Hawkins environmental

Daylight/Sunlight Assessment – 16-17 Redington Gardens, Camden

PKS Architects LLP

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1. INTRODUCTION

Hawkins Environmental Limited has been instructed by PKS Architects LLP to undertake a daylight and sunlight assessment for a development at 16-17 Redington Gardens, Camden NW3.

The proposed development will see the construction of a new dwelling to replace two existing dwellings. **Appendix 1** shows a plan of the site.

During the planning process, it has been identified that the proposed development may have the potential to affect the levels of daylight and sunlight reaching the windows of surrounding properties; furthermore it has also been identified that the proposed development itself may not be adequately daylit. Therefore, this report is being prepared to accompany the planning application and is being used to determine whether the redevelopment will receive enough daylight and to determine whether it will have an impact on surrounding dwellings. This report will use the guidance contained within the Building Research Establishment (BRE) report, *"Site layout planning for daylight and sunlight – Second Edition 2011"* by PJ Littlefair and British Standard BS 8206:2008 Lighting for buildings – Part 2: Code of practice for daylighting.

This report fully incorporates the changes in methodology as a consequence of the publication of the Second Edition of the BRE Report in 2011.

It should be noted that this assessment does not take into account Rights to Light. A Right to Light is a legal right which one property may acquire over another. If a building is erected which reduces the light available to the adjoining property below sufficient levels, Rights to Light may be infringed, which may attract compensation and/or an injunction to stop the development. However, Rights to Light should not be a material planning consideration and therefore, this issue has not been assessed as part of this report. However, in most circumstances, if the development passes the tests contained within the BRE Report, Rights to Light should not be infringed.

2. DAYLIGHT AND SUNLIGHT

The provision of daylight is as important as ensuring low levels of noise, or low levels of odour, in maintaining the enjoyment of one's property. Adequate levels of daylight are important not only to light and heat the home, but also for an occupant's emotional well being. Daylight is widely accepted to have a positive psychological effect on human beings and there is a great deal of evidence to suggest that people who are deprived of daylight are more susceptible to depression and mood swings. This is common in northern countries, such as Norway, Iceland and Canada where daylight is scarce during the winter months.

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. On a cloudy or overcast day diffused daylight still shines through windows, even when sunlight is absent.

2.1. National Policy

The Department for Communities and Local Government (DCLG) sets national planning policy. Their document 'The Planning System: General Principles (2005), published in conjunction with Planning Policy Statement 1: Delivering Sustainable Development, discusses the need to protect amenities in the public's interest, of which the need for daylight/sunlight could be considered one such amenity. However, the government does not have an adopted policy on daylight, sunlight and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance, in the way it has for other environmental impacts such as noise, landscape or air quality.

However, the **Building Research Establishment (BRE) report, *"Site layout planning for daylight and sunlight"* Second Edition 2011 by PJ Littlefair** (referred to as the BRE Report) is almost universally used as the official method in the UK and Ireland for determining the minimum standards of daylight and sunlight and for determining the impact of a development on daylight and sunlight availability; In addition, the **British Standard BS 8206:2008 Lighting for buildings – Part 2: Code of practice for daylighting** contains guidance on the minimum recommended levels of interior daylighting and introduces some of the calculation procedures used in the BRE Report.

2.2. The BRE Report

As this report is assessing the impact of a new development on an existing property, the BRE Report is the appropriate guidance to use to assess daylight and sunlight. The BRE Report contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. 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. However, the report does state that the guidelines are not mandatory, but should be considered a guide to help rather than constrain the designer.

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

- **Daylight** – i.e. the combined impacts of all direct sunlight and indirect skylight during the daytime;

- **Sunlight** – i.e. the impacts of only the direct sunlight; and
- **Overshadowing of Gardens and Open spaces**.

2.3. Daylight Impact Assessment

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, hospitals, hotels and some offices.

When assessing daylight, the numerical criteria must be viewed flexibly and should be considered against other site layout constraints. In addition, it is important to consider whether the existing building is itself a good neighbour, standing a reasonable distance from the boundary and not taking more than its fair share of light.

Figure 2.1 shows the decision chart, showing the processes involved in determining daylight impact. The assessment takes on several specific stages:

1) **The Distance Test**: loss of light to windows need not be analysed if the distance from the existing window to the development is three of more times its height above the centre of the existing window;

2) **The 25° Rule**: loss of light to windows need not be analysed if the angle to the horizontal subtended by the new development from the centre of the existing window is less than 25°;

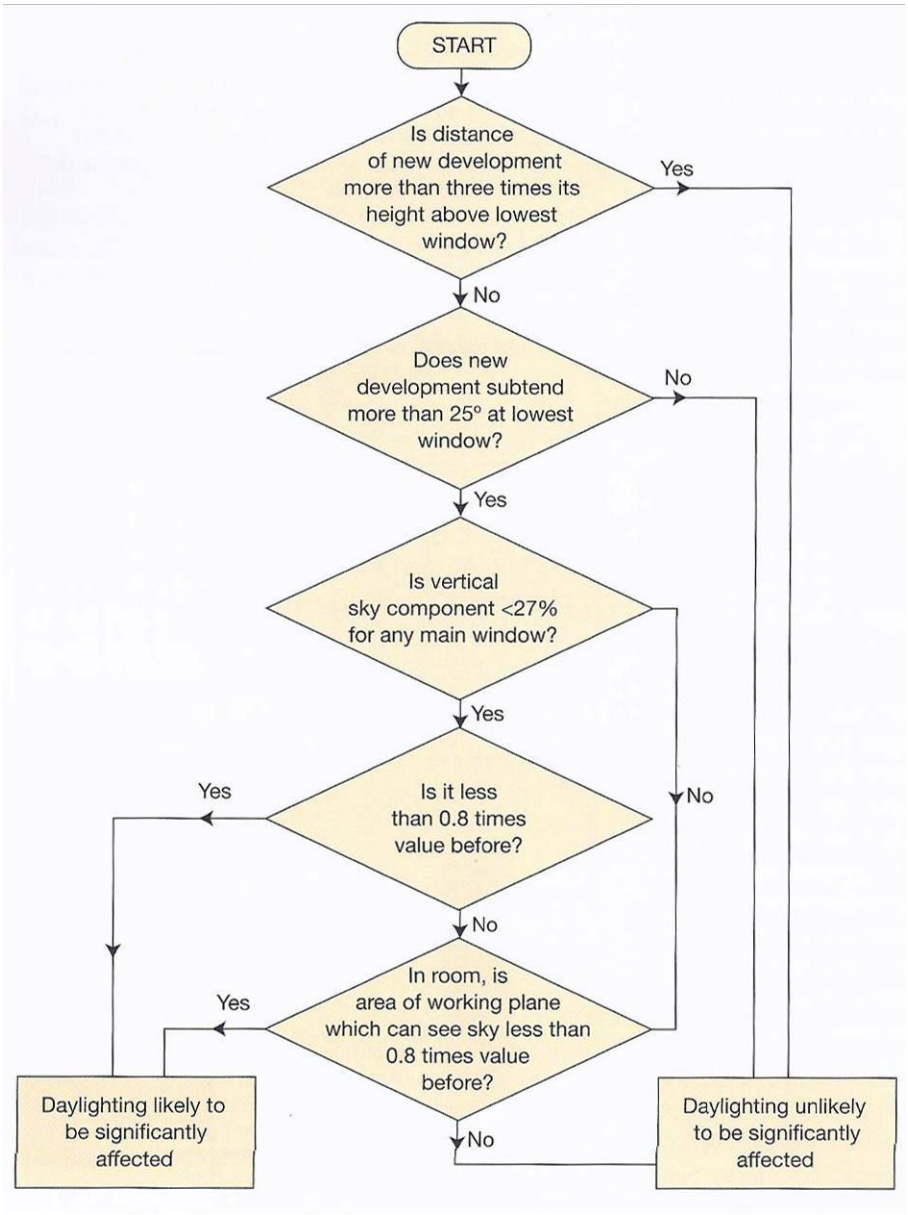
3) **Daylight Assessment**: diffuse daylight of an existing may be adversely affected by a proposed development if either:

   a. 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

   b. 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 at determining the area of the working plane with 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.

Figure 2.1: Decision Chart – Diffuse Daylight in Existing Buildings (taken from the BRE Report)



2.4. Sunlight Impact Assessment

The assessment of sunlight is required for rooms in adjoining dwellings where sunlight is required. Generally, all main living rooms and conservatories should have access to direct sunlight. Kitchens and bedrooms are less important, although care should be taken not to block too much sun.

As with daylight, the numerical criteria for sunlight should be viewed flexibly and should be considered against other site layout constraints. It is important to understand that people like and appreciate sunlight and may resent the loss of sunlight, although is not an essential requirement of a dwelling, unlike daylight availability or access to a quiet noise environment. Therefore, larger reductions in sunlight may be acceptable, for example if new development is to match the height and proportion of existing buildings nearby.

The assessment of sunlight takes on several specific stages:

1. **Facing South**: loss of sunlight to windows only needs to be assessed if the window faces within 90° of due south;
2. **The Distance Test**: loss of sunlight to windows need not be analysed if the distance from the existing window to the development is three of more times its height above the centre of the existing window;
3. **The 25° Rule**: loss of sunlight to windows need not be analysed if the angle to the horizontal subtended by the new development from the centre of the existing window is less than 25°;
4. **Sunlight Assessment**: direct sunlight of an existing windows may be adversely effected by a proposed development if at the centre of a window:
    a. receives less than 25% of Annual Probable Sunlight Hours (APSH), or less than 5% APSH between 21st September and 21st March; **and**
    b. receives less lean 0.8 times its former APSH during either period; **and**
    c. has a reduction in sunlight over the whole year of greater than 4% APSH.

2.5. Internal Daylight Assessment

The BRE report contains guidance on how to design developments, whilst retaining good levels of daylight. As well as advice, the report contains a methodology to assess levels of daylight and contains criteria to determine whether a development is well day lit. However, the report does state that the guidelines are not mandatory, but should be considered a guide to help rather than constrain the designer.

The Average Daylight Factor (ADF) is a very common and easy to understand measure for expressing the 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. However, it is only when the ADF rises above 5% that we perceive it as well day lit. Different types of rooms have different minimum requirements for daylighting. **Table 2.1** details the acceptable criteria for average daylight factor for habitable rooms.

Table 2.1: Daylight Factor Criteria

Criteria	Minimum Daylight Factor
Predominantly daylight without the need for supplementary electric lighting	5%
With supplementary electric lighting: Suitable for kitchens Suitable for living rooms Suitable for bedrooms	 2% 1.5% 1%

2.6. The Impacts of Vegetation

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.

2.7. Determining Significance

The previous edition of the BRE Report has often been significantly misapplied when determining whether an impact to a development is significant and whether a development should be refused planning permission. Page 1 of 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."*

Often, Local Planning Authorities interpret the failure of a development to meet the guideline criteria as an indicator as to whether a development is acceptable. However, this is not the case and the BRE report suggests that the numerical values are purely advisory and there are times where alternative targets may be used, as described in Appendix F of the 2011 Edition of the BRE Report. For example:

- where the site already has an extant planning permission that the developer wants to vary, the VSC and APSH of the permitted scheme may be used as alternative benchmarks;
- in historic city centre environments, it is often not possible to achieve 27% VSC, therefore it is sensible to use a target value consistent with levels of daylight typically experienced in the street. For example, if the obstruction angle from ground floor level at other properties in the street is typically 40°, which corresponds to a VSC of 18%, this level could be used as a target value for development in that street, if new development is to match the scale and size of the existing development;
- where an existing building has windows that are unusually close to the site boundary and taking more than their fair share of light, to ensure that new development matches the height and proportions of existing buildings, the VSC and APSH targets for these windows could be set to those for a "mirror-image" building of the same height and size, an equal distance away on the other side of the boundary.

In addition, Appendix I of the 2011 Edition of the BRE Report provides new guidance on how to assess impact, which suggests that a semantic scale can be used to describe the impact, which can then be used help place the impact in context. **Table 2.2** summarises the impact magnitude criteria as described in the BRE Report.

Table 2.2: Impact Magnitude Criteria (adapted from Appendix I of the BRE Report 2011)

Criteria	Impact Magnitude
Where the decrease in daylight or sunlight fails to meets 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 fully meets the guidelines and a larger number of windows or open space are affected; or Where the decrease in daylight or sunlight fails to meets the guidelines, but 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 only a small number of windows are affected; 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 large and/or the number of affected windows or area of open space affected is large.	Major Beneficial

Note: Appendix I of the BRE report also suggests the use of "moderate adverse" and "moderate beneficial" impacts. However, there is no guidance on how to designate moderate impacts, although the guidance suggests that judgement should be used when classifying impact magnitude.

3. DAYLIGHT/SUNLIGHT PRE-ASSESSMENT

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

3.1. Identification of Receptors

Based on a site visit on the 8th March 2012, and also based on the plans of the development, a number of windows and properties have been identified as of being of concern. 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 following properties have been considered as part of the assessment:

- 15 Redington Gardens; and
- 18 Redington Gardens.

3.2. The Screening Assessments

Two tests are used to determine whether an assessment of daylight or sunlight is required: the distance test and the 25° rule.

The Distance Test states that loss of light to a window does not need to be analysed if the distance from the existing window to the development is three of more times its height above the centre of the existing window.

The 25° Rule states that if the new development subtends an angle of more than 25° to the horizontal from the lowest window of the existing properties, it is possible that the development may affect the amount of daylight reaching the property. Therefore, a full daylight assessment would be required.

In addition, windows need to be assessed to see if the windows face within 90° of due south, as if they do not, they do not require sunlight assessment.

Since the site is to be modelled using the VE-Pro Suite, all windows have been considered in the assessment and it is not considered necessary to conduct a screening assessment. Furthermore, it has been noted that all windows, with the exception of W23, face within 90° of due south and therefore will require the assessment of sunlight.

4. DAYLIGHT/SUNLIGHT IMPACT ASSESSMENT

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

4.1. Methodology

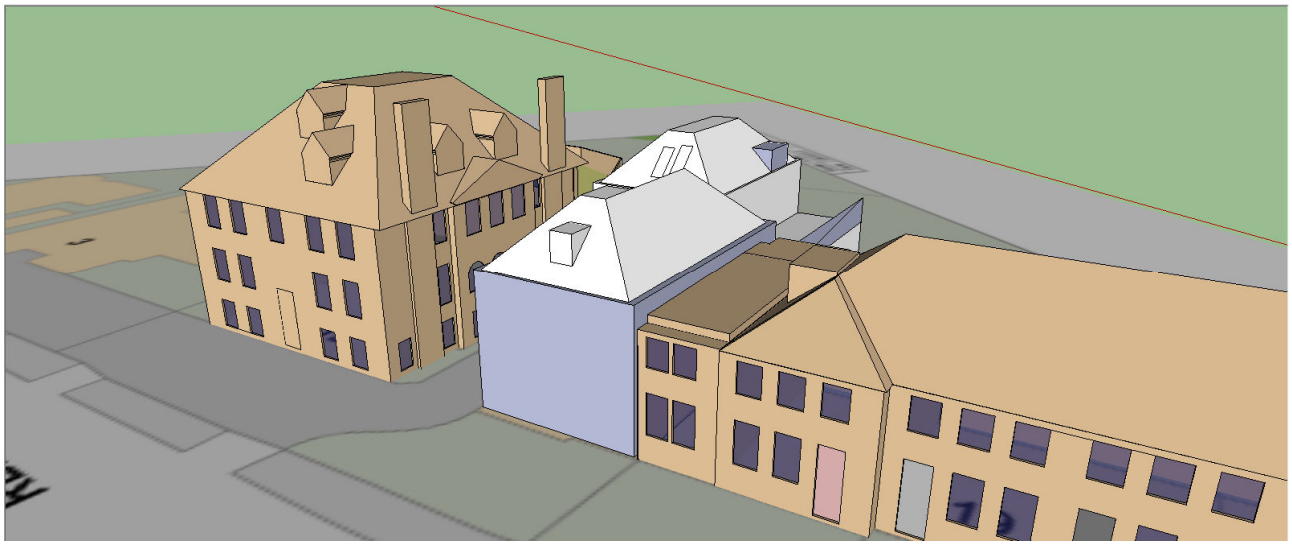
This section summarises the daylight and sunlight impacts of the proposed development on surrounding properties. To determine these impacts, the IES Virtual Environment software (VE-Pro Suite) has been utilised to calculate the changes in levels of daylight and sunlight as a consequence of the proposed development. The VE-Pro software has been accredited by CIBSE and acknowledged by the BRE as a suitable software tool for undertaking daylight, sunlight and overshadowing assessments in accordance with the Building Research Establishment (BRE) report, *"Site layout planning for daylight and sunlight"* Second Edition 2011 by PJ Littlefair BRE Good Practice guidelines. Three separate modules of the VE-Pro suite have been utilised for this assessment:

- ModelIT: enables the creation of three dimensional "Virtual Environment" models without CAD data, or alternatively allows you to create a 3D model from 2D CAD data. ModelIT interfaces with ACAD Revit and Google SketchUp, allowing the import of models created within this packages;
- RadianceIES: is a detailed 3D simulation tool designed to predict daylight and electric light levels, and the appearance of a space prior to construction. Vertical Sky Components and Average Daylight Factors can be calculated for with and without the proposed development using RadianceIES;
- SunCast: is a 3D simulation tool used to calculate solar shading and sunlight availability. SunCast can be used to calculate the Annual Probable Sunlight Hours for with and without the proposed development.

Figures 4.1 and **Figure 4.2** show the three dimensional model of the development, with and without the proposed development.

Figure 4.1: 3D model without new development

Figure 4.2: 3D model with new development



4.2. Daylight Assessment - VSC

When undertaking a daylight assessment, the BRE Report suggests a VSC of 27% or more should be achieved if a room is to be adequately daylit. It also suggests that when existing levels of daylight are below 27% VSC, a reduction of more than 20% from the existing level will be noticeable to the inhabitants, i.e. an impact will occur.

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. This is detailed in **Table 4.1.**

It can be seen from **Table 4.1** that most windows under assessment will see a reduction in the amount of daylight reaching the windows; most windows will continue to receive the minimum recommended 27% VSC and/or the proposed level of daylight would be greater than 0.8 times the former. However, at four windows on the side façade of 15 Redington Gardens (W8, W9, W10 and W13), the levels of daylight will be less than 27% and less than 0.8 times the former; therefore the reduction may be noticeable to the inhabitants. It should be noted that at all four windows, the reduction is greater than 0.69 times the former, i.e. marginally below the recommendations contained within the BRE Report, which does state that the numerical guidelines contained within the report should be interpreted flexibly.

4.2.1. Window W8

The BRE criteria used to assess whether an impact is significant is based upon whether the change in daylight or sunlight is likely to be noticeable. For example, a reduction in daylight or sunlight of up to 20% is acceptable, as a reduction of less than this amount is unlikely to be noticeable to the inhabitants. Window W8 serves a room that is used as a bar, and as such, the window is boarded up from the inside, with just a small arched area at the top with clear glass. Since this has been done to the window to reduce the amount of light entering the room, it is clear that a reduction in daylight in excess of what would normally be considered acceptable will not be noticeable to the inhabitants than therefore the reduction in daylight to this window should not be seen as significant.

4.2.2. Window W10

Window W10 serves a main living room, which is also lit my windows to the rear to 15 Redington Gardens, including W16 and W17, which remain relatively unaffected by the proposed development, both in terms of daylight and sunlight and therefore, the room will remain adequately day lit, even with the reduction to these windows and therefore the reduction in daylight to this window should not be seen as significant.

4.2.3. Residual Impacts

Minor impacts remain on two windows – W9, which serves a home office, and W13 which serves a bedroom. The proposed level of daylight is 0.75 and 0.76 times the existing at each window respectively, therefore the reduction in daylight is only just likely to be noticeable. Based on Appendix I of the BRE Report 2011 (reproduced in **Table 2.2** of this report), since the reductions in daylight are marginally below the guidance and only a small number of windows are affected in each dwellings, the proposed development is considered to have a "*minor adverse*" impact on the levels of VSC at 15 Redington Gardens and a "*negligible*" impact at 18 Redington Gardens.

4.3. Daylight Assessment - NSL

Whilst the VSC determines the amount of daylight entering a room, the no-sky line determines how well the daylight is distributed in the room. Areas beyond the no-sky line will generally look gloomy.

The working plane is a notional surface, typically at about desk or table height, at which the daylight factor or the 'no-sky line' is calculated or plotted. For calculations in dwellings, it is taken to be at a position 0.85 m above the floor.

The no-sky line divides those areas of the working plane which can receive direct skylight, from those which cannot. If the external obstructions already exist, it is possible to measure directly the position of the no-sky line in a room.

Whilst it is desirable to assess the position of the NSL, the assessment requires details of the room and window geometry for the potentially affected properties. Unfortunately, as is the case with many impact assessments, these details are not known and therefore it is not possible to accurately assess the changes in the distribution of daylight.

4.4. Sunlight Assessment

In order to assess the impact of a development on the levels of sunlight, the APSH has been calculated for window W6, which faces within 90° of due south.

According to the BRE Report, direct sunlight on an existing window may be adversely effected by the 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 lean 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.

It can be seen from **Table 4.1** that most windows will continue to receive the recommended percentage of annual sunlight hours, including a minimum of 5% of hours during the winter months, even with the construction of the proposed development. However, at four windows (W6, W10, W12 and W13), which are all situated on the side facade of 15 Redington Gardens, they will receive a reduction in sunlight that will see less than 5% of the APSH being received in the winter months, and of these four windows, three will also see a reduction in full year APSH below 25%.

4.4.1. Window W6

Window W6 serves a bedroom. The BRE report suggests that only main living rooms and conservatories require direct sunlight and whilst access to direct sunlight is desirable, it is not essential. Since other windows (including main living rooms serving the same dwelling) have access to direct sunlight, the reduction in sunlight to this window should not be seen as significant.

4.4.2. Window W10

Window W10 serves a main living room, which is also lit my windows to the rear to 15 Redington Gardens, including W16 and W17, which remain relatively unaffected by the proposed development, both in terms of

daylight and sunlight and therefore, the room will remain adequately day and sun lit, even with the reduction to these windows and therefore the reduction in sunlight to this window should not be seen as significant.

4.4.3. Window W12

Window W12 serves the main living room to the dwelling on the ground floor. This room is also lit by Window W11 on the western façade, which is less affected by the proposed development. Furthermore, Window W11 will continue to be well sunlit, therefore the room served by W12 will continue to receive good levels of both daylight and sunlight, even with the impacts to W12, and therefore the reduction in sunlight to this window should not be seen as significant.

4.4.4. Window W13

Window W13 serves a bedroom, which is understood not to be the master bedroom. As a bedroom, there should not be an expectation for sunlight, as the BRE report suggests that only main living rooms and conservatories require direct sunlight. Therefore the reduction in sunlight to this window should not be seen as significant.

4.4.5. Residual Impacts

Since none of the impacts to sunlight are considered significant, based on Appendix I of the BRE Report 2011 (reproduced in **Table 2.2** of this report), the proposed development is considered to have a "*negligible*" impact on the levels of sunlight at both 15 and 18 Redington Gardens.

Table 4.1: Daylight and Sunlight Impact Assessment

Address	Window Identifier	Floor	Vertical Sky Component			Annual Probable Sunlight Hours					
			Existing	Proposed	Ratio	Existing		Proposed		Ratio	
						Year	Winter	Year	Winter	Year	Winter
15 Redington Gardens	W1	Second	33.8%	28.5%	0.84	42%	17%	36%	10%	0.86	0.61
15 Redington Gardens	W2	Second	38.2%	33.1%	0.87	56%	24%	36%	10%	0.64	0.43
15 Redington Gardens	W3	Second	38.6%	32.2%	0.83	56%	24%	52%	20%	0.93	0.81
15 Redington Gardens	W4	Second	38.5%	32.3%	0.84	57%	25%	51%	20%	0.90	0.78
15 Redington Gardens	W5	Second	30.0%	25.4%	0.85	36%	18%	32%	15%	0.89	0.81
15 Redington Gardens	W6	First	27.7%	22.9%	0.83	42%	11%	32%	4%	0.77	0.34
15 Redington Gardens	W7	First	31.7%	25.3%	0.80	47%	15%	39%	9%	0.84	0.63
15 Redington Gardens	W8	First	31.7%	24.5%	0.77	45%	14%	36%	8%	0.80	0.56
15 Redington Gardens	W9	First	31.4%	23.7%	0.75	47%	16%	32%	5%	0.68	0.35
15 Redington Gardens	W10	First	22.7%	15.6%	0.69	36%	12%	23%	3%	0.64	0.24
15 Redington Gardens	W11	Ground	28.1%	26.2%	0.93	43%	9%	38%	6%	0.89	0.63
15 Redington Gardens	W12	Ground	20.1%	16.2%	0.81	27%	4%	22%	1%	0.80	0.25
15 Redington Gardens	W13	Ground	21.1%	16.0%	0.76	32%	6%	23%	2%	0.72	0.32
15 Redington Gardens	W14	Second	33.1%	30.6%	0.92	56%	29%	51%	22%	0.90	0.78
15 Redington Gardens	W15	Second	32.3%	30.3%	0.94	56%	29%	48%	20%	0.85	0.71

Address	Window Identifier	Floor	Vertical Sky Component			Annual Probable Sunlight Hours					
			Existing	Proposed	Ratio	Existing		Proposed		Ratio	
						Year	Winter	Year	Winter	Year	Winter
15 Redington Gardens	W16	First	31.1%	27.9%	0.90	53%	26%	48%	19%	0.90	0.74
15 Redington Gardens	W17	First	34.5%	32.1%	0.93	53%	26%	45%	17%	0.85	0.66
18 Redington Gardens	W18	First	38.9%	37.7%	0.97	66%	33%	64%	32%	0.97	0.96
18 Redington Gardens	W19	First	37.7%	36.9%	0.98	65%	33%	64%	32%	0.98	0.96
18 Redington Gardens	W20	First	33.8%	33.8%	1.00	56%	31%	54%	30%	0.96	0.96
18 Redington Gardens	W21	First	38.5%	36.4%	0.95	70%	33%	62%	31%	0.88	0.95
18 Redington Gardens	W22	Ground	30.1%	28.4%	0.94	53%	28%	52%	28%	0.97	0.98
18 Redington Gardens	W23	Second	36.7%	35.0%	0.95	Sunlight Assessment Not Required					

5. INTERIOR DAYLIGHTING CALCULATIONS

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:

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

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 m^2);

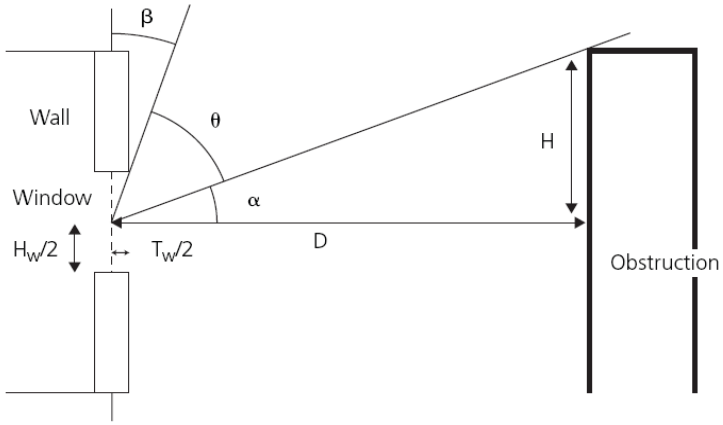
θ is the angle of visible sky in degrees;

A is the total area of room surfaces (in m^2), which includes walls, ceilings and floors; and

R is the average room reflectance (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



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 IES Virtual Environment software (VE-Pro Suite) has been utilised. The VE-Pro software has been accredited by CIBSE and acknowledged by the BRE as a suitable software tool for undertaking daylight, sunlight and overshadowing assessments in accordance with the Building Research Establishment (BRE) report, *"Site layout planning for daylight and sunlight"* Second Edition 2011 by PJ Littlefair. Two separate modules of the VE-Pro suite have been utilised for this assessment:

- ModelIT: enables the creation of three dimensional "Virtual Environment" models without CAD data, or alternatively allows you to create a 3D model from 2D CAD data. ModelIT interfaces with ACAD Revit and Google SketchUp, allowing the import of models created within this packages; and
- RadianceIES: is a detailed 3D simulation tool designed to predict daylight and electric light levels, and the appearance of a space prior to construction. Vertical Sky Components can be calculated for proposed developments using RadianceIES.

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

Window Description	T	A_w	θ	A	R
Dining Room	0.68	6.18 m^2	87°	140 m^2	0.5
Kitchen	0.68	11.76 m^2	43°	122 m^2	0.5
Family Room	0.68	11.77 m^2	30°	108 m^2	0.5
Bedroom 4	0.68	2.47 m^2	87°	74 m^2	0.5
Bedroom 2	0.68	4.94 m^2	87°	97 m^2	0.5
Bedroom 3	0.68	9.18 m^2	71°	84 m^2	0.5
Reception Room North Façade	0.68	2.47 m^2	87°	346 m^2	0.5
Reception Room West Façade	0.68	15.43 m^2	84°	346 m^2	0.5
Reception Room East Façade	0.68	23.89 m^2	78°	346 m^2	0.5
Play Room North Façade	0.68	1.00 m^2	58°	92 m^2	0.5
Play Room East Façade	0.68	0.98 m^2	141°	92 m^2	0.5
Master Bedroom West Façade	0.68	4.80 m^2	86°	130 m^2	0.5

Window Description	T	A_w	θ	A	R
Master Bedroom Southeast Corner	0.68	5.76 m^2	87°	130 m^2	0.5
Master Bedroom East Façade	0.68	0.98 m^2	155°	130 m^2	0.5

Table 5.2: Daylight Factor Assessment

Room	Average Daylight Factor
Dining Room	3.5%
Kitchen	3.7%
Family Room	2.9%
Bedroom 4	2.6%
Bedroom 2	4.0%
Bedroom 3	7.1%
Reception Room	8.9%
Play Room	1.9%
Master Bedroom	7.4%

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 all of the rooms achieve greater than 2%; therefore all of the rooms should be seen as adequately daylit. In addition, a number of rooms have an ADF greater than 5%; therefore these rooms should be seen as predominantly daylight without the need for supplementary electric lighting.

6. CONCLUSIONS

Calculations were conducted in accordance with the BRE Report in order to determine the extent to which the proposed development at 16-17 Redington Gardens will affect the levels of daylight and sunlight at adjacent properties. In addition, calculations have shown whether the proposed development will be adequately daylit.

The calculations have shown that at 15 Redington Gardens, there will be a reduction in daylight at two windows that may just be noticeable (windows W9 and W13, serving a home office and bedroom respectively). None of the windows will experience a reduction in sunlight that is likely to be noticeable.

Although two windows fail to meet the guideline criteria for daylight as a result of the proposed development, it is important to note that failure to meet the guideline criteria is not an indicator as to whether a development is acceptable. The report states that *"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."* Consequently, since the impact on daylight is restricted to only a small number of windows, with a large number of other windows to the building unaffected, and the reductions are considered to only just exceed the guideline criteria, the proposed development is considered to have only a *"minor adverse"* impact on 15 Redington Gardens and therefore daylight should not be a considered a constraint upon development.

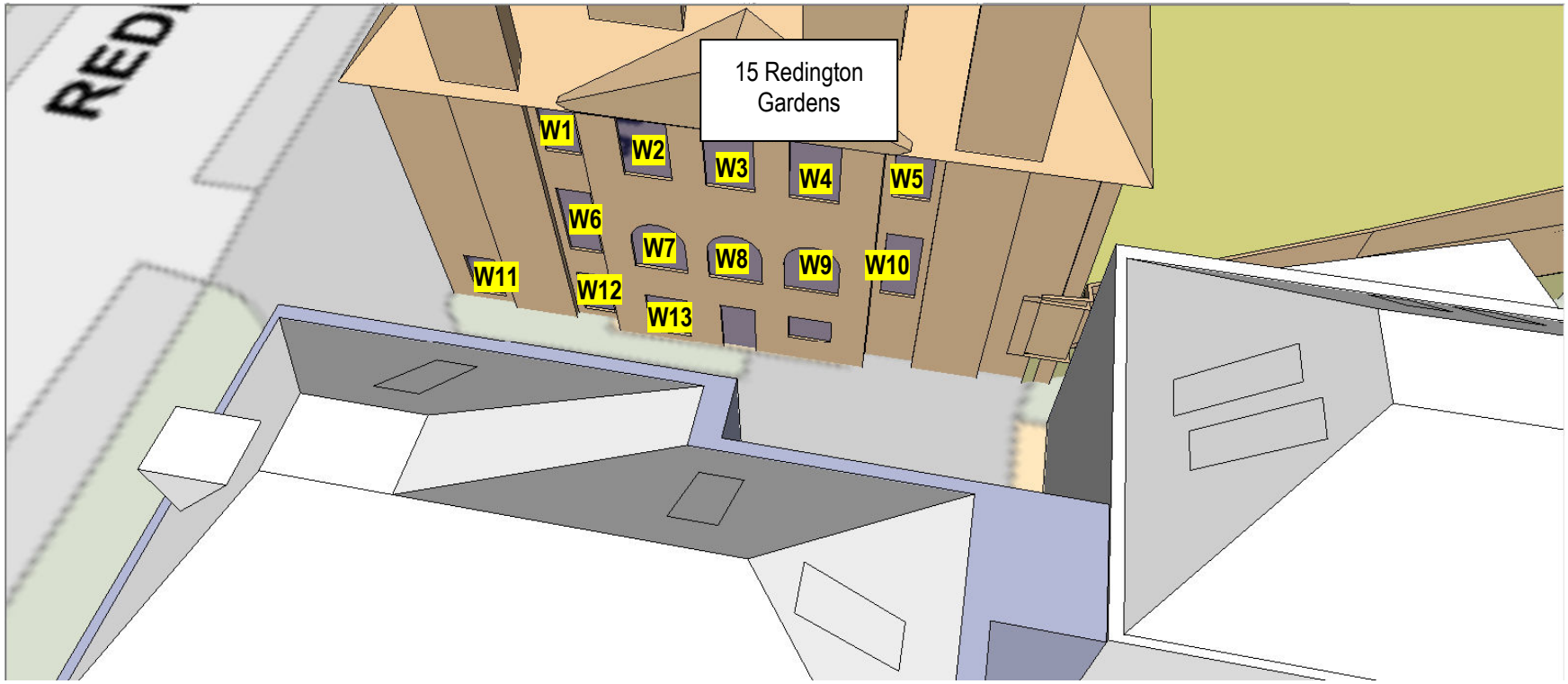
Calculations have also shown that the levels of daylight within the proposed development will be in excess of the levels normally considered to constitute a well lit room for habitable purposes.

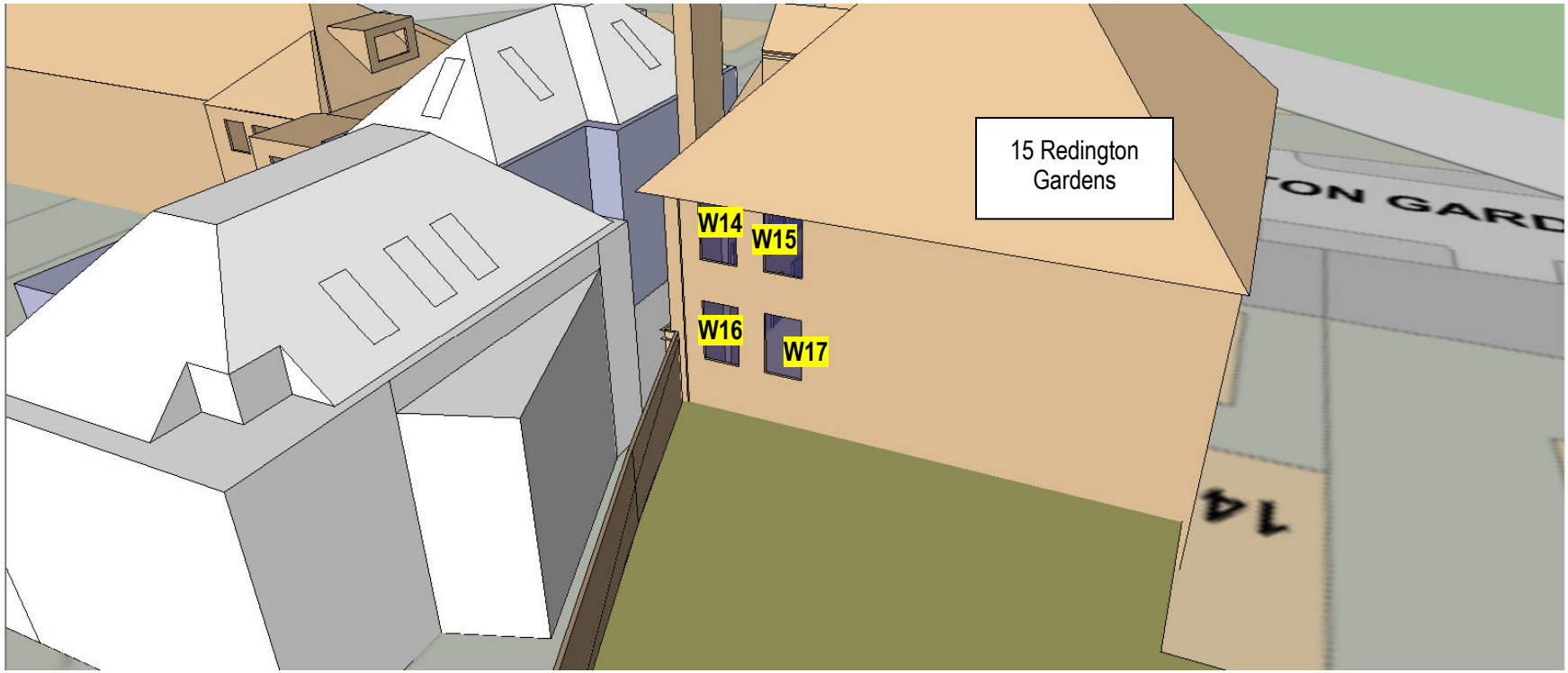
Appendix 1
Site Plan

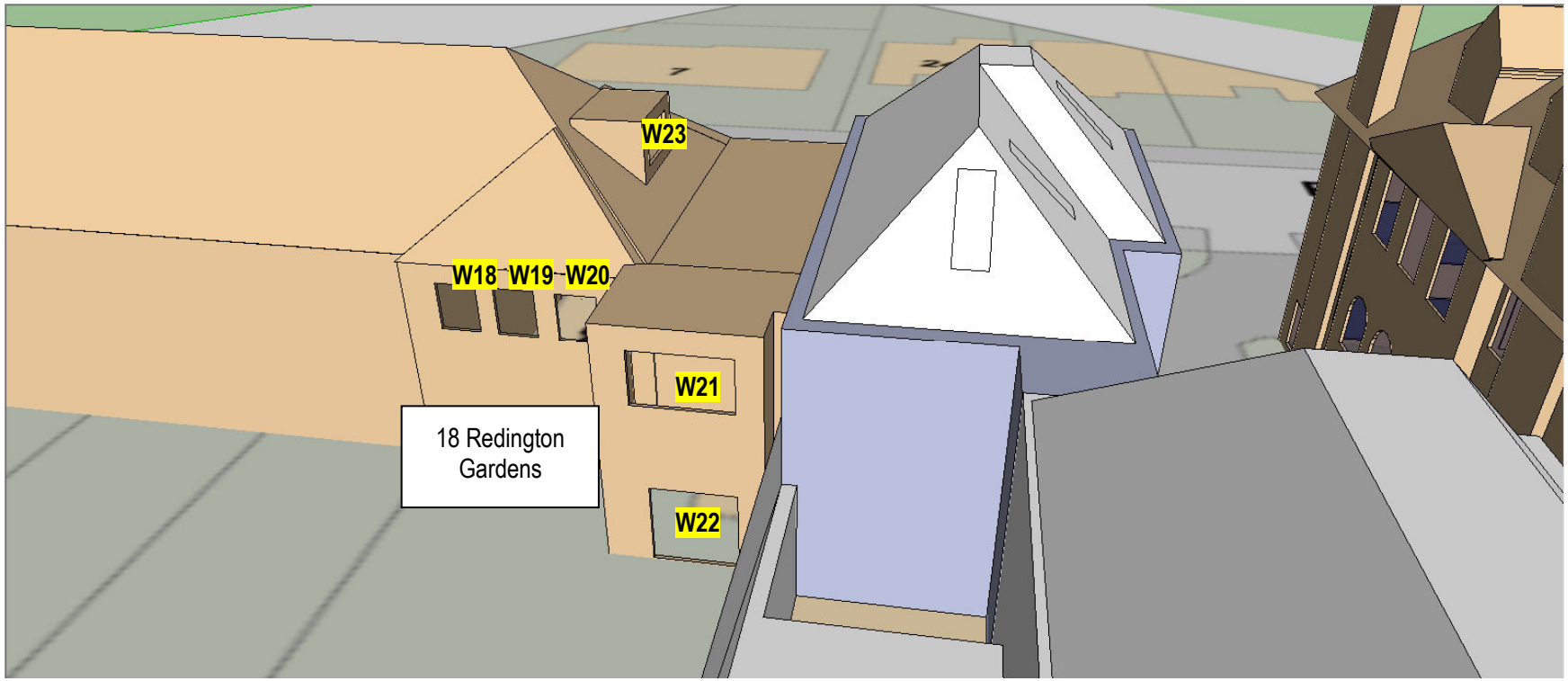
Appendix 1: Site Plan

Appendix 2
Window Schedules

Appendix 2: Window Schedules




15 Redington Gardens
W14
W15
W16
W17


W23
W18
W19
W20
W21
18 Redington Gardens
W22