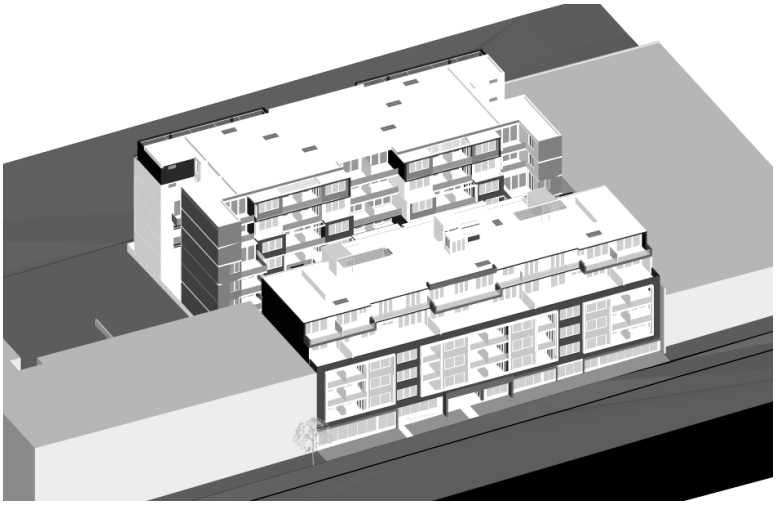
SUMMARY EXPERT OPINION (REVISED DA)

SEPP 65 AMENITY COMPLIANCE

SOLAR ACCESS

NATURAL VENTILATION



PROPOSED MIXED USE RESIDENTIAL DEVELOPMENT

364-374 Canterbury Rd, Canterbury

20 March 2015

Signed,

.....

Steve King

STEVE KING

CONSULTANT

11 Clovelly Road Randwick NSW 2031 Australia

PHONE 0414385485

1.0 PRELIMINARIES/SUMMARY

1.1 I provide this report as an expert opinion, relating to **solar access** and **natural ventilation** compliance with the relevant local controls, and with the Residential Flat Design Code (as it gives effect to the Amenity provisions of SEPP65). The development is a proposed **mixed use residential flat building** at the above address, subject of a revised Development Application.

1.2 My qualifications and experience are included at *2.0 Credentials*.

1.3 The documentation on which I rely is set out in *3.0 Documents*.

1.4 **Solar access**. The number of apartments that are projected to receive over 2 hours of sun to Living areas and private open space between 9am and 3pm on June 21 is 70 units from a total of 100, being 70%.

The applicable DCP and the numerical standards of the RFDC *Rules of Thumb* are satisfied.

1.5 **Natural ventilation.** The numerical standards as set out in the RFDC *Rules of Thumb* are satisfied, with 63.7% of apartments achieving simple cross ventilation. See 6.0 *Natural Ventilation*.

2.0 CREDENTIALS

I taught architectural design, thermal comfort and building services at the Universities of Sydney, Canberra and New South Wales since 1971. From 1992, I was a Research Project Leader in SOLARCH, the National Solar Architecture Research Unit at the University of NSW. Until its disestablishment in November 2006, I was the Associate Director, Centre for Sustainable Built Environments, UNSW.

My research and consultancy includes work in solar access, energy simulation and assessment for houses and multi-dwelling developments, building assessments under the NSW SEDA Energy Smart Buildings program, appropriate design and alternative technologies for museums and other cultural institutions, and asthma and domestic building design. I am the principal author of SITE PLANNING IN AUSTRALIA: Strategies for energy efficient residential planning, funded by the then Department of Primary Industry and Energy, and published by AGPS, and of the RAIA Environment Design Guides on the same topic.

Through UNISEARCH, NEERG Seminars an Linarch Design, I conduct training in solar access and overshadowing assessment for Local Councils. I have delivered professional development courses on topics relating to energy efficient design both in Australia and internationally. I have delivered the key papers in the general area of assessment of ventilation and solar access performance and compliance for NEERG Seminars, cited by Commissioners of the LEC. Senior Commissioner Moore cited my assistance in reframing of the Planning Principle related to solar access (formerly known as the Parsonage Principle) in The Benevolent Society v Waverley Council [2010] NSWLEC 1082.

I taught the wind and ventilation components of environmental control in the architecture program at UNSW. I have supervised PhD level research in natural ventilation, and am the author of internationally referenced, web accessed coursework materials on the subject.

I practiced as a Registered Architect from 1971-2014, and now maintain a specialist consultancy advising on sustainability and amenity in buildings, with special emphasis on solar access and natural ventilation. I regularly assist the Land and Environment Court as an expert witness in related matters.

3.0 DOCUMENTS

3.1 I base my report on

- Development Application drawings Issue B dated 16/03/2015 issued to me by McKenzie International Architects on 16/03/2015:

  - A100 Plans – Basement 03
  - A101 Plans – Basement 02
  - A102 Plans – Basement 01
  - A103 Plans – Ground
  - A104 Plans – First
  - A105 Plans – Second
  - A106 Plans – Third
  - A107 Plans – Fourth
  - A108 Plans – Fifth
  - A109 Plans – Roof
  - A200 Sections - S/01 Section 1
  - A201 Sections - Sections 02
  - A300 Elevations - Elevations 01
  - A301 Elevations - Elevations 02
  - A302 Elevations - Elevations 03

- 3D digital model file in .3ds export format supplied by the architects.

3.2 I have visited the site.

4.0 SITE LAYOUT AND MASSING

The proposal is for a mixed-use residential flat building on an amalgamated site. The site is a rectangle bounded on the north by Canterbury Rd, to the south 'back' boundary by Onslow Street/Lane, on the west side boundary by a 1 & 2 storey concrete panel building (Canterbury BMW) and on the east side boundary by a four storey concrete building. My understanding is that there is an urban design requirement for a zero lot line on the side boundaries and a 'street wall' with upper storey setbacks to Canterbury Rd. There is an approximately 1.5 m slope from south to north across the site.

The dimensions and orientation of the site are such that only one logical site layout suggests itself. The building is divided into two blocks, each with a double loaded floor plate, where apartments on the south side are kept to a lesser number, and planned as shallow, open layouts for maximum daylight quality. This arrangement has the advantage of maximising sun exposure of the northern elevation of each block, which for the southern building faces into the enclosed common area courtyard.

At the given allowable height and courtyard separation, it is likely that the lower stories of the southern block would be overshadowed in winter. Accordingly, the entry level of the southern building is given over to commercial tenancies accessed from the courtyard. It would appear that this arrangement is the only viable strategy for achieving the recommended 70% of dwellings with winter solar access.

5.0 SOLAR ACCESS DISCUSSION AND ANALYSIS

5.1 Relevant solar access standards

5.1.1 Residential Flat Design Code

The Residential Flat Design Code gives the following quantified recommendations:

- Living rooms and private open spaces for at least 70 percent of apartments in a development should receive a minimum of three hours direct sunlight between 9am and 3pm in mid winter. In dense urban areas a minimum of two hours may be acceptable.
- Limit the number of single-aspect apartments with a southerly aspect (SW-SE) to a maximum of 10 percent of the total units proposed.
- Developments which seek to vary from the minimum standards must demonstrate how site constraints and orientation prohibit the achievement of these standards and how energy efficiency is addressed (see Orientation and Energy Efficiency).

(Rules of Thumb: Daylight Access p. 84)

5.1.2 Local controls

The local control is Canterbury DCP 2012 PART 6.2 GENERAL CONTROLS – CLIMATE AND RESOURCE EFFICIENCY. The DCP adopts provisions that are, on the whole, consistent with the requirement of the RFDC. I note that **6.2.6 Daylight and sun access** *New buildings in business zones* reads:

iv. At least 70% of the proposed apartments' living area windows and private open space (balconies) receive at least 2 hours sunlight between 9.00 am and 3.00 pm in mid - winter.
v. At least 50% of communal open space receives 2 hours of sunlight between 9.00 am and 3.00 pm in mid - winter.

In quantifying the compliance for solar access for this application, I rely on satisfying the RFDC as also satisfying the DCP.

5.2 Predicted solar access: methodology

5.2.1 3D digital model

My review and analysis were conducted with the use of a 3D digital model in the *Trimble SketchUp* software package, imported from the CAD file prepared by the architects. I note that the model includes block representations of the adjacent buildings, so that the quantification of solar access takes account of relevant actual overshadowing. I independently geolocated the 3D digital model and checked the direction of True North.

I examine the design by use of 'views from the sun'. The projection referred to as a *'View from the Sun'* shows all sunlit surfaces at a given time and date. It therefore allows a very precise count of sunlight hours on any glazing or horizontal surface, with little or no requirement for secondary calculations or interpolation. Figure 1 illustrates the technique. In this report I include at Appendix B copies at reduced scale of half-hourly views from the sun.

Note that a 'view from the sun' by definition does not show any shadows.

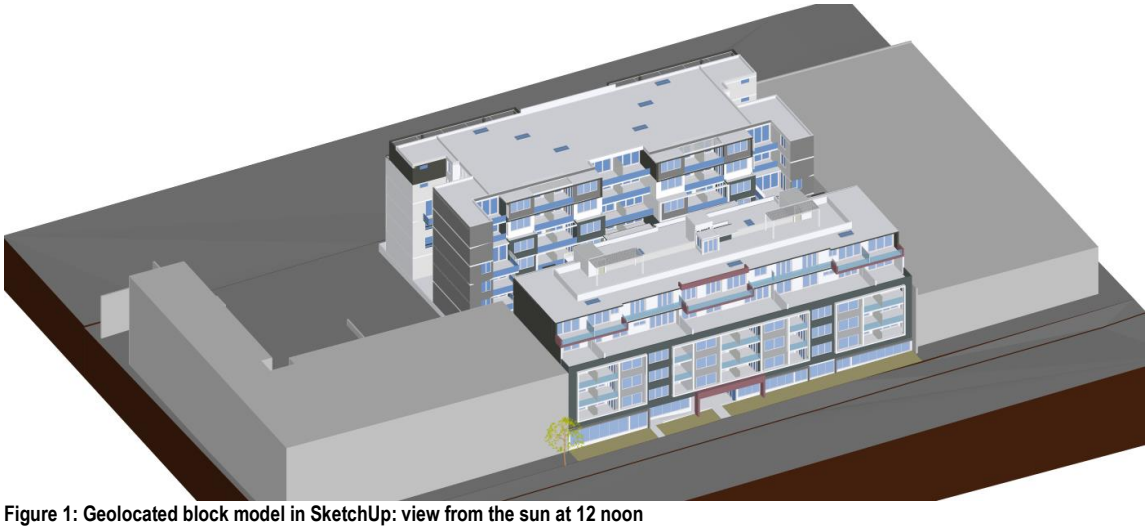


Figure 1: Geolocated block model in SketchUp: view from the sun at 12 noon

5.2.2 Characterisation of solar access compliance

For the purpose of calculating the compliance with the control, I have examined sun patches on the relevant glazing of each apartment. For the determination of what is 'effective sunlight' for both glazing and private open space, I refer specifically to the application of the relevant *L+EC Planning Principle (The Benevolent Society v Waverley Council [2010] NSWLEC 1082):*

- I ignore very large angles of incidence to the glazing surface, and unusably small areas of sunlit glazing.
- I quantify as complying all sun patches of 'reasonable size', which I define for this purpose as a minimum of 1 m² of glass.

5.2.2 Duration of sun access

I begin by classifying as complying when sun access is over three hours total of partially and fully sunlit glazing between 9am and 3pm mid-winter. Given the design, verandas and terraces will in almost every case enjoy a more favourable sun exposure.

The RFDC suggests that a less onerous '2-hour standard' can be applied in dense urban areas. The immediate precinct is zoned to allow multi-storey RFBs with setbacks and separation distances that characterise a closely built-up, high density environment. In these circumstances my view is that at least a proportion of apartments meeting the '2-hour standard' should be considered compliant. My experience is that this is consistent with criteria previously applied elsewhere in the municipality.

5.2.3 Applicable times of day for effective sun

The 9am and 3pm limits are a legacy from early controls for single dwellings in arcadian suburban settings where the desired mature tree canopied character was assumed to limit the likely availability of 'low' winter sun before and after those times.

A suitable 3D digital model can demonstrate what sun exposure is reliably available before 9am and after 3pm. To be relied on to do so, the digital model must incorporate sufficient of the surrounding developments adjacent to, and also remote from the site. Therefore, in my considered opinion, to apply those limits without reference to the actual likely availability of earlier and later sun is inappropriate.

Where apartments will receive additional effective direct winter sun earlier or later than the arbitrary 9am and 3pm limits, I have recorded solar access from 8am and until 4.00pm.

I note that this approach to characterising solar access compliance has been supported by the Land and Environment Court, most lately by the judgement by Brown C. in *Botany Development Pty Ltd v Council of the City of Botany Bay LEC 10360 of 2013* on 31 January 2014.

5.3 Achieved solar access

Table 1 sets out the summary of solar access achieved.

Table 1: Summary of solar access compliance

Number of units	100	
Units which achieve 3 hours or more sunlight to Living and POS 9am – 3pm as defined in the RFDC	53	
Units which achieve 2 hours or more sunlight to Living and POS 9am – 3pm as defined in the RFDC appropriate for closely built up context	17	
Units which achieve 2 hours or more sunlight to Living and POS 8am – 4pm	1	
Total complying	**70**	**70%**

Table 3 in Appendix A sets out the details of solar access for each individual apartment.

6.0 NATURAL VENTILATION

6.1 Performance Objectives

The Residential Flat Design Code (RFDC) gives rules of thumb for interpreting SEPP 65 with respect to natural ventilation:

- Building depths, which support natural ventilation typically range from 10 to 18 metres.
- Sixty percent (60%) of residential units should be naturally cross ventilated.
- Twenty five percent (25%) of kitchens within a development should have access to natural ventilation.
- Developments, which seek to vary from the minimum standards, must demonstrate how natural ventilation can be satisfactorily achieved, particularly in relation to habitable rooms.
  *(*Rules of Thumb: *Natural Ventilation* p.87)

6.2 Cross ventilation

The objectives can be satisfied by a variety of ventilation arrangements, but for simplicity, conventional cross ventilation is preferred. I characterise as cross ventilated for amenity:

- All corner and 'through' apartments with openings in two principal facades;
- Apartments with openings to local corner conditions which may be regarded as sufficiently similar in their likely ventilation performance to deeper 'through' apartments to be regarded as cross ventilated.
- Some apartments that are cross ventilated to suitably fully open portions of the common access galleries;
- Top floor apartments with ventilating skylights.

6.3 Achieved natural ventilation compliance.

Table 2 summarises the compliance achieved for natural ventilation. In Appendix A, Table 3 I report in detail the cross ventilation status of each apartment.

Number of units	100	
Cross ventilated	**64**	**64%**

Table 2: Ventilation compliance

In Appendix A, Table 3 lists the individual apartments with their ventilation status.

7.0 CONCLUSIONS

7.1 Solar access

The proportion of dwellings which achieve projected solar access of minimum 2 hours between 9am and 3pm June is **70 units from a total of 100, being 70%**. The RFDC *Rules of Thumb* nominate as a minimum 70%.

The proposed development therefore complies with the RFDC *Rules of Thumb* and with the relevant local controls.

I note that if I pay regard to the direct sun available before 9am and after 3pm another one apartment can be shown to obtain a minimum of two hours on June 21.

7.2 Natural ventilation

The proportion of apartments which comply with the RFDC *Rule of Thumb* for natural ventilation amenity achieved by **cross ventilation is 64 apartments out of a total 100, or 64%.** The proportion required by the RFDC *Rule of Thumb* is a minimum of 60%.

The proposed development therefore fully complies with the relevant control for natural ventilation.

A.0 APPENDIX: DETAILED COMPLIANCE TABLE

Table 3: Solar access for individual dwellings

Unit	Notes	Solar access																	Solar access compliance			
		8	830	9	930	10	1030	11	1130	12	1230	13	1330	14	1430	15	1530	16	>3 hrs	>2hrs	>2hrs (8-16)	Cross vent
01										Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
02		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
03		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
04		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
05		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
06		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
07		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
08											Y	Y	Y	Y	Y	Y	Y	Y		YES		YES
09																						YES
10																						
11		Y	Y																			YES
12		Y	Y	Y																		YES
13		Y	Y	Y																		
14																						YES
15																						YES
16			Y	Y	Y	Y	Y	Y												YES		
17							Y	Y	Y													YES
18		B	B	B	b	B	B	B	B	B												YES
19			Y	Y	Y	Y	Y	Y	Y											YES		YES
20																						
21																						
22																						YES
23										Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
24		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
25		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
26		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
27		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
28		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
29		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
30											Y	Y	Y	Y	Y	Y	Y	Y		YES		YES
31															B	Y						YES
32																						YES
33		Y	Y	Y	Y	Y	Y														YES	YES
34		Y	Y	Y	Y	Y	Y	Y		Y										YES		YES
35		Y	Y	Y	Y	Y	Y	Y	Y											YES		
36										Y	Y											YES
37																						YES
38			Y	Y	Y	Y	Y	Y												YES		
39							Y	Y	Y	Y	Y	Y								YES		YES
40		B	B	B	B	B	B	B	B	B	B	B										YES
41		Y	Y	Y	Y	Y	Y	Y	B	B										YES		YES
42																						
43																						
44																						YES
45												Y	Y	Y	Y	Y	Y	Y		YES		YES
46		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
47		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
48		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
49		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
50		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
51		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
52												Y	Y	Y	Y	Y	Y	Y		YES		YES
53		Y																				YES
54																						YES
55		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
56		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				YES			YES
57		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y							YES			
58							Y	Y	Y	Y	Y	Y	Y	Y					YES			YES
59									Y	Y	Y	Y	Y	Y						YES		YES
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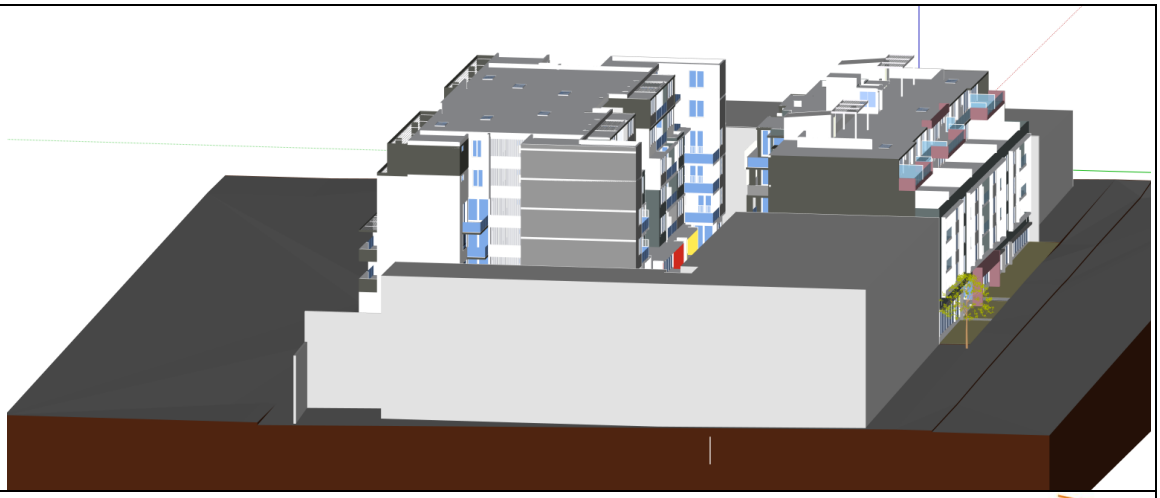
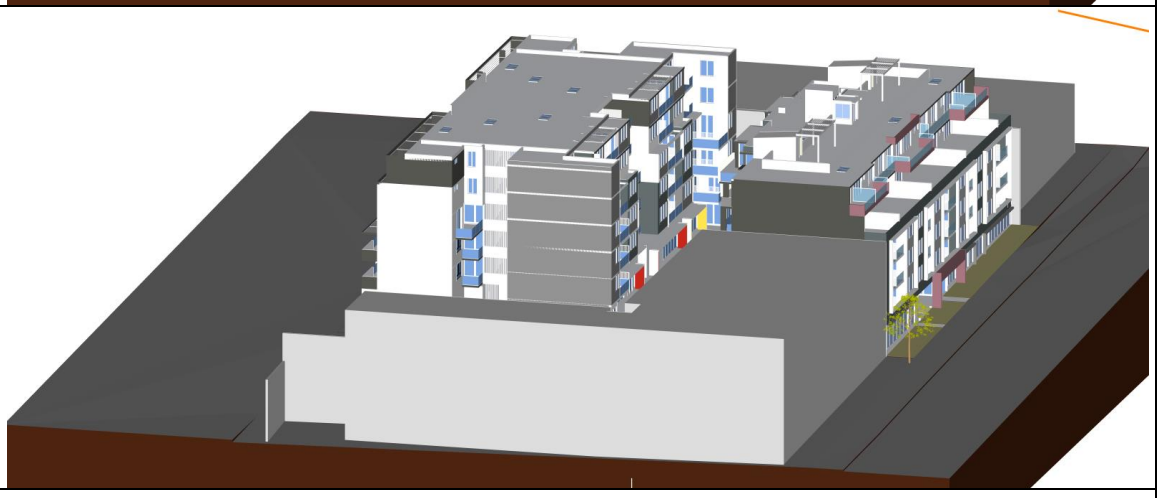
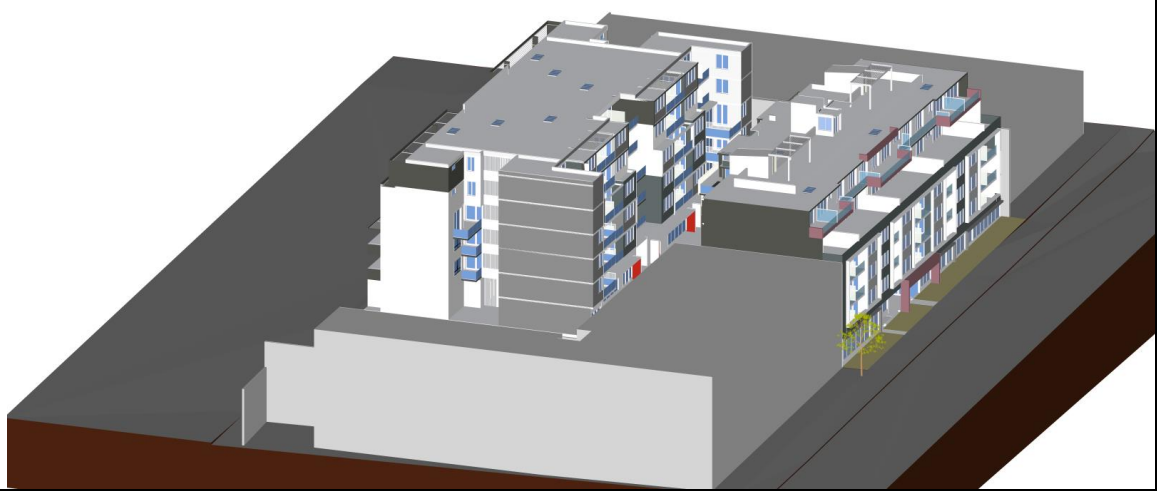
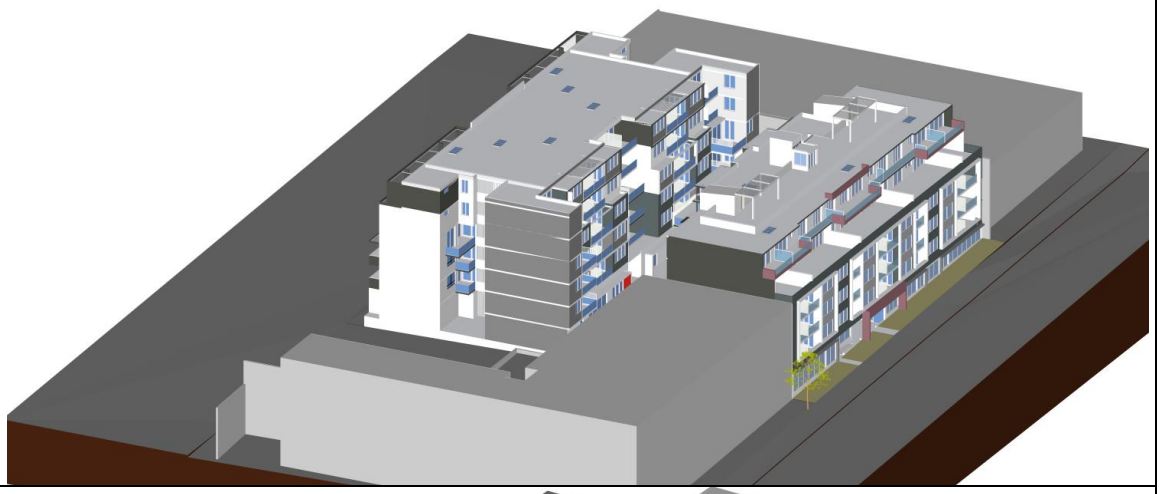
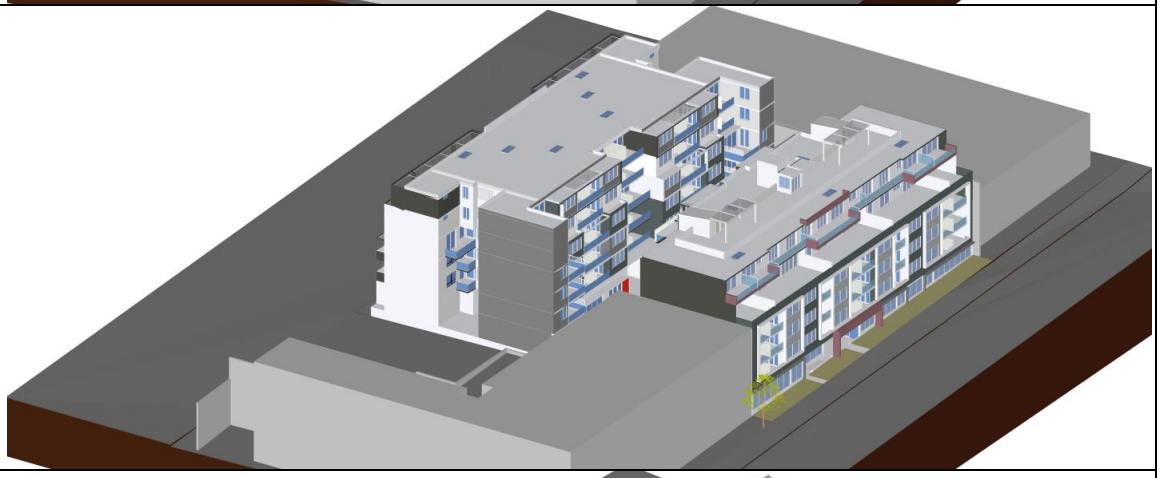
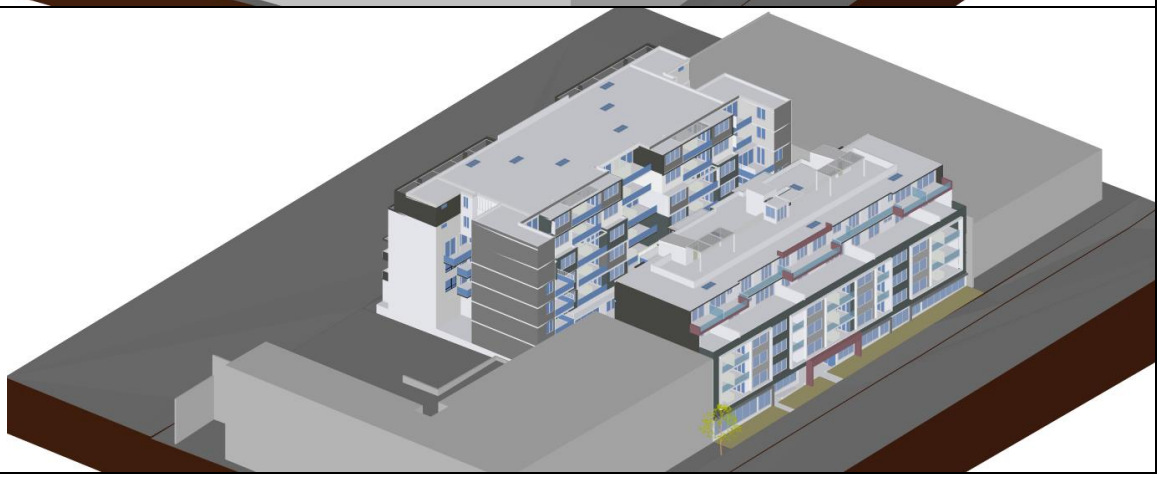
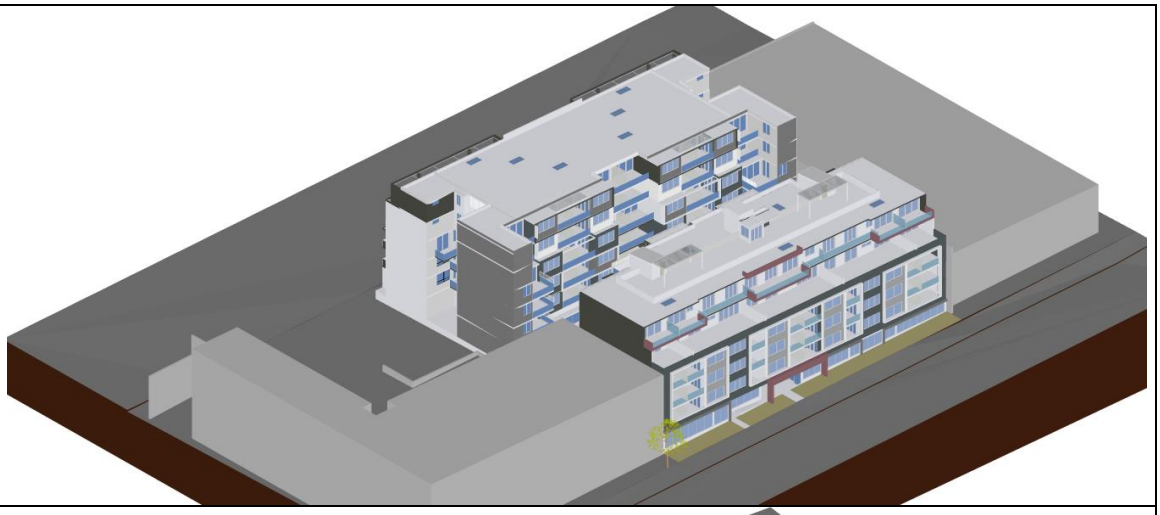
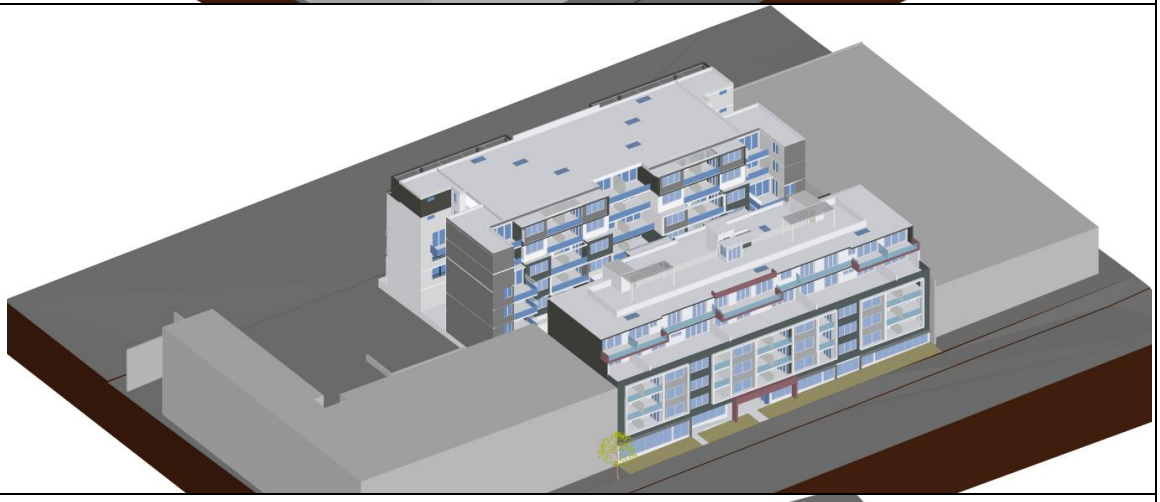
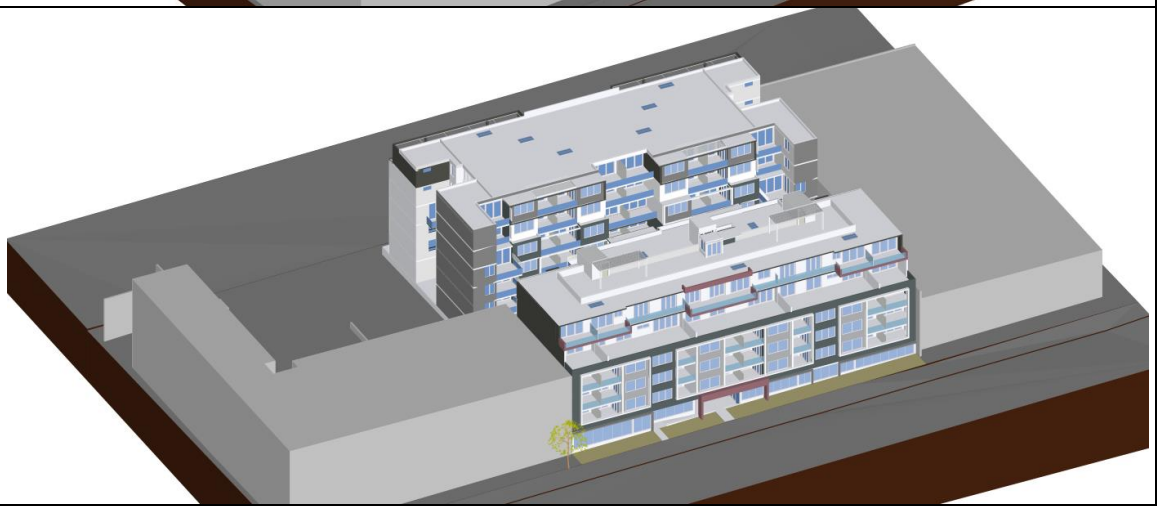
63		Y	Y	Y	Y	Y	Y	Y	B	B										YES		YES
64																						
65																						
66																						YES
67								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
68								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
69								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
70								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			
71								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
72		Y																				YES
73																						YES
74		B	B	B	B	B	B	B	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
75		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
76		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	B		YES			
77											Y	Y	Y	Y	Y	Y				YES		YES
78												Y	Y	Y	Y	Y	Y			YES		YES
79			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			YES			
80						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			YES			YES
81											Y	Y	Y	Y	Y	Y				YES		YES
82																						YES
83																						YES
84		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
85	Ventilated skylight	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
86	Ventilated skylight	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES

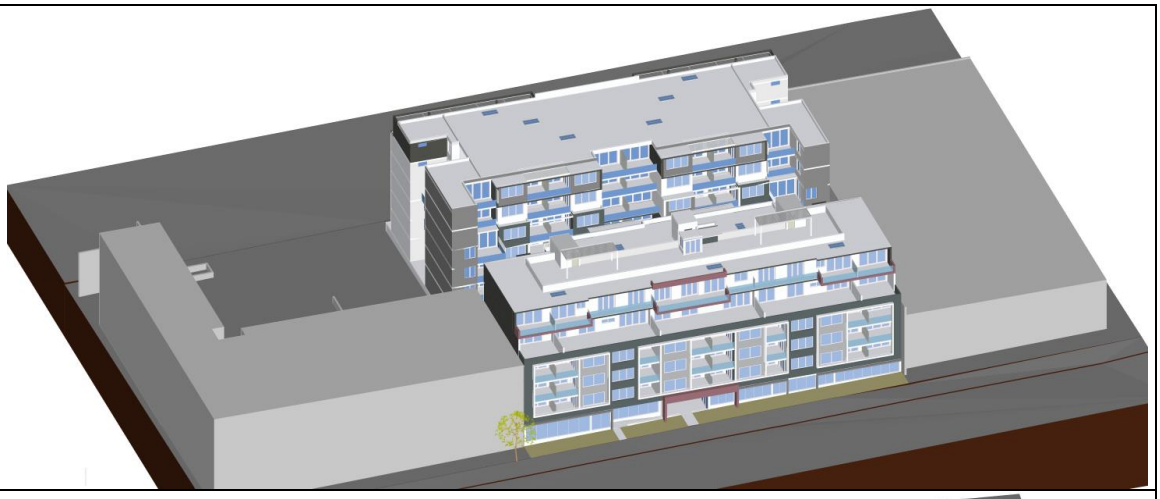
Unit	Notes	Solar access																	Solar access compliance			
		8	830	9	930	10	1030	11	1130	12	1230	13	1330	14	1430	15	1530	16	>3 hrs	>2hrs	>2hrs (8-16)	Cross vent
87	Ventilated skylight	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
88				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
89	Ventilated skylight									Y	Y	Y	Y	Y						YES		YES
90	Ventilated skylight						Y	Y	Y	Y	Y	Y	Y	Y					YES			YES
91		B	B	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		YES			YES
92		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
93	Ventilated skylight	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
94					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
95						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
96	Ventilated skylight	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
97				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
98						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
99	Fixed skylight	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
100	Fixed skylight	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	YES			YES
												100		units					**53**	**17**	**1**	**64**
																			53%	17%	1%	64%
																				70%	**71%**	

B.0 APPENDIX: VIEWS FROM THE SUN

0800	
0830	
0900	

0930	
1000	
1030	

1100	
1130	
1200	

1230	
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