DKPartnership Dublin Cork London
T : 01-813-1930 T : 064-664-1686
E : post@dkpartnership.com

5020 Daylight Reception Analysis Report

DAYLIGHT RECEPTION IN HABITABLE ROOMS WITHIN THE PROPOSED DEVELOPMENT

Phase 5 – Development at Oldtown

Proposed Residential Development

Oldtown,
Swords,
Co. Dublin

Gerard Gannon Properties

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ING Gerard (Craig) van Deventer CEng., BE(mech)., HDip CIOB, MCIBSE

M : [00] 353 (0)87 260 8080
E : gerard@dkpartnership.com

DKPartnership
70 Main Street, Applewood , Swords, Co. Dublin, Ireland
Reen Kenmare Co. Kerry

post@dkpartnership.com
www.dkpartnership.com

T : [00] 353 (0) 1813 1930
T : [00] 353 (0)64664 1686

Contents

1 Introduction

1.1 Report purpose

This report gives information on the level of achieved daylight reception in habitable rooms within the proposed new development.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Oldtown, Swords, Co. Dublin.

1.3 Brief development description

'A proposed Strategic Housing Development consisting of the removal of the temporary site office/site compound structures on site and the construction of 377 no. residential units comprising of duplexes, apartments and houses, all with associated car parking; a childcare facility with associated car parking; landscaping including play equipment; boundary treatments; public lighting; and all associated engineering and site works necessary to facilitate the development including proposed vehicular accesses onto Miller's Avenue, and a proposed stormwater storage tank (with proposed vehicular/service access onto Balheary Road) and overflow outfall gravity sewer to the Broadmeadow River with associated manholes on lands locally known as the Celestica/Motorola site, junction of Glen Ellan Road and Balheary Road, and at/on Balheary Road.'

1.4 Policy and building regulation requirements

There are no particular building regulations in relation day light/shadow effect standards other than recommendations outlined or referred to in the CIBSE lighting guide 10, BS EN17037/EN17037 and the BRE document" Site layout planning for daylight and sun light".

2 Executive summary

2.1 Analysis conducted

This report details the achieved calculated daylight reception in habitable rooms within the new development and compares these for compliance with the recommendations of the relevant guidelines and standards.

2.2 Daylight reception and building orientation

Day light reception in habitable rooms within the proposed development under the BRE, CIBSE and BS EN17037/EN17037 is calculated using the area of the glazed element, the room depth/height ratio, the room light reflection capability and the amount of direct or blocked/partially blocked daylight it receives. i.e. building orientation is not relevant to day light reception or daylight reception calculations. In other words day light factor analysis is equal to all orientations. This note is for clarity as day light is often confused with sunlight or sunlight energy which is effected by orientation.

2.3 Guidelines and standards applied

For this report we applied the recommendations and guideline of the following;

- The Building Research Establishment (BRE) report, site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
- British European Standard BS EN17037/EN17037 Day lighting standards and contains guidance on the minimum recommended levels of interior day lighting.
- CIBSE guide 10 Day light and lighting for buildings.

2.4 Technical analysis

The amount of daylight received in a room is calculated and expressed as a daylight factor. This calculated daylight factor is then compared with the BRE recommended room daylight factor to ensure sufficient daylight reception. Calculations were conducted in accordance with the BRE guidelines to determine the average day light factor in a number of selected rooms within the new development. These selected rooms are generally in (daylight) challenging locations typically based at the lowest (ground floor) levels given that these would receive the least amount of day light. Once the ground floor rooms achieve compliance all other rooms at higher levels with similar room/window configurations and parameters will also achieve compliance as the vertical daylight impact angle will improve increasing the daylight reception typically 0.3%-0.5% per floor level (3m).

2.5 Daylight reception in rooms within the new development conclusion

The calculation assessment has been segregated according to building type, these are;
(I) Residential Apartment blocks: A, B1, B2 and C.
(II) Residential Duplex blocks: A, B, C, D, E and F.
(III) Residential Housing.
The BRE report recommends as a methodology for assessing sufficient daylight reception in a habitable room, that the calculated average daylight factor (ADF) of a habitable room to be in excess of the BRE bench marks of a kitchen at 2%, a living room at 1.5%, a bedroom at 1%, a living/kitchen/dining room at 2% and a living room/bedroom at 1.5%. Calculation findings are as follows; (see images in chapter 5 for receptor locations):

(I) Residential apartment blocks: A, B1, B2 and C.
From the calculation results presented in table 5.1 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline or are equal to minimum guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline.
- Level 02: All floors above the first floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

(II) Residential Duplex blocks: A, B, C, D, E and F.
From the calculation results presented in table 5.2 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline or are equal to minimum guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline.

- Level 02: All floors above the first floor dwellings are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor.

(III) Residential housing
From the calculation results presented in table 5.3 we note;
- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline.
- Level 01: All floors above the ground floor level are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor.

Given the results and conclusions above we, DKP, deem the proposed project at Oldtown to be in compliance with the recommendations in the BRE design guidelines 'site layout and planning for daylight and sunlight - a guide to good practice'.

2.6 Mitigation measures/actions

No mitigation measures anticipated.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google) site map below indicates the location of the site approximately outlined.

Image 3.1 proposed development site outline

4 Approach and methodology

4.1 General approach

This report covers the day light reception of habitable rooms within the new proposed development. The day light reception is expressed as the average day light factor (ADF) in the following rooms:
- Bed rooms within dwellings
- Living rooms/dining rooms
- Kitchens
- Any combination of the above

4.2 The nature and effects of day light and sun light

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still comes in through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings and late evenings during the summer months. It is therefore important to ensure that new buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

4.3 Assessment criteria

National Policy/building regulations:

The government does not have an adopted policy on daylight, sunlight and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance in the way it has for other environmental impacts such as noise, landscape or air quality. However, there are a number of guidance documents which are relevant when considering daylight, sunlight and overshadowing in dwellings:

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
  Although not Government guidance, this report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- British European Standard BS EN17037 / EN17037 Day Lighting for buildings.
  BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- CIBSE guide 10 Day light and lighting for buildings.
  CIBSE lighting guide 10, BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces recommended day light levels for general buildings.

4.4 The BRE Report – "Site Layout and Planning for Daylight and Sunlight – A Guide to Good Practice"

The BRE report contains guidance on how to design developments whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy, its aim is to help rather than constrain the designer. Although it gives numerical guidance values these should be interpreted flexibly since natural lighting is one of many factors in site layout design. The guidance should be applied appropriately to developments to assist in gaining the best development possible without adverse impacts.

As well as advice the report contains a methodology to assess levels of daylight, sunlight and over shadowing and contains criteria to determine the potential impacts of a new development on surrounding buildings. Table 4.1 below details the BRE assessment criteria for daylight reception within the proposed development.

Analysis	Description	Acceptable parameters
Daylight reception criterion	Average daylight factor (ADF)	Habitable rooms to have ADF factors between 1% and 2% pending room type

Table 4.1

There are also recommendations with regards to minimum proposed glazed area in facades in relation to the available sky view component angle. BS EN17037/EN17037 gives guidance on the minimum glazed area with different virtual sky component angles to maintain sufficient daylight reception. Table 4.2 presents the minimum glazed areas fractions relative to the available sky view angle.

Room depth	VSC <=25°	VSC >=25° <=45°	VSC >=45° <=65°	VSC >=65°	Comments
1 to 8	20%	20% - 31%	31% - 35%	35% - 40%	
8 – 11	25%	25% - 40%	40% - 44%	44% - 50%	
11 – 14	30%	30% - 47%	47% - 53%	53% - 60%	
14 - 20	35%	35% - 54%	54% - 61%	61% - 70%	

Table 4.2

4.5 ADF or Average day light factor

The average day light assessment is the amount of day light received by the habitable rooms in the proposed development only. Whereas there are no standards applied for day light factors there are recommendations published in the CIBSE guides and BRE documents in relation to the percentage and minimum area of the room/area to conform to same. Table 4.4 below represents recommended minimum day light factors.

Habitable room types		Minimum day light factor	Minimum floor area cover
Multi-residential buildings	Kitchen	2%	75%
Multi-residential buildings	Living rooms, dining rooms,	1.50%	70%
Multi-residential buildings	Bedrooms	1%	50%

Table 4.3

4.6 ADF or Average Daylight Factor calculation method

The average daylight factor provides a useful technique for assessing the daylight potential of interior spaces under standard overcast conditions. The average daylight factor *df* is defined as;

$df = TAw\ q / [A\ (1-R^2)]\ \%$

where,
T is the diffuse visible transmittance of the glazing, including corrections for dirt on glass
Aw is the net glazed area of the window (m^2)
A is the total area of the room surfaces: ceiling, floor, walls and windows (m^2)
R is their average reflectance of the ceiling, walls and floor surfaces
q is the angle of visible sky in degrees (VSC)

4.7 Project ADF calculation parameters

The following calculation parameters have been applied. For T (Em), the overall maintained light transmittance into the room we applied a conservative 0.66. Current triple glazed elements can now be supplied with light emittance in excess of 0.72 effecting/improving the final resultant ADF by a further 0.3% to 0.5%.

Glass light emittance	0.72
Glazing maintenance factor	8%
Maintained light emittance Em	0.66

For R (Rf), the average reflectance of the walls, ceiling and floor we have used an overall average figure 0.61 representing a dark floor, medium dark walls and a light ceiling. R can also be significantly improved by implementing lighter colours on the walls and floor effecting/improving the ADF by 0.5% to 0.7%.

Ceiling	0.8	95%	Light
Walls	0.6	80%	Medium dark
Floor	0.4	70%	Dark
Combined Rf	0.61		

For q, the vertical sky component angle we use the combined calculated vertical sky component over the full visual horizontal plane from the relevant window/room point. i.e. at each obstacle in the general 180° horizontal view plane the vertical sky component is measured and combined to form the overall resultant VSC. The illustration 4.1 below shows the room analysed to be effected by 3 different vertical sky component angles A, B and C on its horizontal plane. The resultant VSC is a calculated combination of all three VSC angles.

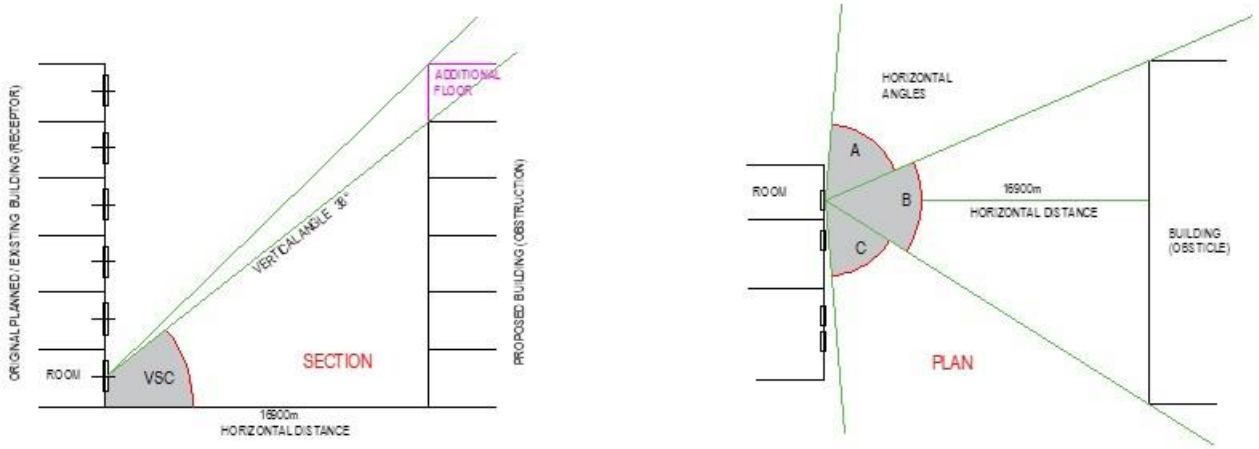

Image 4.1

5 Basis of receptor selection of habitable rooms within the development and Calculation results

5.1 Basis of receptor (room) selection

The daylight reception assessment has been targeted to rooms which are perceived to receive less day light i.e. ground floor rooms / rooms facing close-by large obstacles. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms. A combined total of 185 room locations have been selected on the basis that these locations are more daylight challenging.

5.2 Assessment approach and colour indicators

The result tables provide the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.
The assessment has been segregated according to building type, these are;

(I) Residential Apartment blocks – A, B1, B2 and C.
(II) Residential Duplex blocks – A, B, C, D, E and F.
(III) Residential Housing.

Note: The ADF calculation results have been given the following colour code guide depending on its level of resulting compliance. The overall conclusion is presented at the end of the chapter.

Compliance guide		
☑	0%	Over /equal to
☑	5%	Within
!!	10%	Within
x	10%	In excess of

5.3 (I) Residential Apartment Blocks – receptors and ADF calculation results

Receptors: Images 5.1 to 5.8 indicate the locations of the rooms chosen from residential apartment blocks A, B1, B2 and C for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

Image 5.1: Level 00 with selected rooms – Apartment block A

Image 5.2: Level 01 with selected rooms – Apartment block A

Image 5.3: Level 00 with selected rooms – Apartment block B1

Image 5.4: Level 01 with selected rooms – Apartment block B1

Image 5.5: Level 00 with selected rooms – Apartment block B2

Image 5.6: Level 01 with selected rooms – Apartment block B2

Image 5.7: Level 00 with selected rooms – Apartment block C

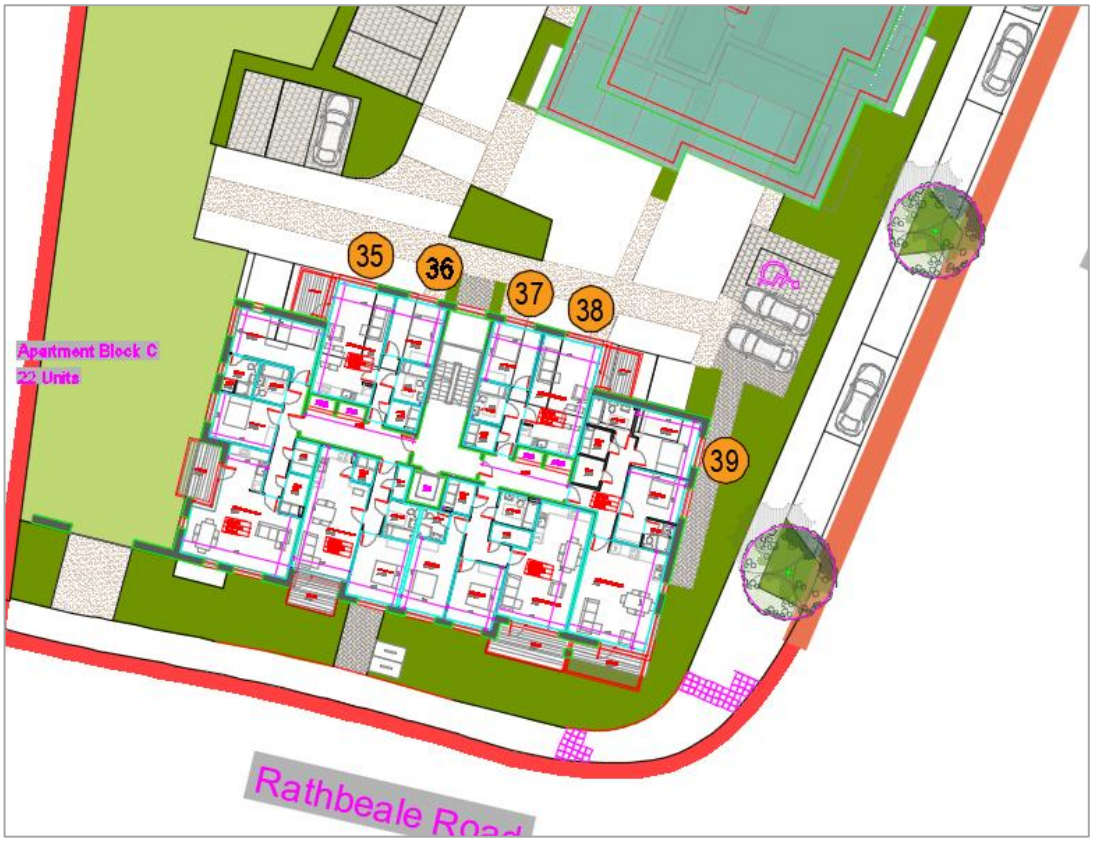

Image 5.8: Level 01 with selected rooms – Apartment block C

ADF calculation results: Residential apartment blocks – A, B1, B2 and C.

The table below provides the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor Level	Room / type	Hor Sec a Hor ∟°	Hor Sec a Vert ∟°	Hor Sec b Hor ∟°	Hor Sec b Vert ∟°	Hor Sec c Hor ∟°	Hor Sec c Vert ∟°	Hor Sec d Hor ∟°	Hor Sec d Vert ∟°	∑ Hor ∟	∑ VSC ∟	glass area m2	Room width m	Room depth m	Room height m	Room ADF %	BRE ADF %
1	block A	Apt 01	00	Living - Kitchen	83	6	28	23	37	15	32	10	180	33%	4.20	4.40	5.20	2.70	3.65	2.00
2	block A	Apt 01	00	Bed room	48	7	116	6	16	20			180	35%	2.00	3.60	3.10	2.70	3.04	1.00
3	block A	Apt 02	00	Living - Kitchen	28	80	22	7	120	6	10	17	180	30%	4.20	3.50	6.30	2.70	3.35	2.00
4	block A	Apt 22	00	Living - Kitchen	4	75	117	7	30	8	29	6	180	34%	4.20	4.80	6.40	2.70	3.03	2.00
5	block A	Apt 22	00	Bed room	13	80	48	7	119	7			180	33%	2.00	3.20	3.20	2.70	3.04	1.00
6	block A	Apt 05	01	Bed room	48	5	29	17	57	15	46	9	180	33%	2.00	3.60	3.60	2.70	2.62	1.00
7	block A	Apt 04	01	Living - Kitchen	49	9	42	37	67	16	22	6	180	30%	3.60	3.30	6.90	2.70	2.79	2.00
8	block A	Apt 04	01	Bed room	39	9	42	37	76	17	23	6	180	30%	2.00	3.10	3.70	2.70	2.58	1.00
9	block A	Apt 09	01	Bed room	29	8	38	37	87	18	26	6	180	30%	2.00	3.10	3.70	2.70	2.58	1.00
10	block A	Apt 09	01	Living - Kitchen	25	8	35	36	92	18	28	6	180	30%	4.00	3.30	6.90	2.70	3.07	2.00
11	block A	Apt 08	01	Bed room	53	74	91	17	20	6	16	70	180	22%	2.00	3.40	3.10	2.70	2.02	1.00
12	block A	Apt 26	01	Bed room	15	70	6	6	107	18	52	75	180	22%	2.00	3.40	3.10	2.70	1.98	1.00
13	block A	Apt 25	01	Living - Kitchen	14	6	22	14	97	18	47	6	180	32%	4.00	3.30	6.90	2.70	3.28	2.00
14	block A	Apt 30	01	Bed room	11	6	61	13	42	25	66	6	180	32%	2.00	3.10	3.70	2.70	2.79	1.00
15	block A	Apt 30	01	Living - Kitchen	11	6	49	13	43	25	77	6	180	33%	4.00	3.30	6.90	2.70	3.32	2.00
16	block B1	Apt 01	00	Living - Kitchen	45	75	76	18	37	5	22	13	180	26%	4.20	4.60	7.55	2.70	2.05	2.00
17	block B1	Apt 01	00	Bed room	42	6	76	18	30	5	32	14	180	33%	2.00	2.90	3.90	2.70	2.82	1.00
18	block B1	Apt 02	00	Living - Kitchen	45	75	59	18	33	6	43	16	180	26%	4.20	4.50	7.55	2.70	2.06	2.00
19	block B1	Apt 05	01	Living - Kitchen	10	11	108	6	43	18	19	75	180	31%	4.00	4.10	7.50	2.70	2.56	2.00
20	block B1	Apt 07	01	Bed room	73	6	57	25	30	11	20	15	180	32%	2.00	3.10	3.60	2.70	2.81	1.00
21	block B1	Apt 07	01	Living - Kitchen	63	6	59	25	29	12	29	75	180	28%	4.00	3.70	6.50	2.70	2.75	2.00
22	block B1	Apt 08	01	Bed room	45	6	56	25	51	11	28	20	180	31%	2.00	3.20	3.56	2.70	2.71	1.00
23	block B1	Apt 08	01	Living - Kitchen	21	75	68	25	57	11	34	23	180	27%	4.00	4.10	7.50	2.70	2.22	2.00
24	block B2	Apt 01	00	Living - Kitchen	44	75	25	6	111	19			180	25%	4.20	4.60	7.55	2.70	2.00	2.00
25	block B2	Apt 01	00	Bed room	35	6	117	19	28	7			180	32%	2.00	2.90	3.90	2.70	2.74	1.00
26	block B2	Apt 02	00	Living - Kitchen	44	75	14	6	113	19	9	8	180	25%	4.20	4.50	7.55	2.70	2.01	2.00
27	block B2	Apt 04	01	Living - Kitchen	25	70	109	15	41	6	5	10	180	29%	4.00	4.10	7.70	2.70	2.36	2.00
28	block B2	Apt 05	01	Living - Kitchen	33	39	117	6	5	8	25	70	180	29%	4.00	4.10	7.50	2.70	2.40	2.00
29	block B2	Apt 05	01	Bed room	27	38	122	6	31	8			180	33%	2.00	3.20	3.50	2.70	2.90	1.00
30	block B2	Apt 08	01	Bed room	13	15	118	6	49	16			180	34%	2.00	3.20	3.56	2.70	2.93	1.00
31	block B2	Apt 08	01	Living - Kitchen	17	70	108	6	55	17			180	31%	4.00	4.10	7.70	2.70	2.54	2.00
32	block C	Apt 01	00	Living - Kitchen	44	80	37	9	99	15			180	25%	4.20	3.30	7.00	2.70	2.68	2.00
33	block C	Apt 02	00	Bed room	124	15	56	9					180	32%	2.00	3.20	3.90	2.70	2.62	1.00
34	block C	Apt 03	00	Living - Kitchen	44	80	85	15	51	8			180	26%	4.20	4.30	7.55	2.70	2.15	2.00
35	block C	Apt 06	01	Living - Kitchen	24	9	51	23	26	7	79	6	180	33%	4.00	3.70	7.03	2.70	3.08	2.00
36	block C	Apt 06	01	Bed room	28	9	52	24	26	7	74	6	180	33%	2.00	3.10	3.60	2.70	2.88	1.00
37	block C	Apt 07	01	Bed room	36	10	65	33	8	7	71	6	180	31%	2.00	3.10	3.60	2.70	2.71	1.00
38	block C	Apt 07	01	Living - Kitchen	44	11	74	26	62	6			180	31%	4.00	3.70	7.03	2.70	2.92	2.00
39	block C	Apt 08	01	Bed room	57	9	92	15	12	6	19	19	180	32%	2.00	3.50	3.99	2.70	2.43	1.00

Table 5.1: Residential apartment blocks results

5.4 (II) Residential Duplex Blocks – receptors and ADF calculation results

Receptors: Images 5.9 to 5.20 indicate the locations of the rooms chosen from residential duplex blocks A, B, C, D, E and F for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

Image 5.9: Level 00 with selected rooms – Duplex block A

Image 5.10: Level 01 with selected rooms – Duplex block A

Image 5.11: Level 00 with selected rooms – Duplex block B

Image 5.12: Level 01 with selected rooms – Duplex block B

Image 5.13: Level 00 with selected rooms – Duplex block C

Image 5.14: Level 01 with selected rooms – Duplex block C

Image 5.15: Level 00 with selected rooms – Duplex block D

Image 5.16: Level 01 with selected rooms – Duplex block D

Image 5.17: Level 00 with selected rooms – Duplex block E

Image 5.18: Level 01 with selected rooms – Duplex block E

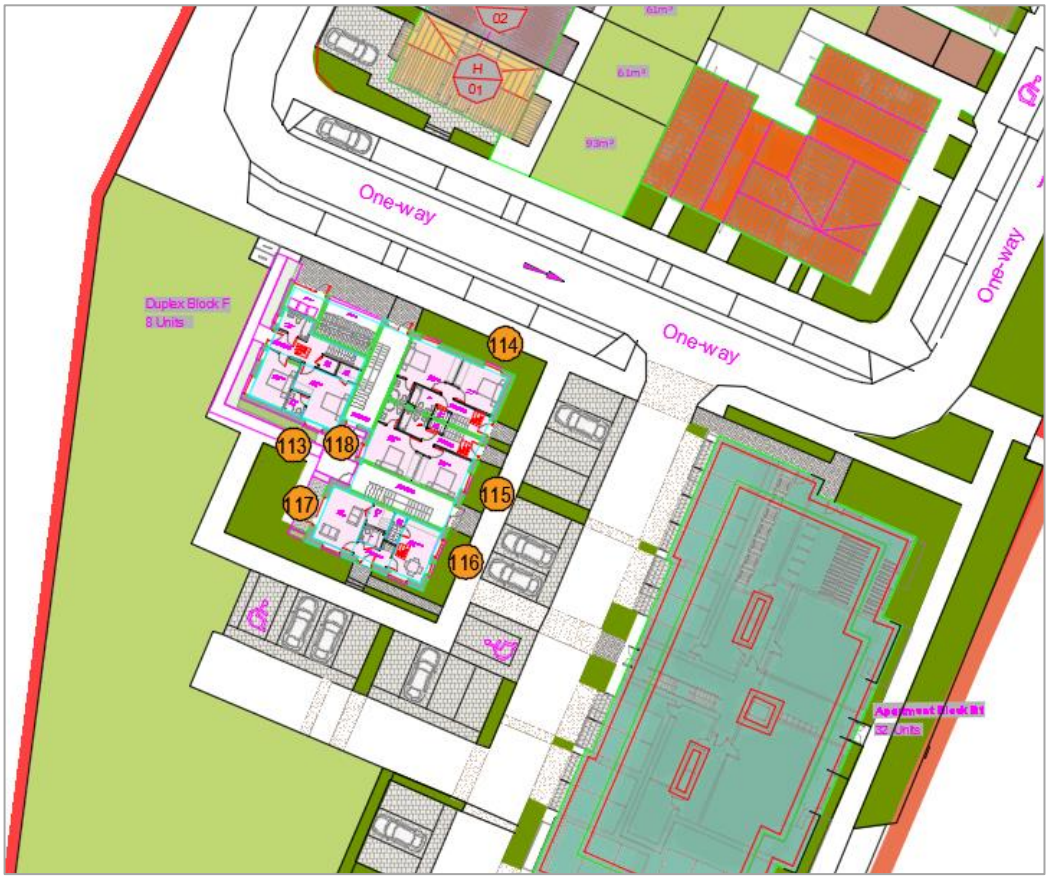

Image 5.19: Level 00 with selected rooms – Duplex block F

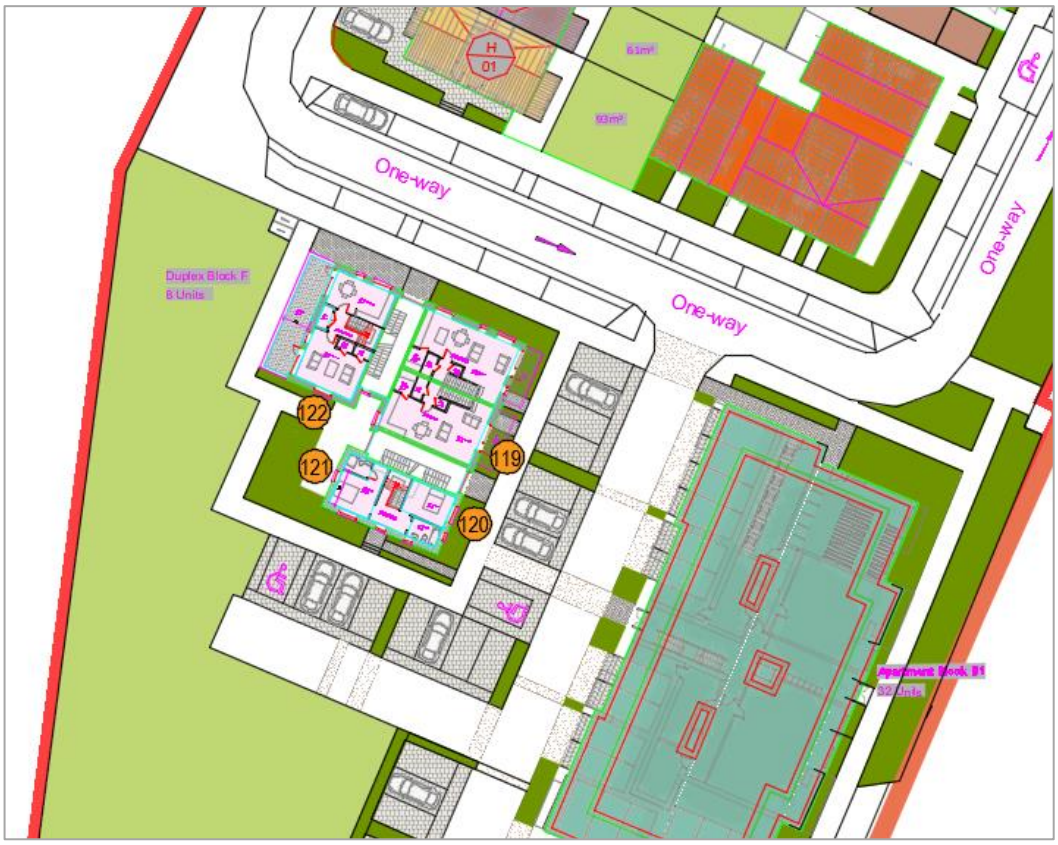

Image 5.20: Level 01 with selected rooms – Duplex block F

ADF calculation results: Residential Duplex blocks – A, B, C, D, E and F

The table below provides the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Level	Room / type	Hor Sec a Hor ∟°	Hor Sec a Vert ∟°	Hor Sec b Hor ∟°	Hor Sec b Vert ∟°	Hor Sec c Hor ∟°	Hor Sec c Vert ∟°	Hor Sec d Hor ∟°	Hor Sec d Vert ∟°	∑ Hor ∟	∑ VSC ∟	glass area m2	Room width m	Room depth m	Room height m	Room ADF %	BRE ADF %
40	duplex A	Apt 02	00	Bed room	25	5	98	14	35	6	22	11	180	33%	2.00	3.30	3.96	2.70	2.61	1.00
41	duplex A	Apt 01	00	Living - Kitchen	28	5	104	14	27	6	21	11	180	33%	2.60	2.70	5.44	2.70	3.02	2.00
42	duplex A	Apt 01	00	Living	67	31	19	5	94	44			180	23%	3.60	4.70	3.60	2.70	2.71	1.50
43	duplex A	Apt 02	00	Bed room	62	31	14	5	13	44	91	80	180	15%	2.00	3.30	4.50	2.70	1.06	1.00
44	duplex A	Apt 04	00	Living	18	23	12	5	80	31	70	62	180	21%	3.60	4.70	3.60	2.70	2.44	1.50
45	duplex A	Apt 06	00	Living	28	28	15	7	96	31	41	45	180	25%	4.00	5.90	3.80	2.70	2.59	1.50
46	duplex A	Apt 08	00	Bed room	77	80	9	25	13	6	81	28	180	18%	2.00	3.38	4.50	2.70	1.23	1.00
47	duplex A	Apt 09	00	Living	85	31	20	6	31	19	44	70	180	23%	4.00	4.70	3.60	2.70	2.98	1.50
48	duplex A	Apt 07	00	Bed room	62	7	75	17	22	9	21	19	180	32%	2.00	4.50	3.38	2.70	2.28	1.00
49	duplex A	Apt 06	00	Living - Kitchen	70	7	83	25	27	9			180	31%	2.60	2.70	4.20	2.70	3.48	2.00
50	duplex A	Apt 05	00	Living - Kitchen	59	7	87	28	34	9			180	30%	2.60	2.70	5.44	2.70	2.77	2.00
51	duplex A	Apt 04	00	Living - Kitchen	52	7	89	28	39	9			180	30%	2.60	2.70	5.44	2.70	2.76	2.00
52	duplex A	Apt 03	00	Bed room	42	6	79	28	43	9	16	11	180	31%	2.00	3.90	3.38	2.70	2.41	1.00
53	duplex A	Apt 01	01	Bed room	65	26	20	5	20	16	75	37	180	27%	2.00	4.70	2.83	2.70	2.02	1.00
54	duplex A	Apt 04	01	Bed room	68	52	80	26	13	5	19	18	180	24%	2.00	4.70	2.83	2.70	1.82	1.00
55	duplex A	Apt 06	01	Bed room	28	23	14	5	98	26	40	31	180	27%	2.00	3.75	2.80	2.70	2.49	1.00
56	duplex A	Apt 06	01	Bed room	25	22	15	5	98	26	42	32	180	27%	1.60	2.60	3.26	2.70	2.31	1.00
57	duplex A	Apt 09	01	Bed room	81	17	20	6	17	16	62	31	180	29%	2.00	4.70	2.83	2.70	2.23	1.00
58	duplex A	Apt 07	01	Living - Kitchen	18	21	19	6	70	10	73	6	180	34%	4.00	8.56	5.38	2.70	2.09	2.00
59	duplex A	Apt 04	01	Bed room	9	8	27	7	91	17	53	6	180	33%	2.00	3.70	3.95	2.70	2.39	1.00
60	duplex A	Apt 03	01	Living - Kitchen	44	5	80	17	42	8	14	8	180	33%	5.00	8.56	5.38	2.70	2.55	2.00
61	duplex A	Apt 02	01	Living - Kitchen	25	5	97	11	33	6	25	10	180	34%	4.00	5.38	8.56	2.70	2.09	2.00
62	duplex B	Apt 01	00	Living - Kitchen	9	10	43	6	88	7	40	7	180	35%	2.60	2.70	5.58	2.70	3.11	2.00
63	duplex B	Apt 01	00	Living	29	9	52	12	27	28	72	57	180	25%	3.60	4.70	3.60	2.70	2.87	1.50
64	duplex B	Apt 04	00	Living	73	56	45	18	20	6	42	14	180	25%	3.60	4.70	3.60	2.70	2.90	1.50
65	duplex B	Apt 04	00	Living - Kitchen	72	6	20	10	42	8	46	8	180	35%	2.60	2.70	5.44	2.70	3.16	2.00
66	duplex B	Apt 03	00	Bed room	78	6	20	10	38	8	44	8	180	35%	2.00	3.38	3.96	2.70	2.69	1.00
67	duplex B	Apt 02	00	Bed room	10	10	43	6	73	7	54	7	180	35%	2.00	3.38	3.96	2.70	2.70	1.00
68	duplex B	Apt 01	01	Bed room	29	7	52	10	27	25	72	52	180	26%	2.20	4.70	2.80	2.70	2.18	1.00
69	duplex B	Apt 04	01	Bed room	73	52	45	16	20	5	42	12	180	26%	2.20	4.70	2.80	2.70	2.19	1.00
70	duplex B	Apt 04	01	Bed room	72	5	20	8	42	7	46	7	180	35%	2.20	3.03	3.95	2.70	3.22	1.00
71	duplex B	Apt 03	01	Living - Kitchen	78	5	20	8	38	7	44	7	180	35%	4.00	5.38	8.64	2.70	2.14	2.00
72	duplex C	Apt 03	00	Bed room	76	6	23	10	59	7	22	8	180	35%	2.00	3.38	3.96	2.70	2.69	1.00
73	duplex C	Apt 04	00	Living - Kitchen	69	6	26	10	59	7	26	9	180	35%	2.40	2.70	5.44	2.70	2.92	2.00
74	duplex C	Apt 04	00	Living	48	56	37	15	55	13	40	38	180	25%	3.60	4.70	3.60	2.70	2.94	1.50
75	duplex C	Apt 01	00	Living	67	56	37	29	22	7	54	13	180	25%	3.60	4.70	3.60	2.70	2.88	1.50
76	duplex C	Apt 01	00	Living - Kitchen	11	10	56	7	105	6	8	10	180	35%	2.40	2.70	5.59	2.70	2.88	2.00
77	duplex C	Apt 03	01	Living - Kitchen	75	5	23	9	54	6	28	7	180	35%	4.00	5.38	8.64	2.70	2.15	2.00
78	duplex C	Apt 04	01	Bed room	48	50	37	13	55	11	40	36	180	26%	2.00	4.70	2.80	2.70	2.02	1.00
79	duplex C	Apt 01	01	Bed room	67	50	37	26	22	5	54	11	180	26%	2.00	4.70	2.80	2.70	2.01	1.00

Table continued on next page ►

80	duplex D	Apt 10	**00**	Living - Kitchen	23	15	15	6	111	11	31	19	180	33%	2.40	2.70	5.40	2.70	2.75	2.00
81	duplex D	Apt 10	**00**	Living	18	10	74	13	24	19	64	49	180	27%	3.60	4.70	3.60	2.70	3.14	1.50
82	duplex D	Apt 09	**00**	Bed room	24	75	68	12	88	75			180	17%	2.00	3.38	4.50	2.70	1.15	1.00
83	duplex D	Apt 07	**00**	Living	64	73	23	12	79	11	14	68	180	22%	3.60	4.70	3.60	2.70	2.59	1.50
84	duplex D	Apt 06	**00**	Living	32	70	25	20	93	12	30	68	180	24%	3.60	5.61	3.80	2.70	2.38	1.50
85	duplex D	Apt 04	**00**	Living	17	60	47	11	48	20	68	75	180	20%	3.60	4.70	3.60	2.70	2.36	1.50
86	duplex D	Apt 02	**00**	Bed room	86	75	18	25	53	12	23	75	180	17%	2.00	3.38	4.50	2.70	1.14	1.00
87	duplex D	Apt 01	**00**	Living	67	65	26	24	57	9	30	11	180	24%	3.60	4.70	3.60	2.70	2.84	1.50
88	duplex D	Apt 01	**00**	Living - Kitchen	50	9	95	14	35	8			180	33%	2.40	2.70	5.40	2.70	2.79	2.00
89	duplex D	Apt 02	**00**	Bed room	43	8	98	14	39	9			180	33%	2.00	3.38	3.96	2.70	2.55	1.00
90	duplex D	Apt 03	**00**	Bed room	32	12	70	9	46	9	32	8	180	34%	2.00	4.50	3.38	2.70	2.39	1.00
91	duplex D	Apt 04	**00**	Living - Kitchen	28	11	71	9	47	9	34	8	180	34%	2.80	2.70	5.44	2.70	3.33	2.00
92	duplex D	Apt 06	**00**	Living - Kitchen	22	10	71	8	47	9	40	9	180	34%	2.80	2.80	4.29	2.70	3.94	2.00
93	duplex D	Apt 07	**00**	Living - Kitchen	27	8	54	8	64	10	35	9	180	34%	2.80	2.70	5.59	2.70	3.27	2.00
94	duplex D	Apt 08	**00**	Bed room	23	7	62	7	59	10	36	10	180	34%	2.00	3.96	3.38	2.70	2.65	1.00
95	duplex D	Apt 09	**00**	Bed room	21	15	13	6	118	11	28	19	180	33%	2.00	3.38	3.96	2.70	2.52	1.00
96	duplex D	Apt 10	**01**	Bed room	18	8	74	11	24	18	64	46	180	28%	2.00	4.70	2.83	2.70	2.12	1.00
97	duplex D	Apt 07	**01**	Bed room	64	65	23	11	79	9	14	61	180	24%	2.00	4.70	2.83	2.70	1.84	1.00
98	duplex D	Apt 04	**01**	Bed room	17	52	47	9	48	17	68	65	180	23%	2.00	4.70	2.83	2.70	1.74	1.00
99	duplex D	Apt 01	**01**	Bed room	67	60	26	21	57	8	30	9	180	26%	2.00	4.70	2.83	2.70	1.96	1.00
100	duplex D	Apt 02	**01**	Living - Kitchen	43	6	98	12	39	7			180	34%	4.00	5.30	8.56	2.70	2.10	2.00
101	duplex D	Apt 09	**01**	Living - Kitchen	21	13	13	5	118	8	28	16	180	34%	4.00	5.30	8.56	2.70	2.11	2.00
102	duplex E	Apt 04	**00**	Living - Kitchen	36	6	44	24	68	8	32	36	180	31%	2.80	2.70	5.44	2.70	3.03	2.00
103	duplex E	Apt 04	**00**	Living	48	55	45	17	15	5	72	20	180	26%	4.00	4.70	3.60	2.70	3.43	1.50
104	duplex E	Apt 03	**00**	Bed room	88	75	17	17	9	5	66	20	180	19%	2.00	3.38	4.50	2.70	1.31	1.00
105	duplex E	Apt 01	**00**	Living	67	58	87	20	9	5	17	19	180	24%	4.00	4.70	3.60	2.70	3.11	1.50
106	duplex E	Apt 01	**00**	Living - Kitchen	90	7	32	11	58	10			180	34%	2.80	2.70	5.59	2.70	3.28	2.00
107	duplex E	Apt 02	**00**	Bed room	75	7	34	11	71	10			180	34%	2.00	3.38	3.96	2.70	2.63	1.00
108	duplex E	Apt 03	**00**	Bed room	30	6	42	24	58	8	50	38	180	30%	2.00	3.38	3.96	2.70	2.28	1.00
109	duplex E	Apt 04	**01**	Bed room	38	4	45	17	52	32	45	7	180	31%	2.00	3.03	3.95	2.70	2.59	1.00
110	duplex E	Apt 04	**01**	Bed room	45	33	49	11	13	5	73	13	180	31%	2.00	4.70	2.80	2.70	2.36	1.00
111	duplex E	Apt 01	**01**	Bed room	19	13	9	5	86	13	66	49	180	27%	2.00	4.70	2.80	2.70	2.07	1.00
112	duplex E	Apt 03	**01**	Living - Kitchen	30	4	43	19	49	32	58	7	180	31%	4.80	5.38	8.64	2.70	2.27	2.00
113	duplex F	Apt 01	**00**	Bed room	67	66	50	5	63	6			180	26%	2.00	3.38	4.50	2.70	1.83	1.00
114	duplex F	Apt 02	**00**	Bed room	47	6	53	22	46	14	34	8	180	32%	2.00	3.96	3.38	2.70	2.50	1.00
115	duplex F	Apt 03	**00**	Bed room	56	18	94	38	30	18			180	26%	2.00	3.38	3.96	2.70	2.00	1.00
116	duplex F	Apt 04	**00**	Living - Kitchen	44	17	98	38	38	18			180	26%	4.00	2.70	5.44	2.70	3.61	2.00
117	duplex F	Apt 04	**00**	Living	50	56	70	6	60	7			180	29%	4.00	4.70	3.60	2.70	3.82	1.50
118	duplex F	Apt 03	**00**	Bed room	88	75	69	7	23	75			180	18%	2.00	3.38	4.50	2.70	1.22	1.00
119	duplex F	Apt 03	**01**	Living - Kitchen	57	14	93	34	17	13	13	6	180	28%	4.80	5.38	8.64	2.70	2.05	2.00
120	duplex F	Apt 04	**01**	Bed room	43	13	99	34	24	14	14	7	180	28%	2.00	3.03	3.95	2.70	2.30	1.00
121	duplex F	Apt 04	**01**	Bed room	50	65	87	6	43	6			180	28%	2.00	4.70	2.80	2.70	2.18	1.00
122	duplex F	Apt 01	**01**	Living - Kitchen	67	65	62	6	51	6			180	26%	3.00	5.34	3.51	2.70	2.35	2.00

Table 5.2: Residential duplex blocks results

5.5 (III) Residential Housing – receptors and ADF calculation results

Receptors: Images 5.21 to 5.25 indicate the locations of the rooms chosen from the residential houses for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

Image 5.21: Level 00 with selected rooms – Residential Houses

Image 5.22: Level 00 with selected rooms – Residential Houses

Image 5.23: Level 00 with selected rooms – Residential Houses

Image 5.24: Level 00 with selected rooms – Residential Houses

Image 5.25: Level 00 with selected rooms – Residential Houses

ADF calculation results: Residential Housing

The table below provides the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor Level	Room / type	Hor Sec a Hor ∟°	Hor Sec a Vert ∟°	Hor Sec b Hor ∟°	Hor Sec b Vert ∟°	Hor Sec c Hor ∟°	Hor Sec c Vert ∟°	Hor Sec d Hor ∟°	Hor Sec d Vert ∟°	∑ Hor ∟	∑ VSC ∟	glass area m2	Room width m	Room depth m	Room height m	Room ADF %	BRE ADF %
123	HT K	116	00	Living - Kitchen	19	70	71	28	62	8	28	5	180	29%	3.14	5.50	5.00	2.70	2.07	2.00
124	HT K	115	00	Living - Kitchen	16	5	111	29	21	7	32	5	180	29%	3.14	5.50	5.00	2.70	2.13	2.00
125	HT S	114	00	Living - Kitchen	36	5	59	33	37	8	48	17	180	30%	3.14	5.10	4.45	2.70	2.51	2.00
126	HT S	113	00	Living - Kitchen	51	5	69	34	20	8	40	17	180	30%	3.14	5.10	4.45	2.70	2.47	2.00
127	HT T	109	00	Living - Kitchen	51	12	103	17	26	5			180	32%	3.14	5.50	5.10	2.70	2.27	2.00
128	HT B	103	00	Living - Kitchen	28	6	118	17	34	7			180	32%	3.14	5.50	5.10	2.70	2.28	2.00
129	HT Q	100	00	Living - Kitchen	25	5	93	17	62	9			180	32%	3.14	5.40	5.30	2.70	2.28	2.00
130	HT K	97	00	Living - Kitchen	45	54	26	5	45	19	64	7	180	29%	3.14	5.70	5.00	2.70	2.02	2.00
131	HT F	96	00	Living - Kitchen	92	16	21	5	47	35	20	7	180	30%	3.14	5.80	3.80	2.70	2.51	2.00
132	HT G	128	00	Living - Kitchen	22	7	93	17	65	27			180	30%	3.14	3.70	4.80	2.70	2.93	2.00
133	HT G	128	00	Living - Kitchen	29	5	87	16	64	7			180	33%	3.14	3.70	4.50	2.70	3.44	2.00
134	HT E	126	00	Living - Kitchen	54	5	103	16	23	7			180	33%	3.14	3.70	4.10	2.70	3.66	2.00
135	HT E	122	00	Living - Kitchen	49	9	104	17	27	8			180	32%	3.14	5.80	4.50	2.70	2.40	2.00
136	HT G	117	00	Living - Kitchen	22	25	99	19	59	8			180	31%	3.14	3.70	4.80	2.70	3.07	2.00
137	HT K	116	00	Living - Kitchen	68	61	30	7	82	17			180	25%	3.14	5.10	4.40	2.70	2.06	2.00
138	HT S	137	00	Living - Kitchen	51	16	31	11	47	30	51	7	180	31%	3.14	5.10	4.10	2.70	2.72	2.00
139	HT G	136	00	Living - Kitchen	96	20	54	13	30	7			180	31%	3.14	3.70	4.80	2.70	3.08	2.00
140	HT E	130	00	Living - Kitchen	30	16	67	13	83	9			180	33%	3.14	5.80	4.50	2.70	2.46	2.00
141	HT E	144	00	Living - Kitchen	40	10	97	18	43	10			180	32%	3.14	5.80	4.50	2.70	2.37	2.00
142	HT K	140	00	Living - Kitchen	49	64	24	7	64	17	43	13	180	26%	3.14	5.10	4.90	2.70	2.05	2.00
143	HT K	140	00	Living - Kitchen	69	4	43	21	48	11	20	9	180	33%	3.14	5.40	3.80	2.70	2.96	2.00
144	HT F	151	00	Living - Kitchen	61	12	56	36	31	6	32	14	180	30%	3.14	5.80	3.70	2.70	2.55	2.00
145	HT C	147	00	Living - Kitchen	27	38	72	16	39	8	42	17	180	30%	3.14	5.60	3.90	2.70	2.57	2.00
146	HT D	173	00	Living - Kitchen	27	33	61	17	12	7	80	14	180	31%	3.14	5.60	4.50	2.70	2.34	2.00
147	HT B	167	00	Living - Kitchen	34	8	81	17	65	15			180	32%	3.14	5.50	5.10	2.70	2.25	2.00
148	HT P	163	00	Living - Kitchen	27	24	47	13	41	34	65	25	180	28%	3.14	5.50	4.20	2.70	2.27	2.00
149	HT L	161	00	Living - Kitchen	64	10	24	6	92	33			180	29%	3.14	4.60	3.70	2.70	2.95	2.00
150	HT F	160	00	Living - Kitchen	48	21	48	33	84	14			180	29%	3.14	5.80	3.70	2.70	2.48	2.00
151	HT K	159	00	Living - Kitchen	63	53	41	10	41	35	35	12	180	25%	3.14	5.20	4.50	2.70	2.02	2.00
152	HT C	158	00	Living - Kitchen	35	28	42	16	77	14	26	9	180	31%	3.14	5.60	3.90	2.70	2.62	2.00
153	HT C	152	00	Living - Kitchen	32	18	30	18	87	15	31	8	180	32%	3.14	5.60	3.90	2.70	2.67	2.00
154	HT P	92	00	Living - Kitchen	37	15	37	9	51	34	55	13	180	30%	3.14	5.60	4.90	2.70	2.17	2.00
155	HT N	94	00	Living - Kitchen	37	12	44	24	59	20	40	8	180	31%	3.14	3.60	5.10	2.70	2.96	2.00
156	HT F	90	00	Living - Kitchen	59	9	58	33	35	8	28	15	180	30%	3.14	5.80	3.70	2.70	2.60	2.00
157	HT F	63	00	Living - Kitchen	38	10	55	19	87	9			180	33%	3.14	5.90	4.00	2.70	2.61	2.00
158	HT F	63	00	Living - Kitchen	55	13	50	37	75	16			180	29%	3.14	5.80	4.00	2.70	2.35	2.00
159	HT G	68	00	Living - Kitchen	18	6	67	10	44	33	51	10	180	31%	3.14	5.50	4.50	2.70	2.44	2.00
160	HT P	70	00	Living - Kitchen	49	29	38	9	53	38	40	11	180	28%	3.14	5.60	4.50	2.70	2.14	2.00
161	HT G	71	00	Living - Kitchen	25	8	89	17	66	21			180	31%	3.14	5.60	4.80	2.70	2.24	2.00
162	HT E	59	00	Living - Kitchen	78	6	75	10	27	8			180	34%	3.14	5.80	4.80	2.70	2.46	2.00
163	HT E	57	00	Living - Kitchen	44	10	89	19	47	12			180	31%	3.14	3.70	4.50	2.70	3.27	2.00
164	HT G	77	00	Living - Kitchen	59	13	93	16	28	8			180	32%	3.14	5.80	4.80	2.70	2.28	2.00
165	HT R	79	00	Living - Kitchen	67	22	69	36	44	17			180	27%	3.14	4.30	4.70	2.70	2.42	2.00
166	HT J1	80	00	Living - Kitchen	22	34	22	8	47	30	89	12	180	30%	3.14	4.70	4.30	2.70	2.70	2.00

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167	HT F	51	00	Living - Kitchen	46	21	47	7	47	25	40	9	180	31%	3.14	5.80	4.00	2.70	2.53	2.00
168	HT D	50	00	Living - Kitchen	43	7	51	15	86	26			180	30%	3.14	5.50	5.50	2.70	2.03	2.00
169	HT T	47	00	Living - Kitchen	62	15	64	16	54	10			180	32%	3.14	5.50	4.90	2.70	2.34	2.00
170	HT D	42	00	Living - Kitchen	39	16	63	8	23	11	55	51	180	28%	3.14	5.60	4.90	2.70	2.04	2.00
171	HT B	40	00	Living - Kitchen	48	8	41	10	67	10	24	19	180	33%	3.14	5.60	5.00	2.70	2.37	2.00
172	HT H	37	00	Living - Kitchen	70	8	60	30	30	9	20	12	180	31%	3.14	5.80	4.70	2.70	2.25	2.00
173	HT G	36	00	Living - Kitchen	38	18	30	16	85	14	27	11	180	32%	3.14	5.80	4.60	2.70	2.32	2.00
174	HT G	31	00	Living - Kitchen	21	8	24	10	83	15	52	20	180	32%	3.14	5.80	4.60	2.70	2.32	2.00
175	HT B	18	00	Living - Kitchen	75	11	52	26	53	11			180	31%	3.14	5.20	5.10	2.70	2.32	2.00
176	HT C	20	00	Living - Kitchen	78	21	26	16	76	13			180	31%	3.14	5.60	3.90	2.70	2.60	2.00
177	HT D	14	00	Living - Kitchen	64	32	62	12	30	17	24	7	180	30%	3.14	5.60	4.50	2.70	2.28	2.00
178	HT N1	13	00	Living - Kitchen	39	9	62	37	31	10	48	13	180	29%	3.14	5.50	4.50	2.70	2.29	2.00
179	HT C	10	00	Living - Kitchen	65	13	27	15	88	13			180	32%	3.14	5.60	3.90	2.70	2.73	2.00
180	HT Ec	29	00	Living - Kitchen	50	12	52	30	78	12			180	31%	3.14	5.90	4.50	2.70	2.25	2.00
181	HT B	8	00	Living - Kitchen	61	11	63	26	38	17	18	9	180	31%	3.14	5.20	5.10	2.70	2.26	2.00
182	HT B	4	00	Living - Kitchen	17	7	57	14	74	37	32	14	180	28%	3.14	5.20	5.10	2.70	2.09	2.00
183	HT B	3	00	Living - Kitchen	14	7	58	14	67	43	41	18	180	27%	3.14	5.20	5.10	2.70	2.02	2.00
184	HT B	2	00	Living - Kitchen	19	7	46	12	66	43	49	19	180	28%	3.14	5.20	5.10	2.70	2.03	2.00
185	HT H	1	00	Living - Kitchen	30	10	52	43	73	22	25	24	180	27%	3.14	5.90	4.30	2.70	2.03	2.00

Table 5.3: Residential houses results

5.6 Daylight reception in buildings within the new development conclusion

The calculation assessment has been segregated according to building type, these are;
(I) Residential Apartment blocks: A, B1, B2 and C.
(II) Residential Duplex blocks: A, B, C, D, E and F.
(III) Residential Housing.
The BRE report recommends as a methodology for assessing sufficient daylight reception in a habitable room, that the calculated average daylight factor (ADF) of a habitable room to be in excess of the BRE bench marks of a kitchen at 2%, a living room at 1.5%, a bedroom at 1% and a living room/bedroom at 1.5%. Calculation findings are as follows; (see images in chapter 5 for receptor locations):

(I) Residential apartment blocks: A, B1, B2 and C.
From the calculation results presented in table 5.1 we note;
- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline or are equal to minimum guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline.
- Level 02: All floors above the first floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

(II) Residential Duplex blocks: A, B, C, D, E and F.
From the calculation results presented in table 5.2 we note;
- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline or are equal to minimum guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline.
- Level 02: All floors above the first floor dwellings are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor.

(III) Residential housing
From the calculation results presented in table 5.3 we note;
- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended BRE guideline.
- Level 01: All floors above the ground floor level are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor.

Given the results and conclusions above we, DKP, deem the proposed project at Oldtown to be in compliance with the recommendations in the BRE design guidelines ‘site layout and planning for daylight and sunlight - a guide to good practice’.

No mitigation measures required.

DKPartnership Dublin Cork London
T : 01-813-1930 T : 064-664-1686
E : post@dkpartnership.com

5025 Effect on Daylight Reception Analysis Report

EFFECT ON DAYLIGHT RECEPTION IN EXISTING NEIGHBOURING BUILDINGS

Phase 5 - Development at Oldtown

Proposed Residential Development

Oldtown,
Swords,
Co. Dublin

Gerard Gannon Properties

DKP-N14-5025 ¦ 1P
2022-03-22

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Architects	Conroy Crowe Kelly Architects		☑	☑
Planning consultant	Downey Planning		☑	☑

Issue	1P#	2021-11-10	Draft issue, for review
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#	Draft
G	General/Information
P	Planning
S	Scheme/concept
D	Design
T	Tender
C	Construction
A	As-build/constructed

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ING Gerard (Craig) van Deventer CEng., BE(mech)., HDip CIOB, MCIBSE

M : [00] 353 (0)87 260 8080
E : gerard@dkpartnership.com

DKPartnership
70 Main Street, Applewood , Swords, Co. Dublin, Ireland
Reen Kenmare Co. Kerry

post@dkpartnership.com
www.dkpartnership.com

T : [00] 353 (0) 1813 1930
T : [00] 353 (0)64664 1686

Contents

1 Introduction

1.1 Report purpose

This report gives information on the level of achieved daylight reception in habitable rooms in existing neighbouring buildings before and after the introduction of the new development.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Oldtown, Swords, Co. Dublin.

1.3 Brief development description

'A proposed Strategic Housing Development consisting of the removal of the temporary site office/site compound structures on site and the construction of 377 no. residential units comprising of duplexes, apartments and houses, all with associated car parking; a childcare facility with associated car parking; landscaping including play equipment; boundary treatments; public lighting; and all associated engineering and site works necessary to facilitate the development including proposed vehicular accesses onto Miller's Avenue, and a proposed stormwater storage tank (with proposed vehicular/service access onto Balheary Road) and overflow outfall gravity sewer to the Broadmeadow River with associated manholes on lands locally known as the Celestica/Motorola site, junction of Glen Ellan Road and Balheary Road, and at/on Balheary Road.'

1.4 Statutory requirement

There are no particular building regulations in relation day light/shadow effect standards other than recommendations outlined or referred to in the CIBSE lighting guide 10, BS EN17037/EN17037 and the BRE document" Site layout planning for daylight and sun light". The aforementioned documents do refer to a" right to a sky view" relating to existing buildings facing a new adjacent development in so far that it compares an existing sky view with the sky view when the new development is constructed. The difference, if any, must be within a certain acceptable threshold.

2 Executive summary

2.1 Analysis conducted

This report details the achieved calculated daylight reception in selected rooms in neighbouring buildings before and after the introduction of the new proposed development and compares these for compliance with the recommendations of the relevant guidelines and standards.

2.2 Daylight reception and building orientation

Day light reception under the BRE, CIBSE and BS 8206 is calculated using the room area of the glazed element, the room depth/height ratio, the room light reflection capability and the amount of direct or blocked/partially blocked daylight it receives. i.e. building orientation is not relevant to day light reception or daylight reception calculations. In other words day light factor analysis is equal to all orientations. This note is for clarity as day light is often confused with sunlight or sunlight energy which is effected by orientation.

2.3 Guidelines and standards applied

For this report we applied the recommendations and guideline of the following:

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
- European/British Standard EN17037/BS EN17037 Lighting for buildings code of practice for day lighting. EN17037/BS EN17037 contains guidance on the minimum recommended levels of interior day lighting.
- CIBSE guide 10 Day light and lighting for buildings.

2.4 Technical analysis

Initially the daylight reception is assessed using the vertical sky component factor and where this is marginally in excess of the maximum allowable change under the BRE recommendations the daylight reception is calculated using the more in-depth daylight factor calculation analysis. The calculated daylight factor is then compared with the BRE recommended room daylight factor to ensure sufficient daylight reception. In basic terms the change in sky views/day light reception between the original and current proposed should not be more than 0.8 its previous value unless other measures (increased glazed areas) have been taken to maintain sufficient day light reception.

2.5 Daylight reception in neighbouring habitable rooms/buildings conclusion

The BRE Report suggests a VSC of 27% or more should be achieved if a room is to have adequate daylight. It also recommends that the effects of a new development on daylight reception should not affect any existing VSC by more than 20% or have a maximum change factor in excess of 0.8. From the calculation results we note all selected neighbouring habitable receptors are effected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. The calculated change in daylight reception in all of the analysed neighbouring receptors achieved a change factor ranging from 0.82 to 0.94 which are all above the maximum change factor of 0.80. Summarized result findings are as follows (see images 5.1-5.5 for receptor locations):

- South neighbouring receptors (Rathbeal cottages): Receptors 1 to 3 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.93-0.94. These receptors resulted in a change of daylight reception, all of which are comfortably within the BRE guidelines.

- Phase 2C neighbouring receptors: Receptors 4 to 15 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.84-0.91. These receptors resulted in a change of daylight reception, all of which are well within the guidelines.

- Phase 2B neighbouring receptors: Receptors 16 to 33 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.90-0.93. These receptors resulted in a change of daylight reception, all of which are comfortably within the guidelines.

- Phase 2A neighbouring receptors: Receptors 34 to 38 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.90-0.94. These receptors resulted in a change of daylight reception, all of which are comfortably within the guidelines also.

- Phase 4D neighbouring receptors: Receptors 39 to 43 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.82-0.93. These receptors resulted in a change of daylight reception, all of which are within the guidelines.

We conclude that the new proposed development's effect on daylight reception in the neighbouring rooms are all within the constraints and recommendations of the BRE Report 'site layout and planning for daylight and sunlight' and we therefore deem the new development to be compliant with this element.

2.6 Mitigation measures/actions

No mitigation measures anticipated.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google maps) site map below indicates the location of the site, approximately outlined.

Image 3.1 proposed development site area outline

4 Approach and methodology

4.1 General approach

This report covers the day light reception in habitable rooms in existing neighbouring buildings. The day light reception is applied as the vertical sky component (angle) but where found to be marginally in excess of the maximum allowable change a second more in depth analysis in the form of an average day light factor calculation is conducted to ensure sufficient levels of daylight is being received.

4.2 The nature and effects of day light and sun light

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still comes in through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight and direct sun received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings and late evenings during the summer months. It is therefore important to ensure that new buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

4.3 Assessment criteria

National Policy/building regulations: The government does not have an adopted policy on daylight, sunlight and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance in the way it has for other environmental impacts such as noise, landscape or air quality. However, there are a number of guidance documents which are relevant when considering daylight, sunlight and overshadowing in dwellings:

- The Building Research Establishment (BRE) report, “Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
  Although not Government guidance, this report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- European / British standard EN17037 / BS EN17037 Lighting for buildings: Code of practice for day lighting. EN17037/BS EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- CIBSE guide 10 Day light and lighting for buildings.
  CIBSE lighting guide 10, like BS EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces recommended day light levels for general buildings.

4.4 The BRE Report – “Site Layout and Planning for Daylight and Sunlight – A Guide to Good Practice”

The BRE report contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy, its aim is to help rather than constrain the designer. Although it gives numerical guidance values, these should be interpreted with flexibility since natural lighting is one of many factors in site layout design. The guidance should be applied appropriately to developments to assist in gaining the best development possible without adverse impacts. As well as advice the report contains a methodology to assess levels of daylight, sunlight and over shadowing and contains criteria to determine the potential impacts of a new development on surrounding buildings. The table below summarises the criteria used to assess the daylight reception in properties.

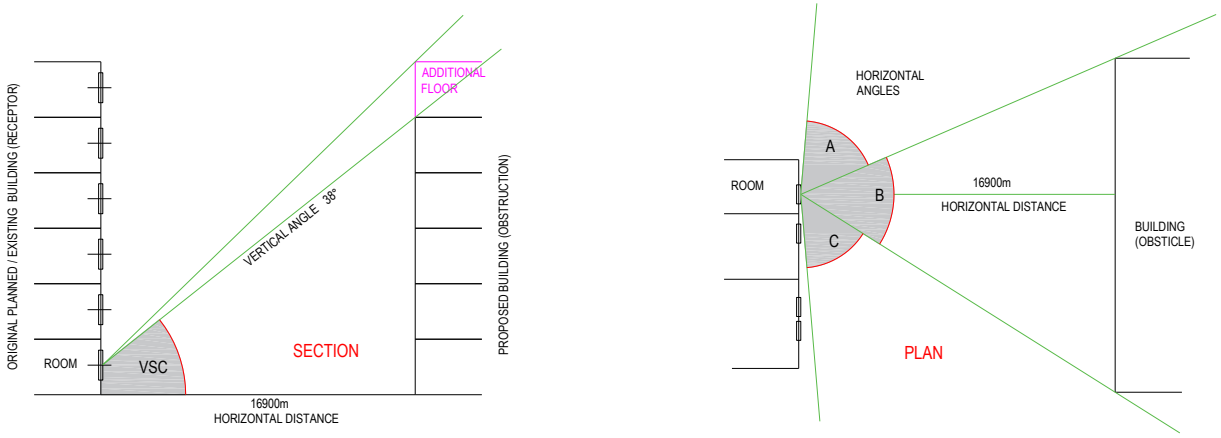
4.5 Day light reception analysis, Sky view component

The day light assessment is the effects the proposed development has on adjoining existing buildings. The assessment of daylight is required for windows serving rooms in adjoining dwellings where daylight is required including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be assessed.

The guidelines also apply to any room that may have a reasonable expectation of daylight, including schools, hospitals, hotels and some offices. When assessing daylight, the numerical criteria must be viewed with flexibility and should be considered against other site layout constraints. In addition, it is important to consider whether the existing building is itself a good neighbour, standing a reasonable distance from the boundary and not taking more than its fair share of light.

The assessment takes on several specific stages:

- The distance test: loss of light to windows need not be analysed if the distance from the existing window to the development is three or more times its height above the centre of the existing window;
- The 25° rule: loss of light to windows need not be analysed if the angle to the horizontal subtended by the new development from the centre of the existing window is less than 25° (an angle of 25° equates to a VSC of 27%).
- Daylight assessment: diffuse daylight of an existing building may be adversely affected by a proposed development if either: the vertical sky component measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value; or the area of the working plane which can receive direct skylight is reduced to less than 0.8 times its former value.



4.6 Criteria for daylight reception effects on neighbouring receptors

Table 4.1 details the BRE assessment criteria for daylight reception.

Analysis	Description	Acceptable parameters
Daylight reception criterion	Existing daylight incoming angle	Existing angles should not be effected more then 0.8 time its former value or a maximum loss of 20%.

Table 4.1

If the vertical sky component angles are beyond the maximum allowable change factor a further analysis can be conducted to establish the effects on daylight reception more accurately. The average day light factor can be applied to calculate the amount of day light received before and after the introduction of the new proposed development however this requires more accurate data on the room effected by the relevant window/receptor.

5 Receptor selection and calculation results

5.1 Basis of receptor (room/window) selection

The VSC assessment has been targeted to neighbouring windows / rooms / dwellings in phase 2A, 2B, 2C, south of the development (Rathbeal cottages) and north east of the development (Phase 4D, Meadowbank houses) that are perceived to be in challenging locations i.e. basement rooms, ground floor rooms and dwellings/rooms in the near vicinity of the new proposed development on the basis that if these rooms pass the minimum requirements all rooms at higher levels will definitely pass the minimum recommendations as a result of the improving vertical sky view angle. Selected neighbouring buildings are listed below in table 5.1 and also shown in image 5.1 to 5.5.

Image 5.1 Neighbouring receptors (1 to 43), overall site image

Image 5.2 Neighbouring receptors (1 to 15)

Image 5.3 Neighbouring receptors (16 to 27)

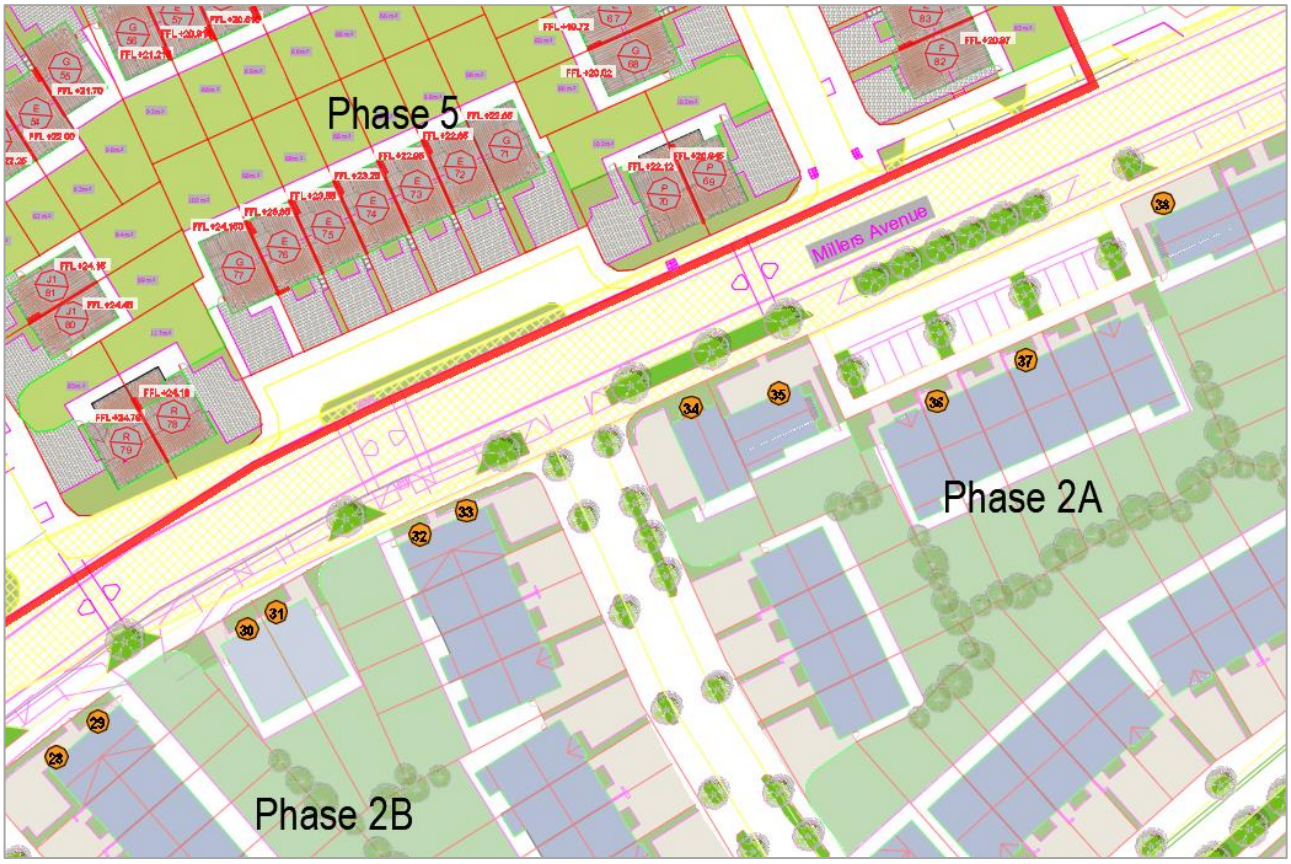


Image 5.4 Neighbouring receptors (28 to 38)

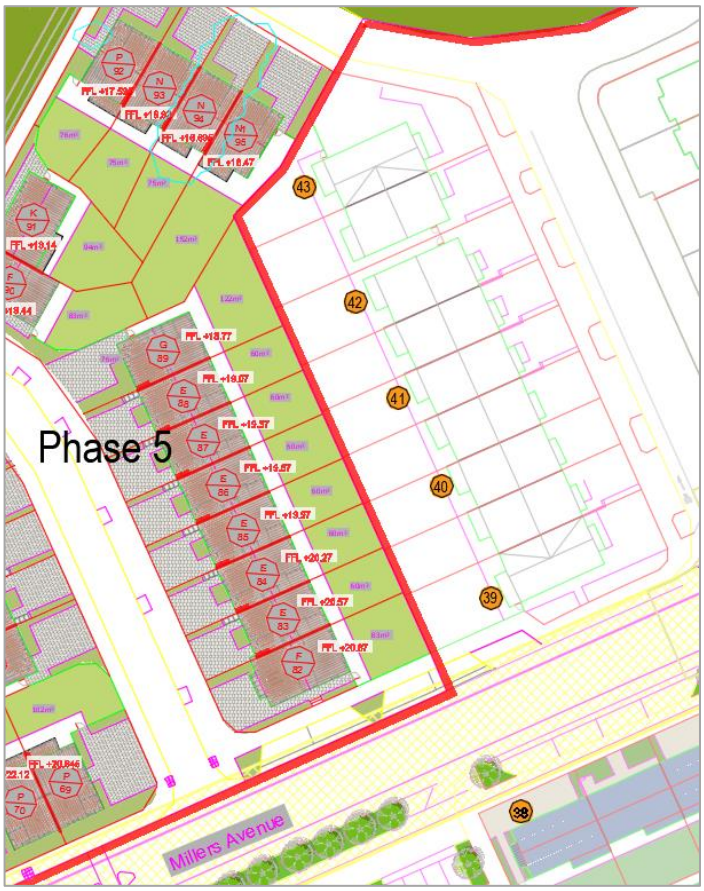


Image 5.5 Neighbouring receptors (39 to 43)

Receptor no.	Unit no. / address	Description	Level description
1	11 Rathbeale Cottages, Oldtown, Swords, Co. Dublin	Residential	GF living space
2	12 Rathbeale Cottages, Oldtown, Swords, Co. Dublin	Residential	GF living space
3	12 Rathbeale Cottages, Oldtown, Swords, Co. Dublin	Residential	GF living space
4	Phase 2C – house no. 30	Residential	GF living space
5	Phase 2C – house no. 31	Residential	GF living space
6	Phase 2C – house no. 32	Residential	GF living space
7	Phase 2C – house no. 33	Residential	GF living space
8	Phase 2C – house no. 34	Residential	GF living space
9	Phase 2C – house no. 35	Residential	GF living space
10	Phase 2C – house no. 36	Residential	GF living space
11	Phase 2C – house no. 37	Residential	GF living space
12	Phase 2C – house no. 38	Residential	GF living space
13	Phase 2C – house no. 39	Residential	GF living space
14	Phase 2C – house no. 40	Residential	GF living space
15	Phase 2C – house no. 41	Residential	GF living space
16	Phase 2B - Block A apartment	Residential	GF living space
17	Phase 2B - Block A apartment	Residential	GF living space
18	Phase 2B - Block A apartment	Residential	GF living space
19	Phase 2B - Block A apartment	Residential	GF living space
20	Phase 2B - House no. 102	Residential	GF living space
21	Phase 2B - House no. 102	Residential	GF living space
22	Phase 2B - House no. 99	Residential	GF living space
23	Phase 2B - House no. 99	Residential	GF living space
24	Phase 2B - House no. 100	Residential	GF living space
25	Phase 2B - House no. 101	Residential	GF living space
26	Phase 2B - House no. 61	Residential	GF living space
27	Phase 2B - House no. 61	Residential	GF living space
28	Phase 2B - House no. 50	Residential	GF living space
29	Phase 2B - House no. 50	Residential	GF living space
30	Phase 2B - House no. 51	Residential	GF living space
31	Phase 2B - House no. 51	Residential	GF living space
32	Phase 2B - House no. 53	Residential	GF living space
33	Phase 2B - House no. 53	Residential	GF living space
34	Phase 2A - House no. 25	Residential	GF living space
35	Phase 2A - House no. 26	Residential	GF living space
36	Phase 2A - House no. 28	Residential	GF living space
37	Phase 2A - House no. 30	Residential	GF living space
38	Phase 2A - House no. 01	Residential	GF living space
39	Phase 4D - Meadowbank Houses	Residential	GF living space
40	Phase 4D - Meadowbank Houses	Residential	GF living space
41	Phase 4D - Meadowbank Houses	Residential	GF living space
42	Phase 4D - Meadowbank Houses	Residential	GF living space
43	Phase 4D - Meadowbank Houses	Residential	GF living space

Table 5.1: List of selected neighbouring receptors

5.2 Vertical sky component (VSC)

The VSC has been calculated for potentially affected windows within the neighbouring /adjacent properties. When undertaking a daylight assessment, the BRE Report suggests a VSC of 27% or more should be achieved if a room is to have adequate daylight. This level need not be applied to rooms which do not require high levels of natural light such as garages, storage rooms, etc. It also recommends that the effects of a new development on daylight reception should not affect any existing VSC by more than 20% or have a maximum change factor in excess of 0.8. The tables below provide the full calculation results of selected neighbouring locations including the overall calculated vertical sky component before and after the introduction of the new development. Note: The VSC calculation results have been given the following colour code guide depending on its level of resulting compliance.

Compliance guide

☑	0% Over /equal to
☑	5% Within
!!	10% Within
x	10% In excess of

5.3 VSC calculation results

DAYLIGHT RECEPTION ANALYSIS

1	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 41m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	58	10	122	4					180	35%	30	10	40	28	110	4			180	33%	0.94

2	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 39m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	69	10	111	4					180	35%	39	10	45	28	96	4			180	33%	0.94

3	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 28m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	78	10	102	4					180	35%	48	10	53	28	79	4			180	32%	0.93

4	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	78	4	102	3					180	36%	78	4	31	24	55	18	16	4	180	33%	0.91

5	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	76	4	104	3					180	36%	70	4	30	24	63	18	17	4	180	32%	0.90

6	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	74	4	106	3					180	36%	57	4	31	24	74	19	18	4	180	32%	0.89

7	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 32m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	73	4	105	3					178	36%	51	4	30	22	80	22	19	4	180	31%	0.86

8	EXISTING								NEW								
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	Section 1		Section 2		Section 3		Section 4		Σ Hor l	Σ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	71	4	109	3					180	36%	41	4	31	22	87	22	21	4	180	31%	0.86

9	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	69	3	111	3					180	36%	37	4	29	21	91	22	23	4	180	31%	0.85

10	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	65	3	115	3					180	36%	28	3	22	16	102	23	28	5	180	31%	0.84

11	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	64	3	116	3					180	36%	26	3	19	16	105	23	30	5	180	31%	0.84

12	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	62	3	118	3					180	36%	23	3	14	15	108	23	35	6	180	31%	0.84

13	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	61	3	119	3					180	36%	31	3	12	13	107	23	30	7	180	31%	0.84

14	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	59	3	121	3					180	36%	20	3	10	12	106	23	44	8	180	31%	0.84

15	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	58	3	122	3					180	36%	19	3	9	11	100	23	52	8	180	31%	0.85

16	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 38m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	120	4	26	3	34	4			180	36%	30	5	51	23	68	12	31	6	180	32%	0.90

17	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 39m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	118	4	27	3	35	4			180	36%	27	5	46	23	71	12	36	6	180	32%	0.90

18	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 38m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	117	4	26	3	37	4			180	36%	26	5	43	23	74	13	37	6	180	32%	0.90

19	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 37m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	119	4	25	3	36	4			180	36%	23	5	38	23	80	13	39	6	180	32%	0.90

20	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 36m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	79	4	35	3	66	4			180	36%	18	5	25	14	73	16	64	6	180	33%	0.91

21	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor	∑ VSC	
Target distance 36m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	72	4	34	3	74	4			180	36%	16	5	23	14	67	16	74	7	180	33%	0.91

22	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 39m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	110	4	14	3	56	3			180	36%	30	5	40	13	80	10	30	8	180	34%	0.93

23	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 38m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	118	4	18	3	44	3			180	36%	28	5	36	13	80	10	36	8	180	34%	0.93

24	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 40m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	121	4	14	3	45	3			180	36%	33	9	72	13	56	10	19	7	180	33%	0.92

25	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 40m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	122	4	15	3	43	3			180	36%	31	9	68	13	54	10	27	7	180	33%	0.92

26	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 39m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	120	4	18	3	42	3			180	36%	18	8	52	10	67	12	43	8	180	33%	0.92

27	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 39m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	117	4	20	3	43	3			180	36%	16	8	42	10	74	12	48	8	180	33%	0.92

28	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 41m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	114	4	24	3	42	3			180	36%	37	7	60	14	57	13	26	6	180	33%	0.91

29	EXISTING										NEW									
VSC test distance 35 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 41m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	97	4	25	3	58	3			180	36%	34	7	56	14	61	13	29	6	180	33%	0.91

30	EXISTING										NEW									
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	94	4	31	3	55	3			180	36%	18	6	39	10	55	17	68	8	180	33%	0.92

31	EXISTING										NEW									
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	106	4	35	3	39	3			180	36%	16	6	37	10	52	17	75	8	180	33%	0.92

32	EXISTING										NEW									
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 35m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	99	4	42	3	39	3			180	36%	31	8	104	12	45	9			180	33%	0.92

33	EXISTING										NEW									
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 35m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	108	4	40	3	32	3			180	36%	26	8	98	12	56	9			180	33%	0.92

34	EXISTING										NEW									
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor I	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	114	4	35	3	31	3			180	36%	95	10	35	19	50	9			180	33%	0.91

35	EXISTING										NEW										
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	15	65	74	4	91	3			180	34%	15	65	56	10	33	19	76	10	180	31%	0.90

36	EXISTING										NEW										
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 34m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	43	45	100	3	37	3			180	32%	43	45	47	11	52	11	38	6	180	30%	0.94

37	EXISTING										NEW										
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 35m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	42	45	48	3	90	3			180	32%	42	45	42	11	51	11	45	6	180	30%	0.94

38	EXISTING										NEW										
VSC test distance 26 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 31m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	111	3	16	4	53	3			180	36%	32	8	47	13	101	6			180	34%	0.94

39	EXISTING										NEW										
VSC test distance 17 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	54	8	25	5	101	3			180	36%	54	8	25	5	74	16	27	6	180	33%	0.93

40	EXISTING										NEW										
VSC test distance 17 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	45	8	16	5	119	3			180	36%	45	8	99	16	36	6			180	32%	0.91

41	EXISTING										NEW										
VSC test distance 17 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	54	7	126	3					180	36%	35	7	95	16	50	9			180	32%	0.91

42	EXISTING										NEW										
VSC test distance 17 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	48	6	132	3					180	36%	26	6	82	16	72	15			180	31%	0.88

43	EXISTING										NEW										
VSC test distance 17 m	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	Section 1		Section 2		Section 3		Section 4		∑ Hor l	∑ VSC	
Target distance 22m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			change
window GF-living	42	5	138	3					180	36%	20	5	55	16	37	10	68	34	180	29%	0.82

5.4 Daylight reception in neighbouring habitable rooms conclusion

The BRE Report suggests a VSC of 27% or more should be achieved if a room is to have adequate daylight. It also recommends that the effects of a new development on daylight reception should not affect any existing VSC by more than 20% or have a maximum change factor in excess of 0.8. From the calculation results we note all selected neighbouring habitable receptors are effected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. The calculated change in daylight reception in all of the analysed neighbouring receptors achieved a change factor ranging from 0.82 to 0.94 which are all above the maximum change factor of 0.80. Summarized result findings are as follows (see images 5.1-5.5 for receptor locations):

- South neighbouring receptors (Rathbeal cottages): Receptors 1 to 3 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.93-0.94. These receptors resulted in a change of daylight reception, all of which are comfortably within the BRE guidelines.

- Phase 2C neighbouring receptors: Receptors 4 to 15 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.84-0.91. These receptors resulted in a change of daylight reception, all of which are well within the guidelines.

- Phase 2B neighbouring receptors: Receptors 16 to 33 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.90-0.93. These receptors resulted in a change of daylight reception, all of which are comfortably within the guidelines.

- Phase 2A neighbouring receptors: Receptors 34 to 38 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.90-0.94. These receptors resulted in a change of daylight reception, all of which are comfortably within the guidelines also.

- Phase 4D neighbouring receptors: Receptors 39 to 43 are residential dwellings with ground floor windows. These dwellings were examined and resulted in a change factor ranging from 0.82-0.93. These receptors resulted in a change of daylight reception, all of which are within the guidelines.

We conclude that the new proposed development's effect on daylight reception in the neighbouring rooms are all within the constraints and recommendations of the BRE Report 'site layout and planning for daylight and sunlight' and we therefore deem the new development to be compliant with this element.

DKPartnership Dublin Cork London
T : 01-813-1930 T : 064-664-1686
E : post@dkpartnership.com

5060 Sunlight Reception Analysis Report

SUNLIGHT RECEPTION IN AMENITY SPACES WITHIN THE PROPOSED DEVELOPMENT
EFFECTS on SUNLIGHT RECEPTION IN EXISTING NEIGHBOURING AMENITY SPACES AS A RESULT OF THE PROPOSED DEVELOPMENT

Phase 5 – Development at Oldtown

Proposed Residential Development

Oldtown,
Swords,
Co. Dublin

Gerard Gannon Properties

Project file no
DKP-N14-5060 ¦ 1P
2022-03-22

Document control

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Circular		Issue >	1P#	1P
Clients	Gerard Gannon Properties		☑	☑
Architects	Conroy Crowe Kelly Architects		☑	☑
Planning consultant	Downey Planning		☑	☑

Issue	1P#	2021-11-10	Draft issue, for review
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Document issue status ID

#	Sketch/draft
P	Planning
C	Concept
D	Design
G	General information
T	Tender
W	Works/construction
Z	As-build/constructed

Issue	Prepared	Checked	Approved
1P#	201	208	208
1P	201	208	208

ING Gerard (Craig) van Deventer CEng., BE(mech)., HDip CIOB, MCIBSE

M : [00] 353 (0)87 260 8080
E : gerard@dkpartnership.com

DKPartnership
70 Main Street, Applewood , Swords, Co. Dublin, Ireland
Reen Kenmare Co. Kerry

post@dkpartnership.com
www.dkpartnership.com

T : [00] 353 (0) 1813 1930
T : [00] 353 (0)64664 1686

Contents

1 Introduction

1.1 Report purpose

This report gives information on the level of achieved sunlight reception in amenity spaces within the proposed new development and the effects of the proposed development on sunlight reception in existing neighbouring amenity spaces.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Oldtown, Swords, Co. Dublin.

1.3 Brief development description

'A proposed Strategic Housing Development consisting of the removal of the temporary site office/site compound structures on site and the construction of 377 no. residential units comprising of duplexes, apartments and houses, all with associated car parking; a childcare facility with associated car parking; landscaping including play equipment; boundary treatments; public lighting; and all associated engineering and site works necessary to facilitate the development including proposed vehicular accesses onto Miller's Avenue, and a proposed stormwater storage tank (with proposed vehicular/service access onto Balheary Road) and overflow outfall gravity sewer to the Broadmeadow River with associated manholes on lands locally known as the Celestica/Motorola site, junction of Glen Ellan Road and Balheary Road, and at/on Balheary Road.'

1.4 Statutory requirement

There are no particular building regulations in relation day light/shadow effect standards other than recommendations outlined or referred to in the CIBSE lighting guide 10, BS EN17037/EN17037 and the BRE document" Site layout planning for daylight and sun light". The aforementioned documents do refer to a" right to a sky view" relating to existing buildings facing a new adjacent development in so far that it compares an existing sky view with the sky view when the new development is constructed. The difference, if any, must be within a certain acceptable threshold.

2 Executive summary

2.1 Analysis conducted

This report details the effects on the sunlight/shadow status of the sunlight/shadow status of new amenity spaces within the proposed development and the effects of the proposed development on sunlight reception in existing neighbouring amenity spaces.

2.2 Guidelines and standards applied

For this report we applied the recommendations and guideline of the following;

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
- British European Standard BS EN17037/EN17037 Day lighting standards and contains guidance on the minimum recommended levels of interior day lighting.
- CIBSE guide 10 Day light and lighting for buildings.

2.3 Technical analysis

Calculations were conducted in accordance with the BRE guidelines to determine the extent to which the proposed development could affect the shadow/sun light reception in any existing amenity spaces and new amenity spaces proposed with the development. For new amenity spaces, in basic terms, the minimum criteria is that at least 50% of the amenity space should receive at least two hours of sunlight on the 21st March and for "existing" amenity spaces there is also the additional criteria that any loss of sunlight should not be greater than 0.8 times its former size.

2.4 Amenity spaces within the development, sunlight assessment conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st March. From the calculation results we note all of the new amenity spaces received more than the recommended sunlight or were equal to minimum guidelines. Calculation findings are summarised as follows (see image 5.1 for amenity locations):

Amenity area outlined in A was calculated to have 03.00 hours at 50% area.
Amenity area outlined in B was calculated to have 10.00 hours at 50% area.
Amenity area outlined in C was calculated to have 06.00 hours at 50% area.
Amenity area outlined in D was calculated to have 09.00 hours at 50% area.
Amenity area outlined in E was calculated to have 02.00 hours at 50% area.
Amenity area outlined in F was calculated to have 11.00 hours at 50% area.
Amenity area outlined in G was calculated to have 07.00 hours at 50% area.
Amenity area outlined in H was calculated to have 02.00 hours at 50% area.
Amenity area outlined in I was calculated to have 09.00 hours at 50% area.
Amenity area outlined in J was calculated to have 10.00 hours at 50% area.
Amenity area outlined in K was calculated to have 05.00 hours at 50% area.
Amenity area outlined in L was calculated to have 03.00 hours at 50% area.
Amenity area outlined in M was calculated to have 08.00 hours at 50% area.
Amenity area outlined in N was calculated to have 09.00 hours at 50% area.

We conclude that the new amenity spaces receive sunlight on 50% of the area is in line with the recommendations of the BRE Report - Site Layout and Planning for Daylight and Sunlight - and therefore deem these to be compliant to this element.

2.5 Existing neighbouring amenity spaces, sunlight assessment conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st March and that and any loss of sunlight should not be greater than 0.8 (20% reduction) times its former size. From the calculation results we note that selected existing amenity spaces all received 2 hours of sunlight or more on at least 50% of the area before and after the introduction of the new development. Results are as follows (see image 6.1 – 6.4 for receptor locations):

- Phase 2C neighbouring receptors: Receptors 1 to 11 are residential dwellings with private front gardens / amenity spaces. These areas resulted in change factors ranging from 0.80-1.00 meaning the new proposed development has an effect on the amenity spaces shadow/sunlight. This effect happens in the late afternoon hours of 17.00-19.00. The results are within BRE recommendations. Receptor 1 and 6 has a change factor of 1.00 meaning the new proposed has no effect on the existing sunlight status.

- Phase 2B neighbouring receptors: Receptors 12 to 17 are residential dwellings with private back gardens / amenity spaces. These areas resulted in change factors ranging from 0.89-0.91 meaning the new proposed development has an effect on the amenity spaces shadow/sunlight. This effect happens in the late afternoon hours of 17.00-19.00. The results are comfortably within BRE guidelines.

- Phase 4D neighbouring receptors: Receptors 18 to 26 are residential dwellings with private back gardens / amenity spaces. These areas resulted in change factors ranging from 0.80-0.85 meaning the new proposed development has an effect on the amenity spaces shadow/sunlight. This effect happens in the afternoon hours of 15.00-19.00. The results are within BRE guidelines and some result in minimum recommendations.

We conclude that the sunlight reception in the existing neighbouring amenity spaces after the introduction of the new development is in accordance with the recommendations of the BRE Report– "Site Layout and Planning for Daylight and Sunlight and therefore deem this to be compliant to this element.

2.6 Mitigation measures / actions

No mitigation measures.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google) site map below indicates the location of the site boundary, approximately outlined.

Image 3.1: proposed development site area outlined

4 Approach and methodology

4.1 General approach

This report covers

- the sunlight reception/shadow status of new proposed amenity spaces within the new development.
- the effects of the new development on the sunlight reception/shadow status of existing neighbouring amenity spaces/gardens.

4.2 The nature and effects of day light and sun light

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still shines through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight and direct sun received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings and late evenings during the summer months. It is therefore important to ensure that buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

4.3 Assessment criteria

National Policy/building regulations.

The government does not have an adopted policy on daylight, sunlight and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance in the way it has for other environmental impacts such as noise, landscape or air quality. However, there are a number of guidance documents which are relevant when considering daylight, sunlight and overshadowing in dwellings:

- The Building Research Establishment (BRE) report, “Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report). Although not Government guidance, this report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- British European Standard BS EN17037/EN17037 Day Lighting for buildings. BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- CIBSE guide 10 Day light and lighting for buildings. CIBSE lighting guide 10 like BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces recommended day light levels for general buildings.

4.4 The BRE Report – “Site Layout and Planning for Daylight and Sunlight – A Guide to Good Practice”

The BRE report contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy, its aim is to help rather than constrain the designer. Although it gives numerical guidance values, these should be interpreted with flexibility since natural lighting is one of many factors in site layout design. The guidance should be applied appropriately to developments to assist in gaining the best development possible without adverse impacts.

As well as advice, the report contains a methodology to assess levels of daylight, sunlight and over shadowing and contains criteria to determine the potential impacts of a new development on surrounding buildings. The table below summarises the criteria used to assess the overshadowing/sunlight reception in amenity spaces.

In this report we have separated the new and existing amenity spaces as they are assessed slightly differently. BRE sunlight/shadow assessment criteria. Table 4.1 Sunlight reception requirements for amenity spaces within the new proposed development.

Type	Criteria	Acceptable parameters
Overshadowing new amenity spaces	Amenity space prevented from receiving any sunlight on March 21st	At least 50% of the amenity space should receive at least two hours of sunlight

Table 4.1

Table 4.2 Effects on Sunlight reception requirements for existing neighbouring amenity spaces.

Type	Criteria	Acceptable parameters
Overshadowing existing amenity spaces	Amenity space prevented from receiving any sunlight on March 21st	Any loss of sunlight should not be greater than 0.8 times its former size.

Table 4.2

4.5 Overshadowing effects measured

The minimum sunlight requirement in this report measured in sunlight time 2 hours (120 minutes) multiplied by 50% area m^2 or the minimum requirement = 120 (min) * 0.5a (m^2) = [ ] min·m^2.

4.6 Existing amenity spaces

The overshadowing/sun light assessment is the effects the proposed development has on existing open amenity spaces. In basic terms, based on the BRE report states that at least 50% of the amenity space should receive at least two hours of sunlight on the 21st March and any loss of sunlight should not be greater than 0.8 times its former size. The overshadowing/sun light assessment is executed in using a 3D model of the project and adjoining buildings with the results illustrated in tabular format showing the hourly status of the shadow/sunlight fraction in the relevant amenity spaces. The impacts of vegetation: It is important to note that according to the BRE Report, calculations do not normally take into account vegetation. The exception is when evergreen vegetation exists that forms a continuous barrier and would be permanent throughout the seasons.

5 Receptor selection and Calculation results - Amenity spaces within the proposed development

5.1 Amenity spaces within the proposed development

Image 5.1 below indicates the amenity areas that have been selected and analysed on the basis that the shadow casted from the proposed development may effect the amenity areas given its geographical location in relation to the development.

Image 5.1: New proposed amenity spaces within phase 5

Receptor	Description	Approx. Area m²
A	Private communal space	450
B	Public park 01	2771
C	Public open space	286
D	Public park 02	500
E	Private communal space	65
F	Public park 03	4147
G	Private communal space	133
H	Residents Garden	379
I	Biodiversity open space	798
J	Public open space	744
K	Private communal space	125
L	Private communal space	123
M	Private communal space	1259
N	Public open space	966

Table 5.1: New proposed amenity spaces

5.2 Assessment approach

The tables below represent the one hourly sunlight/shadow status of the respective new amenity spaces provided within the new development on March 21st. To compare against the BRE guidelines, the calculation results have been given the following colour code guide depending on its level of resulting compliance. See appendix A for the modelled shadow/sunlight imaging per hour on March 21st.

Compliance guide

☑	0%	Over /equal to
☑	5%	Within
!!	10%	Within
x	10%	In excess of

5.3 Proposed development amenity space calculation results

The calculation results of the one hourly sunlight & shadow status of the proposed amenity space of phase 5 development are all detailed in Appendix B. As there is a number of amenity spaces assessed in this report we have only shown the result tables of 2 no. amenity spaces (A & B). Relevant sunlight & shadow calculation results are summarised in the next section.

SUNLIGHT/SHADOW CALCULATION DATA

A				450	m2
NEW STATUS				March 21st	
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	36	2,160
8.00	92%	8%	60	36	2,160
9.00	90%	10%	60	45	2,700
10.00	86%	14%	60	63	3,780
11.00	76%	24%	60	108	6,480
12.00	57%	43%	60	194	11,610
13.00	31%	69%	60	311	18,630
14.00	29%	71%	60	320	19,170
15.00	35%	65%	60	293	17,550
16.00	69%	31%	60	140	8,370
17.00	88%	12%	60	54	3,240
18.00	92%	8%	60	36	2,160
19.00	100%	0%	60	0	0
Required sun hours @ 50% area					2
Achieved sun hours on @ 50% area					3.00
Achieved total sun time (hrs)					3.63
Achieved daily sun time * area					98010

B				2,771	m2
NEW STATUS				March 21st	
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	68%	32%	60	887	53,203
8.00	21%	79%	60	2189	131,345
9.00	15%	85%	60	2355	141,321
10.00	15%	85%	60	2355	141,321
11.00	15%	85%	60	2355	141,321
12.00	15%	85%	60	2355	141,321
13.00	14%	86%	60	2383	142,984
14.00	14%	86%	60	2383	142,984
15.00	17%	83%	60	2300	137,996
16.00	22%	78%	60	2161	129,683
17.00	34%	66%	60	1829	109,732
18.00	77%	23%	60	637	38,240
19.00	100%	0%	60	0	0
Required sun hours @ 50% area					2
Achieved sun hours on @ 50% area					10.00
Achieved total sun time (hrs)					8.73
Achieved daily sun time * area					1451450

5.4 Summary table of results – March 21st

The calculation results of the one hourly sunlight & shadow status of each selected amenity space of the new development are all detailed in Appendix B. The relevant sunlight & shadow calculation data has been summarised in table 5.2 below.

Column 1: The amenity space ID
Column 2: The amenity space area
Column 3: The new status sun hours * amenity space area (hr*m2)
Column 4: The new status total sun hours
Column 5: The new status sun hours on 50% of the area
Column 6: Comment

		NEW STATUS			
Area ID	m²	Sun Hr*m²	Sun Hr	SunHr 50%	COMMENTS
A	450	98010	3.63	3.00	In excess of minimum guidelines
B	2771	1451450	8.73	10.00	In excess of minimum guidelines
C	286	117031.2	6.82	6.00	In excess of minimum guidelines
D	500	213000	7.1	9.00	In excess of minimum guidelines
E	95	18297	3.21	2.00	Minimum guidelines achieved
F	4147	2279191	9.16	11.00	In excess of minimum guidelines
G	133	52987.2	6.64	7.00	In excess of minimum guidelines
H	379	83455.8	3.67	2.00	Minimum guidelines achieved
I	798	373942.8	7.81	9.00	In excess of minimum guidelines
J	744	397742.4	8.91	10.00	In excess of minimum guidelines
K	125	37950	5.06	5.00	In excess of minimum guidelines
L	123	25903.8	3.51	3.00	In excess of minimum guidelines
M	1259	560506.8	7.42	8.00	In excess of minimum guidelines
N	966	459043.2	7.92	9.00	In excess of minimum guidelines

Table 5.2: New proposed amenity spaces, summary table of results

5.5 Amenity spaces within proposed development, sunlight results conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st March. From the calculation results we note all of the new amenity spaces received more than the recommended sunlight or were equal to minimum guidelines. Calculation findings are summarised as follows (see image 5.1 for amenity locations):

Amenity area outlined in A was calculated to have 03.00 hours at 50% area.
Amenity area outlined in B was calculated to have 10.00 hours at 50% area.
Amenity area outlined in C was calculated to have 06.00 hours at 50% area.
Amenity area outlined in D was calculated to have 09.00 hours at 50% area.
Amenity area outlined in E was calculated to have 02.00 hours at 50% area.
Amenity area outlined in F was calculated to have 11.00 hours at 50% area.
Amenity area outlined in G was calculated to have 07.00 hours at 50% area.
Amenity area outlined in H was calculated to have 02.00 hours at 50% area.
Amenity area outlined in I was calculated to have 09.00 hours at 50% area.
Amenity area outlined in J was calculated to have 10.00 hours at 50% area.
Amenity area outlined in K was calculated to have 05.00 hours at 50% area.
Amenity area outlined in L was calculated to have 03.00 hours at 50% area.
Amenity area outlined in M was calculated to have 08.00 hours at 50% area.
Amenity area outlined in N was calculated to have 09.00 hours at 50% area.

We conclude that the new amenity spaces receive sunlight on 50% of the area is in line with the recommendations of the BRE Report - Site Layout and Planning for Daylight and Sunlight - and therefore deem these to be compliant to this element.

6 Receptor selection and calculation results – Existing neighbouring amenity spaces

6.1 Selected existing amenity spaces

Images 6.1-6.4 below indicates the neighbouring amenity areas that have been selected and analysed on the basis that the shadow casted from the new development may effect these amenity areas given its geographical location in relation to the proposed development. To note:

- Amenity spaces south of the proposed (Rathbeal cottages): these private amenity spaces are located south of the phase 5 development with no impact in sunlight/shadow expected for March 21st.
- Phase 2C neighbouring amenity spaces: potential private garden and communal amenity spaces that may be affected.
- Phase 2B neighbouring amenity spaces: potential private garden and communal amenity spaces that may be affected.
- Phase 2A neighbouring amenity spaces: no private garden or communal amenity spaces directly facing the phase 5 development that may be affected with regards its current sunlight/shadow, furthermore phase 2A is south/southeast of phase 5 with no impact in sunlight/shadow expected for March 21st.
- Phase 4D neighbouring amenity spaces: potential private garden amenity spaces that may be affected.

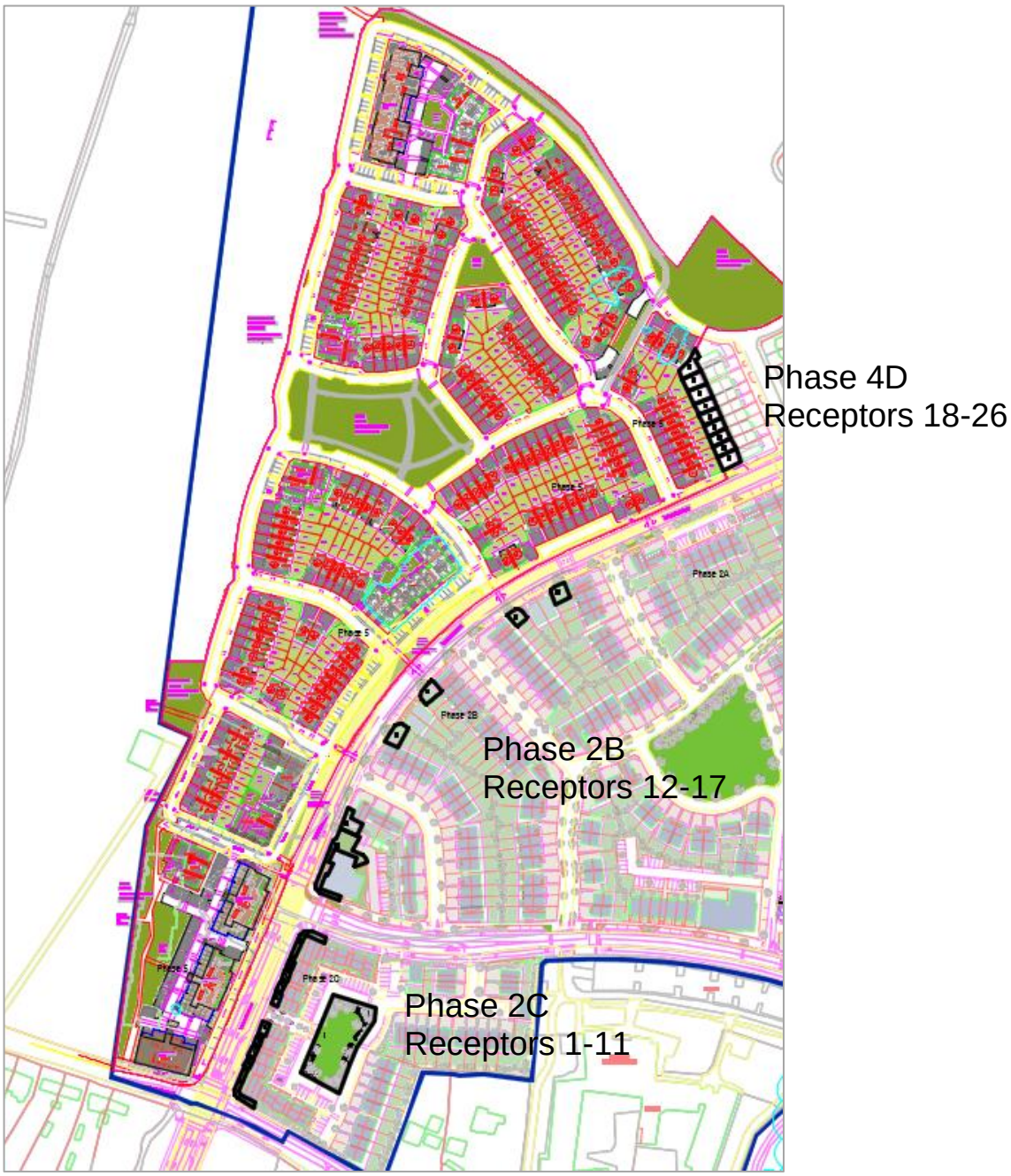

Image 6.1: Existing neighbouring amenity spaces, overall site image

Image 6.2: existing neighbouring amenity spaces, Phase 2C (receptors 1-11)

Image 6.3: existing neighbouring amenity spaces, Phase 2B (receptors 12-17)

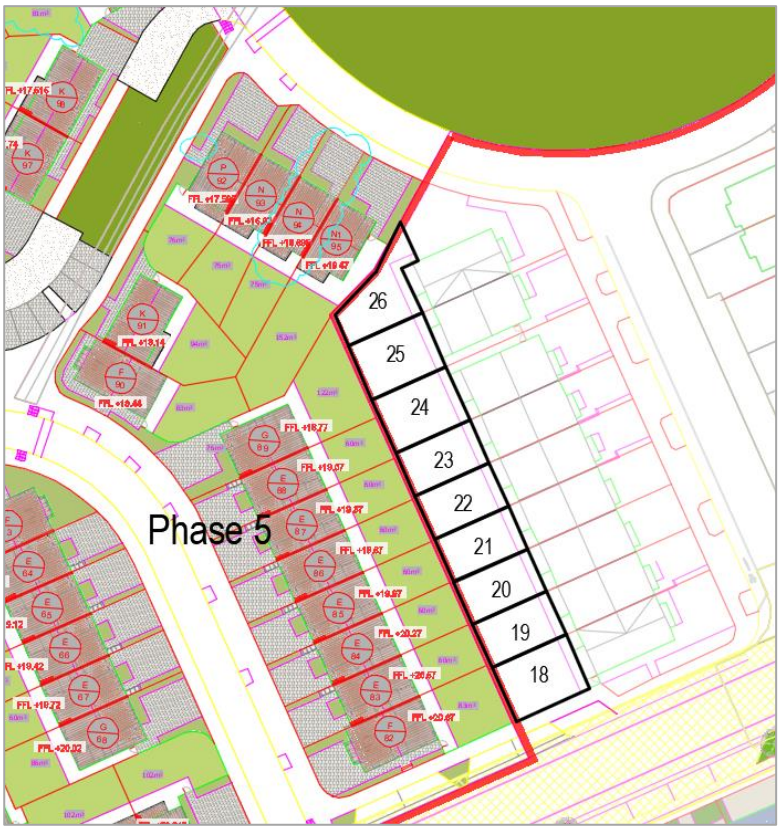

Image 6.4: existing neighbouring amenity spaces, Phase 4D (receptors 18-26)

Receptor	Location / Address	Description	~Area m^2
1	Phase 2C - House	Private amenity space	70
2	Phase 2C - House	Private amenity space	16
3	Phase 2C - House	Private amenity space	17
4	Phase 2C - House	Private amenity space	17
5	Phase 2C - House	Private amenity space	28
6	Phase 2C - Green	Communal amenity space	1160
7	Phase 2C - House	Private amenity space	27
8	Phase 2C - House	Private amenity space	17
9	Phase 2C - House	Private amenity space	17
10	Phase 2C - House	Private amenity space	16
11	Phase 2C - House	Private amenity space	70
12	Phase 2B - Apartment Block A	Communal amenity space	270
13	Phase 2B - House no.102	Private amenity space	88
14	Phase 2B - House no.99	Private amenity space	93
15	Phase 2B - House no.61	Private amenity space	85
16	Phase 2B - House no.50	Private amenity space	64
17	Phase 2B - House no.53	Private amenity space	74
18	Phase 4D - Meadowbank houses	Private amenity space	85
19	Phase 4D - Meadowbank houses	Private amenity space	68
20	Phase 4D - Meadowbank houses	Private amenity space	68
21	Phase 4D - Meadowbank houses	Private amenity space	68
22	Phase 4D - Meadowbank houses	Private amenity space	68
23	Phase 4D - Meadowbank houses	Private amenity space	68
24	Phase 4D - Meadowbank houses	Private amenity space	85
25	Phase 4D - Meadowbank houses	Private amenity space	85
26	Phase 4D - Meadowbank houses	Private amenity space	85

Table 6.1: existing neighbouring amenity spaces

6.2 Assessment approach

The left-hand side calculation tables below represent the one hourly sunlight/shadow status of the respective existing amenity space before the introduction of the new development and the right hand side tables below represent the one hourly sunlight/shadow status of the respective existing amenity space after the introduction of the new development. See appendix A for the predicted sunlight/shadow imaging per hour. Note: The calculation results have been given the following colour code guide depending on its level of resulting compliance.

Compliance guide

☑	0% Over /equal to
☑	5% Within
!!	10% Within
x	10% In excess of

6.3 Existing amenity spaces calculation results

The calculation results of the one hourly sunlight & shadow status of each selected amenity space before and after the introduction of the new development are all detailed in Appendix B. As there is a number of amenity spaces assessed in this report we have only shown the result tables of 2 no. amenity spaces (1 & 2). Relevant sunlight & shadow calculation results are summarised in the next section.

1 — 70 m2

EXISTING STATUS					March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	6	336
8.00	92%	8%	60	6	336
9.00	80%	20%	60	14	840
10.00	76%	24%	60	17	1,008
11.00	70%	30%	60	21	1,260
12.00	61%	39%	60	27	1,638
13.00	22%	78%	60	55	3,276
14.00	0%	100%	60	70	4,200
15.00	0%	100%	60	70	4,200
16.00	0%	100%	60	70	4,200
17.00	16%	84%	60	59	3,528
18.00	57%	43%	60	30	1,806
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	5.00
Achieved total sun time (hrs)	6.34
Achieved daily sun time * area	26628

NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	6	336	0
8.00	92%	8%	60	6	336	0
9.00	80%	20%	60	14	840	0
10.00	76%	24%	60	17	1,008	0
11.00	70%	30%	60	21	1,260	0
12.00	61%	39%	60	27	1,638	0
13.00	22%	78%	60	55	3,276	0
14.00	0%	100%	60	70	4,200	0
15.00	0%	100%	60	70	4,200	0
16.00	0%	100%	60	70	4,200	0
17.00	16%	84%	60	59	3,528	0
18.00	57%	43%	60	30	1,806	0
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	6.34	1.00
Achieved daily sun time * area	26628	1.00

2 — 16 m2

EXISTING STATUS					March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	1	77
8.00	92%	8%	60	1	77
9.00	85%	15%	60	2	144
10.00	85%	15%	60	2	144
11.00	85%	15%	60	2	144
12.00	85%	15%	60	2	144
13.00	53%	47%	60	8	451
14.00	0%	100%	60	16	960
15.00	0%	100%	60	16	960
16.00	0%	100%	60	16	960
17.00	0%	100%	60	16	960
18.00	17%	83%	60	13	797
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	5.00
Achieved total sun time (hrs)	6.06
Achieved daily sun time * area	5817.6

NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	1	77	0
8.00	92%	8%	60	1	77	0
9.00	85%	15%	60	2	144	0
10.00	85%	15%	60	2	144	0
11.00	85%	15%	60	2	144	0
12.00	85%	15%	60	2	144	0
13.00	53%	47%	60	8	451	0
14.00	0%	100%	60	16	960	0
15.00	0%	100%	60	16	960	0
16.00	0%	100%	60	16	960	0
17.00	0%	100%	60	16	960	0
18.00	88%	12%	60	2	115	-682
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	4.00	
Achieved total sun time (hrs)	5.35	0.89
Achieved daily sun time * area	5136	0.89

6.4 Summary table of results – March 21st

The calculation results of the one hourly sunlight & shadow status of each selected amenity space before and after the introduction of the new development are all detailed in Appendix B. The relevant sunlight & shadow calculation data is summarised in table 6.2 below.

Column 1: The amenity space ID
Column 2: The amenity space area
Column 3: The existing status sun hours * amenity space area (hr*m2)
Column 4: The existing status total sun hours
Column 5: The existing status sun hours on 50% of the area
Column 6: The new status sun hours * amenity space area (hr*m2)
Column 7: The new status total sun hours
Column 8: The new status sun hours on 50% of the area
Column 9: The change factor (should be NOT less than 0.8)
Column 10: Comment

		EXISTING STATUS			NEW STATUS				COMMENTS
Area ID	m²	Sun Hr*m²	Sun Hr	SunHr 50%	Sun Hr*m²	Sun Hr	Sun Hr 50%	Change	
1	70	26628	6.34	5	26628	6.34	5	1.00	no change in shadow/sunlight
2	16	5817.6	6.06	5	5136	5.35	4	0.89	change factor within guidelines
3	17	6222	6.1	6	5395.8	5.29	5	0.87	change factor within guidelines
4	17	6415.8	6.29	6	5161.2	5.06	4	0.81	change factor within guidelines
5	28	10920	6.5	6	8635.2	5.14	4	0.80	minimum guidelines achieved
6	1160	567936	8.16	8	567936	8.16	8	1.00	no change in shadow/sunlight
7	27	11404.8	7.04	7	9039.6	5.58	5	0.80	minimum guidelines achieved
8	17	7180.8	7.04	7	5712	5.6	5	0.80	minimum guidelines achieved
9	17	7180.8	7.04	7	5742.6	5.63	5	0.80	minimum guidelines achieved
10	16	6758.4	7.04	7	5404.8	5.63	5	0.80	minimum guidelines achieved
11	70	25914	6.17	7	20496	4.88	5	0.80	minimum guidelines achieved
12	270	87318	5.39	5	75492	4.66	3	0.87	change factor within guidelines
13	88	44721.6	8.47	10	38068.8	7.21	8	0.86	change factor within guidelines
14	93	34038	6.1	7	30243.6	5.42	6	0.89	change factor within guidelines
15	85	37128	7.28	8	33354	6.54	7	0.90	change factor well within guidelines
16	64	24038.4	6.26	5	22464	5.85	5	0.94	change factor well within guidelines
17	74	30813.6	6.94	8	27972	6.3	7	0.91	change factor well within guidelines
18	85	53142	10.42	11	43809	8.59	9	0.83	change factor within guidelines
19	68	38025.6	9.32	10	30273.6	7.42	8	0.80	minimum guidelines achieved
20	68	36312	8.9	9	28723.2	7.04	7	0.80	minimum guidelines achieved
21	68	36312	8.9	9	28723.2	7.04	7	0.80	minimum guidelines achieved
22	68	36312	8.9	9	28723.2	7.04	7	0.80	minimum guidelines achieved
23	68	36312	8.9	9	28723.2	7.04	7	0.80	minimum guidelines achieved
24	85	45390	8.9	9	35904	7.04	7	0.80	minimum guidelines achieved
25	85	45390	8.9	9	37791	7.41	8	0.84	change factor within guidelines
26	85	45390	8.9	9	38148	7.48	7	0.85	change factor within guidelines

Table 6.2: Existing neighbouring amenity spaces, summary table of results

6.5 Existing neighbouring amenity spaces, sunlight assessment conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st March and that and any loss of sunlight should not be greater than 0.8 (20% reduction) times its former size. From the calculation results we note that selected existing amenity spaces all received 2 hours of sunlight or more on at least 50% of the area before and after the introduction of the new development. Results are as follows (see image 6.1 – 6.4 for receptor locations):

- Phase 2C neighbouring receptors: Receptors 1 to 11 are residential dwellings with private front gardens / amenity spaces. These areas resulted in change factors ranging from 0.80-1.00 meaning the new proposed development has an effect on the amenity spaces shadow/sunlight. This effect happens in the late afternoon hours of 17.00-19.00. The results are within BRE recommendations. Receptor 1 and 6 has a change factor of 1.00 meaning the new proposed has no effect on the existing sunlight status.

- Phase 2B neighbouring receptors: Receptors 12 to 17 are residential dwellings with private back gardens / amenity spaces. These areas resulted in change factors ranging from 0.89-0.91 meaning the new proposed development has an effect on the amenity spaces shadow/sunlight. This effect happens in the late afternoon hours of 17.00-19.00. The results are comfortably within BRE guidelines.

- Phase 4D neighbouring receptors: Receptors 18 to 26 are residential dwellings with private back gardens / amenity spaces. These areas resulted in change factors ranging from 0.80-0.85 meaning the new proposed development has an effect on the amenity spaces shadow/sunlight. This effect happens in the afternoon hours of 15.00-19.00. The results are within BRE guidelines and some result in minimum recommendations.

We conclude that the sunlight reception in the existing neighbouring amenity spaces after the introduction of the new development is in accordance with the recommendations of the BRE Report– “Site Layout and Planning for Daylight and Sunlight and therefore deem this to be compliant to this element.

DKPartnership Dublin Cork London
T : 01-813-1930 T : 064-664-1686
E : post@dkpartnership.com

5061 Appendix A

APPENDIX to SUNLIGHT RECEPTION REPORT
1 (one) HOURLY SUNLIGHT / SHADOW STATUS ILLISTRATIONS

Phase 5 – Development at Oldtown

Proposed Residential Development

Oldtown,
Swords,
Co. Dublin

Gerard Gannon Properties

Project file no
DKP-N14-5061 ¦ 1P
2022-03-22

Document control

DKP project no: N14
DKP document no: 5061
Project file no: DKP-N14-5061

Circular		Issue >	1P#	1P
Clients	Gerard Gannon Properties		☑	☑
Architects	Conroy Crowe Kelly Architects		☑	☑
Planning consultant	Downey Planning		☑	☑

Issue	1P#	2021-11-10	Draft issue
Issue	1P	2022-03-22	Planning issue

Document issue status ID

#	Sketch/draft
P	Planning
C	Concept
D	Design
G	General information
T	Tender
W	Works/construction
Z	As-build/constructed

Issue	Prepared	Checked	Approved
1P#	201	208	201
1P	201	208	201

07.00 - March 21st

08.00 - March 21st

09.00 - March 21st

10.00 - March 21st

11.00 - March 21st

12.00 - March 21st

13.00 - March 21st

14.00 - March 21st

15.00 - March 21st

16.00 - March 21st

17.00 - March 21st

18.00 - March 21st

19.00 - March 21st

DKPartnership Dublin Cork London
T : 01-813-1930 T : 064-664-1686
E : post@dkpartnership.com

5062 Appendix B

APPENDIX to SUNLIGHT RECEPTION REPORT
1 (one) HOURLY SUNLIGHT / SHADOW STATUS ILLISTRATIONS WITH THE NEW DEVELOPMENT

Phase 5 – Development at Oldtown

Proposed Residential Development

Oldtown,
Swords,
Co. Dublin

Gerard Gannon Properties

Project file no
DKP-N14-5062 ¦ 1P
2022-03-22

Document control

DKP project no: N14
DKP document no: 5062
Project file no: DKP-N14-5062

Circular		Issue >	1P#	1P
Clients	Gerard Gannon Properties		☑	☑
Architects	Conroy Crowe Kelly Architects		☑	☑
Planning consultant	Downey Planning		☑	☑

Issue	1P#	2021-11-10	Draft issue
Issue	1P	2022-03-22	Planning issue

Document issue status ID

#	Sketch/draft
P	Planning
C	Concept
D	Design
G	General information
T	Tender
W	Works/construction
Z	As-build/constructed

Issue	Prepared	Checked	Approved
1P#	208	201	201
1P	208	201	201

New proposed amenity spaces sunlight-shadow calculations - March 21st 2021

A — **450** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	36	2,160
8.00	92%	8%	60	36	2,160
9.00	90%	10%	60	45	2,700
10.00	86%	14%	60	63	3,780
11.00	76%	24%	60	108	6,480
12.00	57%	43%	60	194	11,610
13.00	31%	69%	60	311	18,630
14.00	29%	71%	60	320	19,170
15.00	35%	65%	60	293	17,550
16.00	69%	31%	60	140	8,370
17.00	88%	12%	60	54	3,240
18.00	92%	8%	60	36	2,160
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 3.00
Achieved total sun time (hrs) 3.63
Achieved daily sun time * area 98010

B — **2,771** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	68%	32%	60	887	53,203
8.00	21%	79%	60	2189	131,345
9.00	15%	85%	60	2355	141,321
10.00	15%	85%	60	2355	141,321
11.00	15%	85%	60	2355	141,321
12.00	15%	85%	60	2355	141,321
13.00	14%	86%	60	2383	142,984
14.00	14%	86%	60	2383	142,984
15.00	17%	83%	60	2300	137,996
16.00	22%	78%	60	2161	129,683
17.00	34%	66%	60	1829	109,732
18.00	77%	23%	60	637	38,240
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 10.00
Achieved total sun time (hrs) 8.73
Achieved daily sun time * area 1451450

C — **286** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	77%	23%	60	66	3,947
8.00	71%	29%	60	83	4,976
9.00	53%	47%	60	134	8,065
10.00	51%	49%	60	140	8,408
11.00	49%	51%	60	146	8,752
12.00	23%	77%	60	220	13,213
13.00	9%	91%	60	260	15,616
14.00	4%	96%	60	275	16,474
15.00	4%	96%	60	275	16,474
16.00	15%	85%	60	243	14,586
17.00	70%	30%	60	86	5,148
18.00	92%	8%	60	23	1,373
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 6.00
Achieved total sun time (hrs) 6.82
Achieved daily sun time * area 117031

D — **500** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	94%	6%	60	30	1,800
8.00	64%	36%	60	180	10,800
9.00	21%	79%	60	395	23,700
10.00	31%	69%	60	345	20,700
11.00	27%	73%	60	365	21,900
12.00	26%	74%	60	370	22,200
13.00	26%	74%	60	370	22,200
14.00	25%	75%	60	375	22,500
15.00	24%	76%	60	380	22,800
16.00	18%	82%	60	410	24,600
17.00	46%	54%	60	270	16,200
18.00	88%	12%	60	60	3,600
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 9.00
Achieved total sun time (hrs) 7.1
Achieved daily sun time * area 213000

E — **95** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	8	456
8.00	63%	37%	60	35	2,109
9.00	27%	73%	60	69	4,161
10.00	47%	53%	60	50	3,021
11.00	71%	29%	60	28	1,653
12.00	85%	15%	60	14	855
13.00	87%	13%	60	12	741
14.00	86%	14%	60	13	798
15.00	85%	15%	60	14	855
16.00	80%	20%	60	19	1,140
17.00	78%	22%	60	21	1,254
18.00	78%	22%	60	21	1,254
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 2.00
Achieved total sun time (hrs) 3.21
Achieved daily sun time * area 18297

F — **4,147** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	74%	26%	60	1078	64,693
8.00	26%	74%	60	3069	184,127
9.00	16%	84%	60	3483	209,009
10.00	12%	88%	60	3649	218,962
11.00	12%	88%	60	3649	218,962
12.00	12%	88%	60	3649	218,962
13.00	12%	88%	60	3649	218,962
14.00	16%	84%	60	3483	209,009
15.00	19%	81%	60	3359	201,544
16.00	22%	78%	60	3235	194,080
17.00	25%	75%	60	3110	186,615
18.00	38%	62%	60	2571	154,268
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 11.00
Achieved total sun time (hrs) 9.16
Achieved daily sun time * area 2279191

G — **133** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	11	638
8.00	71%	29%	60	39	2,314
9.00	44%	56%	60	74	4,469
10.00	18%	82%	60	109	6,544
11.00	18%	82%	60	109	6,544
12.00	17%	83%	60	110	6,623
13.00	8%	92%	60	122	7,342
14.00	11%	89%	60	118	7,102
15.00	16%	84%	60	112	6,703
16.00	65%	35%	60	47	2,793
17.00	86%	14%	60	19	1,117
18.00	90%	10%	60	13	798
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 7.00
Achieved total sun time (hrs) 6.64
Achieved daily sun time * area 52987

H — **379** m2

NEW STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	30	1,819
8.00	88%	12%	60	45	2,729
9.00	84%	16%	60	61	3,638
10.00	84%	16%	60	61	3,638
11.00	73%	27%	60	102	6,140
12.00	59%	41%	60	155	9,323
13.00	49%	51%	60	193	11,597
14.00	50%	50%	60	190	11,370
15.00	38%	62%	60	235	14,099
16.00	52%	48%	60	182	10,915
17.00	74%	26%	60	99	5,912
18.00	90%	10%	60	38	2,274
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 2.00
Achieved total sun time (hrs) 3.67
Achieved daily sun time * area 83456

I **798** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	90%	10%	60	80	4,788
8.00	64%	36%	60	287	17,237
9.00	16%	84%	60	670	40,219
10.00	16%	84%	60	670	40,219
11.00	16%	84%	60	670	40,219
12.00	16%	84%	60	670	40,219
13.00	16%	84%	60	670	40,219
14.00	16%	84%	60	670	40,219
15.00	20%	80%	60	638	38,304
16.00	23%	77%	60	614	36,868
17.00	41%	59%	60	471	28,249
18.00	85%	15%	60	120	7,182
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 9.00
Achieved total sun time (hrs) 7.81
Achieved daily sun time * area 373943

J **744** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	93%	7%	60	52	3,125
8.00	67%	33%	60	246	14,731
9.00	26%	74%	60	551	33,034
10.00	14%	86%	60	640	38,390
11.00	14%	86%	60	640	38,390
12.00	14%	86%	60	640	38,390
13.00	14%	86%	60	640	38,390
14.00	10%	90%	60	670	40,176
15.00	10%	90%	60	670	40,176
16.00	14%	86%	60	640	38,390
17.00	15%	85%	60	632	37,944
18.00	18%	82%	60	610	36,605
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 10.00
Achieved total sun time (hrs) 8.91
Achieved daily sun time * area 397742

K **125** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	10	600
8.00	90%	10%	60	13	750
9.00	81%	19%	60	24	1,425
10.00	74%	26%	60	33	1,950
11.00	55%	45%	60	56	3,375
12.00	48%	52%	60	65	3,900
13.00	24%	76%	60	95	5,700
14.00	16%	84%	60	105	6,300
15.00	21%	79%	60	99	5,925
16.00	13%	87%	60	109	6,525
17.00	88%	12%	60	15	900
18.00	92%	8%	60	10	600
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 5.00
Achieved total sun time (hrs) 5.06
Achieved daily sun time * area 37950

L **123** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	88%	12%	60	15	886
8.00	56%	44%	60	54	3,247
9.00	41%	59%	60	73	4,354
10.00	76%	24%	60	30	1,771
11.00	90%	10%	60	12	738
12.00	84%	16%	60	20	1,181
13.00	85%	15%	60	18	1,107
14.00	79%	21%	60	26	1,550
15.00	45%	55%	60	68	4,059
16.00	32%	68%	60	84	5,018
17.00	81%	19%	60	23	1,402
18.00	92%	8%	60	10	590
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 3.00
Achieved total sun time (hrs) 3.51
Achieved daily sun time * area 25904

M **1,259** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	101	6,043
8.00	78%	22%	60	277	16,619
9.00	71%	29%	60	365	21,907
10.00	63%	37%	60	466	27,950
11.00	31%	69%	60	869	52,123
12.00	22%	78%	60	982	58,921
13.00	17%	83%	60	1045	62,698
14.00	14%	86%	60	1083	64,964
15.00	14%	86%	60	1083	64,964
16.00	14%	86%	60	1083	64,964
17.00	14%	86%	60	1083	64,964
18.00	28%	72%	60	906	54,389
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 8.00
Achieved total sun time (hrs) 7.42
Achieved daily sun time * area 560507

N **966** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	77	4,637
8.00	78%	22%	60	213	12,751
9.00	68%	32%	60	309	18,547
10.00	37%	63%	60	609	36,515
11.00	18%	82%	60	792	47,527
12.00	17%	83%	60	802	48,107
13.00	14%	86%	60	831	49,846
14.00	14%	86%	60	831	49,846
15.00	14%	86%	60	831	49,846
16.00	14%	86%	60	831	49,846
17.00	14%	86%	60	831	49,846
18.00	28%	72%	60	696	41,731
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
Achieved sun hours on @ 50% area 9.00
Achieved total sun time (hrs) 7.92
Achieved daily sun time * area 459043

Neighbouring amenity spaces sunlight-shadow calculations - March 21st 2021

1 — **70** m2

EXISTING STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	6	336
8.00	92%	8%	60	6	336
9.00	80%	20%	60	14	840
10.00	76%	24%	60	17	1,008
11.00	70%	30%	60	21	1,260
12.00	61%	39%	60	27	1,638
13.00	22%	78%	60	55	3,276
14.00	0%	100%	60	70	4,200
15.00	0%	100%	60	70	4,200
16.00	0%	100%	60	70	4,200
17.00	16%	84%	60	59	3,528
18.00	57%	43%	60	30	1,806
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	5.00
Achieved total sun time (hrs)	6.34
Achieved daily sun time * area	26628

NEW STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area	change time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	6	336	0
8.00	92%	8%	60	6	336	0
9.00	80%	20%	60	14	840	0
10.00	76%	24%	60	17	1,008	0
11.00	70%	30%	60	21	1,260	0
12.00	61%	39%	60	27	1,638	0
13.00	22%	78%	60	55	3,276	0
14.00	0%	100%	60	70	4,200	0
15.00	0%	100%	60	70	4,200	0
16.00	0%	100%	60	70	4,200	0
17.00	16%	84%	60	59	3,528	0
18.00	57%	43%	60	30	1,806	0
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	6.34	1.00
Achieved daily sun time * area	26628	1.00

2 — **16** m2

EXISTING STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	1	77
8.00	92%	8%	60	1	77
9.00	85%	15%	60	2	144
10.00	85%	15%	60	2	144
11.00	85%	15%	60	2	144
12.00	85%	15%	60	2	144
13.00	53%	47%	60	8	451
14.00	0%	100%	60	16	960
15.00	0%	100%	60	16	960
16.00	0%	100%	60	16	960
17.00	0%	100%	60	16	960
18.00	17%	83%	60	13	797
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	5.00
Achieved total sun time (hrs)	6.06
Achieved daily sun time * area	5817.6

NEW STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area	change time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	1	77	0
8.00	92%	8%	60	1	77	0
9.00	85%	15%	60	2	144	0
10.00	85%	15%	60	2	144	0
11.00	85%	15%	60	2	144	0
12.00	85%	15%	60	2	144	0
13.00	53%	47%	60	8	451	0
14.00	0%	100%	60	16	960	0
15.00	0%	100%	60	16	960	0
16.00	0%	100%	60	16	960	0
17.00	0%	100%	60	16	960	0
18.00	88%	12%	60	2	115	-682
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	4.00	
Achieved total sun time (hrs)	5.35	0.89
Achieved daily sun time * area	5136	0.89

3 — **17** m2

EXISTING STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	1	82
8.00	92%	8%	60	1	82
9.00	85%	15%	60	3	153
10.00	85%	15%	60	3	153
11.00	85%	15%	60	3	153
12.00	85%	15%	60	3	153
13.00	49%	51%	60	9	520
14.00	0%	100%	60	17	1,020
15.00	0%	100%	60	17	1,020
16.00	0%	100%	60	17	1,020
17.00	0%	100%	60	17	1,020
18.00	17%	83%	60	14	847
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	6.00
Achieved total sun time (hrs)	6.1
Achieved daily sun time * area	6222

NEW STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area	change time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	1	82	0
8.00	92%	8%	60	1	82	0
9.00	85%	15%	60	3	153	0
10.00	85%	15%	60	3	153	0
11.00	85%	15%	60	3	153	0
12.00	85%	15%	60	3	153	0
13.00	49%	51%	60	9	520	0
14.00	0%	100%	60	17	1,020	0
15.00	0%	100%	60	17	1,020	0
16.00	0%	100%	60	17	1,020	0
17.00	10%	90%	60	15	918	-102
18.00	88%	12%	60	2	122	-724
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	5.29	0.87
Achieved daily sun time * area	5396	0.87

4 — **17** m2

EXISTING STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	1	82
8.00	92%	8%	60	1	82
9.00	85%	15%	60	3	153
10.00	85%	15%	60	3	153
11.00	85%	15%	60	3	153
12.00	85%	15%	60	3	153
13.00	30%	70%	60	12	714
14.00	0%	100%	60	17	1,020
15.00	0%	100%	60	17	1,020
16.00	0%	100%	60	17	1,020
17.00	0%	100%	60	17	1,020
18.00	17%	83%	60	14	847
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	6.00
Achieved total sun time (hrs)	6.29
Achieved daily sun time * area	6415.8

NEW STATUS

Time	Shadow	Sunlight	Sun time	Sun area	March 21st time * area	change time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	1	82	0
8.00	92%	8%	60	1	82	0
9.00	85%	15%	60	3	153	0
10.00	85%	15%	60	3	153	0
11.00	85%	15%	60	3	153	0
12.00	85%	15%	60	3	153	0
13.00	30%	70%	60	12	714	0
14.00	0%	100%	60	17	1,020	0
15.00	0%	100%	60	17	1,020	0
16.00	0%	100%	60	17	1,020	0
17.00	52%	48%	60	8	490	-530
18.00	88%	12%	60	2	122	-724
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	4.00	
Achieved total sun time (hrs)	5.06	0.81
Achieved daily sun time * area	5161	0.81

5 — **28** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	2	134	7.00	92%	8%	60	2	134	0
8.00	92%	8%	60	2	134	8.00	92%	8%	60	2	134	0
9.00	85%	15%	60	4	252	9.00	85%	15%	60	4	252	0
10.00	85%	15%	60	4	252	10.00	85%	15%	60	4	252	0
11.00	85%	15%	60	4	252	11.00	85%	15%	60	4	252	0
12.00	75%	25%	60	7	420	12.00	75%	25%	60	7	420	0
13.00	19%	81%	60	23	1,361	13.00	19%	81%	60	23	1,361	0
14.00	0%	100%	60	28	1,680	14.00	0%	100%	60	28	1,680	0
15.00	0%	100%	60	28	1,680	15.00	0%	100%	60	28	1,680	0
16.00	0%	100%	60	28	1,680	16.00	0%	100%	60	28	1,680	0
17.00	0%	100%	60	28	1,680	17.00	65%	35%	60	10	588	-1,092
18.00	17%	83%	60	23	1,394	18.00	88%	12%	60	3	202	-1,193
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	6.00	Achieved sun hours on (hrs) @ 50% area	4.00	
Achieved total sun time (hrs)	6.5	Achieved total sun time (hrs)	5.14	0.80
Achieved daily sun time * area	10920	Achieved daily sun time * area	8635	0.80

6 — **1,160** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	79%	21%	60	244	14,616	7.00	79%	21%	60	244	14,616	0
8.00	71%	29%	60	336	20,184	8.00	71%	29%	60	336	20,184	0
9.00	22%	78%	60	905	54,288	9.00	22%	78%	60	905	54,288	0
10.00	7%	93%	60	1079	64,728	10.00	7%	93%	60	1079	64,728	0
11.00	7%	93%	60	1079	64,728	11.00	7%	93%	60	1079	64,728	0
12.00	7%	93%	60	1079	64,728	12.00	7%	93%	60	1079	64,728	0
13.00	7%	93%	60	1079	64,728	13.00	7%	93%	60	1079	64,728	0
14.00	7%	93%	60	1079	64,728	14.00	7%	93%	60	1079	64,728	0
15.00	7%	93%	60	1079	64,728	15.00	7%	93%	60	1079	64,728	0
16.00	17%	83%	60	963	57,768	16.00	17%	83%	60	963	57,768	0
17.00	63%	37%	60	429	25,752	17.00	63%	37%	60	429	25,752	0
18.00	90%	10%	60	116	6,960	18.00	90%	10%	60	116	6,960	0
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	8.00	Achieved sun hours on (hrs) @ 50% area	8.00	
Achieved total sun time (hrs)	8.16	Achieved total sun time (hrs)	8.16	1.00
Achieved daily sun time * area	567936	Achieved daily sun time * area	567936	1.00

7 — **27** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	2	130	7.00	92%	8%	60	2	130	0
8.00	92%	8%	60	2	130	8.00	92%	8%	60	2	130	0
9.00	85%	15%	60	4	243	9.00	85%	15%	60	4	243	0
10.00	85%	15%	60	4	243	10.00	85%	15%	60	4	243	0
11.00	80%	20%	60	5	324	11.00	80%	20%	60	5	324	0
12.00	36%	64%	60	17	1,037	12.00	36%	64%	60	17	1,037	0
13.00	9%	91%	60	25	1,474	13.00	9%	91%	60	25	1,474	0
14.00	0%	100%	60	27	1,620	14.00	0%	100%	60	27	1,620	0
15.00	0%	100%	60	27	1,620	15.00	0%	100%	60	27	1,620	0
16.00	0%	100%	60	27	1,620	16.00	0%	100%	60	27	1,620	0
17.00	0%	100%	60	27	1,620	17.00	75%	25%	60	7	405	-1,215
18.00	17%	83%	60	22	1,345	18.00	88%	12%	60	3	194	-1,150
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	7.04	Achieved total sun time (hrs)	5.58	0.80
Achieved daily sun time * area	11404.8	Achieved daily sun time * area	9040	0.80

8 — **17** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	1	82	7.00	92%	8%	60	1	82	0
8.00	92%	8%	60	1	82	8.00	92%	8%	60	1	82	0
9.00	85%	15%	60	3	153	9.00	85%	15%	60	3	153	0
10.00	85%	15%	60	3	153	10.00	85%	15%	60	3	153	0
11.00	75%	25%	60	4	255	11.00	75%	25%	60	4	255	0
12.00	43%	57%	60	10	581	12.00	43%	57%	60	10	581	0
13.00	7%	93%	60	16	949	13.00	7%	93%	60	16	949	0
14.00	0%	100%	60	17	1,020	14.00	0%	100%	60	17	1,020	0
15.00	0%	100%	60	17	1,020	15.00	0%	100%	60	17	1,020	0
16.00	0%	100%	60	17	1,020	16.00	0%	100%	60	17	1,020	0
17.00	0%	100%	60	17	1,020	17.00	73%	27%	60	5	275	-745
18.00	17%	83%	60	14	847	18.00	88%	12%	60	2	122	-724
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	7.04	Achieved total sun time (hrs)	5.6	0.80
Achieved daily sun time * area	7180.8	Achieved daily sun time * area	5712	0.80

9 — **17** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	1	82	7.00	92%	8%	60	1	82	0
8.00	92%	8%	60	1	82	8.00	92%	8%	60	1	82	0
9.00	85%	15%	60	3	153	9.00	85%	15%	60	3	153	0
10.00	85%	15%	60	3	153	10.00	85%	15%	60	3	153	0
11.00	75%	25%	60	4	255	11.00	75%	25%	60	4	255	0
12.00	43%	57%	60	10	581	12.00	43%	57%	60	10	581	0
13.00	7%	93%	60	16	949	13.00	7%	93%	60	16	949	0
14.00	0%	100%	60	17	1,020	14.00	0%	100%	60	17	1,020	0
15.00	0%	100%	60	17	1,020	15.00	0%	100%	60	17	1,020	0
16.00	0%	100%	60	17	1,020	16.00	0%	100%	60	17	1,020	0
17.00	0%	100%	60	17	1,020	17.00	73%	27%	60	5	275	-745
18.00	17%	83%	60	14	847	18.00	85%	15%	60	3	153	-694
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	7.04	Achieved total sun time (hrs)	5.63	0.80
Achieved daily sun time * area	7180.8	Achieved daily sun time * area	5743	0.80

10 — **16** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	1	77	7.00	92%	8%	60	1	77	0
8.00	92%	8%	60	1	77	8.00	92%	8%	60	1	77	0
9.00	85%	15%	60	2	144	9.00	85%	15%	60	2	144	0
10.00	85%	15%	60	2	144	10.00	85%	15%	60	2	144	0
11.00	75%	25%	60	4	240	11.00	75%	25%	60	4	240	0
12.00	43%	57%	60	9	547	12.00	43%	57%	60	9	547	0
13.00	7%	93%	60	15	893	13.00	7%	93%	60	15	893	0
14.00	0%	100%	60	16	960	14.00	0%	100%	60	16	960	0
15.00	0%	100%	60	16	960	15.00	0%	100%	60	16	960	0
16.00	0%	100%	60	16	960	16.00	0%	100%	60	16	960	0
17.00	0%	100%	60	16	960	17.00	73%	27%	60	4	259	-701
18.00	17%	83%	60	13	797	18.00	85%	15%	60	2	144	-653
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	7.04	Achieved total sun time (hrs)	5.63	0.80
Achieved daily sun time * area	6758.4	Achieved daily sun time * area	5405	0.80

11 — **70** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	6	336	7.00	92%	8%	60	6	336	0
8.00	45%	55%	60	39	2,310	8.00	45%	55%	60	39	2,310	0
9.00	85%	15%	60	11	630	9.00	85%	15%	60	11	630	0
10.00	85%	15%	60	11	630	10.00	85%	15%	60	11	630	0
11.00	80%	20%	60	14	840	11.00	80%	20%	60	14	840	0
12.00	80%	20%	60	14	840	12.00	80%	20%	60	14	840	0
13.00	39%	61%	60	43	2,562	13.00	39%	61%	60	43	2,562	0
14.00	18%	82%	60	57	3,444	14.00	18%	82%	60	57	3,444	0
15.00	16%	84%	60	59	3,528	15.00	16%	84%	60	59	3,528	0
16.00	14%	86%	60	60	3,612	16.00	14%	86%	60	60	3,612	0
17.00	12%	88%	60	62	3,696	17.00	73%	27%	60	19	1,134	-2,562
18.00	17%	83%	60	58	3,486	18.00	85%	15%	60	11	630	-2,856
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	6.17	Achieved total sun time (hrs)	4.88	0.80
Achieved daily sun time * area	25914	Achieved daily sun time * area	20496	0.80

12 — **270** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	22	1,296	7.00	92%	8%	60	22	1,296	0
8.00	83%	17%	60	46	2,754	8.00	83%	17%	60	46	2,754	0
9.00	54%	46%	60	124	7,452	9.00	54%	46%	60	124	7,452	0
10.00	27%	73%	60	197	11,826	10.00	27%	73%	60	197	11,826	0
11.00	36%	64%	60	173	10,368	11.00	36%	64%	60	173	10,368	0
12.00	47%	53%	60	143	8,586	12.00	47%	53%	60	143	8,586	0
13.00	58%	42%	60	113	6,804	13.00	58%	42%	60	113	6,804	0
14.00	58%	42%	60	113	6,804	14.00	58%	42%	60	113	6,804	0
15.00	56%	44%	60	119	7,128	15.00	56%	44%	60	119	7,128	0
16.00	54%	46%	60	124	7,452	16.00	54%	46%	60	124	7,452	0
17.00	49%	51%	60	138	8,262	17.00	79%	21%	60	57	3,402	-4,860
18.00	47%	53%	60	143	8,586	18.00	90%	10%	60	27	1,620	-6,966
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	5.00	Achieved sun hours on (hrs) @ 50% area	3.00	
Achieved total sun time (hrs)	5.39	Achieved total sun time (hrs)	4.66	0.87
Achieved daily sun time * area	87318	Achieved daily sun time * area	75492	0.87

13 **88** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	90%	10%	60	9	528	7.00	90%	10%	60	9	528	0
8.00	68%	32%	60	28	1,690	8.00	68%	32%	60	28	1,690	0
9.00	43%	57%	60	50	3,010	9.00	43%	57%	60	50	3,010	0
10.00	21%	79%	60	70	4,171	10.00	21%	79%	60	70	4,171	0
11.00	15%	85%	60	75	4,488	11.00	15%	85%	60	75	4,488	0
12.00	15%	85%	60	75	4,488	12.00	15%	85%	60	75	4,488	0
13.00	15%	85%	60	75	4,488	13.00	15%	85%	60	75	4,488	0
14.00	15%	85%	60	75	4,488	14.00	15%	85%	60	75	4,488	0
15.00	18%	82%	60	72	4,330	15.00	18%	82%	60	72	4,330	0
16.00	15%	85%	60	75	4,488	16.00	15%	85%	60	75	4,488	0
17.00	15%	85%	60	75	4,488	17.00	74%	26%	60	23	1,373	-3,115
18.00	23%	77%	60	68	4,066	18.00	90%	10%	60	9	528	-3,538
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	10.00	Achieved sun hours on (hrs) @ 50% area	8.00	
Achieved total sun time (hrs)	8.47	Achieved total sun time (hrs)	7.21	0.86
Achieved daily sun time * area	44721.6	Achieved daily sun time * area	38069	0.86

14 **93** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	7	446	7.00	92%	8%	60	7	446	0
8.00	92%	8%	60	7	446	8.00	92%	8%	60	7	446	0
9.00	86%	14%	60	13	781	9.00	86%	14%	60	13	781	0
10.00	19%	81%	60	75	4,520	10.00	19%	81%	60	75	4,520	0
11.00	23%	77%	60	72	4,297	11.00	23%	77%	60	72	4,297	0
12.00	24%	76%	60	71	4,241	12.00	24%	76%	60	71	4,241	0
13.00	32%	68%	60	63	3,794	13.00	32%	68%	60	63	3,794	0
14.00	71%	29%	60	27	1,618	14.00	71%	29%	60	27	1,618	0
15.00	65%	35%	60	33	1,953	15.00	65%	35%	60	33	1,953	0
16.00	44%	56%	60	52	3,125	16.00	44%	56%	60	52	3,125	0
17.00	21%	79%	60	73	4,408	17.00	21%	79%	60	73	4,408	0
18.00	21%	79%	60	73	4,408	18.00	89%	11%	60	10	614	-3,794
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	Achieved sun hours on (hrs) @ 50% area	6.00	
Achieved total sun time (hrs)	6.1	Achieved total sun time (hrs)	5.42	0.89
Achieved daily sun time * area	34038	Achieved daily sun time * area	30244	0.89

15 **85** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	93%	7%	60	6	357	7.00	93%	7%	60	6	357	0
8.00	59%	41%	60	35	2,091	8.00	59%	41%	60	35	2,091	0
9.00	55%	45%	60	38	2,295	9.00	55%	45%	60	38	2,295	0
10.00	19%	81%	60	69	4,131	10.00	19%	81%	60	69	4,131	0
11.00	14%	86%	60	73	4,386	11.00	14%	86%	60	73	4,386	0
12.00	33%	67%	60	57	3,417	12.00	33%	67%	60	57	3,417	0
13.00	48%	52%	60	44	2,652	13.00	48%	52%	60	44	2,652	0
14.00	56%	44%	60	37	2,244	14.00	56%	44%	60	37	2,244	0
15.00	46%	54%	60	46	2,754	15.00	46%	54%	60	46	2,754	0
16.00	17%	83%	60	71	4,233	16.00	17%	83%	60	71	4,233	0
17.00	16%	84%	60	71	4,284	17.00	16%	84%	60	71	4,284	0
18.00	16%	84%	60	71	4,284	18.00	90%	10%	60	9	510	-3,774
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	8.00	Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	7.28	Achieved total sun time (hrs)	6.54	0.90
Achieved daily sun time * area	37128	Achieved daily sun time * area	33354	0.90

16 **64** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	93%	7%	60	4	269	7.00	93%	7%	60	4	269	0
8.00	63%	37%	60	24	1,421	8.00	63%	37%	60	24	1,421	0
9.00	28%	72%	60	46	2,765	9.00	28%	72%	60	46	2,765	0
10.00	15%	85%	60	54	3,264	10.00	15%	85%	60	54	3,264	0
11.00	15%	85%	60	54	3,264	11.00	15%	85%	60	54	3,264	0
12.00	19%	81%	60	52	3,110	12.00	19%	81%	60	52	3,110	0
13.00	26%	74%	60	47	2,842	13.00	26%	74%	60	47	2,842	0
14.00	57%	43%	60	28	1,651	14.00	57%	43%	60	28	1,651	0
15.00	77%	23%	60	15	883	15.00	77%	23%	60	15	883	0
16.00	69%	31%	60	20	1,190	16.00	69%	31%	60	20	1,190	0
17.00	61%	39%	60	25	1,498	17.00	61%	39%	60	25	1,498	0
18.00	51%	49%	60	31	1,882	18.00	92%	8%	60	5	307	-1,574
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	5.00	Achieved sun hours on (hrs) @ 50% area	5.00	
Achieved total sun time (hrs)	6.26	Achieved total sun time (hrs)	5.85	0.94
Achieved daily sun time * area	24038.4	Achieved daily sun time * area	22464	0.94

17 — **74** m2

EXISTING STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	6	355
8.00	39%	61%	60	45	2,708
9.00	30%	70%	60	52	3,108
10.00	16%	84%	60	62	3,730
11.00	15%	85%	60	63	3,774
12.00	15%	85%	60	63	3,774
13.00	27%	73%	60	54	3,241
14.00	55%	45%	60	33	1,998
15.00	72%	28%	60	21	1,243
16.00	68%	32%	60	24	1,421
17.00	49%	51%	60	38	2,264
18.00	28%	72%	60	53	3,197
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	6.94
Achieved daily sun time * area	30813.6

NEW STATUS — March 21st — change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	6	355	0
8.00	39%	61%	60	45	2,708	0
9.00	30%	70%	60	52	3,108	0
10.00	16%	84%	60	62	3,730	0
11.00	15%	85%	60	63	3,774	0
12.00	15%	85%	60	63	3,774	0
13.00	27%	73%	60	54	3,241	0
14.00	55%	45%	60	33	1,998	0
15.00	72%	28%	60	21	1,243	0
16.00	68%	32%	60	24	1,421	0
17.00	49%	51%	60	38	2,264	0
18.00	92%	8%	60	6	355	-2,842
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	6.3	0.91
Achieved daily sun time * area	27972	0.91

18 — **85** m2

EXISTING STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	80%	20%	60	17	1,020
8.00	18%	82%	60	70	4,182
9.00	5%	95%	60	81	4,845
10.00	5%	95%	60	81	4,845
11.00	5%	95%	60	81	4,845
12.00	5%	95%	60	81	4,845
13.00	5%	95%	60	81	4,845
14.00	5%	95%	60	81	4,845
15.00	5%	95%	60	81	4,845
16.00	5%	95%	60	81	4,845
17.00	5%	95%	60	81	4,845
18.00	15%	85%	60	72	4,335
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	11.00
Achieved total sun time (hrs)	10.42
Achieved daily sun time * area	53142

NEW STATUS — March 21st — change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	80%	20%	60	17	1,020	0
8.00	18%	82%	60	70	4,182	0
9.00	5%	95%	60	81	4,845	0
10.00	5%	95%	60	81	4,845	0
11.00	5%	95%	60	81	4,845	0
12.00	5%	95%	60	81	4,845	0
13.00	5%	95%	60	81	4,845	0
14.00	5%	95%	60	81	4,845	0
15.00	10%	90%	60	77	4,590	-255
16.00	32%	68%	60	58	3,468	-1,377
17.00	83%	17%	60	14	867	-3,978
18.00	88%	12%	60	10	612	-3,723
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	9.00	
Achieved total sun time (hrs)	8.59	0.83
Achieved daily sun time * area	43809	0.83

19 — **68** m2

EXISTING STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	5	326
8.00	76%	24%	60	16	979
9.00	29%	71%	60	48	2,897
10.00	18%	82%	60	56	3,346
11.00	5%	95%	60	65	3,876
12.00	5%	95%	60	65	3,876
13.00	5%	95%	60	65	3,876
14.00	5%	95%	60	65	3,876
15.00	5%	95%	60	65	3,876
16.00	5%	95%	60	65	3,876
17.00	5%	95%	60	65	3,876
18.00	18%	82%	60	56	3,346
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	10.00
Achieved total sun time (hrs)	9.32
Achieved daily sun time * area	38025.6

NEW STATUS — March 21st — change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	5	326	0
8.00	76%	24%	60	16	979	0
9.00	29%	71%	60	48	2,897	0
10.00	18%	82%	60	56	3,346	0
11.00	5%	95%	60	65	3,876	0
12.00	5%	95%	60	65	3,876	0
13.00	5%	95%	60	65	3,876	0
14.00	5%	95%	60	65	3,876	0
15.00	11%	89%	60	61	3,631	-245
16.00	41%	59%	60	40	2,407	-1,469
17.00	83%	17%	60	12	694	-3,182
18.00	88%	12%	60	8	490	-2,856
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	8.00	
Achieved total sun time (hrs)	7.42	0.80
Achieved daily sun time * area	30274	0.80

20 — **68** m2

EXISTING STATUS — March 21st

Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	5	326
8.00	85%	15%	60	10	612
9.00	68%	32%	60	22	1,306
10.00	11%	89%	60	61	3,631
11.00	5%	95%	60	65	3,876
12.00	5%	95%	60	65	3,876
13.00	5%	95%	60	65	3,876
14.00	5%	95%	60	65	3,876
15.00	5%	95%	60	65	3,876
16.00	5%	95%	60	65	3,876
17.00	5%	95%	60	65	3,876
18.00	19%	81%	60	55	3,305
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00
Achieved total sun time (hrs)	8.9
Achieved daily sun time * area	36312

NEW STATUS — March 21st — change

Time	Shadow	Sunlight	Sun time	Sun area	time * area	change
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	5	326	0
8.00	85%	15%	60	10	612	0
9.00	68%	32%	60	22	1,306	0
10.00	11%	89%	60	61	3,631	0
11.00	5%	95%	60	65	3,876	0
12.00	5%	95%	60	65	3,876	0
13.00	5%	95%	60	65	3,876	0
14.00	5%	95%	60	65	3,876	0
15.00	5%	95%	60	65	3,876	0
16.00	44%	56%	60	38	2,285	-1,591
17.00	83%	17%	60	12	694	-3,182
18.00	88%	12%	60	8	490	-2,815
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	7.04	0.80
Achieved daily sun time * area	28723	0.80

21 — **68** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	5	326	7.00	92%	8%	60	5	326	0
8.00	85%	15%	60	10	612	8.00	85%	15%	60	10	612	0
9.00	68%	32%	60	22	1,306	9.00	68%	32%	60	22	1,306	0
10.00	11%	89%	60	61	3,631	10.00	11%	89%	60	61	3,631	0
11.00	5%	95%	60	65	3,876	11.00	5%	95%	60	65	3,876	0
12.00	5%	95%	60	65	3,876	12.00	5%	95%	60	65	3,876	0
13.00	5%	95%	60	65	3,876	13.00	5%	95%	60	65	3,876	0
14.00	5%	95%	60	65	3,876	14.00	5%	95%	60	65	3,876	0
15.00	5%	95%	60	65	3,876	15.00	5%	95%	60	65	3,876	0
16.00	5%	95%	60	65	3,876	16.00	44%	56%	60	38	2,285	-1,591
17.00	5%	95%	60	65	3,876	17.00	83%	17%	60	12	694	-3,182
18.00	19%	81%	60	55	3,305	18.00	88%	12%	60	8	490	-2,815
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	8.9	Achieved total sun time (hrs)	7.04	0.80
Achieved daily sun time * area	36312	Achieved daily sun time * area	28723	0.80

22 — **68** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	5	326	7.00	92%	8%	60	5	326	0
8.00	85%	15%	60	10	612	8.00	85%	15%	60	10	612	0
9.00	68%	32%	60	22	1,306	9.00	68%	32%	60	22	1,306	0
10.00	11%	89%	60	61	3,631	10.00	11%	89%	60	61	3,631	0
11.00	5%	95%	60	65	3,876	11.00	5%	95%	60	65	3,876	0
12.00	5%	95%	60	65	3,876	12.00	5%	95%	60	65	3,876	0
13.00	5%	95%	60	65	3,876	13.00	5%	95%	60	65	3,876	0
14.00	5%	95%	60	65	3,876	14.00	5%	95%	60	65	3,876	0
15.00	5%	95%	60	65	3,876	15.00	5%	95%	60	65	3,876	0
16.00	5%	95%	60	65	3,876	16.00	44%	56%	60	38	2,285	-1,591
17.00	5%	95%	60	65	3,876	17.00	83%	17%	60	12	694	-3,182
18.00	19%	81%	60	55	3,305	18.00	88%	12%	60	8	490	-2,815
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	8.9	Achieved total sun time (hrs)	7.04	0.80
Achieved daily sun time * area	36312	Achieved daily sun time * area	28723	0.80

23 — **68** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	5	326	7.00	92%	8%	60	5	326	0
8.00	85%	15%	60	10	612	8.00	85%	15%	60	10	612	0
9.00	68%	32%	60	22	1,306	9.00	68%	32%	60	22	1,306	0
10.00	11%	89%	60	61	3,631	10.00	11%	89%	60	61	3,631	0
11.00	5%	95%	60	65	3,876	11.00	5%	95%	60	65	3,876	0
12.00	5%	95%	60	65	3,876	12.00	5%	95%	60	65	3,876	0
13.00	5%	95%	60	65	3,876	13.00	5%	95%	60	65	3,876	0
14.00	5%	95%	60	65	3,876	14.00	5%	95%	60	65	3,876	0
15.00	5%	95%	60	65	3,876	15.00	5%	95%	60	65	3,876	0
16.00	5%	95%	60	65	3,876	16.00	44%	56%	60	38	2,285	-1,591
17.00	5%	95%	60	65	3,876	17.00	83%	17%	60	12	694	-3,182
18.00	19%	81%	60	55	3,305	18.00	88%	12%	60	8	490	-2,815
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	8.9	Achieved total sun time (hrs)	7.04	0.80
Achieved daily sun time * area	36312	Achieved daily sun time * area	28723	0.80

24 — **85** m2

EXISTING STATUS					March 21st	NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	7	408	7.00	92%	8%	60	7	408	0
8.00	85%	15%	60	13	765	8.00	85%	15%	60	13	765	0
9.00	68%	32%	60	27	1,632	9.00	68%	32%	60	27	1,632	0
10.00	11%	89%	60	76	4,539	10.00	11%	89%	60	76	4,539	0
11.00	5%	95%	60	81	4,845	11.00	5%	95%	60	81	4,845	0
12.00	5%	95%	60	81	4,845	12.00	5%	95%	60	81	4,845	0
13.00	5%	95%	60	81	4,845	13.00	5%	95%	60	81	4,845	0
14.00	5%	95%	60	81	4,845	14.00	5%	95%	60	81	4,845	0
15.00	5%	95%	60	81	4,845	15.00	5%	95%	60	81	4,845	0
16.00	5%	95%	60	81	4,845	16.00	44%	56%	60	48	2,856	-1,989
17.00	5%	95%	60	81	4,845	17.00	83%	17%	60	14	867	-3,978
18.00	19%	81%	60	69	4,131	18.00	88%	12%	60	10	612	-3,519
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	8.9	Achieved total sun time (hrs)	7.04	0.80
Achieved daily sun time * area	45390	Achieved daily sun time * area	35904	0.80

25 **85** m2

EXISTING STATUS					March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	7	408
8.00	85%	15%	60	13	765
9.00	68%	32%	60	27	1,632
10.00	11%	89%	60	76	4,539
11.00	5%	95%	60	81	4,845
12.00	5%	95%	60	81	4,845
13.00	5%	95%	60	81	4,845
14.00	5%	95%	60	81	4,845
15.00	5%	95%	60	81	4,845
16.00	5%	95%	60	81	4,845
17.00	5%	95%	60	81	4,845
18.00	19%	81%	60	69	4,131
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00
Achieved total sun time (hrs)	8.9
Achieved daily sun time * area	45390

NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	7	408	0
8.00	85%	15%	60	13	765	0
9.00	68%	32%	60	27	1,632	0
10.00	11%	89%	60	76	4,539	0
11.00	5%	95%	60	81	4,845	0
12.00	5%	95%	60	81	4,845	0
13.00	5%	95%	60	81	4,845	0
14.00	5%	95%	60	81	4,845	0
15.00	5%	95%	60	81	4,845	0
16.00	42%	58%	60	49	2,958	-1,887
17.00	48%	52%	60	44	2,652	-2,193
18.00	88%	12%	60	10	612	-3,519
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	8.00	
Achieved total sun time (hrs)	7.41	0.84
Achieved daily sun time * area	37791	0.84

26 **85** m2

EXISTING STATUS					March 21st
Time	Shadow	Sunlight	Sun time	Sun area	time * area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	92%	8%	60	7	408
8.00	85%	15%	60	13	765
9.00	68%	32%	60	27	1,632
10.00	11%	89%	60	76	4,539
11.00	5%	95%	60	81	4,845
12.00	5%	95%	60	81	4,845
13.00	5%	95%	60	81	4,845
14.00	5%	95%	60	81	4,845
15.00	5%	95%	60	81	4,845
16.00	5%	95%	60	81	4,845
17.00	5%	95%	60	81	4,845
18.00	19%	81%	60	69	4,131
19.00	100%	0%	60	0	0

Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00
Achieved total sun time (hrs)	8.9
Achieved daily sun time * area	45390

NEW STATUS					March 21st	change
Time	Shadow	Sunlight	Sun time	Sun area	time * area	time * area
24 Hr	% / %		min	m2	min*m2	min*m2
6.00	100%	0%	60	0	0	0
7.00	92%	8%	60	7	408	0
8.00	85%	15%	60	13	765	0
9.00	68%	32%	60	27	1,632	0
10.00	11%	89%	60	76	4,539	0
11.00	5%	95%	60	81	4,845	0
12.00	5%	95%	60	81	4,845	0
13.00	5%	95%	60	81	4,845	0
14.00	5%	95%	60	81	4,845	0
15.00	5%	95%	60	81	4,845	0
16.00	11%	89%	60	76	4,539	-306
17.00	72%	28%	60	24	1,428	-3,417
18.00	88%	12%	60	10	612	-3,519
19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	
Achieved sun hours on (hrs) @ 50% area	7.00	
Achieved total sun time (hrs)	7.48	0.85
Achieved daily sun time * area	38148	0.85