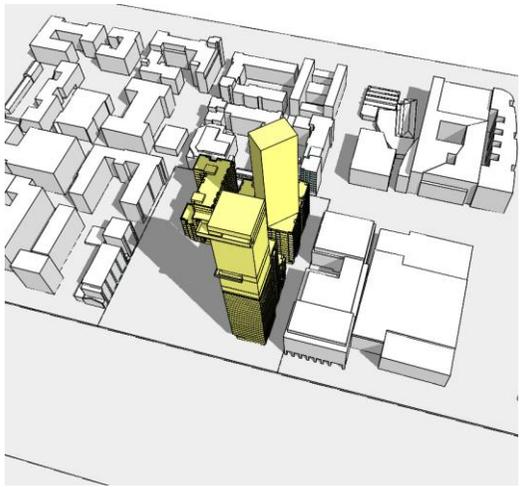
March 21<sup>st</sup> - 16:00



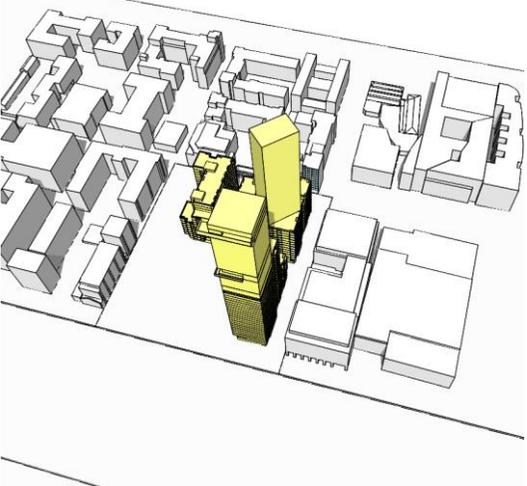
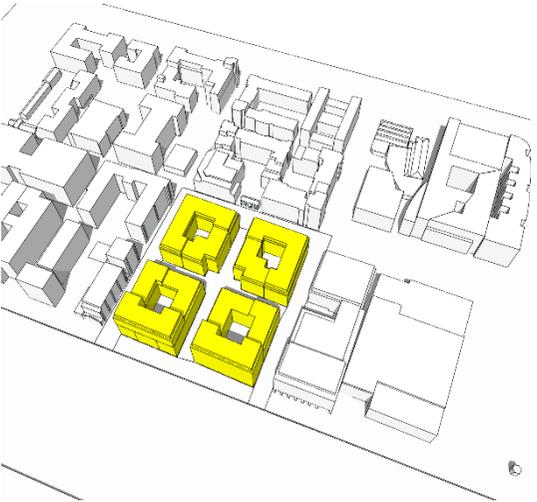
### 6.2.2 June 21st

	SDZ Indicative Scheme	Proposed SHD Scheme	Proposed SHD Scheme plus Proposed Commercial
June 21st - 8:00			

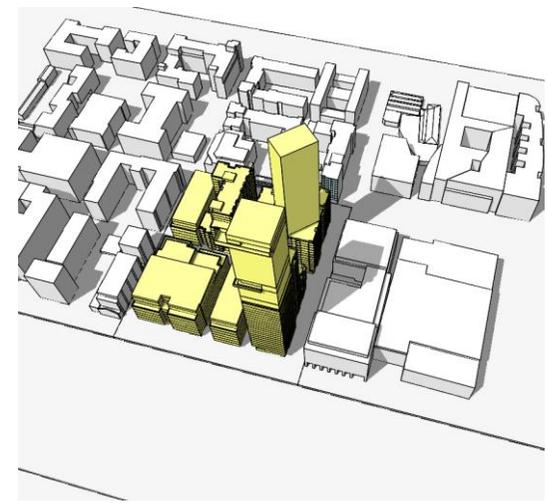
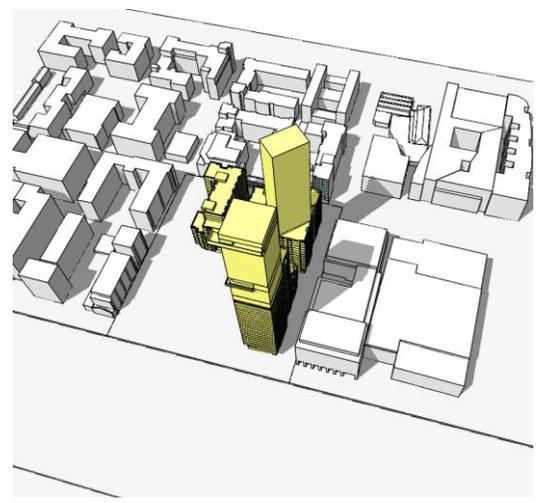
June 21<sup>st</sup> - 10:00



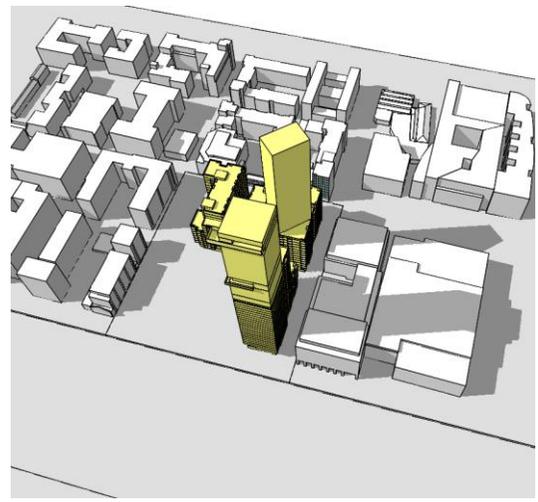
June 21<sup>st</sup> - 12:00



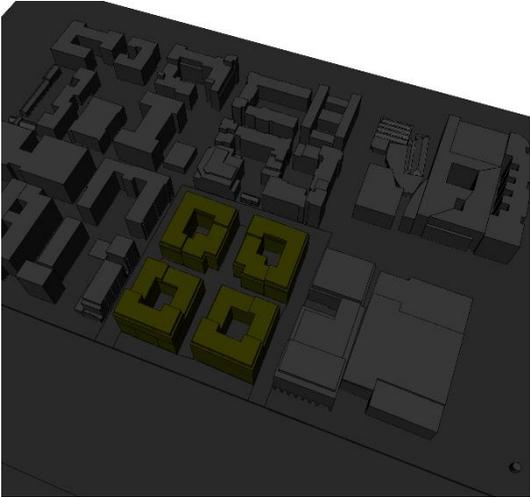
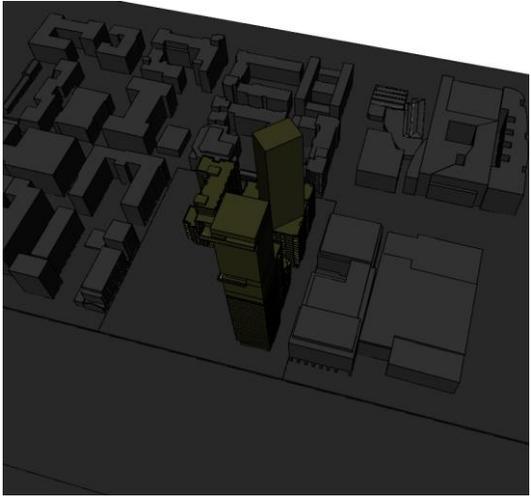
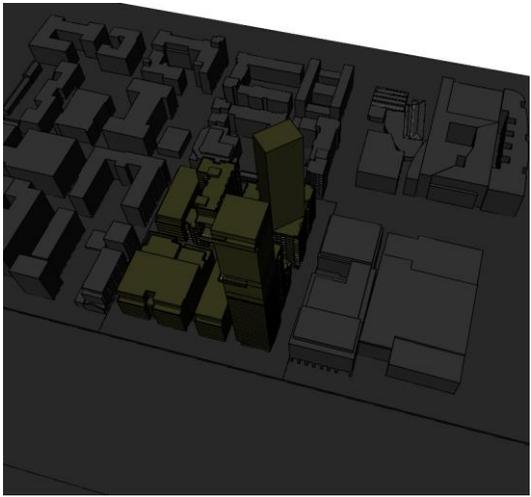
June 21<sup>st</sup> - 14:00

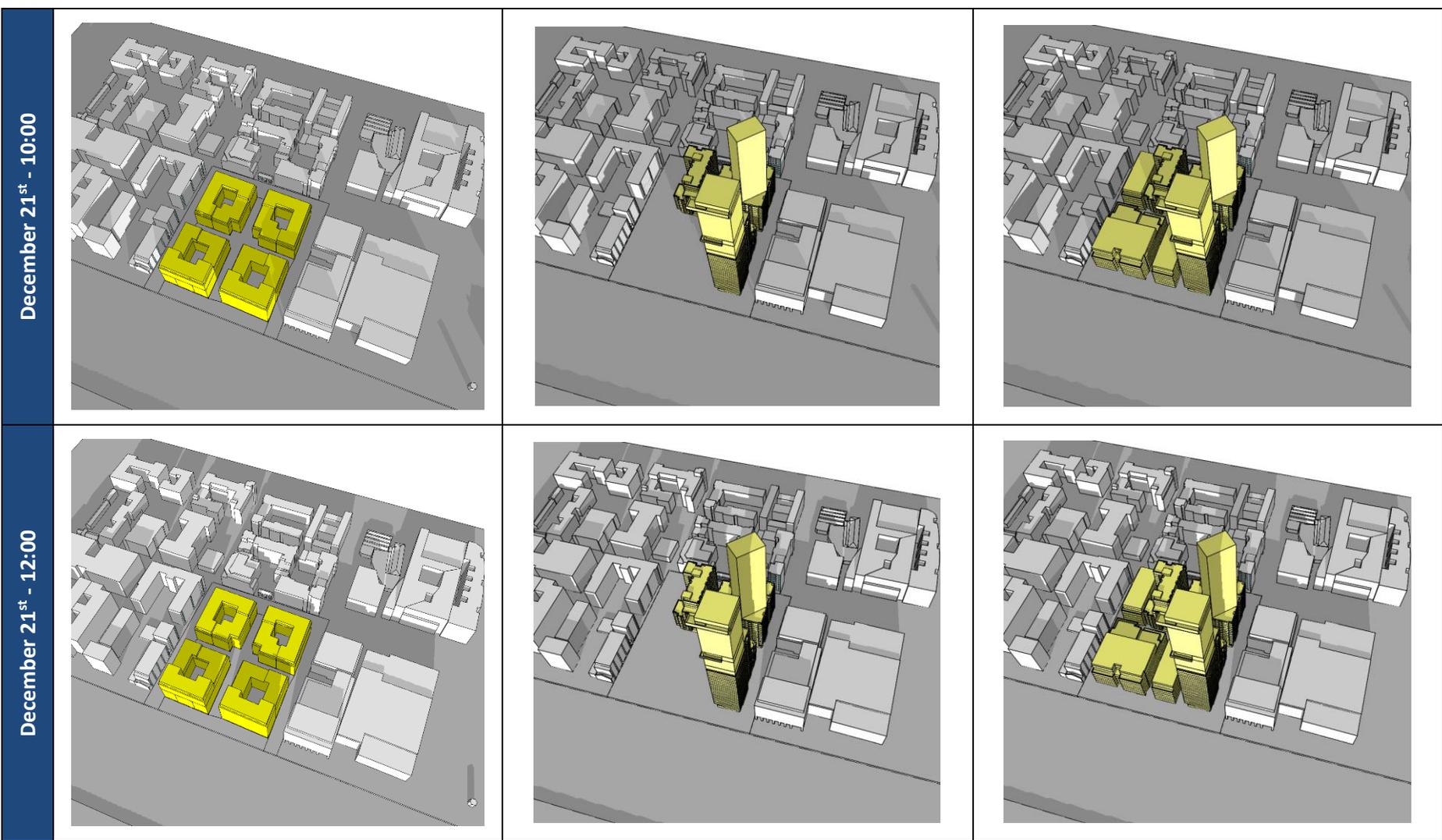


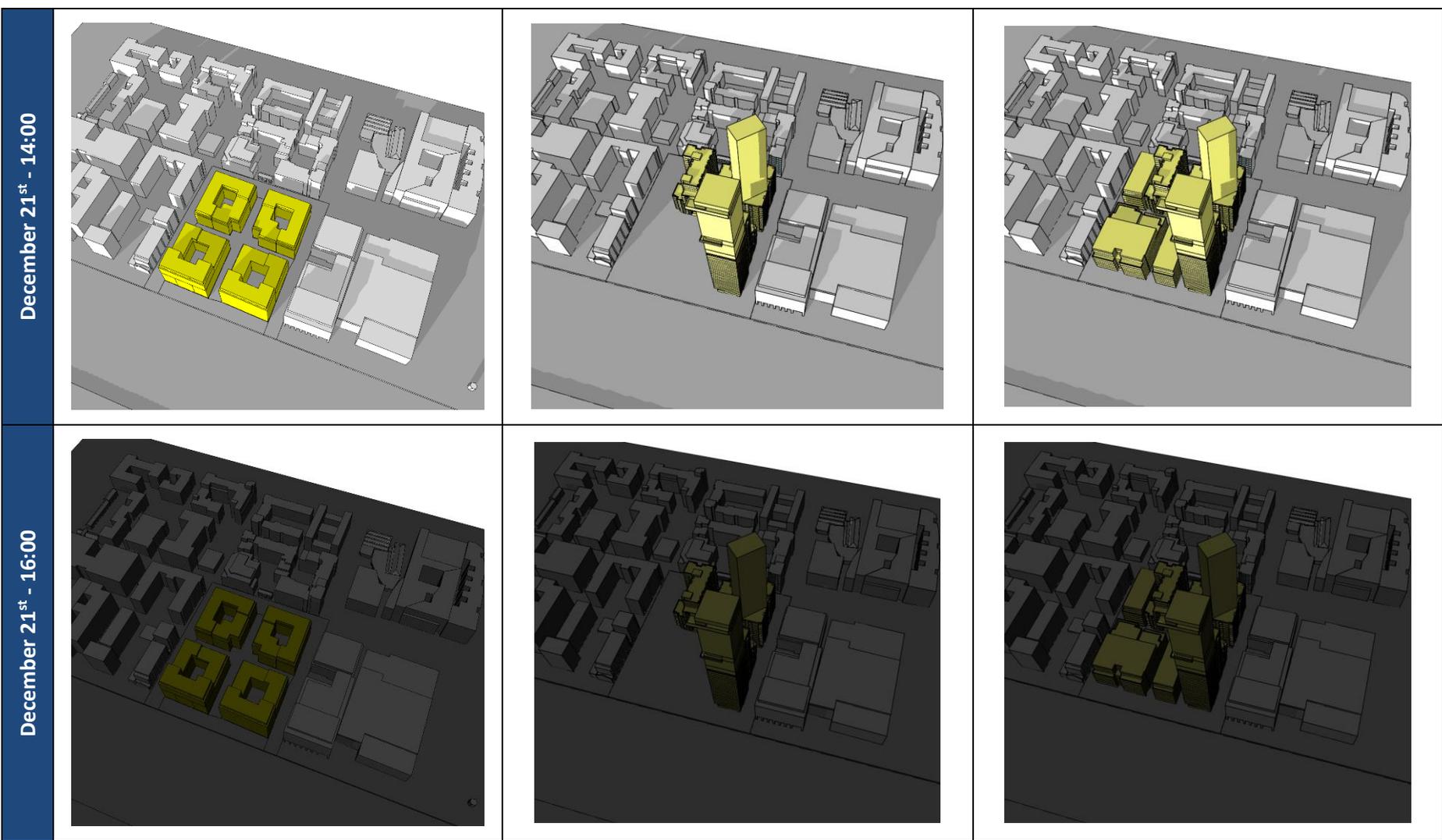
June 21<sup>st</sup> - 16:00



### 6.2.3 December 21st

	SDZ Indicative Scheme	Proposed SHD Scheme	Proposed SHD Scheme plus Proposed Commercial
December 21st - 8:00			





### 6.3 Shadow Analysis Observations

Shading from the proposed development is summarised as follows based on the analysis of images above:

- **Morning (until 12h00)**
  - **Castleforbes Road Permitted Residential Development** – similar shading visible from the proposed development (compared with the SDZ compliant scheme) on the permitted residential dwellings to the West of the development site.
  - **Mayor Street Upper** - similar shading visible from the proposed development (compared with the SDZ indicative scheme) on the existing residential dwellings, as they sit to the North of development site.
  
- **Midday (from 12h00 until 16h00)**
  - **Castleforbes Road Permitted Residential Development** – no additional shading visible from the proposed development on the permitted residential development during the afternoon, as they sit to the West of development site.
  - **Mayor Street Upper** - similar shading visible from the proposed development (compared with the SDZ compliant scheme) on the existing residential dwellings during March, as they sit to the North of development site. No additional shading is visible during June as the shadows cast by the proposed development are contained within the site.
  
- **Late Afternoon (from 16h00)**
  - **Castleforbes Road Permitted Residential Development** – no additional shading visible from the proposed development on the permitted residential development during the afternoon, as they sit to the West of development site.
  - **Mayor Street Upper** - similar shading visible from the proposed development (compared with the SDZ compliant scheme) on the existing residential dwellings during March, as they sit to the North of development site. No additional shading is visible during June as the shadows cast by the proposed development are contained within the site.

When compared the to the SDZ indicative scheme there is minor additional shading noted throughout the periods considered and as such the impact of the proposed development can be classified as a minor adverse impact when considering the overshadowing.

## 7 Annual Probable Sunlight Hours of Proposed Building Amenity Spaces

### 7.1 Requirements

The impact of the development proposal on the sunlight availability in the amenity areas will be considered to determine how they perform when assessed against the BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight which states the following in Section 3.3.17;

#### Summary

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.

BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight states in 3.3.17 that for a space to, appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least 2 hours of sunlight on 21<sup>st</sup> March.

7.2 Solar Amenities



### 7.3 Street Level Amenities

As stated above for a space to appear adequately sunlit throughout the year, at least half of amenity area should receive at least 2 hours of sunlight on 21<sup>st</sup> March.

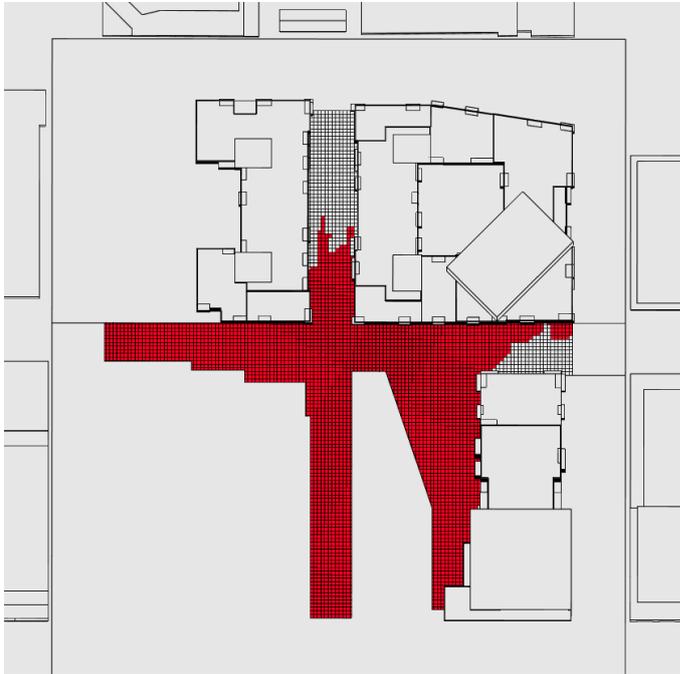
The following images shows the results for the Ground Level Amenity areas receiving at least 2 hours of sunlight on 21<sup>st</sup> March in red for the following scenarios: -

- SDZ scheme
- Proposed SHD Scheme
- Proposed SHD Scheme with the inclusion of the Proposed Commercial Scheme (i.e. separate planning application)

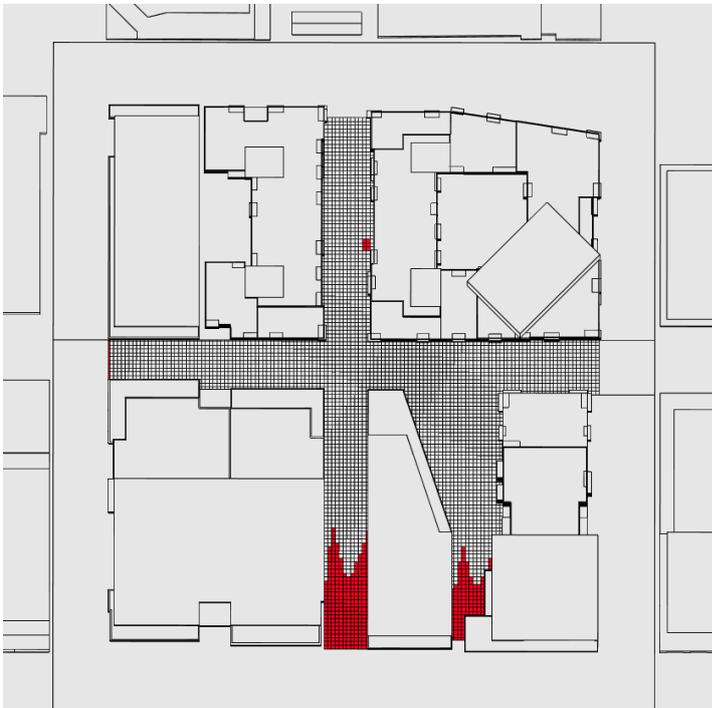
**Plan View - SDZ scheme - 21<sup>st</sup> of March**



**Plan View - Proposed SHD Scheme - 21<sup>st</sup> of March**



**Plan View - Proposed SHD Scheme with Proposed Commercial Scheme - 21<sup>st</sup> of March**



## 7.4 Roof Terrace Amenities

As stated above for a space to, appear adequately sunlit throughout the year, at least half of amenity area at roof level should receive at least 2 hours of sunlight on 21<sup>st</sup> March & 21<sup>st</sup> June.

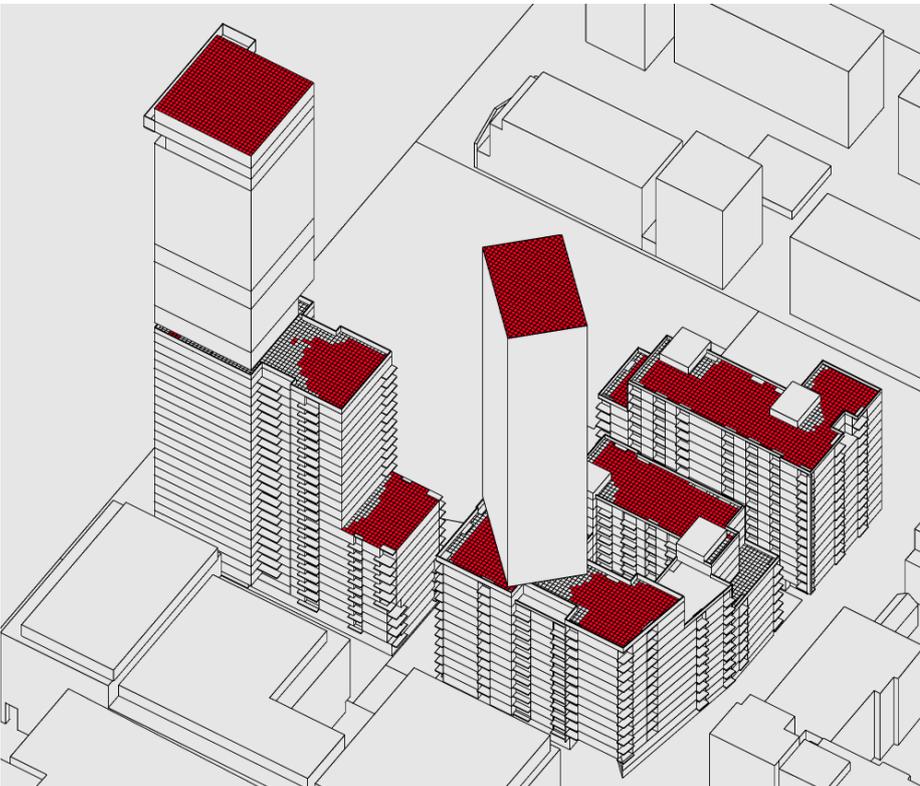
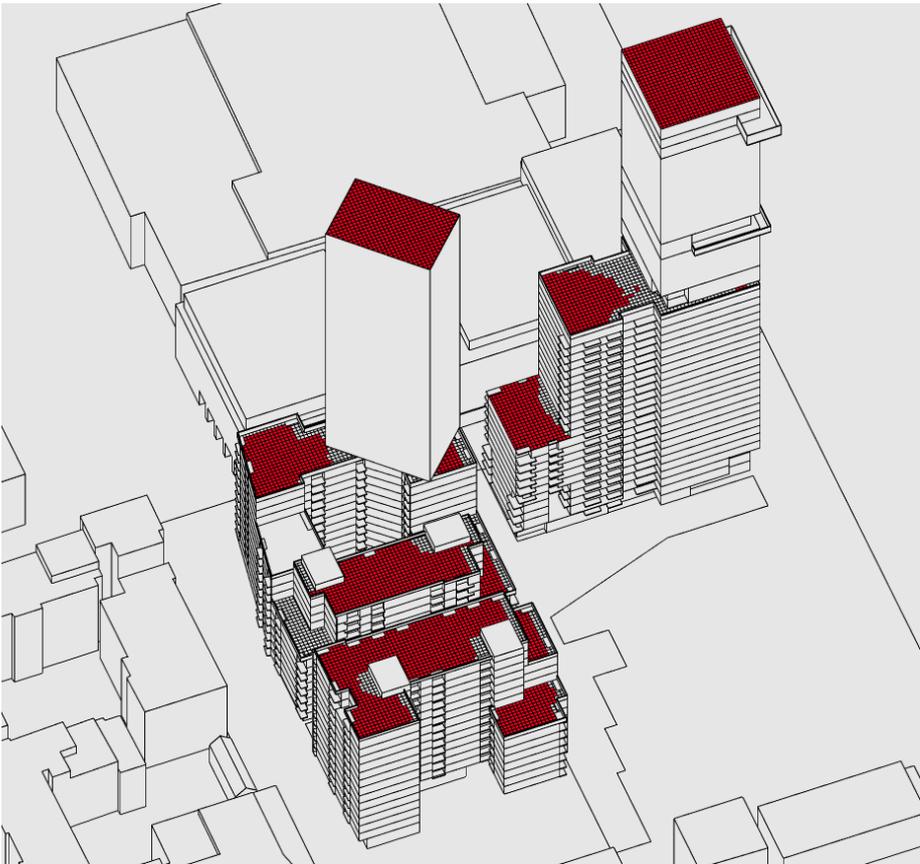
**Plan View – Residential Proposed Scheme - 21<sup>st</sup> of March**



**Plan View - Residential Proposed Scheme - 21<sup>st</sup> of June**



3D View - Residential Proposed Scheme - 21<sup>st</sup> of March



## 7.5 Amenity Observations

As mentioned above under Section 3.3.17 of BRE's Site Layout Planning for Daylight and Sunlight states that for a space to appear adequately sunlit throughout the year, at least half of the amenity area should receive at least 2 hours of sunlight on the 21st of March.

While the proposed pocket park is located in a central location within the proposed development it does not received two hours of Sunlight on March 21<sup>st</sup>. However, the pocket park within the SDZ scheme did not receive 2 hours of sunlight on March 21<sup>st</sup>. This verifies the challenges of achieving sunlight at ground floor level while delivering an acceptable level of density on the site.

The landscape design illustrates how a quality external space can be created in a location where sunlight is at a premium.

The proposed scheme provides a generous amount of shared private amenity space which is in excess of the minimum required. The majority of external shared private amenity space is provided via roof gardens. All of the shared private amenity spaces within the proposed development exceed the BRE's recommendation of over half of their respective areas receiving at least 2 hours of sunlight on March 21<sup>st</sup>.

## 8 Daylight Analysis of Existing Buildings

### 8.1 VSC Guidance Requirements

BRE Site layout planning for daylight and sunlight (Section 2.2)

When designing a new development, it is important to safeguard the daylight to nearby buildings. The BRE's 2011 guidance provide numerical values that are purely advisory. Different criteria may be used based on the requirements for daylighting in an area viewed against other site layout constraints. Another issue is whether the Permitted building is itself a good neighbour, standing a reasonable distance from the boundary and taking no more than its fair share of light. Any reduction in the total amount of skylight can be calculated by finding the vertical sky component at the centre of key reference points. The vertical sky component definition from the BRE's 2011 is described below;

<p>Vertical sky component (VSC)</p>	<p>Ratio of that part of illuminance, at a point on a given vertical plane, that is received directly from a CIE standard overcast sky, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. Usually the 'given vertical plane' is the outside of a window wall. The VSC does not include reflected light, either from the ground or from other buildings.</p>
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The maximum possible VSC value for an opening in a vertical wall, assuming no obstructions, is 40%. This VSC at any given point can be tested in the Radiance module of the IES VE software.

For typical Schemes the BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight which states the following in Section 2.2.7

<p>2.2.7 If this VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. Any reduction below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.8 times its former value, occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window is likely to appear more gloomy, and electric lighting will be needed more of the time.</p>
---

As such this study will compare between the SDZ indicative scheme and current Schemes and consider whether any reduction will be greater than 20%.

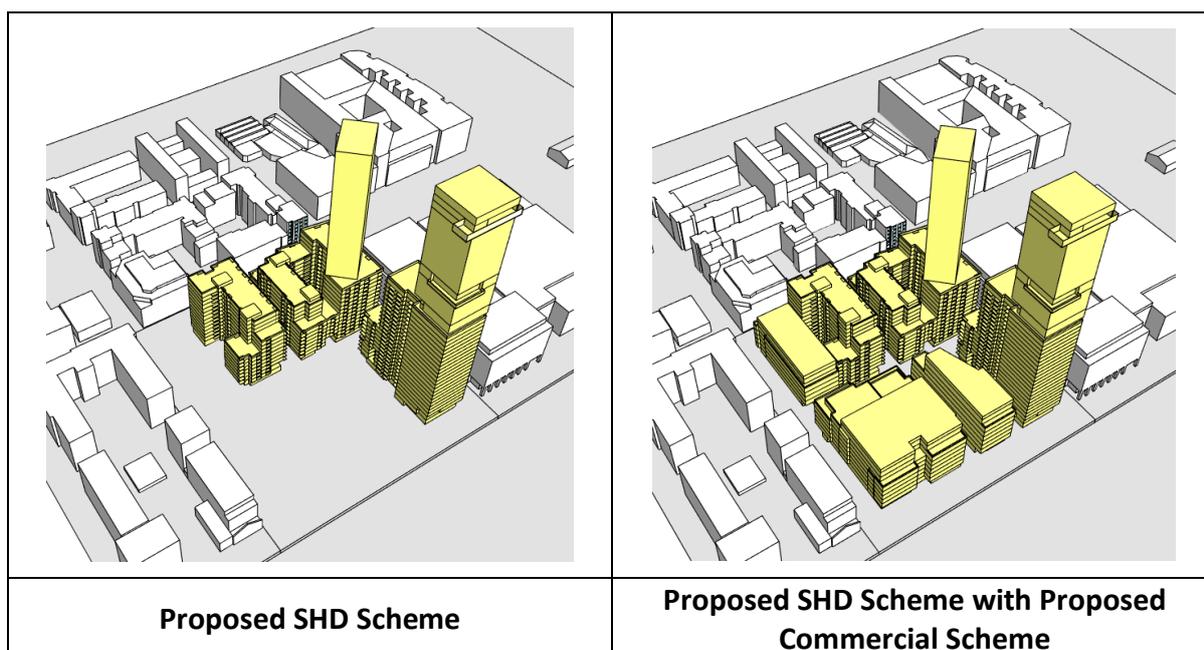
### 8.1.1 VSC values

The BRE Guide also states the following in Section 2.1.6 that the amount of daylight a room needs depends on what it is being used for, but roughly speaking if the VSC is:

- $\geq 27\%$ , conventional window design will usually give reasonable results
- between 15 % and 27 % special measures (larger windows, changes to room layout) are usually needed to provide adequate daylight
- between 5 % and 15 % it is difficult to provide adequate daylight unless very large windows are used
- $< 5\%$  it is often impossible to achieve reasonable daylight even if the whole window wall is glazed

As such these values will be referred to as part of the analysis of the adjacent properties.

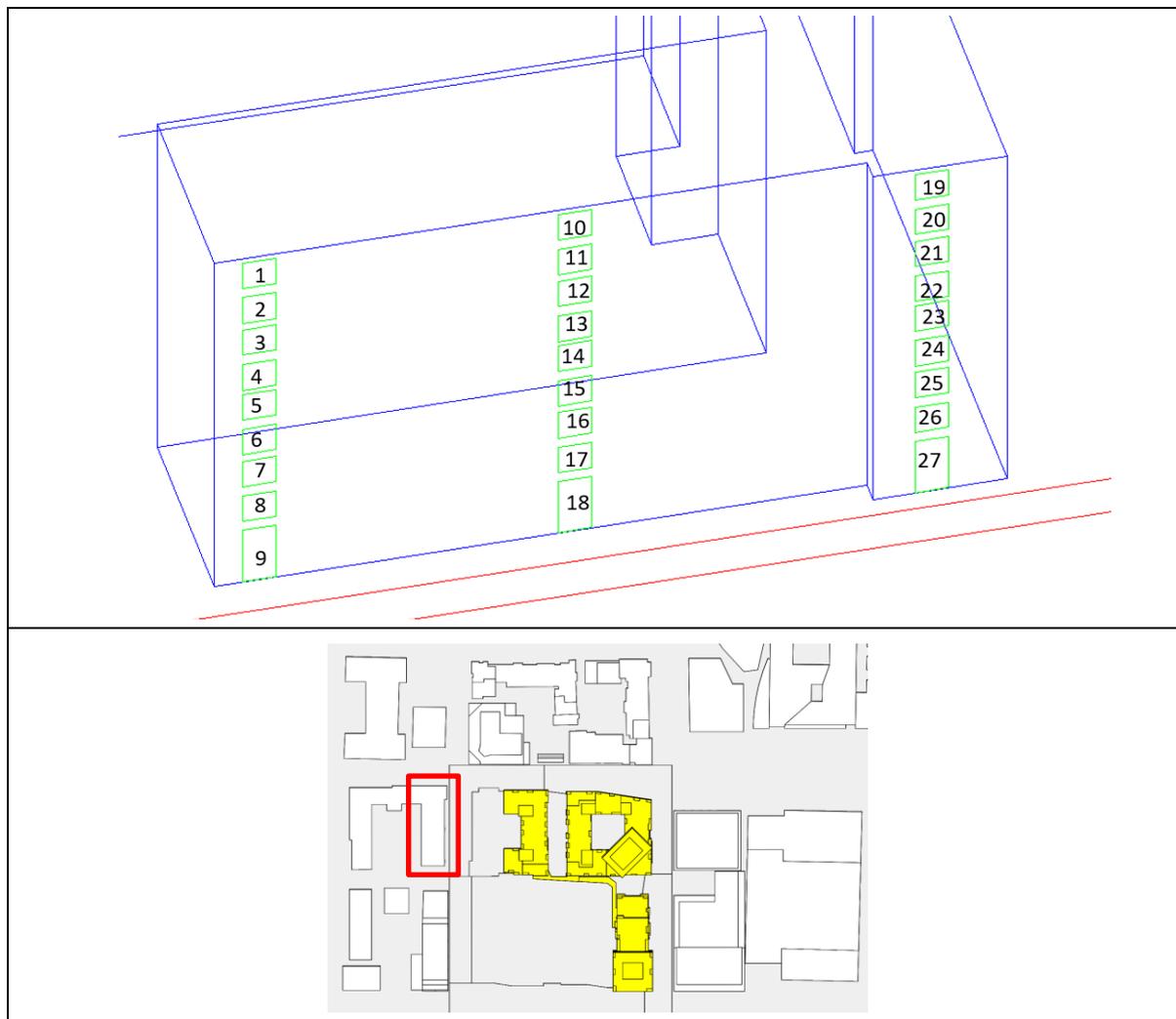
### 8.1.2 Schemes Considered for the Analysis



Note: The adjacent residential property on Mayor Street Upper has been excluded from the VSC analysis as it is owned by Ronan Group Real Estate, the developer of the proposed properties at City Block 9, Waterfront.

## 8.2 Results

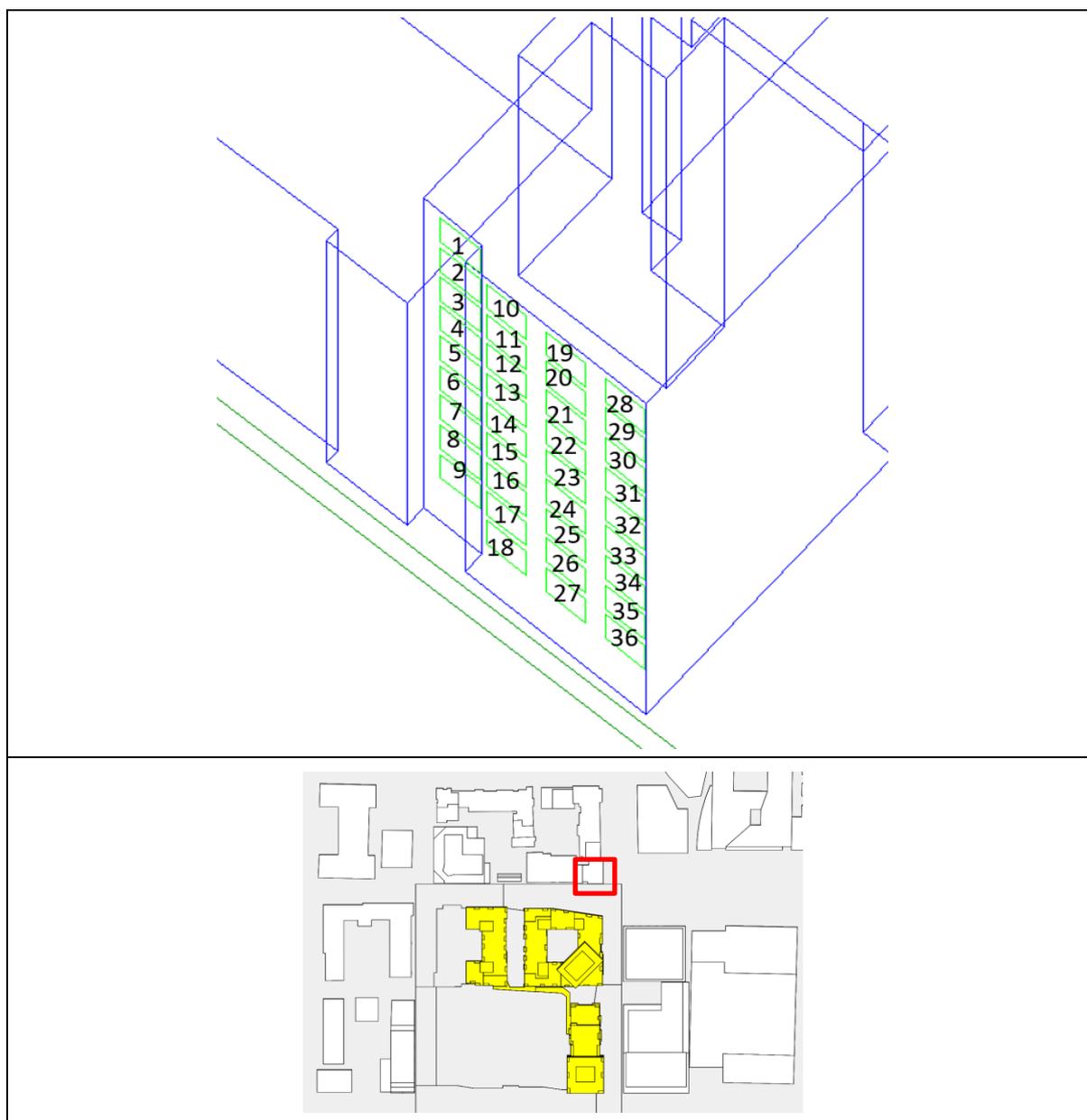
### 8.2.1 VSC View 01 (Castleforbes Road)



Window Point	SDZ Indicative Scheme VSC (%)	Proposed SHD Scheme VSC (%)	Proposed SHD Scheme with Proposed Commercial VSC (%)	(SHD/ SDZ Indicative Scheme) VSC (%)	(SHD Scheme with Proposed Commercial /SDZ Indicative Scheme) VSC (%)
1	37.78	27.34	26.05	72%	69%
2	35.17	26.85	24.34	76%	69%
3	32.28	26.02	21.97	81%	68%
4	25.91	24.59	19.63	95%	76%
5	25.91	24.18	17.41	93%	67%
6	22.92	23.59	15.37	103%	67%
7	20.18	22.61	13.1	112%	65%
8	17.68	21.51	11.33	122%	64%
9	14.65	20.72	8.81	141%	60%
10	38.09	27.38	25.76	72%	68%

Window Point	SDZ Indicative Scheme VSC (%)	Proposed SHD Scheme VSC (%)	Proposed SHD Scheme with Proposed Commercial VSC (%)	(SHD/ SDZ Indicative Scheme) VSC (%)	(SHD Scheme with Proposed Commercial /SDZ Indicative Scheme) VSC (%)
11	35.65	26.04	24.38	73%	68%
12	32.36	25.05	22.17	77%	69%
13	28.87	24.9	19.34	86%	67%
14	25.89	23.53	16.95	91%	65%
15	22.82	22.66	15.23	99%	67%
16	19.92	21.47	13.44	108%	67%
17	16.94	20.56	11.01	121%	65%
18	14.27	19.8	9.72	139%	68%
19	38.38	30.23	30.01	79%	78%
20	36.71	29.48	28.63	80%	78%
21	35.15	28.74	27.17	82%	77%
22	32.38	27.51	25.16	85%	78%
23	29.93	26.53	22.78	89%	76%
24	27.76	25.36	20.73	91%	75%
25	25.17	24.06	18.25	96%	73%
26	22.93	22.78	16.98	99%	74%
27	20.55	20.38	13.91	99%	68%

## 8.2.2 VSC View 03 (Mayor Street Upper Dwelling)



Window Point	SDZ Indicative Scheme VSC (%)	Proposed SHD Scheme VSC (%)	Proposed SHD Scheme with Proposed Commercial VSC (%)	(SHD/ SDZ Indicative Scheme) VSC (%)	(SHD Scheme with Proposed Commercial /SDZ Indicative Scheme) VSC (%)
1	34.81	20.48	19.98	59%	57%
2	33.65	17.69	18.26	53%	54%
3	32.74	15.62	16.26	48%	50%
4	28.97	13.58	13.42	47%	46%
5	25.73	11.9	11.22	46%	44%
6	22.98	10.13	10.59	44%	46%
7	20.54	8.93	9.14	43%	44%

Window Point	SDZ Indicative Scheme VSC (%)	Proposed SHD Scheme VSC (%)	Proposed SHD Scheme with Proposed Commercial VSC (%)	(SHD/ SDZ Indicative Scheme) VSC (%)	(SHD Scheme with Proposed Commercial /SDZ Indicative Scheme) VSC (%)
8	17.28	8.54	8.54	49%	49%
9	15.2	7.33	7.04	48%	46%
10	38.68	24.17	24.37	62%	63%
11	38.33	23.05	22.64	60%	59%
12	37.36	21.07	20.95	56%	56%
13	35.08	19.95	19.33	57%	55%
14	32.37	17.69	17.99	55%	56%
15	28.99	16.76	16.92	58%	58%
16	26.06	15.12	15.17	58%	58%
17	23.15	14.12	13.56	61%	59%
18	21.11	12.62	12.83	60%	61%
19	38.71	25.01	24.94	65%	64%
20	38.17	23.91	24.15	63%	63%
21	37.52	22.69	22.25	60%	59%
22	35.1	21.1	21.05	60%	60%
23	32.59	19.75	19.33	61%	59%
24	29.7	18.04	17.97	61%	61%
25	26.72	17.07	16.36	64%	61%
26	24.43	15.22	15.25	62%	62%
27	21.95	14.11	14.13	64%	64%
28	38.62	26.64	26.86	69%	70%
29	38.39	25.41	25.79	66%	67%
30	37.53	24.14	23.98	64%	64%
31	35.53	22.93	22.93	65%	65%
32	32.98	21.68	21.36	66%	65%
33	30.51	20.14	20.19	66%	66%
34	27.9	18.68	18.35	67%	66%
35	25.46	17.31	17.08	68%	67%
36	23.24	15.52	15.92	67%	69%

### 8.2.1 VSC View 04 (Mayor Street Upper Dwelling)



We didn't complete VSC analysis for the above property as its in the ownership of the applicant and is under review for a future planning application.

### **8.3 VSC Observations**

Daylight analysis for the neighbouring existing dwellings i.e. Castleforbes Road and Mayor Street upper was completed via Vertical Sky Component (VSC) calculations. Overall the results show the balance of protecting daylight to existing buildings while providing a scale to allow the redevelopment of the proposed building has been achieved.

## 9 Average Daylight Factors

This section addresses daylight to the proposed apartments.

BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight states the following in Appendix C with respect to Average Daylight Factors (ADF);

From BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight

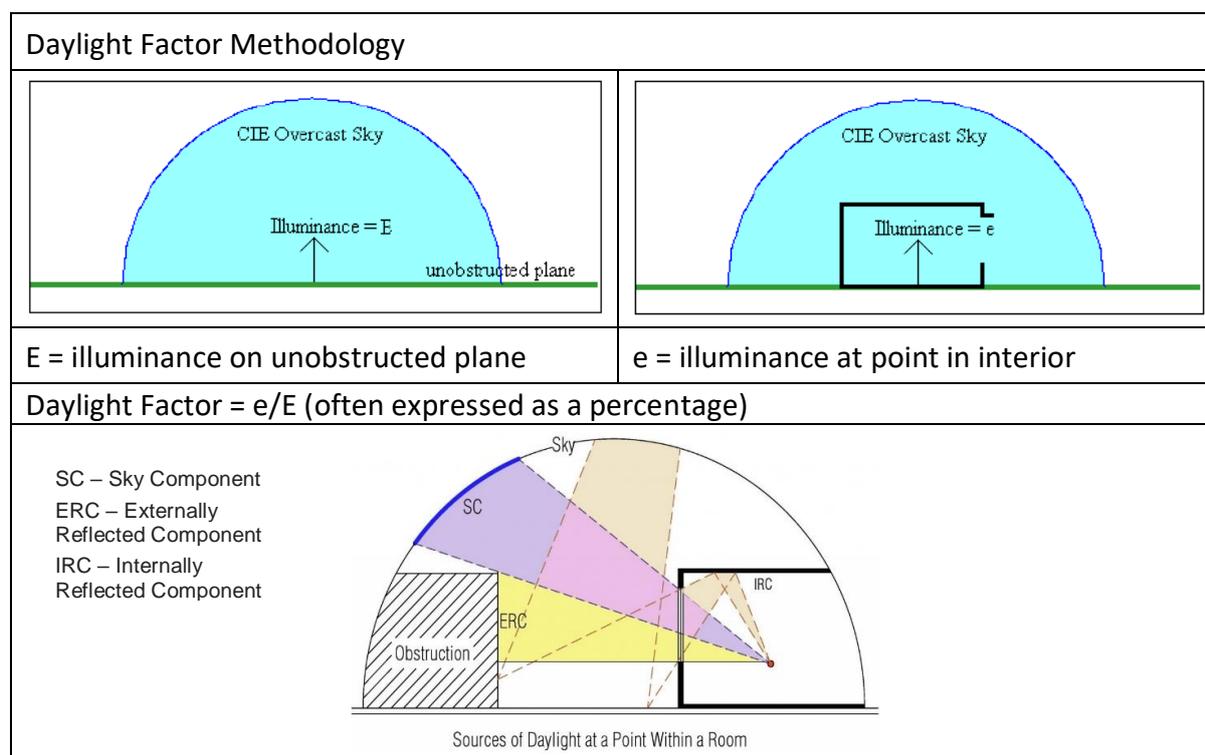
From this the recommended Average Daylight Factors (ADF) are therefore;

- Bedrooms – 1.0%
- Living Rooms / Kitchens – 1.5%

This study will consider the predicted average daylight factor to the subject application. Analysis has been carried by using the Radiance module of IES VE software to quantify the metrics describe below.

Daylight is constantly changing, so its level at a point in a building is usually defined as an average daylight factor.

This is the ratio of the indoor illuminance at the point in question to the outdoor unobstructed horizontal illuminance.



Both illuminances are measured under the same standard sky, a CIE overcast sky. Since the sun is in a particular position for only a short period each day, direct sunlight is excluded. Instead diffuse sunlight is used for average daylight calculations. Diffuse sunlight describes

the sunlight that has been scattered by molecules and particles in the atmosphere but has still made it down to surface of the earth.

For average daylight factor there are three possible paths along which diffuse light can get into a room through glazed windows.

- a) Light from the patch of sky visible at the point considered, is expressed as the sky component.
- b) Light reflected from opposing exterior surfaces and then reaches the point, is expressed as the externally reflected component.
- c) Light entering through the window but reaching the point only after reflection from internal surfaces, is expressed as the internally reflected component.

The purpose of the average daylight factor calculations is to provide evidence the proposed development is achieving a quality standard in terms of daylight. Therefore, we have completed average daylight factor calculations on Level 1, 3, 5, 9, 11, 16 & 25 at various locations (i.e. corner locations, mid façade locations, courtyard locations etc.) which then allow the interpolation of results for intermediary floors to provide an overall percentage of units which exceed the BRE's recommendations.

## 9.1 Assumptions

The following assumptions are to be used in the study:

- Sky Conditions: Standard CIE overcast sky
- Time (24hr): 12:00
- Date: 21 September
- Working Plane: 0.85m
- Floor to Floor Height 3.35 m

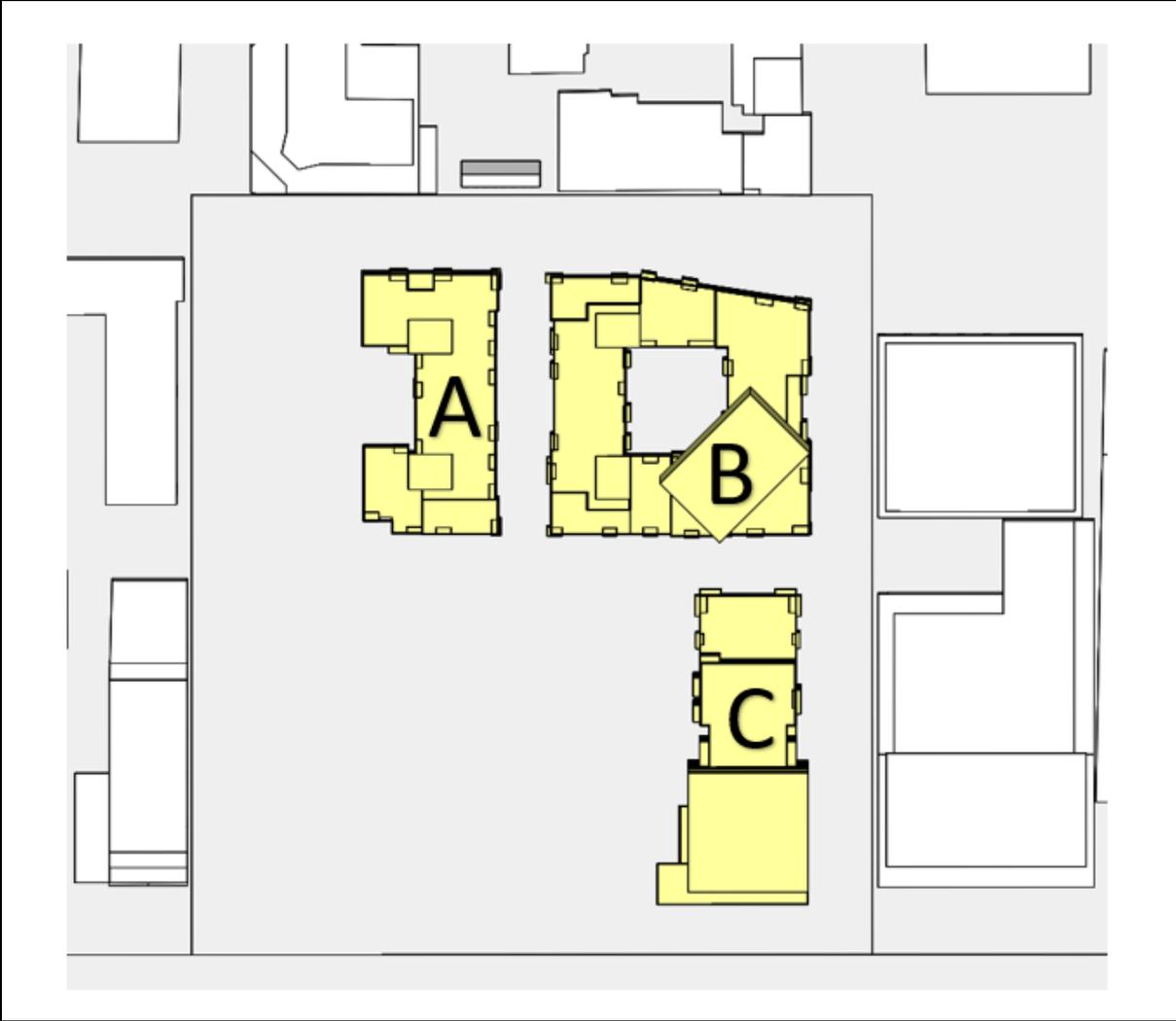
The following Surface Reflectance's are to be used in the study:

Material Surface	Reflectance
External Wall	0.50
Internal Partition	0.50
Roof	0.20
Ground	0.20
Floor/Ceiling (Floor)	0.20
Floor/Ceiling (Ceiling)	0.70

## Glazing Transmittance:

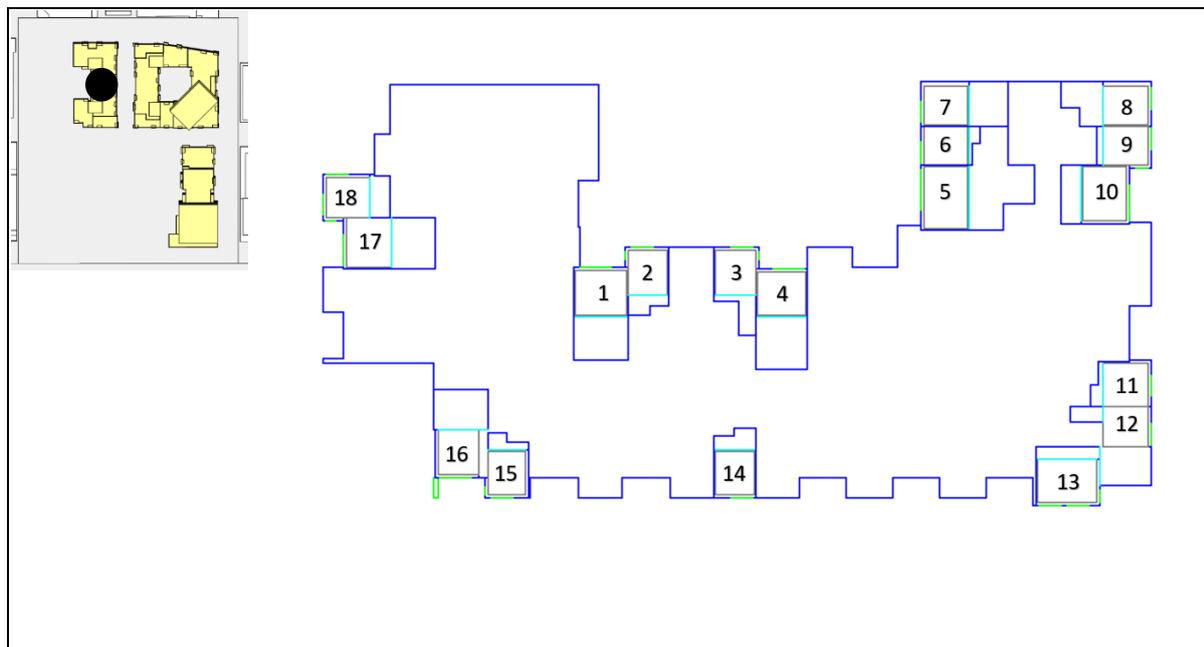
- Light Transmittance: 70%
- Assumed Window Frame thickness: 50 mm

9.2 Average Daylight Factor Results



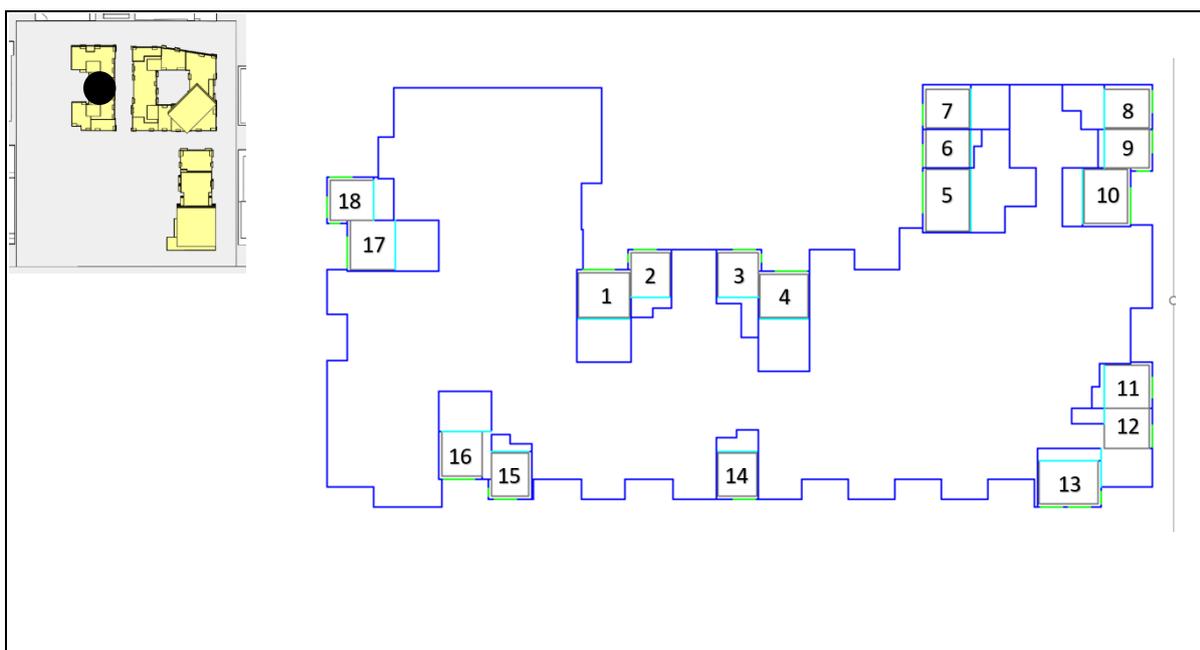
### 9.3 Block A

#### 9.3.1 Level 01



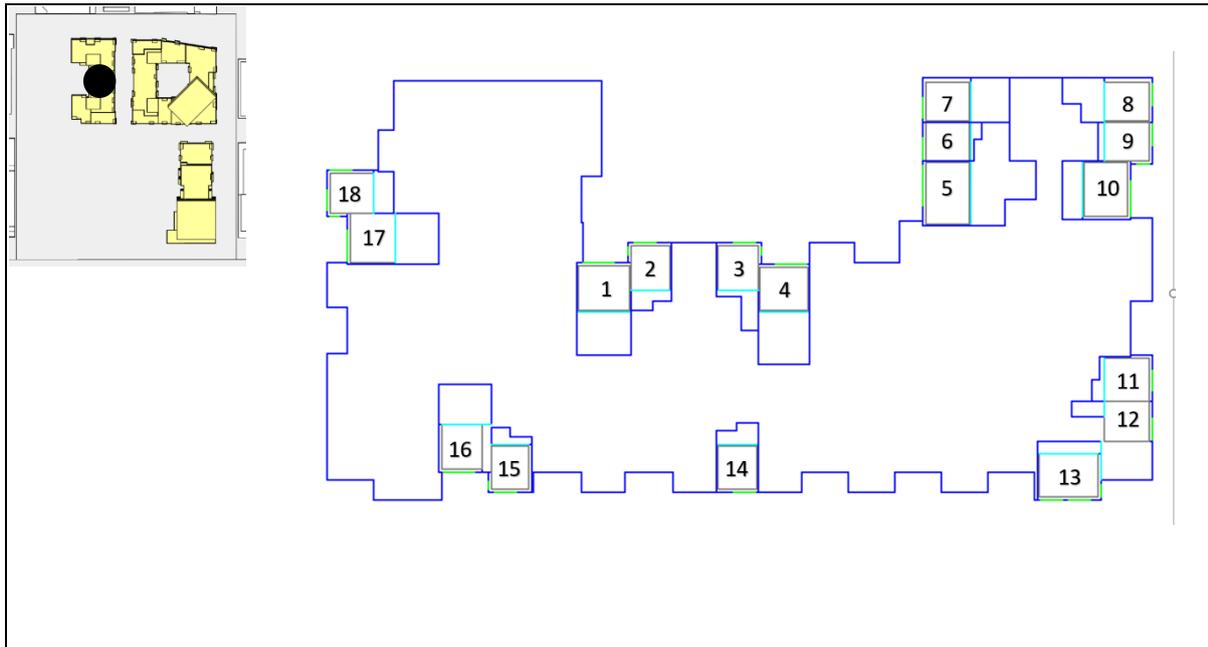
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm . (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L01: 1A-014_Living	Living	1.52	✓	0.11	-
2	L01: 1A-014_Bedroom	Bedroom	2.37	✓	0.22	-
3	L01: 1A-015_Bedroom 02	Bedroom	3.38	✓	0.28	-
4	L01: 1A-015_Living	Living	1.52	✓	0.13	-
5	L01: 1A-017_Living	Living	1.59	✓	0.19	-
6	L01: 1A-017_Bedroom 01	Bedroom	1.83	✓	0.92	-
7	L01: 1A-017_Bedroom 02	Bedroom	2.09	✓	0.95	-
8	L01: 1A-001_Bedroom 01	Bedroom	2.32	✓	2.09	✓
9	L01: 1A-01_Bedroom 02	Bedroom	2.95	✓	2.75	✓
10	L01: 1A-001_Living	Living	1.53	✓	1.50	✓
11	L01: 1A-003_Bedroom 01	Bedroom	3.41	✓	3.38	✓
12	L01: 1A-003_Bedroom 02	Bedroom	3.26	✓	3.25	✓
13	L01: 1A-003_Living	Living	1.79	✓	1.77	✓
14	L01: 1A-015_Bedroom 01	Bedroom	0.43	-	0.39	-
15	L01: 1A-009_Bedroom	Bedroom	1.02	✓	1.01	✓
16	L01: 1A-009_Living	Living	0.55	-	0.39	-
17	L01: 1A-011_Living	Living	2.62	✓	0.47	-
18	L01: 1A-011_Bedroom	Bedroom	6.96	✓	2.28	✓

### 9.3.3 Level 03



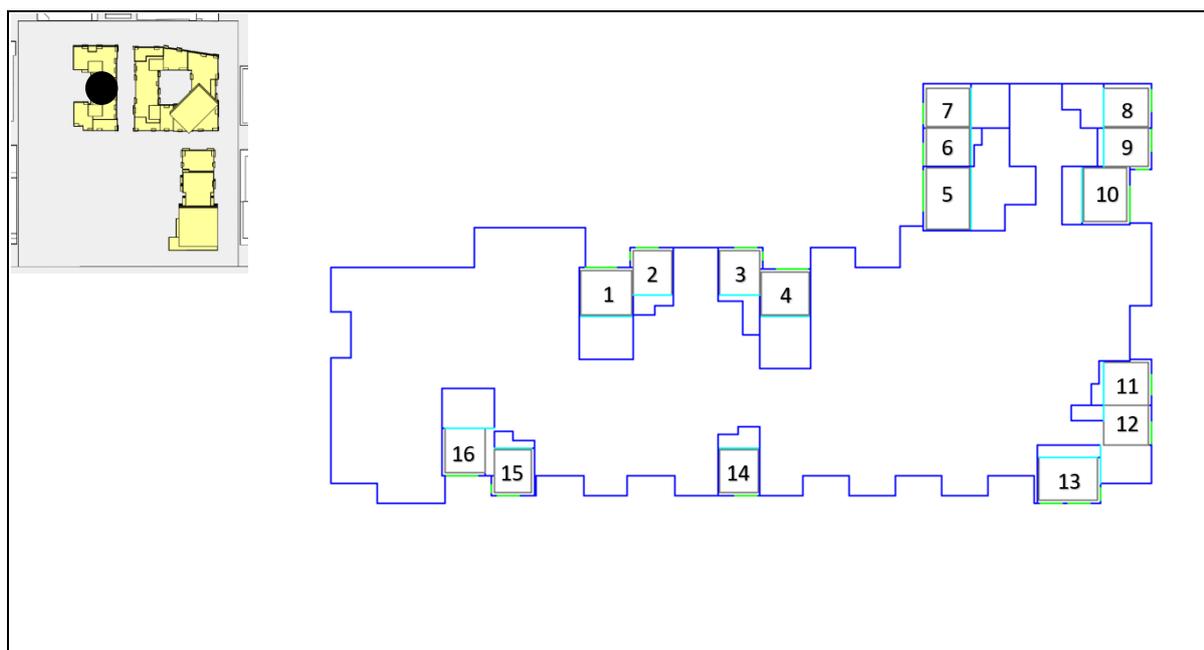
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L03: 3A-015_Living	Living	1.55	✓	0.14	-
2	L03: 3A-015_Bedroom	Bedroom	2.65	✓	0.97	-
3	L03: 3A-016_Bedroom 02	Bedroom	3.59	✓	1.02	-
4	L03: 3A-016_Living	Living	1.75	✓	0.17	-
5	L03: 3A-018_Living	Living	1.71	✓	0.34	-
6	L03: 3A-018_Bedroom 01	Bedroom	2.08	✓	1.07	✓
7	L03: 3A-018_Bedroom 02	Bedroom	2.34	✓	1.02	✓
8	L03: 3A-001_Bedroom 01	Bedroom	3.12	✓	2.99	✓
9	L03: 3A-001_Bedroom 02	Bedroom	3.88	✓	3.75	✓
10	L03: 3A-001_Living	Living	1.66	✓	1.58	✓
11	L03: 3A-003_Bedroom 01	Bedroom	3.70	✓	3.67	✓
12	L03: 3A-003_Bedroom 02	Bedroom	3.50	✓	3.49	✓
13	L03: 3A-003_Living	Living	2.13	✓	2.11	✓
14	L03: 3A-016_Bedroom 01	Bedroom	0.43	-	0.42	-
15	L03: 3A-009_Bedroom	Bedroom	1.07	✓	1.05	✓
16	L03: 3A-009_Living	Living	0.48	-	0.37	-
17	L03: 3A-012_Living	Living	2.65	✓	0.73	✓
18	L03: 3A-012_Bedroom	Bedroom	7.14	✓	3.44	✓

### 9.3.4 Level 05



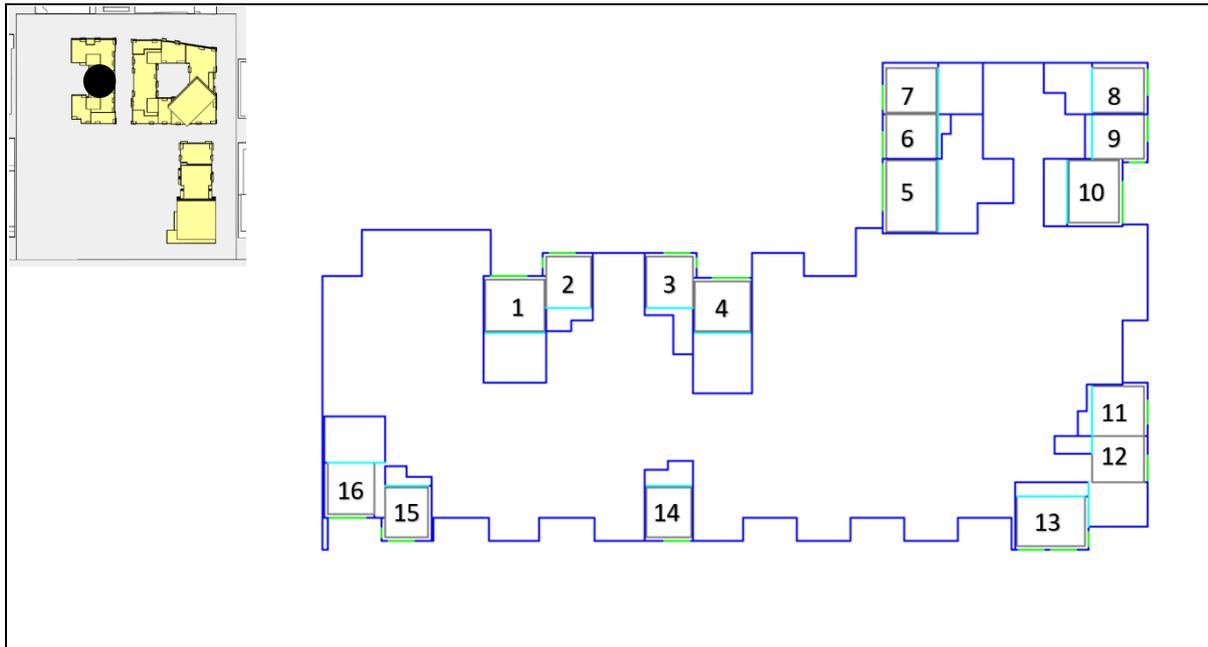
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L05: 5A-015_Living	Living	1.58	✓	0.24	-
2	L05: 5A-015_Bedroom	Bedroom	2.71	✓	1.01	✓
3	L05: 5A-016_Bedroom 02	Bedroom	3.72	✓	1.26	✓
4	L05: 5A-016_Living	Living	1.86	✓	0.26	-
5	L05: 5A-018_Living	Living	2.04	✓	0.84	-
6	L05: 5A-018_Bedroom 01	Bedroom	2.42	✓	1.51	✓
7	L05: 5A-018_Bedroom 02	Bedroom	2.67	✓	1.52	✓
8	L05: 5A-001_Bedroom 01	Bedroom	3.58	✓	3.52	✓
9	L05: 5A-001_Bedroom 02	Bedroom	4.43	✓	4.36	✓
10	L05: 5A-001_Living	Living	2.07	✓	2.03	✓
11	L05: 5A-003_Bedroom 01	Bedroom	3.87	✓	3.85	✓
12	L05: 5A-003_Bedroom 02	Bedroom	3.68	✓	3.66	✓
13	L05: 5A-003_Living	Living	2.78	✓	2.76	✓
14	L05: 5A-016_Bedroom 01	Bedroom	1.08	✓	1.07	✓
15	L05: 5A-009_Bedroom	Bedroom	1.37	✓	1.15	✓
16	L05: 5A-009_Living	Living	0.59	X	0.49	-
17	L05: 5A-012_Living	Living	2.62	✓	1.49	✓
18	L05: 5A-012_Bedroom	Bedroom	7.20	✓	4.99	✓

### 9.3.5 Level 09



Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L09: 9A-012_Living	Living	2.06	✓	1.92	✓
2	L09: 9A-012_Bedroom	Bedroom	4.26	✓	4.04	✓
3	L09: 9A-013_Bedroom 02	Bedroom	3.85	✓	3.58	✓
4	L09: 9A-013_Living	Living	1.94	✓	1.78	✓
5	L09: 9A-015_Living	Living	2.35	✓	2.17	✓
6	L09: 9A-015_Bedroom 01	Bedroom	2.88	✓	2.64	✓
7	L09: 9A-015_Bedroom 02	Bedroom	3.16	✓	2.94	✓
8	L09: 9A-001_Bedroom 01	Bedroom	3.74	✓	3.73	✓
9	L09: 9A-001_Bedroom 02	Bedroom	4.68	✓	4.66	✓
10	L09: 9A-001_Living	Living	2.26	✓	2.25	✓
11	L09: 9A-003_Bedroom 01	Bedroom	4.00	✓	3.99	✓
12	L09: 9A-003_Bedroom 02	Bedroom	3.81	✓	3.80	✓
13	L09: 9A-003_Living	Living	4.34	✓	4.34	✓
14	L09: 9A-013_Bedroom 01	Bedroom	1.85	✓	1.83	✓
15	L09: 9A-009_Bedroom	Bedroom	2.33	✓	2.22	✓
16	L09: 9A-009_Living	Living	1.53	✓	1.53	✓

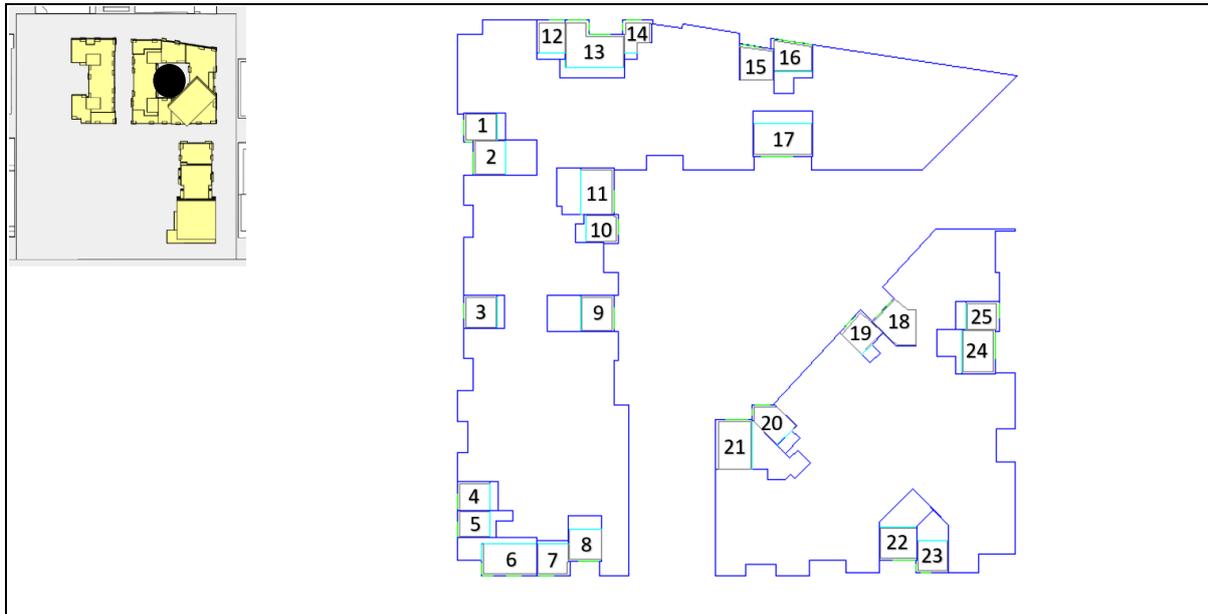
### 9.3.6 Level 11



Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L11: 11A-010_Living	Living	2.07	✓	2.08	✓
2	L11: 11A-010_Bedroom	Bedroom	4.29	✓	4.27	✓
3	L11: 11A-011_Bedroom 02	Bedroom	3.96	✓	3.91	✓
4	L11: 11A-011_Living	Living	1.96	✓	1.98	✓
5	L11: 11A-013_Living	Living	2.49	✓	2.47	✓
6	L11: 11A-013_Bedroom 01	Bedroom	3.21	✓	3.15	✓
7	L11: 11A-013_Bedroom 02	Bedroom	3.45	✓	3.44	✓
8	L11: 11A-001_Bedroom 01	Bedroom	3.78	✓	3.77	✓
9	L11: 11A-001_Bedroom 02	Bedroom	4.74	✓	4.72	✓
10	L11: 11A-001_Living	Living	2.29	✓	2.28	✓
11	L11: 11A-003_Bedroom 01	Bedroom	4.05	✓	4.04	✓
12	L11: 11A-003_Bedroom 02	Bedroom	3.86	✓	3.86	✓

## 9.4 Block B

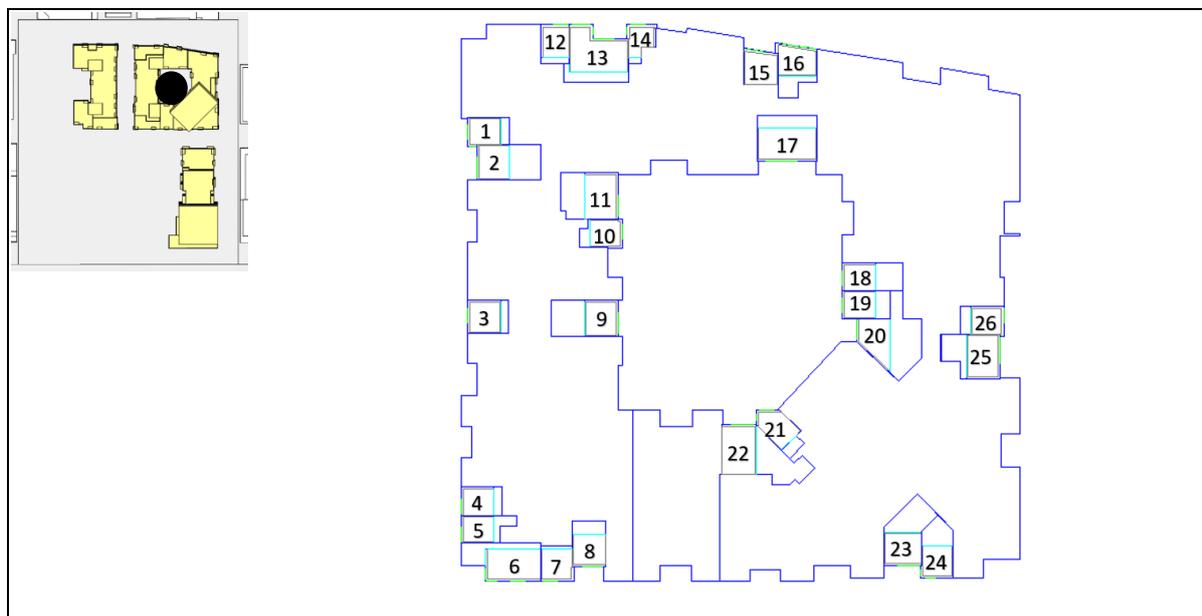
### 9.4.1 Level 01



Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L01: 1B-018_Bedroom	Bedroom	1.01	✓	1.00	✓
2	L01: 1B-018_Living	Living	0.37	-	0.36	-
3	L01: 1B-016_Bedroom	Bedroom	0.40	-	0.35	-
4	L01: 1B-013_Bedroom 02	Bedroom	1.14	✓	1.02	✓
5	L01: 1B-013_Bedroom 01	Bedroom	1.68	✓	1.10	✓
6	L01: 1B-013_Living	Living	3.42	✓	1.31	✓
7	L01: 1B-012_Bedroom	Bedroom	3.32	✓	1.27	✓
8	L01: 1B-012_Living	Living	1.86	✓	0.62	-
9	L01: 1B-016_Living	Living	0.23	-	0.22	-
10	L01: 1B-024_Bedroom	Bedroom	0.32	-	0.32	-
11	L01: 1B-024_Living	Living	0.15	-	0.14	-
12	L01: 1B-002_Bedroom 01	Bedroom	1.97	✓	1.97	✓
13	L01: 1B-002_Living	Living	1.22	✓	1.22	✓
14	L01: 1B-002_Bedroom 02	Bedroom	3.52	✓	3.50	✓
15	L01: 1B-004_Bedroom 01	Bedroom	1.00	✓	1.00	✓
16	L01: 1B-004_Bedroom 02	Bedroom	4.15	✓	4.15	✓
17	L01: 1B-004_Living	Living	0.22	-	0.21	-
18	L01: 1B-020_Living	Living	0.10	-	0.09	-
19	L01: 1B-020_Bedroom	Bedroom	0.15	-	0.15	-
20	L01: 1B-021_Bedroom	Bedroom	0.35	-	0.35	-
21	L01: 1B-021_Living	Living	0.11	-	0.11	-
22	L01: 1B-009_Living	Living	0.49	-	0.65	-
23	L01: 1B-009_Bedroom	Bedroom	1.01	✓	1.07	✓
24	L01: 1B-006_Living	Living	0.83	-	0.83	-
25	L01: 1B-006_Bedroom	Bedroom	1.45	✓	1.46	✓

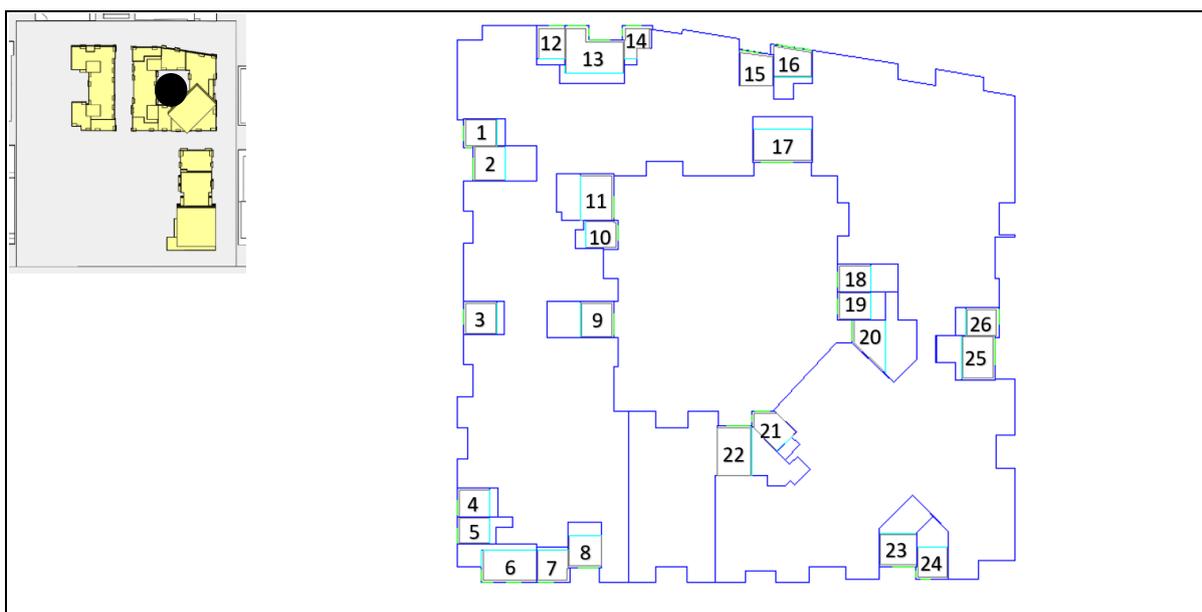
## 9.4.2

### 9.4.3 Level 03



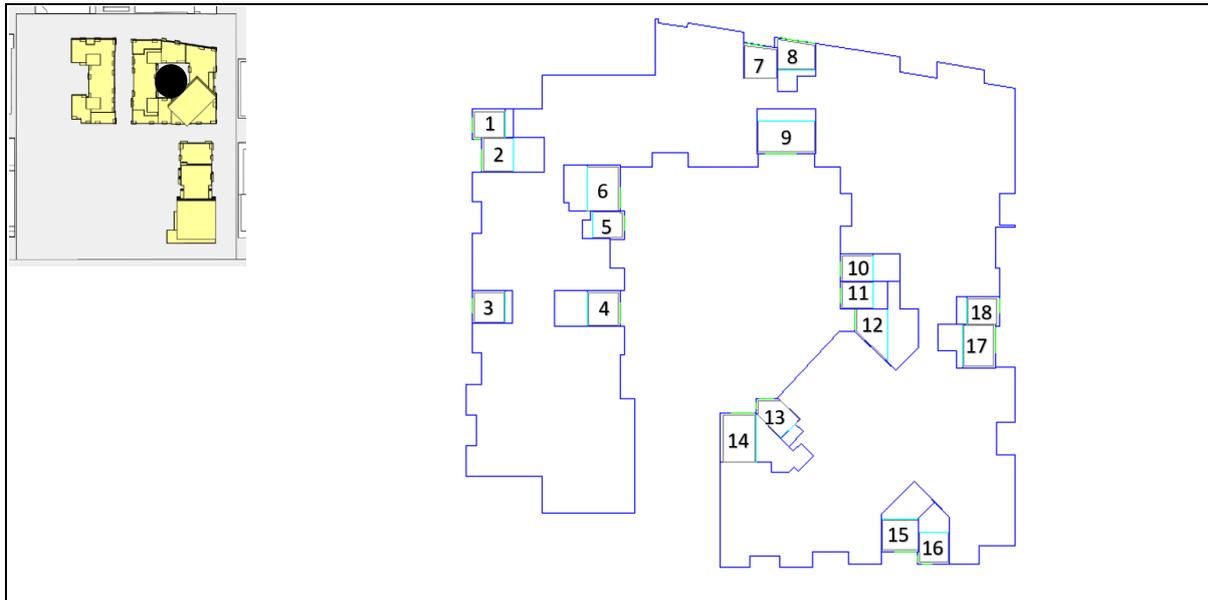
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L03: 3B-022_Bedroom	Bedroom	1.08	✓	1.04	✓
2	L03: 3B-022_Living	Living	0.37	-	0.37	-
3	L03: 3B-020_Bedroom	Bedroom	0.41	-	0.37	-
4	L03: 3B-017_Bedroom 02	Bedroom	1.16	✓	1.06	✓
5	L03: 3B-017_Bedroom 01	Bedroom	1.70	✓	1.28	✓
6	L03: 3B-017_Living	Living	3.48	✓	1.83	✓
7	L03: 3B-016_Bedroom	Bedroom	3.36	✓	1.74	✓
8	L03: 3B-016_Living	Living	1.89	✓	0.73	-
9	L03: 3B-020_Living	Living	0.27	-	0.27	-
10	L03: 3B-030_Bedroom	Bedroom	0.43	-	0.43	-
11	L03: 3B-030_Living	Living	0.18	-	0.18	-
12	L03: 3B-002_Bedroom 01	Bedroom	2.72	✓	2.71	✓
13	L03: 3B-002_Living	Living	1.60	✓	1.60	✓
14	L03: 3B-002_Bedroom 02	Bedroom	4.63	✓	4.63	✓
15	L03: 3B-004_Bedroom 01	Bedroom	1.05	✓	1.05	✓
16	L03: 3B-004_Bedroom 02	Bedroom	5.46	✓	5.46	✓
17	L03: 3B-004_Living	Living	0.32	-	0.31	-
18	L03: 3B-025_Bedroom 02	Bedroom	1.09	✓	1.09	✓
19	L03: 3B-025_Bedroom 01	Bedroom	1.08	✓	1.08	✓
20	L03: 3B-025_Living	Living	0.09	-	0.09	-
21	L03: 3B-026_Bedroom	Bedroom	0.54	-	0.53	-
22	L03: 3B-026_Living	Living	0.12	-	0.12	-
23	L03: 3B-012_Living	Living	0.72	-	0.55	-
24	L03: 3B-012_Bedroom	Bedroom	1.05	✓	1.05	✓
25	L03: 3B-009_Living	Living	1.51	✓	1.51	✓
26	L03: 3B-009_Bedroom	Bedroom	2.05	✓	2.05	✓

### 9.4.4 Level 05



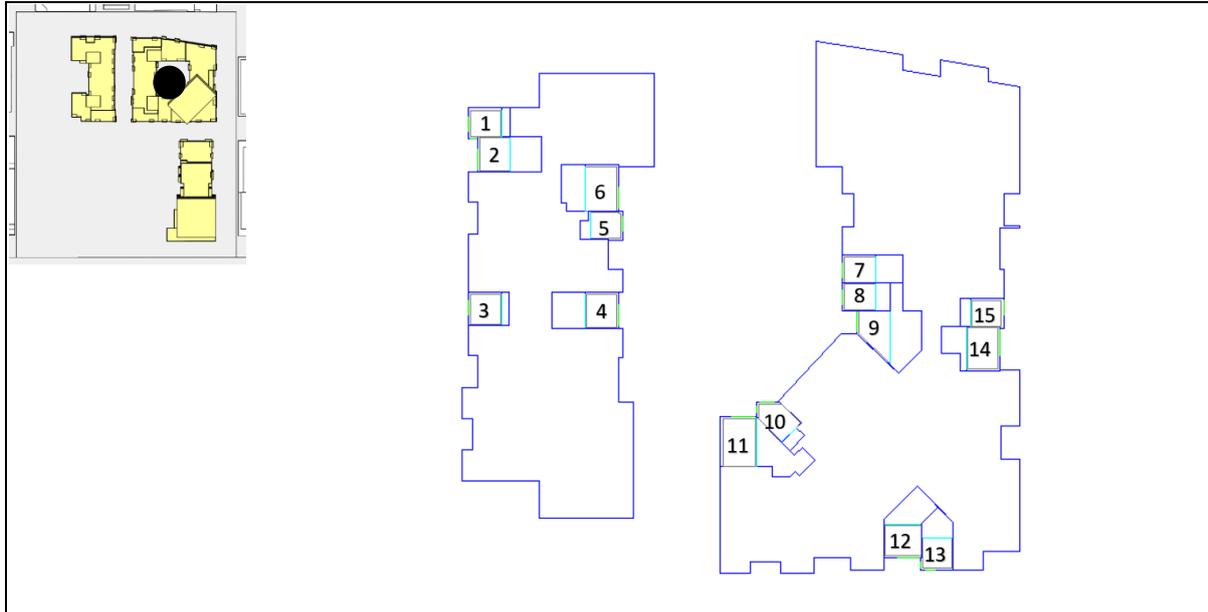
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L05: 5B-021_Bedroom	Bedroom	1.03	✓	1.00	✓
2	L05: 5B-021_Living	Living	0.43	-	0.42	-
3	L05: 5B-019_Bedroom	Bedroom	1.01	✓	1.00	✓
4	L05: 5B-02_Bedroom 02	Bedroom	1.25	✓	1.01	✓
5	L05: 5B-02_Bedroom 01	Bedroom	1.78	✓	1.48	✓
6	L05: 5B-02_Living	Living	3.50	✓	2.45	✓
7	L05: 5B-016_Bedroom	Bedroom	3.37	✓	2.29	✓
8	L05: 5B-016_Living	Living	1.90	✓	1.00	✓
9	L05: 5B-019_Living	Living	0.36	-	0.36	-
10	L05: 5B-029_Bedroom	Bedroom	1.03	✓	1.03	✓
11	L05: 5B-029_Living	Living	0.24	-	0.24	-
12	L05: 5B-002_Bedroom 01	Bedroom	3.44	✓	3.43	✓
13	L05: 5B-002_Living	Living	2.35	✓	2.35	✓
14	L05: 5B-002_Bedroom 02	Bedroom	5.61	✓	5.61	✓
15	L05: 5B-004_Bedroom 01	Bedroom	1.67	✓	1.67	✓
16	L05: 5B-004_Bedroom 02	Bedroom	6.73	✓	6.72	✓
17	L05: 5B-004_Living	Living	0.51	-	0.50	-
18	L05: 5B-024_Bedroom 02	Bedroom	1.10	✓	1.10	✓
19	L05: 5B-024_Bedroom 01	Bedroom	1.09	✓	1.09	✓
20	L05: 5B-024_Living	Living	0.12	-	0.12	-
21	L05: 5B-025_Bedroom	Bedroom	1.03	✓	1.03	✓
22	L05: 5B-025_Living	Living	0.16	-	0.16	-
23	L05: 5B-012_Living	Living	0.80	-	0.66	-
24	L05: 5B-012_Bedroom	Bedroom	1.07	✓	1.03	✓
25	L05: 5B-009_Living	Living	2.00	✓	2.00	✓
26	L05: 5B-009_Bedroom	Bedroom	3.01	✓	3.01	✓

### 9.4.5 Level 09



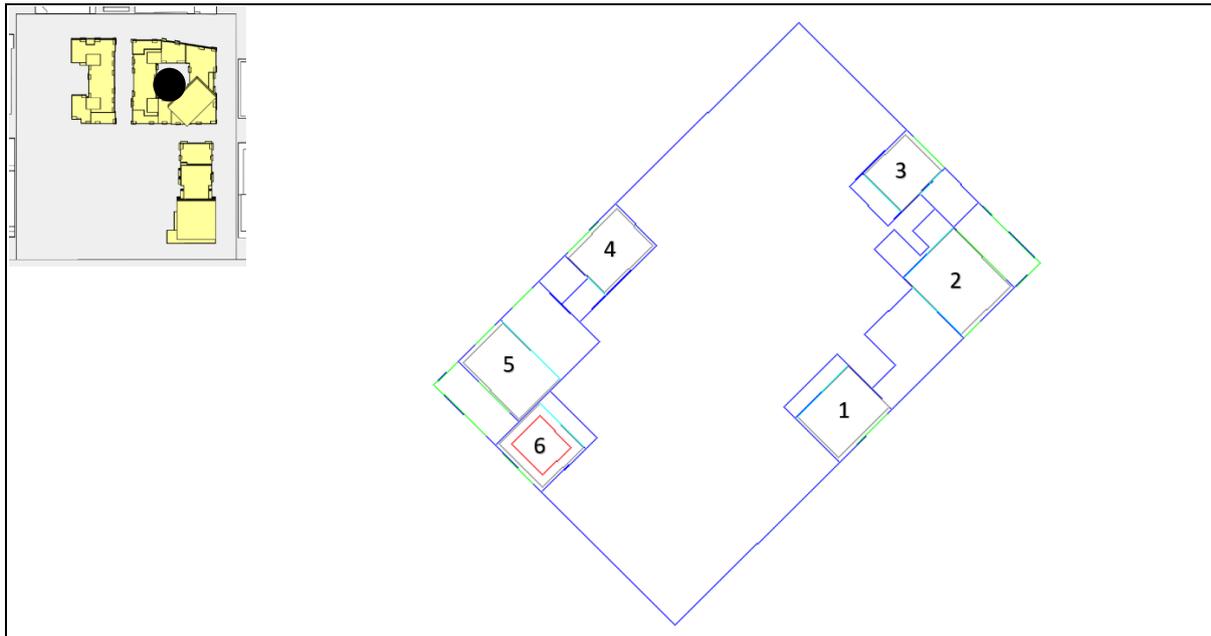
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L09: 9B-017_Bedroom	Bedroom	1.41	✓	1.39	✓
2	L09: 9B-017_Living	Living	0.64	-	0.63	-
3	L09: 9B-015_Bedroom	Bedroom	1.18	✓	1.15	✓
4	L09: 9B-015_Living	Living	0.77	-	0.76	-
5	L09: 9B-024_Bedroom	Bedroom	1.69	✓	1.69	✓
6	L09: 9B-024_Living	Living	0.50	-	0.49	-
7	L09: 9B-002_Bedroom 01	Bedroom	2.22	✓	2.22	✓
8	L09: 9B-002_Bedroom 02	Bedroom	7.75	✓	7.75	✓
9	L09: 9B-002_Living	Living	1.01	-	1.01	-
10	L09: 9B-020_Bedroom 02	Bedroom	3.02	✓	3.02	✓
11	L09: 9B-020_Bedroom 01	Bedroom	2.95	✓	2.95	✓
12	L09: 9B-020_Living	Living	0.54	-	0.54	-
13	L09: 9B-021_Bedroom	Bedroom	2.17	✓	2.17	✓
14	L09: 9B-021_Living	Living	0.75	-	0.75	-
15	L09: 9B-010_Living	Living	1.52	✓	1.50	✓
16	L09: 9B-010_Bedroom	Bedroom	1.57	✓	1.50	✓
17	L09: 9B-007_Living	Living	3.11	✓	3.11	✓
18	L09: 9B-007_Bedroom	Bedroom	3.82	✓	3.82	✓

### 9.4.6 Level 11



Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L11: 11B-015_Bedroom	Bedroom	3.00	✓	2.99	✓
2	L11: 11B-015_Living	Living	2.15	✓	2.14	✓
3	L11: 11B-013_Bedroom	Bedroom	2.28	✓	2.25	✓
4	L11: 11B-013_Living	Living	1.99	✓	1.98	✓
5	L11: 11B-021_Bedroom	Bedroom	2.60	✓	2.59	✓
6	L11: 11B-021_Living	Living	1.95	✓	1.95	✓
7	L11: 11B-017_Bedroom 02	Bedroom	3.66	✓	3.65	✓
8	L11: 11B-017_Bedroom 01	Bedroom	3.56	✓	3.56	✓
9	L11: 11B-017_Living	Living	1.52	✓	1.52	✓
10	L11: 11B-018_Bedroom	Bedroom	2.80	✓	2.81	✓
11	L11: 11B-018_Living	Living	1.52	✓	1.52	✓
12	L11: 11B-008_Living	Living	1.63	✓	1.55	✓
13	L11: 11B-008_Bedroom	Bedroom	1.72	✓	1.68	✓
14	L11: 11B-005_Living	Living	3.64	✓	3.64	✓
15	L11: 11B-005_Bedroom	Bedroom	3.93	✓	3.94	✓

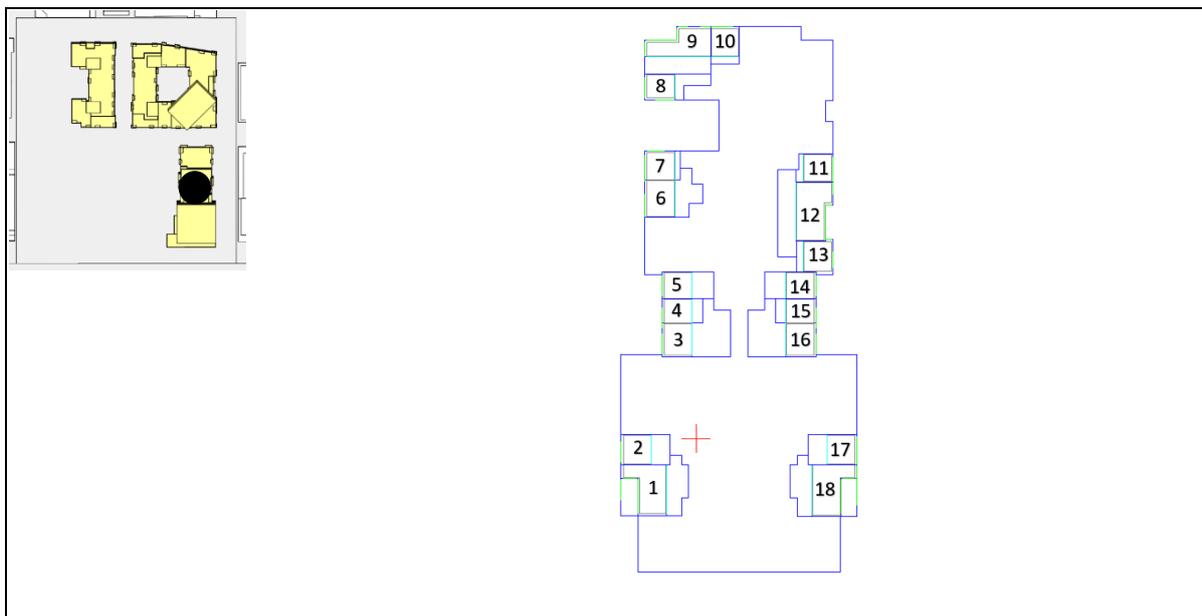
### 9.4.7 Level 16



Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L16: 16B-002_Bedroom 01	Bedroom	5.00	✓	4.99	✓
2	L16: 16B-002_Living	Living	2.53	✓	2.53	✓
3	L16: 16B-002_Bedroom 02	Bedroom	6.23	✓	6.23	✓
4	L16: 16B-004_Bedroom 01	Bedroom	5.92	✓	5.92	✓
5	L16: 16B-004_Living	Living	4.04	✓	3.98	✓
6	L16: 16B-004_Bedroom 02	Bedroom	5.86	✓	5.66	✓

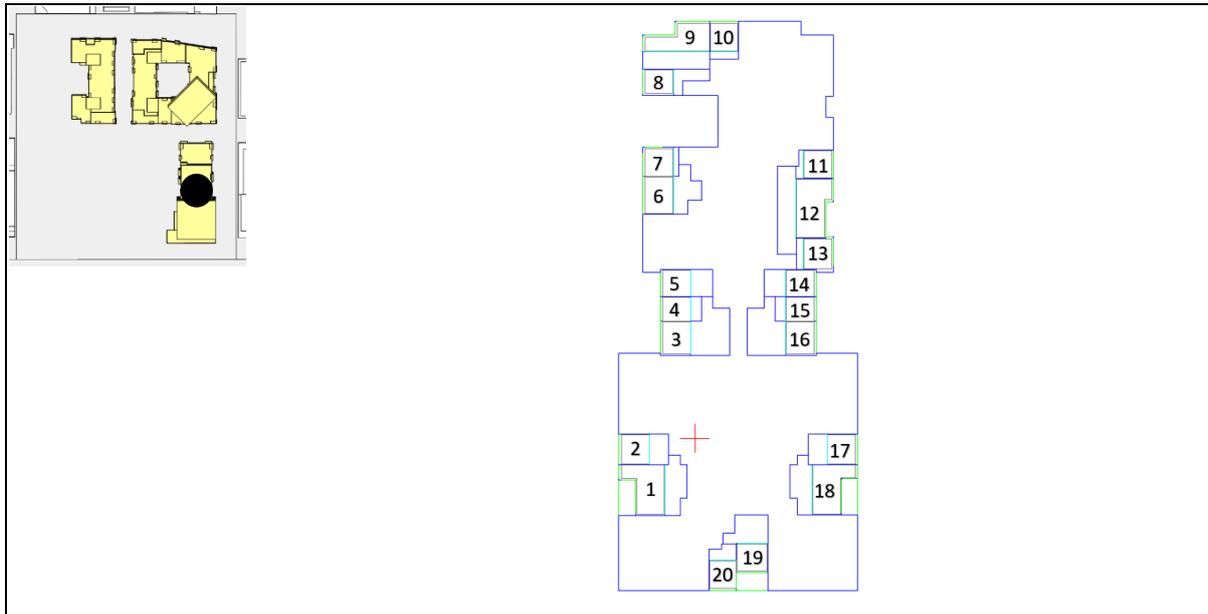
## 9.5 Block C

### 9.5.1 Level 01



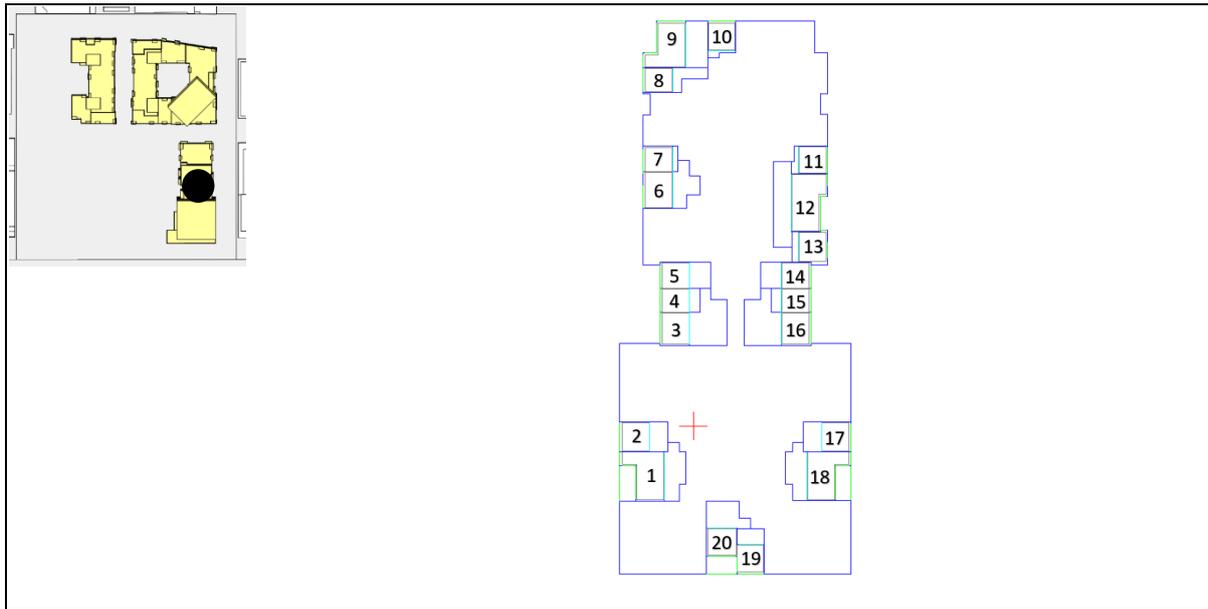
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L01: 1C-008_Living	Living	0.84	-	0.20	-
2	L01: 1C-008_Bedroom	Bedroom	6.44	✓	0.92	-
3	L01: 1C-009_Living	Living	2.64	✓	0.44	-
4	L01: 1C-009_Bedroom 01	Bedroom	2.81	✓	0.44	-
5	L01: 1C-009_Bedroom 02	Bedroom	5.27	✓	0.83	-
6	L01: 1C-011_Living	Living	3.63	✓	0.66	-
7	L01: 1C-011_Bedroom	Bedroom	7.67	✓	2.95	✓
8	L01: 1C-001_Bedroom 01	Bedroom	7.50	✓	3.36	✓
9	L01: 1C-001_Living	Living	2.44	✓	1.58	✓
10	L01: 1C-001_Bedroom 02	Bedroom	1.30	✓	1.07	✓
11	L01: 1C-004_Bedroom 02	Bedroom	2.83	✓	2.82	✓
12	L01: 1C-004_Living	Living	1.51	✓	1.51	✓
13	L01: 1C-004_Bedroom 01	Bedroom	1.68	✓	1.68	✓
14	L01: 1C-005_Bedroom 02	Bedroom	1.85	✓	1.85	✓
15	L01: 1C-005_Bedroom 01	Bedroom	1.01	✓	1.01	✓
16	L01: 1C-005_Living	Living	0.60	-	0.59	-
17	L01: 1C-007_Bedroom	Bedroom	2.30	✓	2.30	✓
18	L01: 1C-007_Living	Living	0.60	-	0.60	-

### 9.5.2 Level 03



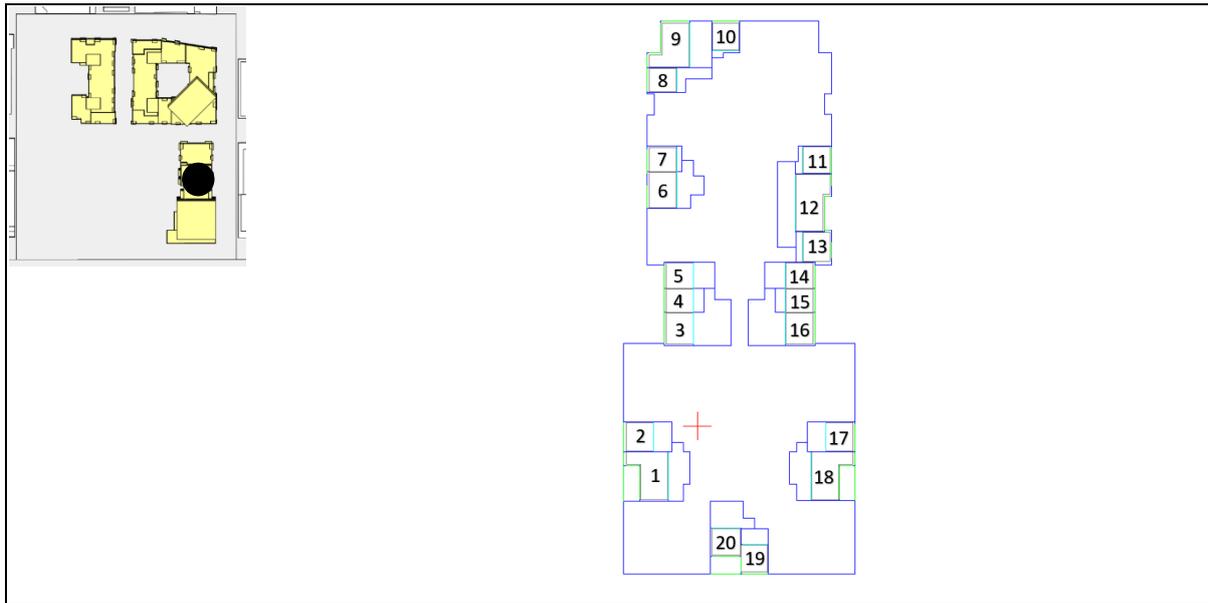
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L03: 3C-011_Living	Living	2.40	✓	0.49	-
2	L03: 3C-011_Bedroom	Bedroom	7.98	✓	1.25	✓
3	L03: 3C-013_Living	Living	2.47	✓	0.47	-
4	L03: 3C-013_Bedroom 01	Bedroom	4.61	✓	1.25	✓
5	L03: 3C-013_Bedroom 02	Bedroom	5.80	✓	1.30	✓
6	L03: 3C-015_Living	Living	4.72	✓	1.43	-
7	L03: 3C-015_Bedroom	Bedroom	7.37	✓	3.51	✓
8	L03: 3C-001_Bedroom 01	Bedroom	6.81	✓	4.12	✓
9	L03: 3C-001_Living	Living	2.97	✓	2.21	✓
10	L03: 3C-001_Bedroom 02	Bedroom	1.73	✓	1.47	✓
11	L03: 3C-004_Bedroom 02	Bedroom	4.37	✓	4.36	✓
12	L03: 3C-004_Living	Living	1.68	✓	1.68	✓
13	L03: 3C-004_Bedroom 01	Bedroom	3.04	✓	3.03	✓
14	L03: 3C-005_Bedroom 02	Bedroom	2.88	✓	2.88	✓
15	L03: 3C-005_Bedroom 01	Bedroom	2.15	✓	2.15	✓
16	L03: 3C-005_Living	Living	0.77	-	0.77	-
17	L03: 3C-007_Bedroom	Bedroom	2.93	✓	2.92	✓
18	L03: 3C-007_Living	Living	0.76	-	0.76	-
19	L03: 3C-009_Living	Living	1.68	✓	1.67	✓
20	L03: 3C-009_Bedroom	Bedroom	8.82	✓	8.79	✓

### 9.5.3 Level 05



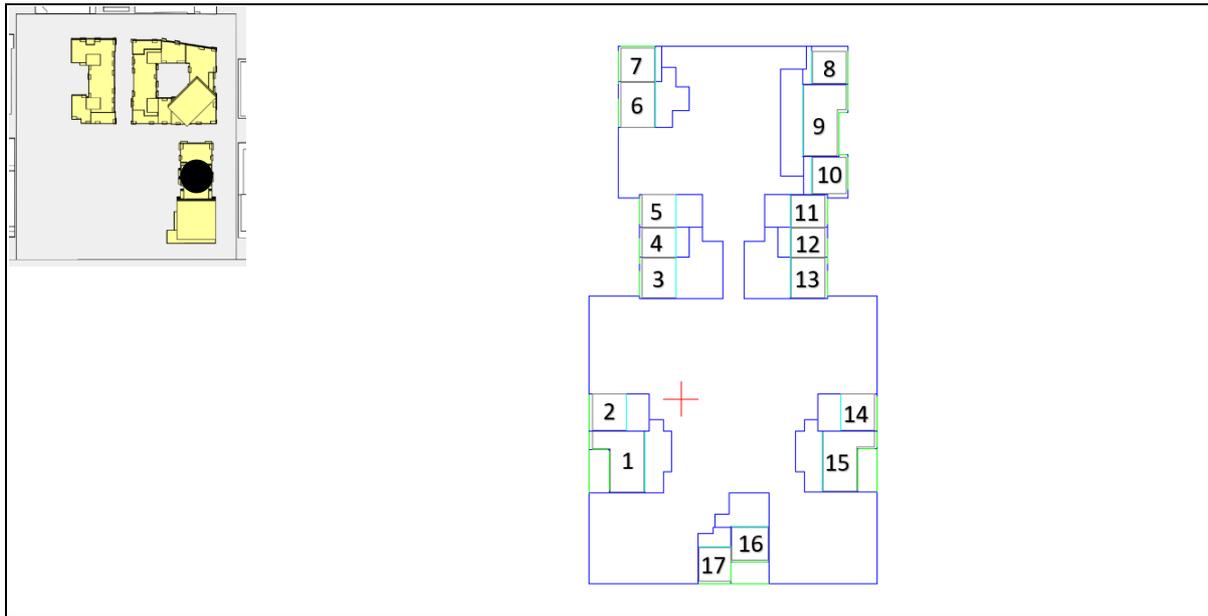
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L05: 5C-011_Living	Living	2.30	✓	0.52	✓
2	L05: 5C-011_Bedroom	Bedroom	7.99	✓	1.65	✓
3	L05: 5C-013_Living	Living	2.52	✓	0.58	✓
4	L05: 5C-013_Bedroom 01	Bedroom	4.68	✓	1.72	✓
5	L05: 5C-013_Bedroom 02	Bedroom	5.86	✓	2.17	✓
6	L05: 5C-015_Living	Living	3.08	✓	0.92	✓
7	L05: 5C-015_Bedroom	Bedroom	6.98	✓	4.01	✓
8	L05: 5C-001_Bedroom 01	Bedroom	6.84	✓	4.99	✓
9	L05: 5C-001_Living	Living	3.42	✓	2.55	✓
10	L05: 5C-001_Bedroom 02	Bedroom	1.90	✓	1.68	✓
11	L05: 5C-004_Bedroom 02	Bedroom	6.05	✓	6.05	✓
12	L05: 5C-004_Living	Living	2.04	✓	2.04	✓
13	L05: 5C-004_Bedroom 01	Bedroom	3.40	✓	3.39	✓
14	L05: 5C-005_Bedroom 02	Bedroom	3.93	✓	3.93	✓
15	L05: 5C-005_Bedroom 01	Bedroom	2.96	✓	2.96	✓
16	L05: 5C-005_Living	Living	1.36	-	1.36	-
17	L05: 5C-007_Bedroom	Bedroom	3.77	✓	3.77	✓
18	L05: 5C-007_Living	Living	0.86	-	0.86	-
19	L05: 5C-009_Bedroom	Bedroom	8.63	✓	8.61	✓
20	L05: 5C-009_Living	Living	1.59	✓	1.58	✓

### 9.5.4 Level 09



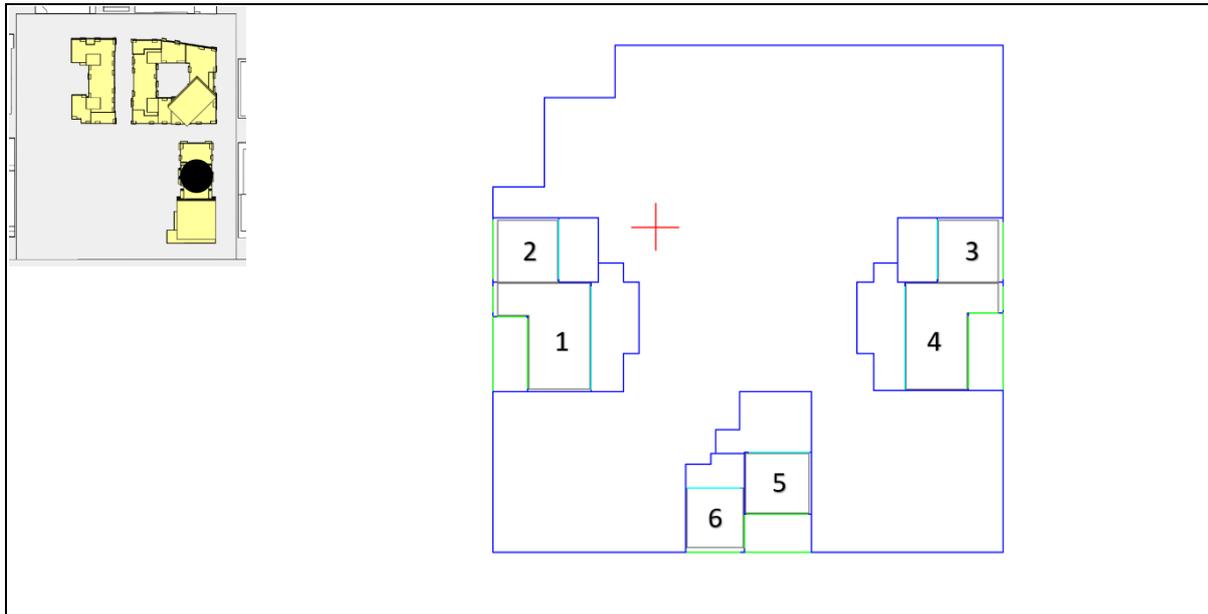
Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L09: 9C-011_Living	Living	2.18	✓	1.43	✓
2	L09: 9C-011_Bedroom	Bedroom	8.00	✓	6.18	✓
3	L09: 9C-013_Living	Living	2.60	✓	1.97	✓
4	L09: 9C-013_Bedroom 01	Bedroom	4.73	✓	3.80	✓
5	L09: 9C-013_Bedroom 02	Bedroom	5.89	✓	4.88	✓
6	L09: 9C-015_Living	Living	3.14	✓	2.60	✓
7	L09: 9C-015_Bedroom	Bedroom	7.57	✓	6.60	✓
8	L09: 9C-001_Bedroom 01	Bedroom	7.15	✓	6.48	✓
9	L09: 9C-001_Living	Living	4.22	✓	3.83	✓
10	L09: 9C-001_Bedroom 02	Bedroom	2.60	✓	2.43	✓
11	L09: 9C-004_Bedroom 02	Bedroom	7.53	✓	7.53	✓
12	L09: 9C-004_Living	Living	3.10	✓	3.10	✓
13	L09: 9C-004_Bedroom 01	Bedroom	4.69	✓	4.68	✓
14	L09: 9C-005_Bedroom 02	Bedroom	5.40	✓	5.39	✓
15	L09: 9C-005_Bedroom 01	Bedroom	4.38	✓	4.39	✓
16	L09: 9C-005_Living	Living	2.42	✓	2.42	✓
17	L09: 9C-007_Bedroom	Bedroom	6.97	✓	6.95	✓
18	L09: 9C-007_Living	Living	1.80	✓	1.80	✓
19	L09: 9C-009_Bedroom	Bedroom	8.82	✓	8.81	✓
20	L09: 9C-009_Living	Living	1.58	✓	1.58	✓

### 9.5.5 Level 11



Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L11: 11C-008_Living	Living	2.48	✓	2.23	✓
2	L11: 11C-008_Bedroom	Bedroom	8.04	✓	7.41	✓
3	L11: 11C-010_Living	Living	1.93	✓	1.72	✓
4	L11: 11C-010_Bedroom 01	Bedroom	2.36	✓	2.11	✓
5	L11: 11C-010_Bedroom 02	Bedroom	5.44	✓	4.91	✓
6	L11: 11C-012_Living	Living	3.15	✓	2.86	✓
7	L11: 11C-012_Bedroom	Bedroom	10.39	✓	9.82	✓
8	L11: 11C-001_Bedroom 01	Bedroom	7.85	✓	7.85	✓
9	L11: 11C-001_Living	Living	4.22	✓	4.21	✓
10	L11: 11C-001_Bedroom 02	Bedroom	6.69	✓	6.69	✓
11	L11: 11C-002_Bedroom 01	Bedroom	5.24	✓	5.25	✓
12	L11: 11C-002_Bedroom 02	Bedroom	2.34	✓	2.34	✓
13	L11: 11C-002_Living	Living	1.95	✓	1.95	✓
14	L11: 11C-004_Bedroom	Bedroom	7.67	✓	7.67	✓
15	L11: 11C-004_Living	Living	2.05	✓	2.05	✓
16	L11: 11C-006_Living	Living	1.64	✓	1.63	✓
17	L11: 11C-006_Bedroom	Bedroom	8.79	✓	8.77	✓

### 9.5.6 Level 25



Reference Number	Room Name	Room Activity	%ADF (SHD)	BRE Recomm. (SHD)	%ADF (SHD + Proposed Commercial)	BRE Recomm. (SHD + Proposed Commercial)
1	L25: 25C-004_Living	Living	2.34	✓	2.34	✓
2	L25: 25C-004_Bedroom	Bedroom	7.76	✓	7.74	✓
3	L25: 25C-002_Bedroom	Bedroom	7.91	✓	7.91	✓
4	L25: 25C-002_Living	Living	2.21	✓	2.21	✓
5	L25: 25C-004_Living	Living	1.56	✓	1.56	✓
6	L25: 25C-004_Bedroom	Bedroom	8.22	✓	8.23	✓

## 9.6 Discussion

We have completed average daylight factor calculations on Level 1, 3, 5, 9, 11, 16 & 25 and interpolated the results for intermediary floors. We have summarised the results within “Table 1 – Summary of Average Daylight Factors”.

The results show 90% of the rooms exceed the BRE recommendations when only the SHD planning application is analysed. When the proposed commercial scheme is accounted for 85% of the rooms exceed the BRE recommendations for average daylight factors.

We have reviewed what is accepted as best practice internationally on high-rise high-density schemes. We have found some very high-quality schemes for example, Thirty Casson Square located South Bank London which would have 66-70% units exceeding BRE recommendations for ADF's.

Overall, we believe the percentage of rooms that exceed the BRE guidelines for ADF's on Project Waterfront to be best practise for a high-density development.



## Summary of Average Daylight Factor results

	Block A		Block B		Block C		Total number of rooms	% Exceeding BRE SHD	% Exceeding BRE SHD and Proposed Commercial	Total number of rooms exceeding BRE SHD Only	Total number of rooms exceeding BRE SHD and Commercial Scheme
	Bedroom	Living	Bedroom	Living	Bedroom	Living					
Level 01	24	17	34	24	16	10	125	62%	49%	78	61
Level 02	24	17	40	28	20	14	143	70%	56%	100	80
Level 03	26	18	45	30	22	15	156	78%	64%	122	100
Level 04	26	18	45	30	22	15	156	82%	69%	128	108
Level 05	26	18	43	29	23	16	155	86%	75%	133	116
Level 06	26	18	45	30	23	16	158	86%	78%	136	123
Level 07	26	18	45	30	23	16	158	87%	81%	137	128
Level 08	22	15	34	24	23	16	134	88%	84%	118	113
Level 09	22	15	34	24	23	16	134	89%	89%	119	119
Level 10	22	15	34	24	23	16	134	94%	94%	126	126
Level 11	19	13	29	21	17	12	111	100%	100%	111	111
Level 12	18	13	19	13	17	12	92	100%	100%	92	92
Level 13	18	13	16	12	17	12	88	100%	100%	88	88
Level 14	-	-	-	-	17	12	29	100%	100%	29	29
Level 15	-	-	8	4	17	12	41	100%	100%	41	41
Level 16	-	-	8	4	17	12	41	100%	100%	41	41
Level 17	-	-	8	4	17	12	41	100%	100%	41	41
Level 18	-	-	8	4	17	12	41	100%	100%	41	41
Level 19	-	-	8	4	17	12	41	100%	100%	41	41
Level 20	-	-	-	-	17	12	29	100%	100%	29	29
Level 21	-	-	8	4	17	12	41	100%	100%	41	41
Level 22	-	-	8	4	17	12	41	100%	100%	41	41
Level 23	-	-	8	4	17	12	41	100%	100%	41	41
Level 24	-	-	8	4	-	-	12	100%	100%	12	12
Level 25	-	-	8	4	7	5	24	100%	100%	24	24
Level 26	-	-	8	4	7	5	24	100%	100%	24	24
Level 27	-	-	8	4	9	7	28	100%	100%	28	28
Level 28	-	-	8	4	9	7	28	100%	100%	28	28
Level 29	-	-	8	4	8	6	26	100%	100%	26	26
Level 30	-	-	8	4	8	6	26	100%	100%	26	26
Level 31	-	-	8	4	8	6	26	100%	100%	26	26
Level 32	-	-	8	4	-	-	12	100%	100%	12	12
Level 33	-	-	8	4	6	4	22	100%	100%	22	22
Level 34	-	-	8	4	7	4	23	100%	100%	23	23
Level 35	-	-	8	4	7	4	23	100%	100%	23	23
Level 36	-	-	8	4	8	4	24	100%	100%	24	24
Level 37	-	-	8	4	8	4	24	100%	100%	24	24
Level 38	-	-	8	4	8	4	24	100%	100%	24	24
Level 39	-	-	8	4	8	4	24	100%	100%	24	24
Level 40	-	-	4	2	6	2	14	100%	100%	14	14
<b>Total</b>	<b>299</b>	<b>208</b>	<b>659</b>	<b>417</b>	<b>553</b>	<b>378</b>	<b>2514</b>			<b>2258</b>	<b>2135</b>
<b>TOTAL PERCENTAGE NUMBER OF UNITS WHICH EXCEED THE BRE RECOMMENDATIONS</b>										<b>90%</b>	<b>85%</b>

Table 1 – Summary of Average Daylight Factors

## **10 Conclusion**

### **10.1 Shadow Analysis**

The Shadow analysis shows different shadows being cast at specific times of the year for the proposed scheme in comparison to the (Strategic Development Zone) SDZ indicative scheme.

When compared to the SDZ indicative scheme there is minor additional shading noted throughout the periods considered.

### **10.2 Annual Probable Sunlight Hours of Proposed Building Amenity Spaces**

As mentioned under Section 3.3.17 of BRE's Site Layout Planning for Daylight and Sunlight states that for a space to appear adequately sunlit throughout the year, at least half of the garden or amenity area should receive at least 2 hours of sunlight on the 21st of March.

While the proposed pocket park is located in a central location within the proposed development it does not received two hours of Sunlight on March 21<sup>st</sup>. However, the pocket park within the SDZ scheme did not receive 2 hours of sunlight on March 21<sup>st</sup>.

The proposed scheme provides a generous amount of shared private amenity space which is in excess of the minimum required. The majority of external shared private amenity space is provided via roof gardens. All of the shared private amenity spaces within the proposed development exceed the BRE's recommendation of over half of their respective areas receiving at least 2 hours of sunlight on March 21<sup>st</sup>.

### **10.3 Daylight Analysis of Existing Adjacent buildings**

Daylight analysis for the neighbouring existing dwellings i.e. Castleforbes Road and Mayor Street upper was completed via Vertical Sky Component (VSC) calculations. Overall the results show the balance of protecting daylight to existing buildings while providing a scale to allow the redevelopment of the proposed building has been achieved.

### **10.4 Average Daylight Factors**

The results show 90% of the rooms exceed the BRE recommendations when only the SHD planning application is analysed. When the proposed commercial scheme is accounted for 85% of the rooms exceed the BRE recommendations for average daylight factors.

We have reviewed what is accepted as best practice internationally on high-rise high-density schemes. We have found some very high-quality schemes for example, Thirty Casson Square located South Bank London which would have 66-70% units exceeding BRE recommendations for ADF's.

Overall, we believe the percentage of rooms that exceed the BRE guidelines for ADF's on Project Waterfront to be best practise for a high-density development.

## **10.5 Discussion**

It should be noted that the guidance in 'Site layout planning for daylight and sunlight: a guide to good practice' is not mandatory and the Report itself states 'although it gives numerical guidelines these should be interpreted flexibly because natural lighting is only one of many factors in site layout design.

Overall, the results demonstrate that the proposed development performance achieves best practise for a high-density development and exceeds many of the BRE recommendations in the BRE 'Site Layout Planning for Daylight and Sunlight' guide, sometimes referred to as BRE Digest 209.



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