



Daylight, Sunlight & Overshadowing Impact Assessment:

Mulberry House, 1A Eldon Road, Reading

Trevor Jenkin – The Faculty Limited

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1. INTRODUCTION

Hawkins Environmental Limited has been instructed by Trevor Jenkin at the Faculty Limited to undertake a daylight, sunlight & overshadowing assessment for the redevelopment of Mulberry House, at 1A Eldon Road, Reading.

The proposed development will see the demolition of the existing single storey dental surgery and the construction of a five-storey building, comprising 7 new dwellings. A site location plan can be seen in **Appendix 1**.

It has been identified that the site may require a daylight/sunlight assessment to determine whether the proposed development may affect the levels of daylight and sunlight falling on the windows of adjacent buildings. As a consequence, a daylight/sunlight assessment has been carried out in accordance with The Building Research Establishment (BRE) report, “*Site layout planning for daylight and sunlight*” by PJ Littlefair. This report summarises an assessment of the impacts of the proposed development on the surrounding properties potential to receive daylight and sunlight.

2. PLANNING POLICY & GUIDANCE

2.1. National Planning Policy Framework (2012)

The National Planning Policy Framework (NPPF) was published on 27th March 2012 and outlines the Government's environmental, economic and social policies for England. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 7 and 14). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.

The NPPF includes 12 core planning principles which include (Paragraph 17) *"Always seek to secure high quality design and a good standard of amenity for all existing and future occupants of land and buildings"*.

It also states that the planning system *"should contribute to and enhance the natural and local environment, by... preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution..."* (Paragraph 109) and *"To prevent unacceptable risks from pollution..., planning policies and decisions should ensure that new development is appropriate for its location"* (Paragraph 120).

However, the NPPF falls short on specifically referencing daylight, sunlight or overshadowing.

2.2. Planning Practice Guidance (2015)

The Planning Practice Guidance (PPG) was launched on 6th March 2014 and provides additional guidance and interpretation to the Government's strategic policies, outlined within the NPPF, in a web based resource. This is updated regularly.

The PPG discusses the importance of good design and references daylight and sunlight on a number of occasions, specifically the need to ensure that daylight and sunlight patterns are considered when considering the form and scale of a new building, especially in relation to tall buildings.

2.3. Local Policy

The Sites and Detailed Policies Document¹ issued by Reading Borough Council states in Policy DM4: Safeguarding Amenity:

"Development will not cause a significant detrimental impact to the living environment of existing or new residential properties, in terms of... Access to sunlight and daylight".

In the associated guidance, the documents states that:

"There is good practice guidance available on some of these issues... For instance, reference to the 'BRE Site Layout Planning for Daylight and Sunlight: A guide to good practice' document may be of use in ensuring that new development adjacent to residential properties is not of adverse bulk and does not block out sunlight and daylight to habitable rooms and outdoor living spaces."

¹ <http://www.reading.gov.uk/media/1049/Sites-and-Detailed-Policies-Adopted-October-2012/pdf/SDPD-Adopted-Oct12-Altered-Jan15.pdf>

The Reading Central Area Action Plan² goes on to say that “*in terms of effects of developments, the Building Research Establishment (BRE)²⁸ has guidelines on assessing daylighting and sunlighting effects of development, which the Council will apply flexibly given the high density of the central area.*”

2.4. Site Layout Planning for Daylight and Sunlight (2011)

The Building Research Establishment (BRE) report, “Site layout planning for daylight and sunlight” Second Edition 2011 by PJ Littlefair (referred to as the BRE Guidance) is almost universally used as the official method in the UK and Ireland for determining whether a development meets good practice standards of daylight and sunlight and for determining the impact of a development on daylight and sunlight availability.

The BRE Guidance contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight, as well as solar dazzle from sloping buildings. In addition, the BRE Report provides advice on how to design buildings to ensure that they retain good practice levels of daylight and sunlight. As well as advice, the report contains a methodology to assess levels of daylight, sunlight and overshadowing, and contains criteria to determine the potential impacts of a new development on surrounding buildings and to determine whether new developments are well lit internally. However, the report does state that the good practice guidelines are not mandatory, but should be considered as a guide to help rather than constrain the designer.

The BRE Report looks at three separate areas when considering the impacts on natural lighting:

1. **Daylight** – i.e. the impacts of diffuse daylight.
2. **Sunlight** – i.e. the impacts of only the direct sunlight; and
3. **Overshadowing** of Gardens and Open spaces.

It is important to note that the methods contained within the BRE Guidance are not tests to determine whether a development meets the guidance, rather “*A Guide to Good Practice*”. Therefore, whilst one should try to achieve the numerical guidance within the report, a transgression from the BRE Guidance does not indicate that the development is unsuitable, nor is it an indication that planning permission should be refused.

2 <http://www.reading.gov.uk/media/1047/Reading-Central-Area-Action-Plan-Adopted-January-2009/pdf/Central-Area-Action-Plan-Jan09.pdf>

3. ASSESSMENT METHODOLOGY

3.1. Methodology Overview

The assessment of daylight, sunlight and overshadowing considered several different areas, specifically:

1. The impact of the Proposed Development on levels of daylight reaching surrounding windows;
2. The impact of the Proposed Development on levels of sunlight reaching surrounding windows; and
3. The impact of the Proposed Development on sunlight and shadowing to surrounding gardens and outdoor amenity space.

The BRE Guidance provides a methodology for calculating the amount of daylight and sunlight falling on a window. The Vertical Sky Component (VSC) is used to describe the amount of daylight falling on a window, with the Annual Probable Sunlight Hours (APSH) used to describe the amount of sunlight falling on the window.

A three-dimensional computer model has been constructed using site survey information for the surrounding buildings. For each potentially effected window, the VSC and APSH has been calculated using the software packages created by MBS Survey Software Limited to create both Waldram Diagrams which plot VSC, as well as the Sunlight Availability Indicators which plot APSH. The tools created by MBS are one of the only tools in the Daylight/Sunlight sector that fully incorporate the methodologies introduced in the BRE Guidance and are widely acknowledged to be a suitable tool for undertaking daylight, sunlight and overshadowing assessments in accordance with the BRE Guidance.

The three-dimensional computer model can also be used to plot transient overshadowing. The BRE Guidance stipulates the Spring Equinox on the 21st March as the control date; however, the winter and summer solstices on the 21st December and 21st June are also commonly plotted.

It is important to note that according to the BRE Report, calculations normally do not take into account vegetation. The exception is when evergreen vegetation exists that forms a continuous barrier.

3.2. Methodology for Determining Sensitive Receptors

The BRE Guidance suggests that the assessment of daylight is required for windows serving rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, store rooms, circulation areas and garages need not be assessed. The guidelines also apply to any room that may have a reasonable expectation of daylight, including schools and hospitals. Commercial properties and hotels are deemed to have a greater reliance upon supplementary electric lighting and are therefore not included within this assessment. For the purposes of this assessment, only habitable rooms within residential properties surrounding the site have been assessed.

The BRE Guidance suggests that the assessment of sunlight is generally applied to all main living rooms and conservatories. Kitchens and bedrooms are less important, although care should be taken not to block too much sun.

Regarding overshadowing, the BRE Report suggests that the following open spaces should be checked:

- Gardens, usually the main back garden of a house;

- Parks and playing fields;
- Children's playgrounds;
- Outdoor swimming pools and paddling pools;
- Sitting out areas such as those between non-domestic buildings and in public squares; and
- Focal points for views such as a group of monuments or fountains.

3.3. Methodology for Determining Impacts

To determine the impact of the proposed development, the VSC, APSH and shadow diagrams are plotted with the proposed development in place based on the three-dimensional computer model of the proposed development and the software packages created by MBS Survey Software Limited.

3.3.1. Daylight

To determine the impact on daylight to windows, diffuse daylight of an existing building may be affected by a proposed development if either:

- The Vertical Sky Component (VSC) measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value; or
- The area of the working plane which can receive direct skylight is reduced to less than 0.8 times its former value.

It should be noted that determining the area of the working plane which can receive direct light from the sky (which is often referred to as the No-Sky Line or NSL) is seen as an additional assessment, rather than as an alternative to VSC. However, since plotting the NSL requires knowledge of the room geometry, which is not usually available during an impact assessment, it is not always possible to calculate the NSL since the use of too many assumptions would make the results meaningless and unreliable.

3.3.2. Sunlight

To determine the impact on sunlight to windows, direct sunlight of an existing windows may be affected by a Proposed Development if at the centre of a window:

- Receives less than 25% of Annual Probable Sunlight Hours (APSH) throughout the whole year, or less than 5% APSH between 21st September and 21st March;
- Receives less than 0.8 times its former APSH during either period; and
- Has a reduction in sunlight over the whole year of greater than 4% APSH.

It should be noted that loss of sunlight to windows only needs to be assessed if the window faces within 90° of due south.

3.3.3. Overshadowing

For a garden or outdoor amenity space to be considered well sunlit, at least 50% of the garden or amenity space must receive at least two hours of direct sunlight on the 21st March. If this cannot be achieved, providing

that the area overshadowed with the Proposed Development in place would be greater than 0.8 times the existing level of shadowing, it is considered that no effect on overshadowing would occur.

3.4. Significance Criteria

The BRE Guidance indicates that if the reduction in daylight or sunlight as a consequence of the impact of a development fails to meet the guidelines, the impact could be considered significant.

However, the BRE Guidance makes note that the guidance represents “Best Practice Guidance” and transgressions from the numerical guidelines within the Guidance does not necessarily meet that the development’s impact would be significant or unacceptable. The BRE Report states: *“The advice given (in the report) is not mandatory and guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in layout design.”*

It should be noted that the numerical targets set out in the main text of the BRE Guidelines have been derived from a low density suburban housing model of well-spaced two storey houses, hence the VSC target of 27%, which is equivalent to an obstruction of 25°. This is why reference is made to the circumstances for setting alternative numerical targets in Appendix F of the Guidelines where the nature of an area is dense or higher rise. For example, in an inner-city location when building are generally more than two storeys in height and when the street patter is tighter, absolute VSC values in the mid-teens are the norm, and anything above 20% will be considered “good”.

Whilst the thresholds contained within the Guidance are an important indicator when determining the impact magnitude and the significance of an impact, the BRE Guidance suggests that professional judgement should be used and the assessment of the impact should rely on a range of factors.

Whilst the threshold of noticeability has a numerical threshold, the method to describe the magnitude of the impact is less rigid and relies on judgement and the consideration of various factors. Appendix I of the BRE Guidance provides guidance on how this can be described. **Table 3.1** shows the impact descriptors upon individual receptors.

Table 3.1: Impact Descriptor

Criteria	Impact Descriptor
Where the decrease in daylight or sunlight fails to meet the guidelines, and one or more of the following scenarios applies: • a large number of windows or large area of open space is affected; • the loss of light is substantially outside the guidelines; • all windows in a particular property are affected; • the affected building or outdoor space has a particularly strong requirement for light, e.g. a living room in a dwelling or a children's playground.	Major Adverse
Where the decrease in daylight or sunlight fails to meet the guidelines, and one or more of the scenarios to describe a Minor Adverse Impact applies, and one or more of the scenarios to describe a Major Adverse Impact applies.	Moderate Adverse
Where the decrease in daylight or sunlight fails to meet the guidelines, and one or more of the following scenarios applies: • only a small number of windows or limited area of open space is affected; • the loss of light is only just outside the guidelines; • an affected room has other sources of light; • the affected building or outdoor space has a low-level requirement for light.	Minor Adverse
Where the increase/decrease in daylight or sunlight fully meets the guidelines and if there is an increase in daylight or sunlight, the increase is "tiny".	Negligible
Where the increase in daylight or sunlight is small and/or the number of affected windows or area of open space affected is small.	Minor Beneficial
Where the increase in daylight or sunlight is moderate and/or the number of affected windows or area of open space affected is moderate.	Moderate Beneficial
Where the increase in daylight or sunlight is large and/or the number of affected windows or area of open space affected is large.	Major Beneficial

Source: Adapted from Appendix I of the BRE Guidance

3.5. Internal Daylight Assessment

The Average Daylight Factor (ADF) is the accepted methodology for measuring daylight availability in a room. It describes the ratio of outside illuminance over inside illuminance, expressed as a percentage. The higher the ADF the more natural light is available in the room.

Rooms with an average DF of 2% give us a feeling of being day lit. Different types of rooms have different minimum requirements for daylighting. **Table 3.2** details the acceptable criteria for average daylight factor for habitable rooms.

Table 3.2: Daylight Factor Criteria

Room Use	Minimum Daylight Factor
Kitchens	2.0%
Living Rooms & Studies	1.5%
Bedrooms	1.0%

4. ASSESSMENT OF IMPACTS

This section summarises the impact of the proposed development on levels of daylight and sunlight on surrounding windows.

4.1. Identification of Receptors

Based on a site visit in October 2017, and also based on the plans of the development, a number of windows that could be affected have been identified. The properties of concern can be seen in the site plan in **Appendix 1**. The windows under consideration can be seen in **Appendix 2**.

The main properties of interest are:

- Hanover House;
- 4-9 Town Place; and
- 1 Eldon Road.

4.2. Computer Model

For the purposes of the assessment, a three dimensional computer model was constructed both with and without the proposed development in place. **Figures 4.1 to Figure 4.8** show the three dimensional model of the development, with and without the proposed development.

At this site, Hawkins Environmental were provided with a site survey of the existing site layout and plans and elevations of the proposed development. This information has been used to construct the three dimensional computer model. Wherever possible, survey information provided by the client and their agents has been utilised to add information to the model; however, where details were not present in the survey information, professional judgement has been used to estimate information where necessary.

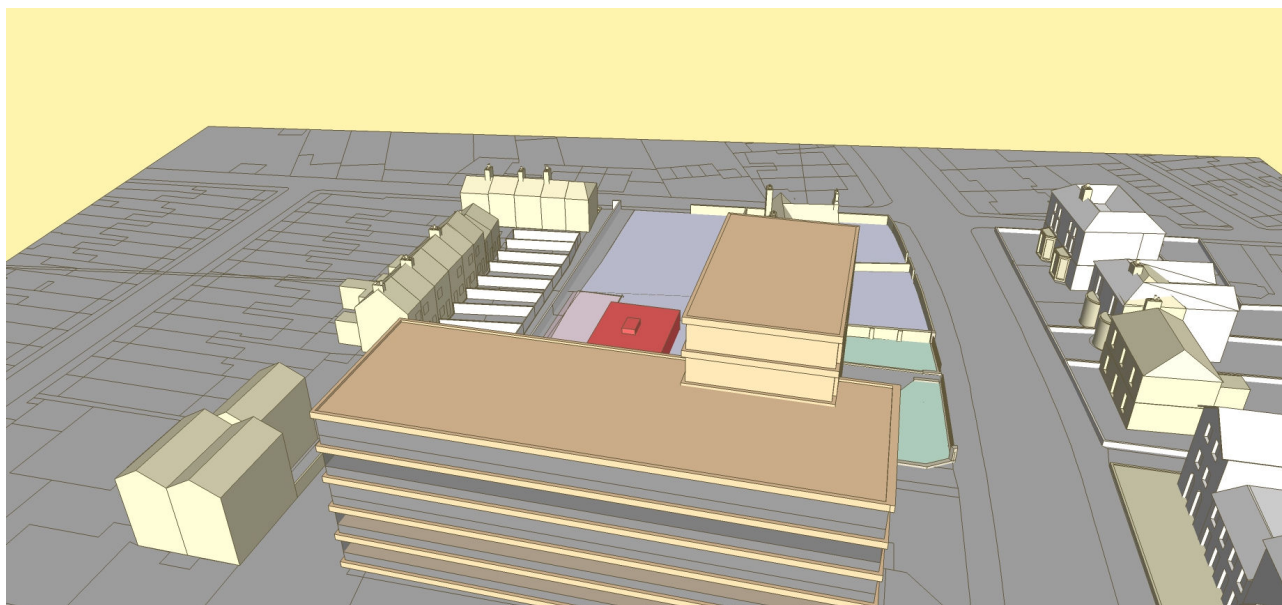
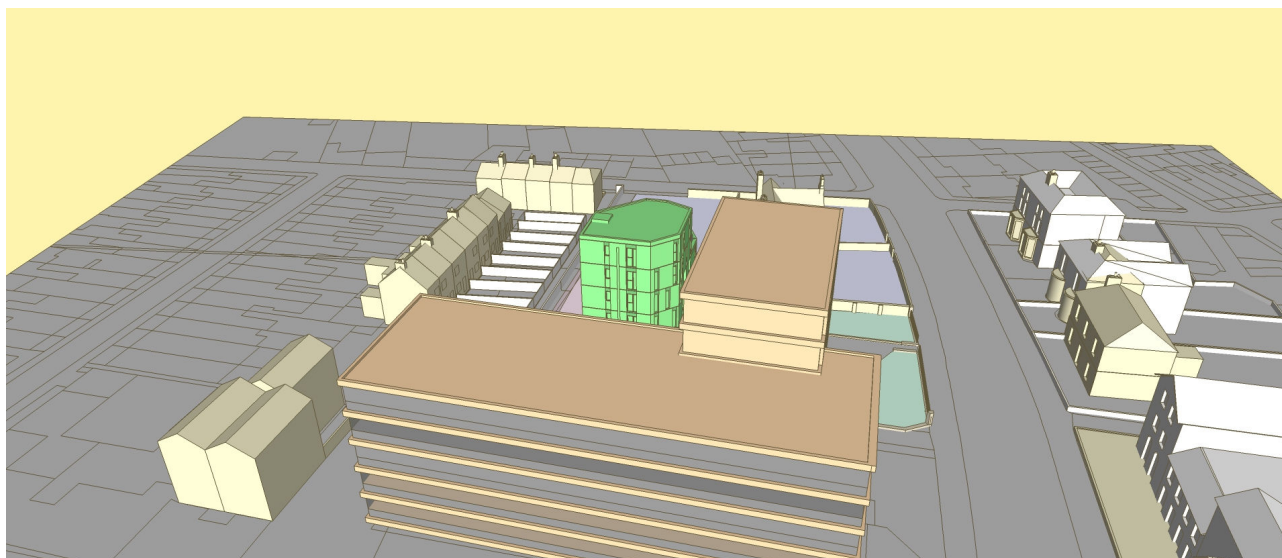
Figure 4.1: 3D model without new development from the North**Figure 4.2: 3D model with new development from the North**

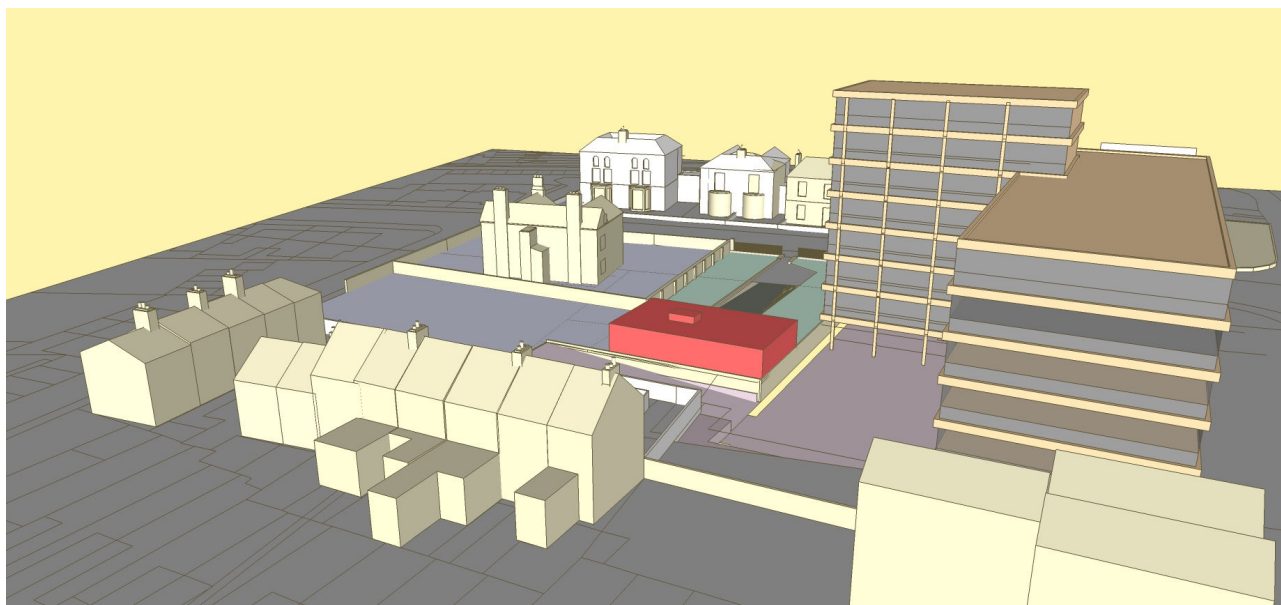
Figure 4.3: 3D model without new development from the East**Figure 4.4: 3D model with new development from the East**

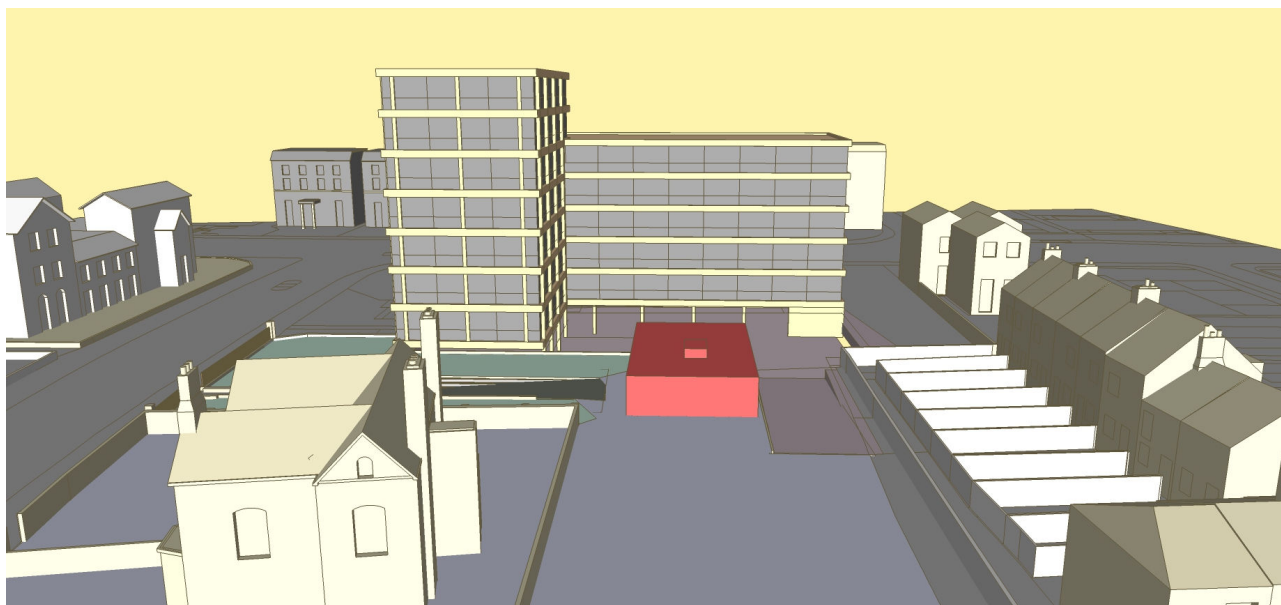
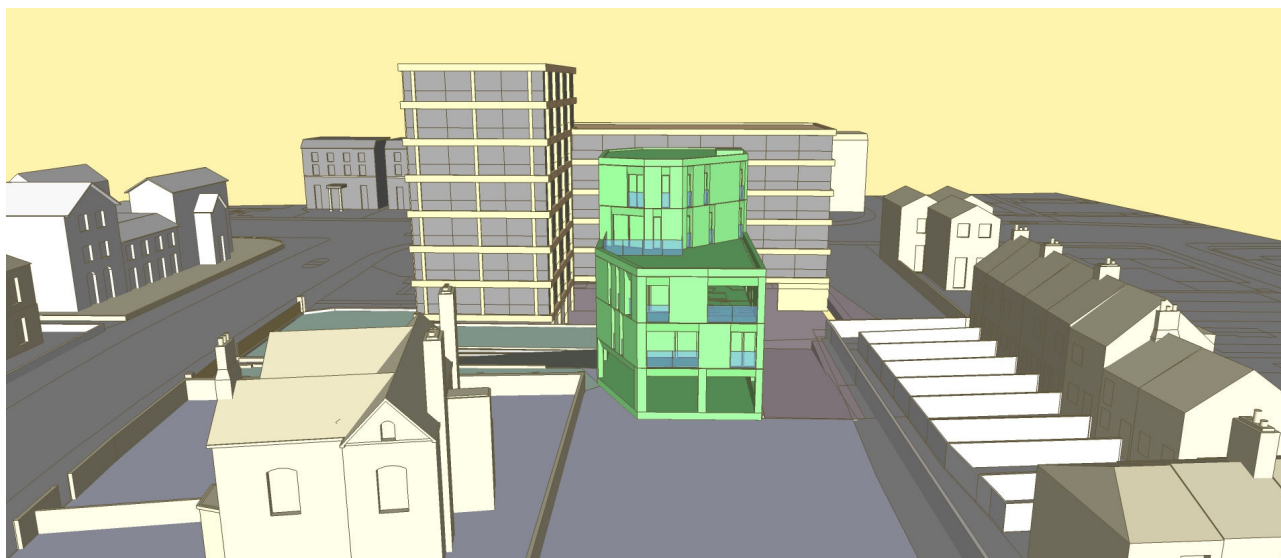
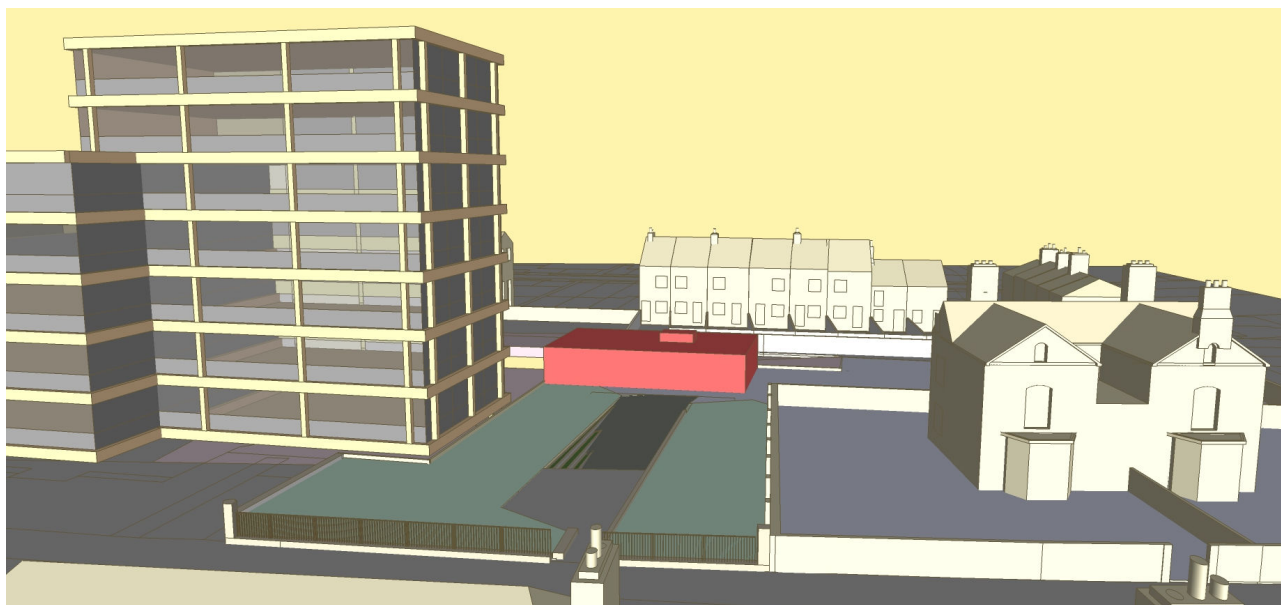
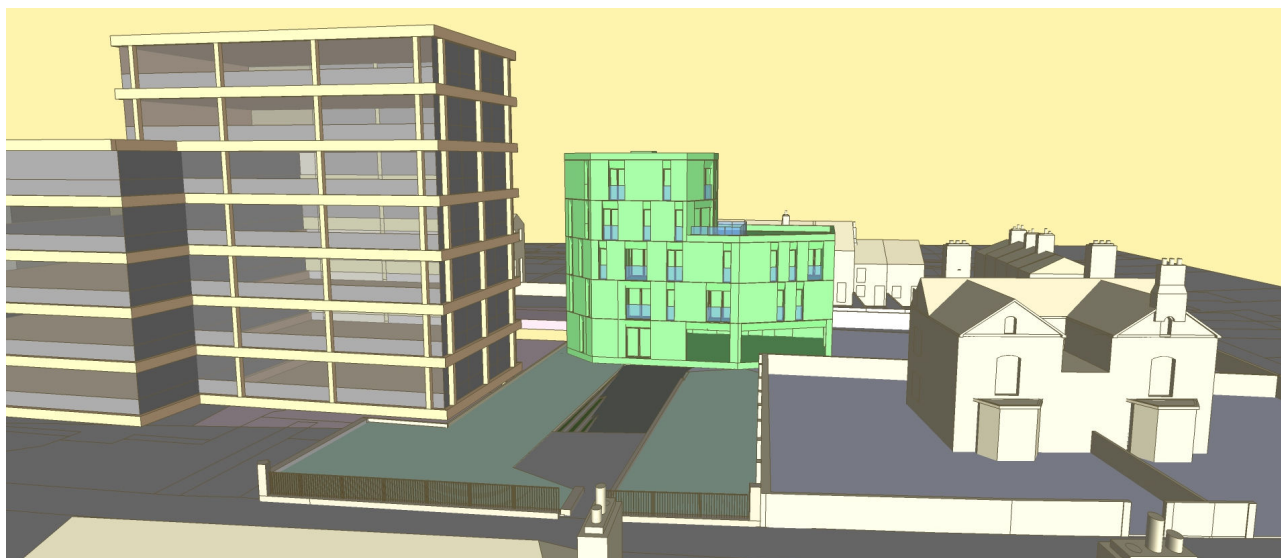
Figure 4.5: 3D model without new development from the South**Figure 4.6: 3D model with new development from the South**

Figure 4.7: 3D model without new development from the West**Figure 4.8: 3D model with new development from the West**

4.3. Daylight Assessment

Based on the plans of the site and the positions of the closest buildings, it is possible to calculate the vertical sky component for the residential buildings, for both with and without the proposed development. The results can be found in **Table 4.1** and summarised in **Table 4.2**, with sample Waldram Diagrams replicated in **Appendix 3**.

The results show that at assessed properties on Eldon Road and Town Place, whilst there is a small reduction in daylight to some of the windows, at all windows assessed at these buildings, the proposed level of daylight will either exceed 27% VSC, or where it does not exceed 27% VSC, the proposed level of daylight would be greater than 0.8 times the existing. Therefore, the reduction in daylight is unlikely to be noticeable and therefore the impact of the proposed development on levels of daylight is considered to be “negligible”.

At the Hannover House, a number of windows facing the proposed development site will not fully satisfy the BRE recommendations.

At windows 1033, 1047, 1061, 1062, 1064, 1065, 1066 and 1067, the reduction in daylight could be considered noticeable by the inhabitants; however, it was noted when visiting the site that since the dwellings are converted from offices via permitted development rights, they have unusually large windows, more in keeping with an office development rather than a residential development. Therefore, it was considered possible, that these dwellings would still be considered well lit even with the reduction in daylight, by virtue of the large windows.

Consequently, floor plans of the dwellings were obtained and Average Daylight Factor (ADF) calculations of these rooms with the proposed development in place were carried out. **Table 4.3** shows these calculations, with **Table 4.4** showing the results. **Table 4.4** shows that each of the rooms will continue to receive a minimum of 2% ADF, which indicates that each of the rooms will continue to be considered well day lit. Consequently, even though there will be a noticeable reduction in daylight at these 8 windows, any impact is considered to be less significant since the rooms will continue to be well lit. Therefore, under the guidance contained within Appendix I of the BRE Report and replicated in **Table 2.1** of this report, it is considered that there will be a “negligible” impact to Hannover House.

It is important to note that the BRE Guidance represents “Best Practice Guidance”; the failure to meet the numerical guidelines within the report does not necessarily mean that the development’s impact will be unacceptable. The BRE report states that “*The advice given (in the report) is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in layout design.*”

The proposed development site is located immediately adjacent to the Reading Centre Area, with Hannover House located within this Area. The Reading Central Area Action Plan notes that “*in terms of effects of developments, the Building Research Establishment (BRE) has guidelines on assessing daylighting and sunlighting effects of development, which the Council will apply flexibly given the high density of the central area.*”

4.4. Sunlight Assessment

In order to assess the impact of a development on the levels of sunlight, the APSH has been calculated for those windows which face within 90° of due south and hence fall within the BRE Sunlight criteria.

According to the BRE Report, direct sunlight on an existing window may be affected by a proposed development if the centre of a window receives less than 25% of Annual Probable Sunlight Hours (APSH), or less than 5% APSH between 21st September and 21st March; **and** receives less than 0.8 times its former APSH during either period; **and** has a reduction in sunlight over the whole year of greater than 4% APSH.

Table 4.1 details the results of the Annual Probable Sunlight Hours (APSH) calculations for the windows under consideration, with sample Sunlight Indicator Diagrams replicated in **Appendix 4**.

It can be seen from **Table 4.1** that 3 windows will be affected during both the whole year and during the winter months, plus a further 3 windows will be affected during the winter months only. These windows serve a total of 5 dwellings. However, of the 5 dwellings, 3 are dual aspect with windows on an alternative façade that will remain well sunlit even with proposed development. Consequently, under the BRE guidance this reduction would not necessarily be considered significant as the occupants would still have access to some direct sunlight. Similarly, the remaining single aspect dwelling will only be affected during the winter months and only to a single window and therefore it is considered that whilst there will be a reduction in the amount of sunlight received at this dwelling, the occupants will still have access to some direct sunlight and therefore the reduction in sunlight to all dwellings would be considered “negligible”.

Table 4.1: Daylight and Sunlight Impact Assessment

Address	Window No.	Vertical Sky Component %			Annual Probable Sunlight Hours %					
		Existing	Proposed	Ratio*	Existing		Proposed		Ratio*	
					Full Year	Winter Only	Full Year	Winter Only	Full Year	Winter Only
Hanover House	1001	35.75	35.63	1.00	78	30	78	30	1.00	1.00
Hanover House	1002	35.69	35.54	1.00	77	30	77	30	1.00	1.00
Hanover House	1003	35.60	35.34	0.99	78	30	78	30	1.00	1.00
Hanover House	1004	35.72	35.32	0.99	78	30	78	30	1.00	1.00
Hanover House	1005	35.26	34.46	0.98	40	11	40	11	1.00	1.00
Hanover House	1006	34.87	34.49	0.99	41	12	41	12	1.00	1.00
Hanover House	1007	33.28	33.08	0.99	40	12	40	12	1.00	1.00
Hanover House	1008	23.44	23.18	0.99	53	17	53	17	1.00	1.00
Hanover House	1009	29.61	29.32	0.99	62	20	62	20	1.00	1.00
Hanover House	1010	33.63	33.30	0.99	73	23	73	23	1.00	1.00
Hanover House	1011	35.92	35.60	0.99	77	24	77	24	1.00	1.00
Hanover House	1012	37.25	36.96	0.99	84	27	84	27	1.00	1.00

Address	Window No.	Vertical Sky Component %			Annual Probable Sunlight Hours %					
		Existing	Proposed	Ratio*	Existing		Proposed		Ratio*	
					Full Year	Winter Only	Full Year	Winter Only	Full Year	Winter Only
Hanover House	1013	38.03	37.78	0.99	84	27	84	27	1.00	1.00
Hanover House	1014	38.51	38.30	0.99	86	28	86	28	1.00	1.00
Hanover House	1015	35.75	35.05	0.98	78	30	76	28	0.97	0.93
Hanover House	1016	35.69	34.79	0.97	77	30	74	27	0.96	0.90
Hanover House	1017	35.60	34.00	0.95	78	30	74	27	0.95	0.90
Hanover House	1018	35.72	33.35	0.93	78	30	74	27	0.95	0.90
Hanover House	1019	33.80	29.07	0.86	39	11	33	5	0.85	0.45
Hanover House	1020	32.16	29.91	0.93	40	12	38	10	0.95	0.83
Hanover House	1021	27.77	26.59	0.96	40	12	40	12	1.00	1.00
Hanover House	1022	20.61	19.10	0.93	45	16	45	16	1.00	1.00
Hanover House	1023	25.41	23.70	0.93	53	20	53	20	1.00	1.00
Hanover House	1024	29.07	27.16	0.93	63	23	63	23	1.00	1.00
Hanover House	1025	31.53	29.62	0.94	68	24	68	24	1.00	1.00

Address	Window No.	Vertical Sky Component %			Annual Probable Sunlight Hours %					
		Existing	Proposed	Ratio*	Existing		Proposed		Ratio*	
					Full Year	Winter Only	Full Year	Winter Only	Full Year	Winter Only
Hanover House	1026	33.11	31.39	0.95	71	25	71	25	1.00	1.00
Hanover House	1027	34.11	32.62	0.96	74	27	74	27	1.00	1.00
Hanover House	1028	34.75	33.51	0.96	77	28	76	27	0.99	0.96
Hanover House	1029	35.64	34.20	0.96	78	30	73	27	0.94	0.90
Hanover House	1030	35.59	33.75	0.95	77	30	74	27	0.96	0.90
Hanover House	1031	35.51	32.45	0.91	78	30	69	25	0.88	0.83
Hanover House	1032	35.62	31.30	0.88	78	30	67	24	0.86	0.80
Hanover House	1033	32.27	24.08	0.75	39	11	25	4	0.64	0.36
Hanover House	1034	29.72	25.55	0.86	40	12	34	6	0.85	0.50
Hanover House	1035	24.81	22.54	0.91	37	12	34	9	0.92	0.75
Hanover House	1036	20.08	17.19	0.86	43	16	40	13	0.93	0.81
Hanover House	1037	24.39	21.13	0.87	52	20	49	17	0.94	0.85
Hanover House	1038	27.87	24.26	0.87	59	23	55	19	0.93	0.83

Address	Window No.	Vertical Sky Component %			Annual Probable Sunlight Hours %					
		Existing	Proposed	Ratio*	Existing		Proposed		Ratio*	
					Full Year	Winter Only	Full Year	Winter Only	Full Year	Winter Only
Hanover House	1039	30.39	26.78	0.88	63	24	59	20	0.94	0.83
Hanover House	1040	32.08	28.85	0.90	68	25	64	21	0.94	0.84
Hanover House	1041	33.22	30.40	0.92	72	27	69	24	0.96	0.89
Hanover House	1042	33.97	31.58	0.93	74	28	71	25	0.96	0.89
Hanover House	1043	34.70	32.49	0.94	78	30	71	27	0.91	0.90
Hanover House	1044	34.70	31.88	0.92	77	30	69	26	0.90	0.87
Hanover House	1045	34.62	30.36	0.88	78	30	65	25	0.83	0.83
Hanover House	1046	34.72	28.99	0.83	78	30	60	24	0.77	0.80
Hanover House	1047	30.25	20.10	0.66	39	11	14	2	0.36	0.18
Hanover House	1048	27.38	21.86	0.80	40	12	28	4	0.70	0.33
Hanover House	1049	22.83	19.62	0.86	36	12	29	5	0.81	0.42
Hanover House	1050	19.80	15.81	0.80	44	16	39	11	0.89	0.69
Hanover House	1051	23.77	19.04	0.80	52	20	47	15	0.90	0.75

Address	Window No.	Vertical Sky Component %			Annual Probable Sunlight Hours %					
		Existing	Proposed	Ratio*	Existing		Proposed		Ratio*	
					Full Year	Winter Only	Full Year	Winter Only	Full Year	Winter Only
Hanover House	1052	27.10	21.88	0.81	57	23	51	17	0.89	0.74
Hanover House	1053	29.59	24.43	0.83	61	24	53	16	0.87	0.67
Hanover House	1054	31.29	26.72	0.85	65	24	59	18	0.91	0.75
Hanover House	1055	32.44	28.43	0.88	72	27	67	22	0.93	0.81
Hanover House	1056	33.21	29.73	0.90	76	28	72	24	0.95	0.86
Hanover House	1057	33.32	30.60	0.92	76	28	67	25	0.88	0.89
Hanover House	1058	33.31	29.86	0.90	75	28	62	22	0.83	0.79
Hanover House	1059	33.22	28.30	0.85	77	29	58	23	0.75	0.79
Hanover House	1060	33.31	26.91	0.81	77	29	59	23	0.77	0.79
Hanover House	1061	28.16	17.21	0.61	39	11	12	1	0.31	0.09
Hanover House	1062	25.31	18.85	0.74	39	11	25	4	0.64	0.36
Hanover House	1063	21.30	17.44	0.82	35	11	24	2	0.69	0.18
Hanover House	1064	19.14	13.88	0.73	42	15	35	8	0.83	0.53

Address	Window No.	Vertical Sky Component %			Annual Probable Sunlight Hours %					
		Existing	Proposed	Ratio*	Existing		Proposed		Ratio*	
					Full Year	Winter Only	Full Year	Winter Only	Full Year	Winter Only
Hanover House	1065	22.75	16.92	0.74	50	19	41	10	0.82	0.53
Hanover House	1066	25.89	19.43	0.75	56	22	48	14	0.86	0.64
Hanover House	1067	28.30	21.92	0.77	60	23	50	13	0.83	0.57
Hanover House	1068	29.91	24.31	0.81	64	24	56	16	0.88	0.67
Hanover House	1069	31.00	26.07	0.84	70	27	62	19	0.89	0.70
Hanover House	1070	31.75	27.37	0.86	73	28	67	22	0.92	0.79
9 Town Place	1071	31.88	27.27	0.86	Sunlight Assessment Not Required					
9 Town Place	1072	30.16	24.57	0.81	Sunlight Assessment Not Required					
8 Town Place	1073	32.39	27.82	0.86	Sunlight Assessment Not Required					
8 Town Place	1074	30.72	25.09	0.82	Sunlight Assessment Not Required					
7 Town Place	1075	33.33	28.98	0.87	Sunlight Assessment Not Required					
7 Town Place	1076	31.76	26.26	0.83	Sunlight Assessment Not Required					
6 Town Place	1077	34.30	30.76	0.90	Sunlight Assessment Not Required					

Address	Window No.	Vertical Sky Component %			Annual Probable Sunlight Hours %					
		Existing	Proposed	Ratio*	Existing		Proposed		Ratio*	
					Full Year	Winter Only	Full Year	Winter Only	Full Year	Winter Only
6 Town Place	1078	32.84	28.12	0.86	Sunlight Assessment Not Required					
5 Town Place	1079	34.87	32.02	0.92	Sunlight Assessment Not Required					
5 Town Place	1080	33.46	29.56	0.88	Sunlight Assessment Not Required					
4 Town Place	1081	35.40	33.18	0.94	Sunlight Assessment Not Required					
4 Town Place	1082	33.97	30.83	0.91	Sunlight Assessment Not Required					
1 Eldon Road	1083	33.49	31.26	0.93	Sunlight Assessment Not Required					
1 Eldon Road	1084	31.73	28.55	0.90	Sunlight Assessment Not Required					
1 Eldon Road	1085	30.05	26.14	0.87	Sunlight Assessment Not Required					

*= Ratio of proposed levels compared to existing levels

Table 4.2: Results of the Daylight Analysis

Receptor	Number of Windows Assessed	Existing Number of Windows Exceeding 27% VSC	Proposed Number of Windows Exceeding 27% VSC	No of Windows Transgressing from the BRE Guidance*
Hanover House	70	56	41	8
9 Town Place	2	2	1	0
8 Town Place	2	2	1	0
7 Town Place	2	2	1	0
6 Town Place	2	2	2	0
5 Town Place	2	2	2	0
4 Town Place	2	2	2	0
1 Eldon Road	3	3	2	0

Note: 'No. of Windows Transgressing from the BRE Guidance' refers to the number of windows where daylight is less than 27% AND less than 0.8 times of existing levels.

Table 4.3: Daylight Factor Calculations – Hannover House

Window	Room Use	T	Aw m2	VSC %	θ Degree s	A m3	R
1033	Lounge/ Kitchen	0.68	4.6	24.07	60	91	0.5
1047	Lounge/ Kitchen	0.68	4.6	20.10	54	91	0.5
1061	Lounge/ Kitchen	0.68	4.6	17.18	49	91	0.5
1062	Bedroom	0.68	3.6	18.85	52	54	0.5
1064	Lounge/ Kitchen	0.68	3.9	13.88	42	75	0.5
1065	Bedroom	0.68	2.7	16.92	48	43	0.5
1066	Bedroom	0.68	2.7	19.42	53	43	0.5
1067	Lounge/ Kitchen	0.68	3.9	21.91	57	75	0.5

Table 4.4: ADF Results – Hanover House

Window	Room Use	Average Daylight Factor (%)
1033	Lounge/ Kitchen	2.7
1047	Lounge/ Kitchen	2.5
1061	Lounge/ Kitchen	2.2
1062	Bedroom	3.1
1064	Lounge/ Kitchen	2.0
1065	Bedroom	2.7
1066	Bedroom	3.0
1067	Lounge/ Kitchen	2.7

4.5. Overshadowing Assessment

This section summarises the overshadowing impacts of the proposed development on gardens and outdoor amenity space. In order to assess the effects of overshadowing on gardens and outdoor amenity space, a three dimensional model of the development and surrounding buildings has been constructed and the shadows caused by the building on the 21st March has been assessed. The 21st March is utilised because the day and night-time periods are of equal length. Furthermore, the 21st March has been chosen as it is the Spring Equinox

and is considered to be the first day of the year when the ability to enjoy ones garden or amenity space is important. **Appendix 5** shows the results of the overshadowing assessment at hourly intervals from 0700 hrs to 1700 hrs on the 21st March for the existing and proposed site layout, as well as on the 21st June (the Summer Solstice) and the 21st December (the Winter Solstice).

The Second Edition of the BRE Report, published in 2011, requires at least 50% of the garden should be capable of receiving at least two full hours of direct sunlight on the 21st March. If this cannot be achieved, providing that the area overshadowed was greater than 0.8 times its former value, no impact would have occurred.

The shadow diagrams in **Appendix 5** shows that on the 21st March, the proposed development causes some additional shading to the rear garden of 220 King's Road (which is used as an educational establishment) during the latter part of the day. However, the shadow diagrams show that the garden receives plenty of direct sunlight during the rest of the day. Consequently, any impact upon this amenity space is considered to be insignificant.

5. INTERIOR DAYLIGHTING CALCULATIONS

It has been determined during the process of the planning application that the habitable rooms will require an internal daylight assessment to determine whether they meet the best practice guidelines on internal daylighting.

5.1. Average Daylight Factor

The average daylight factor assessment has been calculated for all of the proposed development. Under the BRE guidelines, the minimum ADF recommended for bedrooms is 1%, living rooms is 1.5% and for kitchens is 2%.

The ADF is calculated by the following formula provided within the Building Research Establishment (BRE) report, *“Site layout planning for daylight and sunlight – Second Edition 2011”* by PJ Littlefair:

$$\text{ADF} = \frac{T A_w \theta}{A (1 - R^2)}$$

Where:

T is the diffuse visible transmittance of the glazing (normally 0.68 for double glazing, or lower for roof lights that may be susceptible to soiling);

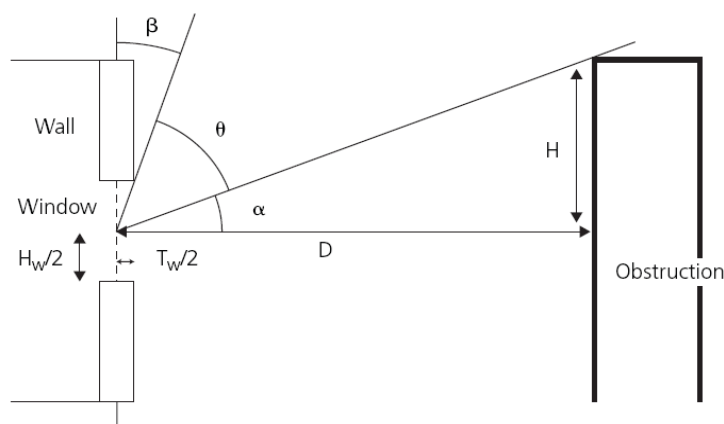
A_w is the net glazed area of the windows (in m²);

θ is the angle of visible sky in degrees;

A is the total area of room surfaces (in m²), which includes walls, ceilings and floors; and

R is the average room reflectance (normally 0.5).

Whilst most of the values in the calculation are self explanatory, the angle of visible sky (θ) is more complicated to calculate. **Figure 5.1** graphically shows the angle of concern. θ (the angle of visible sky), can be calculated by subtracting β (the angle of sky obscured by the thickness of the wall) and α (the angle to the sky from the horizontal) from 90°. The angle to the sky from the horizontal is the most important angle, and this is a function of the height of the main obstruction to the window, as well as the distance to this obstruction.

Figure 5.1: Calculating the Angle of Visible Sky

Where: T is the diffuse visible transmittance of the glazing;
 A_w is the net glazed area of the windows (in m^2);
 θ is the angle of visible sky in degrees;
 A is the total area of room surfaces (in m^2), which includes walls, ceilings and floors; and
 R is the average room reflectance.

In more complex situations, where there are multiple obstructions, at different heights and distances from the windows of concern, it is possible to model the Vertical Sky Component (VSC) of each window. The VSC is the amount of light falling on the window and is a function of the angle of sky visible from the window. Once the VSC is calculated, it is possible to convert this figure into θ , based on factors provided within the BRE Report, in order to calculate the ADF.

To calculate the VSC, the software packages created by MBS Survey Software Limited have been utilised to create Waldram Diagrams which plot VSC. The tools created by MBS are one of the only tools in the Daylight/Sunlight sector that fully incorporate the methodologies introduced in the Building Research Establishment (BRE) report, "*Site layout planning for daylight and sunlight*" Second Edition 2011 by PJ Littlefair and is widely acknowledged to be a suitable tool for undertaking daylight, sunlight and overshadowing assessments in accordance with the BRE Guidance. For the purposes of the assessment, a three-dimensional computer model was constructed both with and without the proposed development in place.

For the proposed dwellings, **Table 5.1** shows the daylight factor calculations for each window, with **Table 5.2** showing the aggregated results of these calculations for each room.

Table 5.1: Daylight Factor Calculations

Room	T	A _w m ²	VSC %	θ°	A m ³	R
Flat 1 – Single Bedroom	0.68	2.4	16.34	47	55.4	0.5
Flat 1 – Double Bedroom	0.68	4.4	16.01	46	66.2	0.5
Flat 1 – Lounge/Kitchen	0.68	1.2	24.49	61	115.6	0.5
	0.68	6.9	11.19	37	115.6	0.5
Flat 2 – Lounge/Kitchen	0.68	2.4	25.54	62	111.0	0.5
	0.68	9.6	11.33	37	111.0	0.5
Flat 2 – Double Bedroom	0.68	3.4	34.41	78	76.2	0.5
	0.68	2.4	33.30	76	76.2	0.5
Flat 2 – Single Bedroom	0.68	2.4	33.19	76	48.0	0.5
Flat 3 – Single Bedroom	0.68	2.4	20.00	54	48.6	0.5
Flat 3 – Lounge/Kitchen	0.68	1.2	20.53	54	111.9	0.5
	0.68	8.5	6.15	28	111.9	0.5
Flat 4 – Double Bedroom	0.68	2.4	29.58	69	57.9	0.5
Flat 4 – Lounge/Kitchen	0.68	2.2	27.57	66	127.8	0.5
	0.68	2.4	27.91	66	127.8	0.5
	0.68	6.2	8.88	31	127.8	0.5
Flat 5 – Lounge/Kitchen	0.68	11.1	15.02	44	96.6	0.5
	0.68	2.4	28.82	68	96.6	0.5
Flat 5 – Double Bedroom	0.68	2.4	35.67	81	55.2	0.5
Flat 6 – Single Bedroom	0.68	2.4	24.08	60	54.4	0.5
Flat 6 – Double Bedroom	0.68	1.3	11.79	38	58.2	0.5
	0.68	2.4	26.07	63	58.2	0.5
Flat 6 – Lounge/Kitchen	0.68	2.4	26.80	65	114.9	0.5
	0.68	5.8	38.56	86	114.9	0.5
	0.68	1.2	29.37	69	114.9	0.5
	0.68	2.4	29.38	69	114.9	0.5

Room	T	A _w m ²	VSC %	θ°	A m ³	R
Flat 7 – Single Bedroom	0.68	2.4	28.41	67	54.4	0.5
Flat 7 – Double Bedroom	0.68	1.3	14.60	44	58.2	0.5
	0.68	2.4	27.77	66	58.2	0.5
Flat 7 – Lounge/Kitchen	0.68	1.2	26.98	65	114.9	0.5
	0.68	2.4	36.57	82	114.9	0.5
	0.68	1.2	30.38	71	114.9	0.5
	0.68	2.4	29.39	69	114.9	0.5

Table 5.2: ADF Results

Room	Average Daylight Factor
Flat 1 – Single Bedroom	1.9
Flat 1 – Double Bedroom	2.8
Flat 1 – Lounge/Kitchen	2.6
Flat 2 – Lounge/Kitchen	4.1
Flat 2 – Double Bedroom	5.4
Flat 2 – Single Bedroom	3.5
Flat 3 – Single Bedroom	2.5
Flat 3 – Lounge/Kitchen	2.5
Flat 4 – Double Bedroom	2.6
Flat 4 – Lounge/Kitchen	3.5
Flat 5 – Lounge/Kitchen	6.2
Flat 5 – Double Bedroom	3.2
Flat 6 – Single Bedroom	2.4
Flat 6 – Double Bedroom	3.2
Flat 6 – Lounge/Kitchen	7.1
Flat 7 – Single Bedroom	2.7
Flat 7 – Double Bedroom	3.4

Room	Average Daylight Factor
Flat 7 – Lounge/Kitchen	4.2

The BRE Report suggests that kitchens should have a minimum ADF of 2%, living rooms 1.5% and bedrooms 1%. **Table 5.2** shows that in the proposed new dwellings, all rooms will meet the minimum recommended best practice levels of interior daylight.

6. CONCLUSIONS

Calculations were conducted in accordance with the BRE Report in order to determine the extent to which the proposed redevelopment of Mulberry House will affect the levels of daylight and sunlight at adjacent properties.

The calculations have shown that whilst there will be a noticeable reduction to daylight to eight windows at Hannover House, the rooms that these windows will serve will retain good levels of daylight by virtue of their large windows. Consequently, it is considered that the proposed development will have a “negligible” impact to surrounding dwellings. It should be noted that the proposed development site is located immediately adjacent to the Reading Centre Area, with Hannover House located within this Area. The Reading Central Area Action Plan notes that “*in terms of effects of developments, the Building Research Establishment (BRE) has guidelines on assessing daylighting and sunlighting effects of development, which the Council will apply flexibly given the high density of the central area*”. Consequently, this impact could be considered acceptable given the dense urban nature of the location of the proposed development and the need for high density housing.

Appendix 1 Site Location Plan

Appendix 1: Site Location Plan

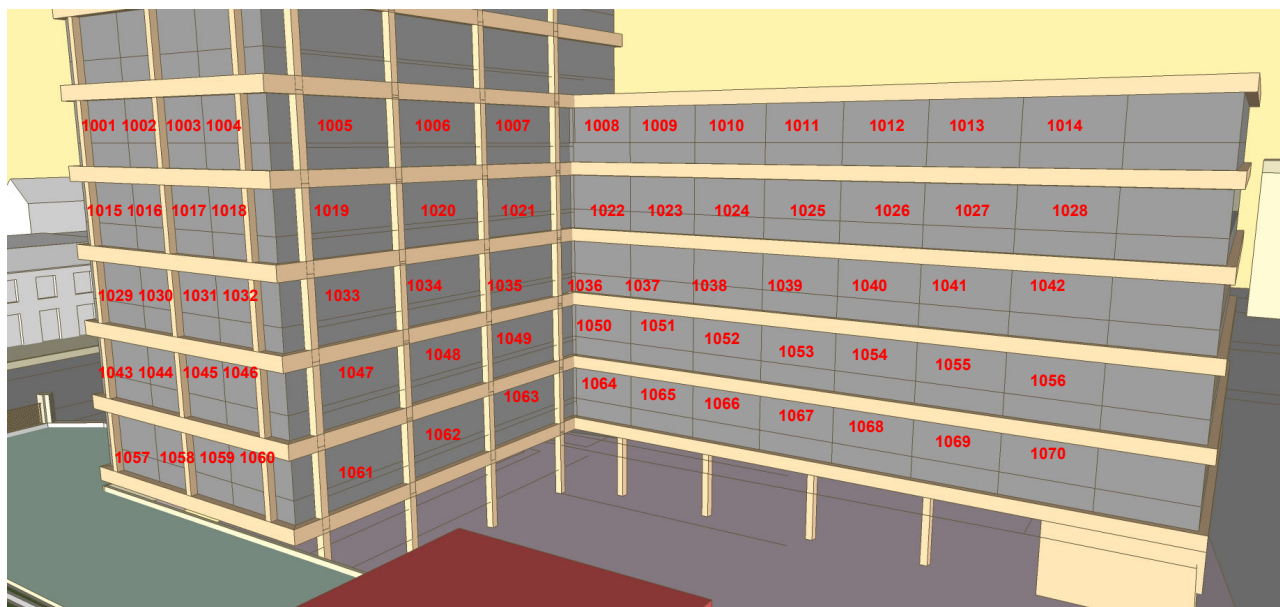


Appendix 2

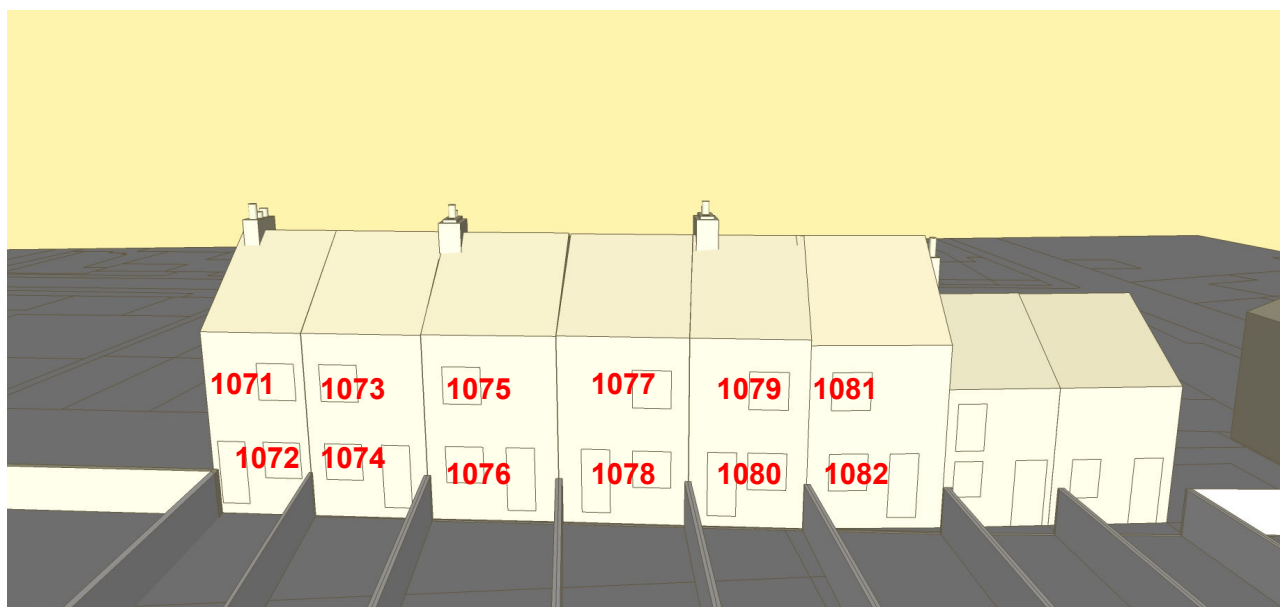
Window Schedules

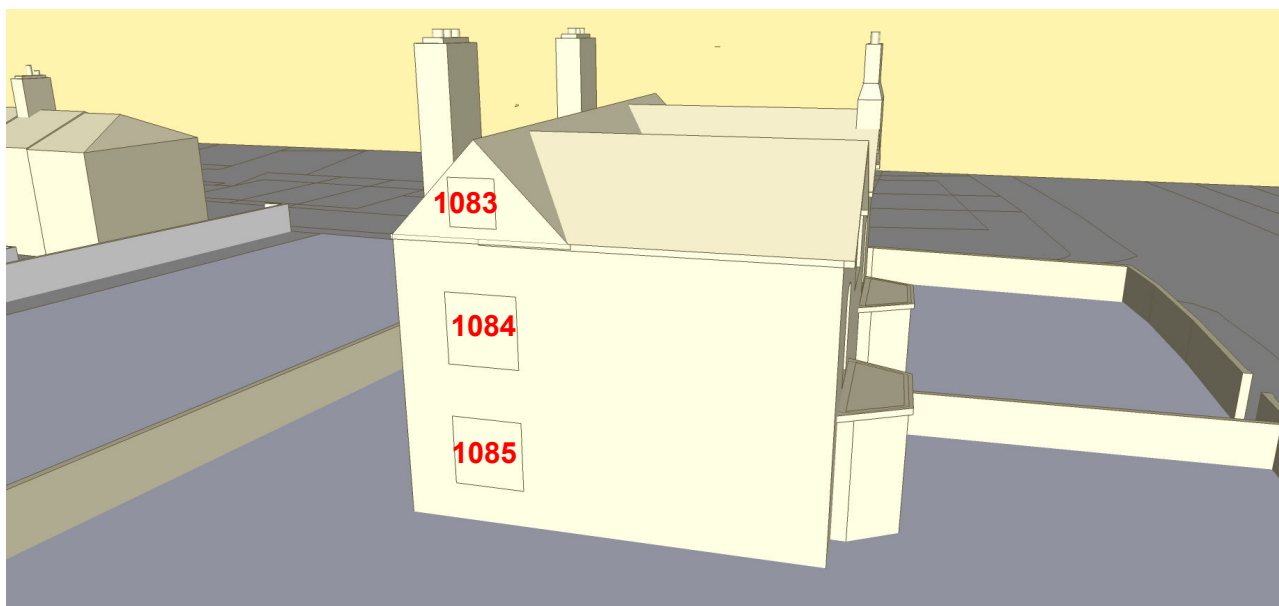
Appendix 2: Window Schedules

Hannover House



9, 8, 7, 6, 5 and 4 Town Place



1 Eldon Road

Appendix 3

Sample Waldram Diagrams

Appendix 3: Sample Waldram Diagrams

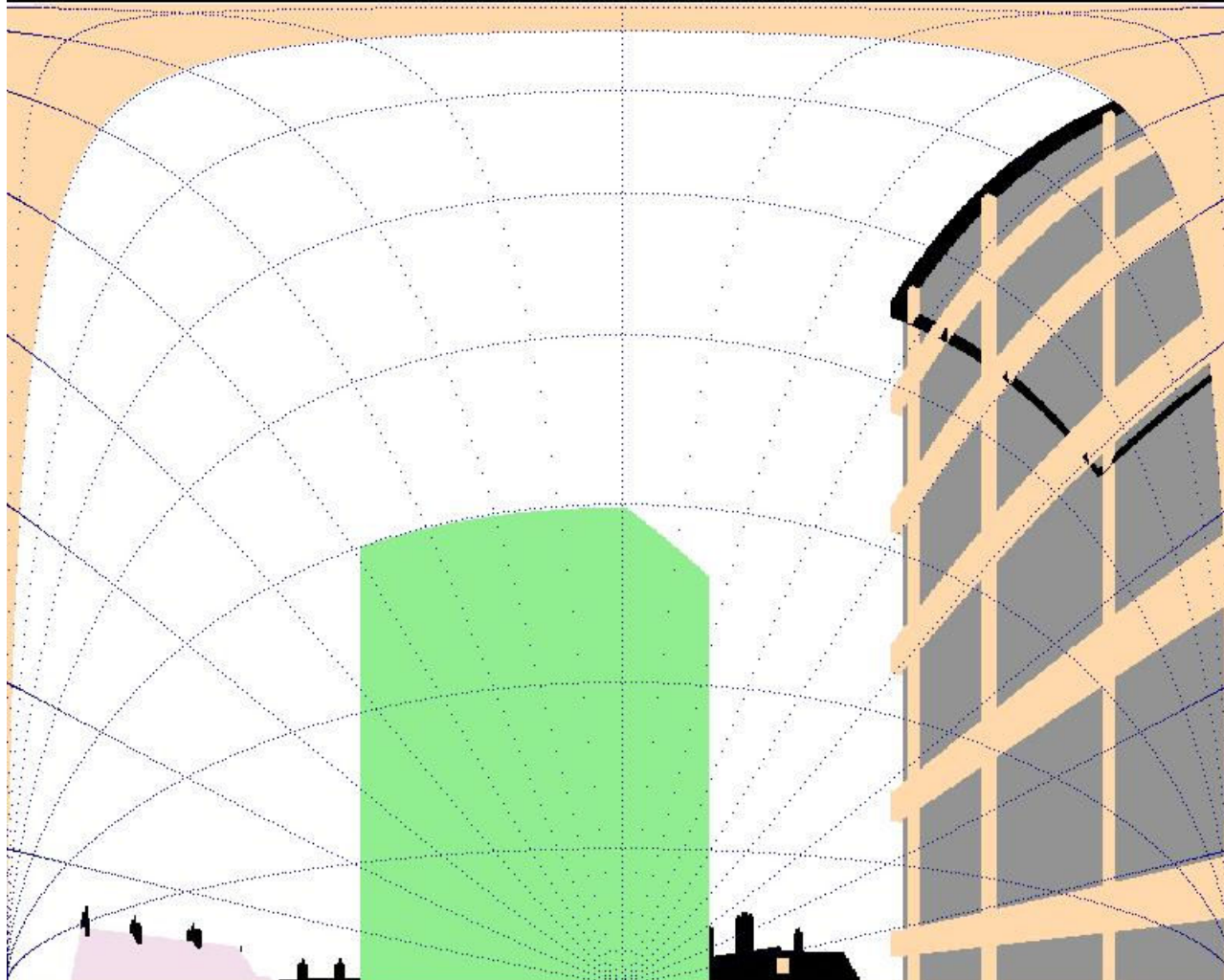
The methodology for calculating the VSC using the Waldram Diagrams is detailed within Appendix B of the Building Research Establishment (BRE) report, “Site layout planning for daylight and sunlight – a guide to good practice” by PJ Littlefair.

The Waldram Diagram dates back to 1923 and consists of a grid of squares, each representing an equal portion of available daylight. Upon the grid, it is possible to draw projections of obstructions as seen from a reference point, plotted with reference to the azimuth angles and altitude angles measured from a reference point. The area of the diagram un-obscured equates to the VSC. If the Waldram Diagram is totally un-obscured by obstructions, this represents the maximum possible VSC of 39.6%. The diagram has been designed in such a way that vertical edges remain vertical in projection, but horizontal edges follow the so called “droop” lines in order to take the cosine law of illumination and the non-uniform luminance of the sky into account. The Waldram Diagram method is a more complex method than the skylight indicator method also described in the BRE report. However, it tends to be more accurate and less open to interpretation and error.

The following pages shows sample Waldram Diagram. It should be noted that the Waldram Diagrams provided here are for information only. The Waldram Diagrams should only be interpreted by professionals with appropriate experience. The full results from these diagrams are provided earlier in the report.

Drawing Ref: Mulberry House, Reading
Window Ref: 1052

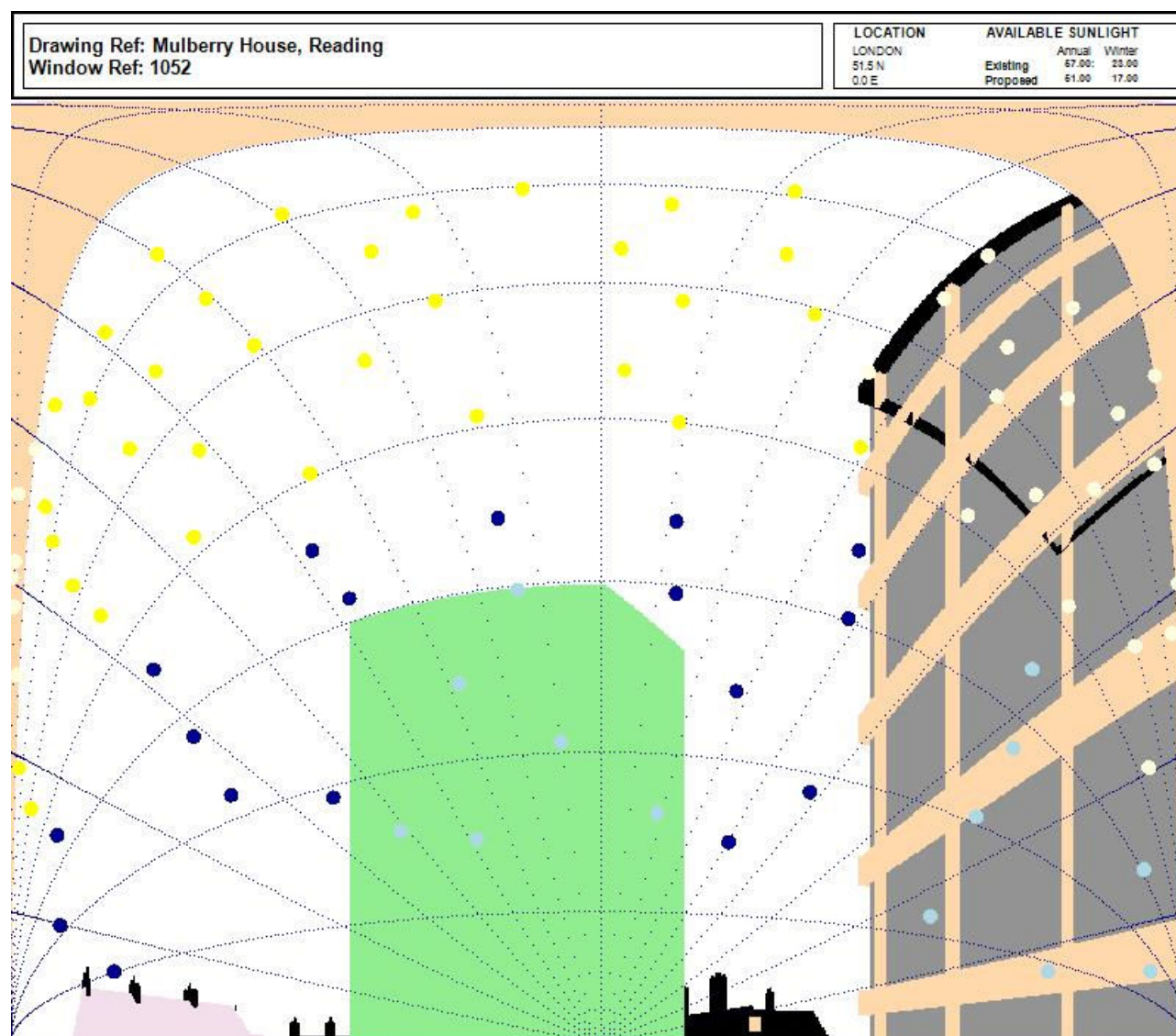
VSC: Existing: 27.10
Proposed: 21.88



Appendix 4

Sample Sunlight Availability Indicators

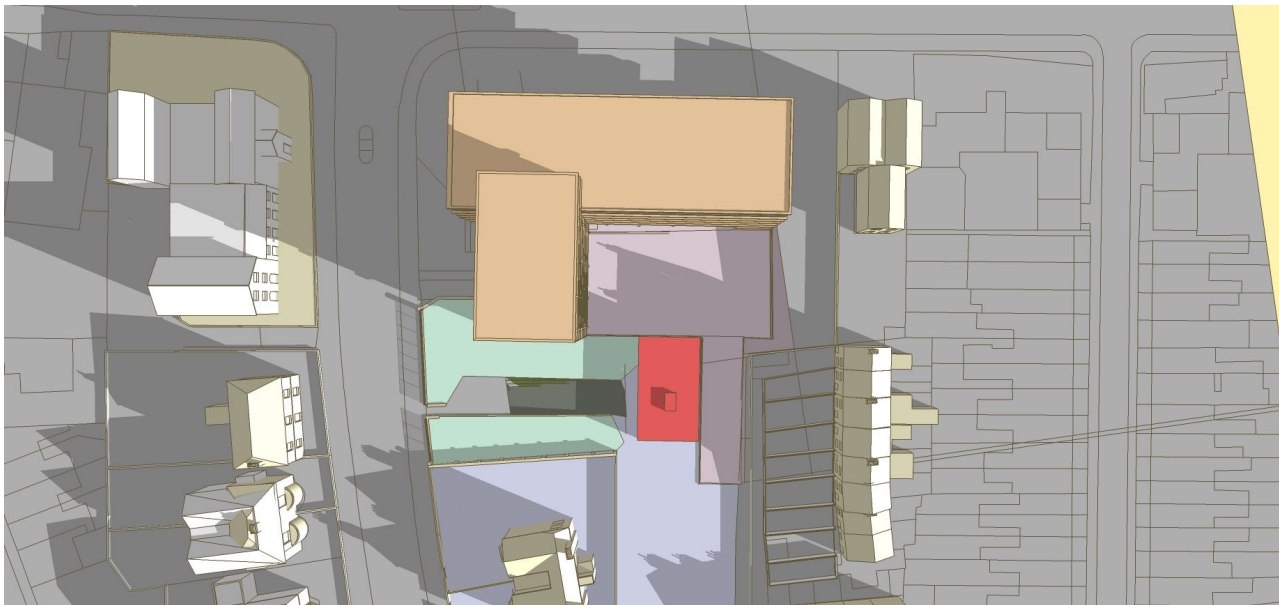
Appendix 4: Sample Sunlight Availability Indicators



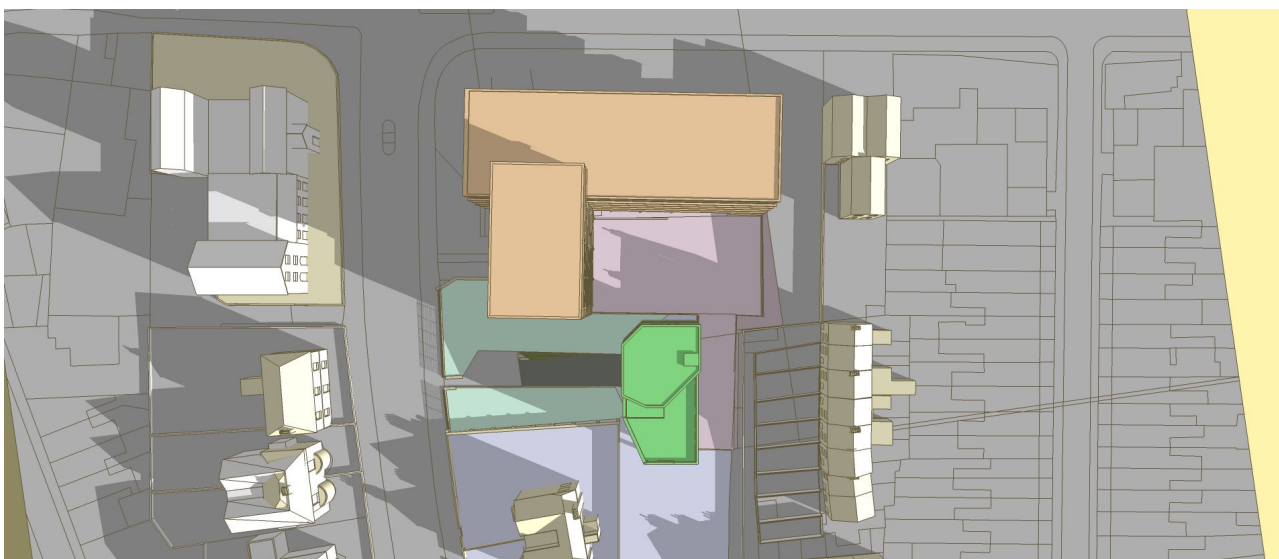
Appendix 5 Shadow Path Diagrams

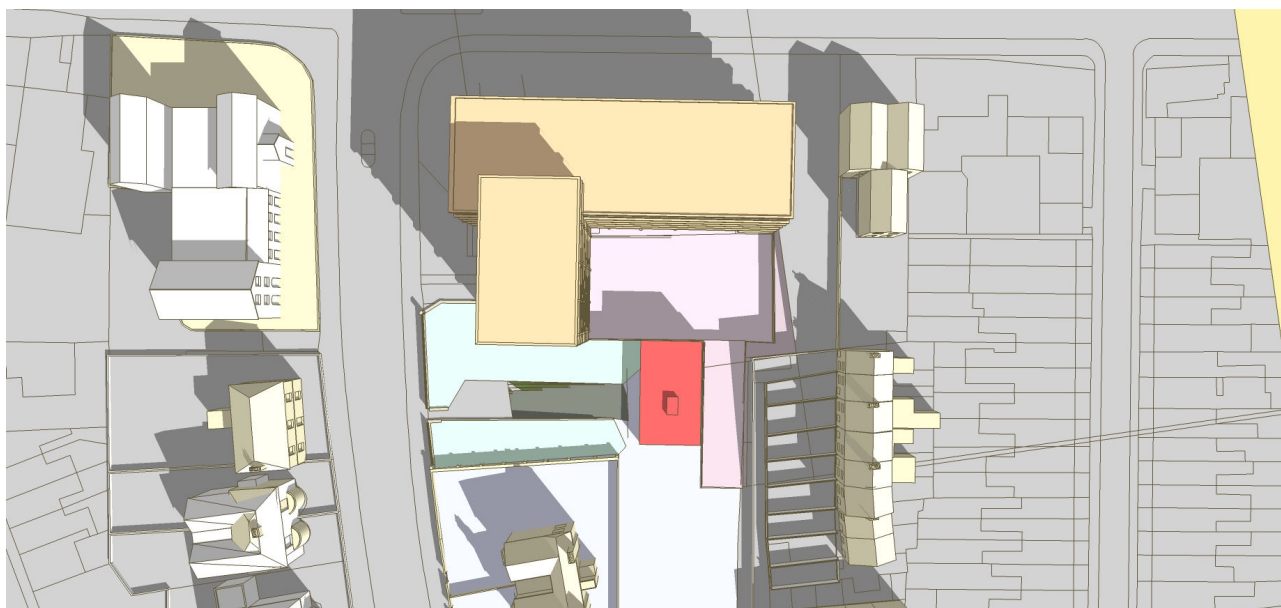
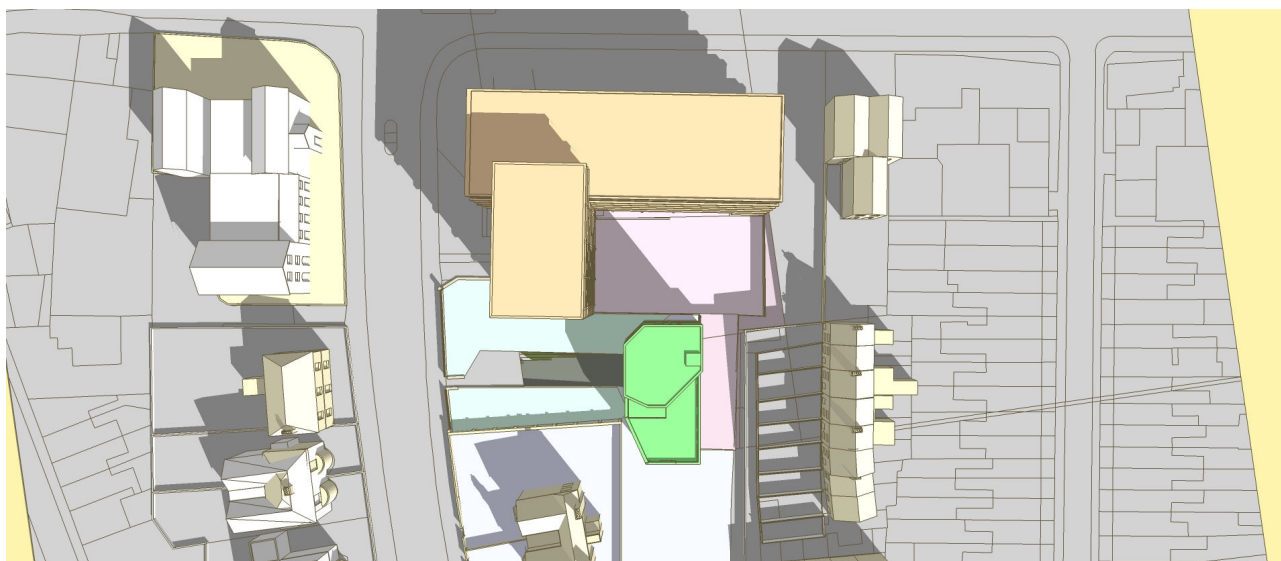
Appendix 5: Shadow Path Diagrams

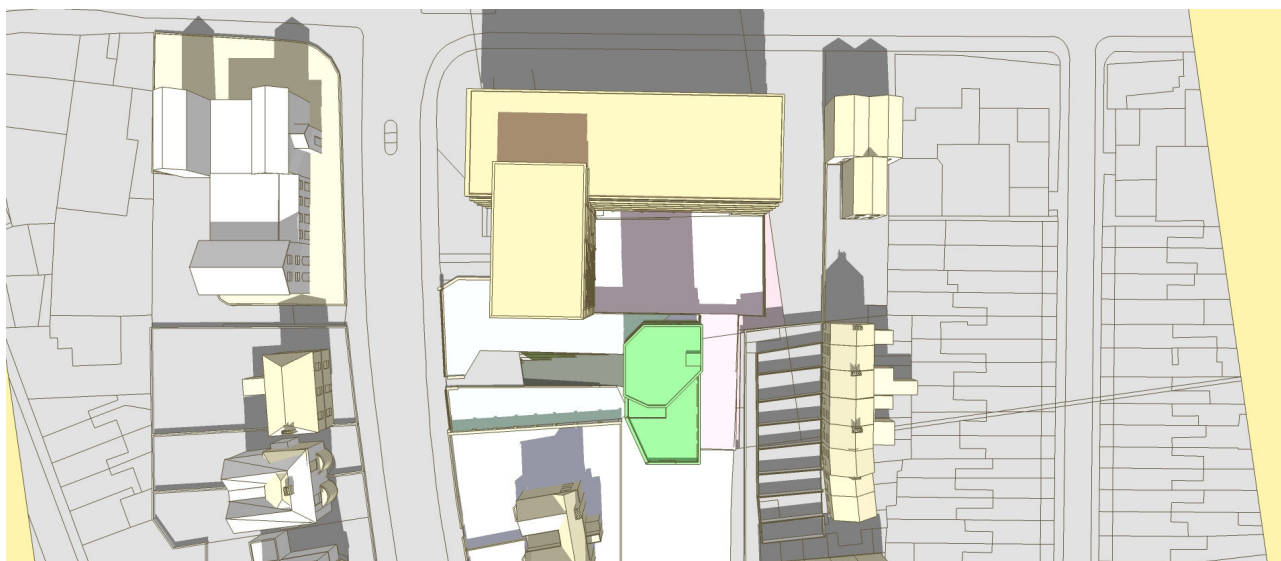
Existing Site Layout – Spring Equinox - 21st March – 0800 hrs

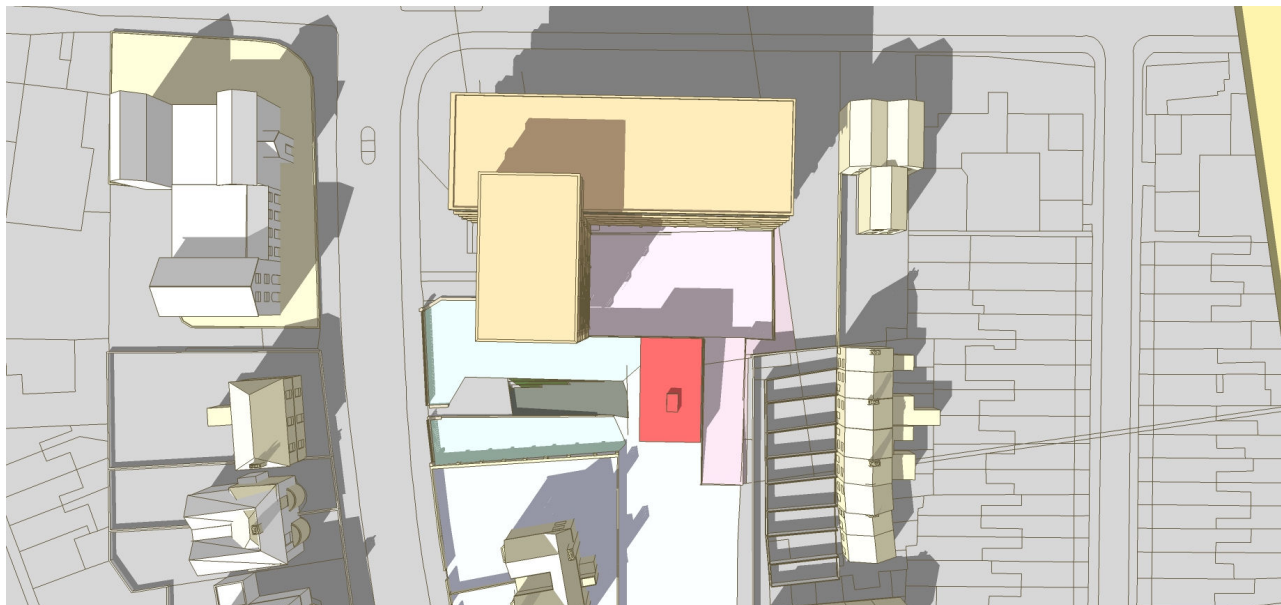
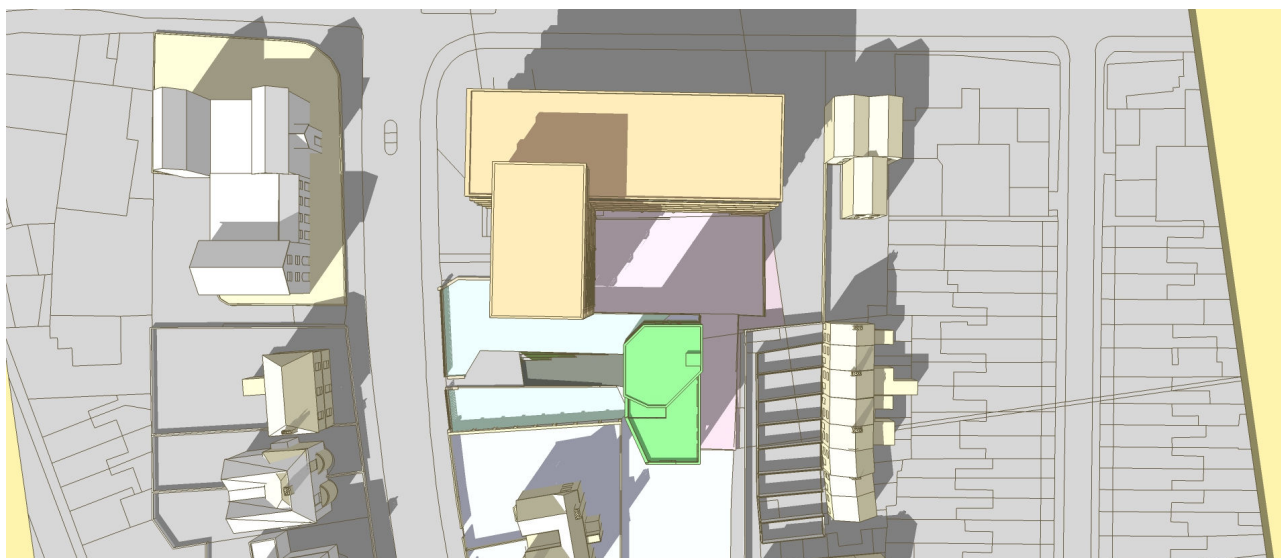


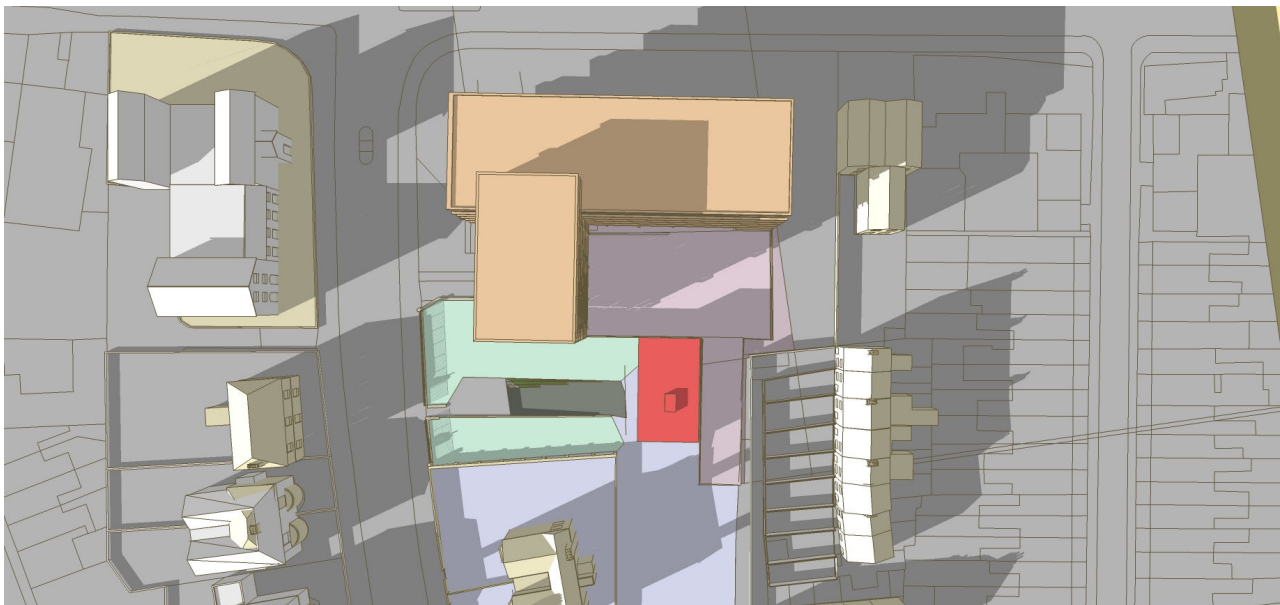
Proposed Site Layout – Spring Equinox - 21st March – 0800 hrs

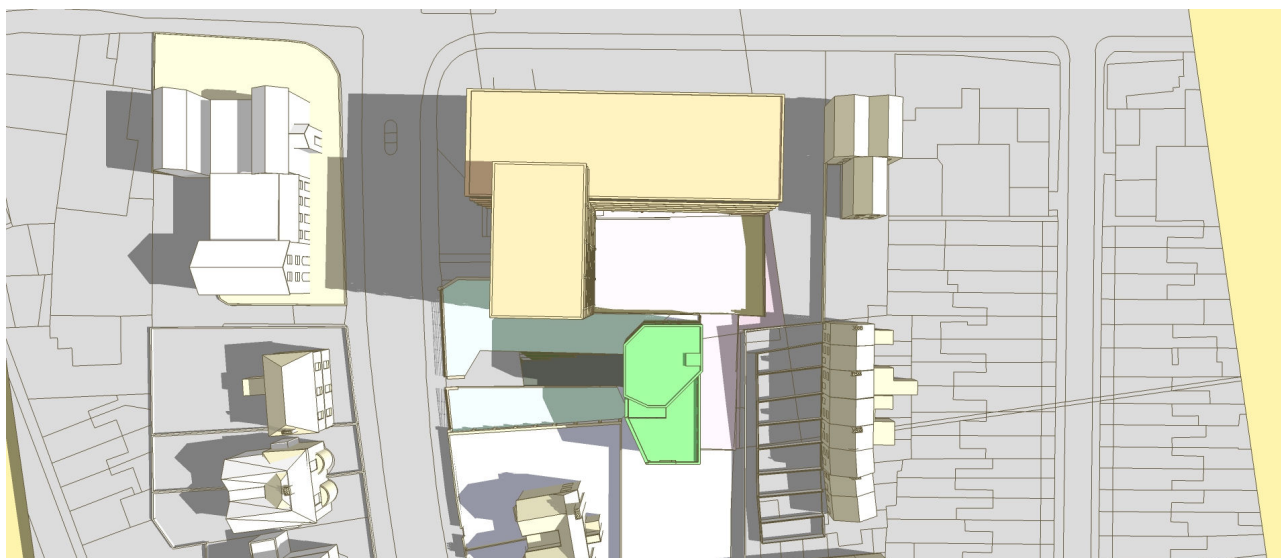


Existing Site Layout – Spring Equinox - 21st March – 1000 hrs**Proposed Site Layout – Spring Equinox - 21st March – 1000 hrs**

Existing Site Layout – Spring Equinox - 21st March – 1200 hrs**Proposed Site Layout – Spring Equinox - 21st March – 1200 hrs**

Existing Site Layout – Spring Equinox - 21st March – 1400 hrs**Proposed Site Layout – Spring Equinox - 21st March – 1400 hrs**

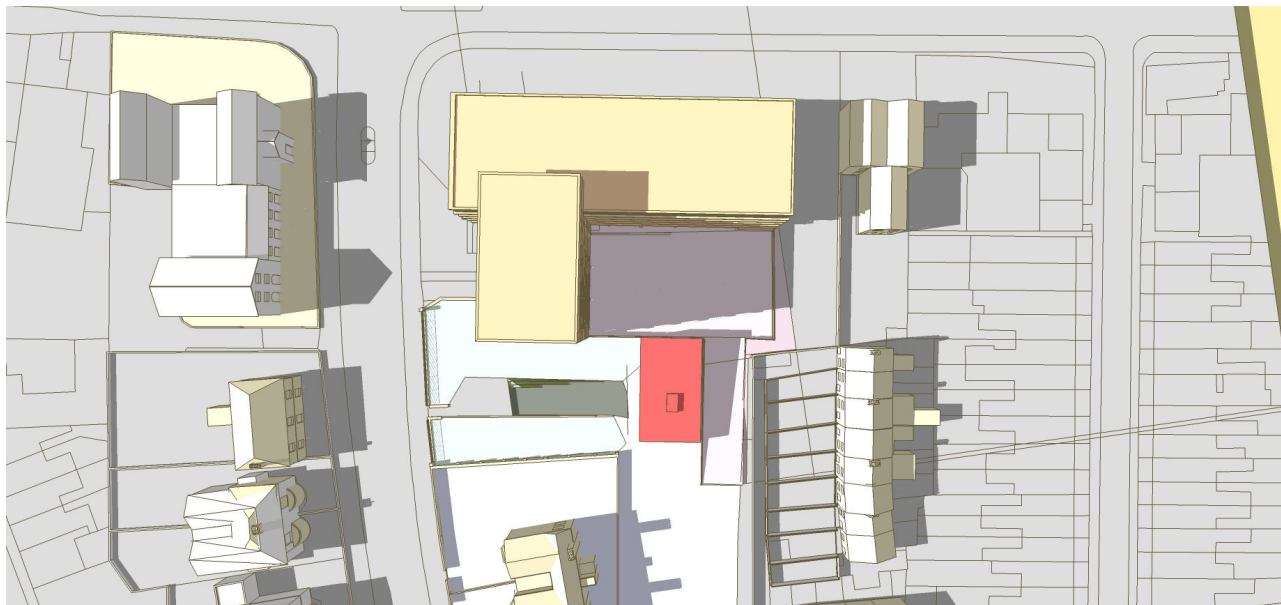
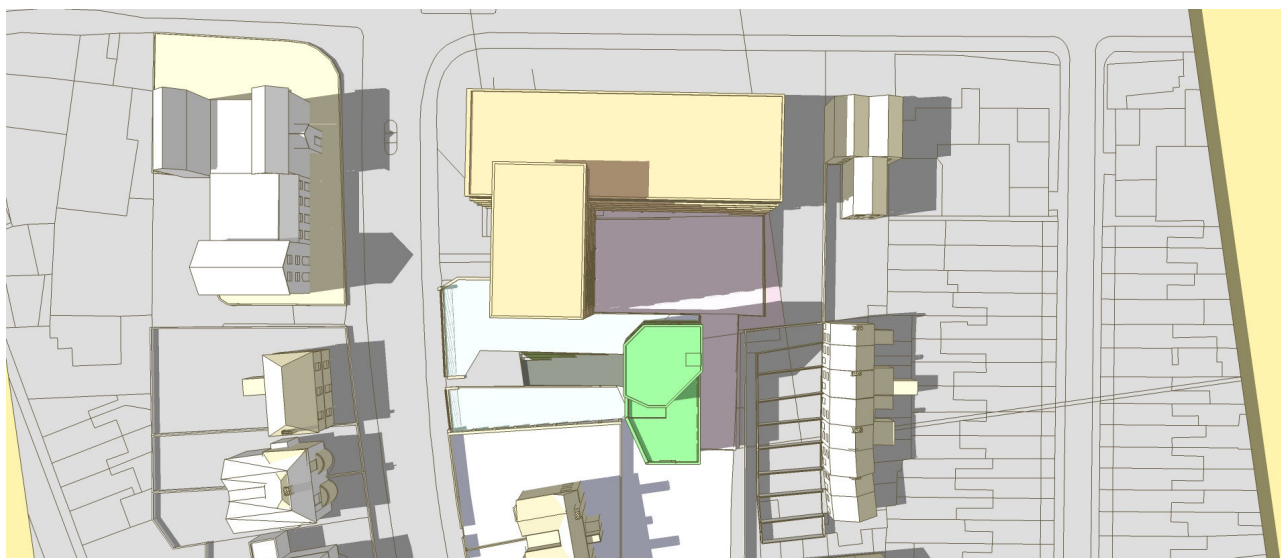
Existing Site Layout – Spring Equinox - 21st March – 1600 hrs**Proposed Site Layout – Spring Equinox - 21st March – 1600 hrs**

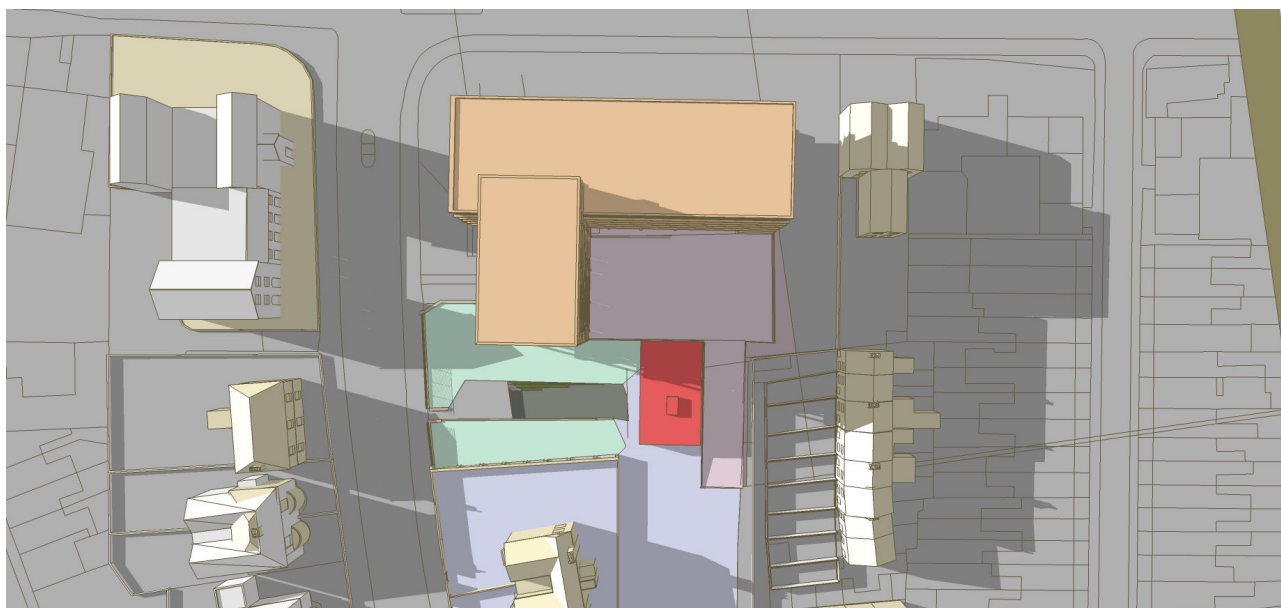
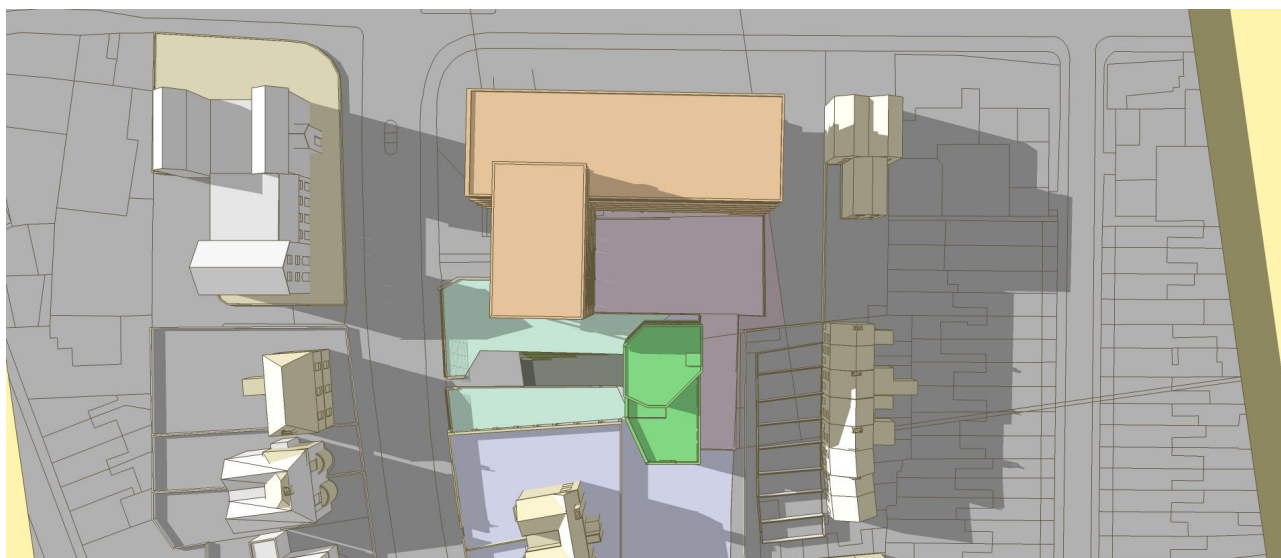
Existing Site Layout – Summer Solstice – 21st June – 0800 hrs**Proposed Site Layout – Summer Solstice – 21st June – 0800 hrs**

Existing Site Layout – Summer Solstice – 21st June – 1000 hrs**Proposed Site Layout – Summer Solstice – 21st June – 1000 hrs**

Existing Site Layout – Summer Solstice – 21st June – 1200 hrs**Proposed Site Layout – Summer Solstice – 21st June – 1200 hrs**

Existing Site Layout – Summer Solstice – 21st June – 1400 hrs**Proposed Site Layout – Summer Solstice – 21st June – 1400 hrs**

Existing Site Layout – Summer Solstice – 21st June – 1600 hrs**Proposed Site Layout – Summer Solstice – 21st June – 1600 hrs**

Existing Site Layout – Summer Solstice – 21st June – 1800 hrs**Proposed Site Layout – Summer Solstice – 21st June – 1800 hrs**

Existing Site Layout – Winter Solstice – 21st December – 1000 hrs**Proposed Site Layout – Winter Solstice – 21st December – 1000 hrs**

Existing Site Layout – Winter Solstice – 21st December – 1200 hrs**Proposed Site Layout – Winter Solstice – 21st December – 1200 hrs**

Existing Site Layout – Winter Solstice – 21st December – 1400 hrs**Proposed Site Layout – Winter Solstice – 21st December – 1400 hrs**