Daylight & Sunlight Assessments of a Strategic Housing Development, Boherboy, Saggart, Co. Dublin.

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1: Introduction

Kelland Homes Ltd and Durkan Estates Ireland Ltd are applying to An Bord Pleanála for permission for a strategic housing development at a site at Boherboy, Saggart, County Dublin. To the immediate north of the site is the Carrigmore residential estate, to the west are agricultural lands and a single dwelling, to the east is the Corbally residential estate while to the south is the Boherboy Road. The proposed application represents the development of the entire Boherboy Neighbourhood as identified in the Fortunestown Local Area Plan (2012).

The development will consist of 655 no. dwellings, comprised of 257 no. 2, 3 & 4 bed, 2 & 3 storey detached, semi-detached & terraced houses, 152 no. 1, 2 & 3 bed duplex units in 17 no. 2-3, 3-4 & 4 storey blocks, and 246 no. 1, 2 & 3 bed apartments in 9 no. buildings ranging in height from 2, 2-5, 4-5 & 5 storeys, and a 2 storey crèche (693m²).

Access to the development will by via one no. vehicular access point from the Boherboy Road, along with proposed upgrade works to Boherboy Road to include the provision of a roadside footpath along the front of the site at the Boherboy Road, continuing eastwards to the junction with the N81 Blessington Road (for an overall distance of c.370m). The proposed development also provides for pedestrian and cyclist connectivity to the adjoining Carrigmore Park to the north-east, and vehicular, pedestrian and cyclist connections to adjoining developments at Corbally Heath to the east and Carrigmore Green to the north.

The proposed development provides for (i) all associated site development works above and below ground, including surface water attenuation & an underground foul sewerage pumping station at the northern end of the site, (ii) public open spaces (c. 3Ha), including alongside the Corbally Stream, which will accommodate the provision of pedestrian / cyclist links to Carrigmore Park to the north-east, (iii) communal open spaces (c. 6,392m²), (iv) hard and soft landscaping and boundary treatments, (v) undercroft, basement & surface car parking (914 no. car parking spaces, including EV parking), (vi) bicycle parking (797 no. bicycle parking spaces), (vii) bin & bicycle storage, (viii) public lighting, and (ix), plant (M&E), utility services & 5 no. ESB sub-stations, all on an overall application site area of 18.3ha. In accordance with the Fortunestown Local Area Plan (2012) an area of approx. 1.42Ha within the site is reserved as a future school site.

1.1 Executive Summary

The report assesses the impact of the proposed development for Daylight and Sunlight on the neighbouring buildings and the quality of daylight and sunlight within the proposed development. This analysis is carried out based on the drawings of McCrossan O'Rourke Manning Architects & Davey + Smyth Architects.

Impact on adjacent properties

There will be minimal impact to the daylight and sunlight to the adjacent dwellings with no perceivable reduction in either daylight or sunlight. There will be a minimal reduction in the sunlight to any of the adjacent amenity spaces.

Assessment of the quality of the proposed development.

All the units within the proposed development exceed the recommendations of the BRE guidelines for quality of Daylight. The bedroom and living space layouts have been optimised for daylight and sunlight. All the living spaces with a kitchen exceed the target ADF value of 2% and all the bedrooms exceed the target ADF value of 1%. The proposed amenity spaces will be bright and achieve sunlight levels that exceed 2 hours sunlight over 50% of the amenity space on the 21st March. This meets the recommendations of the BRE guidelines.

The results find that any impact on the adjacent residential structures would be minimal and imperceivable. There would be a good quality of daylight in the apartments analysed and the amenity areas would have sufficient sunlight to be bright and pleasant spaces. The proposed development meets the recommendations of the BS 8206-2 2008 and BRE guidance document (2011) Site layout planning for daylight and sunlight. The proposed apartments were also assessed for daylight provision in accordance with EN17037:2018 and all the units exceed the minimum target levels.

2: Methodology

2.1 Notes on the use of BS 8206-2 2008 and BRE guidance document (2011) Site layout planning for daylight and sunlight (BR209).

This Daylight and Sunlight Assessment demonstrates compliance with the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) and BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'. This in accordance with the most relevant S.28 Ministerial Guidelines including Section 6.6 of the Sustainable Urban Housing: Design Standards for New Apartments (2020), and Section 3.2 of the Urban Development and Building Heights Guidelines for Planning Authorities (2018).

Sustainable Urban Housing: Design Standards for New Apartments, Guidelines for Planning Authorities (2020) directs planning authorities to have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or British Standard BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'. The standards for daylight and sunlight access in buildings (and the methodologies for assessment of same) suggested in both of these documents have been referenced in this Sunlight and Daylight Access Analysis.

The former standard BS 8206-2 was read in conjunction with BRE BR209 Site layout planning for daylight and sunlight and CIBSE LG10 as guidance only, but the launch of BS EN 17037 directly impacts on the recommendations of these other technical documents due to the withdrawal of BS8206-2:2008. The new standard can no longer be interpreted as guidance and cannot be incorporated into BR209 but BR209 continues to reference a standard that no longer exists. The updated 3rd Edition of the BRE guide 'Site Layout Planning for Daylight and Sunlight' intends to address this and is due to be published in spring 2022.

Neither the British Standard nor the BRE Guide set out rigid standards or limits. The BRE Guide is preceded by the following very clear warning as to how the design advice contained therein should be used:

"The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aims is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design."

That the recommendations of the BRE Guide are not suitable for rigid application to all developments in all contexts is of particular importance in the context of national and local policies for the consolidation and densification of urban areas.

2.2 Daylight to the existing dwellings

A proposed development could potentially have a negative effect on the level of daylight that a neighbouring property receives, if the obstructing building is large in relation to their distance from the existing dwelling. To ensure a neighbouring property is not adversely affected, the Vertical Sky Component (also referred to as VSC) is calculated and assessed. VSC can be defined as the amount of skylight that falls on a vertical wall or window. The site is analysed in plan, section and building use. Windows and amenity area are selected to test for impact from the proposed development.

BRE guidelines recommend that: "*Loss of light to existing windows need not be assessed if the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window."*
The diffuse light of the existing building may be adversely affected if part of a new building measured in a vertical section perpendicular to the main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25º to the horizontal. If a window falls within a 45° angle both in plan and elevation with a new development in place then the window may be affected and should be assessed.

For loss of daylight and sunlight to existing buildings BRE guidance document (2011) "Site layout planning for daylight and sunlight" is used and BS8206 Part 2:2008 Lighting for Buildings, Code of Practice for Daylighting.

For loss of light the report recommends calculation of the Vertical Sky Component. This is the ratio of direct sky illuminance falling on the outside window, to the simultaneous horizontal illuminance under an unobstructed sky. The standard CIE Overcast Sky is used and the ratio is usually expressed as a percentage. The maximum value is just under 40% for a completely unobstructed vertical wall. The Vertical Sky Component on a window is a good measure of the amount of daylight entering it.

The BRE guidelines recommend one of two criteria is met when assessing for the Vertical Sky Component:
a) Where the Vertical Sky Component at the centre of the existing window exceeds 27% with the new development in place then enough sky light should still be reached by the existing window.

b) Where the Vertical Sky Component with the new development in place is both less than 27% and less than 0.8 times its former value, then the area lit by the window is likely to appear more gloomy, and electric light will be needed more of the time.

The BRE Guidelines state that if the VSC is:
- At least 27%, then conventional window design will usually give reasonable results;
- Between 15% and 27%, then special measures (larger windows, changes to room layout) are usually needed to provide adequate daylight;
- Between 5% and 15%, then it is very difficult to prove adequate daylight unless very large windows are used;
- Less than 5%, then it is often impossible to achieve reasonable daylight, even if the whole window wall is glazed

This report assesses the percentage of direct sky illuminance that falls on the centre point of neighbouring windows that could be affected by the proposed development.

2.3 Sunlight

The BRE guidelines recommend assessing the loss of sunlight to the main living rooms and conservatories if they have a window wall facing within 90° of due south. Kitchens and bedrooms are less important but care should be taken not to block too much sun. If the proposed development is fully north then sunlight need not be assessed.

The Annual Probable Sunlight Hours (APSH) is used to assess the quantity of sunlight for a given location. This is the total amount sunshine for a given location on an unobstructed horizontal surface taking cloud cover into account. Statistical data from the Irish Meteorological Service is used to assess the APSH and the Winter Probable Sunlight Hours (taken to fall between the 21st of September and the 21st of March). Table 1 shows the average sunlight hours for each month and the maximum possible without any cloud cover. This gives the factor of possible sunlight hours for each month.

Met Eireann Sunlight Hours Data Set 1981-2010													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Sunlight Hours/ Day	1:54	2:45	3:36	5:32	6:44	6:40	5:17	5:13	4:16	3:17	2:10	1:44	
Average Sunlight Hours/ Month	58:54	77:00	111:36	166:00	208:44	200:00	163:47	161:43	128:00	101:47	65:00	53:44	1496.25
Total Available Sunlight Hours	252	265	358	412	488	485	496	451	375	320	250	248	4383
Probable Sunlight Hours Ratio	23.37%	29.06%	31.17%	40.29%	42.77%	41.24%	33.02%	35.86%	34.13%	31.81%	26.00%	21.67%	34.14%

Table 1: Average monthly sunlight hours recorded at Dublin Airport - Data set 1981-2010

The BRE guidelines recommend that the centre of a window or 1.6m above ground for a door be assessed and receive at least 25% of the APSH and at least 5% during the period of 21st September to 21st March. If the available APSH is less than this then it should not be reduced below 0.8 times its former value or noticeable loss of sunlight may occur.

2.4 Sunlight to gardens and open spaces

For calculations of sunlight analysis it is general practice to use March 21 and the recommendations of the BRE guidance document (2011) “Site layout planning for daylight and sunlight”. P.J Littlefair, in relation to Gardens and open spaces section 3.3.17 state:

“*It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March. If as a result of new development an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable. If a detailed calculation cannot be carried out, it is recommended that the centre of the area should receive at least two hours of sunlight on 21 March*.”

2.5 Calculations of Trees & Hedges

Trees are not usually included in the assessments of impact, unless specified otherwise. In relation to the effects of trees and hedges the BRE guidelines states,

> *“It is generally more difficult to calculate the effects of trees on daylight because of their irregular shape and because some light will generally penetrate through the crown. Where the effects of a new building on existing buildings nearby is being analysed, it is usual to ignore the effects of existing trees. This is because daylight is at its scarcest and most valuable in winter when most trees will not be in leaf.”*

2.6 Daylight in the Proposed Development.

The rooms are assessed for Average Daylight Factor (ADF) and compliance with EN 17037 (2018). Table 2 contains the Input values for material used in the assessment model.

Surface Reflectance			
Element	Reflectance	Transmissivity	Material Description
Internal walls	84%	0%	White Painted Walls
Internal ceiling	88%	0%	White Painted Ceiling
Floor	52%	0%	Light wood Flooring
External walls - proposed development	58.3%	0%	Light yellow Brick
External walls - outside site	20%	0%	CIBSE
External ground	20%	0%	CIBSE
Glass	20.1%	68.8%	Triple glazed clear glass

Table 2: Surface reflectance parameters for ADF calculation

Additional assessment model input parameters for daylight simulation:

- Sensor Grid spacing 0.6m
- Sensor grid inset 0.35m
- Minimum inset 0.3m
- Work plane offset 0.85

2.7 EN17037:2018

EN 17037 is a unified daylighting standard published by the European Committee for Standardization (CEN) in 2018 (CEN 17037:2018). It is applicable across all countries within the EU including Ireland with the Irish edition IS EN17037:2018. The assessment is carried out in addition to the assessment of the Average Daylight Factor as specified in the BRE guidelines and BS8206 Part 2:2008 Lighting for Buildings, Code of Practice for Daylighting.

The EN17037:2018 Standard was enacted prior to the publication of Sustainable Urban Housing: Design Standards for New Apartments in 2020 which has no reference to the new standard. Additionally to date it is not referenced in any planning guidance document by any local authority.

The standard deals exclusively with new developments and does not give guidance or metrics on loss of light or sunlight to existing properties. EN17037:2018 sets out values for Minimum and Target levels but does not give guidance on the number of units within a development that should achieve these values. Additionally it does not differentiate between room use and weighted targets for rooms which would have a lesser requirement and to date there are no guidelines or directives on the implementation of their use.

The compliance calculation is based on an annual, climate-based simulation of interior illuminance distributions. For each hour of the year, the percentage of the floor area achieving minimum and target illuminance thresholds is measured on a room-by-room basis. To meet the standard, a room must achieve both of the following criteria:

- Target Illuminance: 300 lux over 50% of floor area for at least 50% of daylight hours.
- Minimum Illuminance: 100 lux over 95% of floor area for at least 50% of daylight hours.

Daylight hours are defined as the 4380 hours with the most diffuse horizontal illuminance in the weather file. In addition to this baseline (Minimum) requirement, rooms can achieve Medium and High levels of compliance by meeting higher illuminance thresholds, as outlined in the table below:

Minimum Illuminance			Target Illuminance		
High	500 lux	95%	High	750 lux	50%
Medium	300 lux	95%	Medium	500l ux	50%
Minimum	100 lux	95%	Minimum	300 lux	50%

Table 3: EN 17037:2018 Compliance threshold levels.

2.8 Environmental Impact Assessment (BRE Guidelines Appendix I)

The BRE guidelines sets out criteria for classification for assessment of impact where a new development affects a number of existing buildings or open spaces. The guide does not give a specific range or percentages but sets out parameters set out below.

"Where the loss of skylight or sunlight fully meets the guidelines in this book, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate. Where the loss of light is only just within the guidelines, and a larger number of windows or open space area are affected, a minor adverse impact would be more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.

Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:

- *only a small number of windows or limited area of open space are affected*
- *the loss of light is only marginally outside the guidelines*
- *an affected room has other sources of skylight or sunlight*
- *the affected building or open space only has a low level requirement for skylight or sunlight*
- *there are particular reasons why an alternative, less stringent, guideline should be applied.*

Factors tending towards a major adverse impact include:

- *a large number of windows or large area of open space are affected*
- *the loss of light is substantially outside the guidelines*
- *all the windows in a particular property are affected*
- *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, eg a living room in a dwelling or a children's playground.*

Beneficial impacts occur when there is a significant increase in the amount of skylight and sunlight reaching an existing building where it is required, or in the amount of sunlight reaching an open space.

Beneficial impacts should be worked out using the same principles as adverse impacts. Thus a tiny increase in light would be classified as a negligible impact, not a minor beneficial impact."

A flexible approach should be taken when assessing the impact with daylight and sunlight being one of many factors that influence the environment when planning a new development.

3: Daylight to adjacent buildings.

3.1 Site Overview

The location is a greenfield site in Boherboy, Saggart, County Dublin. The houses are 2 - 3 storeys and the apartment blocks are 3 - 5 storeys in height. There are many mature trees being retained along the boundaries, which would reduce any perceptible impact on Daylight and Sunlight.

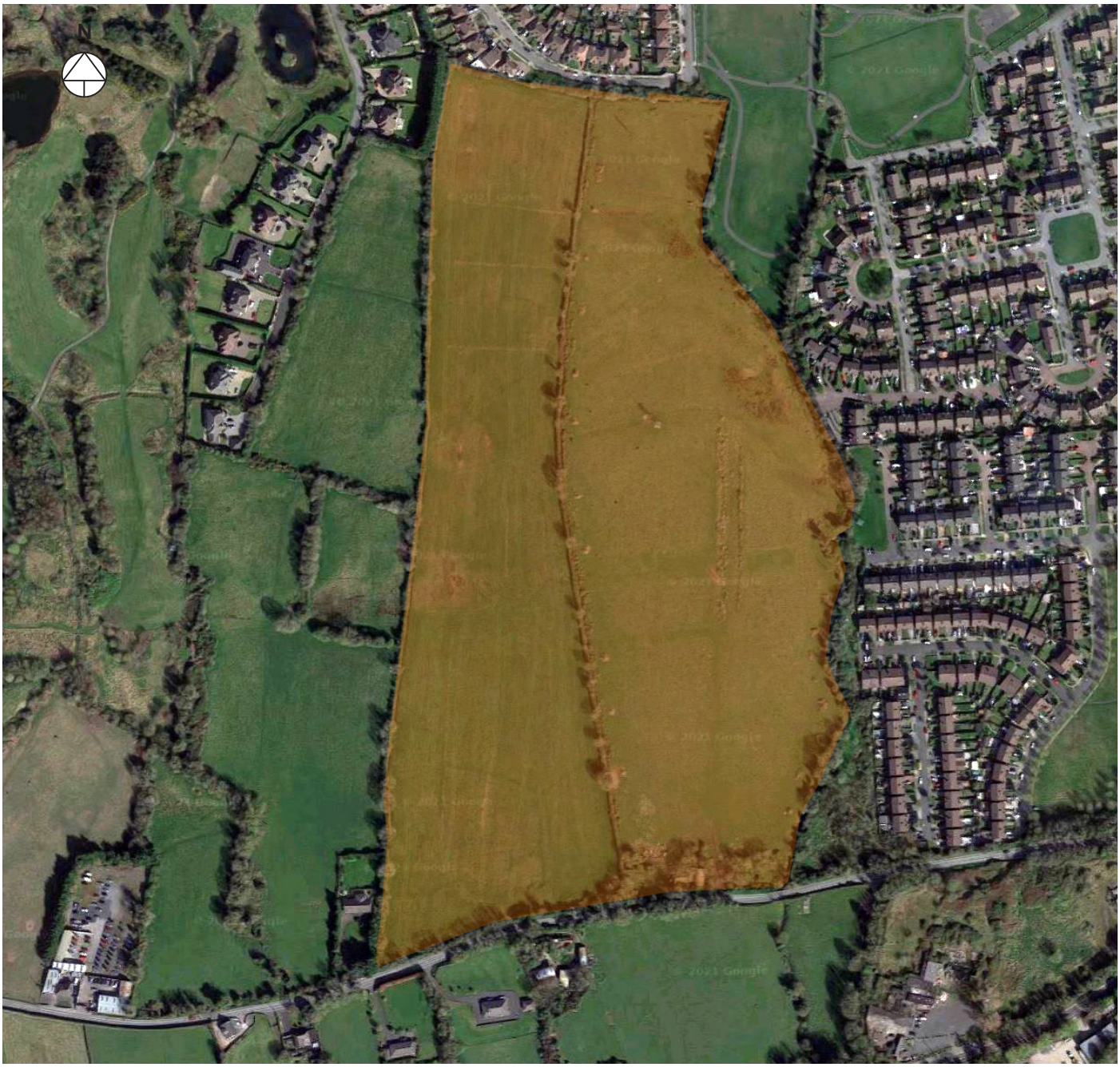

Figure 1: Aerial view of site.

3.2 Preliminary assessment of adjoining dwellings

The BRE guidelines recommend that loss of light to existing windows need not be assessed if the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window.

Section planes perpendicular to the window wall of the adjacent properties facing the proposed development are indicated in blue in Figures 3 & 4. The planes at locations A to D extend and if they intersect the proposed development, they are plotted in Figure 5.

The document also states that if part of a new building measured in a vertical section perpendicular to the main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25º to the horizontal, then the diffuse light of the existing building may be adversely affected. If a window falls within a 45° angle both in plan and elevation with a new development in place then the window may be affected and should be assessed.

Figure 2: Proposed Siteplan highlighting the regions where there are the closest adjacent residential properties.

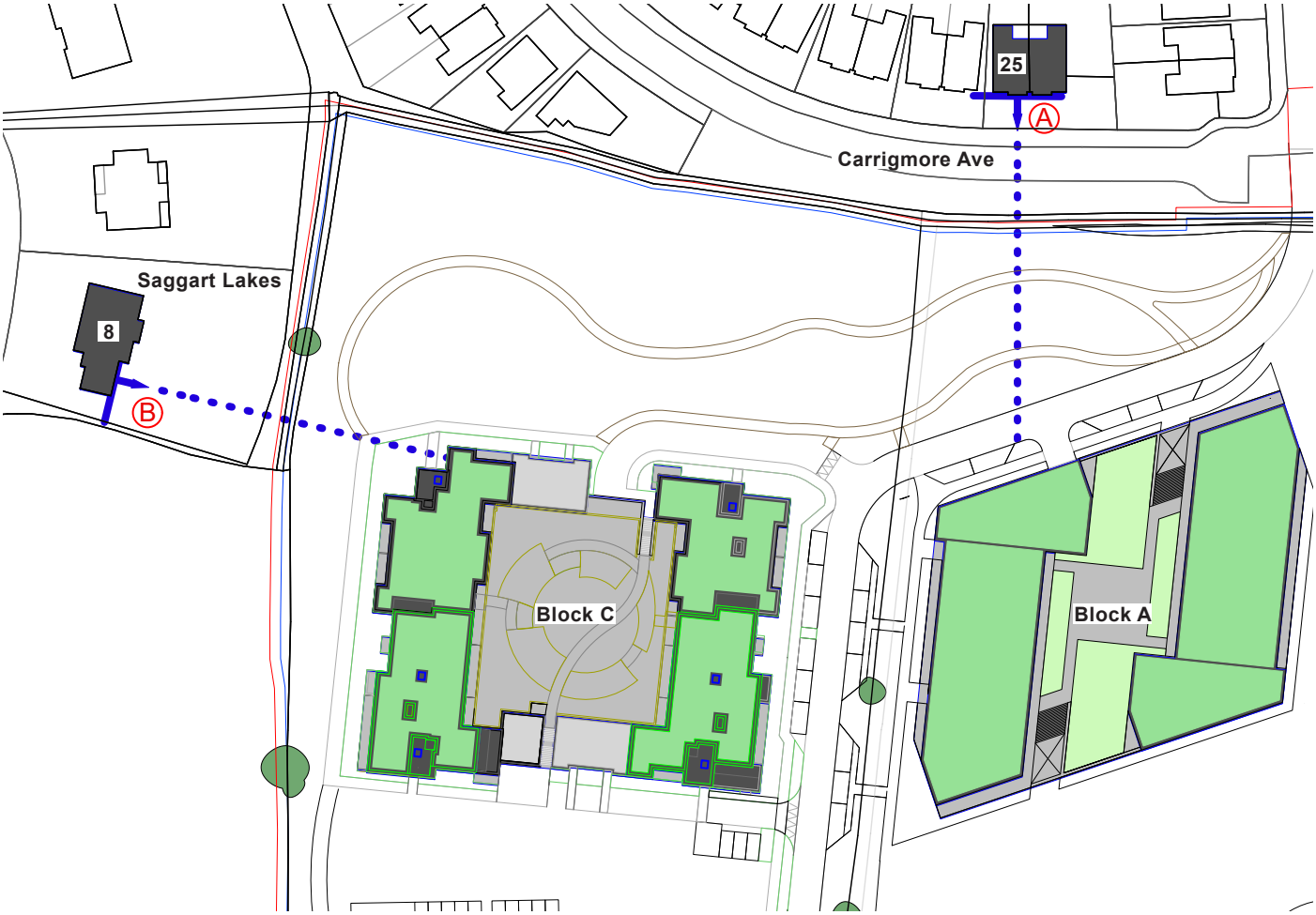

Figure 3: Site plan - Detail area 1 indicating the window wall of the closest residential properties.

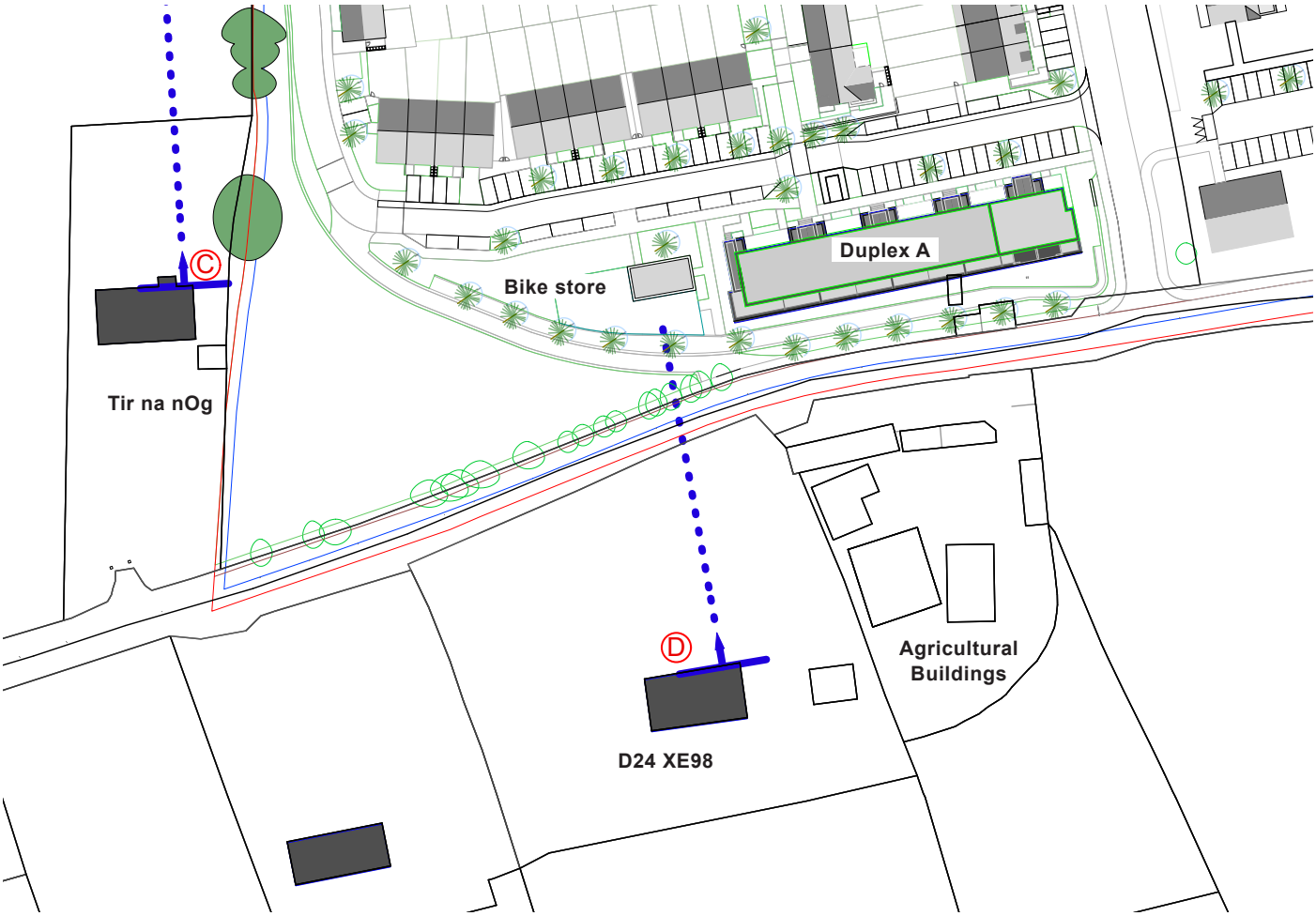

Figure 4: Siteplan - Detail area 1 indicating the window wall of the closest residential properties.

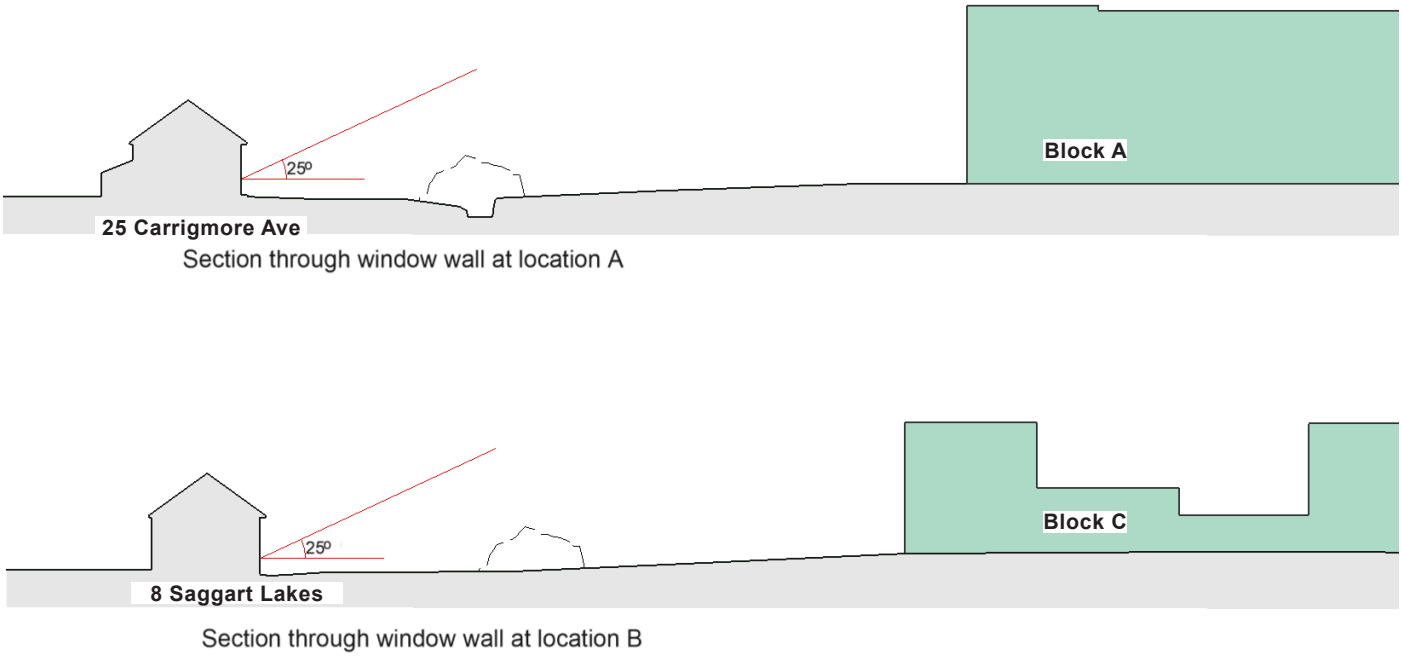

Figure 5: Sections perpendicular to window wall at locations indicated in Figure 3.

The BRE document states that if part of a new building measured in a vertical section perpendicular to the main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25º to the horizontal, then the diffuse light of the existing building may be adversely affected.

We assessed the closest residential properties to the proposed buildings of the greatest height, noted in Figures 2 - 4 at locations A - D.

Location A through 25 Carrigmore Avenue: A 25º angle through the lower ground floor windows of the front elevation would not be subtended by the proposed development, indicating that there would be no impact on their daylight.

Location B through 8 Saggart Lakes: A 25º angle though the lower ground floor windows of the rear elevation would not be subtended by the proposed development, indicating that there would be no impact on their daylight.

Location C through Tír na nÓg, Boherboy Road: The side elevation of this house faces the proposed development. The windows to the main rooms do not face the proposed development and there will be no potential loss of light.

Location D though the bungalow at D24 XE98 on the Boherboy Road: The front elevation of this house that faces towards houses in the proposed development. They are at a scale and distance that could not impact the daylight in this bungalow.

3.3 Conclusion

None of the adjacent properties have the potential to experience a reduction in sunlight or daylight due to the proposed development. The proposed development meets the recommendations of the BRE guidelines.

4: Daylight to Proposed Development.

The BRE guidelines recommend that the Average Daylight Factor (ADF) be assessed in habitable rooms of new developments. BS 8206-2 gives minimum values of ADF of 2% for kitchens and living rooms which include a kitchen, 1.5% for living rooms and 1% for bedrooms. An average daylight factor of 5% is a well ‘daylit’ space. Where there are two room uses within a space then the higher ADF value should be used. The assessment plane covers 100% of living space being considered. For supplementary information, compliance is also demonstrated with a calculation of daylight provision under EN 17037:2018.

There is a variety of building types in this development; houses, apartments and duplex or maisonette units as noted in Figure 6. An appraisal of the multi-dwelling buildings was undertaken, based on the type of units and any potential obstruction. In the apartment buildings all habitable rooms, on all floors, have been assessed.

In the Duplex buildings all habitable rooms, on all floors, of each unit type has been assessed. Where a block type is replicated a number of times, the block in the most challenged position has been selected for assessment. If those results exceed the recommended minimum values for ADF, it is extrapolated that the others also meet the criteria.

The multi dwelling blocks have been assessed, as follows:

- Apartment Blocks A, B & C.
- Duplex A
- Duplex B. This building type is the same as Duplex C.
- Duplex D
- Duplex E
- Duplex H. This building type is the same as Duplex G.
- Duplex I
- Duplex K, as located in Housing Cell 7. There are four Duplex K blocks. One has been assessed and all rooms meet the criteria, the remaining blocks would also.
- Block X, as located in Housing Cell 3. There are two Type X blocks. All rooms comfortably meet the criteria, the remaining block would also.
- Block Y & Y mirror, as located in Housing Cell 2. There are six Type Y blocks. Two have been assessed all rooms comfortably meet the criteria, the remaining blocks would also.

Figure 6: Proposed siteplan locating multi-dwelling blocks.

The factors that affect ADF are room depth, window size relative to floor area and closeness to an adjacent obstruction. A full schedule of results and the associated false colour plans representing the analysis of ADF are shown in Appendix A. The room numbering follows the architectural drawings. A summary of the results are displayed in table 4 below.

Summary of results of the assessment of Average Daylight Factor						
	Total Apt & Duplex Units	No. of Units Assessed	Total % of Units Assessed	No. of Rooms Assessed	No. Meets Criteria	% Meets Criteria
Block A	110	110		305	305	100.0%
Block B	22	22		90	90	100.0%
Block C	91	91		261	261	100.0%
Duplex A	20	20		74	74	100.0%
Duplex B	16	16		64	64	100.0%
Duplex C	16		= Duplex B			
Duplex D	10	10		35	35	100.0%
Duplex E	12	12		47	47	100.0%
Duplex F	6	6		20	20	100.0%
Duplex G	12		= Duplex H			
Duplex H	12	12		42	42	100.0%
Duplex I	12	12		44	44	100.0%
Duplex K	16	16		16	16	100.0%
Block X	8	4		13	13	100.0%
Block Y & Mirror	24	4		20	20	100.0%
Total	387	335	86.56%	1031	1031	100.0%

Table 4: Summary of ADF results of multi - dwelling buildings assessed for ADF.

Within the development the design was optimised for good quality daylight. Priority for light is given to living spaces over bedrooms and where possible they are positioned away from inner corners or projecting stair cores to maximise available daylight. The use of very large windows also enhances available daylight and light penetration to the depths of the rooms.

In the majority of units the main living spaces contain a kitchen. The higher ADF target value of 2% is selected as the BRE guide and BS8602:2 recommend that the higher value should be used were there are multiple uses in a room. The assessment plane covers 100% of living space being considered.

4.3 Conclusion

100% of the rooms assessed exceed the minimum recommendation for the Average Daylight Factor and will be well daylit.
All Living spaces with kitchens (Living, Kitchen, Dining) exceed the target ADF of 2% and all the bedrooms exceed the target ADF value of 1%. All the living rooms without a kitchen exceed the target ADF value of 1.5%. 100% of the units in the proposed development meet the target ADF values. The proposed development meets the recommendations of the BRE Guidelines and BS8206 Part 2:2008 Lighting for Buildings, Code of Practice for Daylighting.

4.4 Assessment for Daylight Provision EN17037:2018

For supplementary information, compliance is also demonstrated with a calculation of Daylight Provision under EN 17037:2018. A complete set of results are shown in Appendix B. A summary of the results are displayed in the table below.

Fraction of rooms at each compliance level (area-weighted)					
		Fail	Minimum	Medium	High
Block A	Target Illuminance	1.1%	5.9%	30.2%	62.8%
	Minimum Illuminance	0.0%	11.7%	44.6%	43.8%
Block B	Target Illuminance	0.0%	4.9%	38.4%	56.7%
	Minimum Illuminance	0.0%	6.6%	38.0%	55.4%
Block C	Target Illuminance	0.0%	9.7%	33.5%	56.7%
	Minimum Illuminance	0.0%	21.8%	41.7%	36.5%
Duplex A	Target Illuminance	0.0%	3.1%	34.9%	62.0%
	Minimum Illuminance	0.0%	30.6%	8.2%	61.3%
Duplex B	Target Illuminance	10.6%	1.5%	41.6%	46.3%
	Minimum Illuminance	0.0%	20.0%	53.0%	27.0%
Duplex D	Target Illuminance	0.0%	10.8%	31.0%	58.2%
	Minimum Illuminance	0.0%	12.3%	40.7%	47.0%
Duplex E	Target Illuminance	7.9%	3.6%	54.9%	33.5%
	Minimum Illuminance	0.0%	27.2%	39.3%	33.5%
Duplex F	Target Illuminance	0.0%	0.0%	7.2%	92.8%
	Minimum Illuminance	0.0%	0.0%	7.2%	92.8%
Duplex H	Target Illuminance	0.0%	0.0%	9.9%	90.1%
	Minimum Illuminance	0.0%	0.0%	18.0%	82.0%
Duplex I	Target Illuminance	0.0%	0.0%	35.1%	64.9%
	Minimum Illuminance	0.0%	0.0%	39.8%	60.2%
Duplex K	Target Illuminance	0.0%	0.0%	25.0%	75.0%
	Minimum Illuminance	0.0%	0.0%	26.0%	74.0%
Block X	Target Illuminance	0.0%	3.4%	23.3%	73.3%
	Minimum Illuminance	0.0%	4.2%	17.9%	77.9%
Block Y	Target Illuminance	0.0%	39.9%	22.5%	37.6%
	Minimum Illuminance	0.0%	42.7%	25.4%	31.9%

Table 5: Summary of room compliance with EN 17037:2018. Individual room results can be viewed in Appendix B

4.5 Conclusion

All the rooms assessed in the proposed development exceed the Minimum Illuminance values for EN17037 : 2018 daylight provision. The majority of the rooms to the units in the development meet the Target Illuminance values for EN17037 : 2018. All the Living Kitchen Dining (LKD) rooms meet the Target Illuminance value in proposed development.

The daylight provision to the proposed development achieves good natural daylighting levels throughout.

5: Sunlight to Habitable Rooms of Proposed Apartment Blocks

5.1 Annual Probable Sunlight Hours

The BRE guidelines recommends that living rooms with window that face within 90° of due South be assessed for Annual Probable Sunlight Hours (APSH) and Probable Sunlight Hours (PSH) for the winter period from September to March. It is recommended that the APSH be greater than 25% of the total sunlight hours possible and that the PSH in winter be greater than 5%.

All windows to living rooms in the apartment blocks have been assessed. Bedrooms need not be assessed. Appendix C details the results per block, indicating if this room has a relevant South facing window. The apartment numbering follows that of the architectural drawings. A summary of the results are displayed in table 6 below.

Annual Probable Sunlight Hours Summary Table					
	Total Units	No. of units with a living room window within 90° South	Ratio of units that have a window within 90° South	No. of windows that meet criteria	Ratio that meet criteria
Block A	110	56	51%	41	73%
Block B	29	23	79%	23	100%
Block C	91	69	76%	63	91%
Total	230	148	64%	127	86%

Table 6: Summary of results of assessment of APSH & PSH.

The BRE Guidelines recommend maximising the amount of units that have a window within 90° due South but does not have set targets. Additionally windows with an aspect of greater than 90° due South, like West or North East, will still receive sunlight, but it is likely to be lesser amounts especially in the winter period. This scheme is well designed for Sunlight, many apartments that do not have a window that faces within 90° South, still meet the criteria for sunlight, as shown in Appendix C.

In the large apartment blocks, A, B & C there are 148 Living / Dining spaces that have windows facing within 90° of due south. Of these 127 meet the criteria to have an APSH percentage greater than the recommended 25% (414 hours) and 5% (75 hours) from September 21st to March 21st. This represents 86% of the applicable units, which face within 90° due South.

5.2 Conclusion

The design and layout of the apartment blocks were optimised for sunlight and to maximise the number of units with a window wall within 90° of due South at 64%. Of these apartments 86% of these exceed the target values set out for sunlight, which includes many windows with overhanging balconies.

6: Sunlight to gardens and open spaces

The BRE document indicates that for an amenity area to have good quality sunlight throughout the year, 50% should receive in excess of 2 hours sunlight on the 21st March. It also states that front gardens need not be assessed for sunlight.

6.1 Sunlight to Amenity within the Proposed Development

A variety of public & communal amenity spaces have been designed into this scheme, as indicated in Figure 7. A plan with generated analysis from a calculation of Sun on the Ground is shown in Figure 8 and results in Table 7 below.

Figure 7: Proposed Landscape plan locating amenity spaces.

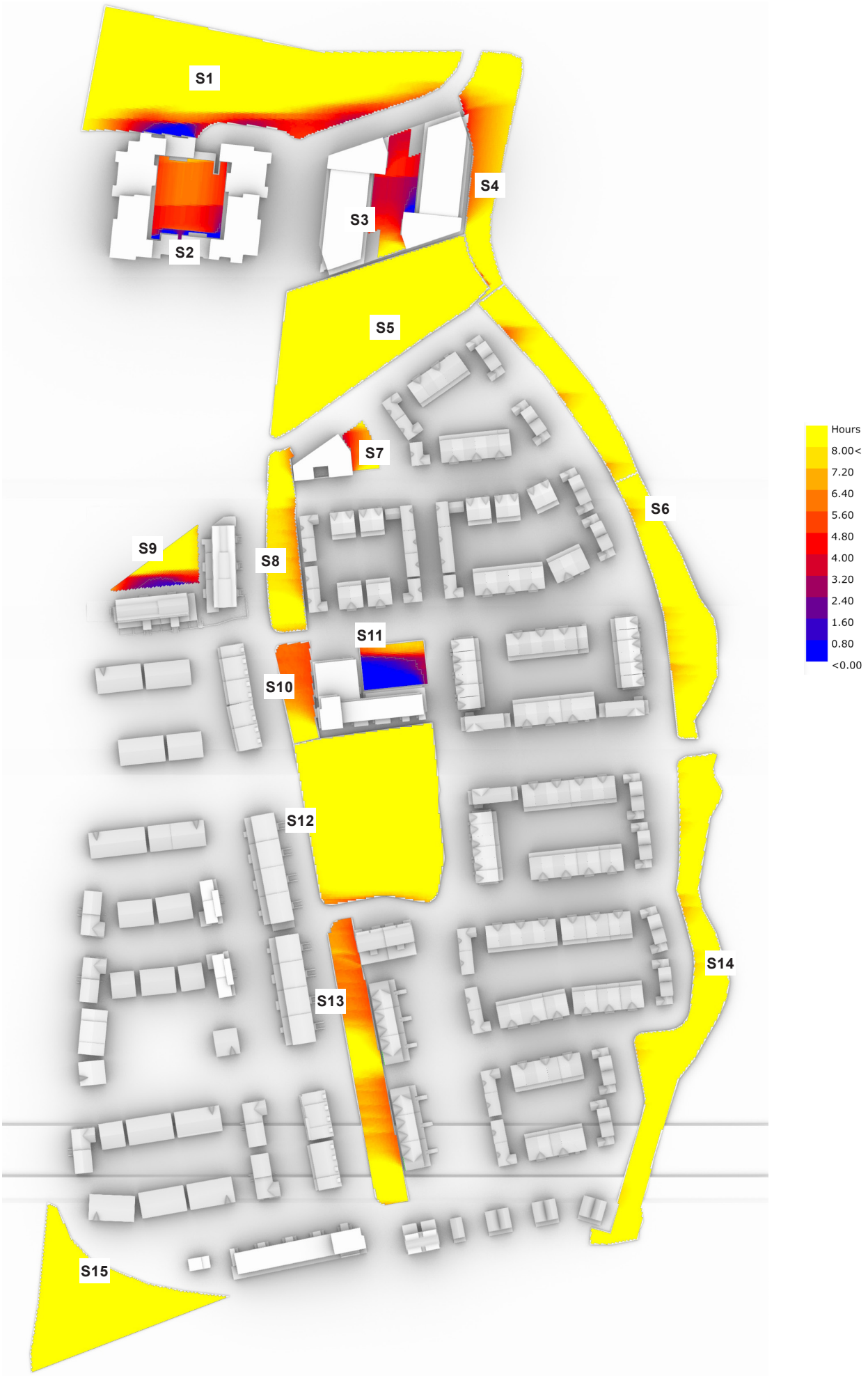

Figure 8: Radiation map of amenity areas, showing available sunlight on 21st March. The scale represents the percentage of daylight received from 0 - 8 hrs.

Sunlight on the Ground - Proposed Development				
Location ID	Description	Area	Proposed: % Area receiving 2 hours sunlight on 21st March	Meets criteria if >50% area receives 2 hours sunlight on 21st March
S1	Public Open Space	7,314	98%	Y
S2	Amenity Block C Plinth Level	1,222	94%	Y
S3	Amenity Block A Plinth Level	986	93%	Y
S4	Public Open Space	1,866	100%	Y
S5	Public Open Space	5,029	100%	Y
S6	Public Open Space	1,606	100%	Y
S7	Creche Site	267	100%	Y
S8	Public Open Space	1,267	100%	Y
S9	Public Open Space	628	89%	Y
S10	Public Open Space	691	100%	Y
S11	Public Open Space	660	38%	
S12	Public Open Space & Playground	5,261	100%	Y
S13	Public Open Space	2,002	100%	Y
S14	Public Open Space	3,587	100%	Y
S15	Public Open Space	2,916	100%	Y
		Total Area		% that meets criteria
		35,302		98.1%

Table 7: Calculation of Sun on the Ground to public amenity spaces within the development

6.2 Comment on the assessment of Sun on the Ground

The site has a variety of public & communal amenity spaces designed into the scheme. The BRE recommends that 50% of the area receive in excess of 2 hours of sunlight on the 21st March. Over 98% of the public and communal amenity space exceeds the BRE recommendation. The area designated S11 has sun on the ground over 38% of its area. This is a small area, representing 1.9% of the total amenity area.

6.3 Conclusion

The proposed development meets and exceeds the criteria set out in the BRE guidelines for sunlight to gardens and open spaces.

7: Shadow Diagrams

7.1 BRE Guidance on Shadow Studies

The BRE guidelines recommend using the 21st March for plotting shadow, it states:

"If a space is used all year round, the equinox (21 March) is the best date for which to prepare shadow plots as it gives an average level of shadowing. Lengths of shadows at the autumn equinox (21 September) will be the same as those for 21 March, so a separate set of plots for September is not required."

June 21st and December 21st are provided below for information but it should be noted that the summer solstice is the best case scenario with shadows at their shortest. The guidelines recommend that "Sunlight at an altitude of 10° or less does not count". In winter even low buildings will cast long shadows and it is common for large areas of the ground to be in shadow throughout the day especially in a built up area as the sun barely rises above an altitude of 10° during the course of the day. Below are the times for the Equinox and Solstice that the sun is above 10° altitude rounded to the nearest half hour.

Equinox: Between 8:30 and 17:30
Summer Solstice: Between 6:30 and 20:00
Winter Solstice: Between 10:30 and 14:00

7.2 Comment on the Shadow Study

The site is a greenfield site, there is no shadows cast from any structures on the site at present so only the proposed condition is plotted.

Shadow diagrams are a visual aid to understand where possible shading may occur. The use of shadow diagrams as an assessment method should be taken over the course of the day and not a specific time due to the transient nature of the sun and the shade caused by obstructions.

Section 7.3 shows the proposed shadow diagrams for the Equinox on the 21st March at two hour intervals during the day between 09:00 and 17:00.
Section 7.4 shows the proposed shadow diagrams for the Summer Solstice on the 21st June at two hourly intervals during the day between 10:00 and 18:00.
Section 7.5 shows the proposed shadow diagrams for the Equinox on the 21st September at two hour intervals during the day between 09:00 and 17:00.
Section 7.6 shows the proposed shadow diagrams for the Winter Solstice on the 21st December at two hourly intervals during the day between 10:00 and 14:00.

7.3 Shadow Casting diagrams March Equinox

Figure 9: Shadow diagrams 21 March 09:00 GMT

Figure 10: Shadow diagrams 21 March 11:00 GMT

Figure 11: Shadow diagrams 21 March 13:00 GMT

Figure 12: Shadow diagrams 21 March 15:00 GMT

Figure 13: Shadow diagrams 21 March 17:00 GMT

7.4 Shadow Casting diagrams June Solstice

Figure 14: Shadow diagrams 21 June 10:00 GMT+1 (DST)

Figure 15: Shadow diagrams 21 June 12:00 GMT+1 (DST)

Figure 16: Shadow diagrams 21 June 14:00 GMT+1 (DST)

Figure 17: Shadow diagrams 21 June 16:00 GMT+1 (DST)

Figure 18: Shadow diagrams 21 June 18:00 GMT+1 (DST)

7.5 Shadow Casting diagrams September Equinox

Figure 19: Shadow diagrams 21 September 09:00 GMT+1 (DST)