



5025

Effect on Daylight Reception Analysis Report

EFFECT ON DAYLIGHT RECEPTION IN EXISTING NEIGHBOURING BUILDINGS

Castlelake SHD

Castlelake,
Carrigwohill,
Co. Cork

BAM

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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 BAM, to carry out the analysis and report for the proposed development at Carrigtwohill, Co. Cork.

1.3 Development description

The development will consist of the construction of a strategic housing development of 716 no. units and a 2 no. storey creche. The proposed development comprises 224 no. houses, 284 no. duplex units and 208 no. apartments. The two storey houses comprise 48 no. detached, 126 no. semi-detached and 50 no. terraced Houses containing 60 no. two bed units, 139 no. three bed units and 25 no. four bed units. The part-one to part-three storey duplex units are contained in 122 no. buildings providing 82 no. one bed units, 142 no. two bed units and 60 no. three bed units. There are 7 no. apartments blocks ranging in height from part-1 to part- 5 no. storeys.

- Block 1 is 4 no. storeys and contains 34 no. units (7 no. one bed units, 19 no. two bed units and 8 no. three bed units).
- Block 2 is part-1 to part-5 no. storeys and contains 42 no. units (15 no. one bed units, 20 no. two bed units and 7 no. three bed units).
- Block 3 is 5 no. storeys and contains 17 no. units (8 no. one bed units and 9 no. two bed units).
- Block 4 is 4 no. storeys and contains 13 no. units (6 no. one bed units and 7 no. two bed units).
- Block 5 is 4 no. storeys and contains 13 no. units (6 no. one bed units and 7 no. two bed units).
- Block 6 is 4 no. storeys and contains 13 no. units (6 no. one bed units and 7 no. two bed units).
- Block 7 is 5 no. storeys over basement and contains 76 no. units (23 no. one bed units, 41 no. two bed units and 12 no. three bed units).
- All blocks contain ancillary internal and external resident amenity space.

The proposed development also provides for: hard and soft landscaping; boundary treatments; public realm works; car parking; bicycle stores and shelters; bin stores; lighting; plant rooms; and all ancillary site development works above and below ground.

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 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 0.80. From the calculation results we note selected neighbouring habitable receptors are affected 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. However, the calculated change in daylight reception in all of the analysed neighbouring receptors resulted in a change factor ranging from 0.81 to 0.99. Summarized result findings are as follows (see images in section 5 for receptor locations):



(For reference) Image 5.1 Neighbouring receptors

- North-east receptors: Receptor no. 1 to 5 are private residential houses located along the station rd, with ground floor windows/rooms. These dwellings were examined and resulted in a change factor range of 0.97-0.99. These receptors are all comfortably within the recommended guidelines. Receptor no. 6 and 7 is a medical centre and is not strictly a habitable dwelling, however, for the purpose of this report it has been treated as such. This building was examined and resulted in a change factor of 0.92. This receptor is also comfortably within the recommended guidelines.
- East / south receptors: Receptor no. 8 to 11 is an education campus currently under construction. These receptors are not a habitable dwelling, however, for the purpose of this report it has been treated as such. These buildings were examined and resulted in a change factor range of 0.93-0.97. These receptors are all well within the recommended guidelines. Receptor no. 12 to 18 are private residential houses located along the station rd, with ground floor windows/rooms. These dwellings were examined and resulted in a change factor range of 0.81-0.99. results are above the minimum guideline of 0.80 change factor.
- South / west receptors: Receptor no. 19 to 24 are residential houses part of Fernbrook housing estate. These dwellings were examined and resulted in a change factor range of 0.94-0.97. These receptors are all comfortably within the recommended guidelines. Receptor no. 25 to 35 are residential units part of Ard Carrig Apartment Complex with ground floor windows/rooms. These units resulted in a change factor range of 0.82-0.95. These receptors are all above the recommended guidelines. Receptor no. 36 to 39 are residential houses part of Oakbrook housing estate. These dwellings resulted in a change factor of 0.89. These receptors are well within the recommended guidelines. Receptor no. 40 to 49 are residential houses part of Pine close housing estate. These dwellings resulted in a change factor range of 0.92-0.93. These receptors are all comfortably within the recommended guidelines. Receptor no. 50 to 66 are residential units part of the Cascade Apartment Complex with ground floor windows/rooms. These units resulted in a change factor range of 0.89-0.94. These receptors are also comfortably within the recommended guidelines.
- West receptors: Receptors 67 to 85 are residential houses part of Maple Crescent and Maple Close housing estate with ground floor windows/rooms. The individual dwellings were examined and resulted in a change factor range of 0.92-0.96. These receptors are comfortably within the recommended guidelines.
- North-west receptors: Receptors 86 to 102 are residential houses part of Maple Lane housing estate with ground floor windows/rooms. The individual dwellings were examined and resulted in a change factor range of 0.84-0.94. These receptors are well within the recommended 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 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) site map below indicates the location of the sites approximately outlined.

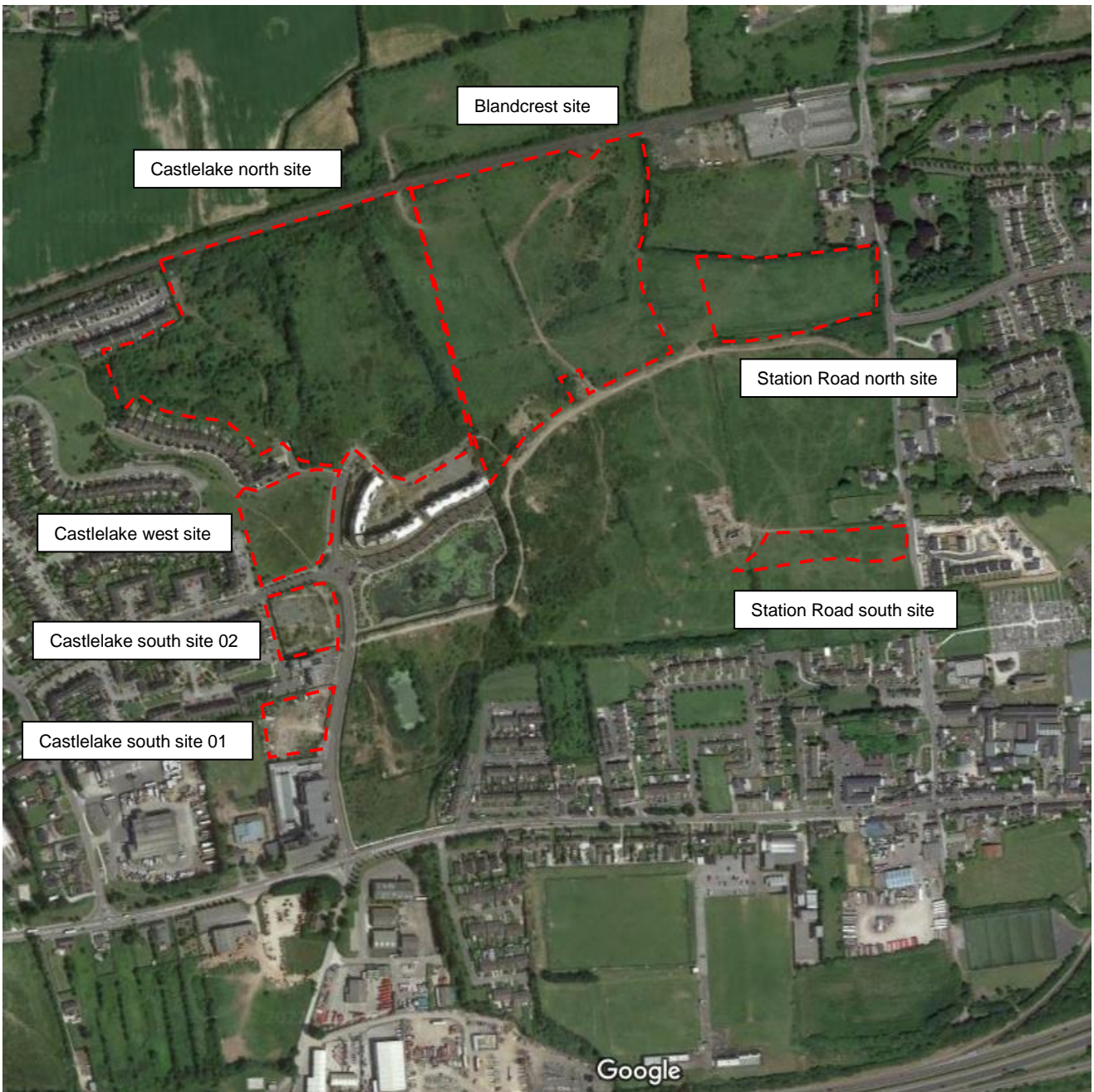


Image 3.1 Approximate proposed development site boundary

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.

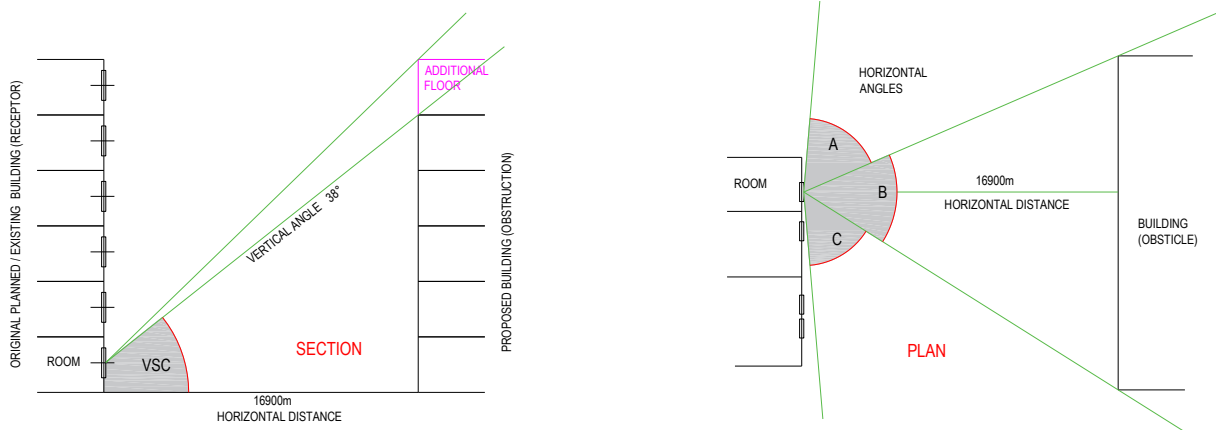
4.5 Day light reception analysis, Sky view component

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 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 and also shown in image 5.1 (overall layout). Image 5.2 – 5.5 are the 4 sections corresponding to overall image 5.1.

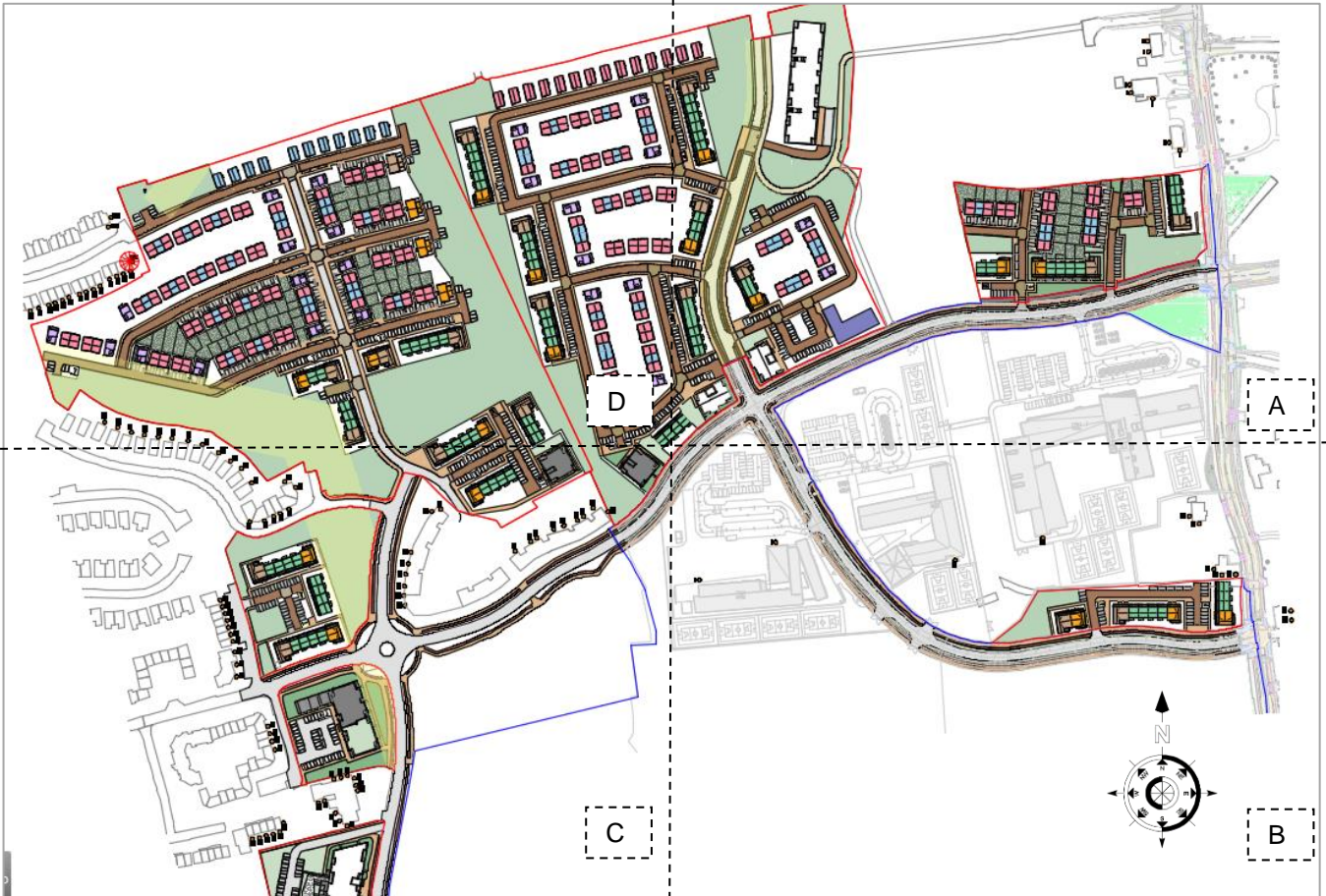


Image 5.1: Selected neighbouring receptors, overall view layout



Image 5.2: Selected neighbouring receptors, view port (A), showing receptors 1-7

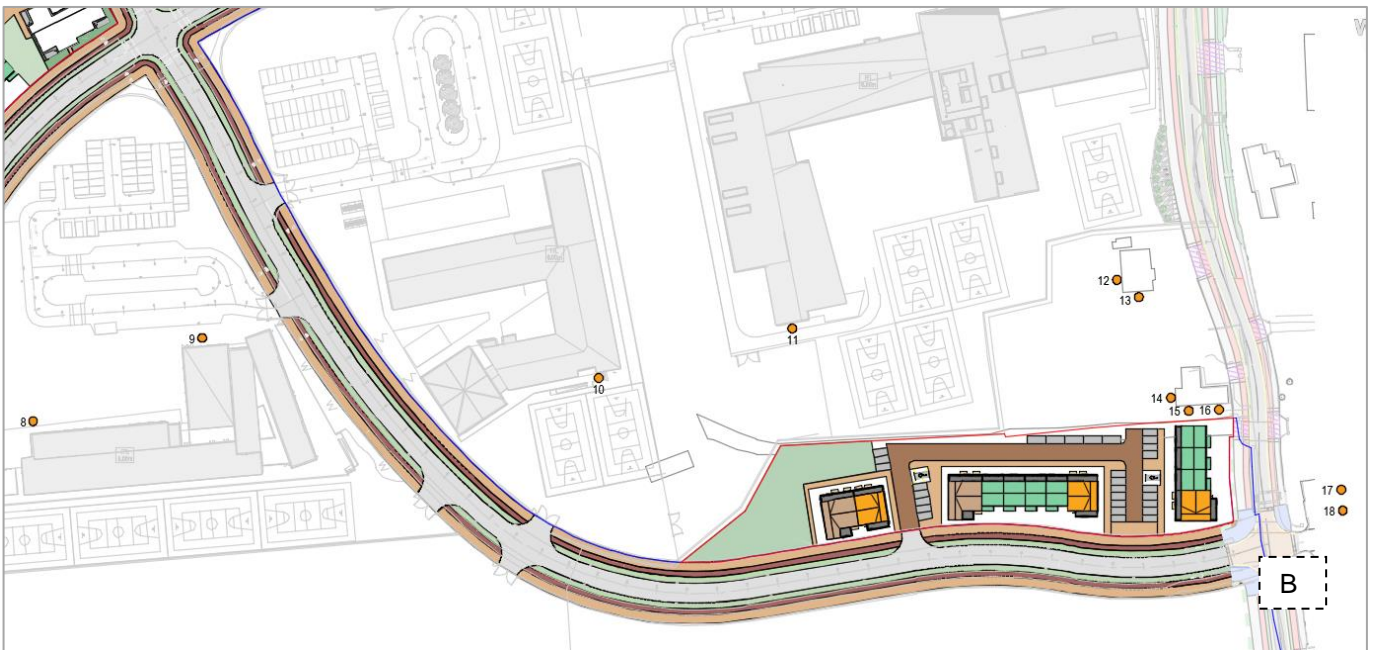


Image 5.3: Selected neighbouring receptors, view port (B), showing receptors 8-18

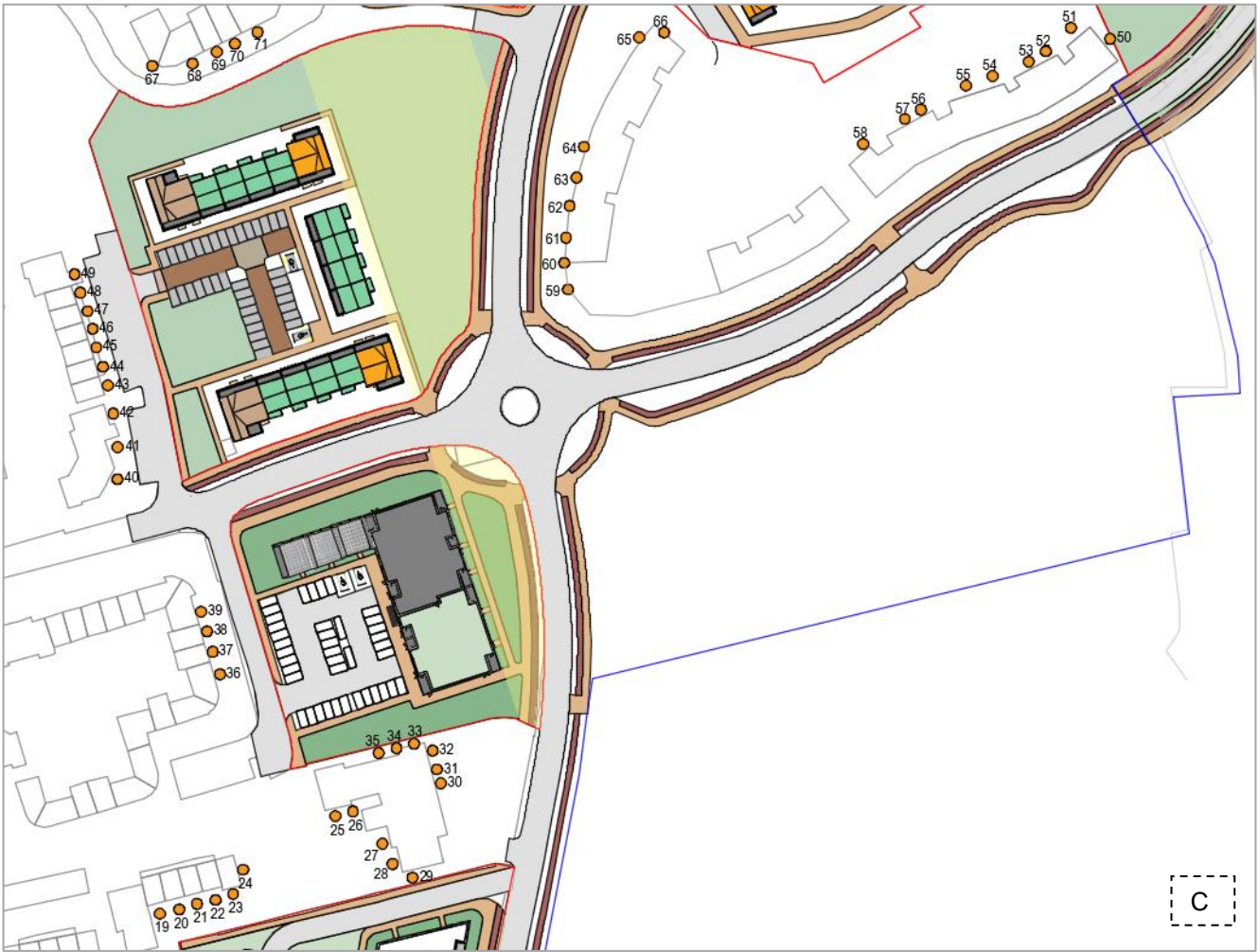


Image 5.4: Selected neighbouring receptors, view port (C), showing receptors 19-66

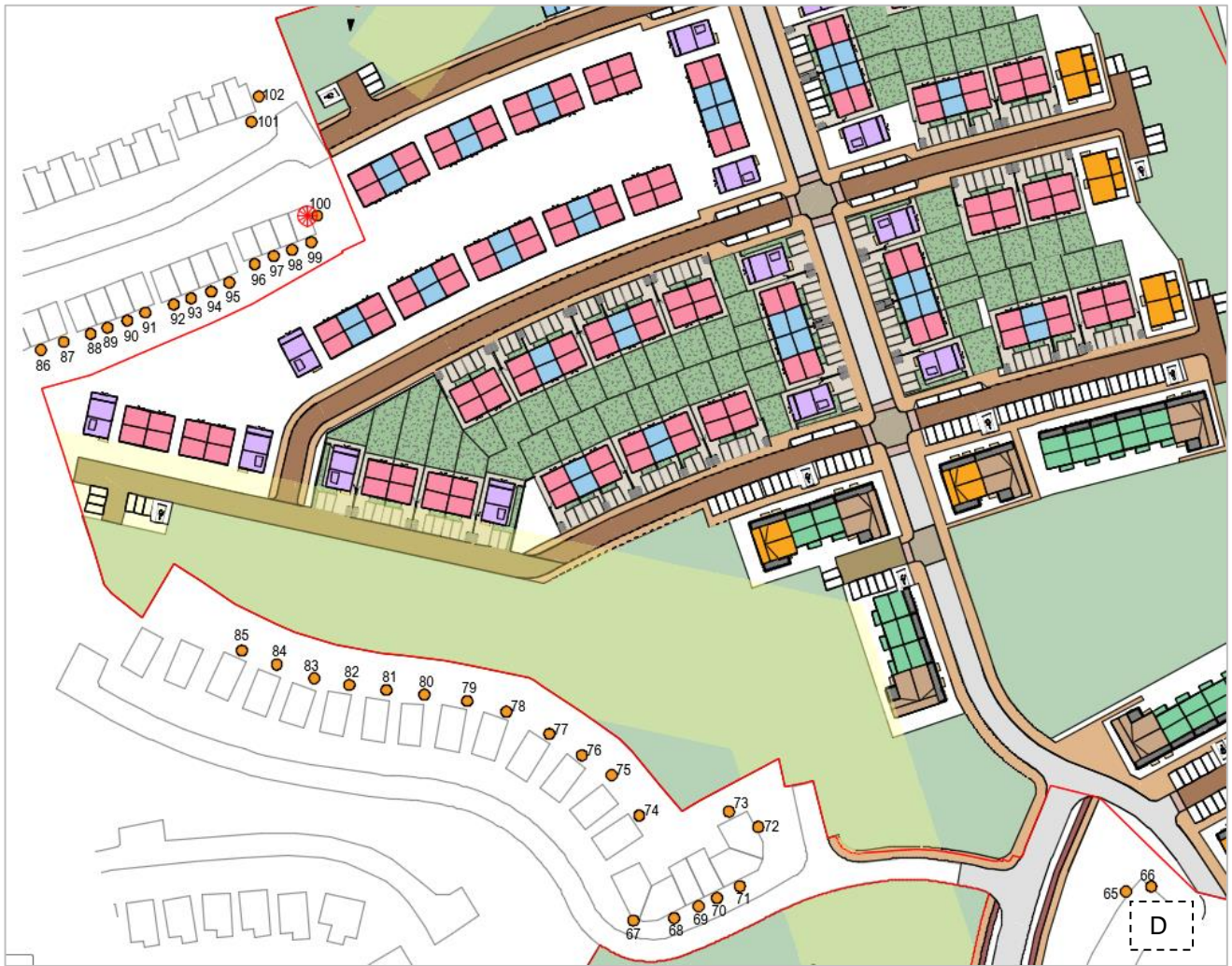


Image 5.5: Selected neighbouring receptors , view port (D), showing receptors 67-102

Receptor/window	Address	Description	Level description
1, 2	Station Rd, Carrigtohill, Co. Cork	Residential house	GF living space
3, 4, 5	Station Rd, Carrigtohill, Co. Cork	Residential house	GF living space
6, 7	Station Rd, Carrigtohill, Co. Cork	Medical centre	GF office
8, 9, 10, 11	Carrigtohill education campus (under construction)	Ed. campus	GF classroom
12, 13	Station Rd, Carrigtohill, Co. Cork	Residential house	GF living space
14, 15, 16	Station Rd, Carrigtohill, Co. Cork	Residential house	GF living space
17	6 Cois Cille, Station Road, Carrigtohill, Co. Cork,	Residential house	GF living space
18	7 Cois Cille, Station Road, Carrigtohill, Co. Cork	Residential house	GF living space
19	3 Fernbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
20	4 Fernbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
21	5 Fernbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
22	6 Fernbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
23, 24	7 Fernbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35	Ard Carrig Apartment Complex, Castlelake, Co. Cork	Residential apt. block	GF living space
36	36 Oakbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
37	35 Oakbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
38	34 Oakbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
39	33 Oakbrook, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
40	4 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
41	5 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
42	6 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
43	7 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
44	8 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
45	9 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
46	10 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
47	11 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
48	12 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
49	13 Pine Ct, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66	Cascade Apartment Complex, Maple Crescent, Carrigtohill, Castlelake, Co. Cork	Residential apt. block	GF living space
67	2 Maple Crescent, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
68	3 Maple Crescent, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
69, 70	4 Maple Crescent, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
71	5 Maple Crescent, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
72, 73	6 Maple Crescent, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
74	1 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
75	2 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
76	3 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
77	4 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
78	5 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
79	6 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
80	7 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
81	8 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
82	9 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space

83	10 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
84	11 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
85	12 Maple Close, Terry's-Land, Castlelake, Co. Cork	Residential house	GF living space
86	44 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
87	43 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
88	42 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
89	41 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
90	40 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
91	39 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
92	38 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
93	37 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
94	36 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
95	35 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
96	34 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
97	33 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
98	32 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
99, 100	31 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space
101, 102	30 Maple Ln, Carrigtohill, Castlelake, Co. Cork	Residential house	GF living space

Table 5.1: List of receptors selected for analysis





5.2 Distance test

We would normally execute a distance test to any selected rooms to determine if any further calculations are required to establish the effects on sky views however despite the fact that in a number of the circumstances the distance test alone would have sufficed, we have executed full VSC calculations for all selected neighbouring buildings habitable rooms.

5.3 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 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. 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
	10% In excess of

5.4 Calculation results

DAYLIGHT RECEPTION ANALYSIS **Castlelake SHD**

ID	EXISTING								NEW								change
	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ Ver	Σ VSC	Σ VSC	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ Ver	Σ VSC	Σ VSC	
1	VSC test distance : 45 m								NEW								0.98
	Target distance 161m								NEW								
	54	2	50	2	76	3	180	36%	54	3	50	7	76	3	180	36%	
2	EXISTING								NEW								0.99
	VSC test distance : 45 m								NEW								
	Target distance 161m								NEW								
	61	2	43	2	76	3	180	36%	61	3	43	7	76	3	180	36%	
3	EXISTING								NEW								0.98
	VSC test distance : 26 m								NEW								
	Target distance 96m								NEW								
	77	2	32	2	71	3	180	36%	77	5	32	7	71	3	180	36%	
4	EXISTING								NEW								0.97
	VSC test distance : 26 m								NEW								
	Target distance 95m								NEW								
	70	2	42	2	68	2	180	37%	70	5	42	7	68	2	180	36%	
5	EXISTING								NEW								0.97
	VSC test distance : 26 m								NEW								
	Target distance 85m								NEW								
	69	8	111	2			180	36%	69	8	111	8			180	34%	
6	EXISTING								NEW								0.92
	VSC test distance : 26 m								NEW								
	Target distance 35m								NEW								
	84	2	33	2	63	2	180	37%	84	13	33	7	63	2	180	34%	
7	EXISTING								NEW								0.92
	VSC test distance : 26 m								NEW								
	Target distance 20m								NEW								
	85	2	95	2			180	37%	85	2	39	24	56	9	180	34%	
8	EXISTING								NEW								0.97
	VSC test distance : 35 m								NEW								
	Target distance 78m								NEW								
	58	6	122	2			180	36%	58	6	61	10	61	4	180	35%	
9	EXISTING								NEW								0.93
	VSC test distance : 35 m								NEW								
	Target distance 95m								NEW								
	17	5	163	2			180	36%	17	5	102	11	61	4	180	34%	
10	EXISTING								NEW								0.98
	VSC test distance : 26 m								NEW								
	Target distance 60m								NEW								
	53	2	127	2			180	37%	53	2	78	2	49	7	180	36%	
11	EXISTING								NEW								0.94
	VSC test distance : 26 m								NEW								
	Target distance 41m								NEW								
	66	2	88	2	26	3	180	36%	66	2	88	13	26	3	180	34%	
12	EXISTING								NEW								0.95
	VSC test distance : 26 m								NEW								
	Target distance 60m								NEW								
	68	2	19	2	93	6	180	36%	68	13	19	2	93	6	180	34%	
13	EXISTING								NEW								0.94
	VSC test distance : 26 m								NEW								
	Target distance 48m								NEW								
	108	2	72	5			180	36%	19	2	89	13	72	5	180	34%	
14	EXISTING								NEW								0.91
	VSC test distance : 26 m								NEW								
	Target distance 24m								NEW								
	99	3	81	6			180	36%	87	20	12	3	81	6	180	32%	
15	EXISTING								NEW								0.81
	VSC test distance : 26 m								NEW								
	Target distance 13m								NEW								
	57	5	123	2			180	36%	57	5	54	42	69	15	180	29%	



ID	VSC test distance	EXISTING								NEW								change				
		Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ Ver	Σ VSC	Σ VSC	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ Ver	Σ VSC	Σ VSC					
16	26 m	62	5	118	2	180	36%	180	36%	62	5	54	5	64	42	180	30%	0.83				
	Target distance 13m																					
	window GF-living																					
17	26 m	61	5	119	4	180	36%	180	36%	61	5	29	12	90	4	180	35%	0.99				
	Target distance 45m																					
	window GF-living																					
18	26 m	51	5	129	4	180	36%	180	36%	51	5	34	12	95	4	180	35%	0.99				
	Target distance 49m																					
	window GF-living																					
19	45 m	89	4	38	11	53	3	180	35%	89	4	28	11	63	14	180	34%	0.97				
	Target distance 60m																					
	window GF-living																					
20	45 m	89	4	39	11	52	3	180	35%	89	4	23	11	68	14	180	34%	0.97				
	Target distance 58m																					
	window GF-living																					
21	45 m	84	4	42	11	54	3	180	35%	84	4	25	11	71	17	180	33%	0.94				
	Target distance 51m																					
	window GF-living																					
22	45 m	82	4	41	11	57	3	180	35%	82	4	27	11	71	17	180	33%	0.94				
	Target distance 48m																					
	window GF-living																					
23	45 m	77	4	43	11	60	3	180	35%	77	4	30	11	63	19	170	33%	0.94				
	Target distance 42m																					
	window GF-living																					
24	45 m	44	4	62	14	53	3	21	11	180	34%	44	4	62	14	53	19	21	11	180	32%	0.94
	Target distance 40m																					
	window GF-living																					
25	45 m	30	8	105	9	45	32	180	31%	30	8	105	18	45	32	180	29%	0.94				
	Target distance 43m																					
	window GF-living																					
26	45 m	26	8	98	9	56	33	180	31%	26	8	98	18	56	33	180	29%	0.93				
	Target distance 43m																					
	window GF-living																					
27	45 m	81	9	47	7	52	33	180	31%	81	19	47	7	52	33	180	29%	0.95				
	Target distance 31m																					
	window GF-living																					
28	45 m	86	9	56	7	38	32	180	32%	86	19	56	7	38	32	180	30%	0.94				
	Target distance 19m																					
	window GF-living																					
29	45 m	48	3	43	11	89	3	180	36%	48	3	80	37	52	3	180	30%	0.84				
	Target distance 16m																					
	window GF-living																					
30	45 m	95	3	85	5	180	36%	95	3	45	5	40	31	180	34%	0.93						
	Target distance 26m																					
	window GF-living																					
31	45 m	94	3	86	5	180	36%	94	3	42	5	44	33	180	33%	0.92						
	Target distance 24m																					
	window GF-living																					



	EXISTING								NEW								change						
	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC	Section 1	Section 2	Section 3	Section 4		Σ Hor	Σ VSC				
32																							
VSC test distance : 45 m																							
Target distance 21m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	92	3	88	5					180	36%			92	3	36	5	52	35	180	32%			0.90
33																							
VSC test distance : 45 m																							
Target distance 13m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	47	5	133	4					180	36%			34	4	61	49	85	6	180	29%			0.82
34																							
VSC test distance : 45 m																							
Target distance 15m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	65	5	115	4					180	36%			31	4	61	48	88	6	180	29%			0.83
35																							
VSC test distance : 45 m																							
Target distance 18m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	70	5	110	4					180	36%			24	4	64	46	92	6	180	29%			0.83
36																							
VSC test distance : 45 m																							
Target distance 50m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	56	23	124	4					180	34%			56	23	67	18	57	14	180	30%			0.89
37																							
VSC test distance : 45 m																							
Target distance 50m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	51	21	129	4					180	34%			51	21	66	18	63	14	180	30%			0.89
38																							
VSC test distance : 45 m																							
Target distance 50m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	48	17	132	4					180	34%			48	17	63	18	69	14	180	31%			0.89
39																							
VSC test distance : 45 m																							
Target distance 50m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	45	17	135	4					180	34%			45	17	59	18	76	15	180	31%			0.89
40																							
VSC test distance : 45 m																							
Target distance 67m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	80	6	100	3					180	36%			80	6	38	14	62	16	180	33%			0.92
41																							
VSC test distance : 26 m																							
Target distance 31m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	34	7	146	4					180	36%			34	7	33	14	51	16	180	33%			0.92
42																							
VSC test distance : 26 m																							
Target distance 28m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	27	7	153	4					180	36%			27	7	35	14	34	16	180	33%			0.93
43																							
VSC test distance : 26 m																							
Target distance 28m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	25	7	155	4					180	36%			25	7	24	14	35	16	180	33%			0.93
44																							
VSC test distance : 26 m																							
Target distance 28m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	43	7	137	4					180	36%			23	7	19	13	36	16	180	33%			0.93
45																							
VSC test distance : 26 m																							
Target distance 35m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	43	7	137	4					180	36%			30	7	61	15	89	10	180	33%			0.92
46																							
VSC test distance : 26 m																							
Target distance 35m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	47	7	133	4					180	36%			36	7	56	15	88	10	180	33%			0.93
47																							
VSC test distance : 26 m																							
Target distance 35m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ	Hor	Σ	VSC	
window GF-living	49	7	131	4					180	36%			36	7	52	15	92	10	180	33%			0.93



ID	VSC test distance	EXISTING						NEW						change		
		Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC			
48	26 m															
	Target distance 30m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	54	7	126	4	180	36%	42	7	42	15	96	10	180	33%	0.93
49	26 m															
	Target distance 30m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	55	7	125	4	180	36%	47	7	40	15	93	10	180	33%	0.93
50	45 m															
	Target distance 32m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	84	3	96	2	180	36%	80	3	41	27	59	14	180	32%	0.89
51	45 m															
	Target distance 57m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	40	10	140	2	180	36%	40	10	69	14	71	10	180	33%	0.91
52	45 m															
	Target distance 57m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	34	10	146	2	180	36%	34	10	78	14	68	10	180	33%	0.91
53	45 m															
	Target distance 57m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	36	10	144	2	180	36%	36	10	80	14	64	10	180	33%	0.91
54	45 m															
	Target distance 57m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	26	10	154	2	180	36%	26	10	85	14	69	10	180	33%	0.91
55	45 m															
	Target distance 60m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	28	12	152	2	180	36%	28	12	90	14	62	9	180	33%	0.91
56	45 m															
	Target distance 61m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	34	14	146	2	180	36%	34	14	93	13	53	9	180	32%	0.91
57	45 m															
	Target distance 61m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	37	14	143	2	180	36%	37	14	92	13	51	9	180	32%	0.91
58	45 m															
	Target distance 67m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	45	16	135	2	180	35%	45	16	88	13	47	9	180	32%	0.92
59	26 m															
	Target distance 49m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	63	4	117	5	180	36%	39	14	83	11	58	5	180	34%	0.94
60	26 m															
	Target distance 50m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	61	4	119	5	180	36%	35	14	83	11	62	5	180	34%	0.94
61	26 m															
	Target distance 50m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	56	4	124	5	180	36%	34	14	80	11	66	5	180	34%	0.94
62	26 m															
	Target distance 50m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	54	4	126	5	180	36%	31	12	74	11	75	7	180	34%	0.94
63	26 m															
	Target distance 55m	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	Hor° Ver°	Hor° Ver°	Hor° Ver°	Hor° Ver°	Σ Hor	Σ VSC	change		
	window GF-living	51	4	139	5	190	36%	29	12	71	11	80	7	180	34%	0.94



ID	VSC test distance	EXISTING							NEW							change
		Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC			
64	26 m															
	Target distance 57m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	49	4	131	5			28	11	65	11	87	7	180 34%		
65	26 m															
	Target distance 36m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	65	5	115	2			37	11	48	5	95	14	180 33%		
66	26 m															
	Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	72	2	108	2			62	10	45	16	73	11	180 33%		
67	26 m															
	Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	47	4	133	5			47	4	46	5	87	16	180 33%		
68	26 m															
	Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	122	4	58	10			43	4	95	16	42	10	180 33%		
69	26 m															
	Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	124	4	56	10			40	4	86	16	54	10	180 33%		
70	26 m															
	Target distance 30m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	120	4	60	10			27	4	93	16	60	10	180 32%		
71	26 m															
	Target distance 29m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	117	4	63	11			36	4	81	16	63	11	180 33%		
72	26 m															
	Target distance 50m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	60	10	120	2			60	10	43	6	77	8	180 34%		
73	26 m															
	Target distance 50m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	47	16	133	2			47	16	68	7	65	9	180 33%		
74	26 m															
	Target distance 79m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	60	17	120	2			60	17	68	9	52	7	180 33%		
75	26 m															
	Target distance 74m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	47	16	133	2			47	16	75	9	58	7	180 33%		
76	26 m															
	Target distance 66m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	14	16	166	2			14	16	73	8	93	7	180 34%		
77	26 m															
	Target distance 73m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	33	3	147	2			83	8	97	7			180 34%		
78	17 m															
	Target distance 55m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	51	3	129	2			56	8	124	7			180 34%		
79	17 m															
	Target distance 52m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			
	window GF-living	57	3	123	2			49	8	131	7			180 34%		



ID	VSC test distance	EXISTING								NEW								change	
		Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC	Section 1	Section 2	Section 3	Section 4	Σ Hor	Σ VSC						
80	17 m																		
	Target distance 52m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	73	3	107	2					180	36%	34	7	146	8			180	34%
81	17 m																		
	Target distance 52m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	78	3	102	2					180	36%	32	7	148	8			180	34%
82	17 m																		
	Target distance 52m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	84	3	96	2					180	36%	29	6	151	8			180	34%
83	17 m																		
	Target distance 52m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	77	3	103	2					180	36%	31	6	149	8			180	34%
84	17 m																		
	Target distance 52m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	83	3	97	2					180	36%	30	6	150	8			180	34%
85	17 m																		
	Target distance 53m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	90	3	90	2					180	36%	25	5	42	3	113	8	180	35%
86	17 m																		
	Target distance 15m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	137	4	43	2					180	36%	85	4	54	29	41	12	180	32%
87	17 m																		
	Target distance 14m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	144	4	36	2					180	36%	70	4	64	30	46	12	180	31%
88	17 m																		
	Target distance 15m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	142	4	38	2					180	36%	49	4	74	29	57	12	180	31%
89	17 m																		
	Target distance 15m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	143	4	37	2					180	36%	41	4	75	29	64	12	180	30%
90	17 m																		
	Target distance 18m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	144	4	36	2					180	36%	38	4	68	29	74	12	180	31%
91	17 m																		
	Target distance 19m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	142	4	38	2					180	36%	30	4	64	29	86	12	180	31%
92	17 m																		
	Target distance 24m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	136	4	44	2					180	36%	19	4	46	20	115	13	180	32%
93	17 m																		
	Target distance 24m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	133	4	47	2					180	36%	17	4	37	20	126	13	180	32%
94	17 m																		
	Target distance 24m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	130	4	50	2					180	36%	15	4	92	20	73	13	180	31%
95	17 m																		
	Target distance 24m	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Σ Hor	Σ VSC
	window GF-living	129	4	49	2					178	36%	13	4	69	20	98	13	180	31%



	EXISTING								NEW								change				
	Section 1	Section 2	Section 3	Section 4	Hor ^o	Ver ^o	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor ^o	Ver ^o	Σ	VSC					
96																					
VSC test distance · 17 m																					
Target distance 23m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
window GF-living	124	4	56	2					180	36%	99	16	81	13					180	31%	0.88
97																					
VSC test distance · 17 m																					
Target distance 23m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
window GF-living	121	4	59	2					180	36%	92	16	88	13					180	31%	0.88
98																					
VSC test distance · 17 m																					
Target distance 23m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
window GF-living	120	4	60	2					180	36%	99	16	81	13					180	31%	0.88
99																					
VSC test distance · 17 m																					
Target distance 23m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
window GF-living	118	4	62	2					180	36%	111	16	69	13					180	31%	0.88
100																					
VSC test distance · 17 m																					
Target distance 14m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
window GF-living	71	3	109	2					180	36%	71	13	51	26	58	5			180	31%	0.87
101																					
VSC test distance · 17 m																					
Target distance 32m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
window GF-living	105	11	75	2					180	34%	105	11	75	15					180	32%	0.94
102																					
VSC test distance · 17 m																					
Target distance 36m	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Hor ^o	Ver ^o	Σ	VSC			
window GF-living	37	3	143	2					180	36%	25	11	67	15	88	2			180	34%	0.93



5.5 Daylight reception in neighbouring habitable rooms conclusion

The BRE 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 0.80. From the calculation results we note selected neighbouring habitable receptors are affected 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. However, the calculated change in daylight reception in all of the analysed neighbouring receptors resulted in a change factor ranging from 0.81 to 0.99. Summarized result findings are as follows (see images in section 5 for receptor locations):



(For reference) Image 5.1 Neighbouring receptors

- North-east receptors: Receptor no. 1 to 5 are private residential houses located along the station rd, with ground floor windows/rooms. These dwellings were examined and resulted in a change factor range of 0.97-0.99. These receptors are all comfortably within the recommended guidelines. Receptor no. 6 and 7 is a medical centre and is not strictly a habitable dwelling, however, for the purpose of this report it has been treated as such. This building was examined and resulted in a change factor of 0.92. This receptor is also comfortably within the recommended guidelines.
- East / south receptors: Receptor no. 8 to 11 is an education campus currently under construction. These receptors are not a habitable dwelling, however, for the purpose of this report it has been treated as such. These buildings were examined and resulted in a change factor range of 0.93-0.97. These receptors are all well within the recommended guidelines. Receptor no. 12 to 18 are private residential houses located along the station rd, with ground floor windows/rooms. These dwellings were examined and resulted in a change factor range of 0.81-0.99. results are above the minimum guideline of 0.80 change factor.
- South / west receptors: Receptor no. 19 to 24 are residential houses part of Fernbrook housing estate. These dwellings were examined and resulted in a change factor range of 0.94-0.97. These receptors are all comfortably within the recommended guidelines. Receptor no. 25 to 35 are residential units part of Ard Carrig Apartment Complex with ground floor windows/rooms. These units resulted in a change factor range of 0.82-0.95. These receptors are all above the recommended guidelines. Receptor no. 36 to 39 are residential houses part of Oakbrook housing estate. These dwellings resulted in a change factor of 0.89. These receptors are well within the recommended guidelines. Receptor no. 40 to 49 are residential houses part of Pine close housing estate. These dwellings resulted in a change factor range of 0.92-0.93. These receptors are all comfortably within the recommended guidelines. Receptor no. 50 to 66 are residential units part of the Cascade Apartment Complex with ground floor windows/rooms. These units resulted in a change factor range of 0.89-0.94. These receptors are also comfortably within the recommended guidelines.
- West receptors: Receptors 67 to 85 are residential houses part of Maple Crescent and Maple Close housing estate with ground floor windows/rooms. The individual dwellings were examined and resulted in a change factor range of 0.92-0.96. These receptors are comfortably within the recommended guidelines.

- North-west receptors: Receptors 86 to 102 are residential houses part of Maple Lane housing estate with ground floor windows/rooms. The individual dwellings were examined and resulted in a change factor range of 0.84-0.94. These receptors are well within the recommended 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 development to be compliant with this element.