SUMMARY EXPERT OPINION

INDEPENDENT CERTIFICATION: OVERSHADOWING AND CROSS VENTILATION ANALYSIS

PROPOSED MIXED USE DEVELOPMENT

at the former Kirrawee Brick Pit, Kirrawee
MP10_0076

21 August 2011

0.0 SUMMARY/CERTIFICATION

I have undertaken an evaluation of the shadow diagrams and overshadowing analysis prepared for the proposed development of multi-storey apartments over commercial and other premises, at the former Kirrawee Brick Pit, Kirrawee, which is the subject of a Part 3A development application. I supply the following independent expert opinion.

Property: **Former Kirrawee Brick Pit, Kirrawee MP10_0076**
Approval: **Part 3A**
Condition:

I hereby confirm that
SOLAR ACCESS AND NATURAL VENTILATION ANALYSIS
to establish the likely amenity compliance under the Residential Flat Design Code (SEPP65)
as supplied to me in drawings and schedules by Woodhead Architects, dated 18/08/2011
may be considered as accurate and fit for the purpose,
set out in Attachment 1 of the requirements of the Department of Planning and Infrastructure in accordance with section 75H of the Environmental Planning and Assessment Act 1979.

Documents to which I refer are:
Updated schematic plans dated 18/08/2011
'Views from the sun' of digital 3D model
Digital copy of 3D Model prepared in Autodesk Revit software

I refer to the discussion in 5.0 Analysis below.

Signed,

……
Steve King

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1.0 CREDENTIALS

I have been teaching 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 December 2006 I was the Associate Director, Centre for Sustainable Built Environments (SOLARCH), UNSW.

My research and consultancy includes work in solar access, energy simulation and assessment for houses and multi-dwelling developments. I am the principal author of *SITE PLANNING IN AUSTRALIA: Strategies for energy efficient residential planning*, published by AGPS, and of the BDP Environment Design Guides on the same topic. Through UNSWGlobal and NEERG Seminars, 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 teach the wind and ventilation components of environmental control in the undergraduate course in architecture at UNSW, and am the author of internationally referenced, web accessed coursework materials on the subject.

Of particular relevance, I have delivered the key papers in the general area of assessment of *ventilation and solar access performance and compliance* at the NEERG Seminars and other professional development settings. Most Recently, Senior Commissioner Moore cited my assistance in reframing of the Land and Environment Court Planning Principle related to solar access (formerly known as the Parsonage Principle) in *The Benevolent Society v Waverley Council [2010] NSWLEC 1082.* See http://www.lawlink.nsw.gov.au/lecjudgments/2010nswlec.nsf/19eb930e64c0733bca257363001d0a87/34316f1bf070268eca257703000db6e0?OpenDocument

I am a Registered Architect and maintain a specialist consultancy practice in Sydney and Canberra. 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 the following documents issued to me by Woodhead Architects, dated 18/08/2011.

(a) Updated schematic plans dated 18/08/2011:

- 0140 - BASEMENT 1 PLAN.pdf
- 0150 - BASEMENT 2 PLAN.pdf
- 0160 - BASEMENT 3 PLAN.pdf
- 0180 - FLOOR PLANS BUILDING A TO C - SHEET 1.pdf
- 0180_A - FLOOR PLANS BUILDING A TO C - SHEET 2.pdf
- 0181 - FLOOR PLANS BUILDING D1, D2, E.pdf
- 0182 - FLOOR PLANS BUILDING F, G & H.pdf
- 0120 - UPPER GROUND FLOOR PLAN.pdf
- 0130 - LOWER GROUND FLOOR PLAN.pdf

(b) 'Views from the sun' of digital 3D model. Drawings:

- 0417 - DAYLIGHT ACCESS ANALYSIS REVISED 1.pdf
- 0418 - DAYLIGHT ACCESS ANALYSIS REVISED 2.pdf
- 0419 - DAYLIGHT ACCESS ANALYSIS REVISED 3.pdf
- 0420 - DAYLIGHT ACCESS ANALYSIS REVISED 4.pdf

(c) Digital copy of 3D Model prepared in Autodesk Revit software.

3.2 I have visited the site.

4.0 DISCUSSION AND ANALYSIS

4.1 Introduction

4.1.1 I take as the scope of my expert opinion that part of the requirements of the Department of Planning and Infrastructure which relate to solar access and Natural ventilation amenity under the RFDC:

> Given the scale of the residential component of the proposal, the Concept Plan must demonstrate how individual residential buildings can achieve compliance with the SEPP 65, and particularly the Residential Flat Design Code guidelines. The Department requires further detailed information on the following:
>
> - How proposed buildings C and D can comply with the solar access requirements at midwinter;
> - That a minimum of 60% of apartments within each residential building are naturally cross ventilated;
> - That the depth of the proposed building envelopes will support a high level of residential amenity for future occupants;
> - That less than 10% of all units within each residential building are south facing…

4.1.2 I note that the Part 3A development application is for *Concept Development* plans, to which the Department has responded with **Issues to be Addressed in Preferred Project Report.** *Inter alia* the Department's response makes clear that further design development is to occur by way of design commissions to a number of different architects.

I take from this a clear indication that the objective of the present Concept Development plans is to ensure such future designs will be able to be carried out safely achieving compliance under the Residential Flat Design Code — rather than to lock down one detailed design with tight compliance parameters.

4.1.3 I infer as the fundamental strategy of the site layout and massing is to ensure that each building has a characteristic orientation, such that one side of the building has an exposure to midwinter sun for a minimum of three contiguous hours, free of mutual overshadowing by other buildings.

I also infer that the use of specific computer modelling technique is directed at adjusting in detail the location and appropriate extent and height of the various building blocks, to achieve this objective.

4.2 Accuracy of the applicant's solar access diagrams

4.2.1 Quantification of solar access for compliance with the requirements of the Residential Flat Design Code has been carried out by the architects, by use of a 3D digital model and the heliodon routine of a commercial CAD application.

4.2.2 I have independently verified the direction of North, by reference to the cadastral grid north, which is, as expected, within 1° of the 'True North' to which the digital model is aligned.

4.2.3 I have also independently verified the relevant model and location parameters, as well as time and date settings used to generate the views in the architects' comparison table. From the model, I have summarily checked the topographical and building dimensions that might otherwise give rise to any errors, by reference to figured RL dimensions. Having established the accuracy of the key points, I feel confident to rely on the general accuracy of the modelling.

4.2.4 The architects use the 3D digital model to verify in true 3D the potential areas of sunlit glazing achieved by the proposed layout and massing of buildings on the site. The technique of half-hourly 'views from the sun' allows very accurate assessment of what is sunlit. The critical 12 noon view is illustrated in Figure 1. The whole set of hourly views from 9am to 3pm on June 21 is included in Appendix A.

3D computer software in analysis is generally used to render shadow views in OpenGL using arbitrary aerial views. Such rendering can on very rare occasions result in shadow artefacts that do not completely accord with reality. Revit prepares the shadow views by reference to accurate solar geometry, and the use of the views from the sun eliminates any possible errors of shadow casting, as by definition the views do not include shadows, only sunlit surfaces.

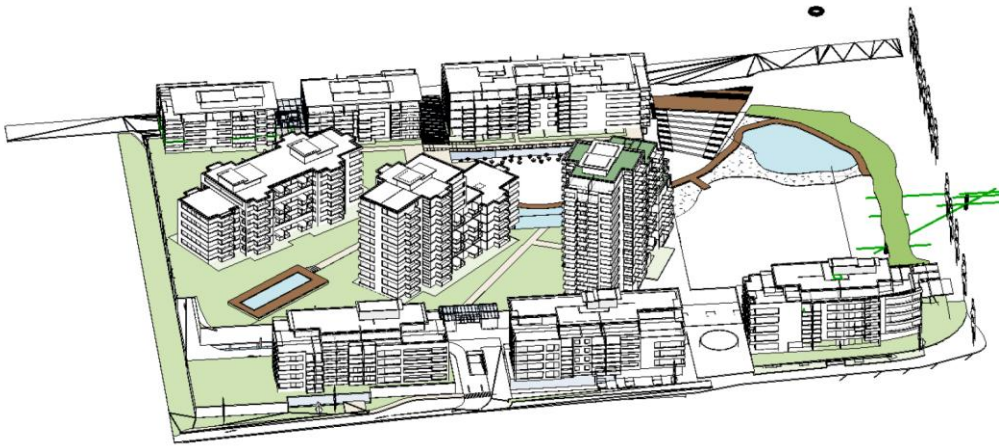


Figure 1: View from the sun 12 noon

The resulting projections of sunlit surfaces are accurate beyond the confidence limits of the original survey information, and far more informative than any manually calculated and drawn shadows could possibly achieve.

4.3 Projected solar access

4.3.1 The architects' tabulation of the proportion of apartments projected to achieve complying solar access on a half-hourly basis is included as Appendix B.

I note that the architects' table takes the approach of summarising for each building, for each half-hour the proportion of apartments which achieve effective solar access. I considered this to be an appropriate response to the provisional status of the Concept Development plans as described in 4.1.2 above.

4.3.2 Table 1 summarises the projected levels of compliance for the individual buildings.

Table 1: Summary of solar access compliance

Building	Minimum 3 hour period complying *(see 4.1.3)*	% Dwellings achieving >3hours
Block A	12-3	70%
Block B	11.30-2.30	75%
Block C	10.30-1.30	70%
Block D1	11.30-2.30	81%
Block D2	9-12	70%
Block E	10-1	77%
Block F	9-12	80%
Block G	9-12	76%
Block H	9-12	78%

4.3.3 I note that the two buildings least favoured by location — and thus subject of most overshadowing by buildings to their north — are Blocks C and D2. However, the analysis indicates that both of these buildings can be designed to achieve a minimum of 70% of apartments with projected effective winter sun for at least three hours between 9 AM and 3 PM on June 21.

4.4 Cross ventilation

4.4.1 The concept plans are sufficiently detailed to allow a simple classification of apartments as single sided ventilation or cross ventilated, on the simple premise that the latter are characterised by openings on two or more of separate elevations.

4.4.2 Cross ventilation is generally achieved by all corner apartments, by single-storey 'through' apartments, and by two-storey 'crossover' apartments. The latter apartment type is not generally favoured in the speculative apartment market place, which discourages its more prolific use to address issues of solar

access and cross ventilation amenity requirements. The resulting apartment mix is clearly optimised with one of the object functions being a target of 60% of apartments overall to be cross ventilated. My independent summary count of such conventionally defined cross ventilated apartments confirms that the 60% target has been met.

4.4.3 Blocks F, G and H, being lowrise buildings accommodating a disproportionate number of smaller apartments, achieve between 54% and 57% conventional cross ventilation.

It is self-evident that these proportions could be manipulated by amalgamation of the smaller apartments into a lesser number of larger apartments. In my considered opinion, such a strategy would be an inappropriate artifice.

On the other hand, I note that a significant number of *upper level apartments which are conventionally classified as single aspect*, would in reality enjoy significantly enhanced patterns of ventilation. Such enhanced single sided ventilation is likely due to a combination of accelerated wind velocities at the greater heights, and the detailed facade design — where significant facade 'relief' is associated with multi-room, shallow plans. Such apartments would in reality achieve natural ventilation patterns comparable to the cross ventilation achieved by deep crossover, or deep through apartments.

4.4.4 Overall, in my considered opinion the development achieves a reasonable minimum of over 60% fully cross ventilated apartments. In addition, on this site and with this building layout, I would classify all south facing single aspect apartments above Level 4 as complying with the natural ventilation amenity objectives of the Residential Flat Design Code.

5.0 SUMMARY

5.1 Mandated solar access

Shadow projections have been prepared by the architects by use of a suitable 3D digital model in the computer application *Autodesk Revit.*

I am satisfied from my independent access to that digital model that the modelling is accurate to a suitable degree compatible with the graphical information of the provided plans. The resulting views from the sun showing all sunlit areas on a half hourly basis on June 21, are accurate beyond the confidence limits of the survey information, and far more informative than any manually calculated and drawn shadows could possibly achieve.

The solar access projections supplied by the Applicant allow an overview of the likely minimum periods of effective sun available to dwellings in the proposed building blocks. They are accurate, clear and sufficient to make an assessment of the extent of such overshadowing.

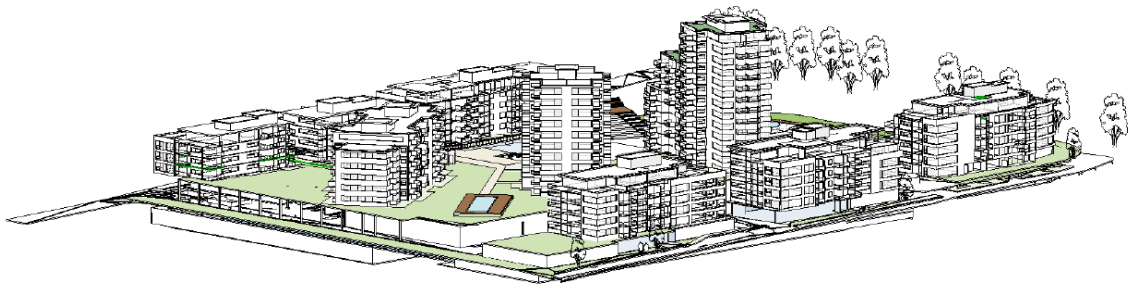
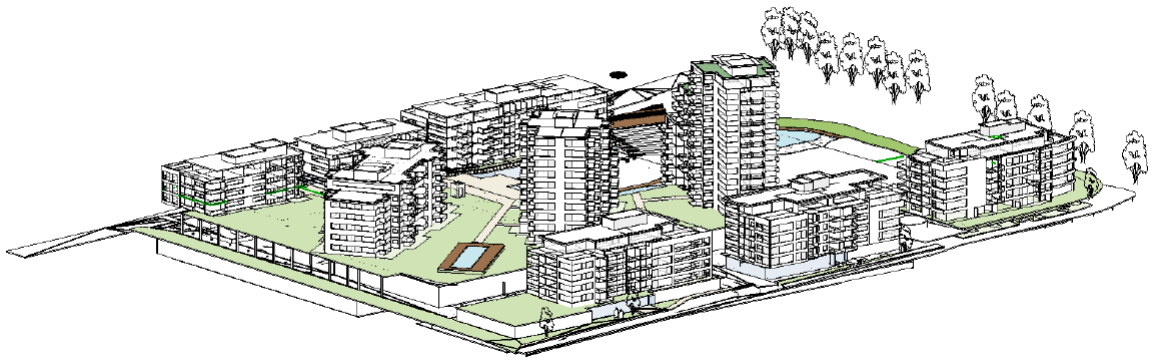
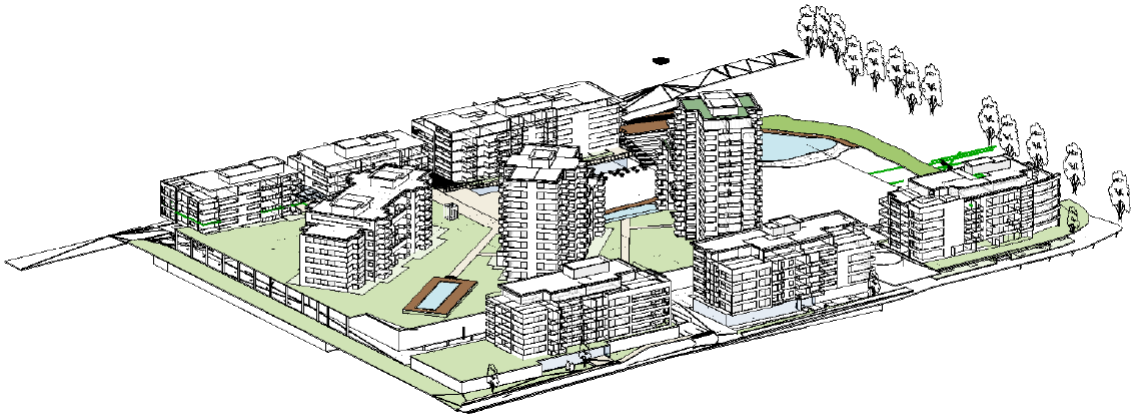
5.2 Cross ventilation

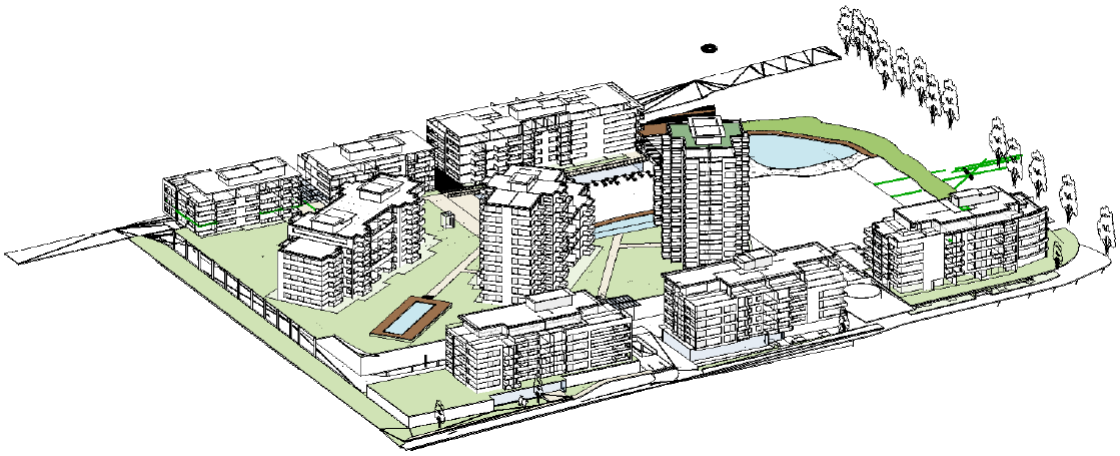
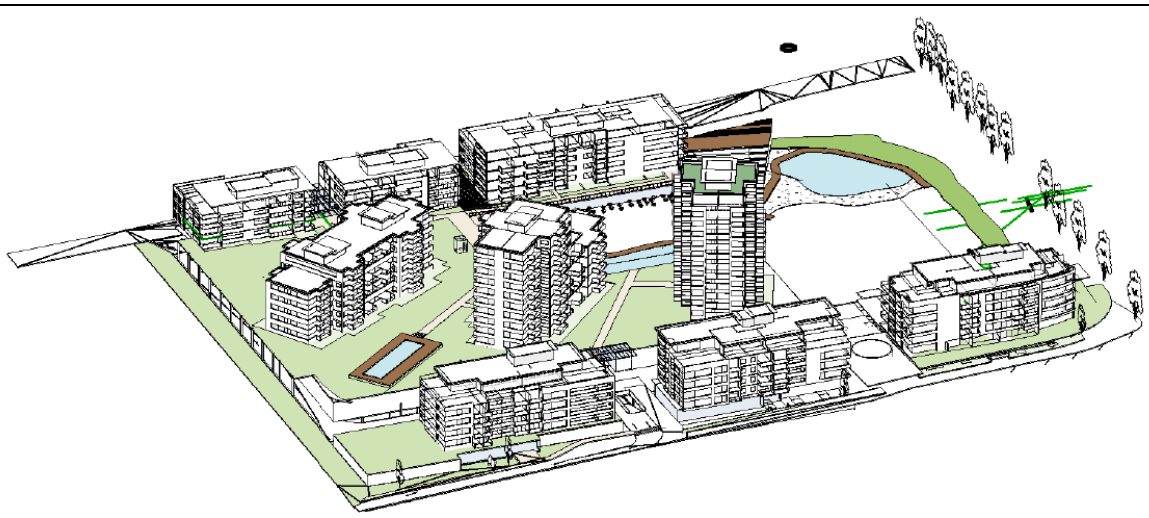
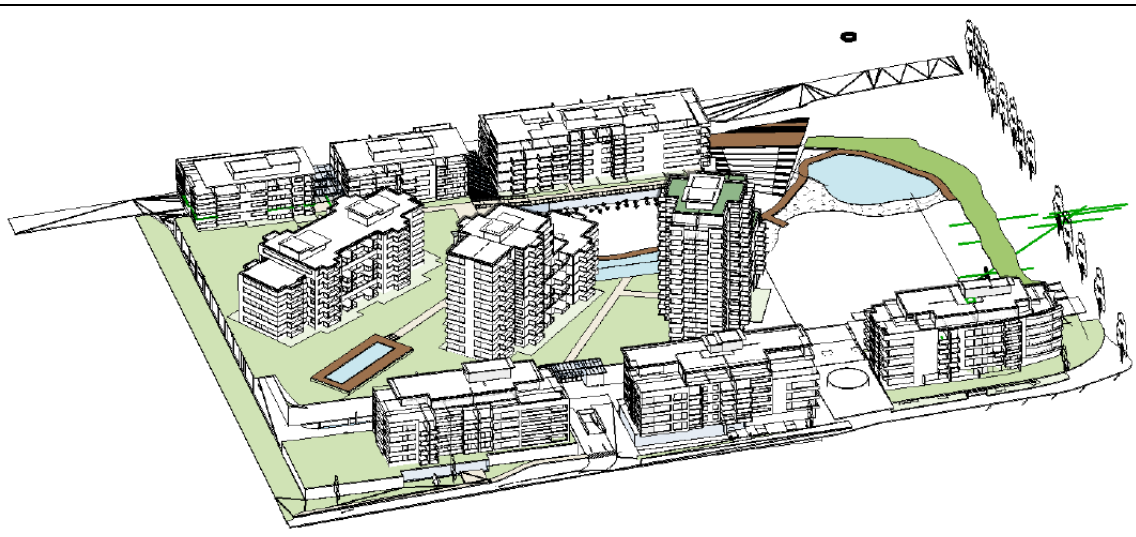
The cross ventilation status of individual apartments may be determined from the schematic concept plans.

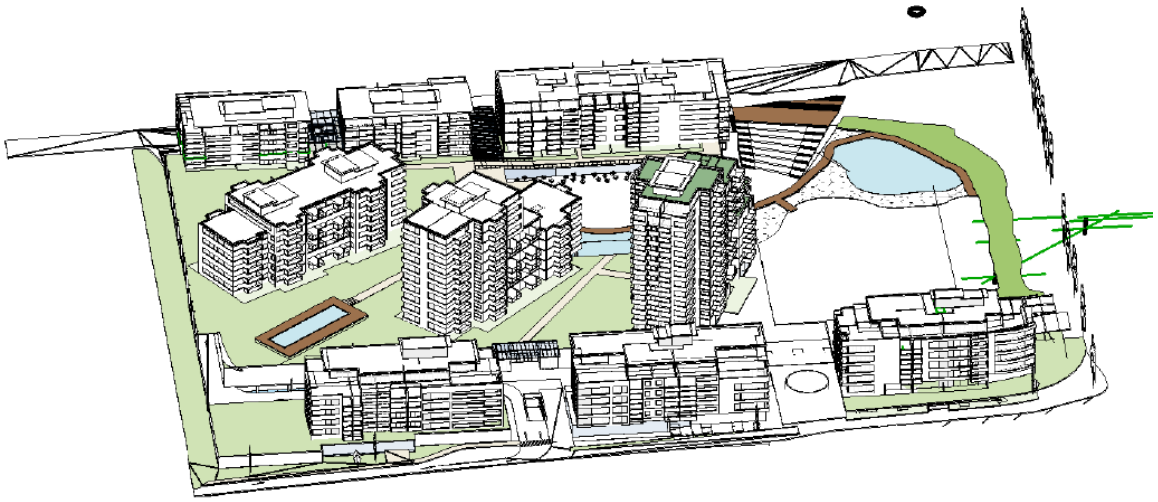
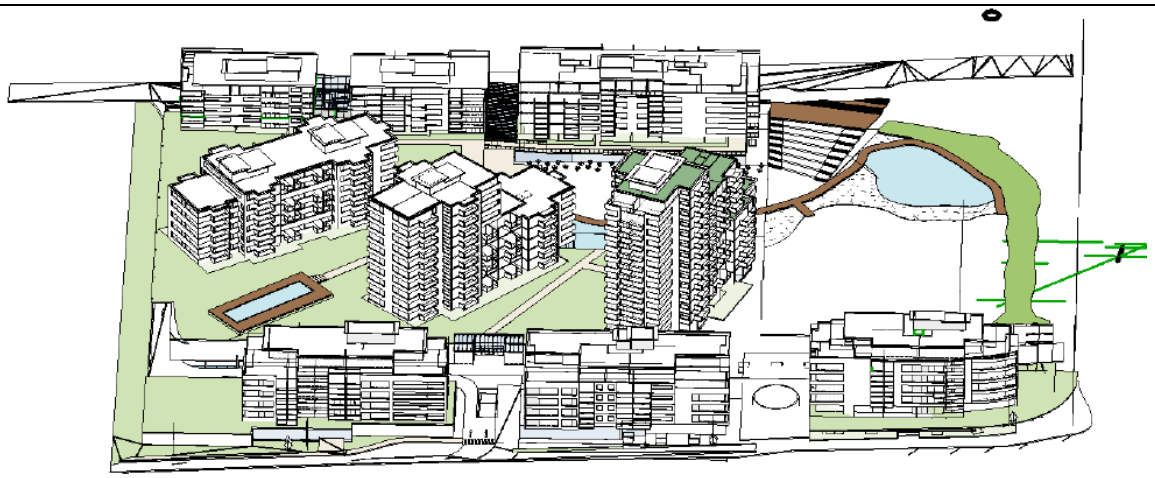
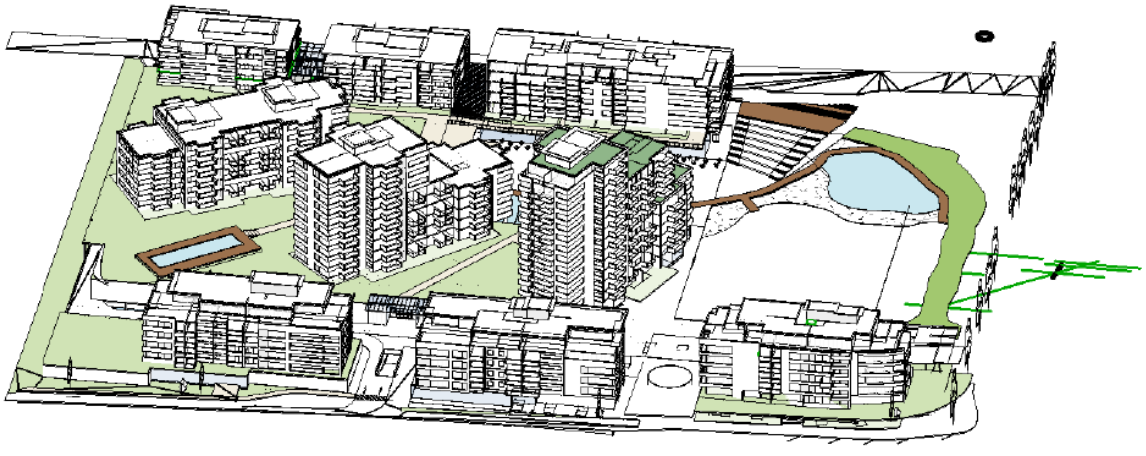
I have independently verified that while Blocks F, G and H, being lowrise buildings accommodating a disproportionate number of smaller apartments, achieve between 54% and 57% conventional cross ventilation, *the apartment mix proposed for the overall site can be provided with a minimum of 60% of the apartments achieving full cross ventilation.*

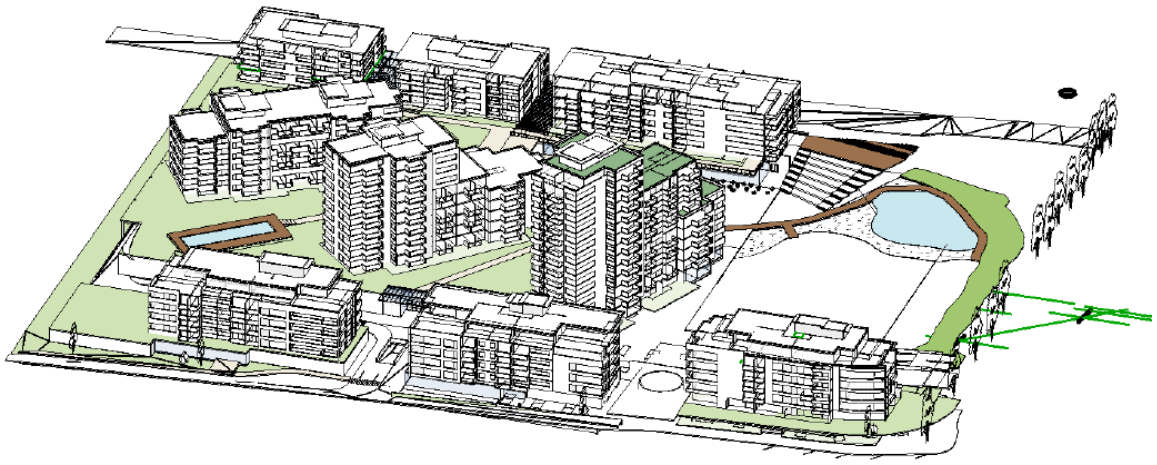
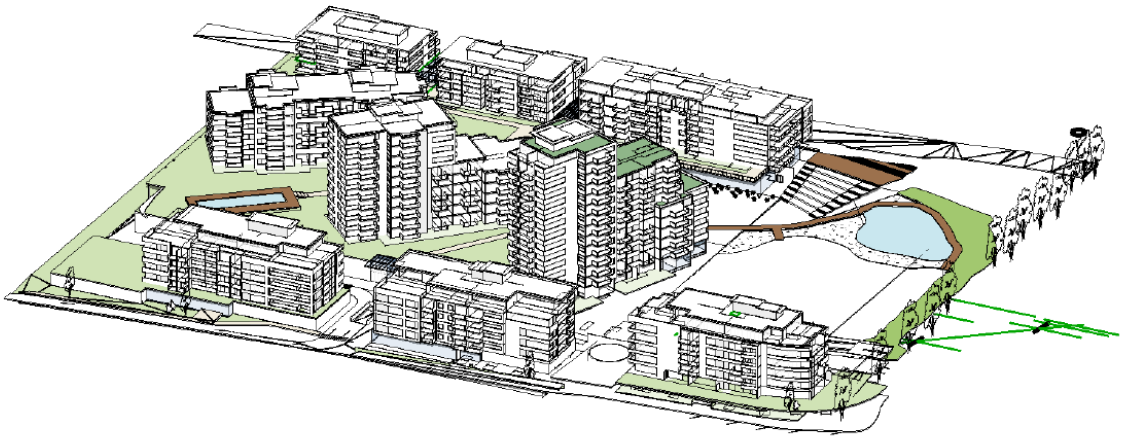
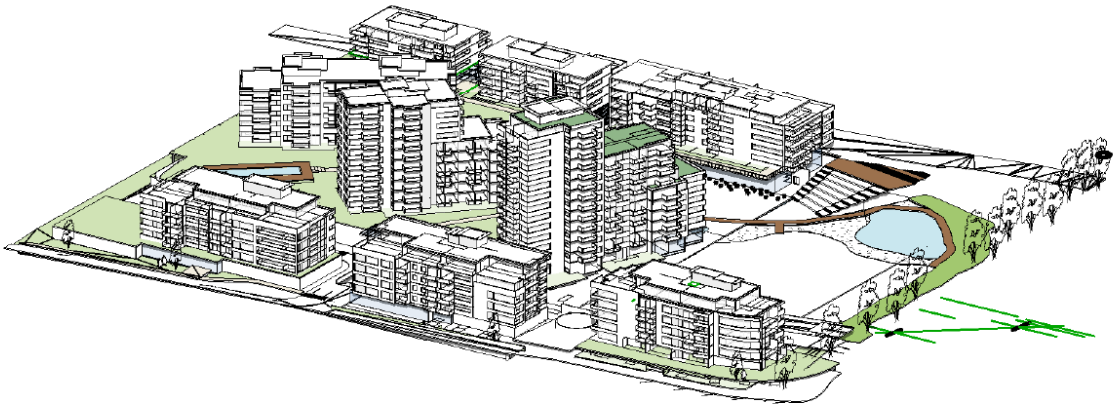
A.0 APPENDIX: VIEWS FROM THE SUN

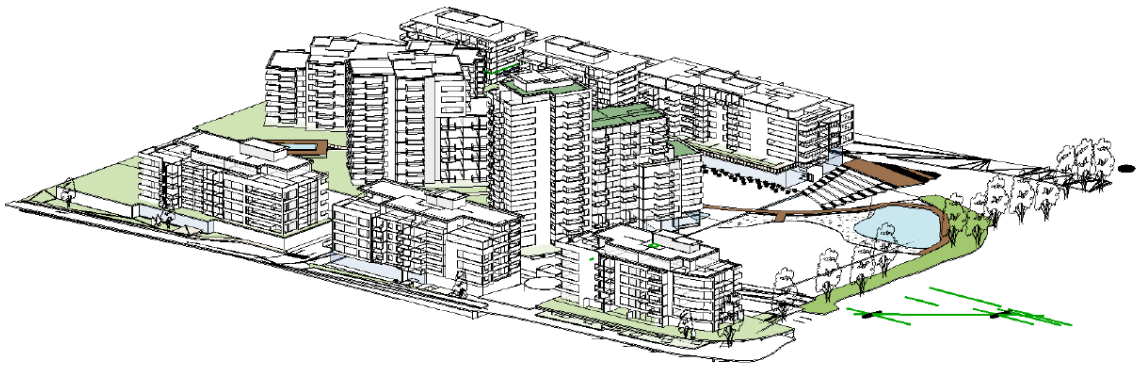
The attached table reproduces in reduced form for reference the half-hourly views of solar access projections for June 21. The projections were prepared by the architects, and independently verified by me by comparison to the digital model.

	Views from the sun
9.00	
9.30	
10.00	

10.30	
11.00	
11.30	

12.00	
12.30	
1.00	

1.30	
2.00	
2.30	

3.00	

B.0 APPENDIX: ARCHITECTS' COMPLIANCE TABLE FOR SOLAR ACCESS

The attached table reproduces for reference the solar access compliance table prepared by the architects.

APARTMENT MIX BY BLOCK

Block/ Time of Day	Number of apartments with solar access	Total Apartments		
	No.	No.		
Block A				
9:00am	56		57%	
9:30am	56		57%	
10:00am	56		57%	
10:30am	56		57%	
11:00am	48		49%	
11:30am	55		56%	
12 noon	69		70%	**70**
12:30pm	69		70%	
1:00pm	72		73%	
1:30pm	74		76%	
2:00pm	76		78%	
2:30pm	76		78%	
3:00pm	75		77%	
Sub Total		**98**		
	No.	No.		
Block B				
9:00am	38		51%	
9:30am	44		59%	
10:00am	39		52%	
10:30am	54		72%	
11:00am	51		68%	
11:30am	56		75%	
12 noon	63		84%	**75**
12:30pm	63		84%	
1:00pm	61		81%	
1:30pm	61		81%	
2:00pm	58		77%	
2:30pm	57		76%	
3:00pm	50		67%	
Sub Total		**75**		
	No.	No.		
Block C				
9:00am	38		68%	
9:30am	37		66%	
10:00am	37		66%	
10:30am	42		75%	
11:00am	46		82%	**70**
11:30am	47		84%	
12 noon	47		84%	
12:30pm	46		82%	
1:00pm	44		79%	
1:30pm	39		70%	
2:00pm	35		63%	
2:30pm	25		45%	
3:00pm	16		29%	
Sub Total		**56**		
Block D1				
9:00am	8		38%	
9:30am	9		43%	
10:00am	12		57%	
10:30am	14		67%	
11:00am	17		81%	
11:30am	17		81%	
12 noon	18		86%	
12:30pm	17		81%	
1:00pm	18		86%	**81**
1:30pm	18		86%	
2:00pm	18		86%	
2:30pm	18		86%	
3:00pm	15		71%	
Sub Total		**21**		
Block D2				
9:00am	16		70%	
9:30am	16		70%	
10:00am	16		70%	
10:30am	16		70%	
11:00am	16		70%	
11:30am	16		70%	
12 noon	16		70%	

12:30pm	13	57%	
1:00pm	16	70%	**70**
1:30pm	16	70%	
2:00pm	16	70%	
2:30pm	14	61%	
3:00pm	11	48%	
Sub Total	**23**		

Block E

9:00am	31	72%	
9:30am	30	70%	
10:00am	38	88%	
10:30am	39	91%	
11:00am	37	86%	
11:30am	37	86%	
12 noon	38	88%	
12:30pm	33	77%	**77**
1:00pm	36	84%	

1:30pm	36	84%	
2:00pm	36	84%	
2:30pm	35	81%	
3:00pm	34	79%	
Sub Total	**43**		

Block F

9:00am	28	80%	
9:30am	28	80%	
10:00am	28	80%	
10:30am	28	80%	
11:00am	28	80%	
11:30am	28	80%	
12 noon	28	80%	
12:30pm	24	69%	**80**
1:00pm	28	80%	
1:30pm	28	80%	
2:00pm	28	80%	
2:30pm	28	80%	
3:00pm	28	80%	
Sub Total	**35**		

Block G

9:00am	28	76%	
9:30am	28	76%	
10:00am	28	76%	
10:30am	28	76%	**76**
11:00am	28	76%	
11:30am	28	76%	
12 noon	28	76%	
12:30pm	24	65%	
1:00pm	28	76%	
1:30pm	28	76%	
2:00pm	28	76%	
2:30pm	28	76%	
3:00pm	28	76%	
Sub Total	**37**		

Block H

9:00am	35	78%	
9:30am	35	78%	
10:00am	35	78%	
10:30am	35	78%	**78**
11:00am	35	78%	
11:30am	35	78%	
12 noon	35	78%	
12:30pm	30	67%	
1:00pm	30	67%	
1:30pm	32	71%	
2:00pm	35	78%	
2:30pm	35	78%	
3:00pm	35	78%	
Sub Total	**45**		
TOTAL AVERAGE			**75.2222**