# Cross Avenue, Blackrock Dublin

## Daylight & Sunlight Assessment

Project Ref: 20538

Client: 1 Players Land Limited

Date: 14/05/2024

BPC ENGINEERS

BUILDING PERFORMANCE CONSULTING

| Rev | Description | Date: | Written By | Approved By: |
|---|---|---|---|---|
| P1-02 | Final Report | 07/05/2024 | John Gleeson | John Gleeson<br>CEng MIEI, CMVP (AEE) |
| P1-03 | Final Report | 09/05/2024 | John Gleeson | John Gleeson<br>CEng MIEI, CMVP (AEE) |
| P1-04 | Final Report | 14/05/2024 | John Gleeson | John Gleeson<br>CEng MIEI, CMVP (AEE) |

# 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 skyline**
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.

# Executive Summary

This report provides information on the daylight and sunlight analysis undertaken for the proposed amendment to a permitted Strategic Housing Development (planning reference ABP-311190-21) at Cross Avenue, Blackrock. The proposed amendment would increase the number of apartments in the development by five units. This report focuses on the effect of the proposed development on daylight and sunlight to existing neighbouring dwellings 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 of the amenity spaces tested show that greater than 50% of the area receive at least two hours of sunlight on 21st March. Therefore, these proposed open spaces exceed the BRE's recommendation for sunlight and should appear adequately sunlit throughout the year.

In terms of internal daylight provision for the proposed development, the proposed units achieved 96% 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.

Overall, the development has been designed with due consideration for sunlight and daylight. BPC Engineers believe the proposed development performs at an exemplar level for a scheme of this scale 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)."

# Contents

# 1 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 additional units for a development at Cross Avenue, Blackrock.

The proposed amendment to a permitted Strategic Housing Development (planning reference ABP-311190-21) at Cross Avenue. The proposed amendment would increase the number of apartments in the development by five units.

This report assesses the proposed development's impact on daylight and sunlight to the existing buildings using the following methods and metrics:

- Light from the sky via Vertical Sky Component (VSC)

The report also assesses access to daylight and sunlight for the proposed development by means of:

- Target Illuminance ($E_T$)/Spatial Daylight Autonomy (sDA)
- Sunlight to Gardens/Open Spaces

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

# 2 Site Description

## 2.1 Location & Context

The proposed development site is on Cross Avenue, Co. Dublin. The proposed development site is outlined below in red in Figure 1.


*Figure 1: Site Plan*

## 2.2 Proposed Development

The proposed amendment to a permitted Strategic Housing Development (planning reference ABP-311190-21) at Cross Avenue, Blackrock. The proposed amendment would increase the number of apartments in the development by five units.

## 2.3 Sensitive Receptors

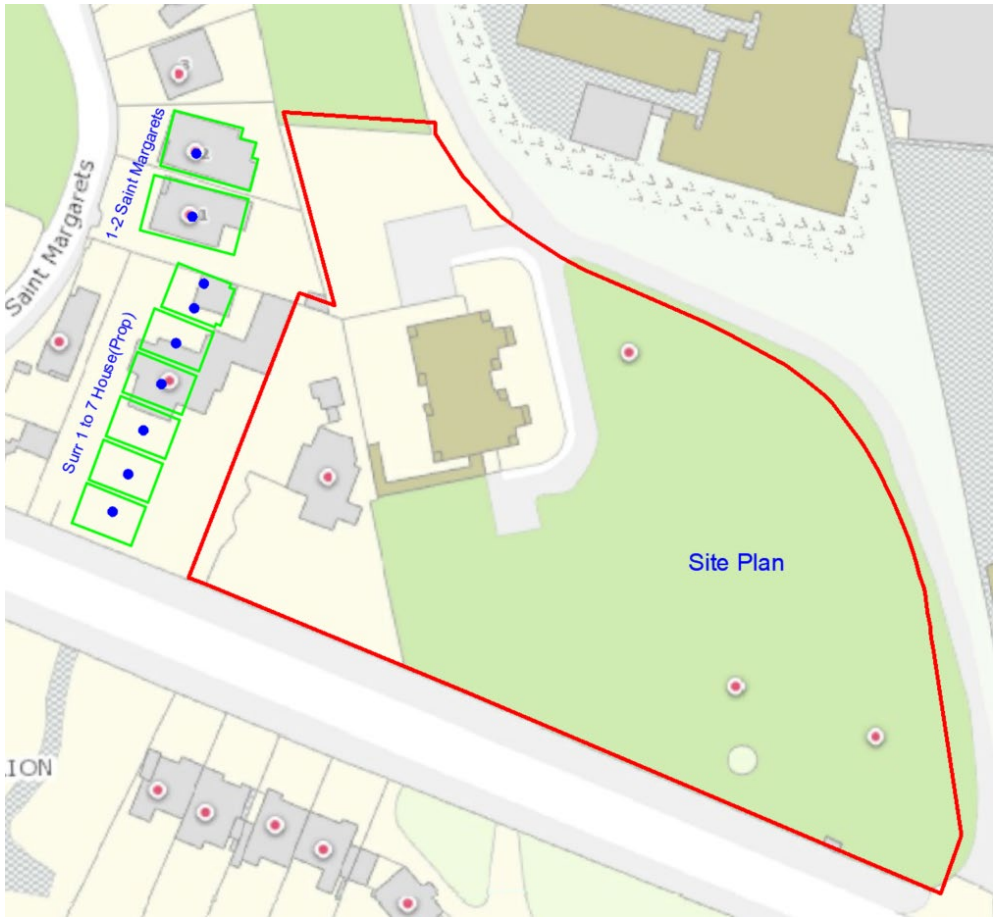
The BRE guide states that when assessing the potential effects of a proposed development on existing buildings, only those windows and rooms that have a 'reasonable expectation' of daylight and sunlight need to be considered. Windows and rooms which meet these criteria are 'sensitive receptors. Paragraph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

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

*Table 1: Assessed Neighbouring Properties*

| Neighbouring Properties Location Map | Legend |
|---|---|
|  <br>(Background Image/Map credit: https://www.eircode.ie/) | Site Boundary<br>Assessed Neighbouring Properties<br><br>Notes:<br>• *Site boundary is only indicative. Refer to architectural drawings for accurate site boundary details.* |

# 3 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 ray-tracing. 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 3.2.)

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.

## 3.1 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.

### 3.1.1 Light from the Sky

#### *3.1.1.1 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 , 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.

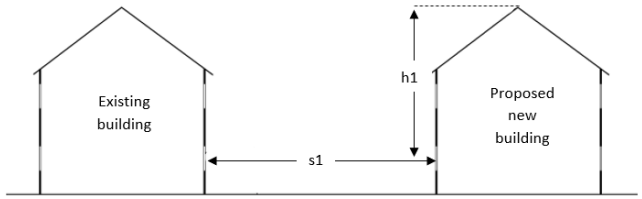



*Figure 2: Spacing-to-Height Ratio*

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.

*"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)

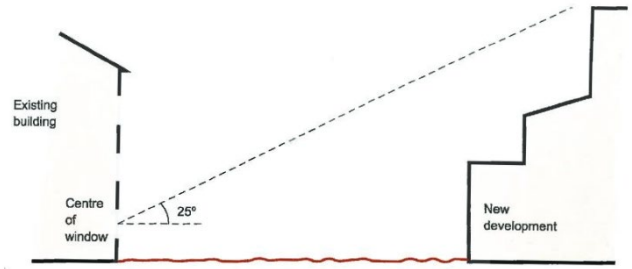



*Figure 3: Obstruction Angle Check (25 Degree Line Test)*

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.

### *3.1.1.2 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.

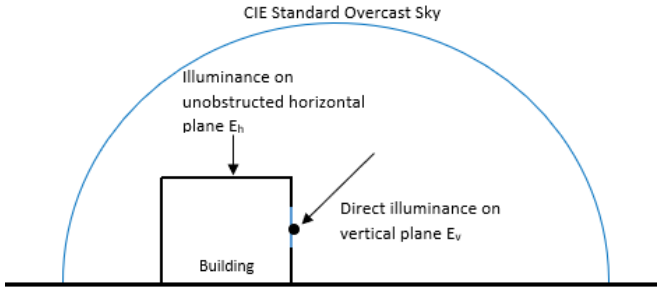



*Figure 4: Vertical Sky Component*

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)

### *3.1.1.3 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.

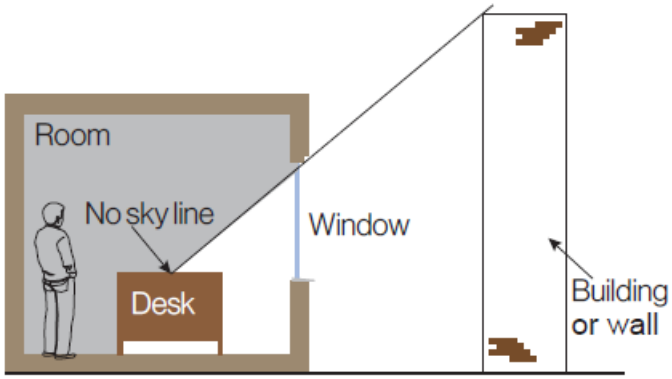



*Figure 5: No Skyline [courtesy (BRE Building Technology Group, 2022)]*

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 skyline 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.)

### 3.1.2 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.

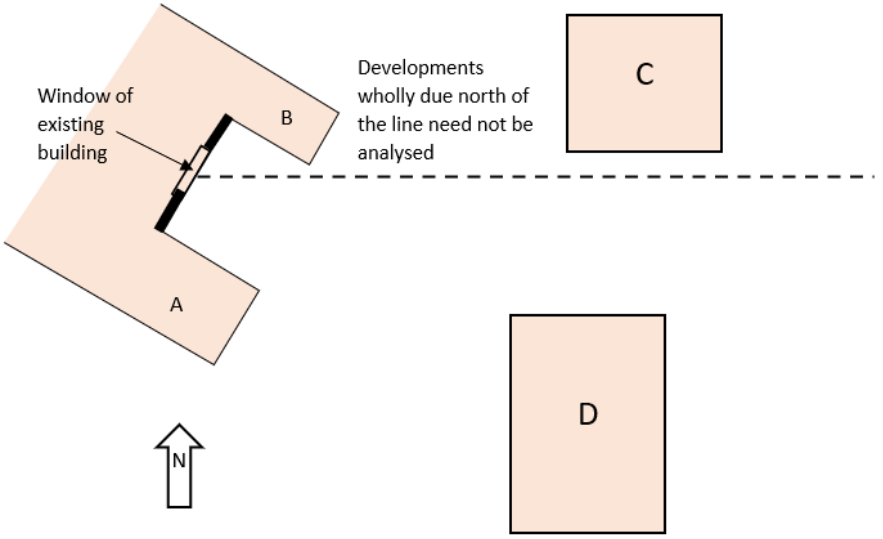



*Figure 6: Sunlight Analysis Scenarios for Existing Buildings*

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.

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.

#### *3.1.2.1 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 also has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours.

#### *3.1.2.2 Basic Assessment*

It is not always necessary to do a full calculation using Annual Probable Sunlight Hours APSH (section 3.1.2.1). The same "spacing-to-height ratio" and "obstruction angle" checks discussed in section 3.1.1.1 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 window [see Figure ] (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 [Figure ]. 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)

### 3.1.3 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)

#### *3.1.3.1 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."*

### 3.1.4 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***<br>• *only a small number of windows losing light (within the guidelines)* ***or***<br>• *limited area of open space losing light (within the guidelines)* |
| *Minor adverse impact (a)* | • *Loss of light only just within guidelines* ***and***<br>  ○ *a larger number of windows are affected* ***or***<br>  ○ *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.*<br>• *the loss of light is only marginally outside the guidelines.*<br>• *an affected room has other sources of skylight or sunlight.*<br>• *the affected building or open space only has a low-level requirement for skylight or sunlight*<br>• *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.*<br>• *the loss of light is substantially outside the guidelines.*<br>• *all the windows in a particular property are affected.*<br>• *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".*

## 3.2 New Buildings

The daylight provision was also checked for the proposed development.

### 3.2.1 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.

#### *3.2.1.1 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."*

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 presentation of the internal daylight provision results and how the various metrics are related are discussed in more detail in Appendix C.

[1] Some additional information on sDA is provided in Appendix C.

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 grid spacing is 0.1m.
- A band of 0.3m from the walls is excluded from the grid.
- Window frame factor is set to 10%.
- The glazing transmittance (normal) was set to 0.70.
- The glazing maintenance factor is set to 92% (This accounts for the reduction in glazing transmittance due to dirt; 8% 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<br>Refractive Index: 1.52 |

### 3.2.2 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 the minimum criterion.

### 3.2.3 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 space was assessed against the above criterion.

# 4 Analysis

## 4.1 Overview of Computational Models

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:

- Beige/buff elements represent the existing surrounding buildings that are analysed.
- The green elements are any existing buildings on the proposed site that will be demolished or significantly altered, and
- The blue elements are the buildings in the proposed development.


*Figure 7: Existing Model (Plan View)*

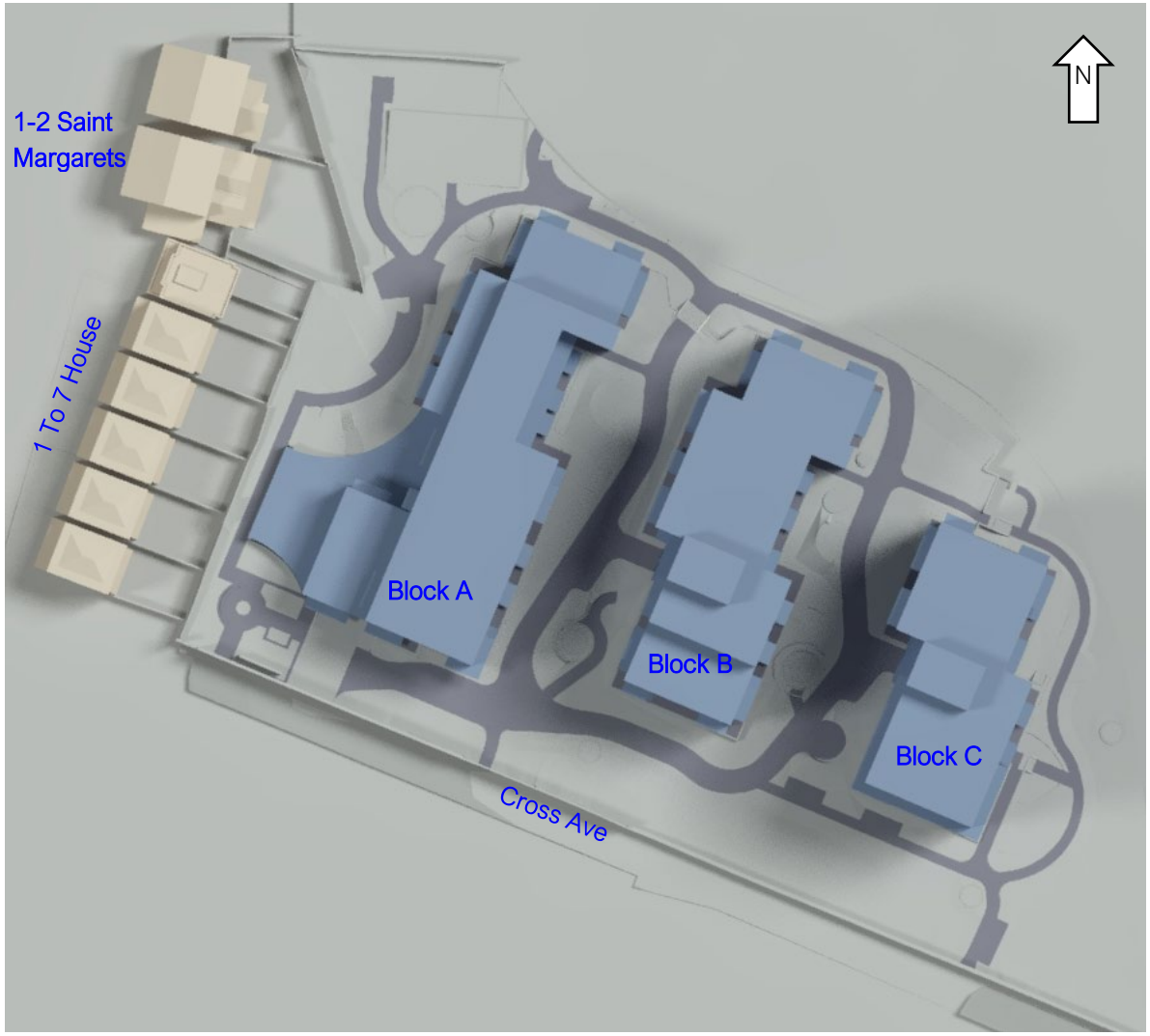



*Figure 8: Proposed Model (Plan View)*

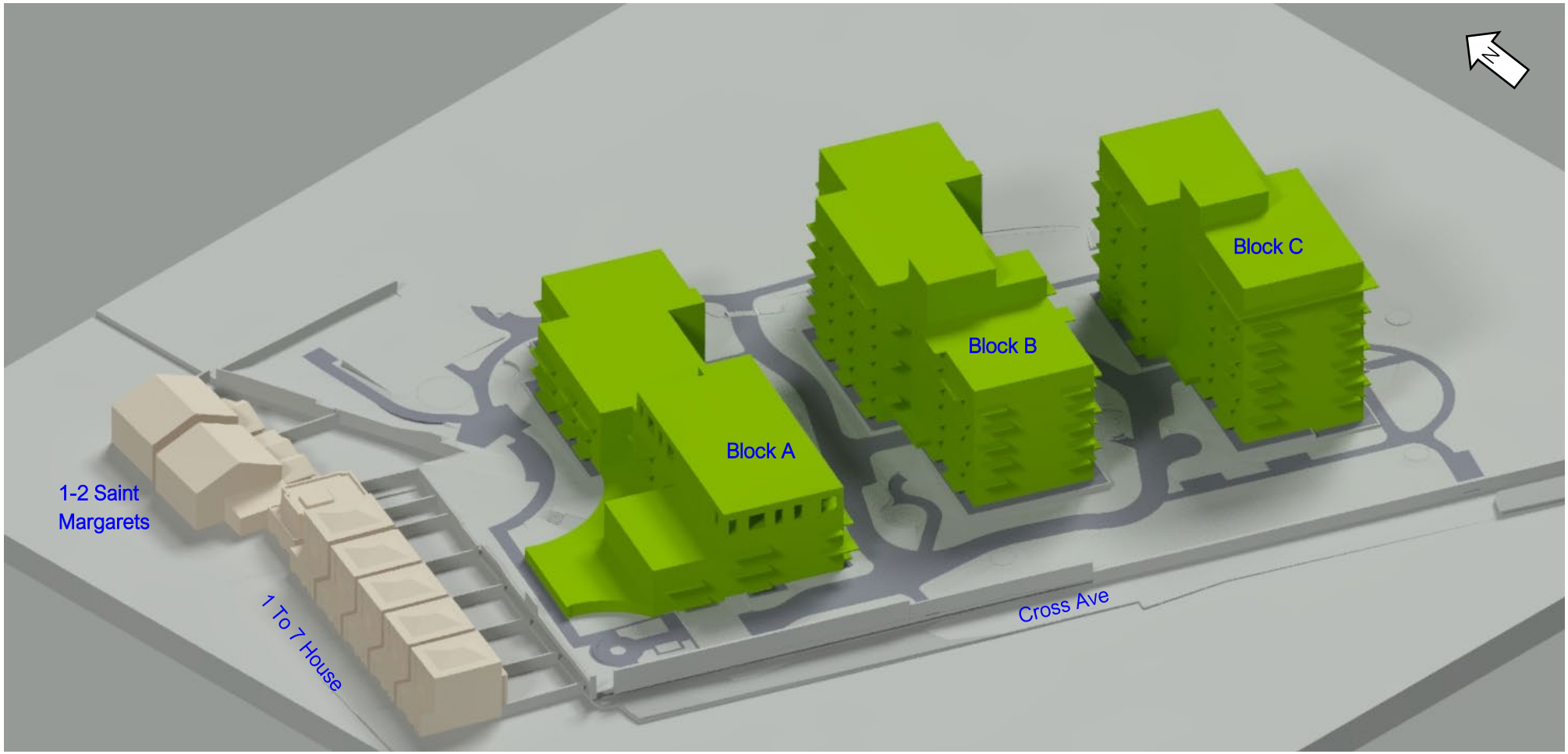



Figure 9: Existing Model (Perspective View From S-W)

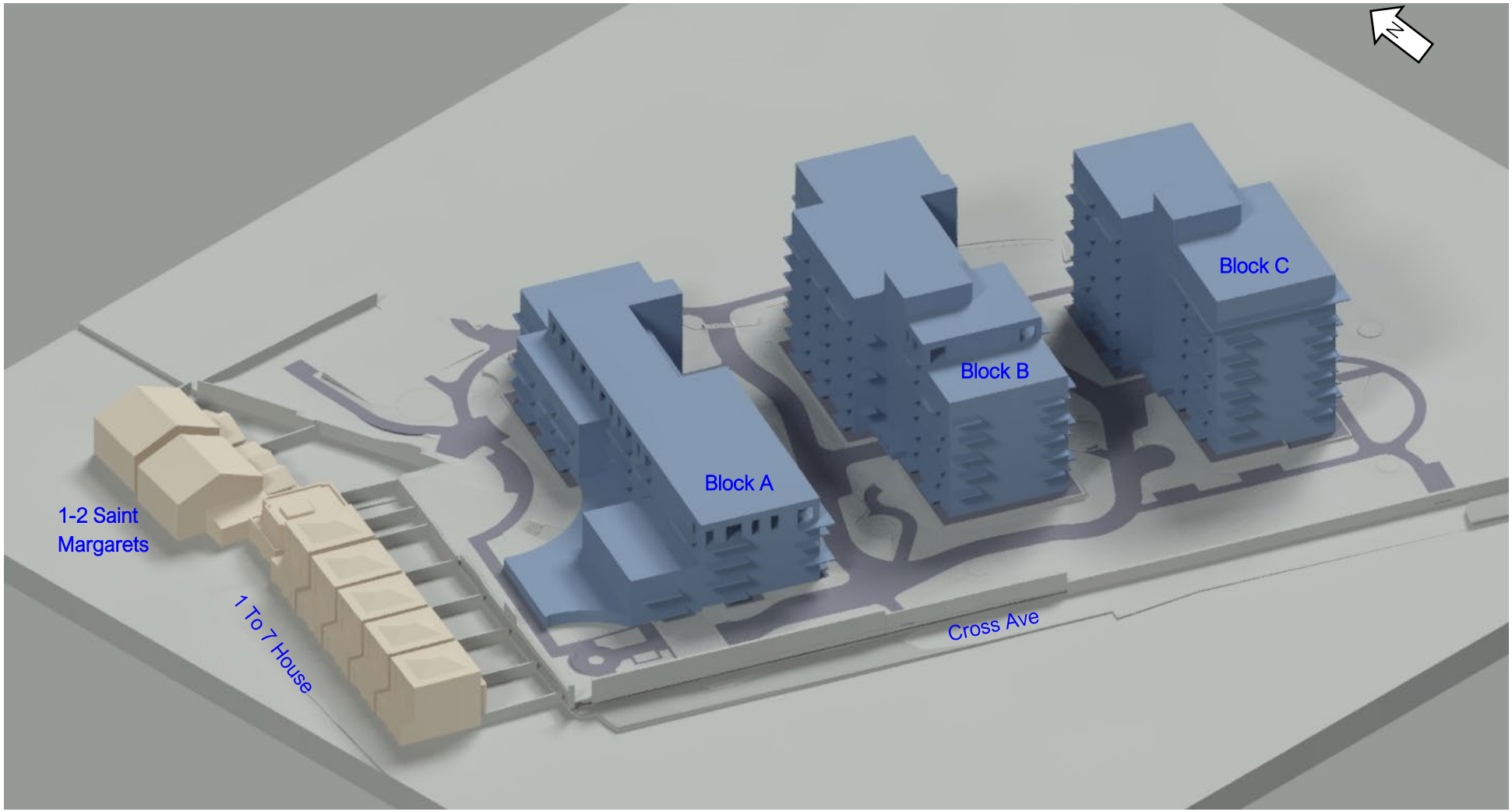



*Figure 10: Proposed Model (Perspective View From S-W)*

## 4.2 Existing Buildings

### 4.2.1 VSC Analysis

VSC analysis has been performed for the closest neighbouring properties which have a view of the proposed development. Some assumptions had to be made for window positions at the rear of these properties where adequate information could not be gleaned from available resources. Where assumptions had to be made, multiple VSC points are spaced evenly across each facade facing the proposed development or estimates of window (or glazed door) locations were made based on visual evidence from similar neighbouring properties. The VSC points for each property are shown in the following figures. (The VSC points are at the centre of each window or 1.6m above floor level for glazed doors.)

### 4.2.2 25 Degree Line Test

The obstruction angle was checked for the closest properties to the site that have windows directly opposite the proposed development. The only properties in close proximity to the site, as identified in Table 1, are located to southeast and south of the proposed site. The obstruction angle for the closest windows to the new development were tested. These were at:

- 1 House
- 2 House
- 3 House
- 4 House
- 5 House
- 6 & 7 House.
-

We utilised Google maps and Bing maps to estimate the location of the windows to the rear of these properties, so assumptions were made for window positions. The planes were drawn from 1.6m above ground level which should correspond roughly to the centre of the windows. 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 each neighbouring property listed above are shown in the following figures.

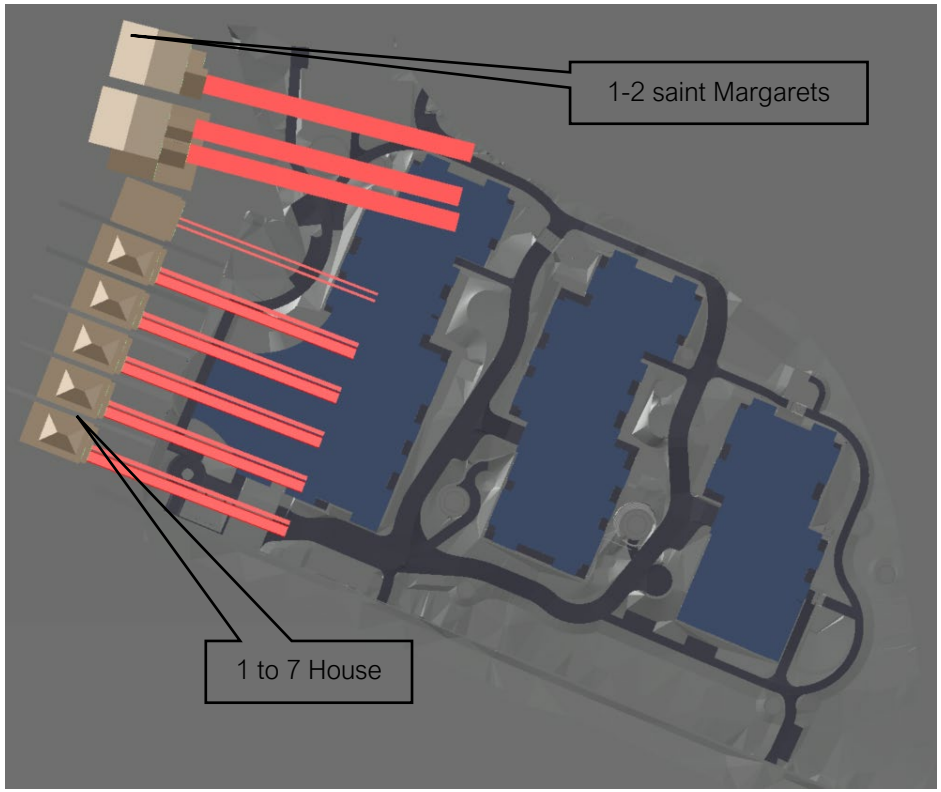



*Figure 11: 25-degree planes Plan View*

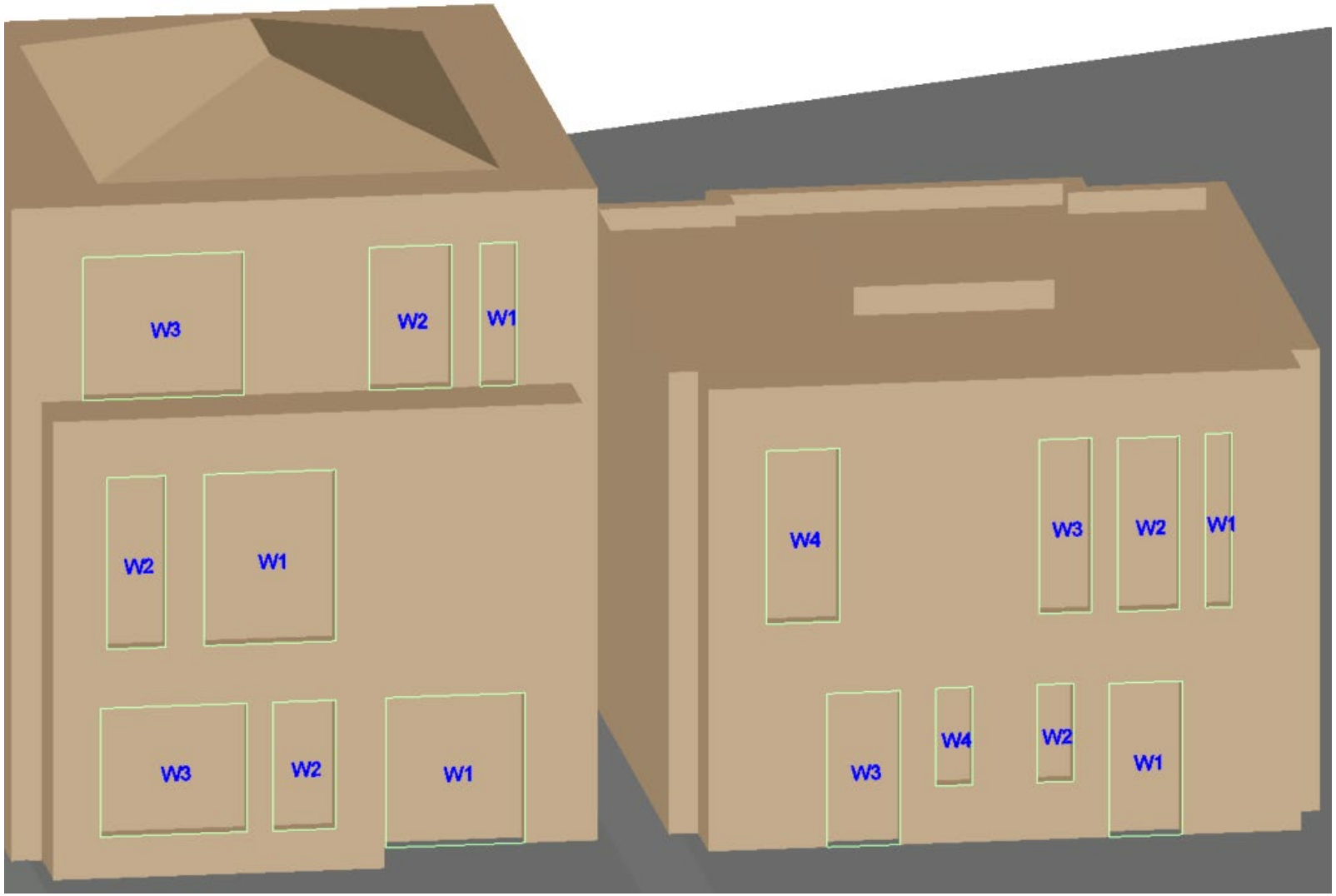



*Figure 12: 5 & 6-7 House (View from Northwest)*

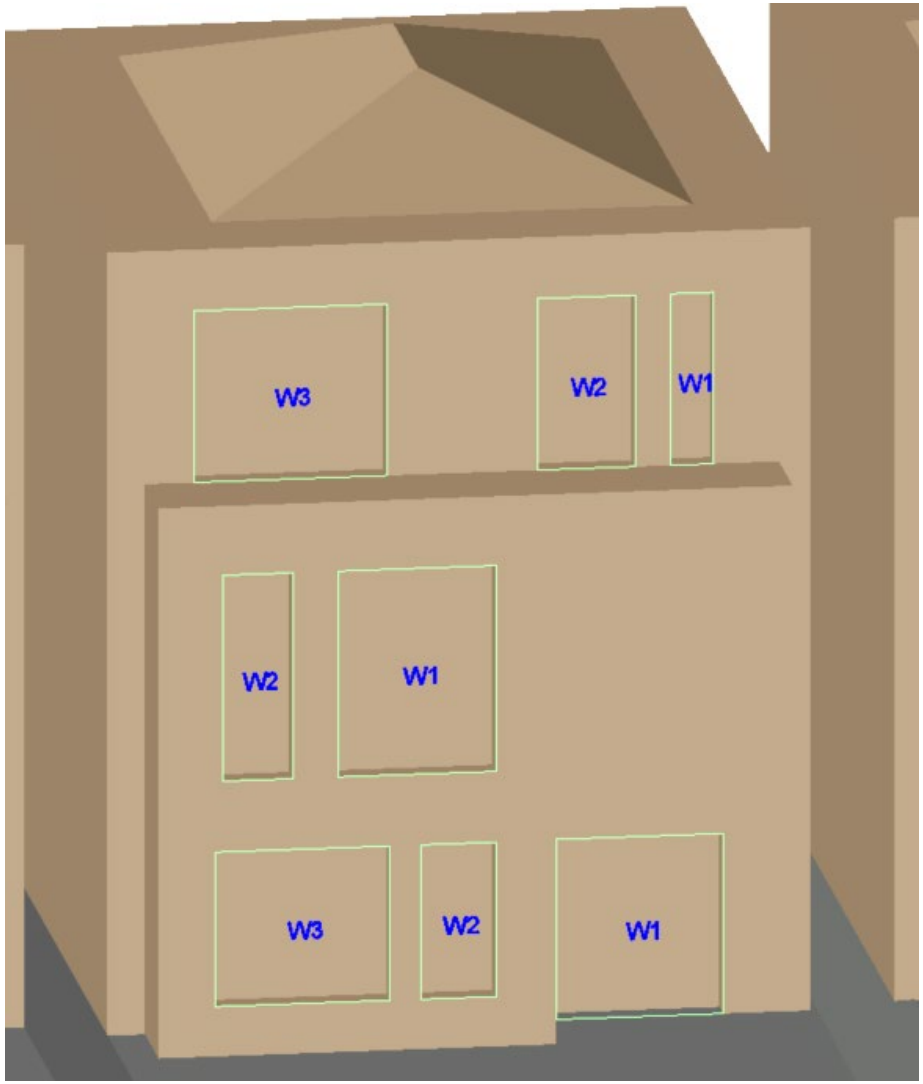



*Figure13: 4 House (View from Northwest)*

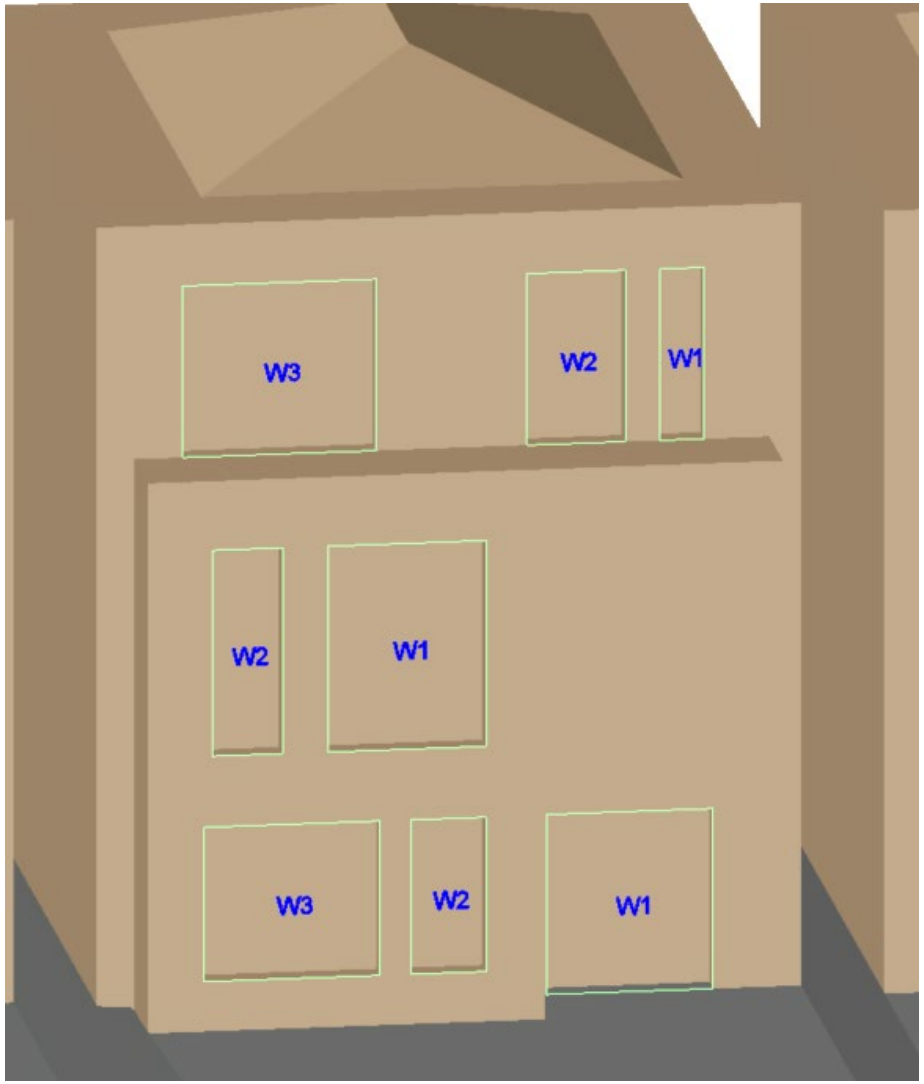



*Figure 14: 3 House (View from Northwest)*

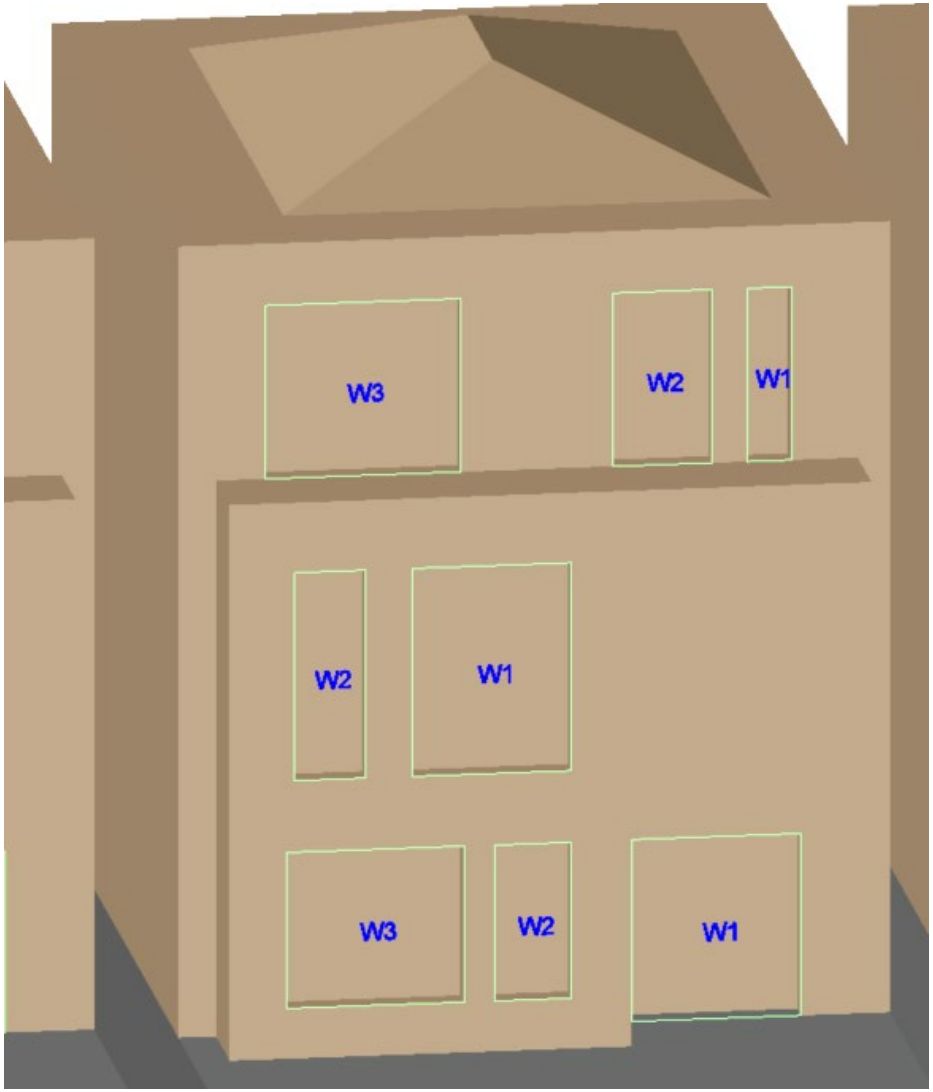



*Figure15: 2 House (View from Northwest)*

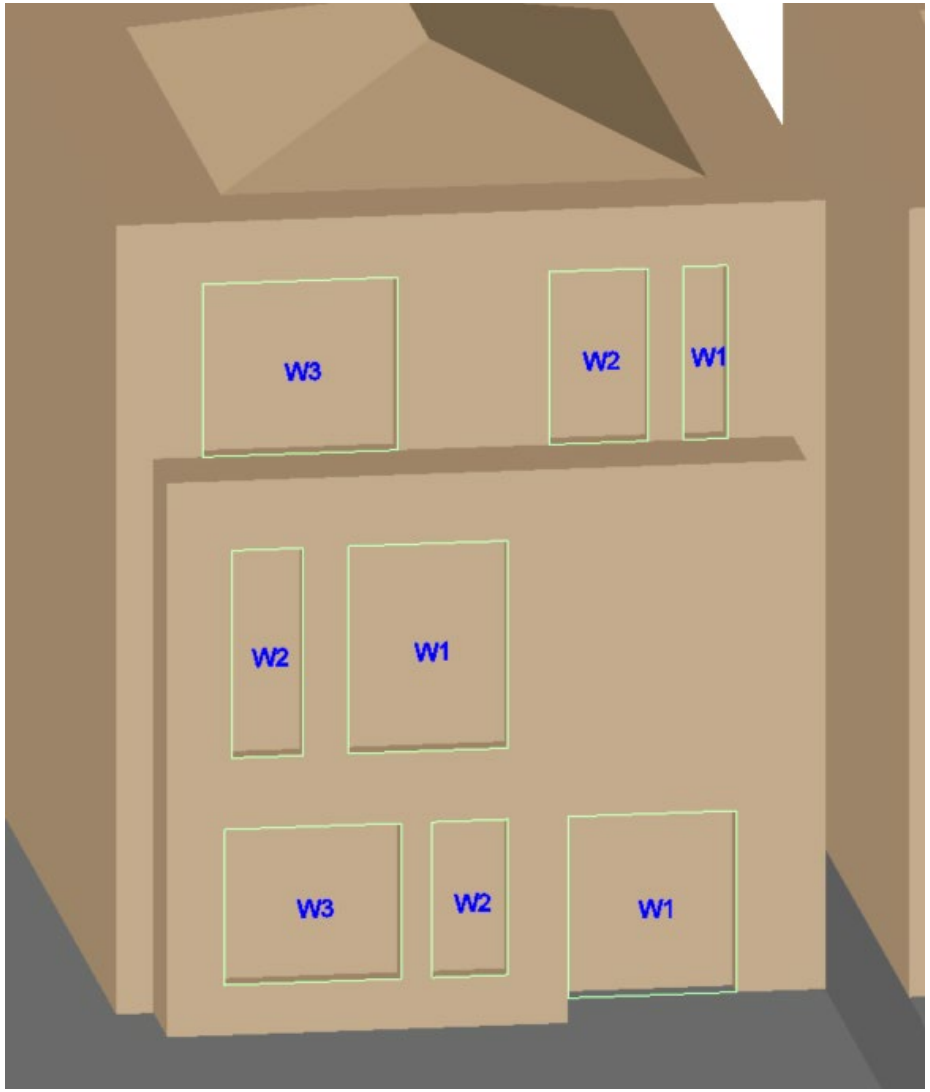



*Figure 16: 1 House (View from Northwest)*

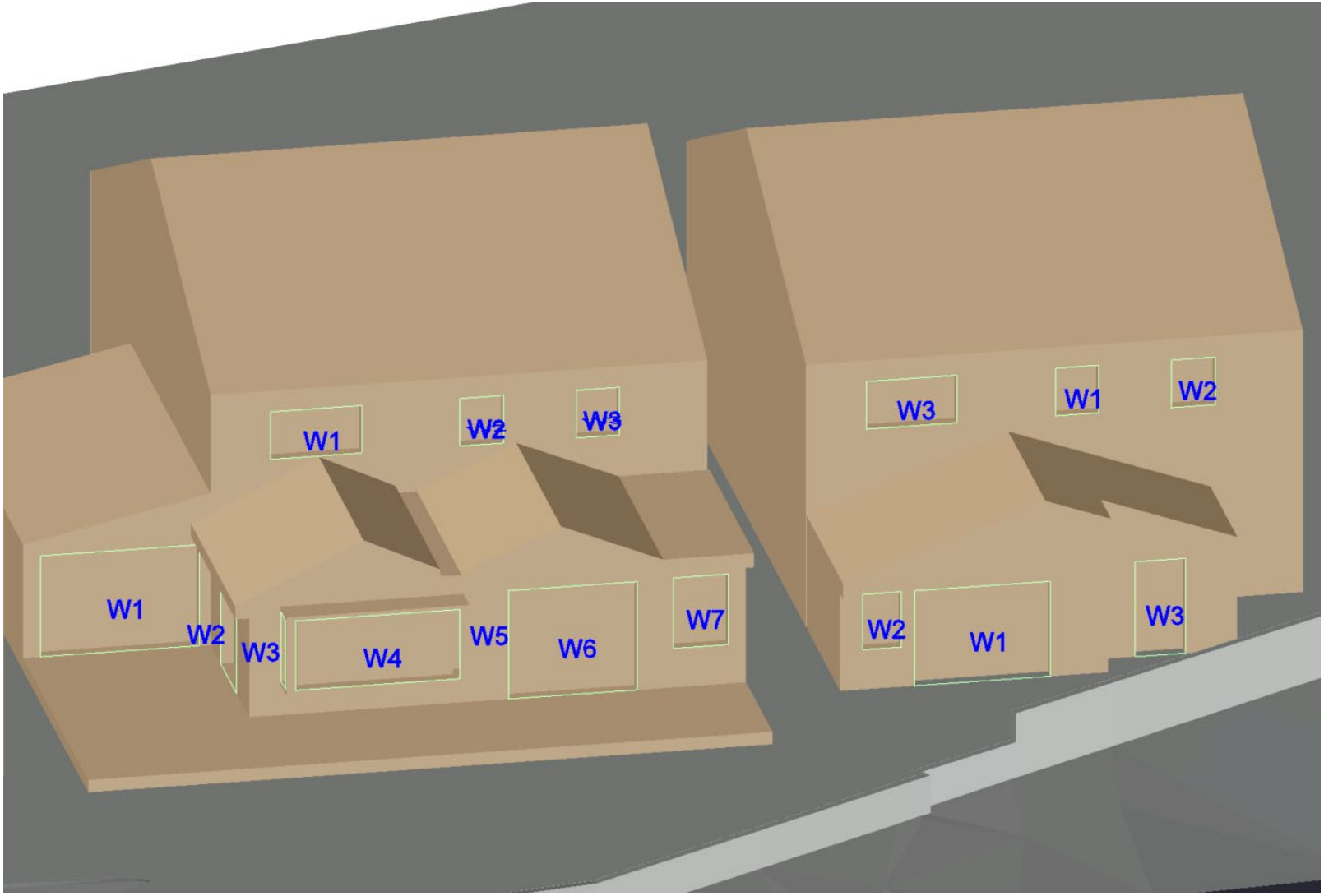



*Figure 17: 1-2 Saint Margarets (View from Northwest)*

*Table 7: VSC Results Ctd...*

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **House 06-07** | | | | | | |
| Ground | W1 | Existing | 29.63 | 0.98 | YES | 111° |
| | | Proposed | 29.11 | | | |
| | W2 | Existing | 29.45 | 0.98 | YES | 111° |
| | | Proposed | 28.93 | | | |
| | W3 | Existing | 28.88 | 0.98 | YES | 111° |
| | | Proposed | 28.37 | | | |
| | W4 | Existing | 28.58 | 0.98 | YES | 111° |
| | | Proposed | 28.05 | | | |
| First | W1 | Existing | 33.92 | 0.99 | YES | 111° |
| | | Proposed | 33.58 | | | |
| | W2 | Existing | 33.85 | 0.99 | YES | 111° |
| | | Proposed | 33.51 | | | |
| | W3 | Existing | 33.80 | 0.99 | YES | 111° |
| | | Proposed | 33.45 | | | |
| | W4 | Existing | 33.65 | 0.99 | YES | 111° |
| | | Proposed | 33.27 | | | |

*Table 8: VSC Results Ctd...*

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **House 05** | | | | | | |
| Ground | W1 | Existing | 19.69 | 0.98 | YES | 111° |
| | | Proposed | 19.23 | | | |
| | W2 | Existing | 31.09 | 0.99 | YES | 111° |
| | | Proposed | 30.63 | | | |
| | W3 | Existing | 31.02 | 0.99 | YES | 111° |
| | | Proposed | 30.59 | | | |
| First | W1 | Existing | 33.46 | 0.99 | YES | 111° |
| | | Proposed | 33.09 | | | |
| | W2 | Existing | 33.44 | 0.99 | YES | 111° |
| | | Proposed | 33.08 | | | |
| Second | W1 | Existing | 35.32 | 0.99 | YES | 111° |
| | | Proposed | 35.13 | | | |
| | W2 | Existing | 35.31 | 0.99 | YES | 111° |
| | | Proposed | 35.11 | | | |
| | W3 | Existing | 35.33 | 0.99 | YES | 111° |
| | | Proposed | 35.12 | | | |

*Table 9: VSC Results Ctd...*

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **House 04** | | | | | | |
| Ground | W1 | Existing | 19.58 | 0.98 | YES | 111° |
| | | Proposed | 19.23 | | | |
| | W2 | Existing | 30.80 | 0.99 | YES | 111° |
| | | Proposed | 30.47 | | | |
| | W3 | Existing | 30.65 | 0.99 | YES | 111° |
| | | Proposed | 30.34 | | | |
| First | W1 | Existing | 33.50 | 0.99 | YES | 111° |
| | | Proposed | 33.20 | | | |
| | W2 | Existing | 33.58 | 0.99 | YES | 111° |
| | | Proposed | 33.29 | | | |
| Second | W1 | Existing | 35.36 | 0.99 | YES | 111° |
| | | Proposed | 35.14 | | | |
| | W2 | Existing | 35.39 | 0.99 | YES | 111° |
| | | Proposed | 35.17 | | | |
| | W3 | Existing | 35.51 | 0.99 | YES | 111° |
| | | Proposed | 35.30 | | | |

*Table 10: VSC Results Ctd...*

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **House 03** | | | | | | |
| Ground | W1 | Existing | 19.98 | 0.99 | YES | 111° |
| | | Proposed | 19.73 | | | |
| | W2 | Existing | 31.38 | 0.99 | YES | 111° |
| | | Proposed | 31.14 | | | |
| | W3 | Existing | 31.42 | 0.99 | YES | 111° |
| | | Proposed | 31.20 | | | |
| First | W1 | Existing | 34.24 | 0.99 | YES | 111° |
| | | Proposed | 34.01 | | | |
| | W2 | Existing | 34.44 | 0.99 | YES | 111° |
| | | Proposed | 34.22 | | | |
| Second | W1 | Existing | 35.81 | 0.99 | YES | 111° |
| | | Proposed | 35.60 | | | |
| | W2 | Existing | 35.88 | 0.99 | YES | 111° |
| | | Proposed | 35.67 | | | |
| | W3 | Existing | 36.13 | 0.99 | YES | 111° |
| | | Proposed | 35.92 | | | |

*Table 11: VSC Results Ctd...*

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **House 02** | | | | | | |
| Ground | W1 | Existing | 21.06 | 0.99 | YES | 111° |
| | | Proposed | 20.89 | | | |
| | W2 | Existing | 32.45 | 0.99 | YES | 111° |
| | | Proposed | 32.27 | | | |
| | W3 | Existing | 32.43 | 0.99 | YES | 111° |
| | | Proposed | 32.25 | | | |
| First | W1 | Existing | 35.50 | 0.99 | YES | 111° |
| | | Proposed | 35.30 | | | |
| | W2 | Existing | 35.70 | 0.99 | YES | 111° |
| | | Proposed | 35.52 | | | |
| Second | W1 | Existing | 36.56 | 0.99 | YES | 111° |
| | | Proposed | 36.35 | | | |
| | W2 | Existing | 36.68 | 0.99 | YES | 111° |
| | | Proposed | 36.47 | | | |
| | W3 | Existing | 36.96 | 0.99 | YES | 111° |
| | | Proposed | 36.77 | | | |

*Table 12: VSC Results Ctd...*

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **House 01** | | | | | | |
| Ground | W1 | Existing | 21.90 | 1.00 | YES | 111° |
| | | Proposed | 21.80 | | | |
| | W2 | Existing | 33.44 | 1.00 | YES | 111° |
| | | Proposed | 33.34 | | | |
| | W3 | Existing | 33.05 | 1.00 | YES | 111° |
| | | Proposed | 32.96 | | | |
| First | W1 | Existing | 36.33 | 1.00 | YES | 111° |
| | | Proposed | 36.22 | | | |
| | W2 | Existing | 36.45 | 1.00 | YES | 111° |
| | | Proposed | 36.35 | | | |
| Second | W1 | Existing | 37.24 | 1.00 | YES | 111° |
| | | Proposed | 37.10 | | | |
| | W2 | Existing | 37.28 | 1.00 | YES | 111° |
| | | Proposed | 37.15 | | | |
| | W3 | Existing | 37.38 | 1.00 | YES | 111° |
| | | Proposed | 37.27 | | | |

Table 13: VSC Results Ctd...

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **1 SAINT MARGARETS** | | | | | | |
| Ground | W1 | Existing | 21.06 | 0.99 | YES | 105° |
| | | Proposed | 20.78 | | | |
| | W2 | Existing | 13.39 | 1.00 | YES | 195° |
| | | Proposed | 13.38 | | | |
| | W3 | Existing | 10.89 | 0.99 | YES | 195° |
| | | Proposed | 10.81 | | | |
| | W4 | Existing | 33.75 | 0.99 | YES | 105° |
| | | Proposed | 33.38 | | | |
| | W5 | Existing | 16.08 | 1.00 | YES | 15°N |
| | | Proposed | 16.08 | | | |
| | W6 | Existing | 30.88 | 0.99 | YES | 105° |
| | | Proposed | 30.56 | | | |
| | W7 | Existing | 28.31 | 0.99 | YES | 105° |
| | | Proposed | 28.05 | | | |
| First | W1 | Existing | 35.60 | 1.00 | YES | 105° |
| | | Proposed | 35.55 | | | |
| | W2 | Existing | 36.03 | 1.00 | YES | 105° |
| | | Proposed | 35.97 | | | |
| | W3 | Existing | 36.24 | 1.00 | YES | 105° |
| | | Proposed | 36.19 | | | |

``

*Table 14: VSC Results Ctd...*

| Floor Ref. | Window Ref. | | VSC | Pr/Ex | Meets BRE Criteria | Window Orientation |
|---|---|---|---|---|---|---|
| **2 SAINT MARGARETS** | | | | | | |
| Ground | W1 | Existing | 30.76 | 0.99 | YES | 105° |
| | | Proposed | 30.52 | | | |
| | W2 | Existing | 30.03 | 0.99 | YES | 105° |
| | | Proposed | 29.79 | | | |
| | W3 | Existing | 28.38 | 0.99 | YES | 105° |
| | | Proposed | 28.19 | | | |
| First | W1 | Existing | 37.09 | 1.00 | YES | 105° |
| | | Proposed | 37.03 | | | |
| | W2 | Existing | 37.24 | 1.00 | YES | 105° |
| | | Proposed | 37.18 | | | |
| | W3 | Existing | 36.83 | 1.00 | YES | 105° |
| | | Proposed | 36.76 | | | |

*Table 15: VSC Results Summary*

| Property | Number of Windows Tested | Windows that meet BRE Guidelines | |
|---|---|---|---|
| | | No. | % |
| House 06-07 | 8 | 8 | 100% |
| House 05 | 8 | 8 | 100% |
| House 04 | 8 | 8 | 100% |
| House 03 | 8 | 8 | 100% |
| House 02 | 8 | 8 | 100% |
| House 01 | 8 | 8 | 100% |
| 1 SAINT MARGARETS | 10 | 10 | 100% |
| 2 SAINT MARGARETS | 6 | 6 | 100% |
| **Total** | **64** | **64** | **100%** |

All windows tested have VSC values greater than 27%, a VSC value no less than 0.8 times its former value or where larger windows are situ a VSC value greater than 15% with the proposed development in place.

All bar two windows meet the recommendations of the BRE Guide and show that the proposed development will have a minor adverse impact on skylight to the neighbouring dwellings.

### 4.2.3 Impact on Sunlight to Neighbouring Gardens.

The sunlight availability was checked for the neighbouring existing dwellings main gardens, as necessary. The main gardens for the properties at 1-2 St Margarets and 7 new houses adjacent were tested.

The garden areas were estimated from the site plans and Google Maps. The gardens analysed are shown in the following figures. (North is vertically up for all figures shown.)

- House 1
- House 2
- House 3
- House 4
- House 5
- House 6-7
- 1 Saint Margarets
- 2 Siant Margarets

The legend below illustrates the colour coding used in the results.

| Legend | |
|---|---|
| | > 2hrs for Existing & Proposed |
| | < 2hrs for Existing & Proposed |
| | Loss |
| | Gain |

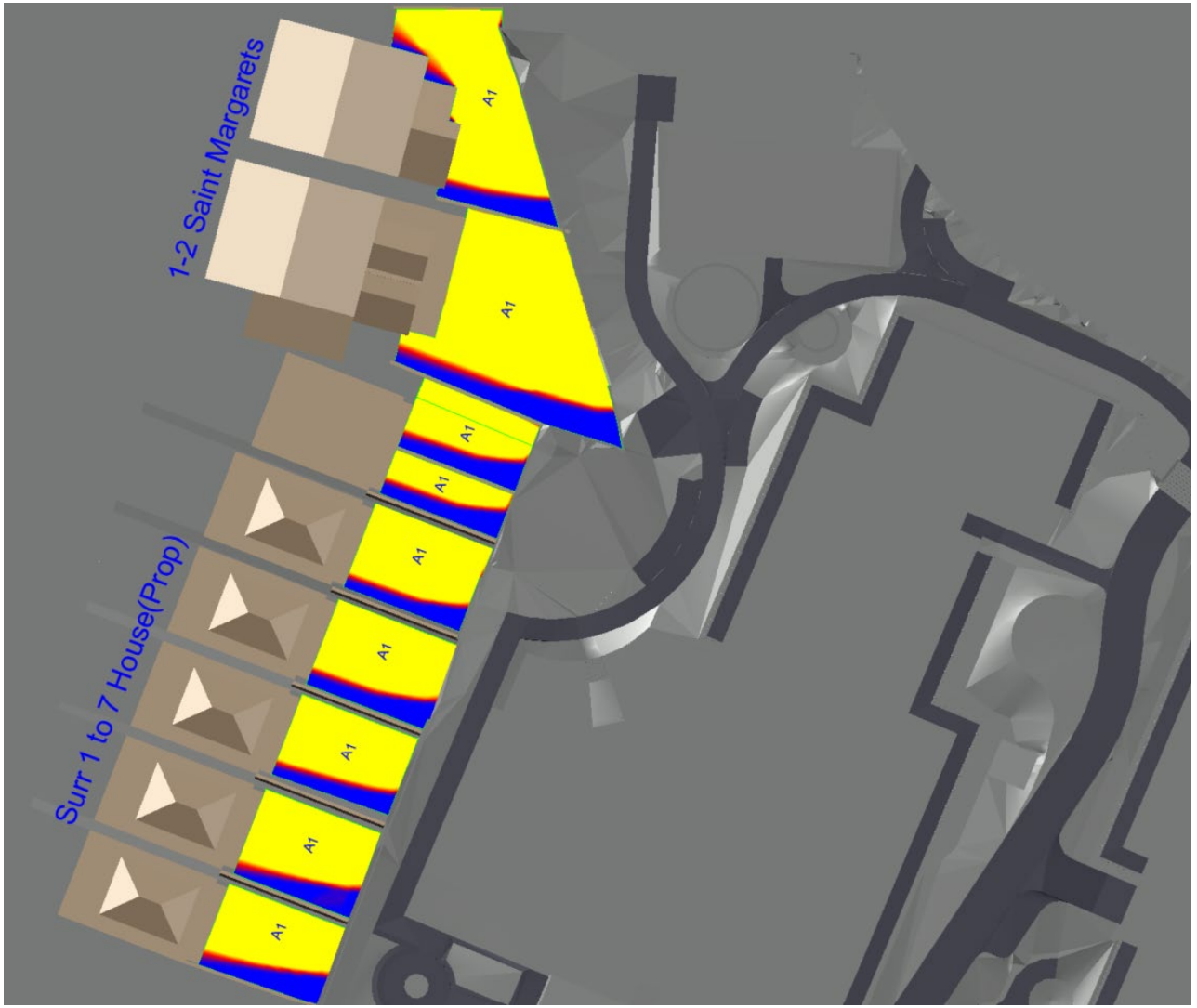



*Figure 182: Sunlight to Garden Test –Surr (Prop) House 1 to 7 & 1-2 Saint Margarets*

*Table 76: Sunlight to Amenity - Neighbour Analysis Results*

| Floor Ref | Amenity Ref | | Amenity Area | Lit Area Existing | Lit Area Proposed | Pr/Ex | Meets BRE Criteria |
|---|---|---|---|---|---|---|---|
| **House 07** | | | | | | | |
| Ground | A1 | Area m2 | 70.96 | 46.38 | 46.07 | 0.99 | YES |
| | | Percentage | | 65% | 65% | | |
| **House 06** | | | | | | | |
| Ground | A1 | Area m2 | 46.30 | 23.89 | 23.89 | 1.00 | YES |
| | | Percentage | | 52% | 52% | | |
| **House 05** | | | | | | | |
| Ground | A1 | Area m2 | 87.56 | 67.45 | 67.45 | 1.00 | YES |
| | | Percentage | | 77% | 77% | | |
| **House 04** | | | | | | | |
| Ground | A1 | Area m2 | 92.38 | 67.36 | 67.36 | 1.00 | YES |
| | | Percentage | | 73% | 73% | | |
| **House 03** | | | | | | | |
| Ground | A1 | Area m2 | 81.50 | 61.06 | 61.06 | 1.00 | YES |
| | | Percentage | | 75% | 75% | | |
| **House 02** | | | | | | | |
| Ground | A1 | Area m2 | 88.30 | 65.14 | 65.11 | 1.00 | YES |
| | | Percentage | | 74% | 74% | | |
| **House 01** | | | | | | | |
| Ground | A1 | Area m2 | 83.95 | 58.97 | 58.97 | 1.00 | YES |
| | | Percentage | | 70% | 70% | | |

*Table 17: Sunlight to Amenity - Neighbour Analysis Results*

| Floor Ref | Amenity Ref | | Amenity Area | Lit Area Existing | Lit Area Proposed | Pr/Ex | Meets BRE Criteria |
|---|---|---|---|---|---|---|---|
| **1 SAINT MARGARETS** | | | | | | | |
| Ground | A1 | Area m2 | 231.66 | 177.54 | 176.05 | 0.99 | YES |
| | | Percentage | | 77% | 76% | | |
| **2 SAINT MARGARETS** | | | | | | | |
| Ground | A1 | Area m2 | 146.01 | 113.95 | 113.88 | 1.00 | YES |
| | | Percentage | | 78% | 78% | | |

The analysis shows more than 50% of each garden tested receives at least 2hrs of sunlight on March 21st before and after the proposed development.

Based on the results, there will be a negligible impact on sunlight to the gardens due to the proposed development.

Therefore, the proposed neighbouring gardens exceeds the BRE's recommendation for sunlight, will appear adequately sunlit throughout the year and is not significantly affected by the proposed development.

## 4.3 Proposed Development

### 4.3.1 Daylight Analysis for Proposed Development

The daylight provision in the proposed units in the proposed development was checked using the target illuminance ($E_T$) method. The results are presented in the following tables. (See Appendix A for the illuminance contours images and room labels.)

*Table 18: Illuminance Results Summary*

| Property | Number of Rooms Tested | Rooms satisfying Criteria | | Rooms not satisfying Criteria |
|---|---|---|---|---|
| | | No. | % | |
| Block A | 7 | 7 | 100% | 0 |
| Block B | 4 | 4 | 100% | 0 |
| **Total** | **11** | **11** | **100%** | **0** |

In terms of internal daylight provision for the proposed development, the proposed units achieved 96% 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.

*Table 19: Illuminance Results – Block A Fourth*

| Floor Ref | Room Ref | Room Use | Median Lux | % of Area Meeting Req Lux | Req Lux | Req % of Effective Area | Req % of Daylight Hours | Daylight Hours | Meets Criteria |
|---|---|---|---|---|---|---|---|---|---|
| **Block B** | | | | | | | | | |
| Seventh | R1 | Bedroom | 305 | 100% | 100 | 50% | 50% | 4380 | YES |
| | R2 | LKD | 786 | 94% | 200 | 50% | 50% | 4380 | YES |
| | R3 | LKD | 710 | 87% | 200 | 50% | 50% | 4380 | YES |
| | R4 | Bedroom | 287 | 100% | 100 | 50% | 50% | 4380 | YES |
| **Block A** | | | | | | | | | |
| Fourth | R1 | Bedroom | 775 | 100% | 100 | 50% | 50% | 4380 | YES |
| | R2 | LKD | 234 | 60% | 200 | 50% | 50% | 4380 | YES |
| | R3 | Bedroom | 276 | 100% | 100 | 50% | 50% | 4380 | YES |
| | R4 | LKD | 282 | 68% | 200 | 50% | 50% | 4380 | YES |
| | R5 | Bedroom | 282 | 100% | 100 | 50% | 50% | 4380 | YES |
| | R6 | LKD | 285 | 69% | 200 | 50% | 50% | 4380 | YES |
| | R7 | Bedroom | 327 | 100% | 100 | 50% | 50% | 4380 | YES |

### 4.3.2 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 were analysed.


*Figure 19: Proposed Open Spaces 2hr Sunlight Test (Whole Site)*

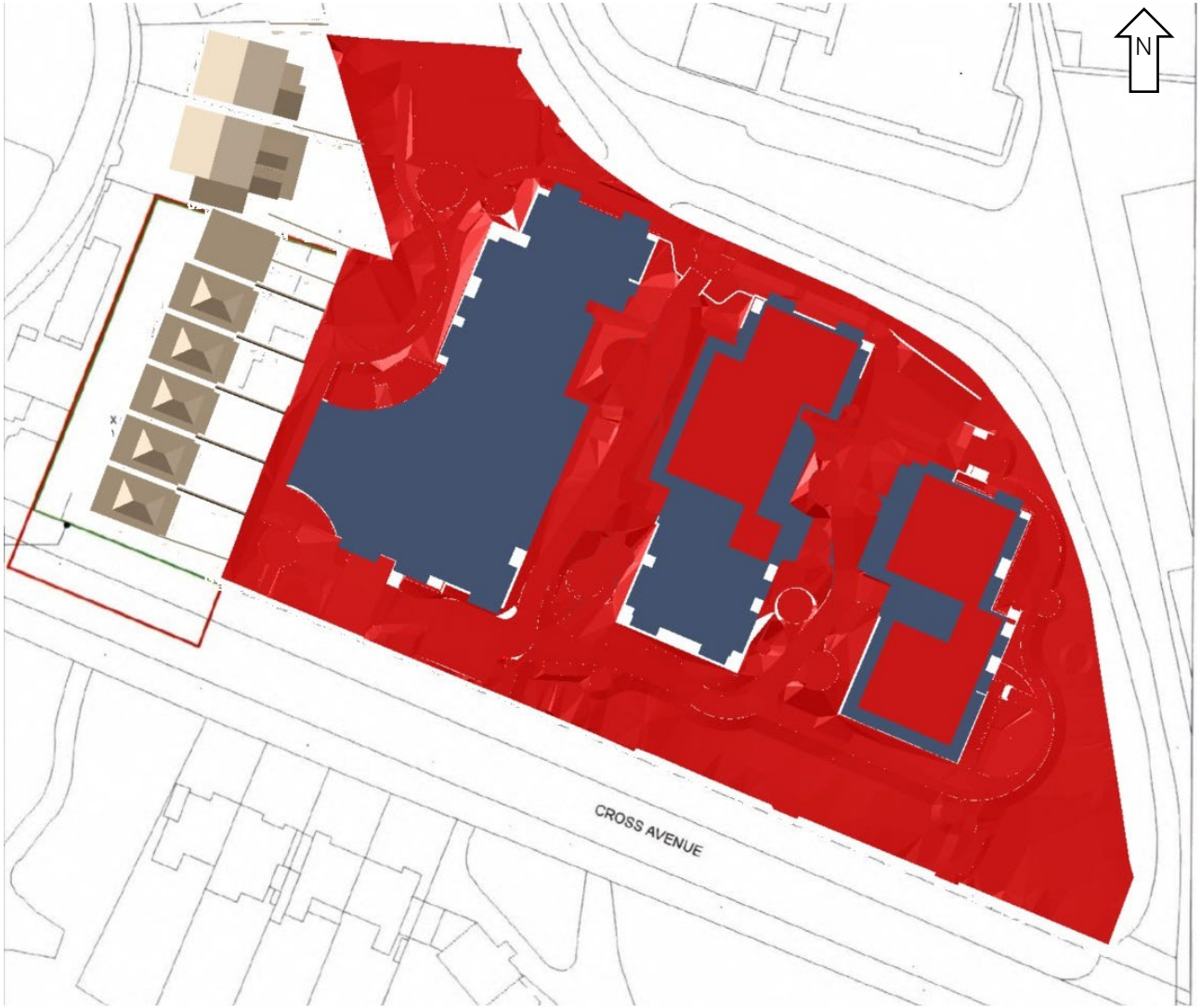



*Figure 20: Proposed Open Spaces 2hr Sunlight Test (Whole Site)*

*Table 20: Open Spaces 2hr Sunlight Test Results*

| Open Space | Area ($m^2$) | 2hr Sun Area ($m^2$) | % Area | Meets Criteria |
|---|---|---|---|---|
| **A1** | 1797.35 | 1622.70 | 90.38% | Yes |
| **A2** | 592.10 | 543.07 | 91.60% | Yes |
| **A3** | 1480.58 | 1290.49 | 87.31% | Yes |
| **A4** | 2016.05 | 1801.61 | 89.29% | Yes |
| **A5** | 1360.11 | 1790.53 | 131.69% | Yes |
| **Roof Terrace B** | 584.55 | 573.23 | 98.07% | Yes |
| **Roof Terrace C** | 588.47 | 576.98 | 98.05% | Yes |

The results show that the open spaces receives greater than 2 hours of sunlight on March 21st. Therefore, the proposed open space exceeds 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)

# 5 Conclusion

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 of the amenity spaces tested show that greater than 50% of the area receive at least two hours of sunlight on 21st March. Therefore, these proposed open spaces exceed the BRE's recommendation for sunlight and should appear adequately sunlit throughout the year.

In terms of internal daylight provision for the proposed development, the proposed units achieved 96% 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.

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)".

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

## A.1 Apartment Block-A 4th


*Figure 21: Block A Fourth Floor sDA Contours.*

## A.2 Apartment Block-B 7th.


*Figure 22: Block B Seventh Floor sDA Contours*

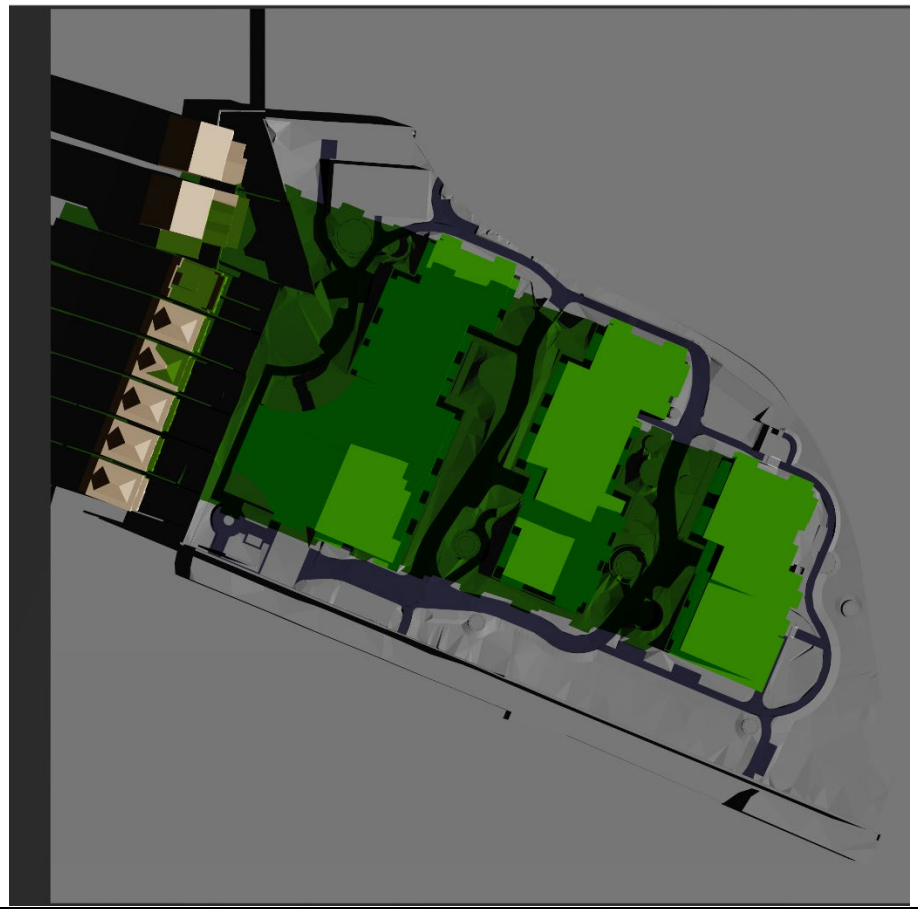
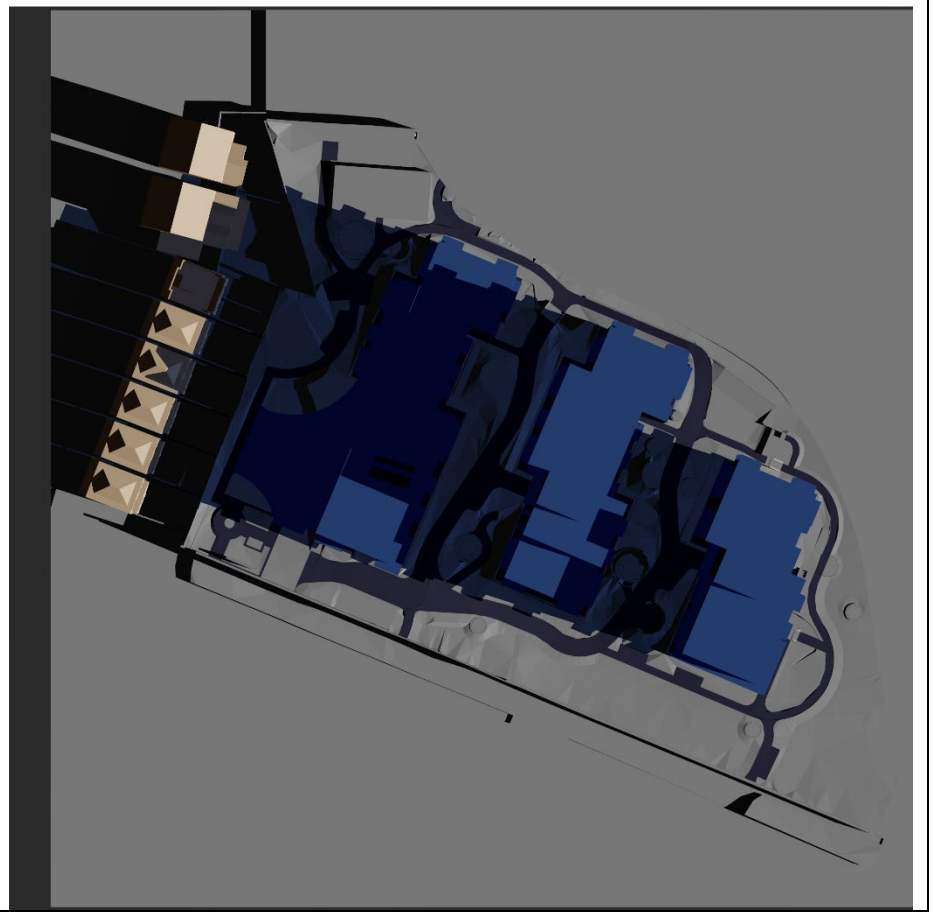
# Appendix B Shadow Images

'Before' and 'after' shadow plots are used to show the difference that 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.)

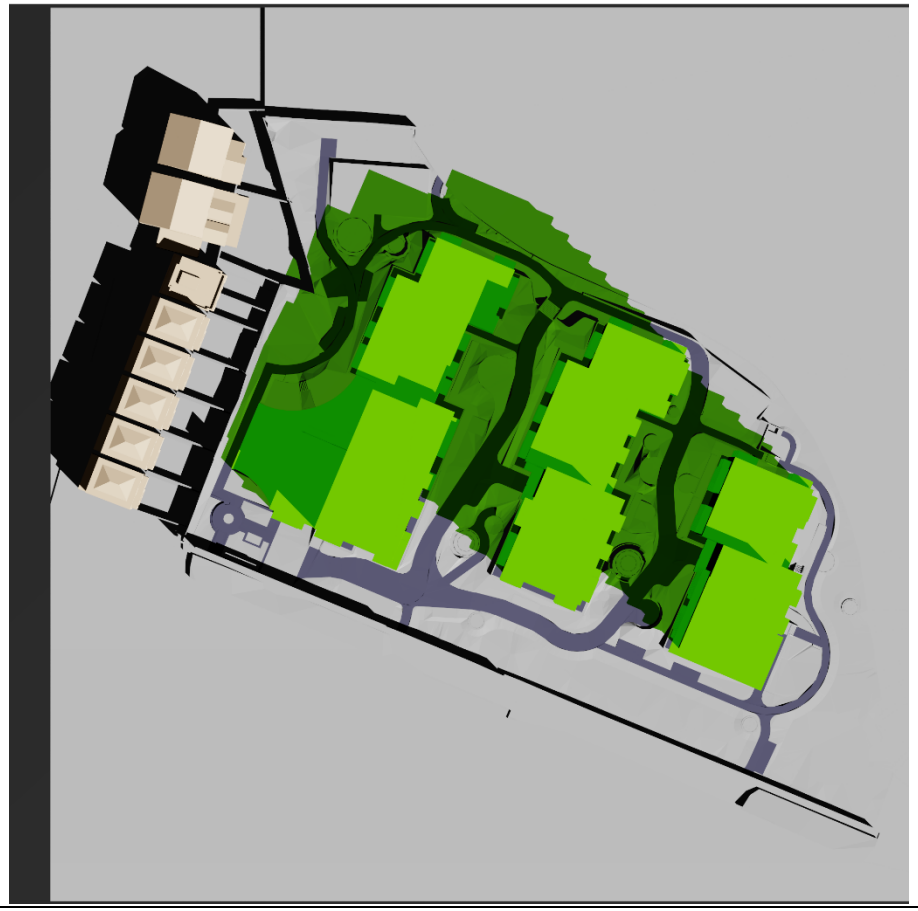
The shadow plots are purely illustrative (as opposed to other quantitative or quantitative metrics used in the analysis).

## B.1 March 21st

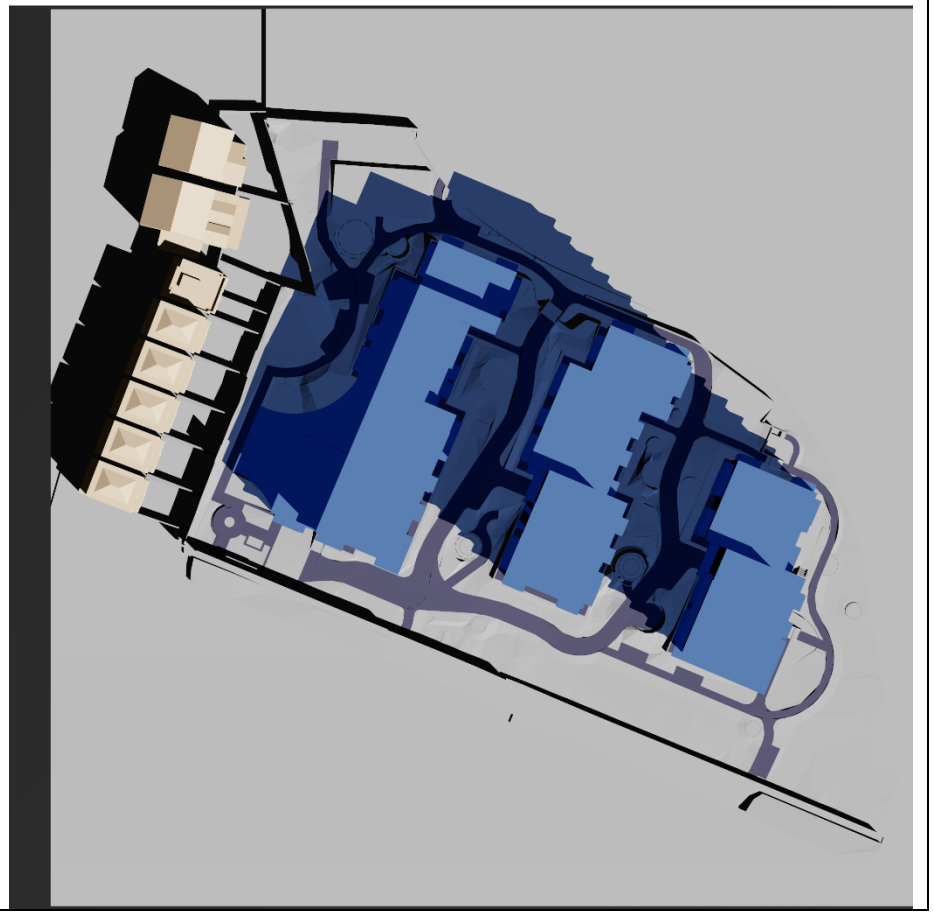
| | Existing | Proposed |
|---|---|---|
| March 21st - 08:00 (UTC) | 20538-CRO-BPC-XX-ZZ-M3-P1-03<br>EXISTING-21-Mar 08-00  | 20538-CRO-BPC-XX-ZZ-M3-P1-03<br>PROPOSED-21-Mar 08-00  |

March 21st – 10:00 (UTC)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Mar 10-00

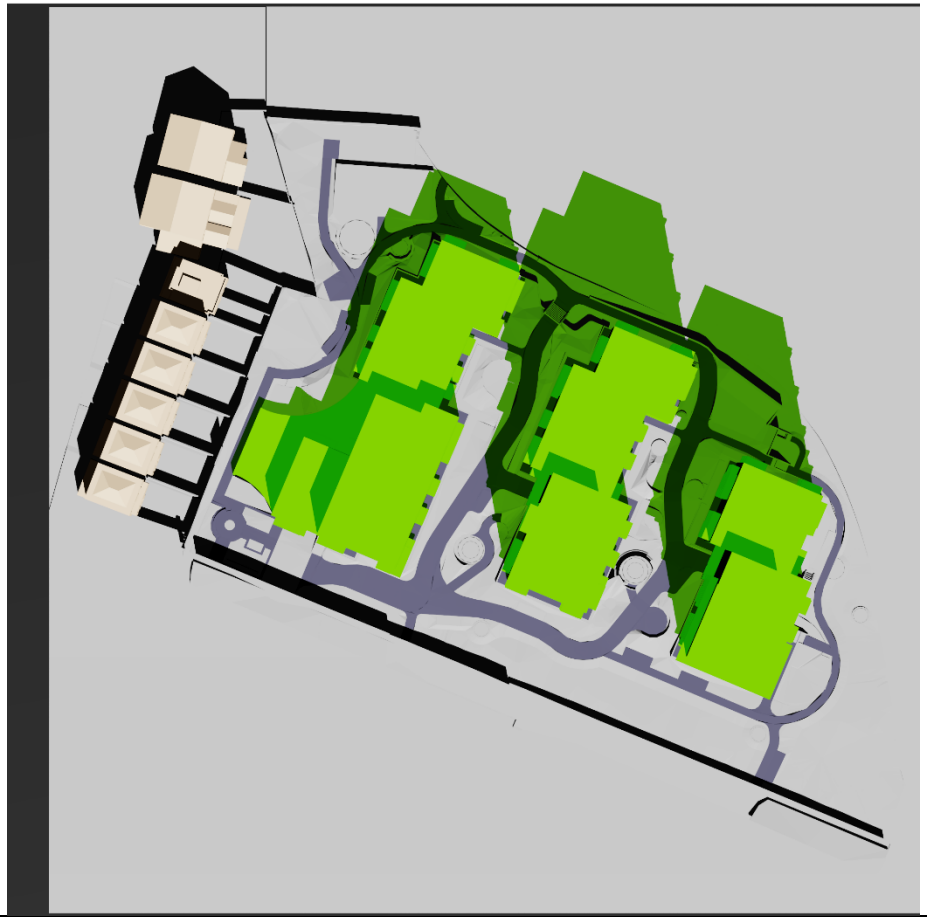


20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Mar 10-00

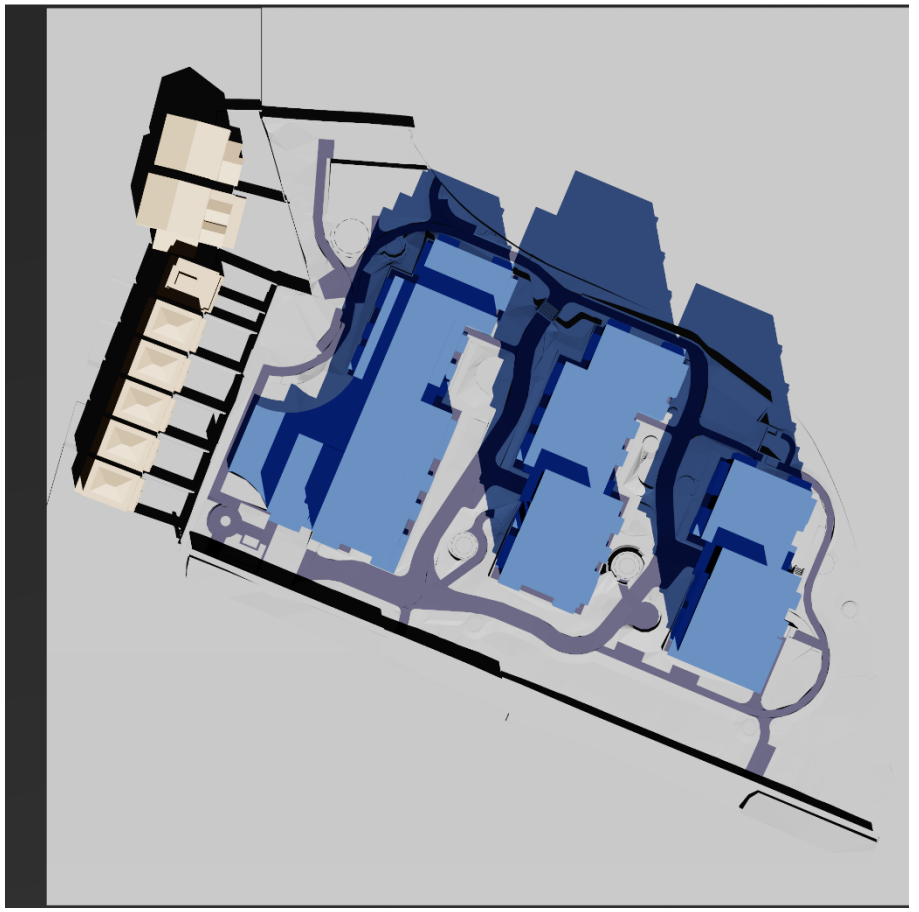


March 21st - 12:00 (UTC)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Mar 12-00

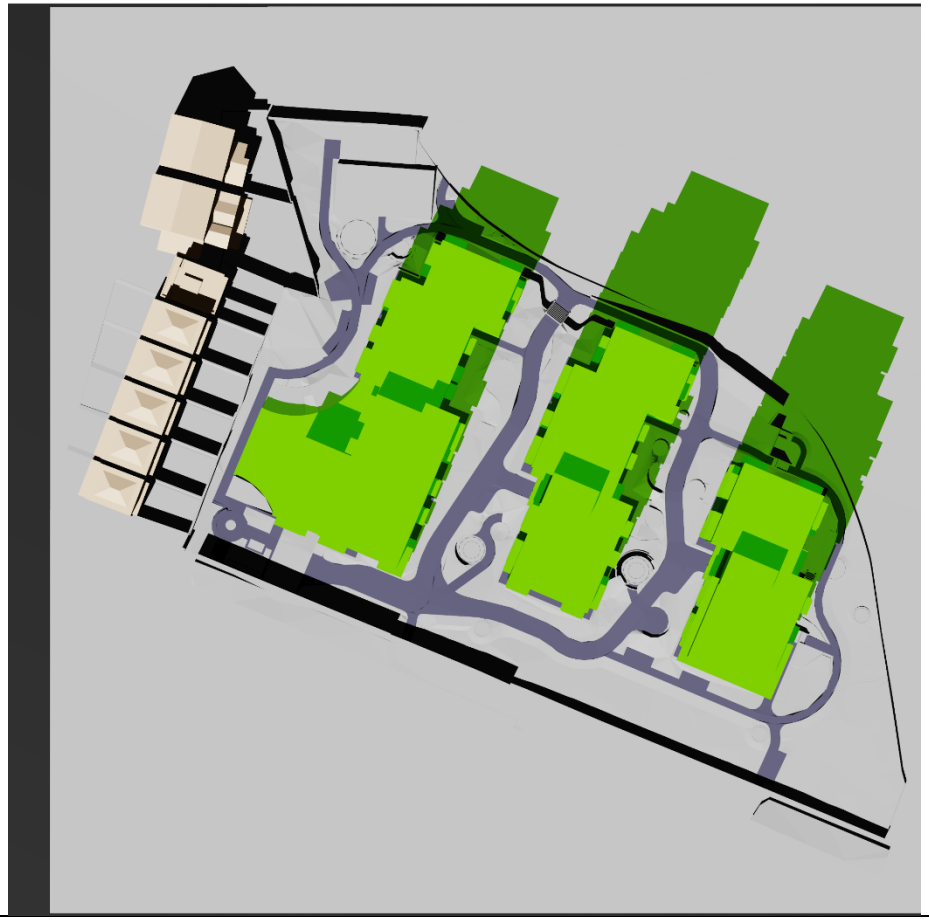


20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Mar 12-00

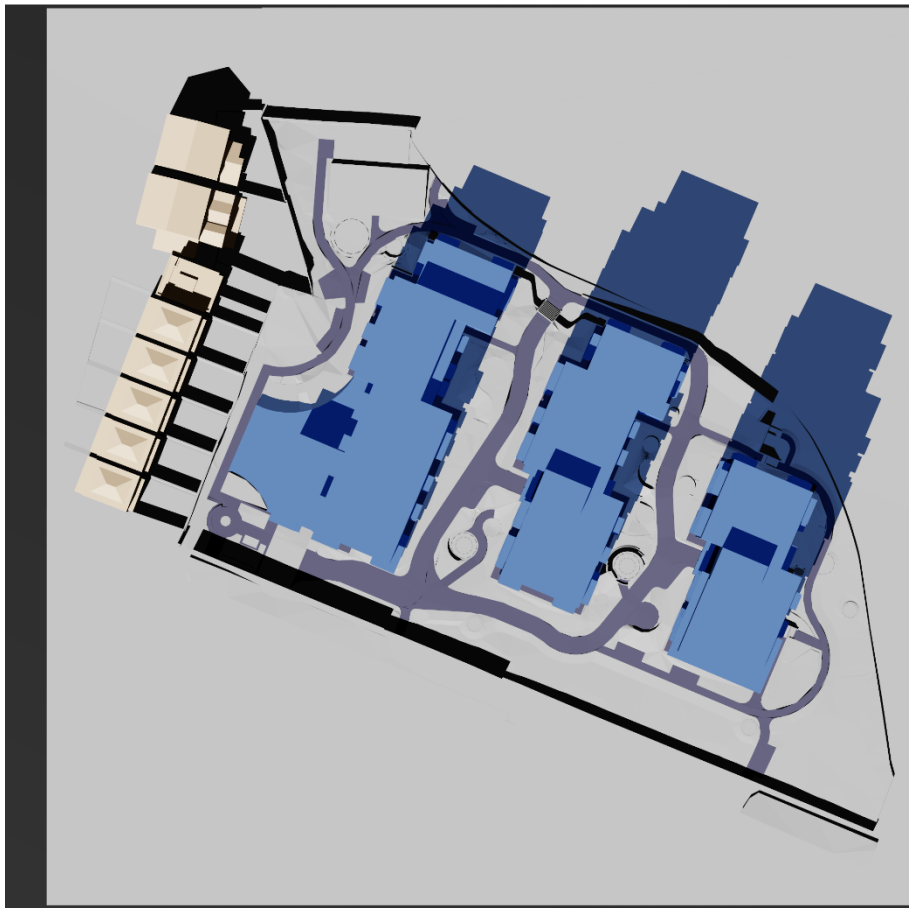


March 21st - 14:00 (UTC)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Mar 14-00

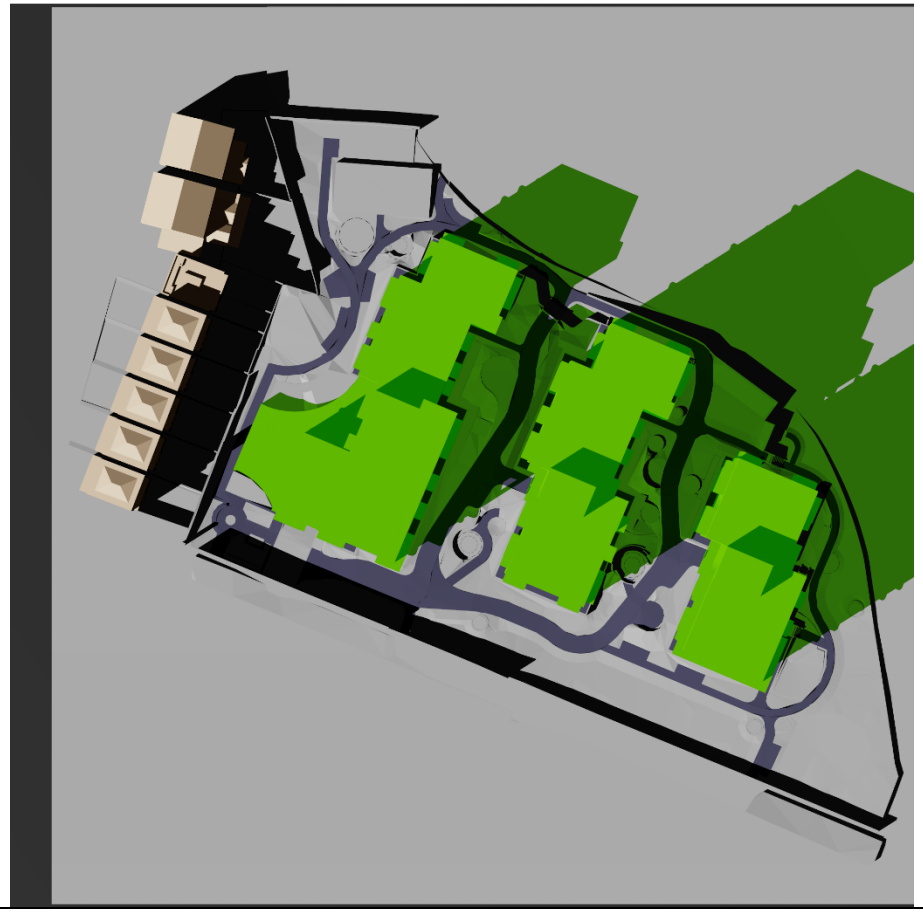


20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Mar 14-00

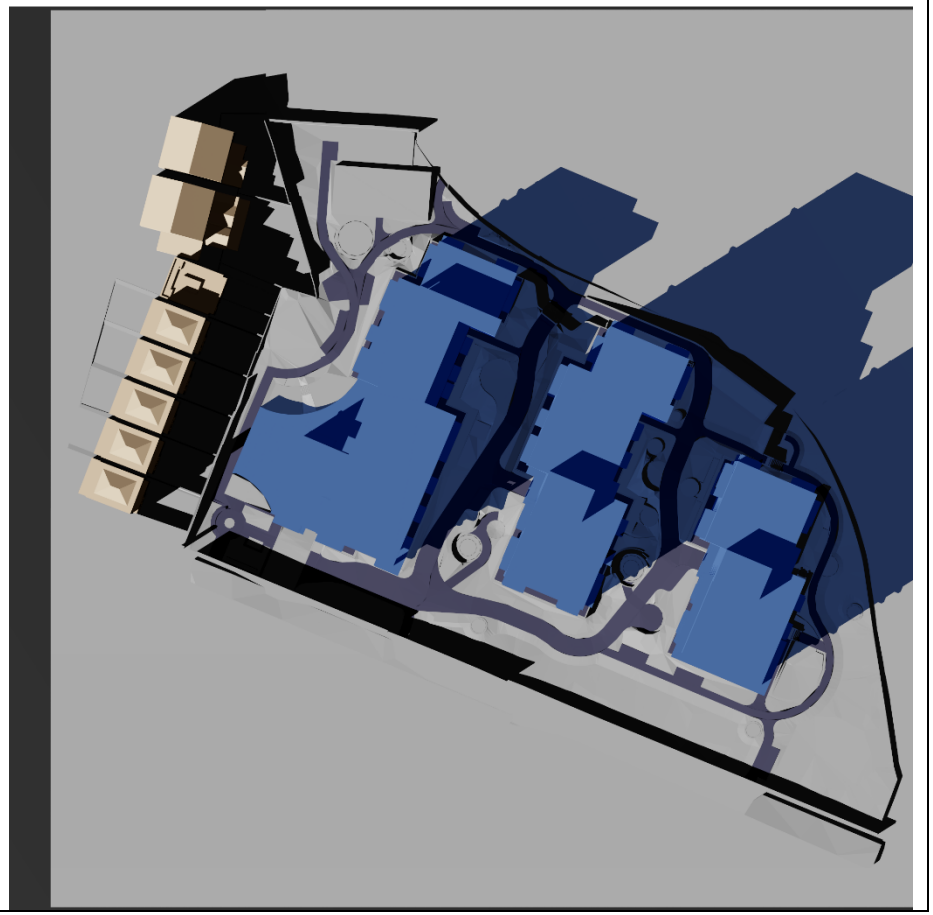


March 21st - 16:00 (UTC)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Mar 16-00

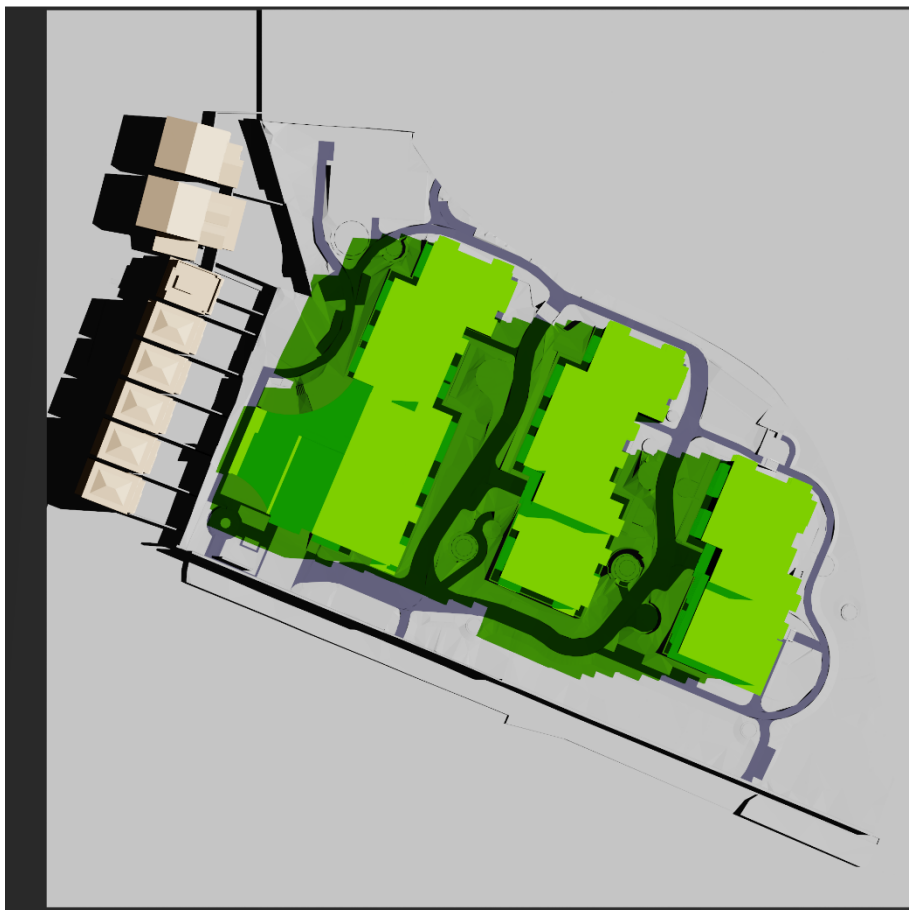


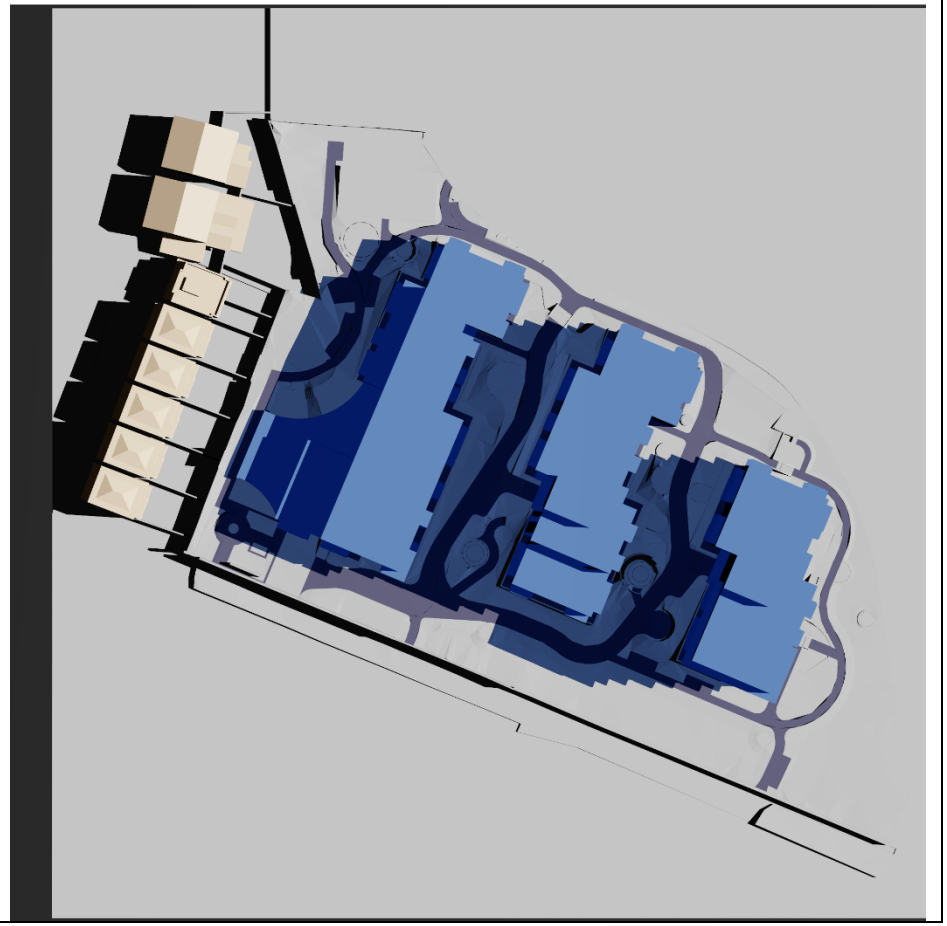
20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Mar 16-00



## B.2 June 21st

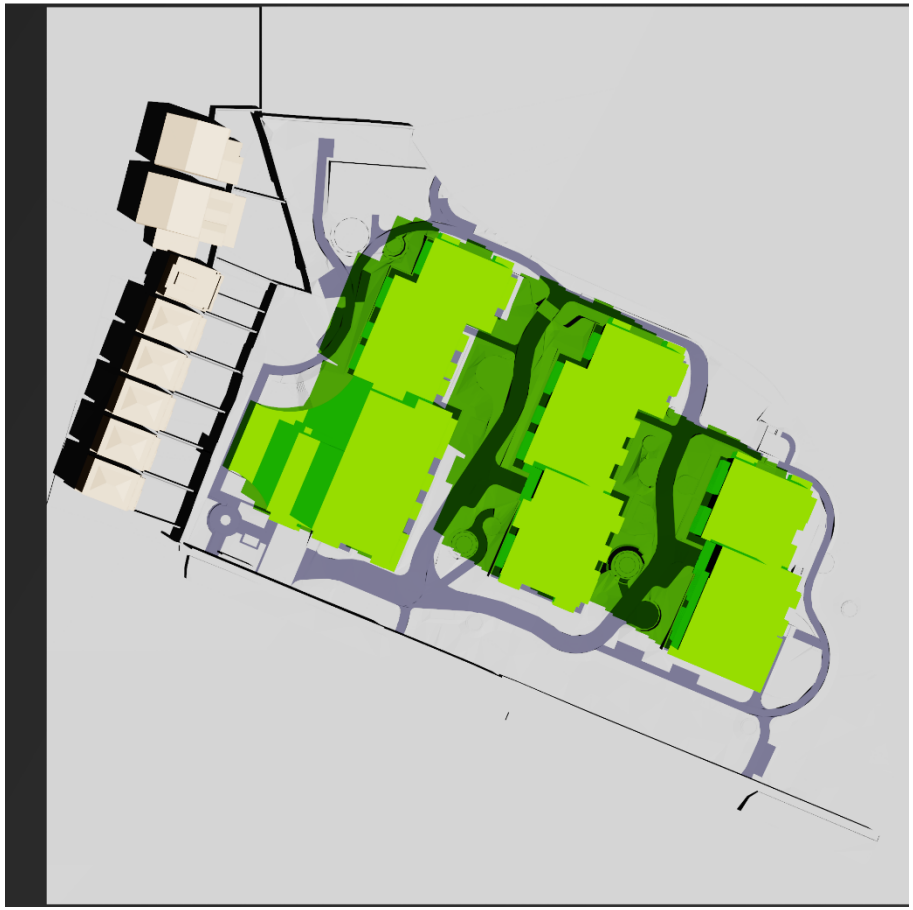
| | Existing | Proposed |
|---|---|---|
| June 21st - 8:00 (UTC+1) | 20538-CRO-BPC-XX-ZZ-M3-P1-03<br>EXISTING-21-Jun 08-00 | 20538-CRO-BPC-XX-ZZ-M3-P1-03<br>PROPOSED-21-Jun 08-00 |



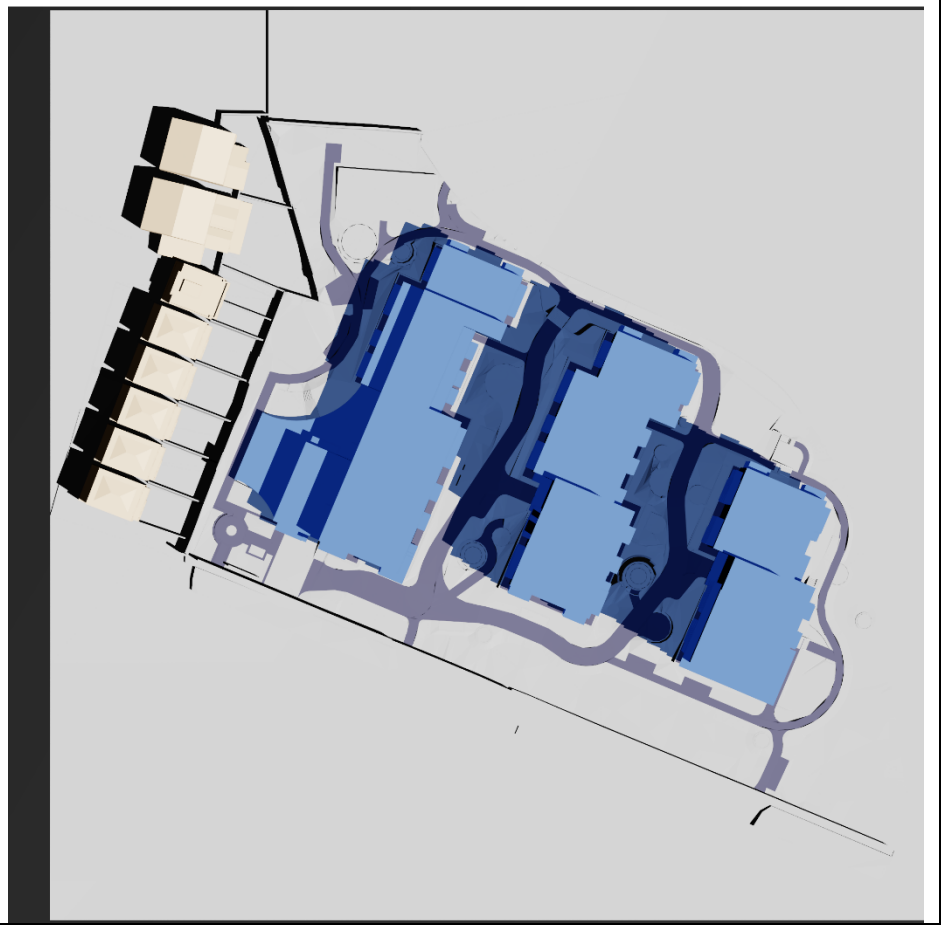


June 21st - 10:00 (UTC+1)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Jun 10-00

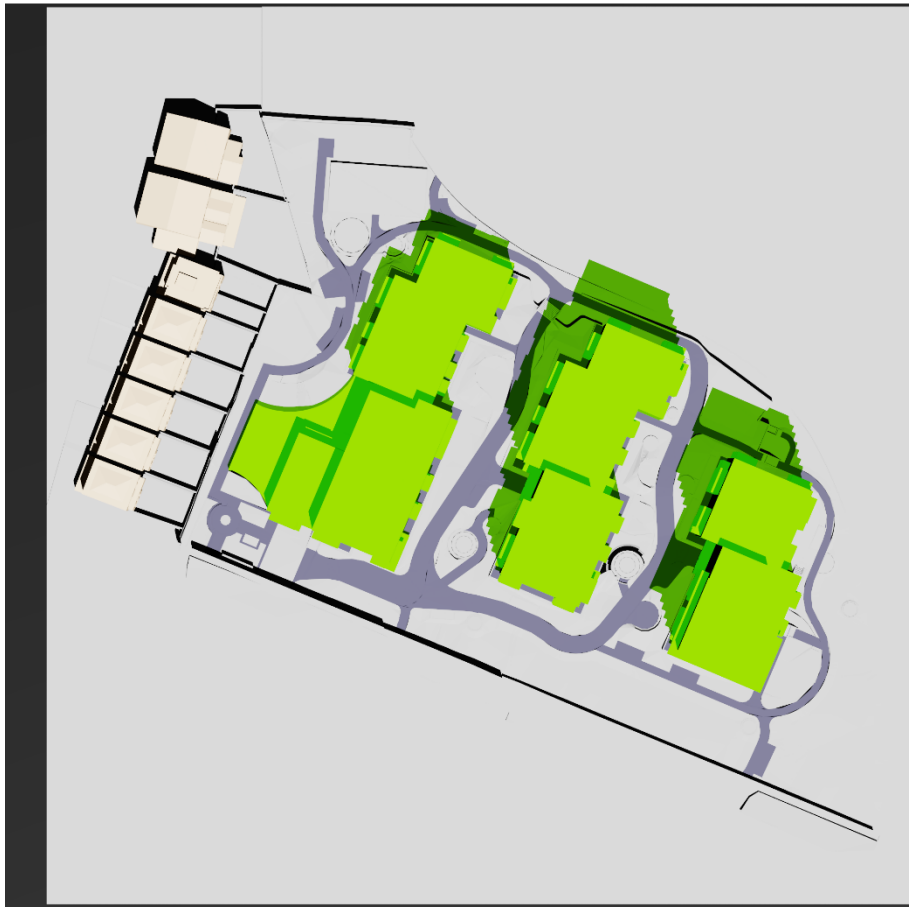


20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Jun 10-00

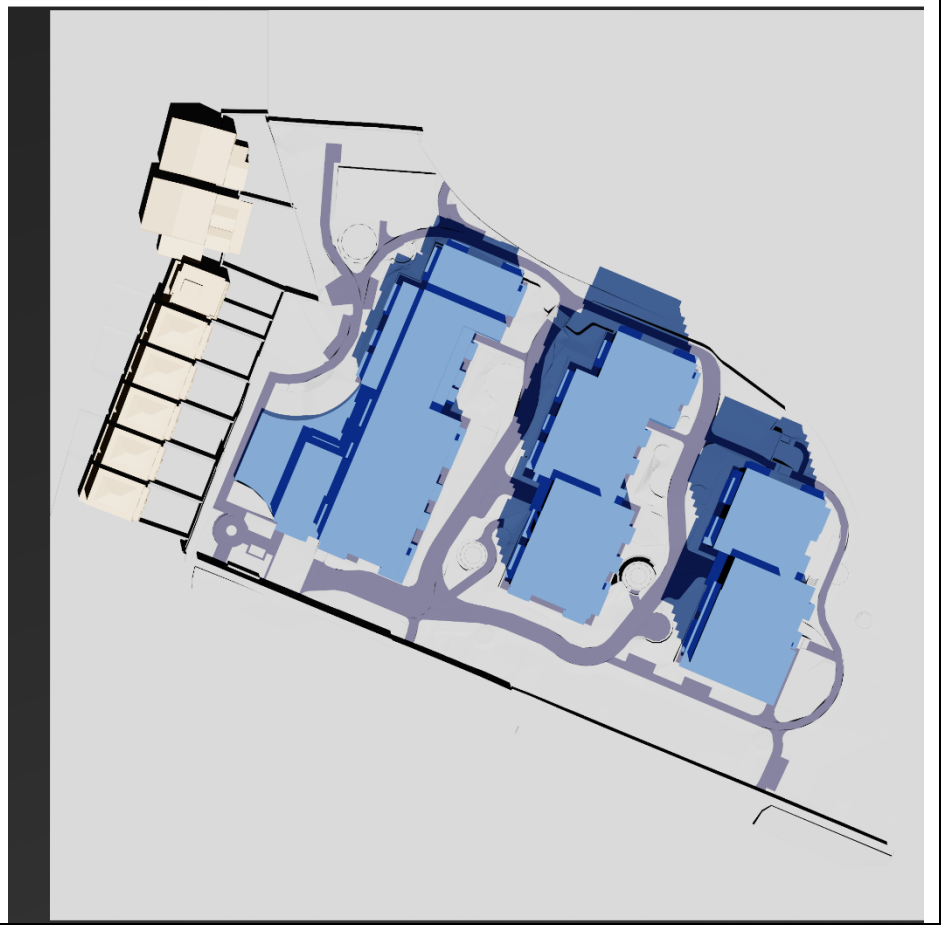


June 21st - 12:00 (UTC+1)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Jun 12-00

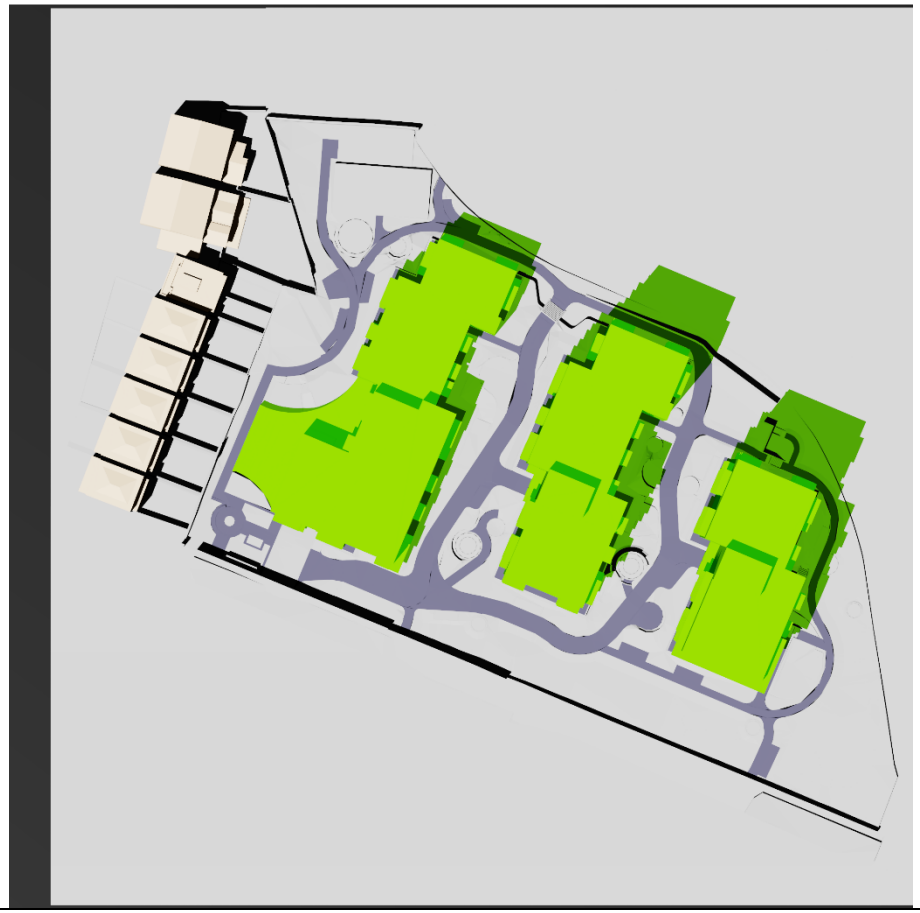


20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Jun 12-00

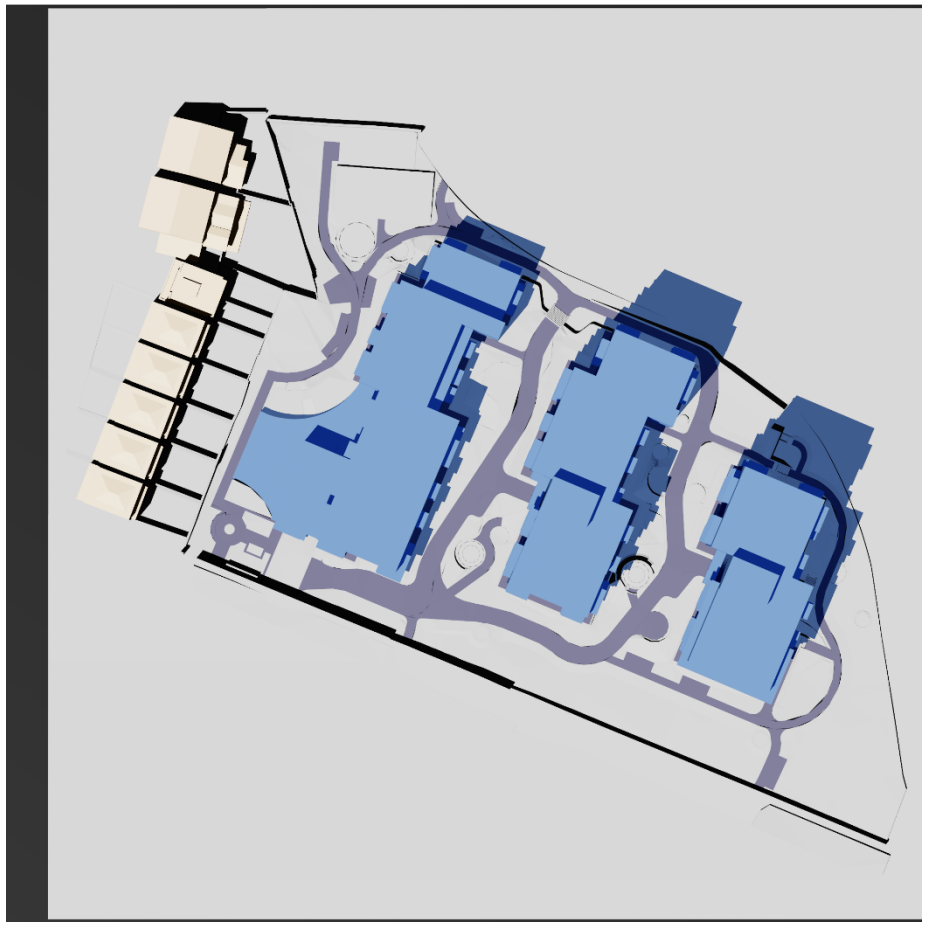


June 21st - 14:00 (UTC+1)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Jun 14-00

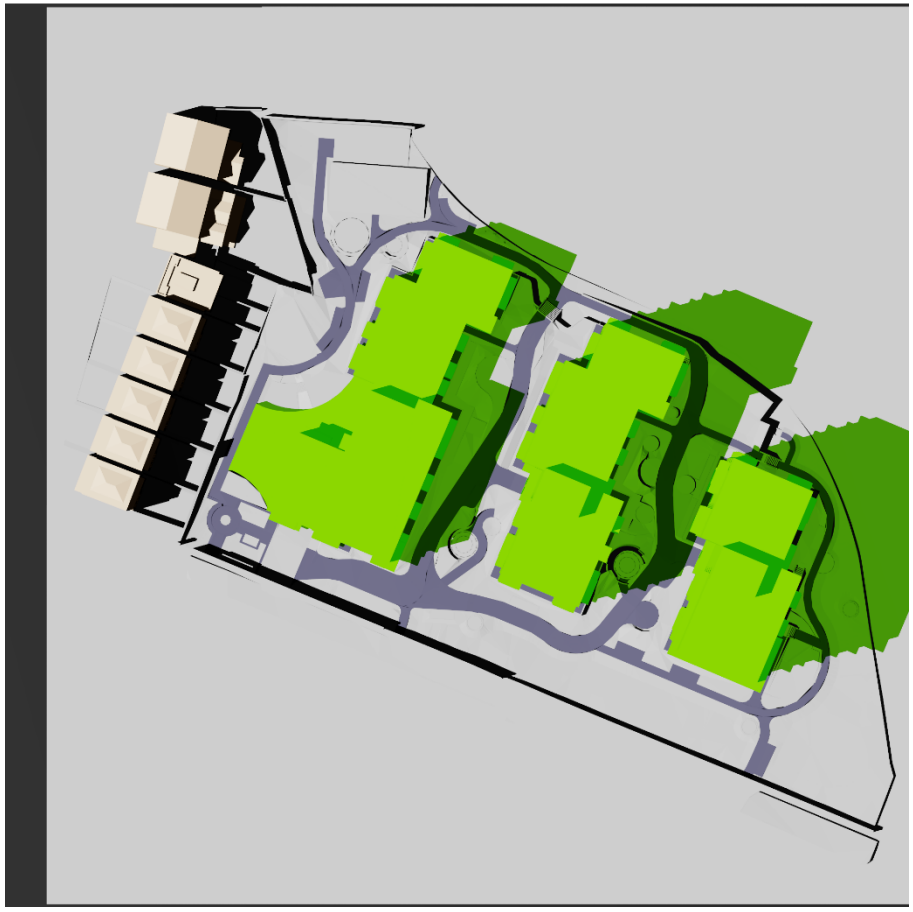


20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Jun 14-00

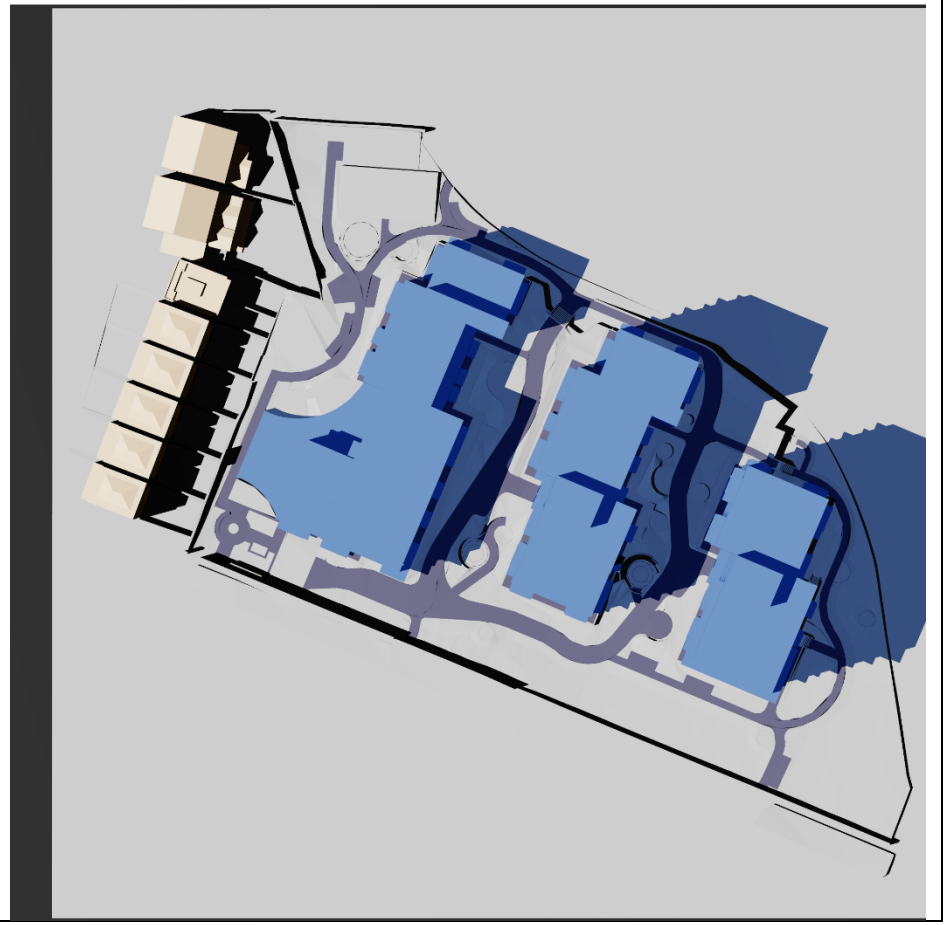


June 21st - 16:00 (UTC+1)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Jun 16-00

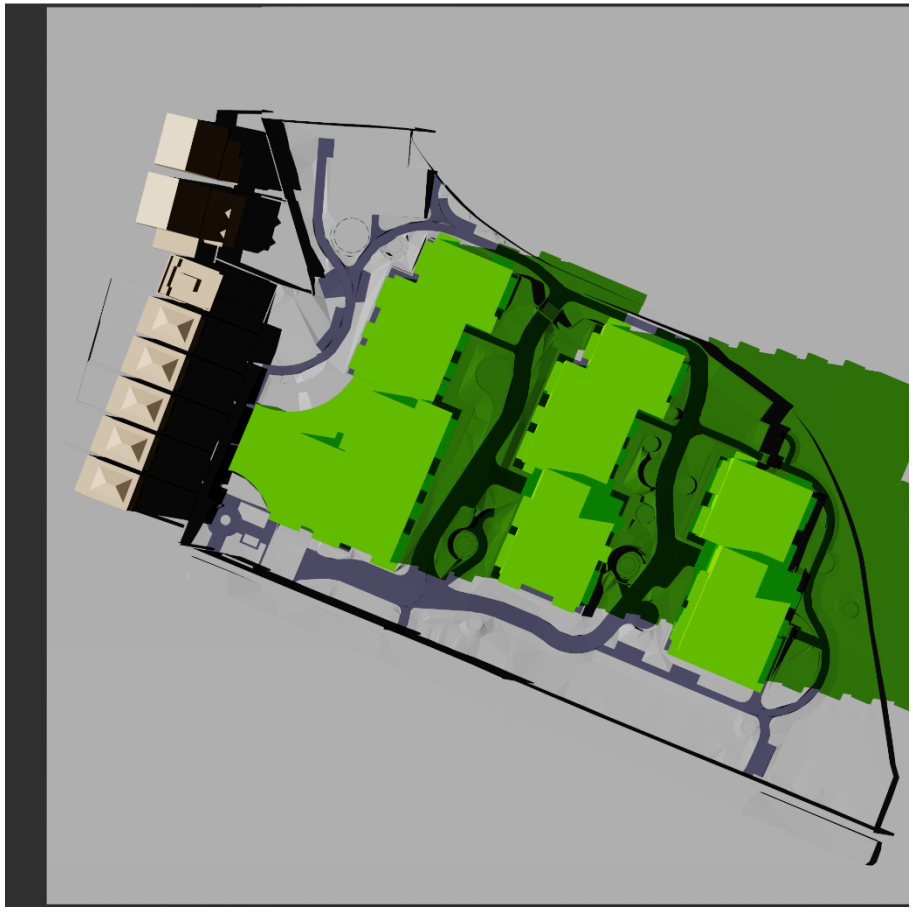


20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Jun 16-00

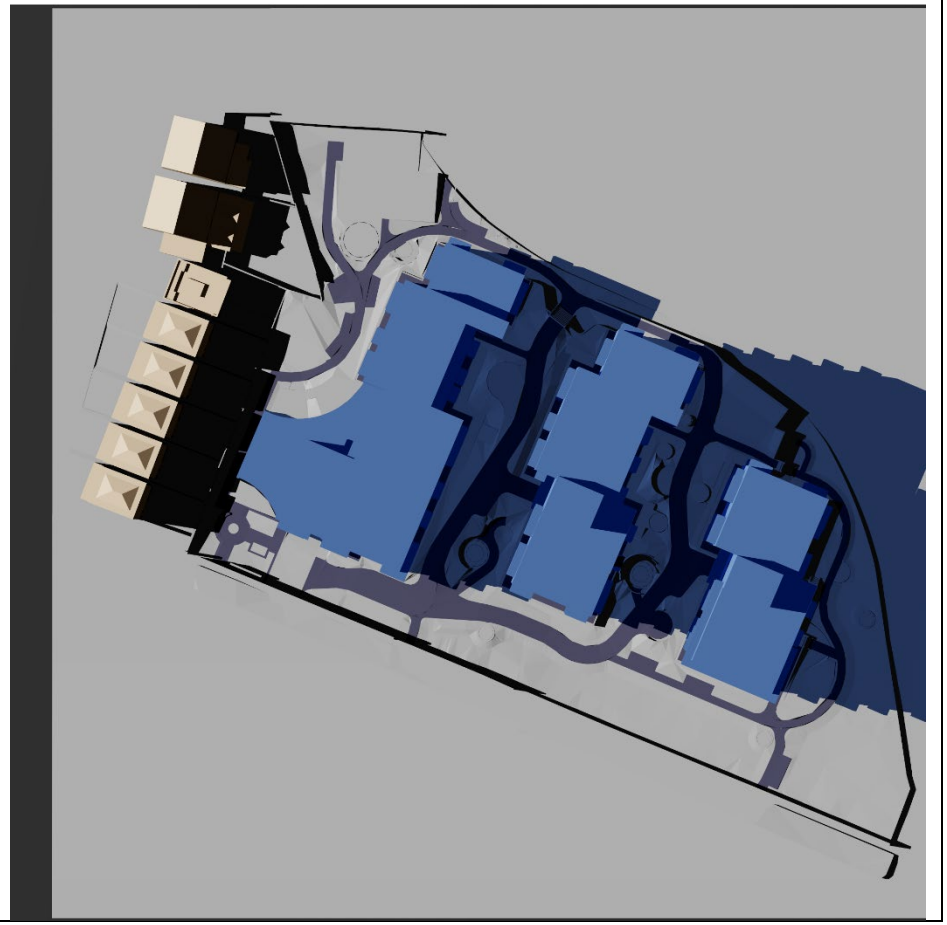


June 21st – 18:00 (UTC+1)

20538-CRO-BPC-XX-ZZ-M3-P1-03
EXISTING-21-Jun 18-00



20538-CRO-BPC-XX-ZZ-M3-P1-03
PROPOSED-21-Jun 18-00



# Appendix C Interior daylighting recommendations & sDA

As discussed in section 3.2, there are numbers 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 21: 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 | $sDA_{200,50\%} > 50\%$ |

# 6 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.

CIE. (2020). *CIE S 017:2020 ILV: International Lighting Vocabulary, 2nd edition.* CIE.

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


www.bpcengineers.com

BUILDING PERFORMANCE CONSULTING