Residential Development at Old Fort Road, Ballincollig

Amenities, VSC & Shadow Assessment

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Glossary

Illuminance
A measure of the amount of light falling on a surface, usually measured in lux.

Target illuminance (E_T)
Illuminance from daylight that should be achieved for at least half of annual daylight hours across a specified fraction of the reference plane in a daylit space.

Minimum target illuminance (E_{TM})
Illuminance from daylight that should be achieved for at least half of annual daylight hours across 95% of the reference plane in spaces with vertical and/or inclined daylight apertures.

Daylight factor (D)
Ratio of total daylight illuminance at a reference point on the working plane within a space to outdoor illuminance on a horizontal plane due to an unobstructed CIE standard overcast sky. Thus a 1% DF would mean that the indoor illuminance at that point in the space would be one hundredth the outdoor unobstructed horizontal illuminance.

Daylight, natural light
Part of global solar radiation capable of causing a visual sensation. (CIE, 2020) (Combined skylight and sunlight.)

No sky line
The outline on the working plane of the area from which no sky can be seen.

Obstruction Angle
The angular altitude of the top of an obstruction above the horizontal, measured from a reference point in a vertical plane in a section perpendicular to the vertical plane.

Skylight
Part of *diffuse* sky radiation capable of causing a visual sensation. (CIE, 2020)

Sunlight
Part of direct solar radiation capable of causing a visual sensation. (CIE, 2020)

Annual Probable Sunlight Hours (APSH)
The long-term average of the total number of hours during the year in which direct sunlight reaches the unobstructed ground (when clouds are considered).

Winter Probable Sunlight Hours (WPSH)
The long-term average of the total number of hours between the 21st of September and the 21st of March in which direct sunlight reaches the unobstructed ground (when clouds are considered).

Vertical Sky Component (VSC)
Ratio of that part of illuminance, at a point on a given vertical plane, that is received directly from a sky of assumed or known luminance distribution (usually CIE standard overcast sky), to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. Usually the 'given vertical plane' is the outside of a window wall. The VSC does not include reflected light, either from the ground or from other buildings.

Reference plane or working plane
Horizontal, vertical or inclined plane in which a visual task lies. Normally the working plane may be taken to be horizontal, 0.85 m above the floor in houses and factories, 0.7 m above the floor in offices.

Spatial Daylight Autonomy (sDA)
Spatial Daylight Autonomy (sDA) is a metric describing annual sufficiency of ambient daylight levels in interior environments. It is defined as the percent of an analysis area that meets a minimum daylight illuminance level for a specified fraction of the operating/daylight hours per year. The sDA value is expressed as a percentage of area.

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1 Executive Summary

This report provides information on the daylight and sunlight analysis undertaken for the proposed development at Old Fort Road. This report focuses on the effect of the proposed development on daylight and sunlight to existing neighbouring dwellings, including the impact on sunlight to neighbouring gardens/amenity areas along with the internal daylight performance of the proposed apartments and sunlight performance to the proposed amenity spaces.

The analysis and assessments in this report have been carried in line with the recommendations of BRE's "Site Layout Planning for daylight and sunlight, a Guide to good practice" (BRE Building Technology Group, 2022) and BS EN 17037.

The BRE Guide provides useful recommendations to ensure adequate levels of daylight and sunlight in the proposed development. However, it has relevance to the impact of the proposed development on existing neighbouring dwellings also. The Guidelines make it clear that levels of daylight and sunlight cannot be expected to be as high in dense urban locations as would be the case in suburban or rural ones. It should be noted that whilst widely used, these are guidelines, and they do not have a statutory or mandatory basis.

The results show that the proposed development will have a negligible impact on surrounding buildings with respect to:

- access to skylight,
- access to sunlight, and
- sunlight to gardens/open spaces.

All surrounding buildings tested in the proposed development meet the minimum recommendations for internal daylight provision as set out in the BRE Guide and BS EN 17037 (National Annex).

In terms of internal daylight provision for the proposed development we reviewed schemes of a similar density recently approved in Cork. There are examples of quality schemes in which 82% of the apartments exceed the BRE internal daylight recommendations. The aim was to achieve in excess of 80% of units exceeding the BRE Guidelines. This was a very challenging figure to achieve primarily due to the requirements for private amenity spaces via balconies which in turn significantly reduce the quantum of light entering windows below them. The proposed development achieved 86% pass rate using the more onerous target of 200 lux in the Living/Kitchen/Dining room. Therefore, we believe the proposed development performs at an exemplar level for a scheme of this scale and aligns to national policy to ensure high quality sustainable development.

In order to maximise available light, glazing to all habitable rooms is in excess of 20%. The design team have developed the proposed building using the principles of the BREs "Site Layout Planning for Daylight and Sunlight, A guide to good practice".

In terms of the amenity spaces provided the results show that all open spaces receive greater than 2 hours of sunlight on March 21st. Therefore, the proposed open spaces exceed the BRE's recommendation for sunlight and should appear adequately sunlit throughout the year.

Overall, the development has been designed with due consideration for sunlight and daylight and meets the recommendations as set out in the BRE Guide – BR 209 "Site Layout Planning for Daylight and Sunlight, A guide to good practice (2022)."

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2 Introduction

Site layout planning to achieve good daylighting and sun lighting, within buildings and in the open spaces around them is an important aspect in designing new buildings or developments. Daylight animates an interior and makes it attractive and interesting, as well as providing light to work or read by. Good daylight and sunlight can contribute to making a building energy-efficient; they can reduce the need for electric lighting, while winter solar gain can reduce heating requirements.

This report provides information on the daylight and sunlight analysis undertaken for the proposed development at Old Fort Road.

The Proposed Development consists of 3 blocks which vary in height from 2 & 6 stories. The Site is located on the northern edge of the Town Centre, with excellent pedestrian, bicycle, car and public transport connectivity within the town, and in a wider context to Cork City.

The Development is situated on a developable site area of 1.21 Ha, which slopes down approximately 8m from the south to the north boundaries. The proposed number of units is 157 apartments over a range of 2 to 6 floors, with a proposed density of 130.2 units to the hectare.

The 3 Blocks are orientated along a North-South axis which allows for predominantly East and West facing apartments. This layout also allows for views through the site from Old Fort Road to the Regional Park and Lee Valley Hills beyond. Street Level Units and the main Entrances Lobbies are strategically located along Old Fort Road to create an active street front. The Creche is located on the ground floor away from the active street front and allowing direct access to a play area.

The analysis and assessments in this report have been carried in line with the recommendations of BRE's "Site Layout Planning for daylight and sunlight, a Guide to good practice" (BRE Building Technology Group, 2022) and BS EN 17037. The aforementioned BRE guide is also known as BRE Guide BR 209 and may be referenced as such or simply as the "BRE Guide" hereafter in this document.

This report assesses the proposed development's impact on daylight and sunlight to the existing buildings by the following means:

- Obstruction Angle Check (25-degree Line test)
- Vertical Sky Component (VSC)
- Sunlight to Gardens/Open Spaces

The report also assesses access to sunlight for the proposed development by means of sunlight to gardens/open spaces

Additionally, Appendix B provides shadow images for the proposed development.

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3 Site Description

3.1 Location & Context

The site is located on Old Fort Road, Ballincollig, Co. Cork.

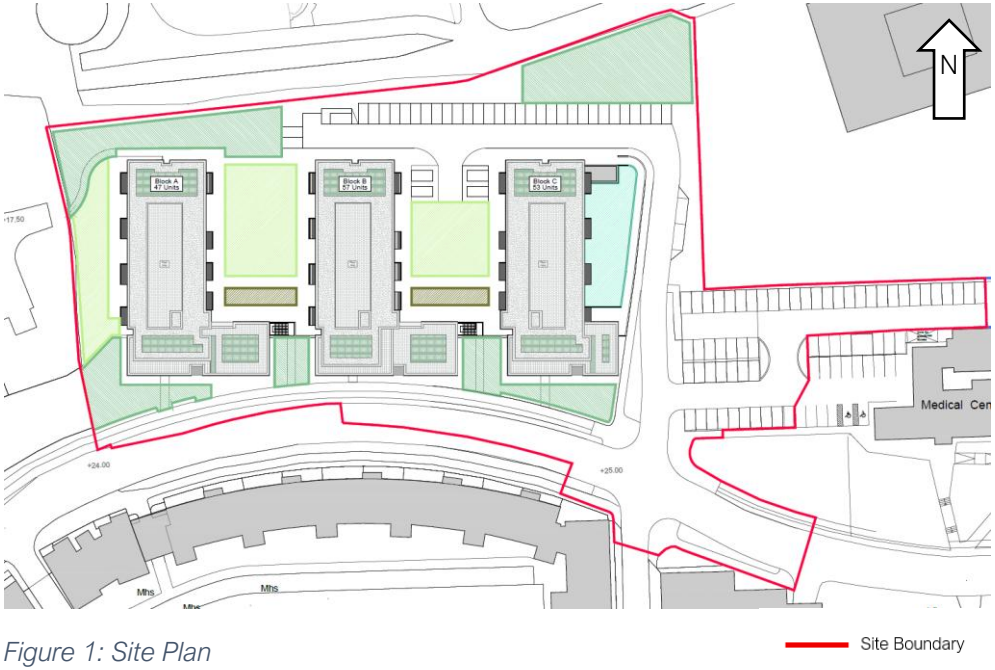


Figure 1: Site Plan

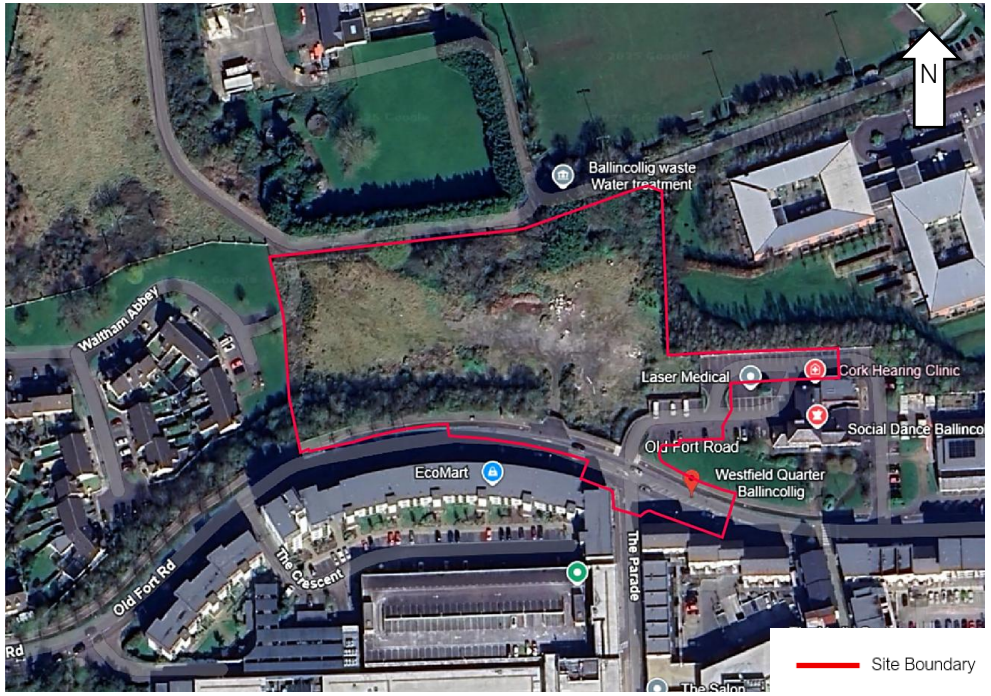


Figure 2: Aerial View of Site (Courtesy Google Maps) [Site boundary is only indicative. Refer to architectural drawings for accurate site boundary details.]

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3.2 Proposed Development

The proposed planning application is for the Development is situated on a developable site area of 1.21 Ha, which slopes down approximately 8m from the south to the north boundaries. The proposed number of units is 157 apartments over a range of 2 to 6 floors, with a proposed density of 130.2 per Ha units to the hectare.

The 3 Blocks are orientated along a North-South axis which allows for predominantly East and West facing apartments. This layout also allows for views through the site from Old Fort Road to the Regional Park and Lee Valley Hills beyond. Street Level Units and the main Entrances Lobbies are strategically located along Old Fort Road to create an active street front. The Creche is located on the ground floor away from the active street front and allowing direct access to a play area.

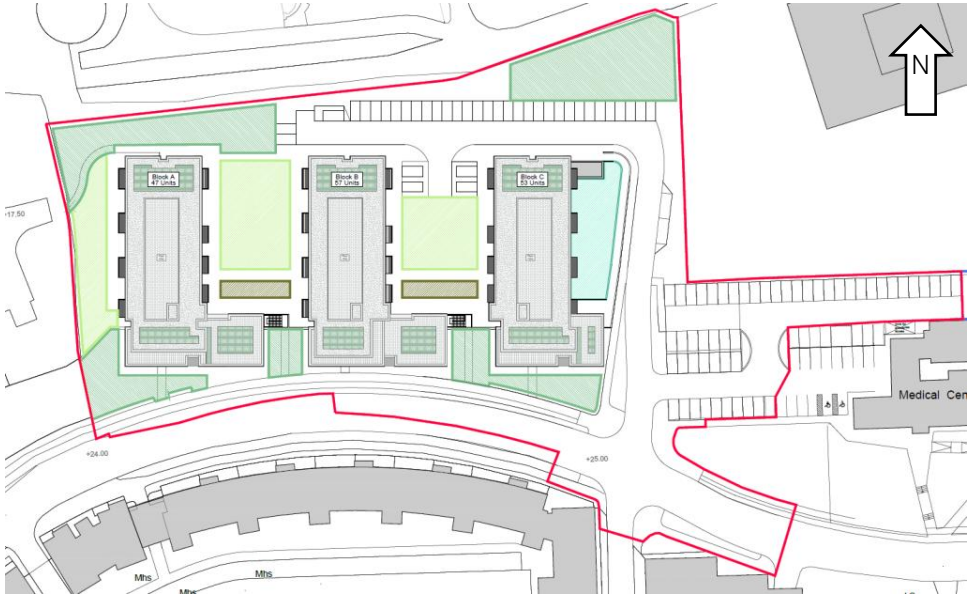


Figure 3: Proposed development-plan view

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3.3 Sensitive Receptors

The BRE guide states that when assessing the potential effects of a proposed development on existing buildings, only those windows and rooms that have a 'reasonable expectation' of daylight and sunlight need to be considered. Windows and rooms which meet these criteria are considered to be 'sensitive receptors. Paragraph 2.2.2 of the BRE guide clarifies what are considered sensitive receptors with respect to sunlight and daylight as follows:

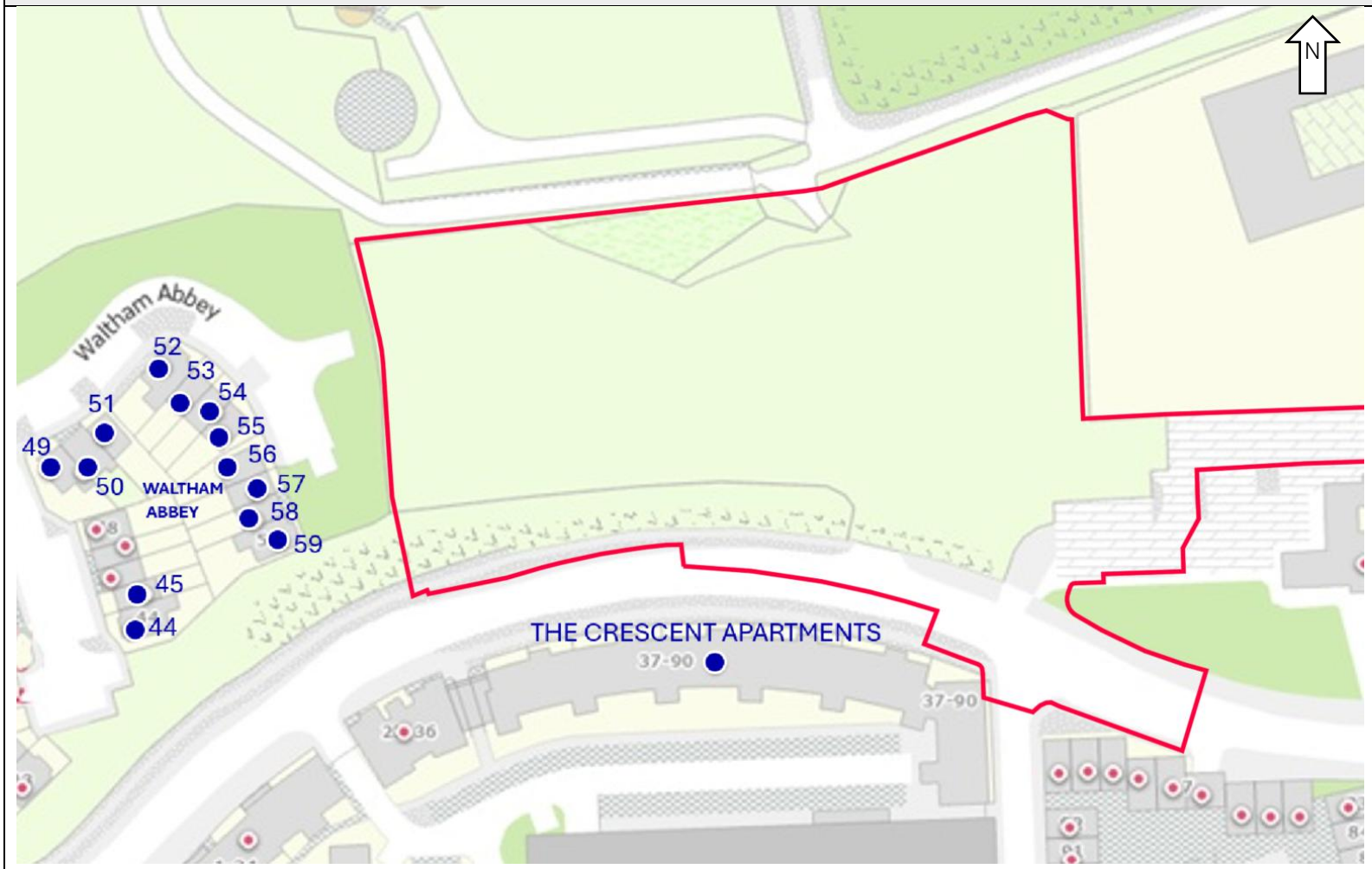
"The guidelines given here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. The guidelines may also be applied to any existing non-domestic building where the occupants have a reasonable expectation of daylight; this would normally include schools, hospitals, hotels and hostels, small workshops and some offices."

Outdoor amenity spaces which have a reasonable expectation of sunlight, whether they are private gardens, communal open spaces or outdoor public amenity areas, are also considered sensitive receptors.

Sensitive receptors that may be affected by the proposed development are highlighted in Table 1 below.

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Table 1: Sensitive Receptors

Sensitive Receptors Image/Map	Legend
 (Background Image/Map credit: https://www.eircode.ie/)	Site Boundary Potential Sensitive Receptors Notes: 1. Properties highlighted in blue will not definitely be impacted by the proposed development. This is just an initial indication of properties that will be assessed.

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4 Methodology & Assessment Criteria

The analyses and assessments are based on the guidelines set out in the BRE guide (BR 209) "Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice" (BRE Building Technology Group, 2022). This guide is intended to be used in conjunction with interior lighting recommendations in BS EN 17037 Daylight in buildings, and in the CIBSE publication LG 10 Daylighting – a guide for designers.

It should also be noted that although the BRE guide gives numerical guidelines, "*these should be interpreted flexibly since natural lighting is only one of many factors in site layout design.*" (BRE Building Technology Group, 2022)

Advanced lighting simulation software is used to perform the analysis. The software combines 3D modelling capabilities with a suite of programs which employ advanced raytracing. The software fully meets all relevant guidelines set out in the BRE Guide BR209. The software has the ability to perform annual simulations based on hourly climatic data. This type of simulation is used for the assessment of internal daylight provision in new buildings (discussed in section 4.2.)

Throughout this report an effort will be made to differentiate between metrics used to assess skylight only, sunlight only or a combination of both - daylight. As defined in the glossary of the BRE Guide, "Daylight" is an umbrella term that includes both skylight and sunlight—the diffuse and direct components of light from the sky respectively. Unfortunately, the terms daylight and skylight are often used interchangeably but this report will aim to specify when daylight specifically refers to skylight or when it also encompasses sunlight.

The following sub-sections outline the methodology and assessment criteria used.

4.1 Existing Buildings

The impact of the proposed development on the existing buildings (sensitive receptors only) with respect to daylight is assessed using the following methodologies. The methodologies are grouped into sub-sections based on whether they are "Light from the sky" analysis or "Sun lighting" analysis.

4.1.1 Light from the Sky

4.1.1.1 Obstruction Angle Check

The BRE guide states that:

"Loss of light to existing windows need not be analysed if the distance of each part of the proposed development from the existing window is three or more times its height above the centre of the existing window. In these cases, the loss of light will be small." (BRE Building Technology Group, 2022)

Therefore, in Figure 5, if the distance s1 was at least 3 times greater than h1, loss of light to the existing windows would not need to be analysed.

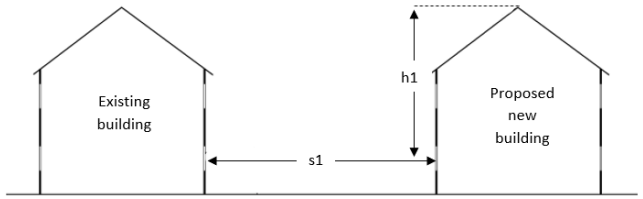


Figure 4: Spacing-to-Height Ratio

If the development is taller or closer than this, then the obstruction angle of the new development can be checked, where the obstruction angle is the angle subtended by the new development at the level of the centre of the lowest window in the existing building.

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"If this angle is less than 25° for the whole of the development then it is unlikely to have a substantial effect on the diffuse skylight enjoyed by the existing building." (BRE Building Technology Group, 2022)

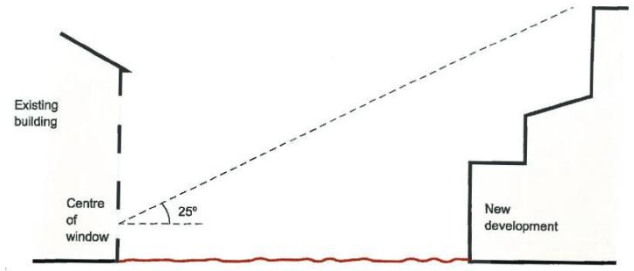


Figure 5: Obstruction Angle Check (25 Degree Line Test)

The obstruction angle is measured from the 3D CAD model. This check is suitable for existing windows where the proposed development is directly opposite an existing window, i.e. proposed development is cut by a vertical section drawn perpendicular to the window.

If, for any part of the new development, this angle is more than 25°, a more detailed check is needed to find the loss of skylight to the existing building. This may also be required in cases where the existing windows are not opposite the proposed development.

4.1.1.2 Vertical Sky Component (VSC)

Any reduction in the total amount of skylight for the existing properties can be calculated by finding the VSC at the centre of each main window. The Vertical Sky Component (VSC) is the ratio of the direct sky illuminance at the vertical reference point, to the simultaneous illuminance on an unobstructed horizontal plane. Reflected light is not included.

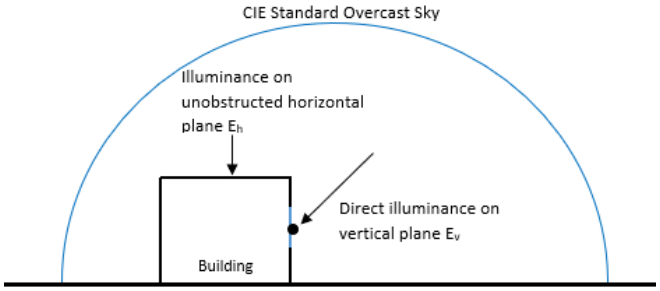


Figure 6: Vertical Sky Component

In the case of a floor-to-ceiling window such as a patio door, a point 1.6 m above ground (or balcony level for an upper storey) on the centre line of the window is used. The reference point is in the external plane of the window wall. Windows to bathrooms, toilets, storerooms, circulation areas and garages are not analysed.

Note that because the CIE standard overcast sky model is used, VSC is independent of orientation and location. (It is a *skylight* metric.)

The diffuse daylighting of any existing building may be adversely affected if:

"The VSC measured at the centre of an existing main window [or 1.6m above bottom of glazed door] is less than 27%, and less than 0.8 times its former value." (BRE Building Technology Group, 2022)

4.1.1.3 No Skyline

While VSC provides an indication of skylight availability, it does provide any information on the distribution of light within a space. In addition to external obstructions, the distribution of daylight within a space is dependent on window sizes and positioning, and room layouts. The no skyline divides points on the working plane which can and cannot see the sky.

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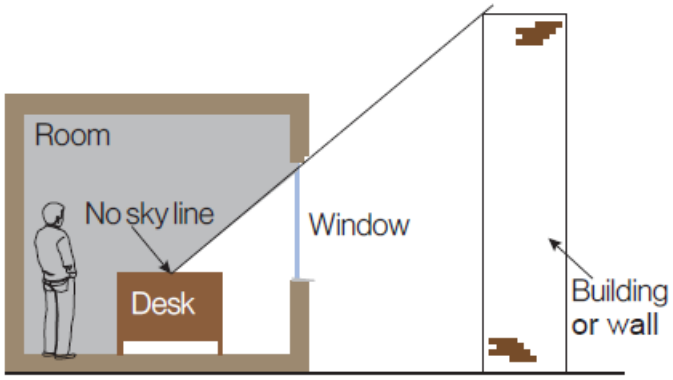


Figure 7: No Skyline [courtesy (BRE Building Technology Group, 2022)]

Areas beyond the no skyline, since they receive no direct daylight, usually look dark and gloomy compared with the rest of the room.

Where room layouts are known, the impact on the daylighting distribution in the existing building should be found by plotting the no sky line in each of the main rooms.

The diffuse daylighting of an existing building may be adversely affected if:

"the area of the working plane in a room which can receive direct skylight is reduced to less than 0.80 times its former value." (BRE Building Technology Group, 2022)

(Room layouts for neighbouring buildings are often not readily available, hence VSC is often the only analysis performed.)

4.1.2 Sun lighting

"In designing a new development or extension to a building, care should be taken to safeguard the access to sunlight both for existing dwellings, and for any nearby non-domestic buildings where there is a particular requirement for sunlight." (BRE Building Technology Group, 2022)

Obstruction to sunlight may become an issue if:

- Some part of a new development is situated within 90° of due south of a main window wall of an existing building.
- In the section drawn perpendicular to this existing window wall, the new development subtends an angle greater than 25° to the horizontal measured from the centre of the lowest window to a main living room.

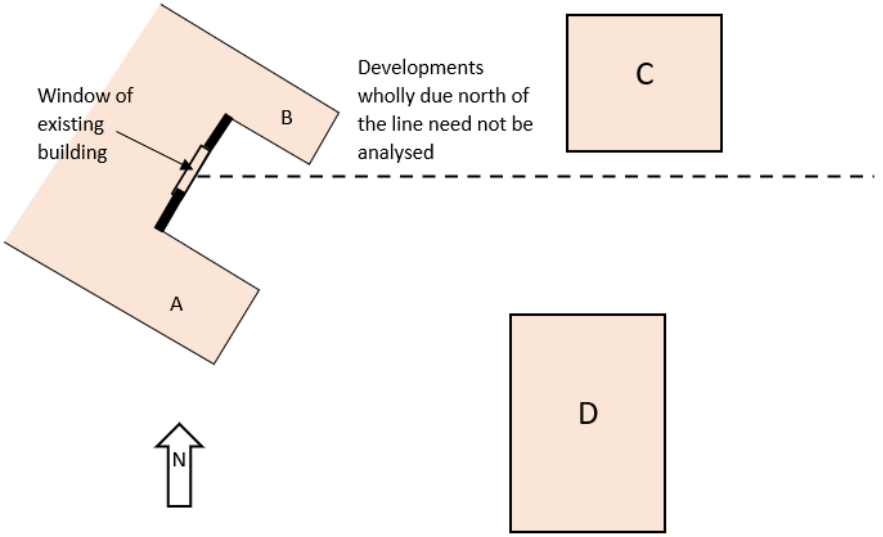


Figure 8: Sunlight Analysis Scenarios for Existing Buildings

No sunlight check is required on the existing window for proposed extension B and new building C, as they lie within 90° of due north of the window. The impact on sunlight to the existing window should be checked for proposed extension A, and new building D if it subtends more than 25° to the horizontal, measured in section from the centre of the window.

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To assess loss of sunlight to an existing building, it is suggested that all main living rooms of dwellings, and conservatories, should be checked if they have a window facing within 90° of due south.

4.1.2.1 Probable Sunlight Hours

To calculate the loss of sunlight to an existing building over the year, the annual probable sunlight hours (APSH) metric can be used. "*Here 'probable sunlight hours' means the total number of hours in the year that the sun is expected to shine on unobstructed ground, allowing for average levels of cloudiness for the location in question (based on sunshine probability data). The sunlight reaching a window is quantified as a percentage of this unobstructed annual total.*" (BRE Building Technology Group, 2022)

Sunlight to an existing dwelling may be adversely affected if the centre of a main living room window (which faces within 90° of due south):

- receives less than 25% of annual probable sunlight hours (APSH) and less than 0.80 times its former annual value.
- or less than 5% of annual probable sunlight hours between 21 September and 21 March (often referred to as winter probable sunlight hours - WPSH) and less than 0.80 times its former value during that period.
- and has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours.

4.1.2.2 Basic Assessment

It is not always necessary to do a full calculation using Annual Probable Sunlight Hours APSH (section 4.1.2.1). The same "spacing-to-height ratio" and "obstruction angle" checks discussed in section 4.1.1.1 can be used to determine if a more detailed calculation is necessary or not. Additionally, depending on the VSC and orientation of the existing windows an APSH assessment may not be required. The recommendation for safeguarding sunlight to existing neighbouring buildings will be met 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 (note: obstructions within 90° of due north of the existing window need not count here).*
- *The window wall faces within 90° of due south and no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal. Again, obstructions within 90° of due north of the existing window need not be counted.*
- *The window wall faces within 20° of due south and the reference point has a VSC of 27% or more."* (BRE Building Technology Group, 2022)

4.1.3 Sunlight to Existing Gardens & Open Spaces

Good site layout planning for daylight and sunlight should not limit itself to providing natural lighting inside buildings. Sunlight in the spaces between buildings has an important impact on the overall appearance and ambience of a development.

"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." (BRE Building Technology Group, 2022)

4.1.3.1 Shadow Plots

The BRE guide states:

"Where a large building is proposed which may affect a number of gardens or open spaces it is often illustrative to plot a shadow plan showing the location of shadows at different times of day and year."

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4.1.4 Impact Classification

Appendix H of the BRE Guide – "Environmental Impact Assessment" states that the impact of a new building on its surroundings can be classified as negligible, minor, moderate or major adverse. Where the loss of skylight or sunlight fully meets the guidelines in the BRE guide, the impact is assessed as negligible or minor adverse.

Where the loss of skylight or sunlight does not meet the BRE guidelines, the impact is assessed as minor, moderate or major adverse.

Table 2 provides a more detailed description of the impact classification.

Table 2: Environmental Impact Assessment: Impact Classification

Negligible impact	• *Loss of light well within guidelines,* ***or*** • *only a small number of windows losing light (within the guidelines)* ***or*** • *limited area of open space losing light (within the guidelines)*

Minor adverse impact (a)	• *Loss of light only just within guidelines* ***and***
	  ○ *a larger number of windows are affected* ***or***
	  ○ *larger area of open space is affected (within the guidelines)*

Minor adverse impact (b)	• *only a small number of windows or limited open space areas 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*
Major adverse impact	• *large number of windows or large open space areas 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 (living rooms / playground)*

A moderate adverse impact falls somewhere between the criteria for *"Minor Adverse Impact (b)"* and *"Major Adverse Impact"*.

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4.2 New Buildings

The daylight provision was also checked for the proposed development.

4.2.1 Light from the Sky

Section 2.1.8 of the BRE Guide states that:

"Daylight provision in new rooms may be checked using either of the methods in BS EN 17037 Daylight in Buildings: direct prediction of illuminance levels using hourly climate data, or the use of the daylight factor (D)".

Both methods are measures of the overall amount of daylight in a space.

The daylight factor (D) method addresses daylight provision as a ratio of unobstructed external illuminance under overcast sky conditions. This method involves calculating the daylight factor (D) that would be exceeded over half of the room, i.e. the median daylight factor (this is not the same as the average daylight factor used in the previous standard, BS8206-2). The recommended daylight factor values are location specific. This method will not be discussed in any more detail in this report as the illuminance method is the preferred option.

4.2.1.1 Illuminance Method (Target Illuminance E_T)

The illuminance method "*involves using climatic data for the location of the site (via the use of an appropriate, typical or average year, weather file within the software) to calculate the illuminance from daylight at each point on an assessment grid on the reference plane at an at least hourly interval for a typical year."* (BRE Building Technology Group, 2022)

"A target illuminance (E_T) should be achieved across at least half of the reference plane in a daylit space for at least half of the daylight hours. Another target illuminance (E_{TM}) should also be achieved across 95% of the reference plane for at least half of the daylight hours; this is the minimum target illuminance to be achieved towards the back of the room." (BRE Building Technology Group, 2022)

(Note that since hourly climatic data is used based on the location of the site, location and orientation are accounted for. The target illuminance can therefore be considered a *daylight* metric, i.e. incorporating both skylight and sunlight.)

BS EN 17037 gives three levels of recommendation for daylight provision in interior spaces: minimum, medium and high. For compliance with the standard, a daylit space should achieve the minimum level of recommendation.

Table 3 gives the target illuminances for side lit rooms. Different targets, given in Table A2 of BS EN 17037, apply in spaces with horizontal rooflights.

Table 3: EN 17037 Target Illuminances

Level of recommendation	Target illuminance E_T (lx) for half of assessment grid	Target illuminance E_{TM} (lx) for 95% of assessment grid
Minimum	300	100
Medium	500	300
High	750	500

The guidance contained in BR 209 is intended to be used with BS EN 17037 and its UK National Annex. The UK National Annex gives specific minimum recommendations for habitable rooms in dwellings in the UK. Although Ireland adopted EN17037 directly as IS EN EN17037, it is expected that all councils in Ireland will adopt the UK National Annex recommendations. The Dubin City Council Development Plan 2022-2028 states:

"is important to note that no amendments were made to [the IS EN 17037] document and unlike BS EN 17037, it does not contain a national annex. It offers only a single target for new buildings (there are no space-by-space targets – e.g. a kitchen would have the same target as a warehouse or office). […] These limitations make it unsuitable for use in planning policy or during planning applications. BR 209 must still be used for this purpose."

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Even if a predominantly daylit appearance is not achievable for a room in a dwelling, the National Annex NA recommends that the target illuminance values given in Table 4 are exceeded over 50% of the points on a reference plane 0.85 m above the floor, for at least half of the daylight hours.

Table 4: BS EN 17037 NA Target Illuminances for dwellings

Room type	Target illuminance E_T (lx)
Bedroom	100
Living Room	150
Kitchen	200

Where one room in a dwelling serves more than a single purpose, it is recommended that the target illuminance is that for the room type with the highest value – for example, in a space that combines a living room and a kitchen the target illuminance is recommended to be 200 lx.

However, it is recommended that local authorities use discretion here. For example: *"The target for a living room could be used for a combined living/dining/kitchen area if the kitchens are not treated as habitable spaces."* (BRE Building Technology Group, 2022). This may be appropriate in instances where small internal kitchens are unavoidable in apartment developments.

The minimum target illuminance level to be achieved across 95% of the reference plane within a space need not be applied to rooms in dwellings.

To avoid any confusion, the targets in Table 4 are those used for the purposes of this analysis.

The illuminance method is detailed and calculation intensive. It can take some time to process depending on the software, detail of the calculation model and the available computing power hence why the daylight factor (D) method may be preferred by some. However, it can provide additional information beyond the limits of the Daylight Factor method due to the use of hourly climate data.

There are a few ways the results of this type of analysis can be presented. One method is to report the % *area* of the reference plane exceeding the target illuminance E_T (for half of the daylight hours.) (This area should be greater than 50% to meet the BS EN 17037 recommendations.) This is equivalent to Spatial Daylight Autonomy (sDA)[1]. BR209 recommends reporting the median illuminance (exceeded over 50% of the reference plane) as this enables comparison with the different recommendations in BS EN 17037. It says that "*As an optional extra, the proportional area of the reference plane exceeding a particular target value may be presented".* It should be noted that the calculation methodology and results are the same in both instances. It is only the *presented* result that differs. For completeness, the results will be presented in both ways, i.e. both of the below metrics will be presented:

- The ***median illuminance*** (the illuminance exceeded over 50% of the reference plane).
- The ***% area*** of the reference plane exceeding a particular target illuminance (lux).

The settings used in the computational model for the illuminance calculations are outlined below:

- The reference/working plane is taken to be 0.85m above the floor.

The settings used in the computational model for the illuminance calculations are outlined below:

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- The reference/working plane is taken to be 0.85m above the floor.
- The grid spacing is 0.1m.
- A band of 0.3m from the walls is excluded from the grid.
- Window frame factor is set to 20% (This is based on the size of the window openings and the area of the window which is framing.)
- The glazing transmittance (normal) was set to 0.70.
- The glazing maintenance factor is set to 96% (This accounts for the reduction in glazing transmittance due to dirt; 4% loss of daylight compared with clean glazing.)
- The illuminance calculations take account of light which has been reflected from both external and internal surfaces. In the absence of detailed information on surface reflectances the recommended default reflectances from BR209 2022 have been used. These are detailed in Table 5 below.

Table 5: Surface Reflectances

Surface Type	Reflectance
Interior walls	0.50
Floors	0.20
Ceilings	0.70
Exterior walls and obstructions	0.20
Exterior Ground	0.20

Table 6: Balcony Glazing Properties

Surface Type	Properties
Balcony Glazing	Transmittance: 0.80 Refractive Index: 1.52

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4.2.2 Sun lighting

For interiors, access to sunlight can be quantified based on the methodology set out in BS EN 17037.

"In general, a dwelling, or non-domestic building that has a particular requirement for sunlight, will appear reasonably sunlit provided:

- *at least one main window wall faces within 90° of due south and*
- *a habitable room, preferably a main living room, can receive a total of at least 1.5 hours of sunlight on 21 March. This is assessed at the inside centre of the window(s); sunlight received by different windows can be added provided they occur at different times and sunlight hours are not double counted.*

Where groups of dwellings are planned, site layout design should aim to maximise the number of dwellings with a main living room that meets the above recommendations."
(BRE Building Technology Group, 2022)

There are 3 levels of recommendation provided in EN 17037 relating to sunlight to a room:

- 1.5 hours is the minimum level,
- 3 hours is the medium level, and
- 4 hours is the high level

For dwellings, as outlined above, at least one habitable room, preferably a main living room, should meet at least the minimum criterion.

4.2.3 Sunlight to Proposed Open Spaces

The BRE Guide recommends:

"*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."*

The communal open spaces and amenity space are analysed and assessed against the above criterion.

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5 Analysis

5.1 Overview of Computational Models

3D models of the existing the proposed scenarios were created. The site plans and 2D drawings provided by the architect were used to correctly position the surrounding buildings relative to the existing and proposed buildings.

3D models of the existing the proposed schemes were created. The existing and analysed (surrounding) models are based on 2D drawings provided by the architect supplemented by Google Street Maps and OS maps. The proposed model is based on the 2D CAD drawings provided by the architect:

In the following figures the building colours correspond to the following:

	Grey elements are the surrounding buildings (not analysed).
	Beige/buff elements represent the existing surrounding buildings that are analysed.
	Green elements (if present) are any existing buildings/ structures on the proposed site that will be demolished or significantly altered.
	The blue elements are the proposed buildings.

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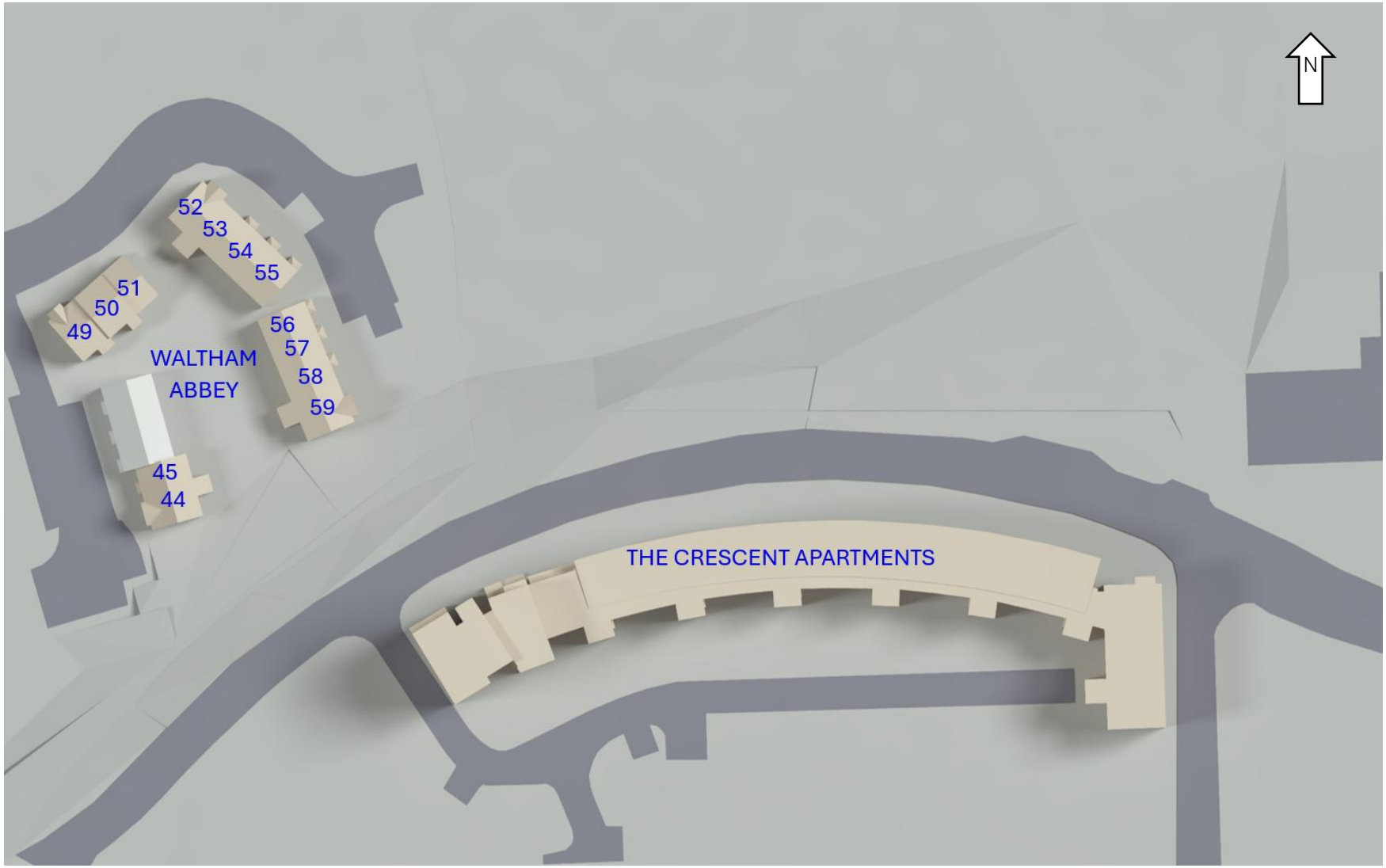


Figure 9: Existing site-plan view

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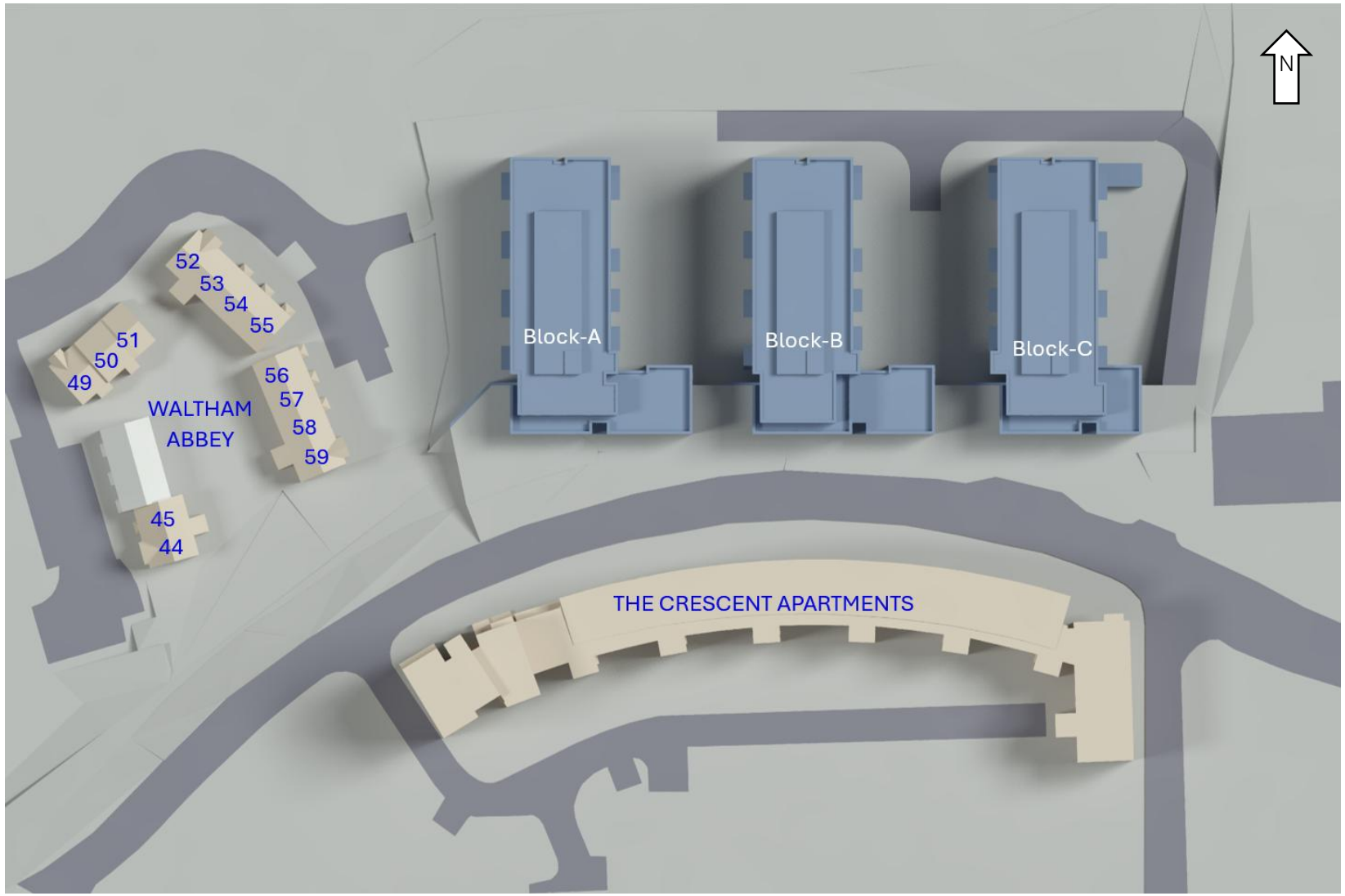


Figure 10: Proposed Development-plan view

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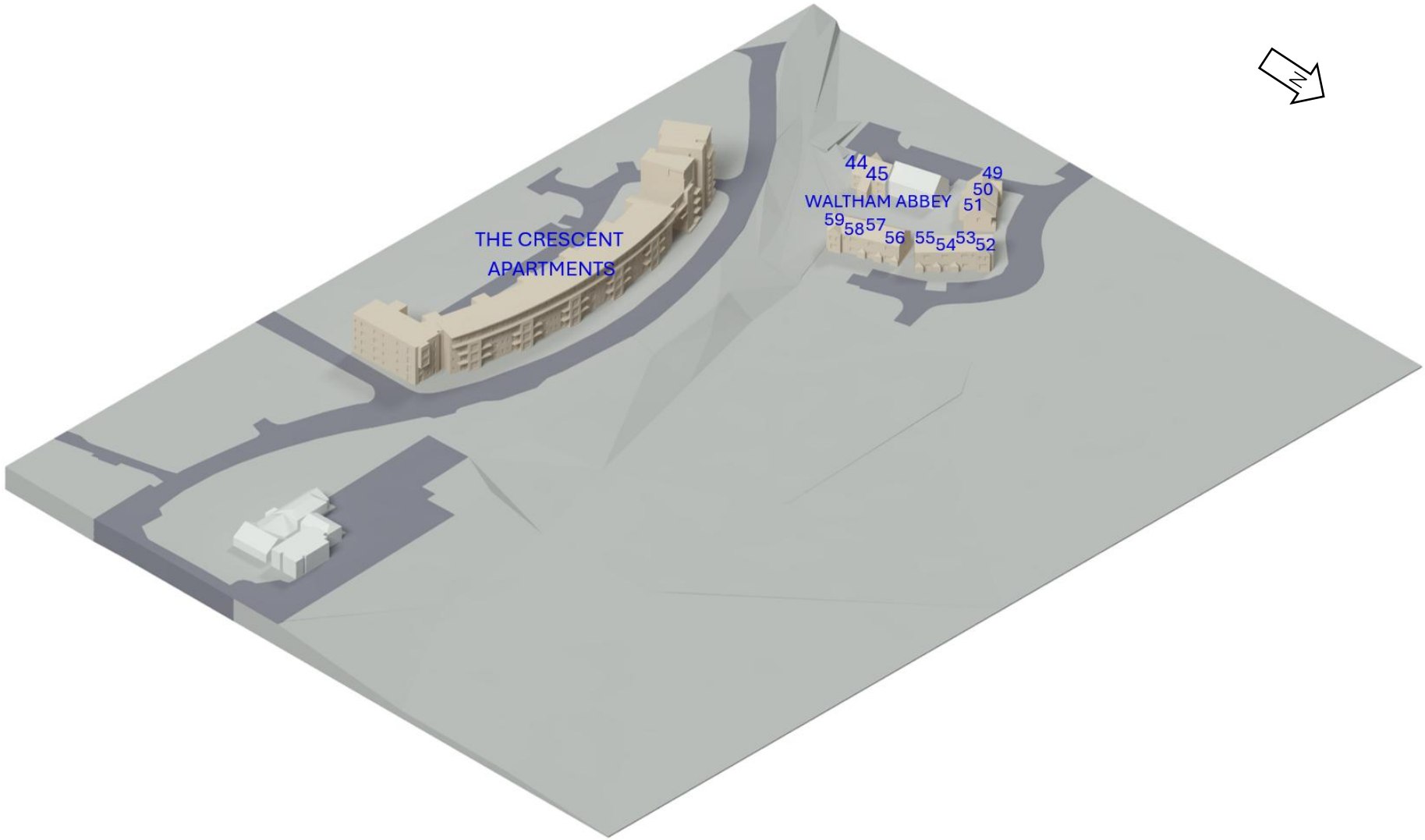


Figure 11: Existing Site-Perspective view

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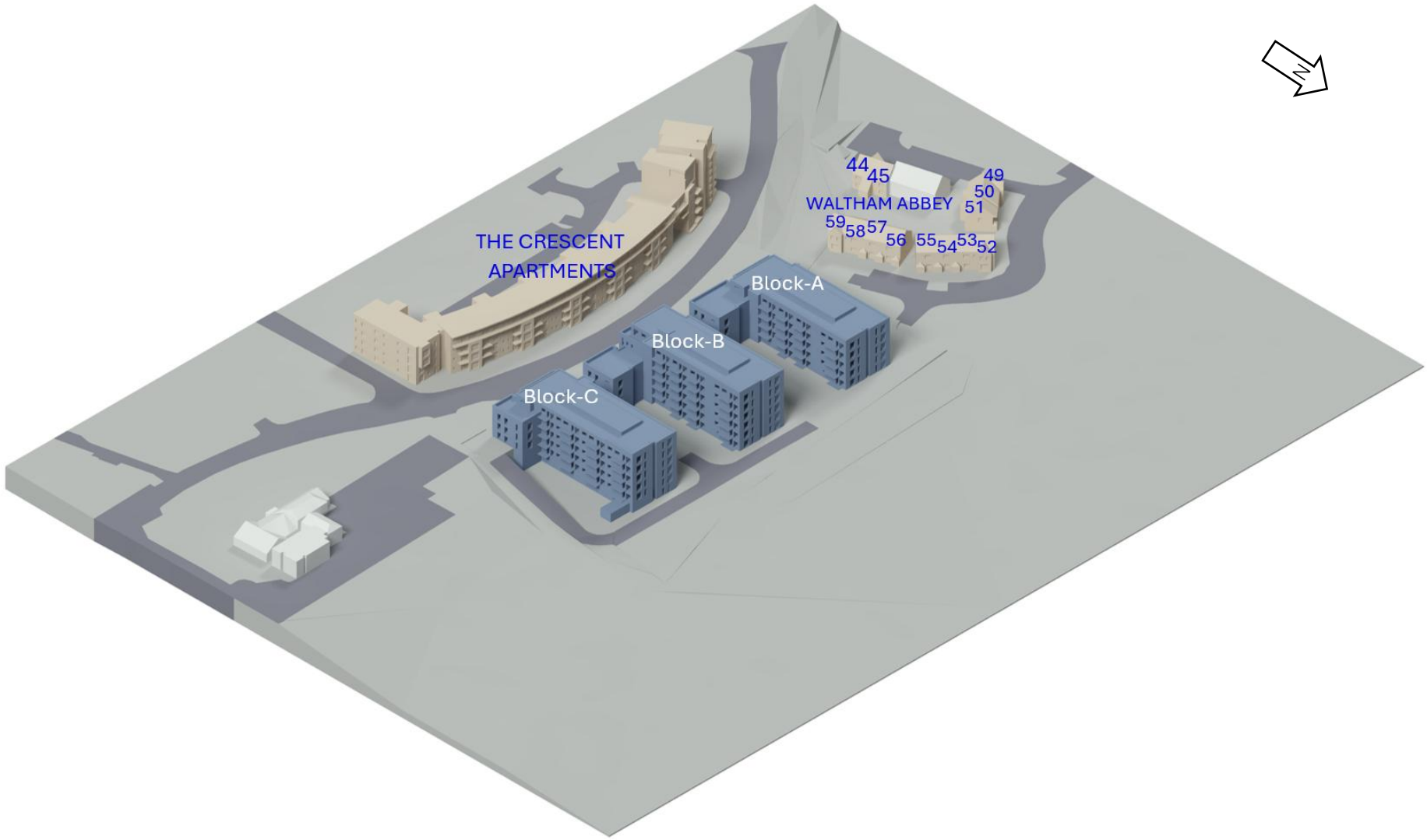


Figure 12: Proposed Development Site-Perspective view

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5.2 Existing Buildings

5.2.1 25 Degree Line Test

The obstruction angle was checked for the closest properties to the site that have windows directly opposite the proposed development. These are illustrated in the image below.

25-degree planes were drawn from the centre of the closest windows of the neighbouring properties. As these windows are the closest to the proposed development, if they are not adversely impacted, then it follows that the other adjacent neighbouring properties will not be adversely impacted.

The results for the “25-degree line test” are shown in the following figures. The 25-degree planes are shown in red.

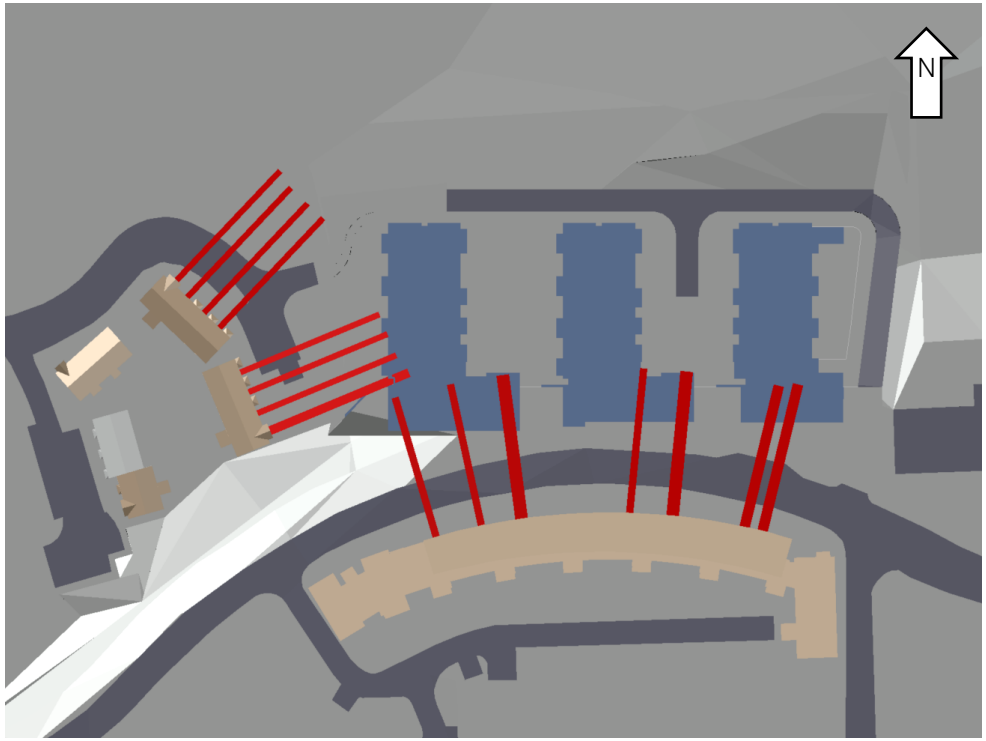


Figure 13: 25-degree lines-plan view

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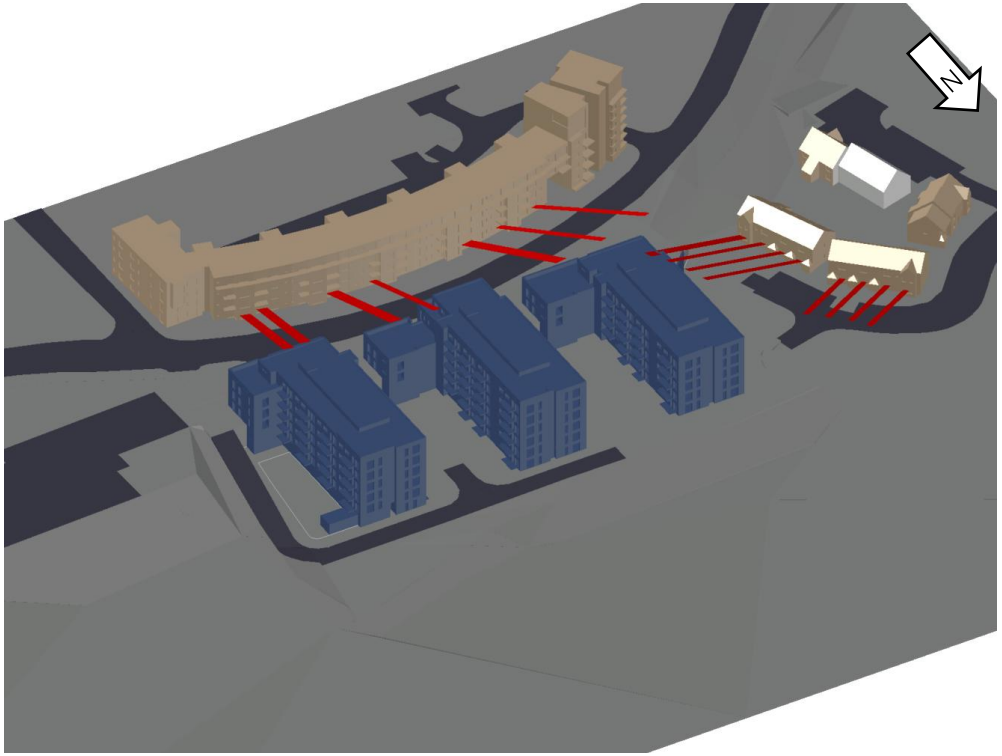


Figure 14: 25-degree lines-perspective view

The analysis shows that none of the 25-degree planes cut the proposed development. That is to say, the obstruction angle is less than 25 degrees for all of the properties/windows tested. Therefore, the proposed development will have a negligible impact on the skylight enjoyed by the existing neighbouring dwellings. (See Table 1: Sensitive Receptors for building labels.)

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5.2.2 VSC Analysis

The 25-degree plane test shows that the development will have a negligible impact on the houses at Waltham Abbey. However, not all neighbouring properties are directly opposite the proposed development, so VSC analysis has been performed for the remaining neighbouring properties. These are labelled in Table 1: Sensitive Receptors as:

- 44-45 Waltham Abbey.
- 49-59 Waltham Abbey.
- The Crescent Apartments

Some assumptions had to be made for window positions at the rear of these properties where information could not be gleaned from Google Street View or otherwise. Where assumptions must be made, multiple VSC points are spaced evenly across each facade facing the proposed development. The VSC points for each property are shown in the following figures.

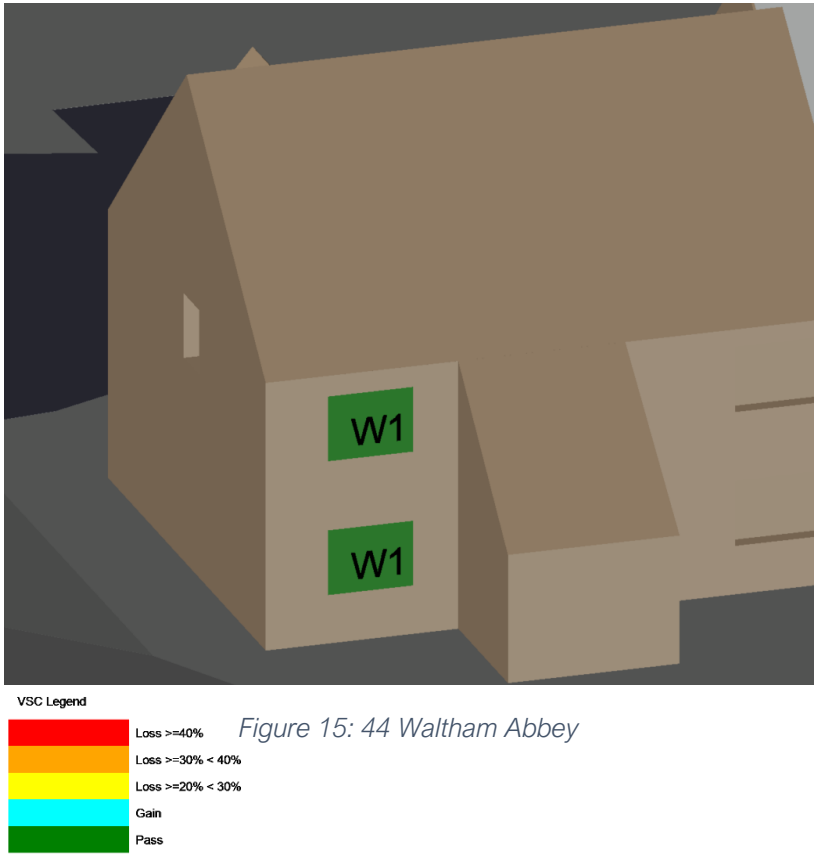


Figure 15: 44 Waltham Abbey

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Figure 16: 45 Waltham Abbey

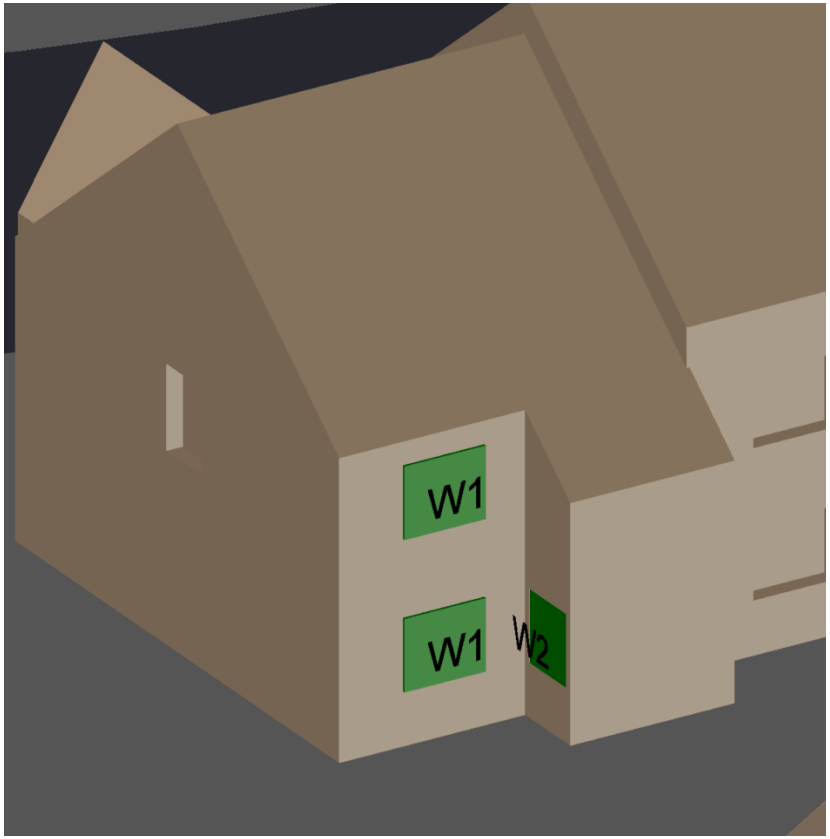
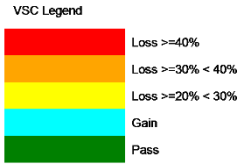


Figure 17: 49 Waltham Abbey



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Figure 18: 50 Waltham Abbey

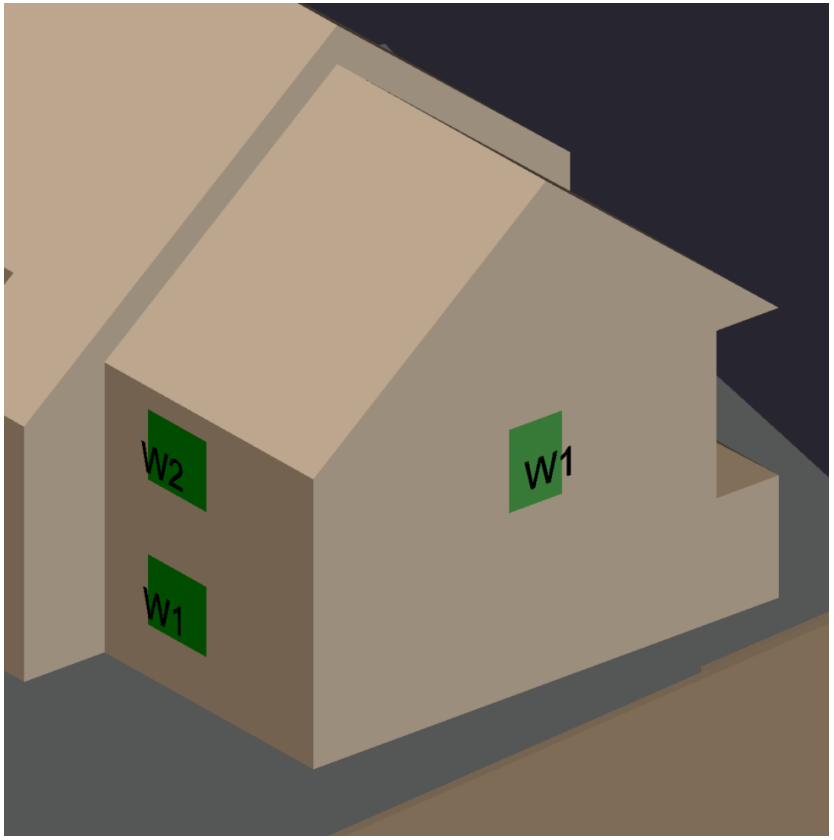
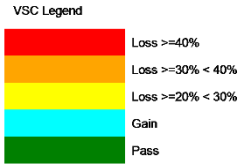


Figure 19: 51 Waltham Abbey



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Figure 20: 52 Waltham Abbey

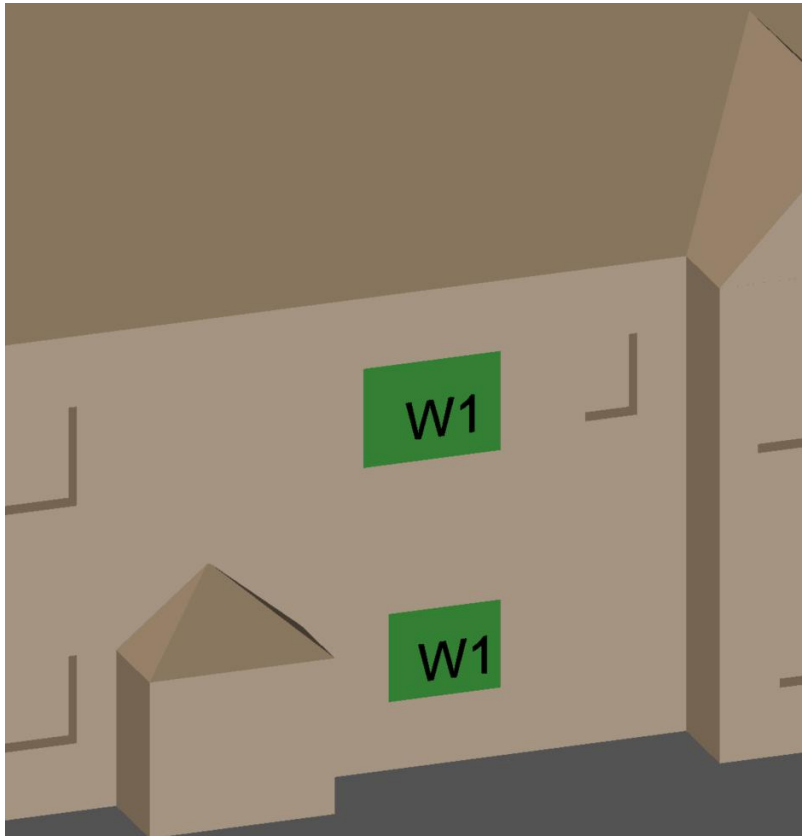
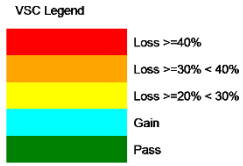


Figure 21: 53 Waltham Abbey



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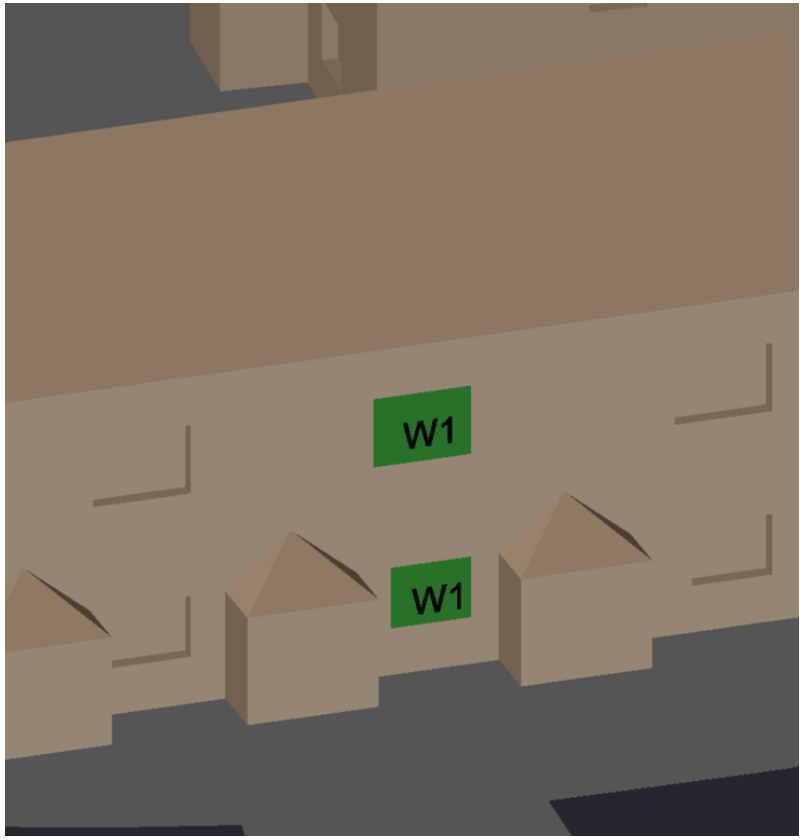


Figure 22: 54 Waltham Abbey

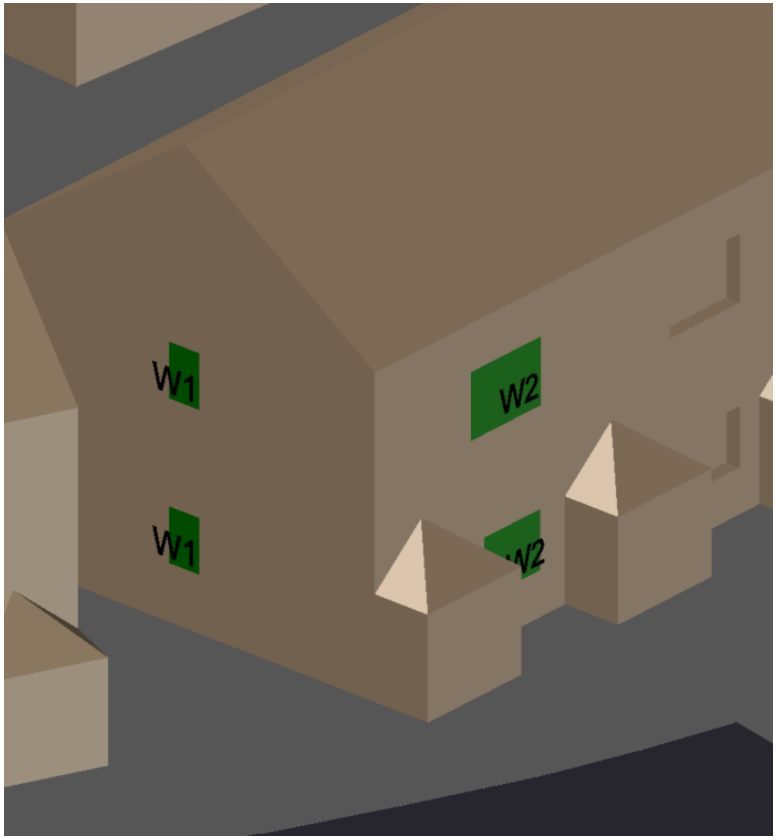
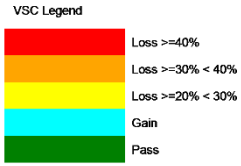


Figure 23: 55 Waltham Abbey



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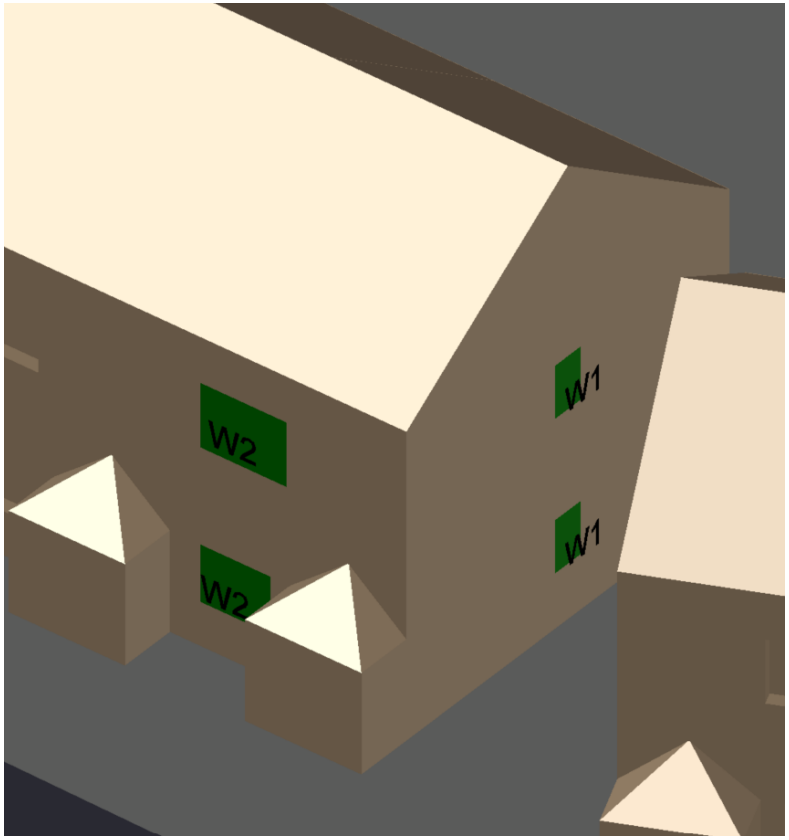


Figure 24: 56 Waltham Abbey

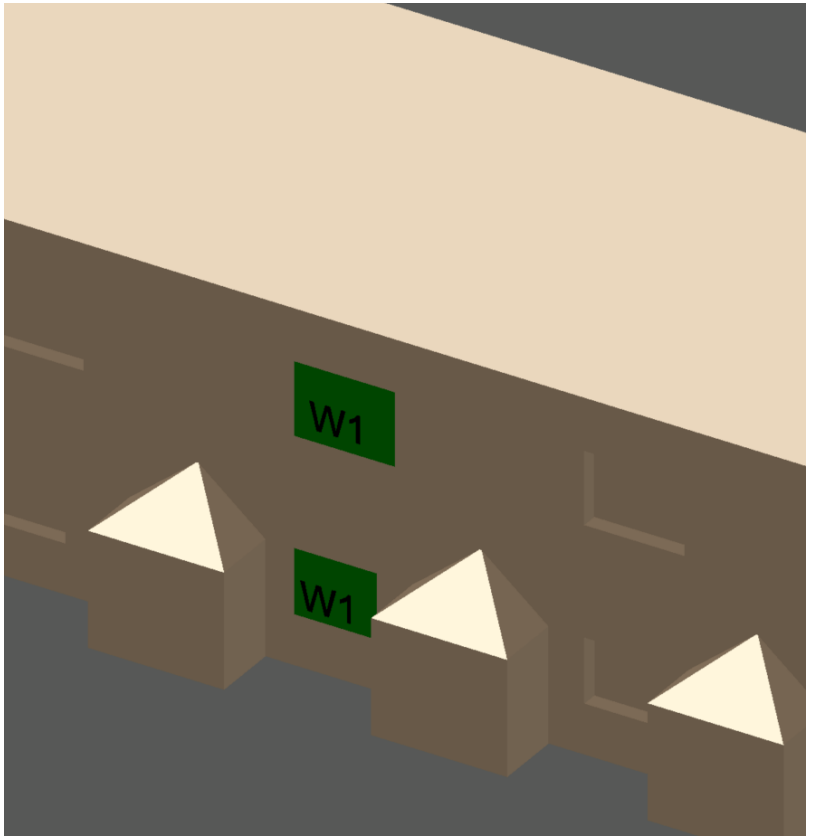
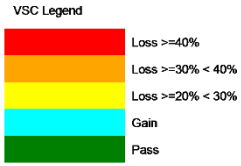


Figure 25: 57 Waltham Abbey



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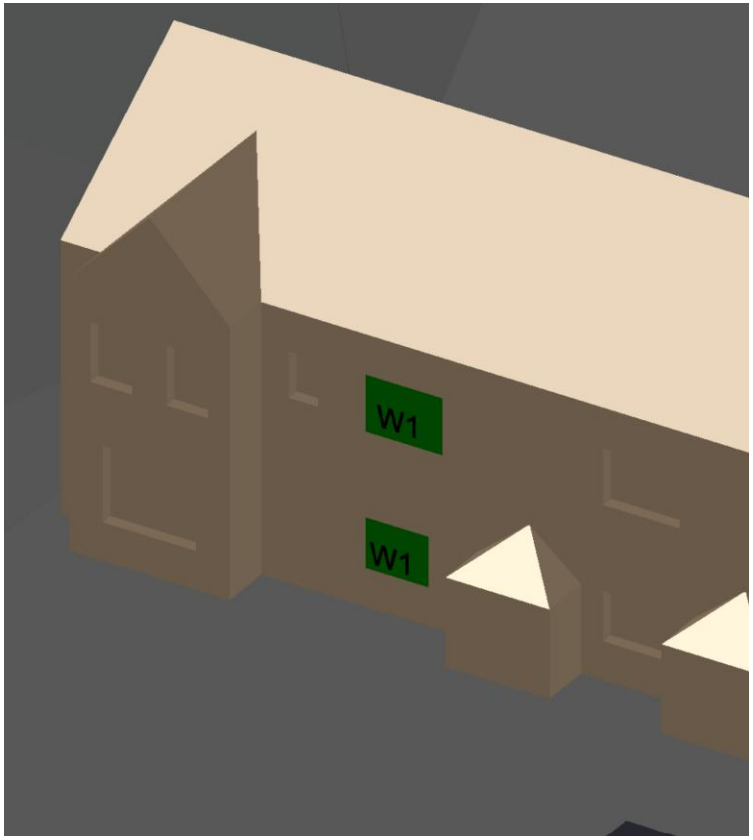


Figure 26: 58 Waltham Abbey

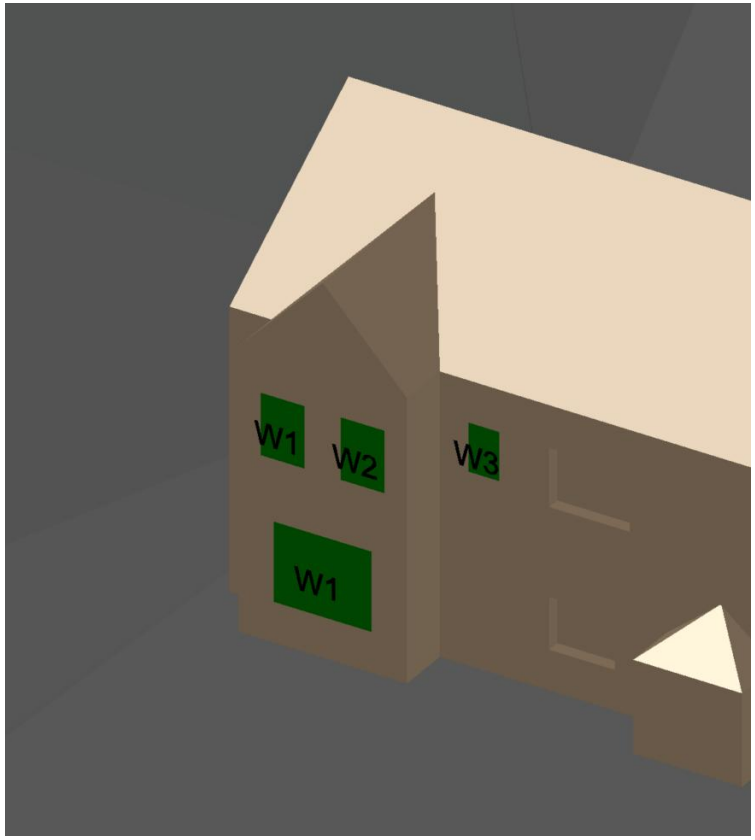
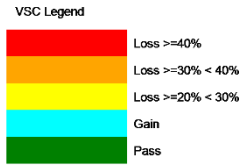


Figure 27: 59 Waltham Abbey



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Figure 28: The Crescent Apartments

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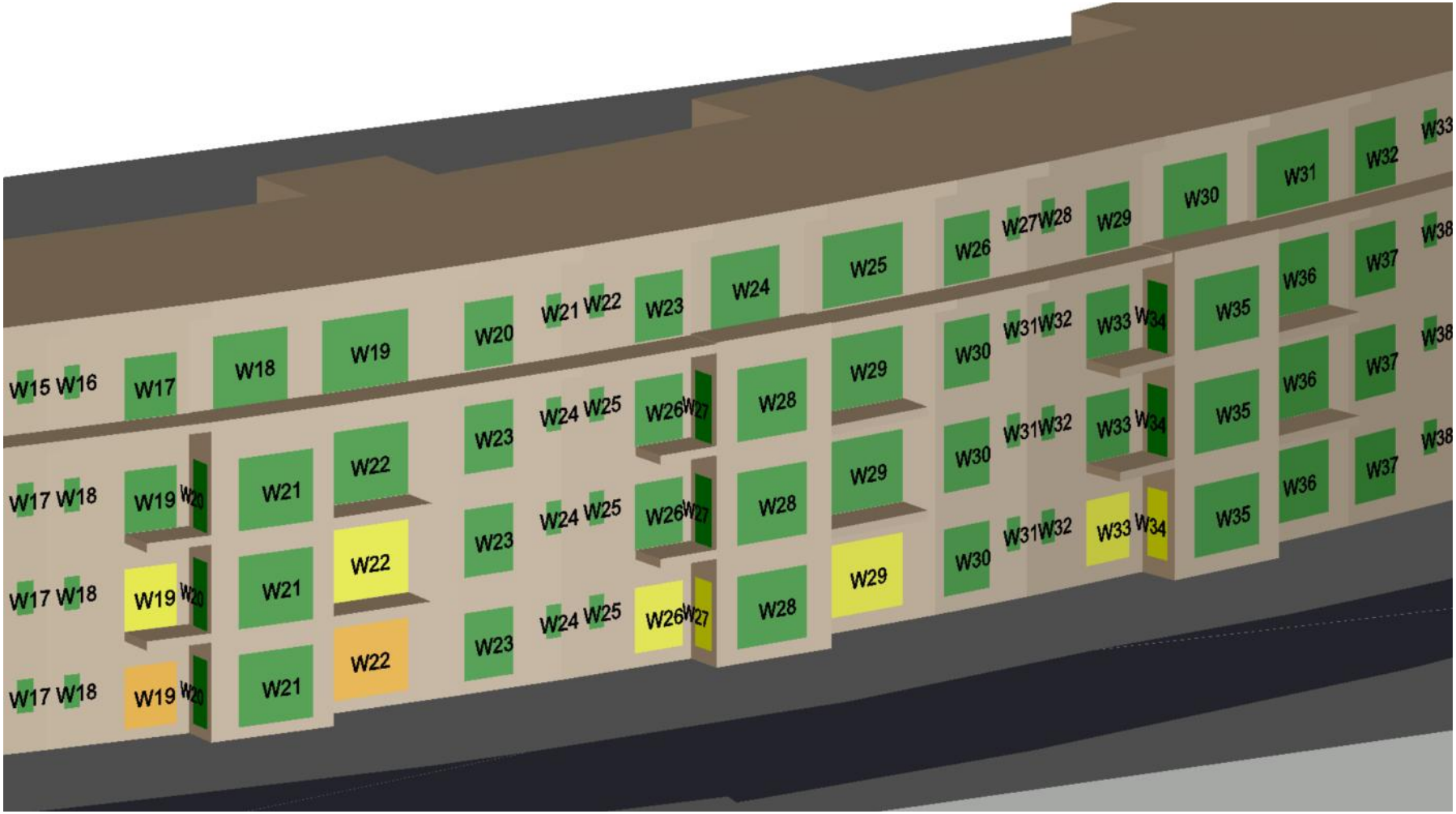


Figure 29: The Crescent Apartments

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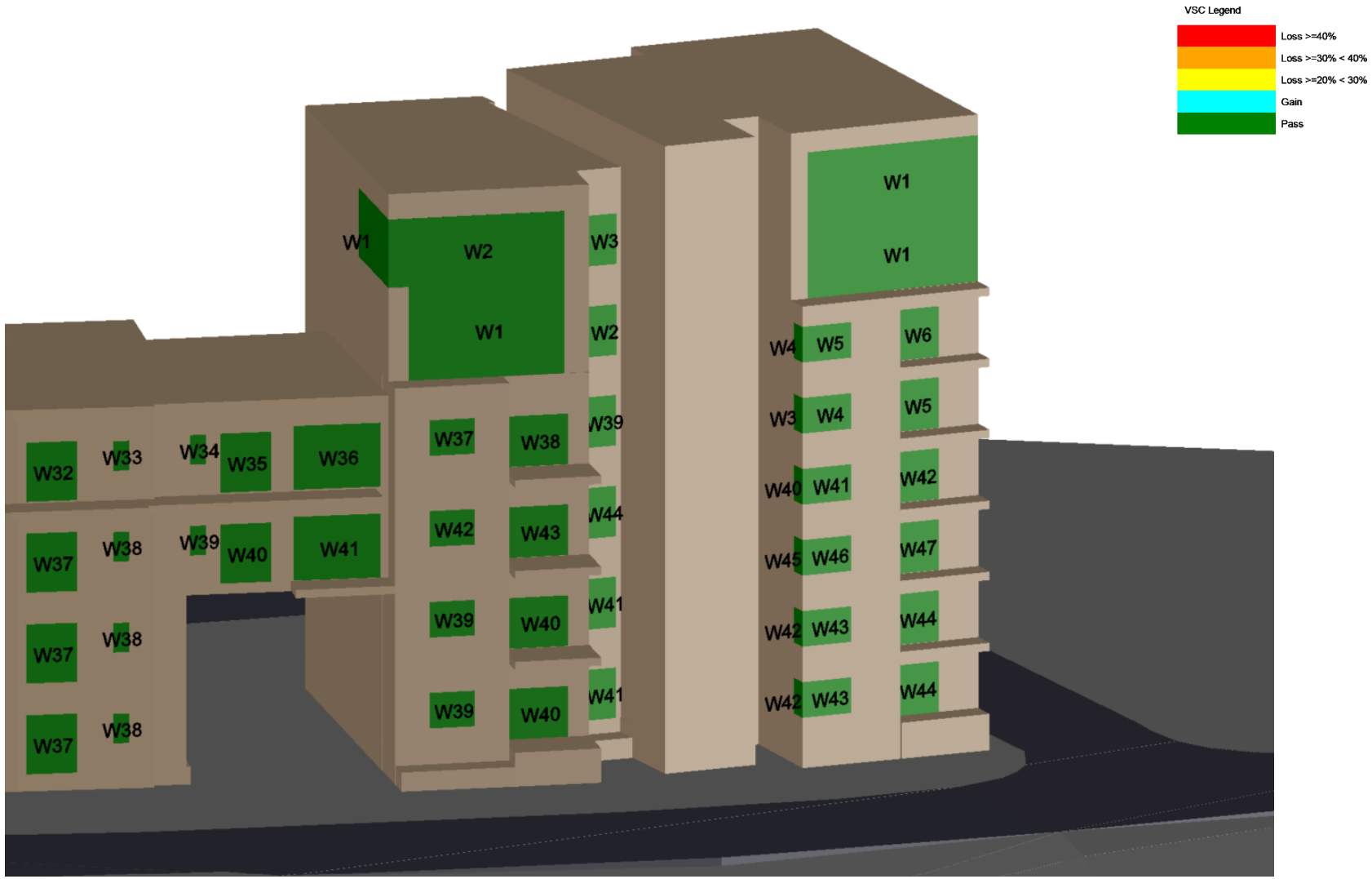


Figure 30: The Crescent Apartments

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Table 7: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
44 WALTHAM ABBEY					
Ground	W1	Existing	26.54	0.96	YES
		Proposed	25.55		
First	W1	Existing	33.24	0.97	YES
		Proposed	32.31		

Table 8: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
45 WALTHAM ABBEY					
Ground	W1	Existing	29.12	1.00	YES
		Proposed	28.98		
First	W1	Existing	32.65	1.00	YES
		Proposed	32.49		

Table 9: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
49 WALTHAM ABBEY					
Ground	W1	Existing	21.93	1.00	YES
		Proposed	21.93		
	W2	Existing	20.99	1.00	YES
		Proposed	20.99		
First	W1	Existing	30.82	1.00	YES
		Proposed	30.76		

Table 10: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
50 WALTHAM ABBEY					
Ground	W1	Existing	21.13	1.00	YES
		Proposed	21.13		
First	W1	Existing	29.97	1.00	YES
		Proposed	29.95		

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Table 11: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
51 WALTHAM ABBEY					
Ground	W1	Existing	27.55	1.00	YES
		Proposed	27.55		
First	W1	Existing	32.49	1.00	YES
		Proposed	32.47		
	W2	Existing	32.42	1.00	YES
		Proposed	32.37		

Table 12: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
52 WALTHAM ABBEY					
Ground	W1	Existing	39.31	0.95	YES
		Proposed	37.39		
First	W1	Existing	39.41	0.96	YES
		Proposed	37.79		
	W2	Existing	39.42	0.96	YES
		Proposed	37.92		
	W3	Existing	33.55	0.95	YES
		Proposed	31.79		

Table 13: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
53 WALTHAM ABBEY					
Ground	W1	Existing	37.48	0.95	YES
		Proposed	35.45		
First	W1	Existing	38.79	0.95	YES
		Proposed	36.82		

Table 14: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
54 WALTHAM ABBEY					
Ground	W1	Existing	35.58	0.94	YES
		Proposed	33.34		
First	W1	Existing	39.31	0.94	YES
		Proposed	36.76		

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Table 15: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
55 WALTHAM ABBEY					
Ground	W1	Existing	16.11	0.80	YES
		Proposed	12.85		
	W2	Existing	35.18	0.93	YES
		Proposed	32.58		
First	W1	Existing	22.85	0.89	YES
		Proposed	20.24		
	W2	Existing	39.31	0.92	YES
		Proposed	36.11		

Table 16: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
56 WALTHAM ABBEY					
Ground	W1	Existing	10.60	0.98	YES
		Proposed	10.37		
	W2	Existing	34.46	0.81	YES
		Proposed	27.92		
First	W1	Existing	17.59	0.99	YES
		Proposed	17.40		
	W2	Existing	38.06	0.86	YES
		Proposed	32.85		

Table 17: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
57 WALTHAM ABBEY					
Ground	W1	Existing	34.83	0.80	YES
		Proposed	27.98		
First	W1	Existing	37.81	0.86	YES
		Proposed	32.39		

Table 18: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
58 WALTHAM ABBEY					
Ground	W1	Existing	35.31	0.81	YES
		Proposed	28.54		
First	W1	Existing	37.36	0.86	YES
		Proposed	32.02		

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Table 19: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
59 WALTHAM ABBEY					
Ground	W1	Existing	36.29	0.81	YES
		Proposed	29.54		
First	W1	Existing	36.95	0.85	YES
		Proposed	31.53		
	W2	Existing	37.13	0.85	YES
		Proposed	31.66		
	W3	Existing	33.41	0.84	YES
		Proposed	28.22		

Table 20: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Ground	W1	Existing	36.81	0.88	YES
		Proposed	32.35		
	W2	Existing	35.46	0.87	YES
		Proposed	30.98		
	W3	Existing	31.87	0.87	YES
		Proposed	27.59		
	W4	Existing	36.34	0.86	YES
		Proposed	31.19		
	W5	Existing	24.49	0.81	YES
		Proposed	19.86		
	W6	Existing	16.06	0.98	YES
		Proposed	15.77		
	W7	Existing	39.53	0.84	YES
		Proposed	33.15		
	W8	Existing	27.90	0.77	YES*
		Proposed	21.46		
	W9	Existing	37.39	0.82	YES
		Proposed	30.66		
	W10	Existing	37.98	0.83	YES
		Proposed	31.38		

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Table 21: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Ground	W11	Existing	36.46	0.81	YES
		Proposed	29.66		
	W12	Existing	27.59	0.77	YES*
		Proposed	21.27		
	W13	Existing	15.04	0.88	YES
		Proposed	13.30		
	W14	Existing	39.57	0.79	YES
		Proposed	31.37		
	W15	Existing	26.57	0.68	YES*
		Proposed	18.14		
	W16	Existing	37.35	0.76	YES
		Proposed	28.45		
	W17	Existing	38.00	0.77	YES
		Proposed	29.43		
	W18	Existing	37.02	0.77	YES
		Proposed	28.36		
	W19	Existing	28.09	0.69	YES*
		Proposed	19.52		
	W20	Existing	15.89	0.84	YES
		Proposed	13.37		
	W21	Existing	39.59	0.75	YES
		Proposed	29.86		
	W22	Existing	27.02	0.69	YES*
		Proposed	18.66		

Table 22: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Ground	W23	Existing	38.06	0.79	YES
		Proposed	29.92		
	W24	Existing	38.06	0.81	YES
		Proposed	30.65		
	W25	Existing	36.41	0.81	YES
		Proposed	29.35		
	W26	Existing	27.79	0.75	YES*
		Proposed	20.96		
	W27	Existing	15.87	0.79	YES*
		Proposed	12.46		
	W28	Existing	39.59	0.81	YES
		Proposed	32.12		
	W29	Existing	28.52	0.78	YES*
		Proposed	22.11		
	W30	Existing	37.89	0.82	YES
		Proposed	31.19		
	W31	Existing	37.89	0.83	YES
		Proposed	31.61		
	W32	Existing	36.34	0.83	YES
		Proposed	30.29		
	W33	Existing	27.83	0.78	YES*
		Proposed	21.66		
	W34	Existing	15.32	0.77	YES*
		Proposed	11.82		

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Table 23: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Ground	W35	Existing	39.57	0.85	YES
		Proposed	33.60		
	W36	Existing	28.36	0.85	YES
		Proposed	24.13		
	W37	Existing	37.81	0.89	YES
		Proposed	33.57		
	W38	Existing	38.65	0.91	YES
		Proposed	34.99		
	W39	Existing	38.84	0.95	YES
		Proposed	36.88		
	W40	Existing	25.46	0.95	YES
		Proposed	24.17		
	W41	Existing	14.57	1.00	YES
		Proposed	14.57		
	W42	Existing	21.88	0.90	YES
		Proposed	19.70		
	W43	Existing	39.59	0.98	YES
		Proposed	38.72		
	W44	Existing	26.19	1.00	YES
		Proposed	26.15		

Table 24: VSC Results

Table 25: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
First	W1	Existing	28.16	0.89	YES
		Proposed	25.05		
	W2	Existing	31.98	0.90	YES
		Proposed	28.78		
	W3	Existing	31.39	0.90	YES
		Proposed	28.32		
	W4	Existing	36.08	0.90	YES
		Proposed	32.57		
	W5	Existing	24.56	0.87	YES
		Proposed	21.37		
	W6	Existing	16.01	0.99	YES
		Proposed	15.82		
	W7	Existing	39.58	0.89	YES
		Proposed	35.09		
	W8	Existing	27.80	0.84	YES
		Proposed	23.25		
	W9	Existing	36.80	0.87	YES
		Proposed	32.06		
	W10	Existing	37.07	0.88	YES
		Proposed	32.53		
	W11	Existing	35.77	0.87	YES
		Proposed	31.11		
	W12	Existing	27.43	0.84	YES
		Proposed	23.07		

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Table 26: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
First	W13	Existing	15.00	0.92	YES
		Proposed	13.78		
	W14	Existing	39.60	0.86	YES
		Proposed	34.02		
	W15	Existing	26.51	0.79	YES*
		Proposed	20.86		
	W16	Existing	36.73	0.84	YES
		Proposed	30.81		
	W17	Existing	37.05	0.85	YES
		Proposed	31.46		
	W18	Existing	36.22	0.84	YES
		Proposed	30.55		
	W19	Existing	27.91	0.79	YES*
		Proposed	22.14		
	W20	Existing	15.84	0.89	YES
		Proposed	14.16		
	W21	Existing	39.61	0.84	YES
		Proposed	33.08		
	W22	Existing	26.91	0.79	YES*
		Proposed	21.27		
	W23	Existing	37.20	0.86	YES
		Proposed	31.82		
	W24	Existing	36.98	0.87	YES
		Proposed	32.19		

Table 27: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
First	W25	Existing	35.46	0.87	YES
		Proposed	30.95		
	W26	Existing	27.55	0.84	YES
		Proposed	23.09		
	W27	Existing	15.65	0.85	YES
		Proposed	13.26		
	W28	Existing	39.62	0.88	YES
		Proposed	34.87		
	W29	Existing	28.47	0.86	YES
		Proposed	24.50		
	W30	Existing	37.14	0.89	YES
		Proposed	33.04		
	W31	Existing	36.89	0.90	YES
		Proposed	33.21		
	W32	Existing	35.52	0.90	YES
		Proposed	32.01		
	W33	Existing	27.60	0.87	YES
		Proposed	23.91		
	W34	Existing	15.13	0.85	YES
		Proposed	12.82		
	W35	Existing	39.62	0.91	YES
		Proposed	36.09		
	W36	Existing	28.31	0.91	YES
		Proposed	25.86		

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Table 28: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
First	W37	Existing	37.12	0.93	YES
		Proposed	34.57		
	W38	Existing	37.64	0.94	YES
		Proposed	35.48		
	W39	Existing	38.87	0.97	YES
		Proposed	37.68		
	W40	Existing	25.52	0.97	YES
		Proposed	24.76		
	W41	Existing	14.71	1.00	YES
		Proposed	14.71		
	W42	Existing	22.09	0.93	YES
		Proposed	20.52		
	W43	Existing	39.62	0.98	YES
		Proposed	39.02		
	W44	Existing	26.25	1.00	YES
		Proposed	26.22		

Table 29: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Second	W1	Existing	38.72	0.95	YES
		Proposed	36.70		
	W2	Existing	27.75	0.93	YES
		Proposed	25.80		
	W3	Existing	31.31	0.94	YES
		Proposed	29.46		
	W4	Existing	29.13	0.93	YES
		Proposed	27.17		
	W5	Existing	24.29	0.93	YES
		Proposed	22.47		
	W6	Existing	15.52	0.99	YES
		Proposed	15.43		
	W7	Existing	39.62	0.93	YES
		Proposed	36.94		
	W8	Existing	29.73	0.91	YES
		Proposed	26.97		
	W9	Existing	31.52	0.91	YES
		Proposed	28.65		
	W10	Existing	28.20	0.91	YES
		Proposed	25.57		
	W11	Existing	28.27	0.90	YES
		Proposed	25.58		
	W12	Existing	27.97	0.91	YES
		Proposed	25.42		

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Table 30: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Second	W13	Existing	14.98	0.95	YES
		Proposed	14.25		
	W14	Existing	39.62	0.92	YES
		Proposed	36.46		
	W15	Existing	28.91	0.89	YES
		Proposed	25.85		
	W16	Existing	31.56	0.90	YES
		Proposed	28.31		
	W17	Existing	28.53	0.90	YES
		Proposed	25.57		
	W18	Existing	28.63	0.89	YES
		Proposed	25.60		
	W19	Existing	28.21	0.88	YES
		Proposed	24.95		
	W20	Existing	15.88	0.94	YES
		Proposed	14.91		
	W21	Existing	39.62	0.91	YES
		Proposed	35.91		
	W22	Existing	29.03	0.89	YES
		Proposed	25.76		
	W23	Existing	28.94	0.90	YES
		Proposed	25.94		
	W24	Existing	25.45	0.90	YES
		Proposed	22.89		

Table 31: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Second	W25	Existing	24.25	0.90	YES
		Proposed	21.91		
	W26	Existing	25.32	0.90	YES
		Proposed	22.87		
	W27	Existing	14.17	0.90	YES
		Proposed	12.77		
	W28	Existing	39.62	0.94	YES
		Proposed	37.19		
	W29	Existing	27.29	0.93	YES
		Proposed	25.42		
	W30	Existing	29.25	0.94	YES
		Proposed	27.40		
	W31	Existing	24.80	0.94	YES
		Proposed	23.24		
	W32	Existing	24.65	0.94	YES
		Proposed	23.18		
	W33	Existing	26.33	0.94	YES
		Proposed	24.75		
	W34	Existing	14.60	0.91	YES
		Proposed	13.33		
	W35	Existing	39.62	0.96	YES
		Proposed	38.14		
	W36	Existing	27.24	0.96	YES
		Proposed	26.27		

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Table 32: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Second	W37	Existing	29.66	0.96	YES
		Proposed	28.53		
	W38	Existing	26.04	0.96	YES
		Proposed	25.12		
	W39	Existing	24.29	0.97	YES
		Proposed	23.49		
	W40	Existing	29.50	0.97	YES
		Proposed	28.59		
	W41	Existing	28.06	0.97	YES
		Proposed	27.25		
	W42	Existing	39.10	0.99	YES
		Proposed	38.57		
	W43	Existing	25.52	0.99	YES
		Proposed	25.20		
	W44	Existing	15.04	1.00	YES
		Proposed	15.04		
	W45	Existing	22.31	0.96	YES
		Proposed	21.34		
	W46	Existing	39.62	0.99	YES
		Proposed	39.26		
	W47	Existing	26.25	1.00	YES
		Proposed	26.23		

Table 33: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Third	W1	Existing	39.22	0.98	YES
		Proposed	38.39		
	W2	Existing	29.23	0.97	YES
		Proposed	28.40		
	W3	Existing	33.43	0.98	YES
		Proposed	32.66		
	W4	Existing	30.87	0.98	YES
		Proposed	30.20		
	W5	Existing	32.32	0.97	YES
		Proposed	31.45		
	W6	Existing	31.51	0.97	YES
		Proposed	30.61		
	W7	Existing	31.38	0.97	YES
		Proposed	30.39		
	W8	Existing	31.33	0.97	YES
		Proposed	30.32		
	W9	Existing	31.87	0.97	YES
		Proposed	30.80		
	W10	Existing	32.08	0.97	YES
		Proposed	30.97		
	W11	Existing	31.81	0.96	YES
		Proposed	30.67		
	W12	Existing	31.22	0.96	YES
		Proposed	30.11		

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Table 34: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Third	W13	Existing	31.22	0.96	YES
		Proposed	30.09		
	W14	Existing	32.01	0.96	YES
		Proposed	30.80		
	W15	Existing	29.05	0.97	YES
		Proposed	28.06		
	W16	Existing	29.29	0.97	YES
		Proposed	28.29		
	W17	Existing	32.10	0.96	YES
		Proposed	30.86		
	W18	Existing	31.19	0.96	YES
		Proposed	30.05		
	W19	Existing	31.15	0.97	YES
		Proposed	30.08		
	W20	Existing	31.35	0.97	YES
		Proposed	30.38		
	W21	Existing	28.86	0.97	YES
		Proposed	28.08		
	W22	Existing	28.11	0.97	YES
		Proposed	27.40		
	W23	Existing	31.61	0.97	YES
		Proposed	30.75		
	W24	Existing	30.95	0.98	YES
		Proposed	30.23		

Table 35: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Third	W25	Existing	30.99	0.98	YES
		Proposed	30.36		
	W26	Existing	31.63	0.98	YES
		Proposed	31.07		
	W27	Existing	28.44	0.99	YES
		Proposed	28.02		
	W28	Existing	28.42	0.99	YES
		Proposed	28.04		
	W29	Existing	31.74	0.99	YES
		Proposed	31.29		
	W30	Existing	31.13	0.99	YES
		Proposed	30.75		
	W31	Existing	31.35	0.99	YES
		Proposed	31.04		
	W32	Existing	32.15	0.99	YES
		Proposed	31.88		
	W33	Existing	31.26	0.99	YES
		Proposed	31.06		
	W34	Existing	38.16	1.00	YES
		Proposed	38.00		
	W35	Existing	39.02	0.99	YES
		Proposed	38.81		
	W36	Existing	37.12	1.00	YES
		Proposed	36.94		

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Table 36: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Third	W37	Existing	39.62	1.00	YES
		Proposed	39.52		
	W38	Existing	35.30	1.00	YES
		Proposed	35.30		
	W39	Existing	15.75	1.00	YES
		Proposed	15.75		
	W40	Existing	22.53	0.98	YES
		Proposed	21.99		
	W41	Existing	39.62	1.00	YES
		Proposed	39.47		
	W42	Existing	26.25	1.00	YES
		Proposed	26.25		
Fourth	W1	Existing	39.38	1.00	YES
		Proposed	39.38		
	W2	Existing	16.13	1.00	YES
		Proposed	16.13		
	W3	Existing	22.72	0.99	YES
		Proposed	22.55		
	W4	Existing	39.62	1.00	YES
		Proposed	39.59		
	W5	Existing	26.25	1.00	YES
		Proposed	26.25		

Table 37: VSC Results

Floor Ref.	Window Ref.		VSC	Pr/Ex	Meets BRE Criteria
THE CRESCENT APARTMENTS					
Fifth	W1	Existing	39.62	1.00	YES
		Proposed	39.62		
	W2	Existing	39.48	1.00	YES
		Proposed	39.48		
	W3	Existing	17.38	1.00	YES
		Proposed	17.38		
	W4	Existing	22.95	1.00	YES
		Proposed	22.95		
	W5	Existing	39.62	1.00	YES
		Proposed	39.62		
	W6	Existing	26.25	1.00	YES
		Proposed	26.25		
Sixth	W1	Existing	39.62	1.00	YES
		Proposed	39.62		
	W2	Existing	39.62	1.00	YES
		Proposed	39.62		
Seventh	W1	Existing	39.62	1.00	YES
		Proposed	39.62		
	W2	Existing	39.62	1.00	YES
		Proposed	39.62		

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Table 38: VSC Summary Results

Property	Number of Windows Tested	Windows that meet BRE Guidelines		VSC Windows No. of Windows Experiencing Adverse Impacts		
		No.	%	20-29.99% loss (minor adverse losses)	30-39.99% loss (moderate adverse losses)	>40% loss (substantial losses)
44 WALTHAM ABBEY	2	2	100%	0	0	0
45 WALTHAM ABBEY	2	2	100%	0	0	0
49 WALTHAM ABBEY	3	3	100%	0	0	0
50 WALTHAM ABBEY	2	2	100%	0	0	0
51 WALTHAM ABBEY	3	3	100%	0	0	0
52 WALTHAM ABBEY	4	4	100%	0	0	0
53 WALTHAM ABBEY	2	2	100%	0	0	0
54 WALTHAM ABBEY	2	2	100%	0	0	0
55 WALTHAM ABBEY	4	4	100%	0	0	0
56 WALTHAM ABBEY	4	4	100%	0	0	0
57 WALTHAM ABBEY	2	2	100%	0	0	0
58 WALTHAM ABBEY	2	2	100%	0	0	0
59 WALTHAM ABBEY	4	4	100%	0	0	0
THE CRESCENT APARTMENTS	192	179	93%	10	3	0
Total	**228**	**215**	**94%**	**10**	**3**	**0**

The results indicate that although 13 windows experience a VSC reduction greater than 20%, each of these windows retains a resultant VSC exceeding 15%. Given their window sizes, these VSC levels are expected to provide sufficient daylight.

It should also be noted that we could have alternatively applied Appendix K of the BRE Guide, which allows the acceptable VSC level to be benchmarked against the existing values at The Crescent Apartments. Had this method been adopted, the results would demonstrate an even more favourable outcome. On this basis, all windows would clearly comply with the BRE Guide.

Accordingly, we can confirm that the design team has taken all reasonable steps to ensure that the proposed development does not cause a significant impact on the daylight levels to neighbouring dwellings. This assessment has been carried out with full regard to relevant national policy, including the Compact Settlement Guidelines 2024 and the Sustainable Urban Housing: Design Standards for New Apartments 2025 ("Apartment Guidelines 2025").

Furthermore, irrespective of any percentage reduction, the BRE states that if a window retains a VSC of 27% or greater, the effect on daylight is classified as *negligible*. All tested windows maintain VSC values above 27% with the proposed development in place. Therefore, they will continue to receive adequate skylight, and the overall impact will be negligible.

In conclusion, the results meet the recommendations of the BRE Guide and demonstrate that the proposed development will have a negligible impact on skylight to all neighbouring dwellings.

YES*	When the Proposed/Existing VSC value is above 0.8 i.e. there less than a 20% reduction with proposed building when compared to Existing scenario and/or the result VSC is above 27%.
YES	When the Proposed/Existing VSC value is above 0.75 % and/or the Proposed VSC value is above 15%.
NO*	When the Proposed/Existing VSC value is below 0.75 % and/or the Proposed VSC value is below 15% but above 13.5%.
NO	When the Proposed/Existing VSC value is below 0.75 % and/or the Proposed VSC value is below 13.5%.

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5.3 Proposed Development

5.3.1 Daylight Analysis for Proposed Development

The daylight provision in the duplex units in the proposed development was checked using the target illuminance (E_T) method. The results are presented in the following tables.

Table 39: Illuminance Results – Block-A Ground Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-A									
Ground	R1	LKD	618	97%	200	50%	50%	4380	YES
	R2	Bedroom	324	100%	100	50%	50%	4380	YES
	R3	Bedroom	361	100%	100	50%	50%	4380	YES
	R4	LKD	231	56%	200	50%	50%	4380	YES
	R5	Bedroom	316	100%	100	50%	50%	4380	YES
	R6	Bedroom	356	100%	100	50%	50%	4380	YES
	R7	LKD	223	54%	200	50%	50%	4380	YES
	R8	Bedroom	310	100%	100	50%	50%	4380	YES
	R9	Bedroom	348	100%	100	50%	50%	4380	YES
	R10	Bedroom	73	31%	100	50%	50%	4380	NO
	R11	LKD	83	23%	200	50%	50%	4380	NO
	R12	Bedroom	82	43%	100	50%	50%	4380	NO
	R13	LKD	108	29%	200	50%	50%	4380	NO
	R14	Bedroom	136	64%	100	50%	50%	4380	YES
	R15	Bedroom	222	97%	100	50%	50%	4380	YES
	R16	LKD	547	93%	200	50%	50%	4380	YES

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Table 40: Illuminance Results – Block-A First Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-A									
First	R1	LKD	643	97%	200	50%	50%	4380	YES
	R2	Bedroom	337	100%	100	50%	50%	4380	YES
	R3	Bedroom	378	100%	100	50%	50%	4380	YES
	R4	LKD	247	59%	200	50%	50%	4380	YES
	R5	Bedroom	332	100%	100	50%	50%	4380	YES
	R6	Bedroom	375	100%	100	50%	50%	4380	YES
	R7	LKD	241	59%	200	50%	50%	4380	YES
	R8	Bedroom	329	100%	100	50%	50%	4380	YES
	R9	Bedroom	371	100%	100	50%	50%	4380	YES
	R10	LKD	253	60%	200	50%	50%	4380	YES
	R11	Bedroom	292	100%	100	50%	50%	4380	YES
	R12	Bedroom	78	44%	100	50%	50%	4380	NO
	R13	LKD	73	24%	200	50%	50%	4380	NO
	R14	Bedroom	102	52%	100	50%	50%	4380	YES
	R15	LKD	102	32%	200	50%	50%	4380	NO
	R16	Bedroom	106	53%	100	50%	50%	4380	YES
	R17	LKD	128	35%	200	50%	50%	4380	NO
	R18	Bedroom	210	80%	100	50%	50%	4380	YES
	R19	Bedroom	174	81%	100	50%	50%	4380	YES
	R20	LKD	522	93%	200	50%	50%	4380	YES

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Table 41: Illuminance Results – Block-A Second Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-A									
Second	R1	LKD	654	98%	200	50%	50%	4380	YES
	R2	Bedroom	346	100%	100	50%	50%	4380	YES
	R3	Bedroom	387	100%	100	50%	50%	4380	YES
	R4	LKD	258	61%	200	50%	50%	4380	YES
	R5	Bedroom	343	100%	100	50%	50%	4380	YES
	R6	Bedroom	386	100%	100	50%	50%	4380	YES
	R7	LKD	254	60%	200	50%	50%	4380	YES
	R8	Bedroom	340	100%	100	50%	50%	4380	YES
	R9	Bedroom	384	100%	100	50%	50%	4380	YES
	R10	LKD	270	67%	200	50%	50%	4380	YES
	R11	Bedroom	315	100%	100	50%	50%	4380	YES
	R12	Bedroom	474	100%	100	50%	50%	4380	YES
	R13	LKD	482	96%	200	50%	50%	4380	YES
	R14	LKD	141	43%	200	50%	50%	4380	NO
	R15	Bedroom	75	30%	100	50%	50%	4380	NO
	R16	Bedroom	70	28%	100	50%	50%	4380	NO
	R17	LKD	125	40%	200	50%	50%	4380	NO
	R18	Bedroom	121	62%	100	50%	50%	4380	YES
	R19	LKD	264	67%	200	50%	50%	4380	YES
	R20	Bedroom	284	94%	100	50%	50%	4380	YES
	R21	Bedroom	143	72%	100	50%	50%	4380	YES
	R22	LKD	107	32%	200	50%	50%	4380	NO
	R23	Bedroom	176	80%	100	50%	50%	4380	YES
	R24	LKD	152	41%	200	50%	50%	4380	NO
	R25	Bedroom	174	76%	100	50%	50%	4380	YES
	R26	LKD	167	45%	200	50%	50%	4380	NO
	R27	Bedroom	263	93%	100	50%	50%	4380	YES
	R28	Bedroom	229	94%	100	50%	50%	4380	YES
	R29	LKD	542	94%	200	50%	50%	4380	YES

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Table 42: Illuminance Results – Block-A Third Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-A									
Third	R1	LKD	658	98%	200	50%	50%	4380	YES
	R2	Bedroom	348	100%	100	50%	50%	4380	YES
	R3	Bedroom	392	100%	100	50%	50%	4380	YES
	R4	LKD	262	61%	200	50%	50%	4380	YES
	R5	Bedroom	345	100%	100	50%	50%	4380	YES
	R6	Bedroom	390	100%	100	50%	50%	4380	YES
	R7	LKD	259	61%	200	50%	50%	4380	YES
	R8	Bedroom	343	100%	100	50%	50%	4380	YES
	R9	Bedroom	388	100%	100	50%	50%	4380	YES
	R10	LKD	276	67%	200	50%	50%	4380	YES
	R11	Bedroom	321	100%	100	50%	50%	4380	YES
	R12	LKD	536	100%	200	50%	50%	4380	YES
	R13	Bedroom	206	98%	100	50%	50%	4380	YES
	R14	Bedroom	182	92%	100	50%	50%	4380	YES
	R15	LKD	220	54%	200	50%	50%	4380	YES
	R16	Bedroom	220	97%	100	50%	50%	4380	YES
	R17	Bedroom	113	61%	100	50%	50%	4380	YES
	R18	LKD	213	51%	200	50%	50%	4380	YES
	R19	Bedroom	207	98%	100	50%	50%	4380	YES
	R20	LKD	374	81%	200	50%	50%	4380	YES
	R21	Bedroom	334	99%	100	50%	50%	4380	YES
	R22	Bedroom	214	100%	100	50%	50%	4380	YES
	R23	LKD	173	44%	200	50%	50%	4380	NO
	R24	Bedroom	247	100%	100	50%	50%	4380	YES
	R25	LKD	226	55%	200	50%	50%	4380	YES
	R26	Bedroom	230	100%	100	50%	50%	4380	YES
	R27	LKD	237	56%	200	50%	50%	4380	YES
	R28	Bedroom	318	100%	100	50%	50%	4380	YES
	R29	Bedroom	279	100%	100	50%	50%	4380	YES
	R30	LKD	574	95%	200	50%	50%	4380	YES

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Table 43: Illuminance Results – Block-A Fourth Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-A									
Fourth	R1	LKD	671	98%	200	50%	50%	4380	YES
	R2	Bedroom	471	100%	100	50%	50%	4380	YES
	R3	Bedroom	405	100%	100	50%	50%	4380	YES
	R4	LKD	284	64%	200	50%	50%	4380	YES
	R5	Bedroom	470	100%	100	50%	50%	4380	YES
	R6	Bedroom	404	100%	100	50%	50%	4380	YES
	R7	LKD	280	64%	200	50%	50%	4380	YES
	R8	Bedroom	468	100%	100	50%	50%	4380	YES
	R9	Bedroom	401	100%	100	50%	50%	4380	YES
	R10	LKD	302	72%	200	50%	50%	4380	YES
	R11	Bedroom	457	100%	100	50%	50%	4380	YES
	R12	LKD	556	100%	200	50%	50%	4380	YES
	R13	Bedroom	497	100%	100	50%	50%	4380	YES
	R14	Bedroom	520	100%	100	50%	50%	4380	YES
	R15	Bedroom	380	100%	100	50%	50%	4380	YES
	R16	LKD	238	57%	200	50%	50%	4380	YES
	R17	Bedroom	400	100%	100	50%	50%	4380	YES
	R18	LKD	288	68%	200	50%	50%	4380	YES
	R19	Bedroom	359	100%	100	50%	50%	4380	YES
	R20	LKD	292	68%	200	50%	50%	4380	YES
	R21	Bedroom	340	100%	100	50%	50%	4380	YES
	R22	Bedroom	411	100%	100	50%	50%	4380	YES
	R23	LKD	585	95%	200	50%	50%	4380	YES

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Table 44: Illuminance Results – Block-B Ground Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-B									
Ground	R1	LKD	513	92%	200	50%	50%	4380	YES
	R2	Bedroom	163	78%	100	50%	50%	4380	YES
	R3	Bedroom	193	74%	100	50%	50%	4380	YES
	R4	LKD	98	27%	200	50%	50%	4380	NO
	R5	Bedroom	103	53%	100	50%	50%	4380	YES
	R6	Bedroom	146	60%	100	50%	50%	4380	YES
	R7	LKD	71	23%	200	50%	50%	4380	NO
	R8	Bedroom	73	34%	100	50%	50%	4380	NO
	R9	Bedroom	112	54%	100	50%	50%	4380	YES
	R10	Bedroom	74	34%	100	50%	50%	4380	NO
	R11	LKD	82	24%	200	50%	50%	4380	NO
	R12	Bedroom	98	47%	100	50%	50%	4380	NO
	R13	LKD	109	28%	200	50%	50%	4380	NO
	R14	Bedroom	141	64%	100	50%	50%	4380	YES
	R15	Bedroom	228	97%	100	50%	50%	4380	YES
	R16	LKD	545	93%	200	50%	50%	4380	YES

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Table 45: Illuminance Results – Block-B First Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-B									
First	R1	LKD	548	93%	200	50%	50%	4380	YES
	R2	Bedroom	208	91%	100	50%	50%	4380	YES
	R3	Bedroom	246	86%	100	50%	50%	4380	YES
	R4	LKD	116	35%	200	50%	50%	4380	NO
	R5	Bedroom	169	73%	100	50%	50%	4380	YES
	R6	Bedroom	215	78%	100	50%	50%	4380	YES
	R7	LKD	92	30%	200	50%	50%	4380	NO
	R8	Bedroom	133	69%	100	50%	50%	4380	YES
	R9	Bedroom	188	71%	100	50%	50%	4380	YES
	R10	LKD	91	28%	200	50%	50%	4380	NO
	R11	Bedroom	113	59%	100	50%	50%	4380	YES
	R12	Bedroom	80	42%	100	50%	50%	4380	NO
	R13	LKD	67	22%	200	50%	50%	4380	NO
	R14	Bedroom	107	52%	100	50%	50%	4380	YES
	R15	LKD	105	33%	200	50%	50%	4380	NO
	R16	Bedroom	127	61%	100	50%	50%	4380	YES
	R17	LKD	132	37%	200	50%	50%	4380	NO
	R18	Bedroom	215	81%	100	50%	50%	4380	YES
	R19	Bedroom	175	81%	100	50%	50%	4380	YES
	R20	LKD	519	92%	200	50%	50%	4380	YES

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Table 46: Illuminance Results – Block-B Second Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-B									
Second	R1	LKD	579	94%	200	50%	50%	4380	YES
	R2	Bedroom	264	100%	100	50%	50%	4380	YES
	R3	Bedroom	301	100%	100	50%	50%	4380	YES
	R4	LKD	167	45%	200	50%	50%	4380	NO
	R5	Bedroom	235	100%	100	50%	50%	4380	YES
	R6	Bedroom	285	100%	100	50%	50%	4380	YES
	R7	LKD	149	40%	200	50%	50%	4380	NO
	R8	Bedroom	212	100%	100	50%	50%	4380	YES
	R9	Bedroom	258	96%	100	50%	50%	4380	YES
	R10	LKD	139	38%	200	50%	50%	4380	NO
	R11	Bedroom	193	92%	100	50%	50%	4380	YES
	R12	Bedroom	285	100%	100	50%	50%	4380	YES
	R13	LKD	305	67%	200	50%	50%	4380	YES
	R14	LKD	107	36%	200	50%	50%	4380	NO
	R15	Bedroom	41	18%	100	50%	50%	4380	NO
	R16	Bedroom	37	17%	100	50%	50%	4380	NO
	R17	LKD	99	34%	200	50%	50%	4380	NO
	R18	Bedroom	104	56%	100	50%	50%	4380	YES
	R19	LKD	296	77%	200	50%	50%	4380	YES
	R20	Bedroom	283	91%	100	50%	50%	4380	YES
	R21	Bedroom	144	72%	100	50%	50%	4380	YES
	R22	LKD	102	30%	200	50%	50%	4380	NO
	R23	Bedroom	177	80%	100	50%	50%	4380	YES
	R24	LKD	153	41%	200	50%	50%	4380	NO
	R25	Bedroom	189	86%	100	50%	50%	4380	YES
	R26	LKD	169	46%	200	50%	50%	4380	NO
	R27	Bedroom	263	94%	100	50%	50%	4380	YES
	R28	Bedroom	232	94%	100	50%	50%	4380	YES
	R29	LKD	540	94%	200	50%	50%	4380	YES

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Table 47: Illuminance Results – Block-B Third Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-B									
Third	R1	LKD	615	96%	200	50%	50%	4380	YES
	R2	Bedroom	304	100%	100	50%	50%	4380	YES
	R3	Bedroom	348	100%	100	50%	50%	4380	YES
	R4	LKD	212	52%	200	50%	50%	4380	YES
	R5	Bedroom	288	100%	100	50%	50%	4380	YES
	R6	Bedroom	336	100%	100	50%	50%	4380	YES
	R7	LKD	198	50%	200	50%	50%	4380	YES
	R8	Bedroom	280	100%	100	50%	50%	4380	YES
	R9	Bedroom	325	100%	100	50%	50%	4380	YES
	R10	LKD	210	51%	200	50%	50%	4380	YES
	R11	Bedroom	282	100%	100	50%	50%	4380	YES
	R12	LKD	485	100%	200	50%	50%	4380	YES
	R13	Bedroom	170	85%	100	50%	50%	4380	YES
	R14	Bedroom	148	75%	100	50%	50%	4380	YES
	R15	LKD	194	48%	200	50%	50%	4380	NO
	R16	Bedroom	96	45%	100	50%	50%	4380	NO
	R17	Bedroom	192	92%	100	50%	50%	4380	YES
	R18	LKD	181	47%	200	50%	50%	4380	NO
	R19	Bedroom	201	98%	100	50%	50%	4380	YES
	R20	LKD	405	86%	200	50%	50%	4380	YES
	R21	Bedroom	315	98%	100	50%	50%	4380	YES
	R22	Bedroom	214	100%	100	50%	50%	4380	YES
	R23	LKD	162	42%	200	50%	50%	4380	NO
	R24	Bedroom	246	100%	100	50%	50%	4380	YES
	R25	LKD	221	55%	200	50%	50%	4380	YES
	R26	Bedroom	253	100%	100	50%	50%	4380	YES
	R27	LKD	239	56%	200	50%	50%	4380	YES
	R28	Bedroom	313	100%	100	50%	50%	4380	YES
	R29	Bedroom	279	100%	100	50%	50%	4380	YES
	R30	LKD	574	95%	200	50%	50%	4380	YES

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Table 48: Illuminance Results – Block-B Fourth Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-B									
Fourth	R1	LKD	642	97%	200	50%	50%	4380	YES
	R2	Bedroom	334	100%	100	50%	50%	4380	YES
	R3	Bedroom	378	100%	100	50%	50%	4380	YES
	R4	LKD	242	59%	200	50%	50%	4380	YES
	R5	Bedroom	329	100%	100	50%	50%	4380	YES
	R6	Bedroom	372	100%	100	50%	50%	4380	YES
	R7	LKD	235	56%	200	50%	50%	4380	YES
	R8	Bedroom	325	100%	100	50%	50%	4380	YES
	R9	Bedroom	369	100%	100	50%	50%	4380	YES
	R10	LKD	256	60%	200	50%	50%	4380	YES
	R11	Bedroom	327	100%	100	50%	50%	4380	YES
	R12	LKD	616	100%	200	50%	50%	4380	YES
	R13	Bedroom	236	100%	100	50%	50%	4380	YES
	R14	Bedroom	202	100%	100	50%	50%	4380	YES
	R15	LKD	272	61%	200	50%	50%	4380	YES
	R16	Bedroom	465	100%	100	50%	50%	4380	YES
	R17	Bedroom	277	100%	100	50%	50%	4380	YES
	R18	LKD	209	52%	200	50%	50%	4380	YES
	R19	Bedroom	301	100%	100	50%	50%	4380	YES
	R20	LKD	274	66%	200	50%	50%	4380	YES
	R21	Bedroom	304	100%	100	50%	50%	4380	YES
	R22	LKD	285	68%	200	50%	50%	4380	YES
	R23	Bedroom	356	100%	100	50%	50%	4380	YES
	R24	Bedroom	318	100%	100	50%	50%	4380	YES
	R25	LKD	600	96%	200	50%	50%	4380	YES

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Table 49: Illuminance Results – Block-B Fifth Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-B									
Fifth	R1	LKD	691	98%	200	50%	50%	4380	YES
	R2	Bedroom	472	100%	100	50%	50%	4380	YES
	R3	Bedroom	403	100%	100	50%	50%	4380	YES
	R4	LKD	281	64%	200	50%	50%	4380	YES
	R5	Bedroom	470	100%	100	50%	50%	4380	YES
	R6	Bedroom	401	100%	100	50%	50%	4380	YES
	R7	LKD	279	64%	200	50%	50%	4380	YES
	R8	Bedroom	466	100%	100	50%	50%	4380	YES
	R9	Bedroom	399	100%	100	50%	50%	4380	YES
	R10	LKD	303	74%	200	50%	50%	4380	YES
	R11	Bedroom	459	100%	100	50%	50%	4380	YES
	R12	Bedroom	1224	100%	100	50%	50%	4380	YES
	R13	Bedroom	483	100%	100	50%	50%	4380	YES
	R14	LKD	809	100%	200	50%	50%	4380	YES
	R15	Bedroom	437	100%	100	50%	50%	4380	YES
	R16	LKD	274	64%	200	50%	50%	4380	YES
	R17	Bedroom	461	100%	100	50%	50%	4380	YES
	R18	LKD	327	76%	200	50%	50%	4380	YES
	R19	Bedroom	458	100%	100	50%	50%	4380	YES
	R20	LKD	342	79%	200	50%	50%	4380	YES
	R21	Bedroom	390	100%	100	50%	50%	4380	YES
	R22	Bedroom	460	100%	100	50%	50%	4380	YES
	R23	LKD	647	97%	200	50%	50%	4380	YES

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Table 50: Illuminance Results – Block-C Ground Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-C									
Ground	R1	LKD	424	90%	200	50%	50%	4380	YES
	R2	Bedroom	235	100%	100	50%	50%	4380	YES
	R3	Bedroom	131	66%	100	50%	50%	4380	YES
	R4	LKD	99	25%	200	50%	50%	4380	NO
	R5	Bedroom	88	42%	100	50%	50%	4380	NO
	R6	LKD	81	21%	200	50%	50%	4380	NO
	R7	Bedroom	67	31%	100	50%	50%	4380	NO

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Table 51: Illuminance Results – Block-C First Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-C									
First	R1	LKD	536	93%	200	50%	50%	4380	YES
	R2	Bedroom	173	81%	100	50%	50%	4380	YES
	R3	Bedroom	205	79%	100	50%	50%	4380	YES
	R4	LKD	131	35%	200	50%	50%	4380	NO
	R5	Bedroom	124	61%	100	50%	50%	4380	YES
	R6	LKD	101	31%	200	50%	50%	4380	NO
	R7	Bedroom	98	48%	100	50%	50%	4380	NO
	R8	LKD	74	23%	200	50%	50%	4380	NO
	R9	Bedroom	72	32%	100	50%	50%	4380	NO
	R10	Bedroom	154	91%	100	50%	50%	4380	YES
	R11	LKD	197	50%	200	50%	50%	4380	YES
	R12	Bedroom	322	100%	100	50%	50%	4380	YES
	R13	Bedroom	292	100%	100	50%	50%	4380	YES
	R14	LKD	213	52%	200	50%	50%	4380	YES
	R15	Bedroom	350	100%	100	50%	50%	4380	YES
	R16	Bedroom	316	100%	100	50%	50%	4380	YES
	R17	LKD	225	54%	200	50%	50%	4380	YES
	R18	Bedroom	358	100%	100	50%	50%	4380	YES
	R19	Bedroom	323	100%	100	50%	50%	4380	YES
	R20	LKD	602	97%	200	50%	50%	4380	YES

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Table 52: Illuminance Results – Block-C Second Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-C									
Second	R1	LKD	563	94%	200	50%	50%	4380	YES
	R2	Bedroom	222	94%	100	50%	50%	4380	YES
	R3	Bedroom	256	90%	100	50%	50%	4380	YES
	R4	LKD	173	43%	200	50%	50%	4380	NO
	R5	Bedroom	179	77%	100	50%	50%	4380	YES
	R6	LKD	145	41%	200	50%	50%	4380	NO
	R7	Bedroom	163	73%	100	50%	50%	4380	YES
	R8	LKD	110	32%	200	50%	50%	4380	NO
	R9	Bedroom	130	62%	100	50%	50%	4380	YES
	R10	Bedroom	299	100%	100	50%	50%	4380	YES
	R11	LKD	368	84%	200	50%	50%	4380	YES
	R12	LKD	235	55%	200	50%	50%	4380	YES
	R13	Bedroom	127	77%	100	50%	50%	4380	YES
	R14	Bedroom	261	98%	100	50%	50%	4380	YES
	R15	LKD	592	91%	200	50%	50%	4380	YES
	R16	Bedroom	352	100%	100	50%	50%	4380	YES
	R17	Bedroom	160	92%	100	50%	50%	4380	YES
	R18	LKD	210	51%	200	50%	50%	4380	YES
	R19	Bedroom	336	100%	100	50%	50%	4380	YES
	R20	Bedroom	306	100%	100	50%	50%	4380	YES
	R21	LKD	224	55%	200	50%	50%	4380	YES
	R22	Bedroom	361	100%	100	50%	50%	4380	YES
	R23	Bedroom	327	100%	100	50%	50%	4380	YES
	R24	LKD	233	57%	200	50%	50%	4380	YES
	R25	Bedroom	367	100%	100	50%	50%	4380	YES
	R26	Bedroom	338	100%	100	50%	50%	4380	YES
	R27	LKD	616	97%	200	50%	50%	4380	YES

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Table 53: Illuminance Results – Block-C Third Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-C									
Third	R1	LKD	589	95%	200	50%	50%	4380	YES
	R2	Bedroom	274	100%	100	50%	50%	4380	YES
	R3	Bedroom	307	100%	100	50%	50%	4380	YES
	R4	LKD	238	57%	200	50%	50%	4380	YES
	R5	Bedroom	237	100%	100	50%	50%	4380	YES
	R6	LKD	212	53%	200	50%	50%	4380	YES
	R7	Bedroom	220	100%	100	50%	50%	4380	YES
	R8	LKD	175	45%	200	50%	50%	4380	NO
	R9	Bedroom	191	97%	100	50%	50%	4380	YES
	R10	LKD	537	100%	200	50%	50%	4380	YES
	R11	Bedroom	247	100%	100	50%	50%	4380	YES
	R12	Bedroom	198	100%	100	50%	50%	4380	YES
	R13	LKD	282	63%	200	50%	50%	4380	YES
	R14	Bedroom	155	92%	100	50%	50%	4380	YES
	R15	Bedroom	281	100%	100	50%	50%	4380	YES
	R16	LKD	636	93%	200	50%	50%	4380	YES
	R17	Bedroom	396	100%	100	50%	50%	4380	YES
	R18	Bedroom	164	95%	100	50%	50%	4380	YES
	R19	LKD	221	56%	200	50%	50%	4380	YES
	R20	Bedroom	347	100%	100	50%	50%	4380	YES
	R21	Bedroom	323	100%	100	50%	50%	4380	YES
	R22	LKD	233	57%	200	50%	50%	4380	YES
	R23	Bedroom	370	100%	100	50%	50%	4380	YES
	R24	Bedroom	337	100%	100	50%	50%	4380	YES
	R25	LKD	241	57%	200	50%	50%	4380	YES
	R26	Bedroom	374	100%	100	50%	50%	4380	YES
	R27	Bedroom	344	100%	100	50%	50%	4380	YES
	R28	LKD	624	98%	200	50%	50%	4380	YES

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Table 54: Illuminance Results – Block-C Fourth Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-C									
Fourth	R1	LKD	625	96%	200	50%	50%	4380	YES
	R2	Bedroom	312	100%	100	50%	50%	4380	YES
	R3	Bedroom	355	100%	100	50%	50%	4380	YES
	R4	LKD	280	69%	200	50%	50%	4380	YES
	R5	Bedroom	291	100%	100	50%	50%	4380	YES
	R6	LKD	267	64%	200	50%	50%	4380	YES
	R7	Bedroom	273	100%	100	50%	50%	4380	YES
	R8	LKD	225	53%	200	50%	50%	4380	YES
	R9	Bedroom	243	100%	100	50%	50%	4380	YES
	R10	LKD	655	100%	200	50%	50%	4380	YES
	R11	Bedroom	287	100%	100	50%	50%	4380	YES
	R12	Bedroom	237	100%	100	50%	50%	4380	YES
	R13	LKD	340	73%	200	50%	50%	4380	YES
	R14	Bedroom	286	98%	100	50%	50%	4380	YES
	R15	Bedroom	330	100%	100	50%	50%	4380	YES
	R16	LKD	681	93%	200	50%	50%	4380	YES
	R17	Bedroom	443	100%	100	50%	50%	4380	YES
	R18	Bedroom	172	97%	100	50%	50%	4380	YES
	R19	LKD	234	58%	200	50%	50%	4380	YES
	R20	Bedroom	363	100%	100	50%	50%	4380	YES
	R21	Bedroom	336	100%	100	50%	50%	4380	YES
	R22	LKD	241	57%	200	50%	50%	4380	YES
	R23	Bedroom	377	100%	100	50%	50%	4380	YES
	R24	Bedroom	345	100%	100	50%	50%	4380	YES
	R25	LKD	247	57%	200	50%	50%	4380	YES
	R26	Bedroom	380	100%	100	50%	50%	4380	YES
	R27	Bedroom	348	100%	100	50%	50%	4380	YES
	R28	LKD	630	98%	200	50%	50%	4380	YES

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Table 55: Illuminance Results – Block-C Fifth Floor

Floor Ref	Room Ref	Room Use	Median Lux	% of Area Meeting Req Lux	Criteria				Meets Criteria
					Req Lux	Req % of Effective Area	Req % of Daylight Hours	Daylight Hours	
Block-C									
Fifth	R1	LKD	657	97%	200	50%	50%	4380	YES
	R2	Bedroom	465	100%	100	50%	50%	4380	YES
	R3	Bedroom	391	100%	100	50%	50%	4380	YES
	R4	LKD	348	78%	200	50%	50%	4380	YES
	R5	Bedroom	445	100%	100	50%	50%	4380	YES
	R6	LKD	335	78%	200	50%	50%	4380	YES
	R7	Bedroom	425	100%	100	50%	50%	4380	YES
	R8	LKD	284	67%	200	50%	50%	4380	YES
	R9	Bedroom	377	100%	100	50%	50%	4380	YES
	R10	LKD	622	100%	200	50%	50%	4380	YES
	R11	Bedroom	576	100%	100	50%	50%	4380	YES
	R12	Bedroom	593	100%	100	50%	50%	4380	YES
	R13	Bedroom	305	100%	100	50%	50%	4380	YES
	R14	LKD	277	67%	200	50%	50%	4380	YES
	R15	Bedroom	365	100%	100	50%	50%	4380	YES
	R16	Bedroom	435	100%	100	50%	50%	4380	YES
	R17	LKD	248	57%	200	50%	50%	4380	YES
	R18	Bedroom	366	100%	100	50%	50%	4380	YES
	R19	Bedroom	436	100%	100	50%	50%	4380	YES
	R20	LKD	249	57%	200	50%	50%	4380	YES
	R21	Bedroom	367	100%	100	50%	50%	4380	YES
	R22	Bedroom	437	100%	100	50%	50%	4380	YES
	R23	LKD	613	97%	200	50%	50%	4380	YES

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A summary of the results is provided below for the duplex units.

Table 56: Illuminance Results Summary

Property	Number of Rooms Tested	Rooms satisfying Criteria		Rooms not satisfying Criteria
		No.	%	
Block-A	118	102	86%	16
Block-B	143	115	80%	28
Block-C	133	120	90%	13
Total	**394**	**337**	**86%**	**57**

The results show that 86% of all rooms meet or exceed the BRE's minimum recommendations for internal daylight provision in dwellings.

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5.3.2 Sunlight to Proposed Amenity Spaces

The BRE guide recommends:

"*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.*"

The main communal open spaces and the open space was analysed. These areas are identified in the following figures and labelled for reference in the results Table 56.

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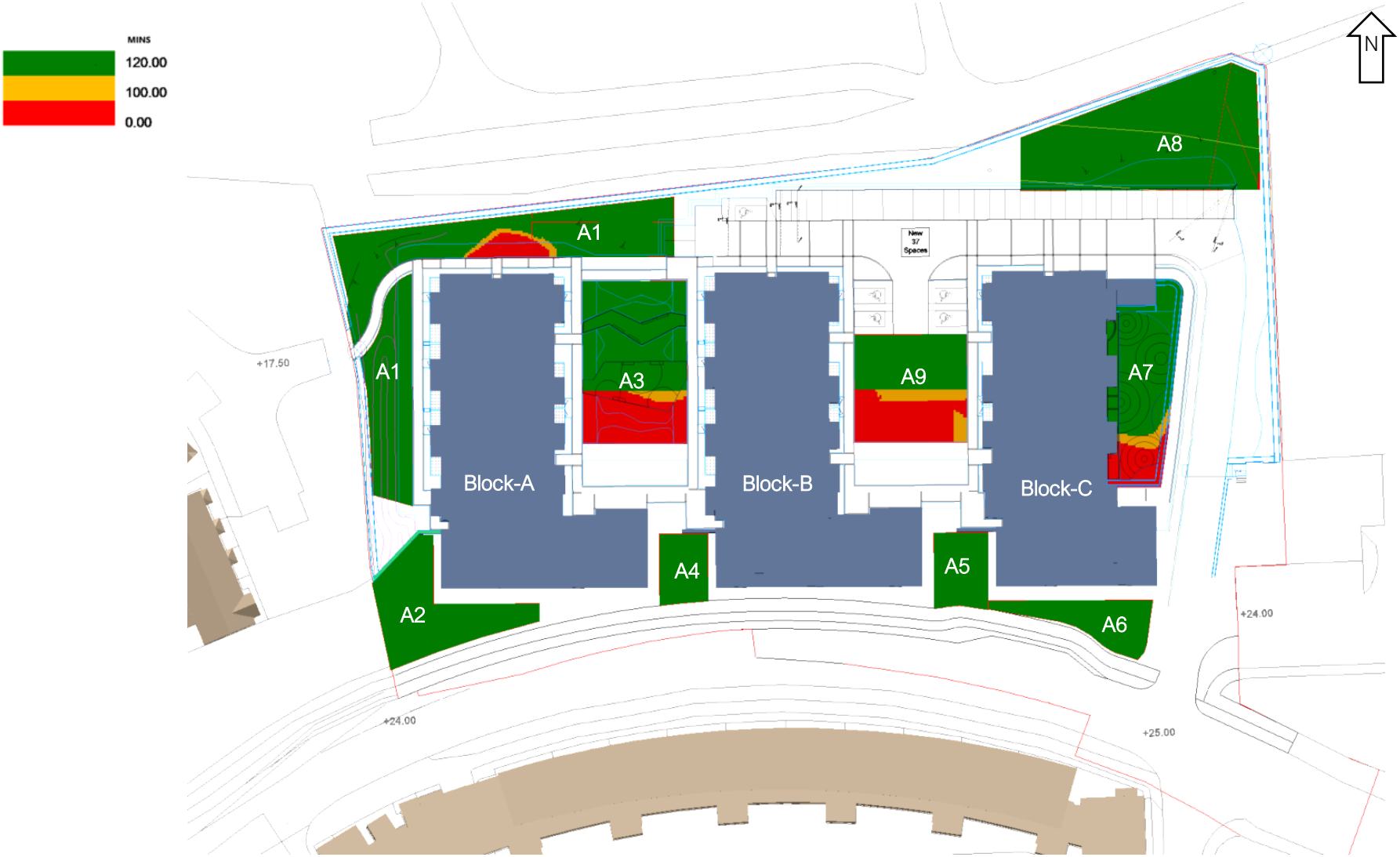


Figure 31: Proposed Amenity Space

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Table 57: Open Spaces 2hr Sunlight Test Results

Open Space	Area (m^2)	2hr Sun Area (m^2)	% Area	Meets Criteria
A1	626.1878	578.8856	92.45%	Yes
A2	235.6222	235.6222	100.00%	Yes
A3	418.8311	282.4675	67.44%	Yes
A4	83.8747	83.8747	100.00%	Yes
A5	100.3798	100.3798	100.00%	Yes
A6	121.1412	121.1412	100.00%	Yes
A7	309.7898	228.7687	73.85%	Yes
A8	558.7955	558.0448	99.87%	Yes
A9	299.6882	152.4957	50.88%	Yes
Total	**2754.31**	**2341.68**	**85.01%**	Yes

The results show that the open spaces receive greater than 2 hours of sunlight on March 21st. Therefore, the proposed open spaces exceed the BRE's recommendation for sunlight and should appear adequately sunlit throughout the year.

Trees/Shrubs, including the existing trees, have not been modelled except for around the Meadowbrook property where there is a dense band of evergreen trees. The reason other trees/shrubs have not been modelled is because the shadows they produce are almost impossible to predict and "*the dappled shade of a tree is more pleasant than the deep shadow of a building (this applies particularly to deciduous trees).*" (BRE Building Technology Group, 2022) As per the BRE guidance, in assessing the impact of buildings on sunlight in gardens, trees are not normally included in the calculation unless a dense belt of evergreens is specifically planned. Nevertheless, the location for planting trees should be chosen with care. "*The aim should normally be to have some areas of partial shade under trees while leaving other parts of the garden or amenity area in full sun.*" (BRE Building Technology Group, 2022)

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6 Conclusion

The analysis and assessments in this report have been carried in line with the recommendations of BRE's "Site Layout Planning for daylight and sunlight, a Guide to good practice" (BRE Building Technology Group, 2022) and BS EN 17037.

The results show that the proposed development will have a negligible impact on surrounding buildings with respect to:

- access to skylight,
- access to sunlight, and
- sunlight to gardens/open spaces.

All surrounding buildings tested in the proposed development meet the minimum recommendations for internal daylight provision as set out in the BRE Guide and BS EN 17037 (National Annex).

In terms of internal daylight provision for the proposed development we reviewed schemes of a similar density recently approved by Cork City Council. There are examples of quality schemes in which 82% of the apartments exceed the BRE internal daylight recommendations. The aim was to achieve in excess of 80% of units exceeding the BRE Guidelines. This was a very challenging figure to achieve primarily due to the requirements for private amenity spaces via balconies which in turn significantly reduce the quantum of light entering windows below them. The proposed development achieved 86% pass rate using the more onerous target of 200 lux in the Living/Kitchen/Dining room. Therefore, we believe the proposed development performs at an exemplar level for a scheme of this scale and aligns to national policy to ensure high quality sustainable development.

In order to maximise available light, glazing to all habitable rooms is in excess of 20%. The design team have developed the proposed building using the principles of the BREs "Site Layout Planning for Daylight and Sunlight, A guide to good practice".

In terms of the amenity spaces provided the results show that the open spaces receive greater than 2 hours of sunlight on March 21st. Therefore, the proposed open spaces exceed the BRE's recommendation for sunlight and should appear adequately sunlit throughout the year

Overall, the development has been designed with due consideration for sunlight and daylight and meets the recommendations as set out in the BRE Guide – BR 209 "Site Layout Planning for Daylight and Sunlight, A guide to good practice (2022)."

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Appendix A Proposed Illuminance Contours (with Room & Window Legends)

A.1 Block_A



Figure 32: Block-A Ground Floor sDA Contours

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Figure 33: Block-A First Floor sDA Contours

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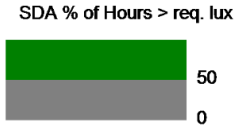
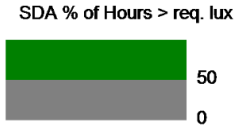




Figure 34: Block-A Second Floor sDA Contours

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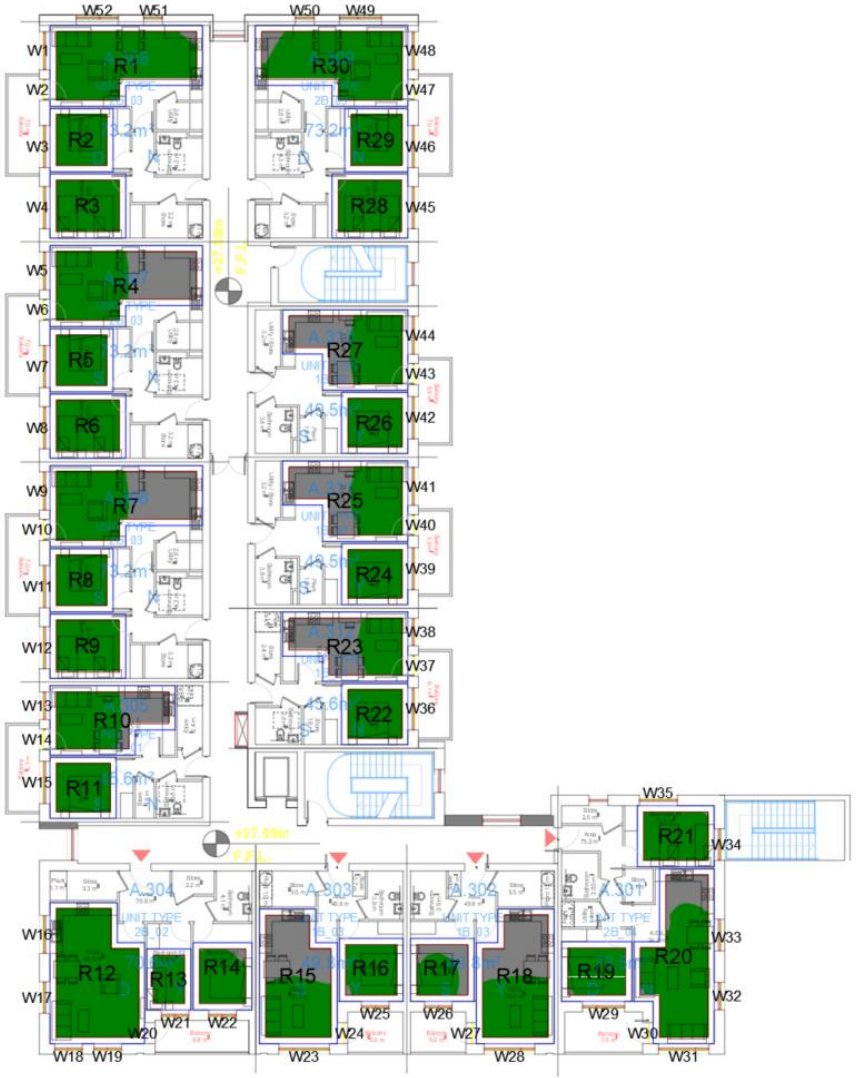


Figure 35: Block-A Third Floor sDA Contours

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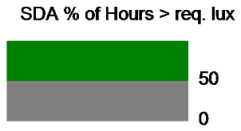




Figure 36: Block-A Fourth Floor sDA Contours

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A.2 Block_B

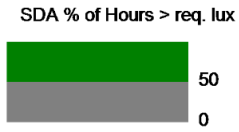




Figure 37: Block-B Ground Floor sDA Contours

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Figure 38: Block-B First Floor sDA Contours

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Figure 39: Block-B Second Floor sDA Contours

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Figure 40: Block-B Third Floor sDA Contours

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Figure 41: Block-B Fourth Floor sDA Contours

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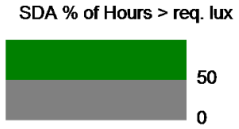




Figure 42: Block-B Fifth Floor sDA Contours

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A.3 Block_C

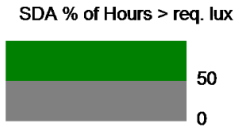




Figure 43: Block-C Ground Floor sDA Contours

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Figure 44: Block-C First Floor sDA Contours

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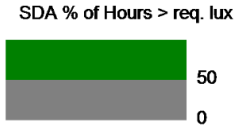




Figure 45: Block-C Second Floor sDA Contours

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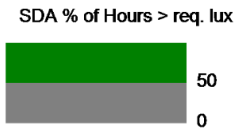
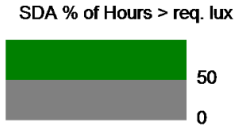




Figure 46: Block-C Third Floor sDA Contours

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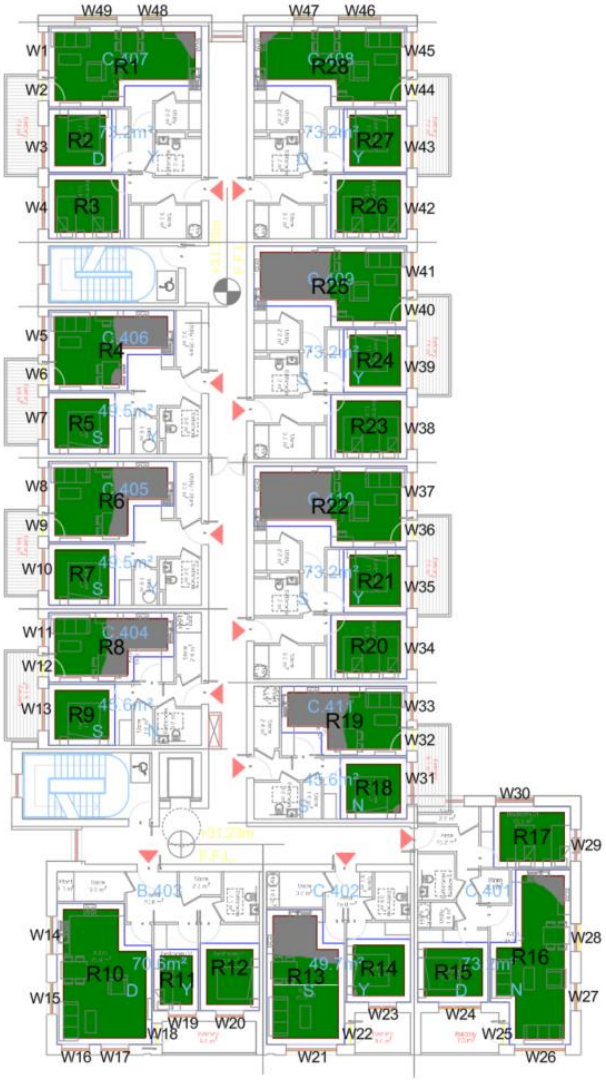


Figure 47: Block-C Fourth Floor sDA Contours

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Figure 48: Block-C Fifth Floor sDA Contours

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Appendix B Shadow Images

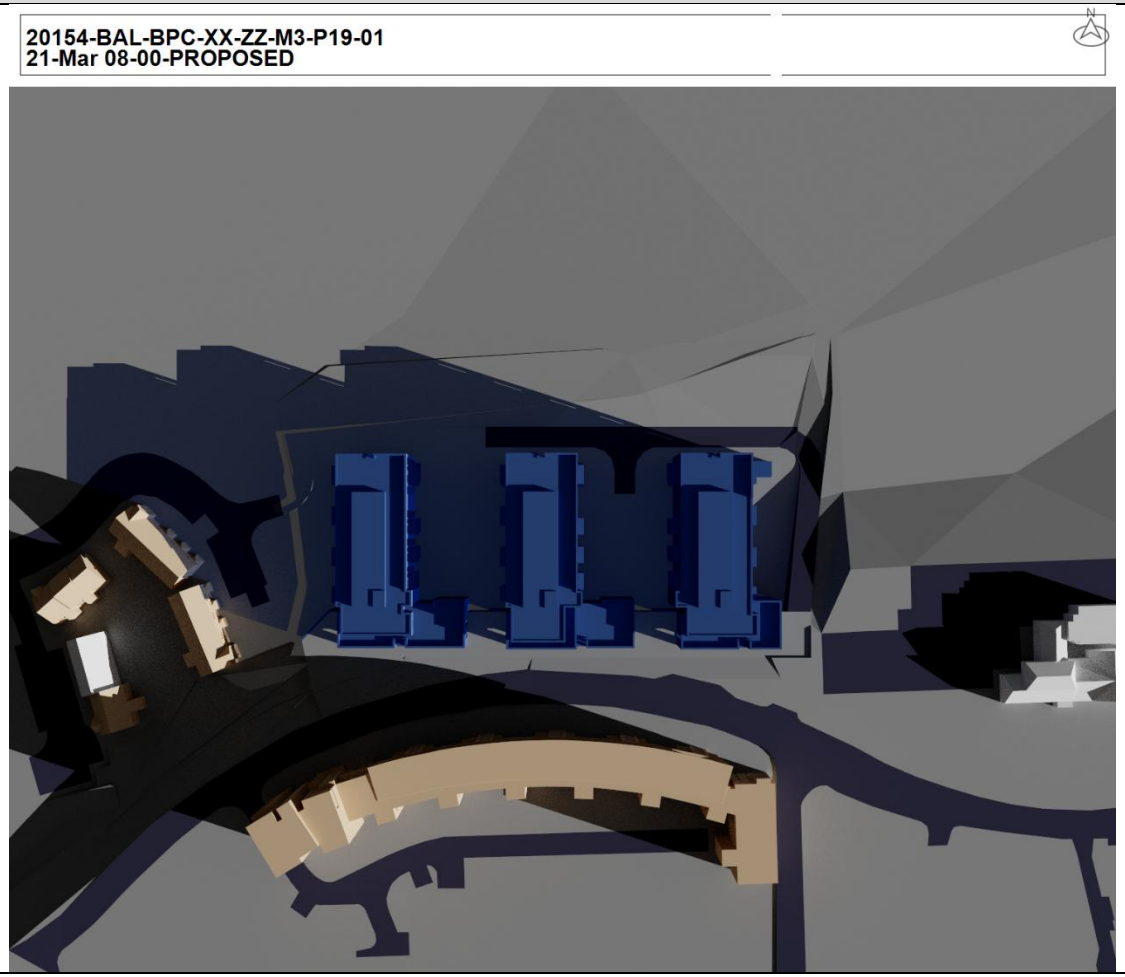
Shadow plots are used to show the shadows which the proposed building makes. "*In interpreting the impact of such differences, it must be borne in mind that nearly all structures will create areas of new shadow, and some degree of transient overshadowing of a space is to be expected.*" (BRE Building Technology Group, 2022)

Shadow plots were created for March 21st and June 21st. March 21st is the equinox and as such provides the average level of shadowing that can be expected. June 21st is a summertime plot and represents the best case for shadow. (December 21st has not been plotted as at this time of year even low buildings will cast long shadows. In a built-up area, it is common for large areas of the ground to be in shadow in December.)

The shadow plots are purely illustrative (as opposed to other quantitative or quantitative metrics used in the analysis).

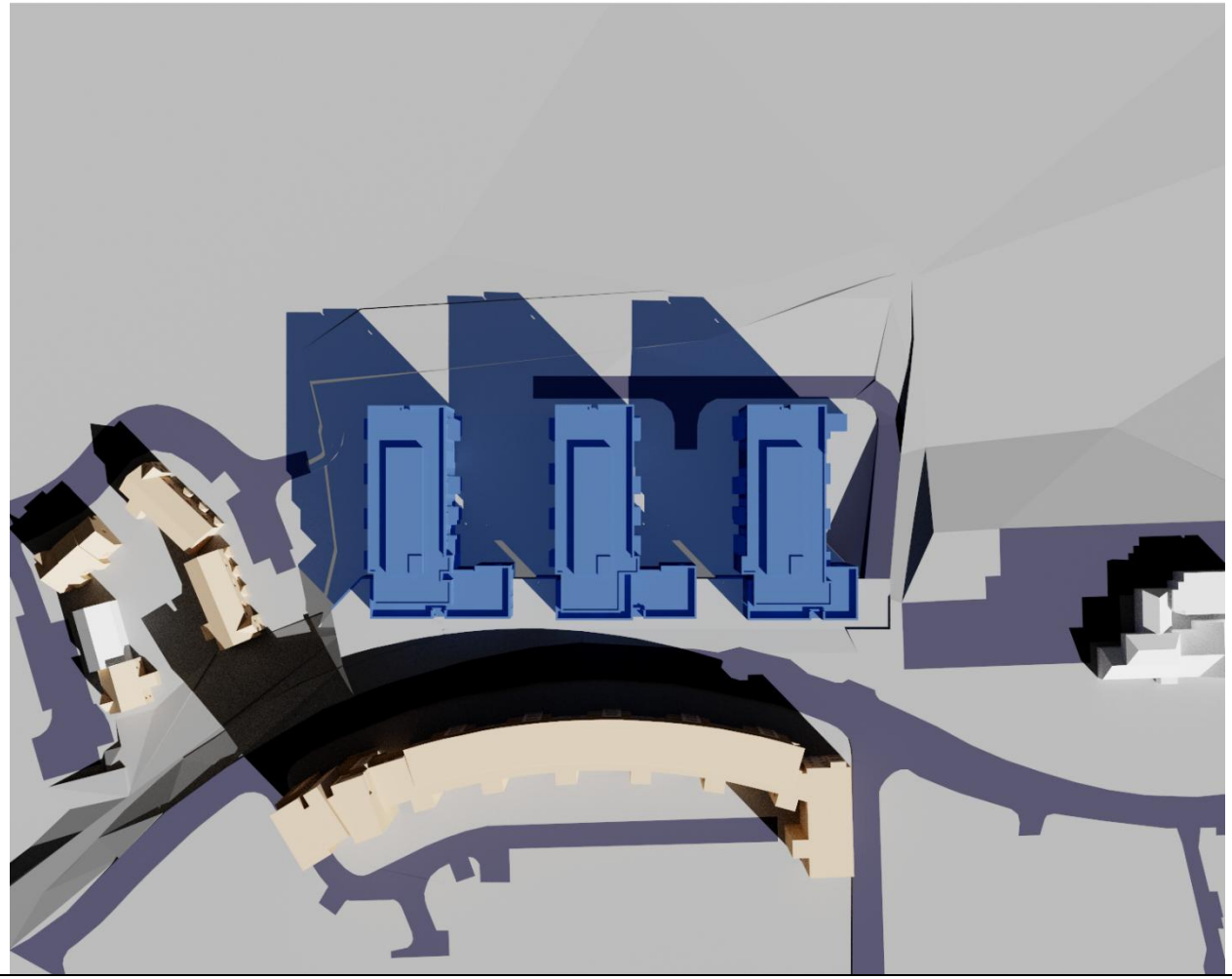
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B.1 March 21st

	Proposed
March 21st - 08:00 (UTC)	

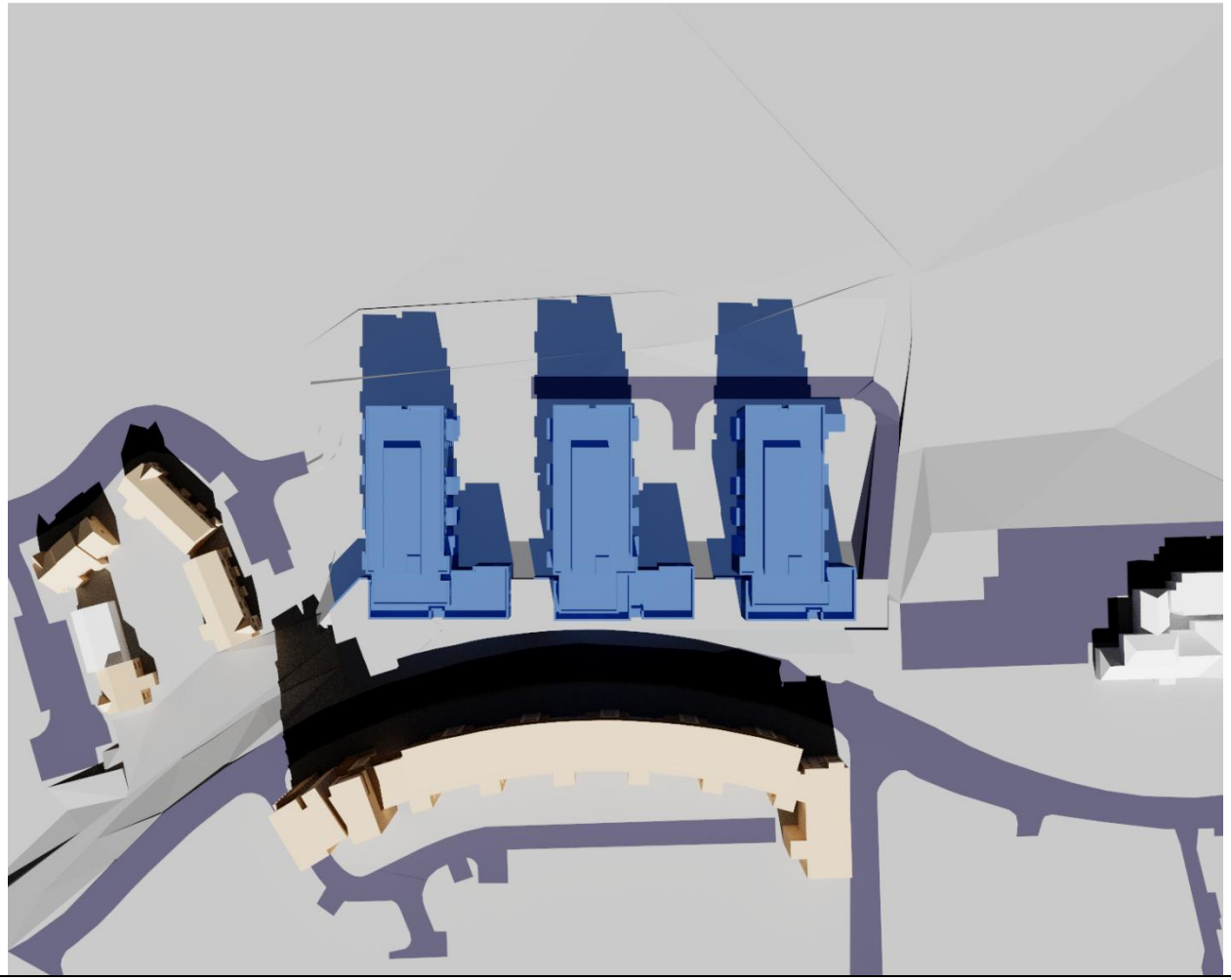
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March 21st – 10:00 (UTC)



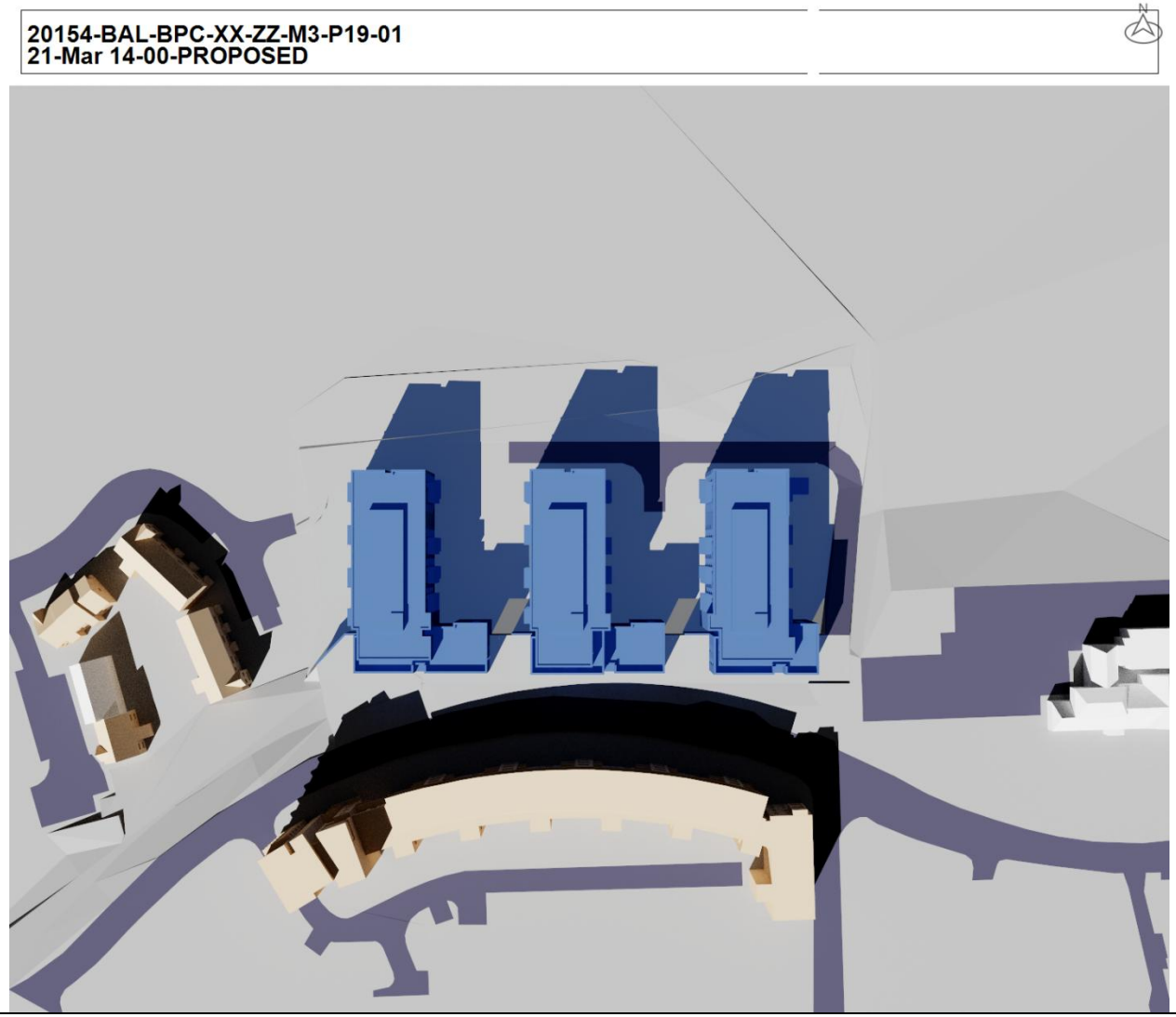
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March 21st - 12:00 (UTC)



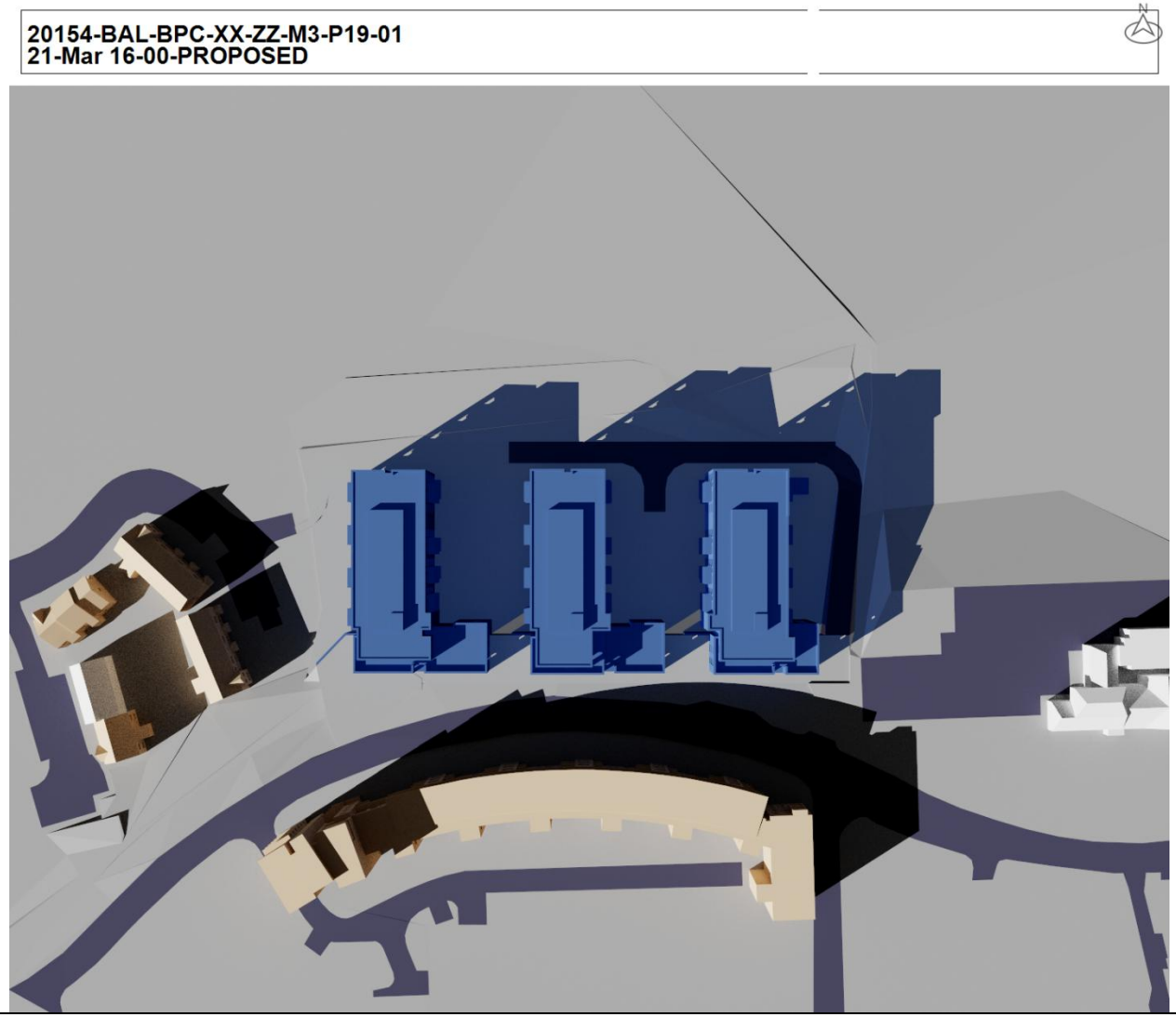
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March 21st - 14:00 (UTC)



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March 21st - 16:00 (UTC)



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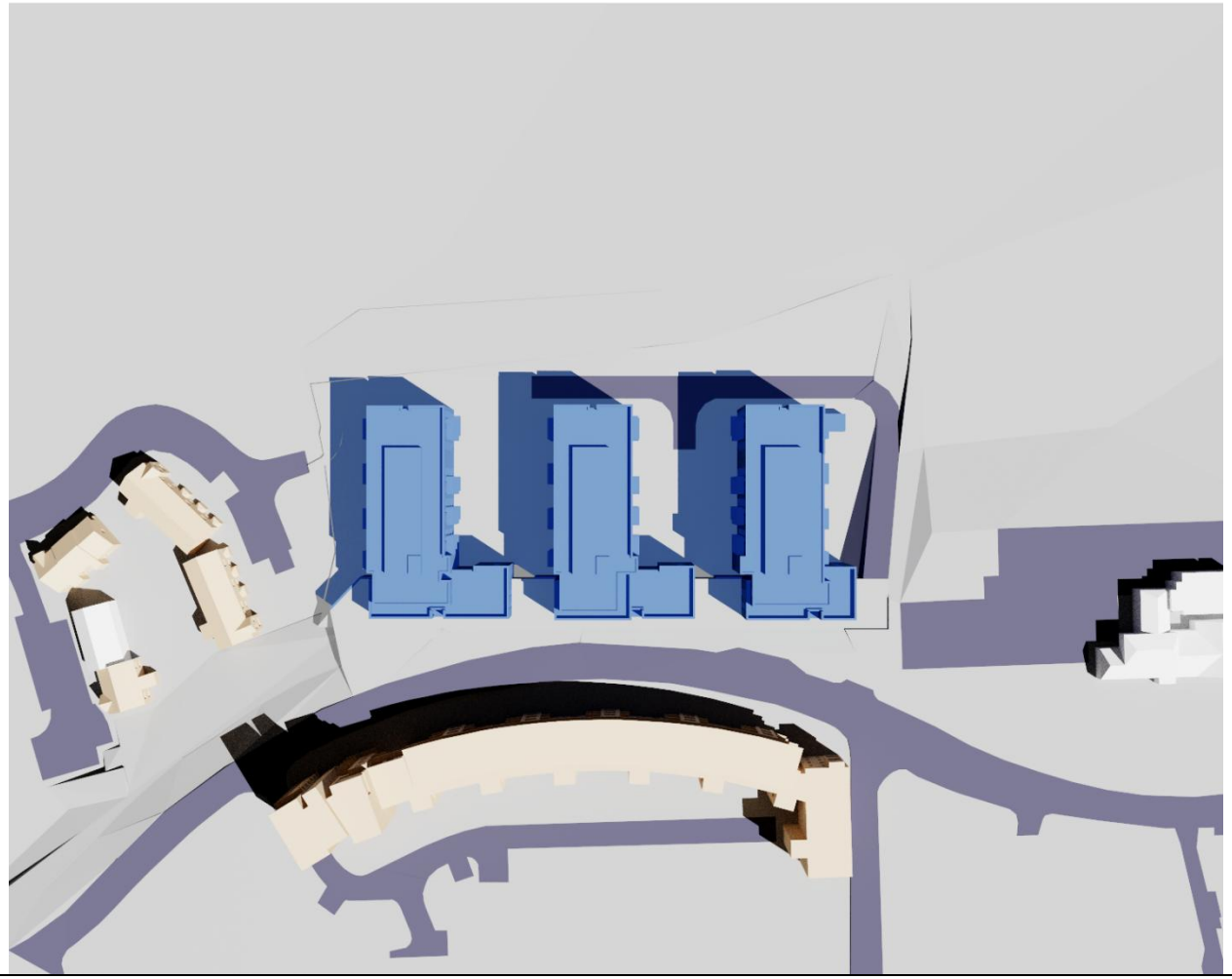
B.2 June 21st

	Proposed
June 21st - 8:00 (UTC+1)	

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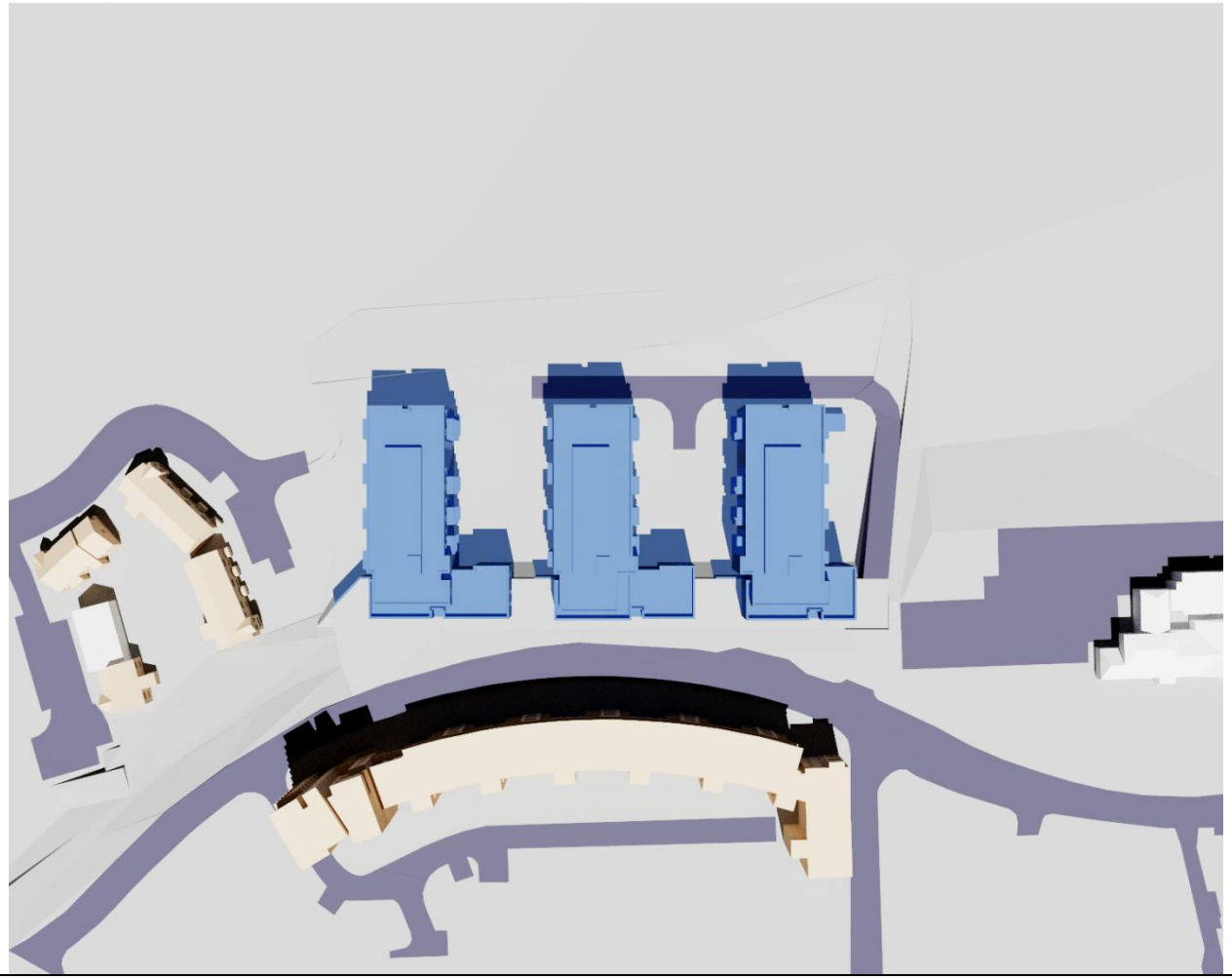
June 21st - 10:00 (UTC+1)

20154-BAL-BPC-XX-ZZ-M3-P19-01
21-Jun 10-00-PROPOSED



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June 21st - 12:00 (UTC+1)



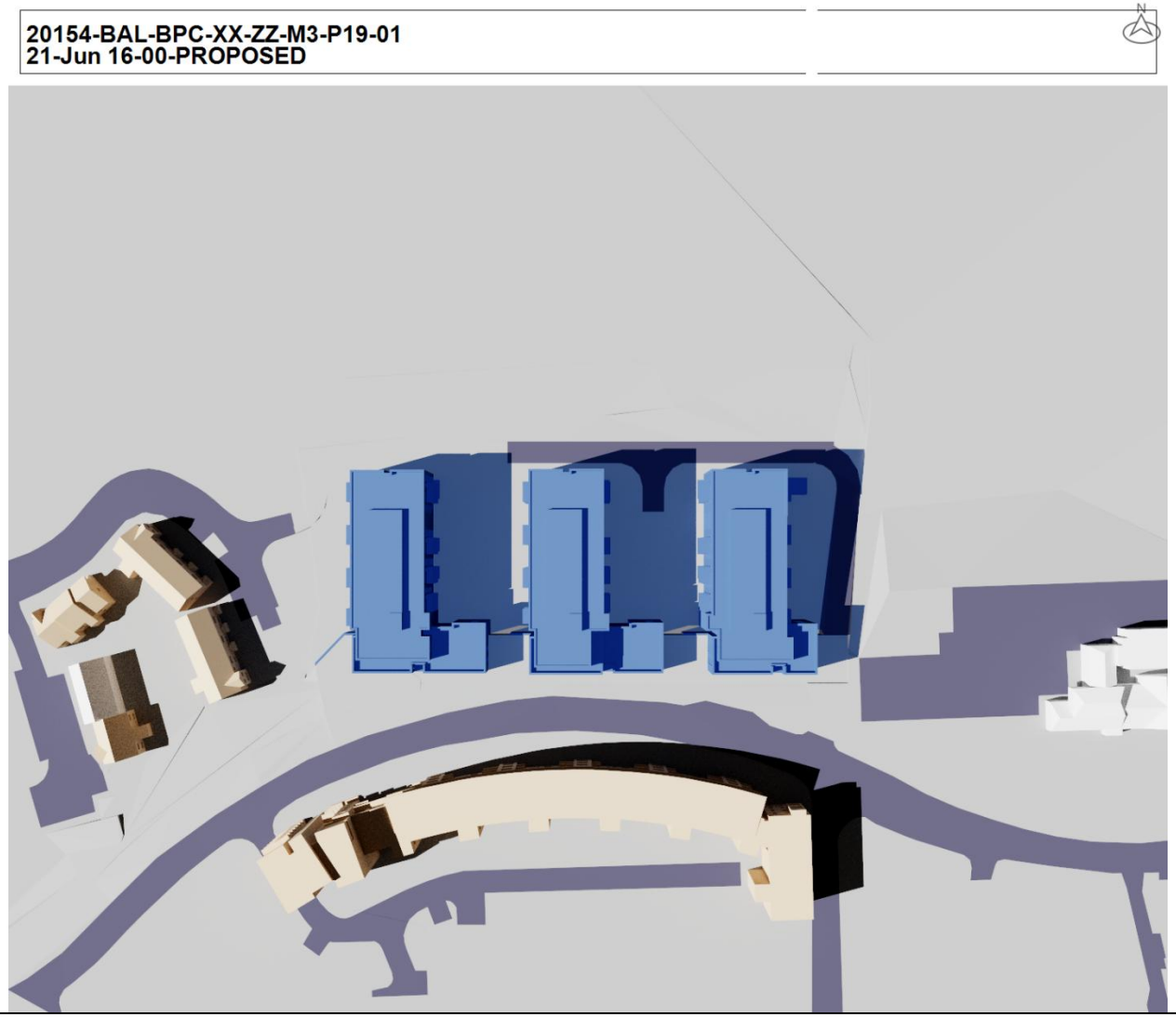
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June 21st - 14:00 (UTC+1)



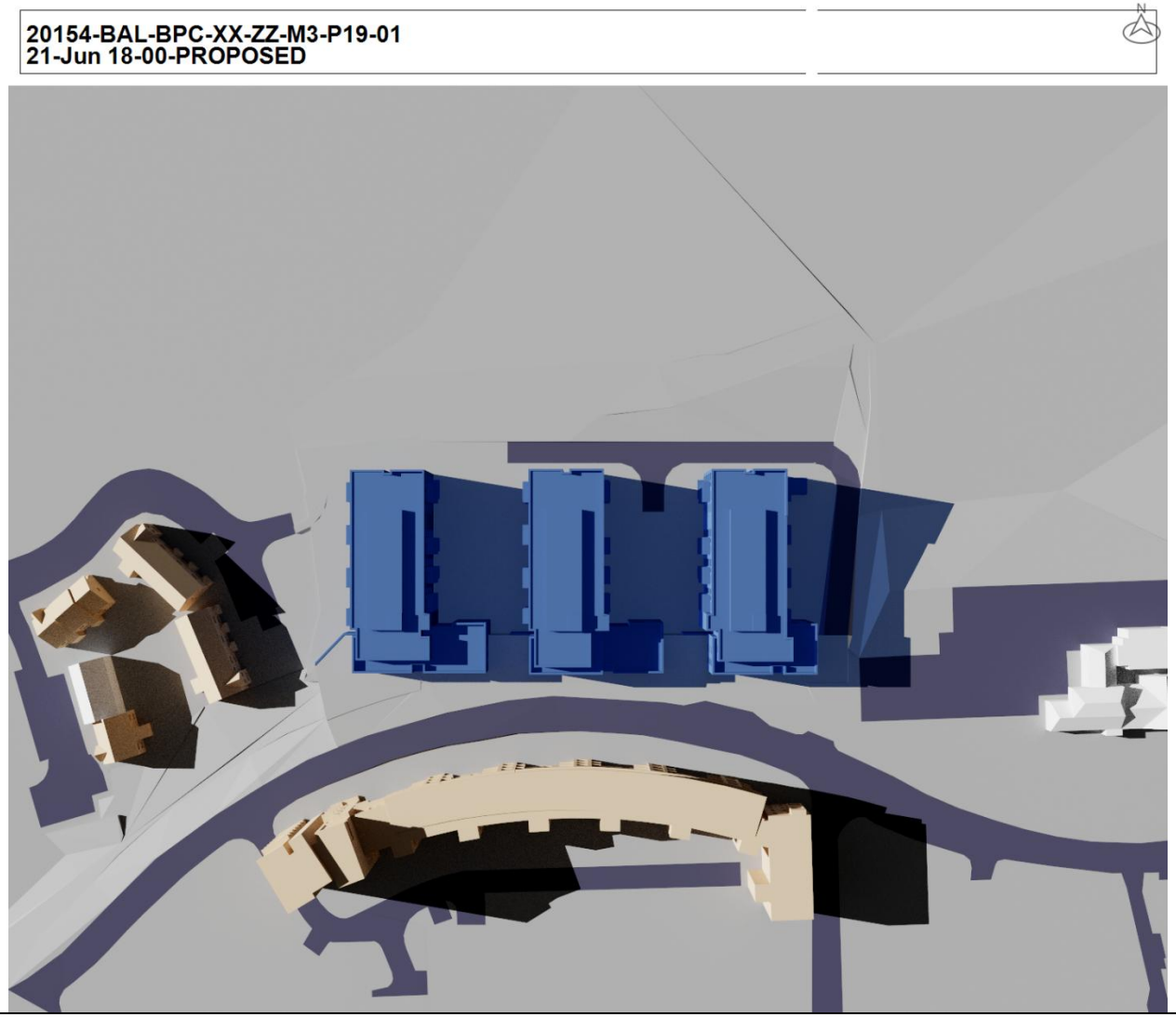
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June 21st - 16:00 (UTC+1)



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June 21st – 18:00 (UTC+1)



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Appendix C Interior daylighting recommendations & sDA

As discussed in section 4.2, there are a number of ways the interior daylighting results can be presented. BR209 recommends reporting the median illuminance (exceeded over 50% of the reference plane) as this enables comparison with the different recommendations in BS EN 17037. Another method, which may be included as an "optional extra", is to report the % *area* of the reference plane exceeding the target illuminance E_T (for half of the daylight hours.) This is equivalent to Spatial Daylight Autonomy (sDA).

Daylight Autonomy (DA) is a daylight availability metric that corresponds to the percentage of time when a target illuminance at a point in a space is met. *Spatial* Daylight Autonomy (sDA) is "*An annual daylighting metric that quantifies the fraction of the area within a space for which the daylight autonomy exceeds a specified value.*" (Illuminating Engineering Society, 2022). If the defined threshold is set based upon electric lighting criteria, a higher sDA yields greater *autonomy* from electric lighting.

In basic terms, sDA is the percentage of the reference plane meeting a target illuminance for a specified amount of time. It is often presented in a format similar to that shown below:

- $sDA_{300,50\%} \geq 55\%$, means 300lux should be achieved for 50% of the time across at least 55% of the reference plane,
- $sDA_{150,50\%} \geq 60\%$, means 150lux should be achieved for 50% of the time across at least 60% of the reference plane, etc.

So, the illuminance targets E_T in BS EN 17037 could also be presented in sDA format. Remembering that the illuminance targets Et are for 50% of the reference plane for 50% of daylight hours, the targets could be presented as follows:

Table 58: Equivalent sDA for Target Illuminance E_T

Room type	Target illuminance E_T (lx)	Target sDA (sDA lux / % time) > % area
Bedroom	100	$sDA_{100,50\%} > 50\%$
Living Room	150	$sDA_{150,50\%} > 50\%$
Kitchen	200	$sDA_{200,50\%} > 50\%$

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7 Bibliography

BRE Building Technology Group. (2022). *Site layout planning for daylight and sunlight, A guide to good practice.* London: BRE.

CEN. (2019). *BS EN 17037:2018 Daylight in buildings.* BSI Standards Limited 2019.

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Illuminating Engineering Society. (2022). *https://www.ies.org/standards/definitions/*. Retrieved from https://www.ies.org: https://www.ies.org/standards/definitions/

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