Daylight and Sunlight Assessment

QMUL Mile End Campus
Hatton House Site

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Contents Page

Client: QMUL

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Document References:
14966-hhp-22-0315(DaySun)
Principles of Daylight and Sunlight
Existing Drawings: 14966/IS01/01-03 (Rel01)
Proposed Drawings: 14966/IS01/01-03 (Rel02)
Daylight and Sunlight Results (Rel02)

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Appended to this report:

Appendix 01 - Principles of Daylight and Sunlight
Appendix 02 - Existing & Proposed Drawings
Appendix 03 - Daylight and Sunlight Results

Sources of Information:

Information Received:	Valuation Office Agency
	Tower Hamlets Council –Online Planning Database Search
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3D Models:	CBRE -IR01-14966
	Nicholas Hare Architects –IR04-14966
Site Photos:	GIA
	Google: Maps & Street Views

1.0 Executive Summary

GIA have been instructed to prepare a daylight and sunlight report for the site at Hatton House, Mile End Campus *"the Site".* This report is based on a model that has been created using photogrammetry and Site photography.

The full description of the Proposed Scheme is as follows:

> "Demolition of the existing Hatton House (Student Accommodation Use Class C2), the construction of a new building for teaching and educational purposes (Use Class F.1), retention, refurbishment and extension of the existing No. 357 Mile End Road and retention and repurposing of Lock Keeper's Cottage along with associated access, public realm works, landscaping and cycle parking and associated works."

Following successful implementation of the Proposed Scheme, of the six properties containing residential use that were considered within our assessments, four would achieve BRE compliance for both daylight and sunlight. Overall there will be a 100% Vertical Sky Component (VSC) and a 97.4% No Sky Line (NSL) compliance rate, which we would consider to be very high values, given the urban context of the Site. We conclude that the proposal will not result in harm to the daylight amenity of surrounding residential properties.

In relation to Annual Probably Sunlight Hours (APSH), all properties that have windows within 90 degrees of due south considered within our analysis will have an 98.1% compliance rate. In consideration of the rooms located within these properties, 100% of those analysed within our assessments will achieve BRE compliance for APSH. We are of therefore of the opinion that the sunlight amenity to the residential properties will not be adversely impacted.

Overall, the Proposed Scheme has been designed sensitively to respect the light amenity of the neighbouring residential properties, which is demonstrated by the high overall compliance rates for both daylight and sunlight. Three transgressions have been noted, but these are minor and this is particularly so in the context of the flexible application of the BRE guidelines in urban localities such as Mile End. This point is also supported by the National Planning Policy Framework (July 2021), which calls for local authorities to *"take a flexible approach in applying policies or guidance relating to daylight and sunlight, where they would otherwise inhibit making efficient use of a site (as long as the resulting scheme would provide acceptable living standards)."*

2.0 Introduction

GIA have been instructed to analyse the Nicholas Hare architects' scheme (received on 14th January 2022) *"the Proposed Scheme"* for the site at Mile End Campus *"the Site"* and advise on the daylight and sunlight impacts that will be experienced by neighbouring residential properties, following its implementation.

3.0 Daylight and Sunlight

Daylight and Sunlight

The primary authority for daylight and sunlight matters is the BRE guide, Site Layout and Planning for Daylight and Sunlight –A Guide to Good Practice (2011). Definitions of daylight and sunlight along with an overview of the BRE are located in Appendix 01.

The technical analysis that forms the basis of this report has been predicated against the methodologies set out within the Building Research Establishment Guidelines entitled 'Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice (2011)'. The guidelines in question are precisely that; guidelines which provide a recommendation to inform site layout and design. They are not mandatory nor do they form planning policy and their interpretation may be treated flexibility depending on the specifics of each site.

The BRE Guidelines provide three methodologies for daylight assessment, namely;

1) The Vertical Sky Component (VSC);
2) The No Sky Line (NSL); and
3) The Average Daylight Factor (ADF).

We have used the VSC and NSL assessment methods to analyse the effects of the Proposed Scheme on the surrounding properties. ADF is not generally recommended by the BRE for assessing daylight to existing surrounding properties, however, it may be used in certain circumstances and these are explained in more detail within the BRE handbook.

In addition, we have used one methodology provided by the BRE Guidelines for sunlight assessment, denoted as Annual Probable Sunlight Hours (APSH).

Appendix 01 of this report elaborates on the mechanics of each of the above assessment criteria, explains the appropriateness of their use and the parameters of each specific recommendation.

4.0 Policy and the Wider Context

3.1 Below we have detailed sections from the following documents as they are, in our opinion, the most pertinent in relation to daylight and sunlight matters and how we have approached the effects of the Proposed Development on the relevant neighbouring properties.

- *National Planning Policy Framework (NPPF) (July 2021) (Ministry of Housing Communities and Local Government (MHCLG));*
- *National Planning Practice Guidance (NPPG) (updated October 2019) (MHCLG);*
- *The London Plan – The Spatial Development Strategy for London Consolidated with Alterations Since 2011 (March 2016) (Greater London Authority);*
- *Sustainable Design & Construction Supplementary Planning Guidance (2014); and*
- *Tower Hamlets Local Plan (adopted January 2020).*

National Planning Policy Framework (July 2021)

3.2 The NPPF (July 2021) states that local planning authorities should refuse applications which they consider fail to make efficient use of land. The discussion in relation to daylight and sunlight highlights the Government's recognition that increased flexibility is required in response to the requirement for higher density development.

National Planning Practice Guidance (Updated July 2019)

3.3 In light of the update to the Government's Planning Practice Guidance, we have considered the relevant paragraphs on daylight and sunlight.

3.4 Paragraph 6 of the NPPG (Ref ID: 66-006- 20190722) acknowledges that new development may cause an impact on daylight and sunlight levels enjoyed by neighbouring occupiers. It requires local authorities to assess whether the impact to neighbouring occupiers would be "unreasonable".

Consolidated London Plan (March 2021)

3.5 The London Plan was published in March 2021 and sets out the integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years.

3.6 Part D of Policy D6 (Housing Quality and Standards) states that the design of development "should provide sufficient daylight and sunlight to new and surrounding housing that is appropriate for its context, whilst avoiding overheating, minimising overshadowing and maximising the usability of outside amenity space."

3.7 It is clear that the GLA's focus is on sufficient or retained daylight and sunlight to neighbouring properties and highlights that context will be a consideration to determine sufficiency.

Sustainable Design & Construction Supplementary Planning Guidance (2014)

3.8 Section 2.3 of the SPG provides guidance on key areas such as site layout and micro-climate in relation to site layout and building design.

3.9 With regard to site layout, paragraph 2.3.6 refers to measures to reduce carbon dioxide emissions "include enabling access to daylight and sunlight for uses that require [light]." In addition, the guidance states that "site planning can minimise the impact of the shadow created by the new buildings to protect existing features such as open space and renewable solar technologies on roofs." It goes on to say that "developers should ensure the layout of their site and buildings maximises the opportunities provided by natural systems, such as light."

3.10 Paragraph 2.3.8 of the SPG continues with effects on the micro-climate caused by new buildings which include "overshadowing and reducing access to sunlight."

3.11 The guidance states that the above effects should "be considered during the design of a development and assessed once the designed is finalised."

Tower Hamlets Local Plan (Adopted January 2020)

3.12 Policy S.DH1 of the Tower Hamlets Local Plan 'Delivering High Quality Design' states in part H that development must "use design and construction techniques to ensure that the development does not result in unacceptably harmful impacts arising from overheating, wind, air pollution, light pollution and noise pollution and the loss of sunlight and daylight, whilst optimising energy and waste efficiency"

3.13 The Local Plan further states in part D of Policy D.DH8 'Amenity' that development should "not result in an unacceptable material deterioration of the sunlight and daylight conditions of surrounding development and not resulting in an unacceptable level of overshadowing to surrounding open space and private outdoor space"

5.0 Assumptions

a) We have relied upon a photogrammetric model (circa 300mm tolerance) and site photographs to produce the three-dimensional computer model which forms the basis of the technical analysis. GIA have created a three-dimensional DWG model of the Site and surrounding properties based on photogrammetry and site photography. Where information is missing (access issues, foliage etc.), the surrounding environment has been modelled based on site photographs and OS maps.

b) All residential buildings have been identified by reference to the Valuation Office Agency (VOA) search and/or external observation.

c) We have not sought access to the adjoining properties thus have made reasonable assumptions as to the internal layouts of the rooms behind the fenestration based upon the building form and architecture. This is normal practice where access to adjoining properties is not available. Unless the building form dictates otherwise, we assume a standard 4.2m deep room (14ft) for residential properties.

d) Floor levels have been assumed for the adjoining properties. This dictates the level of the working place which is relevant for the No Skyline assessment.

e) The light levels within each surrounding property have been assessed based on the Site as it currently exists. We have then inserted the proposed Nicholas Hare architects scheme, received on 14th January 2022, in to our model and projected light levels have been recorded within adjoining properties. GIA are not aware of any changes to the Site or surrounding properties since then and indeed any changes that have been made are not material.

f) Floor plans have been obtained for the following properties:

- Guardian Angels RC Primary School;
- 4 Whitman Road;
- 359 Mile End Road; and
- 438 Mile End Road.

g) It is only those properties that contain residential accommodation that have been considered in this daylight and sunlight report as these properties have the highest requirement for light.

6.0 The Site

The existing Site is detailed in the image below (further images can be found in Appendix 02):

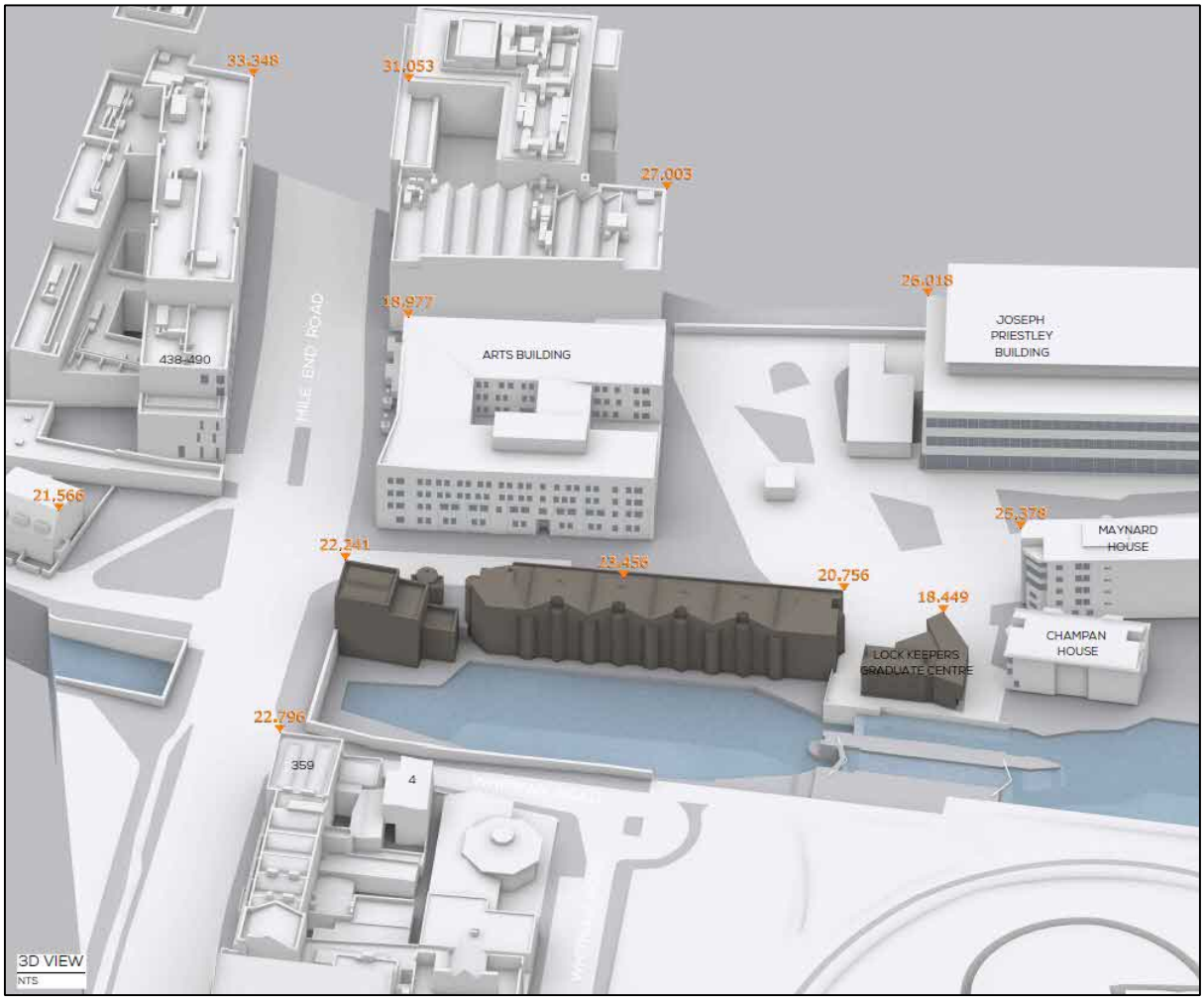


Figure 01 – Existing Site

Note that the existing Site is predominantly surrounded by student accommodation, the building names of which are detailed below:

- Maynard House
- Chesney House
- Chapman House

7.0 The Proposal

A full description of the Proposed Scheme is included below:

"Demolition of the existing Hatton House (Student Accommodation Use Class C2) and the construction of a new building for teaching and educational purposes (Use Class D1) along with associated access, public realm works, landscaping and cycle parking."

The Proposed Scheme is detailed in the image below (further images can be found in Appendix 02):

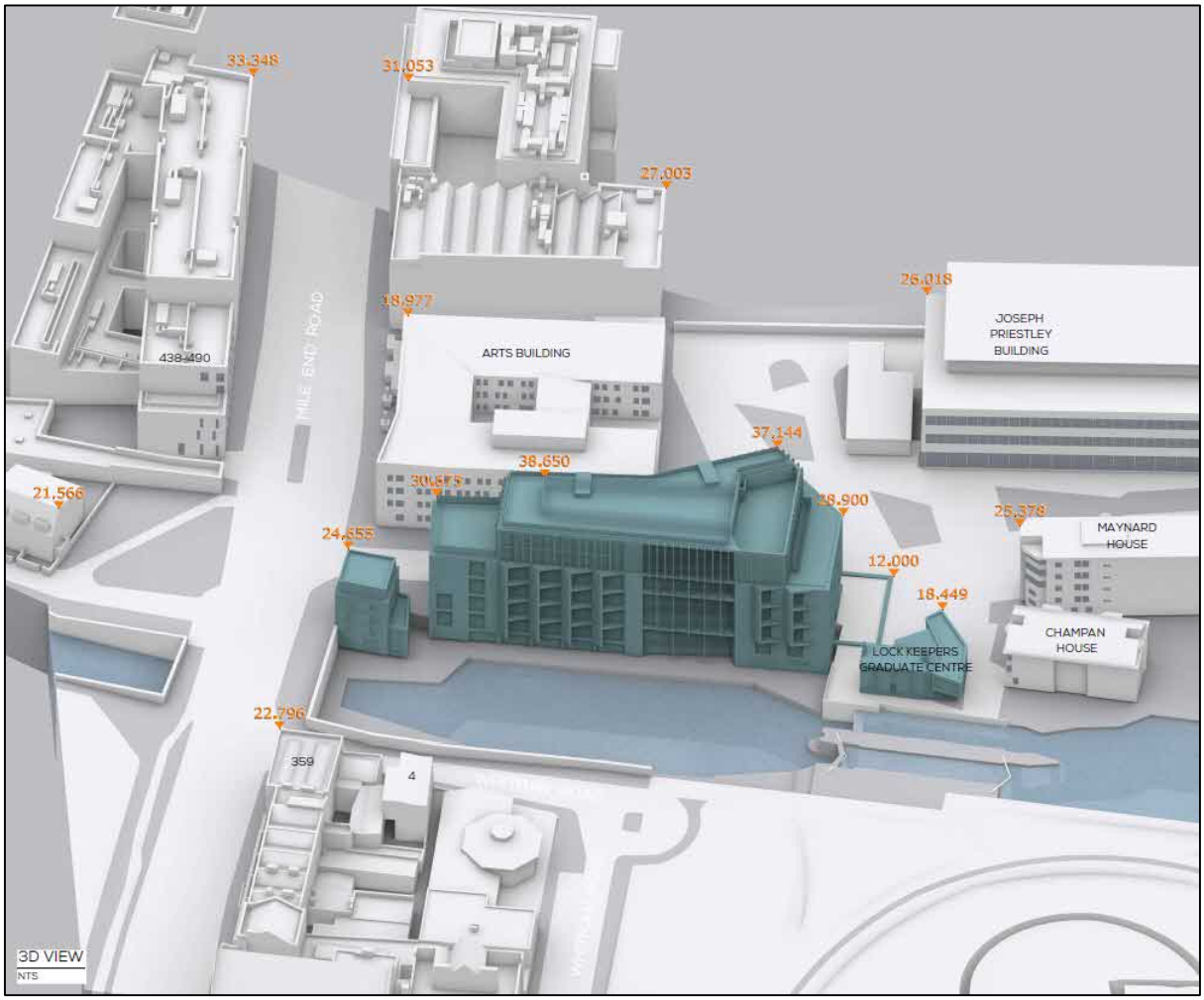


Figure 02 – Proposed Scheme

8.0 Surrounding Properties

The following properties achieve full BRE compliance for both daylight and sunlight and so have not been discussed in any further detail:

- 359 Mile End Road;
- 438-490 Mile End Road;
- 4 Whitman Road; and
- Chesney House.

The full technical results for the above properties can be found within Appendix 03. All properties that experience a BRE transgression to either/or their daylight and sunlight levels have been discussed in greater detail below:

Maynard House

Following the implementation of the Proposed Scheme, all 35 windows and 20 rooms assessed within this property for VSC and NSL will achieve BRE compliance.

In relation to APSH, of the eight windows facing within 90 degrees of due south of the development that have therefore been assessed within Maynard House, seven will achieve BRE compliance on implementation of the Proposed Scheme. The single window that will not meet the baseline BRE guidelines will experience a transgression of over 40% during the winter months, however it will retain a winter value of 4%, which we would note is just marginally below the BRE recommended value of 5%. Further to this, the impacted window will remain fully BRE compliant during the summer months, with a retained value in excess of the BRE recommended 25%, at 35%.

In addition, all five rooms assessed for APSH within Maynard House will achieve full BRE compliance following the implementation of the Proposed Scheme. Therefore, we are of the opinion that there will be a minor impact to this property's sunlight amenity, following the implementation of the Proposed Scheme.

Chapman House

Of the 22 windows facing towards the development Site and that are therefore relevant for assessment within this property for VSC, all will achieve BRE compliance following the implementation of the Proposed Scheme.

In relation to NSL, of the 13 rooms assessed, all but two will achieve BRE compliance following the implementation of the Proposed Scheme. One kitchen located at first floor level and one kitchen located at second floor level will experience NSL reductions only marginally in excess of the 20% parameter suggested as acceptable by the BRE guidelines, those being 24.6% and 22.8% respectively. Furthermore, both of these rooms will achieve retained NSL values well in excess of 50% in the proposed condition, which we would consider to be high given the urban context of the Site. As such, we are of the opinion that unacceptable harm will not be caused.

In relation to sunlight, all 13 rooms and 19 windows facing within 90 degrees of due south of the development and that have been assessed within this property for APSH will achieve BRE compliance, following the implementation of the Proposed Scheme.

Although two of the 13 rooms assessed in this property for NSL will not achieve the minimum parameters recommended by the BRE guidelines, given the high retained NSL values, combined with this property's full compliance with the BRE guidelines for VSC, we of the opinion that the daylight amenity at this property will remain acceptable.

9.0 Conclusion

GIA have carried out a daylight and sunlight analysis to understand the impacts that will be experienced by neighbouring residential properties, following the implementation of the proposed Nicholas Hare architects scheme for the site at QMUL Mile End Campus.

Of the six properties assessed, four will achieve BRE compliance for both daylight and sunlight, following the implementation of the Proposed Scheme. In relation to VSC, of the 124 windows assessed, all will achieve BRE compliance in the proposed condition.

In relation to NSL, of the 76 rooms assessed overall, 74 (97.4%) will achieve BRE compliance, following the implementation of the Proposed Scheme. This leaves only two rooms which will experience NSL reductions of between 20-30%, which are only marginally in excess of the 20% suggested as acceptable by the BRE guidelines. In summary, we are of the opinion that the overall NSL compliance rate of 97.4% is very high and suggests that the impact of the Proposed Scheme on the daylight amenity of the neighbouring residential properties will be minor.

A total of 52 windows located within the neighbouring residential properties were assessed for APSH, 51 (98.1%) of which will achieve BRE compliance, following the implementation of the Proposed Scheme. A total of 35 rooms were assessed, all of which achieve BRE compliance with the Proposed Scheme in-situ. Given that all of the rooms assessed within our APSH assessment achieve BRE compliance, we are of the opinion that this compliance rate is very high, especially when taking the urban context of the Site into consideration.

Notwithstanding our conclusion that the daylight and sunlight effects of the scheme are acceptable, it should be noted that both of the buildings served by these windows are occupied as student accommodation. Given that these buildings are not permanent residences, the minor impacts should attract lesser weight than in the case of dwellinghouses.

Note that we have not identified any amenity spaces in the immediate vicinity of the Site which we deem pertinent for assessment. Where amenity areas do exist, these are too far away from the Proposed Scheme to warrant technical assessment.

Overall, we are of the opinion that the daylight and sunlight impacts that will be experienced by neighbouring residential properties will be minor, following the implementation of the Proposed Scheme.

In instances where transgressions beyond the parameters suggested by the BRE guidelines do occur, the residential properties still retain high levels of daylight and sunlight within their rooms.

It should also be noted that the advice set-out in the BRE guidelines is not mandatory and the guidelines explicitly state that they should be applied flexibly.

This is also supported by the National Planning Policy Framework (July 2021), which calls for local authorities to *"take a flexible approach in applying policies or guidance relating to daylight and sunlight, where they would otherwise inhibit making efficient use of a site (as long as the resulting scheme would provide acceptable living standards)."*

Appendix 01

Principles of Daylight & Sunlight

PRINCIPLES OF DAYLIGHT, SUNLIGHT & OVERSHADOWING

The Building Research Establishment (BRE) have set out in their handbook 'Site Layout Planning for Daylight & Sunlight: A Guide to Good Practice 2nd edition (2011)', guidelines and methodology for the measurement and assessment of daylight and sunlight.

BACKGROUND & CONTEXT

A 2.1 The quality of amenity and open spaces is often stipulated within planning policy for protection or enhancement and is often a concern for adjoining owners and other interested parties.

A 2.2 The BRE Guidelines provide advice on site layout planning to determine the quality of Daylight and Sunlight within open spaces between buildings.

A 2.3 The BRE Guidelines note that the document is intended to be used in conjunction with the interior Daylight recommendations found within the British Standard BS8206-2:2008 and The Applications Manual on Window Design of the Chartered Institution of Building Services Engineers (CIBSE).

A 2.4 The BRE Guidelines are typically referred to for daylight and sunlight amenity issues, however, they were not intended to be used as an instrument of planning policy, nor were the figures intended to be fixedly applied to all locations.

A 2.5 In the introduction of 'Site Layout Planning for Daylight and Sunlight (2011)', section 1.6 (page 1), states that:-

> "*The guide is intended for building designers and their clients, consultants and planning officials. The advice given here is not mandatory and this document 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 because natural lighting is only one of many factors in site layout design (see Section 5). In special circumstances the developer or Planning Authority may wish to use different target values. For example, in an historic city centre, or in an area with modern high rise buildings, a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings*".[1]

A 2.6 Paragraph 2.2.3 (page 7) of the document states:-

> *"Note that numerical values given here are purely advisory. Different criteria may be used, based on the requirements for daylighting in an area viewed against other site layout constraints".*[2]

A 2.7 The numerical criteria suggested by the BRE are therefore designed to provide industry advice/ guidance to plan/design with daylight in mind. Alternative values may be appropriate in certain circumstances such as highly dense urban areas around London. The BRE approach to creating alternative criteria is detailed within Appendix F of the Document.

A 2.8 The BRE Guidelines state that they 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."*[3]

A 2.9 They are therefore primarily designed to be used for residential properties however, the BRE Guidelines continue to state that they may be applied to any existing non-residential buildings where there may be a reasonable expectation of daylight including; schools, hospitals, hostels, small workshop and some offices.

A 2.10 It is important to note, however, that this document is a guide and states that its aim *"is to help rather than constrain the designer"*[4].

A 2.11 The document provides advice, but also clearly states that *"it is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location."*[5]

A 2.12 Many Local Planning Authorities consider daylight and sunlight an important factor for determining planning applications. Policies refer to both the protection of daylight and sunlight amenity within existing properties as well as the creation of proposed dwellings with high levels of daylight and sunlight amenity.

A 2.13 In terms of considering what is a material deterioration in light, Local Authorities typically refer to the BRE Guide. Although Local Authorities will look to the BRE Guide to understand impacts it is their Planning Policies that will determine whether the changes in light should be a reason for refusal at planning.

A 2.14 It is an inevitable consequence of the built up urban environment that Daylight and Sunlight will be more limited in dense urban areas. It is well acknowledged

that in such situations there may be many other conflicting and potentially more important planning and urban design matters to consider other than just the provision of ideal levels of Daylight and Sunlight.

A 2.15 The following sections extract relevant sections from the Guide.

DAYLIGHT

A 2.16 The BRE Guidelines provide three methodologies for daylight assessment, namely;

1. The Vertical Sky Component (VSC);
2. The No Sky Line (NSL); and
3. The Average Daylight Factor (ADF).

Vertical Sky Component (VSC)

A 2.17 The Vertical Sky Component (VSC) method is described in the BRE Guidelines as the;

> *"Ratio of that part of illuminance, at a point on a given vertical plane, that is received directly from a 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"*[6]

A 2.18 Put simply, the VSC provides an assessment of the amount of skylight falling on a vertical plane (generally a window) directly from the sky, in the circumstance of an overcast sky (CIE standard).

A 2.19 The national numerical value target "ideal" for VSC is 27%. The BRE Guidelines advise that upon implementation of a development, a window should retain a VSC value of 27% or at least 0.8 of its former value (i.e. no more than a 20% change).[7]

A 2.20 This form of assessment does not take account of window size, room use, room size, window number or dual aspect rooms. The assessment also assumes that all obstructions to the sky are 100% non-reflective.

A 2.21 The VSC calculation has been undertaken in both the existing and proposed scenarios so as to make a comparison.

A 2.22 The image in Figure 01 depicts a waldram diagram which is used to calculate the VSC. The existing buildings are solidly pictured with the proposed scheme semi-transparent in the foreground.

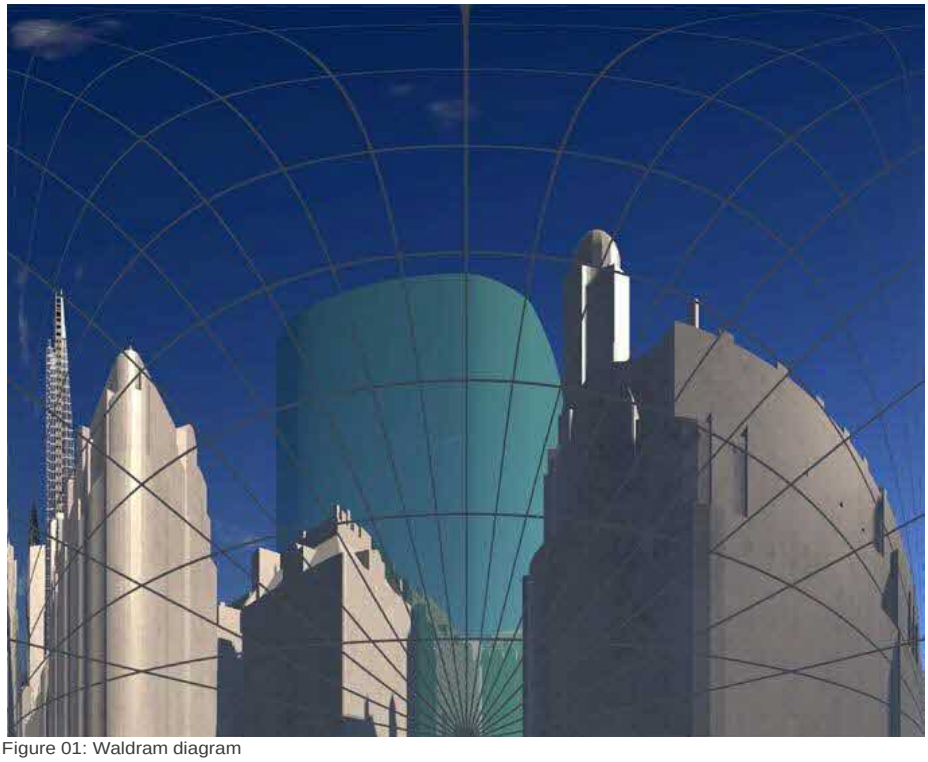


Figure 01: Waldram diagram

No Sky Line (NSL)

A 2.23 The BRE recommends the No Sky Line (NSL) method where internal layouts are known.

A 2.24 The No Sky Line (NSL) method is described as *"the outline on the working plane of the area from which no sky can be seen."*[8]

A 2.25 In summary, the NSL calculation assesses where the sky can and cannot be seen from inside a room at the working plane, *"in houses the working plane is assumed to be horizontal and 0.85m high"*.[9]

A 2.26 The change in position of the NSL between the existing and proposed scenario is then calculated. This change can be illustrated on a contour plot, an example of which can be found in Figure 02.

A 2.27 The BRE Guidelines state at paragraph 2.2.9 that;

> *"If, following construction of a new development, the no sky line moves so that the area of the existing room, which does receive direct skylight, is reduced to less than 0.8 times its former value this will be noticeable to the occupants, and more of the room will appear poorly lit. This is also true if the no sky line encroaches on key areas like kitchen sinks and worktops."*[10]

A 2.28 If the NSL experiences more than a 20% change from the existing situation then, in accordance with the strict application of the national numerical values, the change in daylight would be noticeable to the occupants.

A 2.29 This assessment takes the number and size of windows serving a room into account however, there is no qualitative assessment of the light in the room, only where sky can or cannot be seen.

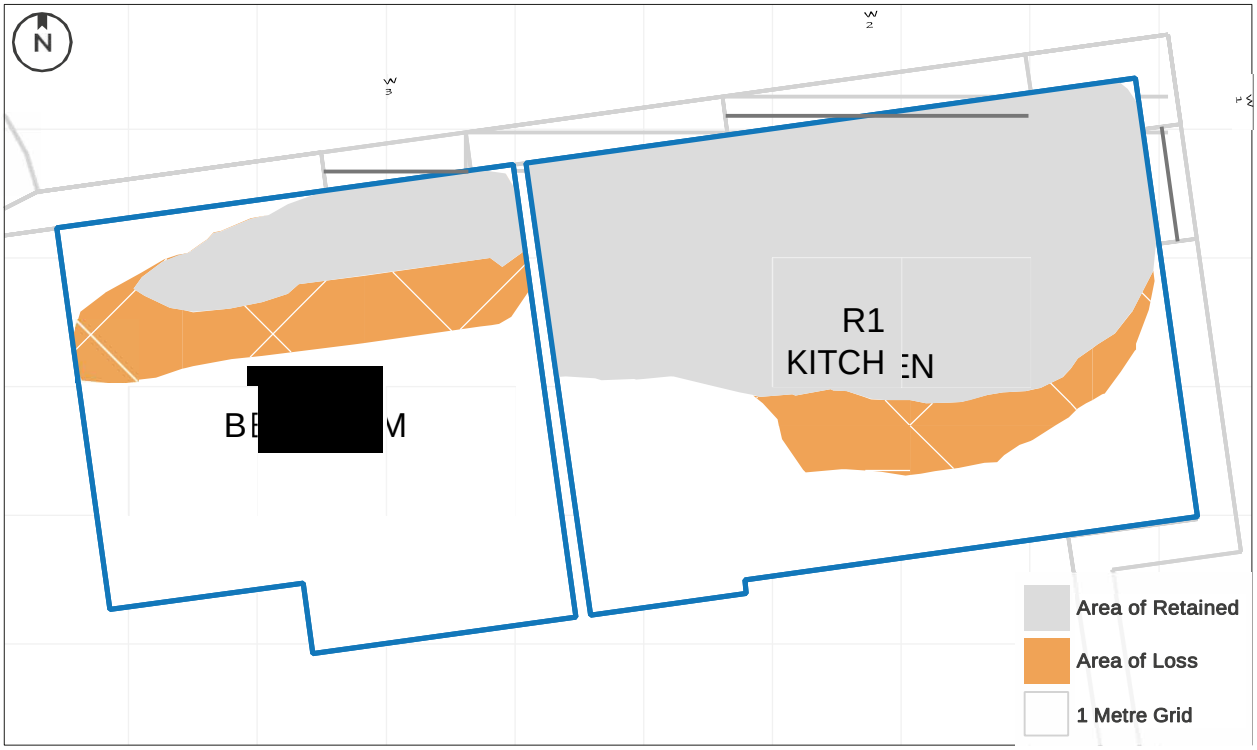


Figure 02: Example NSL diagram

Decision Chart (Figure 20 of the BRE Guide)

A 2.30 The flowchart in Figure 03 illustrates the steps and criteria outlined within the BRE Guidelines to understand whether the daylighting (VSC and NSL) may be *significantly affected*.

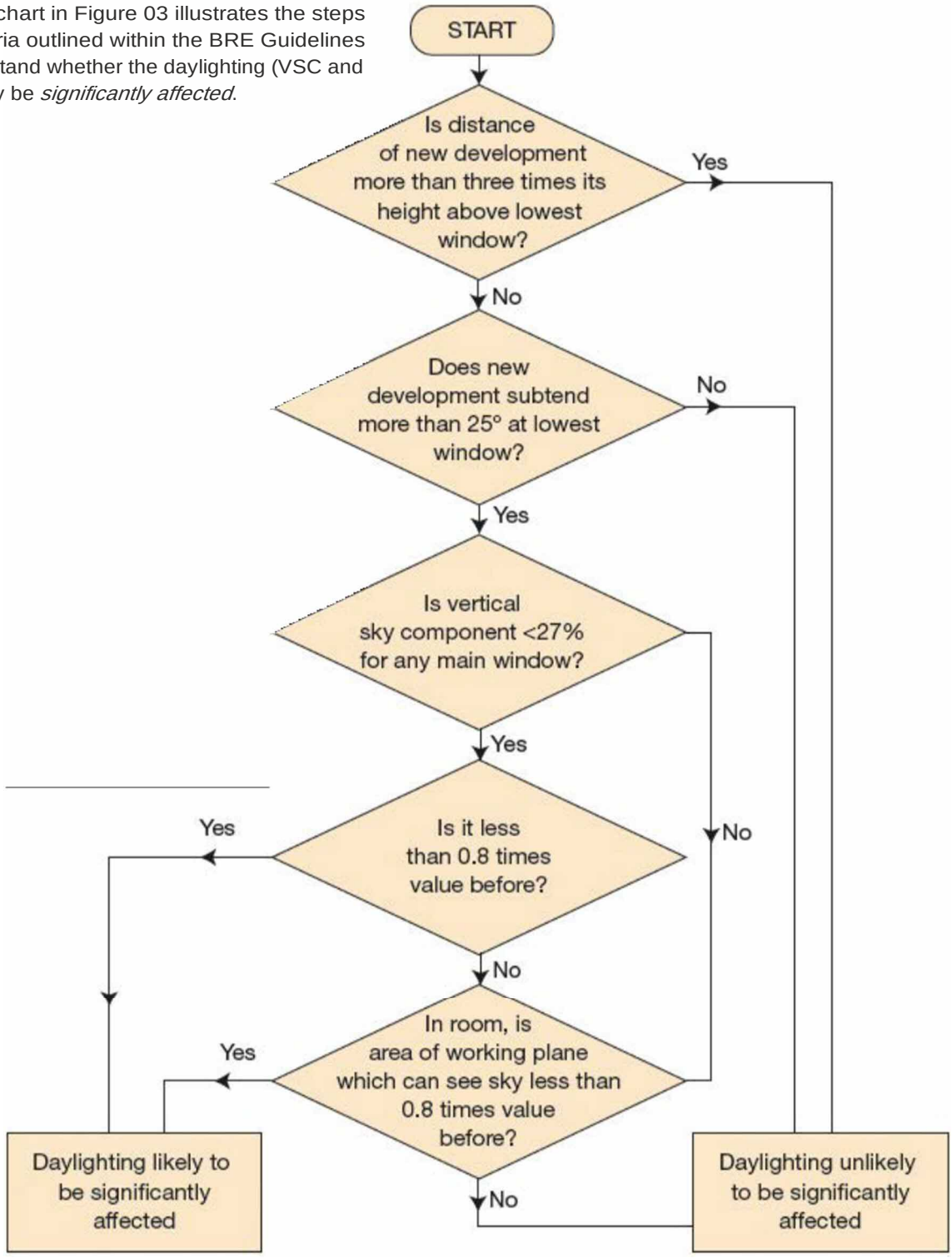


Figure 03: BRE Decision Chart (Figure 20): *diffuse daylight in existing buildings. This does not include an assessment of rights to light issues, which a developer may need to consider separately*

Average Daylight Factor (ADF)

A 2.31 The Average Daylight Factor (ADF) is defined within the 2011 BRE Guidelines as the *'ratio of total daylight flux incident on the working plane to the area of the working plane, expressed as a percentage of the outdoor illuminance on a horizontal plane due to an unobstructed CIE standard overcast sky. Thus a 1% ADF would mean that the average indoor illuminance would be one hundredth the outdoor unobstructed illuminance'*.[11]

A 2.32 This calculation considers not only the amount of skylight falling on the vertical face of the window, but also the glazing size, transmittance value, average reflectance, room area and room use. It is therefore a more detailed analysis of the daylight levels within a room.

A 2.33 British Standard 8206-2 quotes a number of recommended ADF levels based on room use. The ADF criteria is the prescribed methodology for evaluating the Daylight within proposed accommodation and the values referenced by the BRE Guidelines can be found in the British Standard document BS8206 Part II. The values for those rooms that are most relevant for our assessments are:

- Bedrooms 1% ADF
- Living rooms 1.5% ADF
- Kitchens 2% ADF[12]

A 2.34 Where one room serves more than one purpose, the minimum ADF should be that for the room type with the highest value.

A 2.35 As per the *British Standard Lighting for buildings - Part 2: Code of practice for daylighting* the ADF value should be 5%+ for a well daylit space:

> *"It is considered good practice to ensure that rooms in dwellings and in most other buildings have a predominantly daylit appearance. In order to achieve this the average daylight factor should be at least 2%. If the average daylight factor in a space is at least 5% then electric lighting is not normally needed during the daytime, provided the uniformity is satisfactory. If the average daylight factor in a space is between 2% and 5% supplementary electric lighting is usually required."*[13]

A 2.36 Appendix F of the BRE guidance states that, though not being generally recommended, the use of the ADF for loss of light to existing buildings can be appropriate in some situations:

- where the existing building is one of a series of new buildings that are being built one after another;
- where the existing building is proposed (i.e. consented) but not built;
- where the developer of the new building also owns the existing nearby building and proposes to carry out improvements to the existing building;
- where the developer also owns the existing nearby building and the affected rooms are either unoccupied or would be occupied by different people following construction of the new building.[14]

SUNLIGHT

Annual Probable Sunlight Hours (APSH)

A 2.37 The BRE Guidance suggests that to understand sunlight impacts to a property an assessment

A 2.38 of Annual Probable Sunlight Hours (APSH) is undertaken. The APSH is defined as:

> *"the long-term average of the total number of hours during a year in which direct sunlight reaches the unobstructed ground (when clouds are taken into account)"*[15]

A 2.39 In interpreting the results, the BRE Guidance states that the Sunlight to a window may be adversely affected if a point at the centre of a window:

- receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21 September and 21 March, and
- receives less than 0.8 times its former sunlight hours during either period, and
- has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours."[16]

A 2.40 To understand the potential sunlight impacts therefore, all windows facing within 90 degrees of due south and overlooking the development have been assessed for APSH.

A 2.41 The image in Figure 04 depicts the APSH sun spots on a waldram diagram. The existing buildings are solidly pictured with the proposed scheme semi-transparent in the foreground. The yellow spots indicate summer sun and the blue spots indicate winter sun.

A 2.42 The number of sun spots is calculated for both the whole year and during the winter period (21 September to 21 March), prior to an obstruction and after the obstruction is put in place. This provides a percentage of APSH for each of the time periods for each window assessed.

A 2.43 The BRE Guidelines note that:

> *"all main living rooms of dwellings…should be checked if they have a window facing within 90° of due south. Kitchens and bedrooms are less important, although care should be taken not to block too much sun:* and
>
> *"If the main living room to a dwelling has a main window facing within 90° of due north, but a secondary window facing within 90° of due south, sunlight to the secondary window should be checked."*[17]

A 2.44 The BRE Guidelines set out the overall methodology and criteria for the assessment of Sunlight in Chapter 3. The BRE Guidelines state:

> *"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 degrees of due south. Kitchens and bedrooms are less important, although care should be taken not to block too much sun.*
>
> *A point at the centre of the window on the outside face of the window wall may be taken.*
>
> *If this window reference point can receive more than one quarter of Annual Probable Sunlight Hours [25%], including at least 5% of APSH in the winter months between 21 September and 21 March, then the room should still receive enough sunlight.*
>
> *Any reduction in sunlight access below this level should be kept to a minimum. If the available sunlight hours are both less than the amount above and less than 0.8 times their former value, either over the whole year or just during the winter months (21 September - 21 March), then the occupants of the existing building will notice the loss of sunlight; if the overall annual loss is greater than 4% of APSH, the room may appear colder and less cheerful and pleasant."*[18]

Figure 04: Waldram diagram

OVERSHADOWING

A 2.45 The BRE guidance in respect of overshadowing of amenity spaces is set out in section 3.3 of the handbook. Here it states as follows:

> *"Sunlight in the spaces between buildings has an important impact on the overall appearance and ambiance of a development. It is valuable for a number of reasons:*
>
> - *To provide attractive sunlit views (all year)*
> - *To make outdoor activities, like sitting out and children's play more pleasant (mainly during the warmer months)*
> - *To encourage plant growth (mainly in spring and summer)*
> - *To dry out the ground, reducing moss and slime (mainly during the colder months)*
> - *To melt frost, ice and snow (in winter)*
> - *To dry clothes (all year)"*[19]

A 2.46 It must be acknowledged that in urban areas the availability of sunlight on the ground is a factor which is significantly controlled by the existing urban fabric around the site in question and so may have very little to do with the form of the development itself. Likewise, there may be many other urban design, planning and site constraints which determine and run contrary to the best form, siting and location of a proposed development in terms of availability of sun on the ground.

Sun Hours on Ground & Transient Overshadowing

A 2.47 The Sun Hours on Ground (SHOG) method of overshadowing assessment uses a simulation software to determine the areas which receive direct Sunlight and those which do not.

A 2.48 The BRE Guidelines suggest that the Spring Equinox (21 March) is a suitable date for the assessment as this is the midpoint of the sun's position throughout the year. Using specialist software, the path of the sun is tracked to determine where the sun would reach the ground and where it would not.

> *"It is recommended that for it [an amenity space] 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."*[20]

A 2.49 The Transient Overshadowing study is recommended where large buildings are proposed which may affect a number of gardens or open spaces. For the purpose of this assessment, the shadow is mapped at hourly intervals (from sun rise to sun set) on the following dates:

- 21 March (Spring equinox)
- 21 June (Summer solstice)
- 21 December (Winter solstice)

A 2.50 The September equinox is not assessed as this would provide the same results as those for 21 March.

A 2.51 The BRE guidelines do not provide any criteria for Transient Overshadowing.

BRE GUIDELINES: ADDITIONAL DAYLIGHT AND SUNLIGHT TESTS

Daylight - VSC and APSH to Rooms

A 2.52 As outlined within the BRE Guidelines the VSC value is calculated for each window; however -

> *"If a room has two or more windows of equal size, the mean of their VSC's may be taken".*[21]

A 2.53 Although not strictly in accordance with the BRE methodology, where a room is served by two or more windows of the same or different sizes, the VSC value to the room can be calculated by applying an average weighting calculation to understand the VSC value to the room. The formula used is as follows;

$$\Sigma(Vn*An) / \Sigma An$$

Where:

V = window VSC
A = window area
n = the number of windows

A 2.54 The BRE provide a methodology to calculate APSH in relation to the room and window.

> *"If a room has multiple windows on the same walls or adjacent walls, the highest value of ASPH should be taken. If a room has two windows on opposite walls, the ASPH due to each can be added together."*[22]

A 2.55 The above extract of the BRE is in relation to proposed units rather than existing buildings. It does, however, make sense to apply this methodology to existing rooms. A room served by multiple windows could receive the benefit of Sunlight entering from all of them and not just one.

A 2.56 GIA calculate the APSH room assessment in the following way:

1 The sunlight hours (both winter and annual) are calculated for each window. Instead of simply returning the overall per cent pass rate, i.e. one figure for winter, and one for the whole year, the yes/no result of each of the 100 sun spots is tracked. For this accounting to work, each sun dot needs to be assigned a unique identifier, e.g. from 1 to 100;

2 The sets of 100 sun spots are combined for each room using Boolean logic, i.e. conjunctions of yes/no values. The outcome of this step is a set of 100 yes/no values corresponding to the 100 sun spots, but on a per-room basis. Each per-room dot is counted if it is unobstructed for at least one of its windows; and

3 The unobstructed sun dots for the room are summed up and expressed as a percentage of the total number of annual and winter spots. This returns the per-room pass rate consistent with Section 3.1.10 of BR 209.

Balconies/ Overhangs

A 2.57 The BRE recognises that existing architectural features on neighbouring buildings such as balconies and overhangs inherently restrict the quantum of skylight to a window. The BRE Guidelines note on page 5, paragraph 2.1.17 and page 8, paragraph 2 .2 .11:

> "*This is a particular problem if there are large obstructions opposite; with the combined effect of the overhang and the obstruction, it may be impossible to see the sky from inside the room, and hence to receive any direct skylight or sunlight at all."*

> "*Existing windows with balconies above them typically receive less daylight. Because the balcony cuts out light from the top part of the sky, even a modest obstruction opposite may result in a large relative impact on the VSC, and on the area receiving direct skylight. One way to demonstrate this would be to carry out an additional calculation of the VSC and the area receiving direct skylight, for both the existing and proposed situations, without the balcony in place."*[23]

A 2.58 As noted by the BRE Guidelines, where there are existing overhanging features larger reductions in skylight and sunlight may be unavoidable and alternative criteria can be used. The guidance suggests that in such situations a calculation is carried out that excludes the balcony or the obstruction.

DAYLIGHT - MIRROR MASSING & ADJOINING DEVELOPMENT LAND

Alternative target Values for Skylight and Sunlight Access "Mirror Massing"

A 2.59 The BRE Guidelines provide a calculation for the VSC and APSH analysis to quantify an appropriate alternative value based on the context of an environment. This approach is known as the 'mirror image' analysis (see Figure 05).

A 2.60 The BRE notes:

> *"where an existing building has windows that are unusually close to the site boundary and taking more than their fair share of light. Figure 3 shows an example where side windows of an existing building are close to the boundary. 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."*[24]

A 2.61 This analysis is used to understand the levels of Daylight (VSC) and Sunlight (APSH) that would be experienced by an extant neighbouring property if there were a building of the same height and extent opposite.

A 2.62 The mirror image assessment is fairly simplistic and is not, therefore, easily applied to large and complex site footprints which are not all built at equal distances from the site boundary or of the same footprint.

Adjoining Development Land

A 2.63 The *"Adjoining Development Land"* analysis provided within the BRE Guidelines is a simple test to ensure that a proposal is a reasonable distance from the boundary so as to *"enable future nearby developments to enjoy a similar access to daylight."*

A 2.64 The BRE comments that:

> *"The diffuse daylight coming over the boundary may be quantified in the following way. As a first check, draw a section in a plane perpendicular to the boundary (Figure 21). If a road separates the two sites then the centre line of the road should be taken. Measure the angle to the horizontal subtended at a point 1.6 m. above the boundary by the proposed new buildings. If this angle is less than 43 ° then there will normally still be the potential for good daylighting on the adjoining development site (but see Sections 2.3.6 and 2.3.7)."*[25]
>
> *"The guidelines above should not be applied too rigidly. A particularly important exception occurs when the two sites are very unequal in size and the proposed new building is larger in scale than the likely future development nearby. This is because the numerical values above are derived by assuming the future development will be exactly the same size as the ·proposed new building (Figure 22). If the adjoining sites for development are a lot smaller, a better approach is to make a rough prediction of where the nearest window wall of the future development may be; then to carry out the 'new building' analysis in Section 2.1 for this window wall."*[26]
>
> *"The 43° angle should not be used as a form generator, to produce a building which slopes or steps down towards the boundary. Compare Figure 23 with Figure 22 to see how this can result in a higher than anticipated obstruction to daylight. In Figure 23 the proposed building subtends 34° at its mirror image, rather than the maximum of 25° suggested here. In cases of doubt, the best approach is again to carry out a new building analysis for the most likely location of a window wall of a future development."*[27]

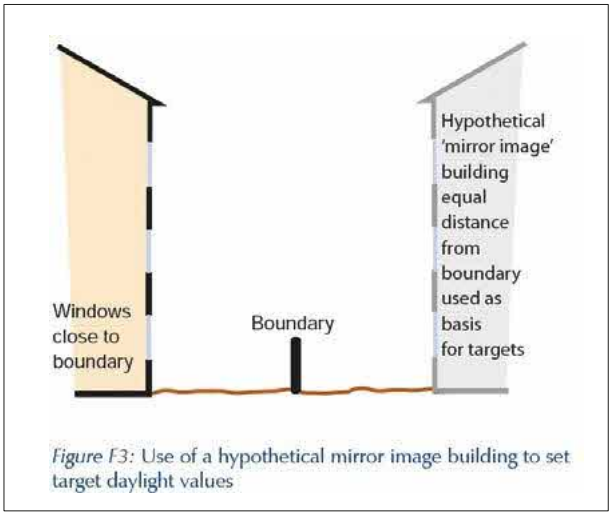


Figure 05: Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: HIS BRE Press p 64 Figure F3

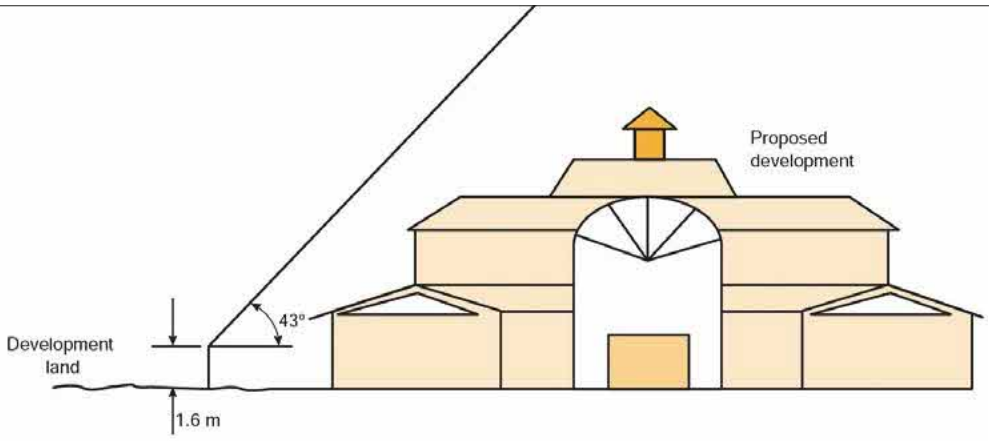


Figure 21: Angular criterion for overshadowing of future development land (on left)

Figure 06: Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: HIS BRE Press p 11 Figure F21

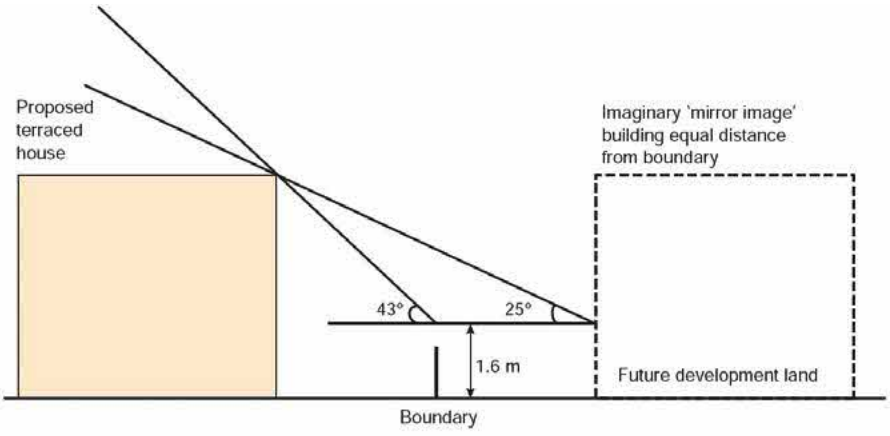


Figure 22: Derivation of an angular boundary criterion to safeguard future development of adjoining land

Figure 07: Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: HIS BRE Press p 12 Figure 22

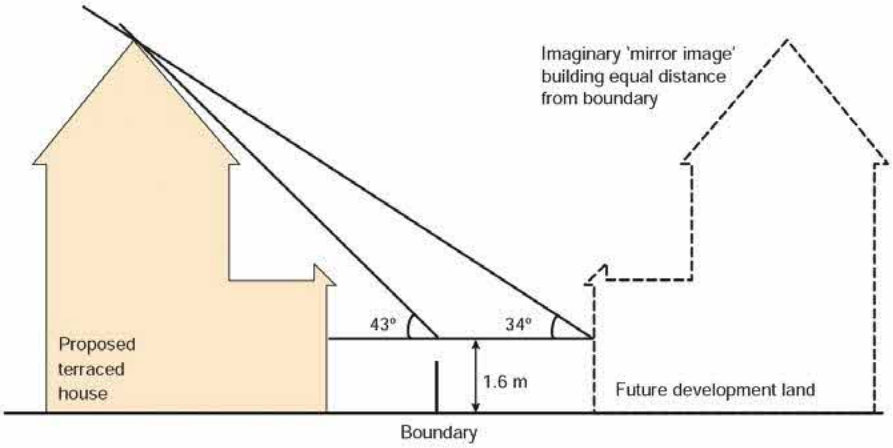


Figure 23: Problems with the boundary criterion can occur when a stepped façade overlooks adjoining land

Figure 08: Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: HIS BRE Press p 12 Figure 23

A 2.65 As is outlined above the Adjoining Development Land analysis is predicated on ensuring that a proposal next to future development land is not negatively impacting the ability to develop in consideration of light matters.

Other Amenity Considerations

A 2.66 Daylight and sunlight is one factor among many under the heading of residential amenity considerations for any given development design or planning application; others include:

- outlook;
- sense of enclosure;
- privacy;
- access to outdoor space e.g. balconies or communal garden/courtyard.

CONTEXT METHODOLOGY

A 2.67 In May 2019 the British Standard (BS8206-2:2008) was superseded by the new European Standard on daylight *"BS EN 17037:2018 Daylight in buildings"* but this standard is only applicable for assessing the levels of light within proposed developments. Until and unless it is revised, therefore, BR209 remains the basis for assessing impacts to neighbours and the new European Standard is not relevant for this report.

ENDNOTES

1 Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 1, paragraph 1.6

2 Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 7, paragraph 2.2.3

3 Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 7 paragraph 2.2.

4 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 1, paragraph 1.6

5 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page v

6 Littlefair, P. (2011). Site Layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page viii

7 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 7, paragraph 2.2.7

8 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page viii

9 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 7, paragraph 2.2.8

10 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 8, paragraph 2.2.9

11 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page viii

12 British Standard 8206-2:2008, page 10, paragraph 5.6

13 British Standard 8206-2:2008, page 9-10, paragraph 5.5

14 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 64, paragraph F8

15 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page viii

16 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 17, paragraph 3.2.11

17 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 16 paragraph 3.2.3 and paragraph 3.2.4

18 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 16 paragraph 3.2.3, paragraph 3.2.4 and 3.2.5 and page 17 paragraph 3.2.6

19 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 18, paragraph 3.3.1

20 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 20, paragraph 3.3.17

21 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 7, paragraph 2.2.6

22 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 16, paragraph 3.1.12

23 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 5, paragraph 2.1.17 and page 8, paragraph 2.2.11

24 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 62, paragraph F5

25 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 11, paragraph 2.3.3

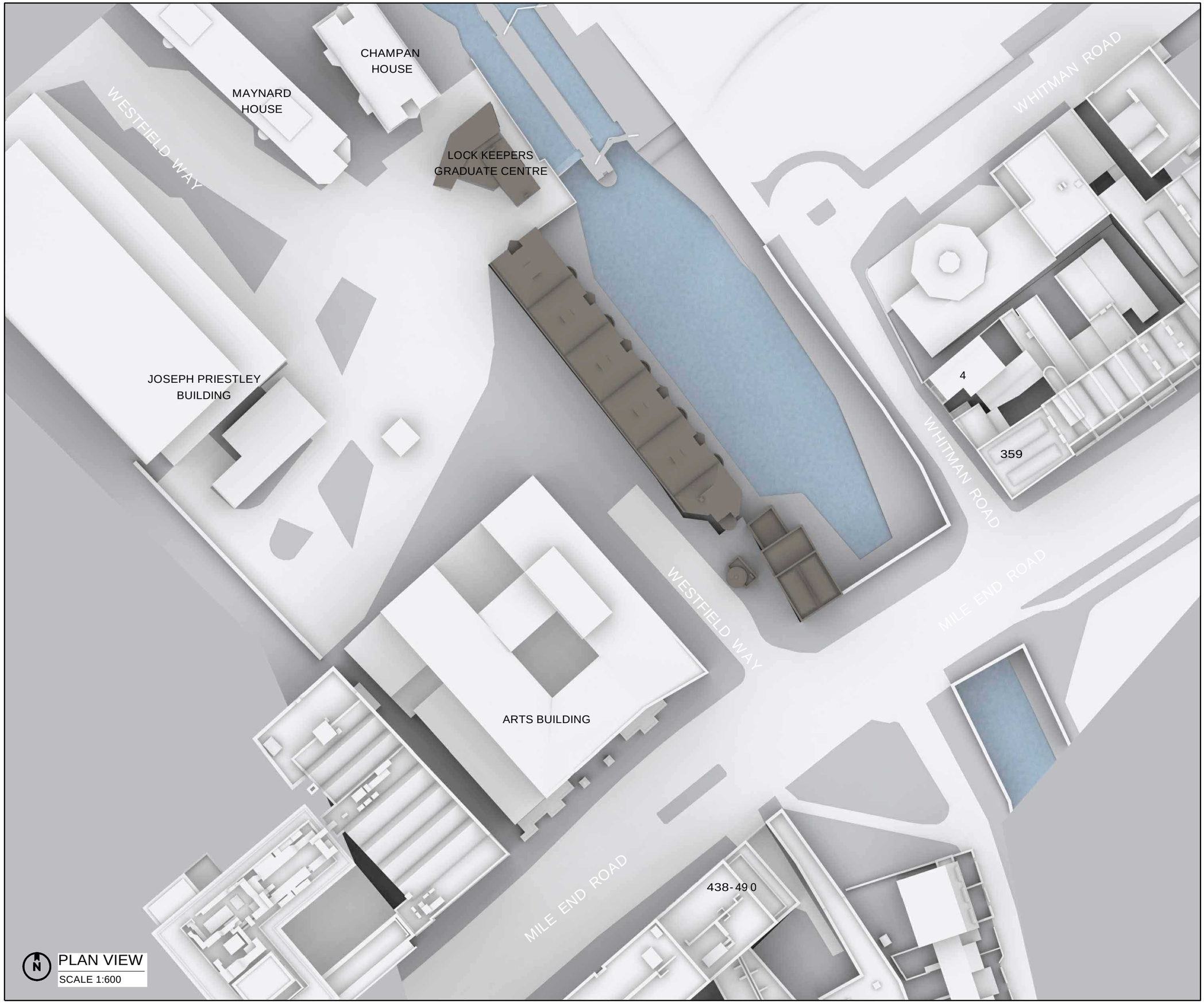
26 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 11, paragraph 2.3.6

27 Littlefair, P. (2011). Site layout Planning for Daylight and Sunlight –A Guide to Good Practice. Hertfordshire: IHS BRE Press, page 11 paragraph 2.3.7

Appendix 02

Drawings

Existing



PLAN VIEW
SCALE 1:600

SOURCES OF INFORMATION

CBRE
IR01-14966

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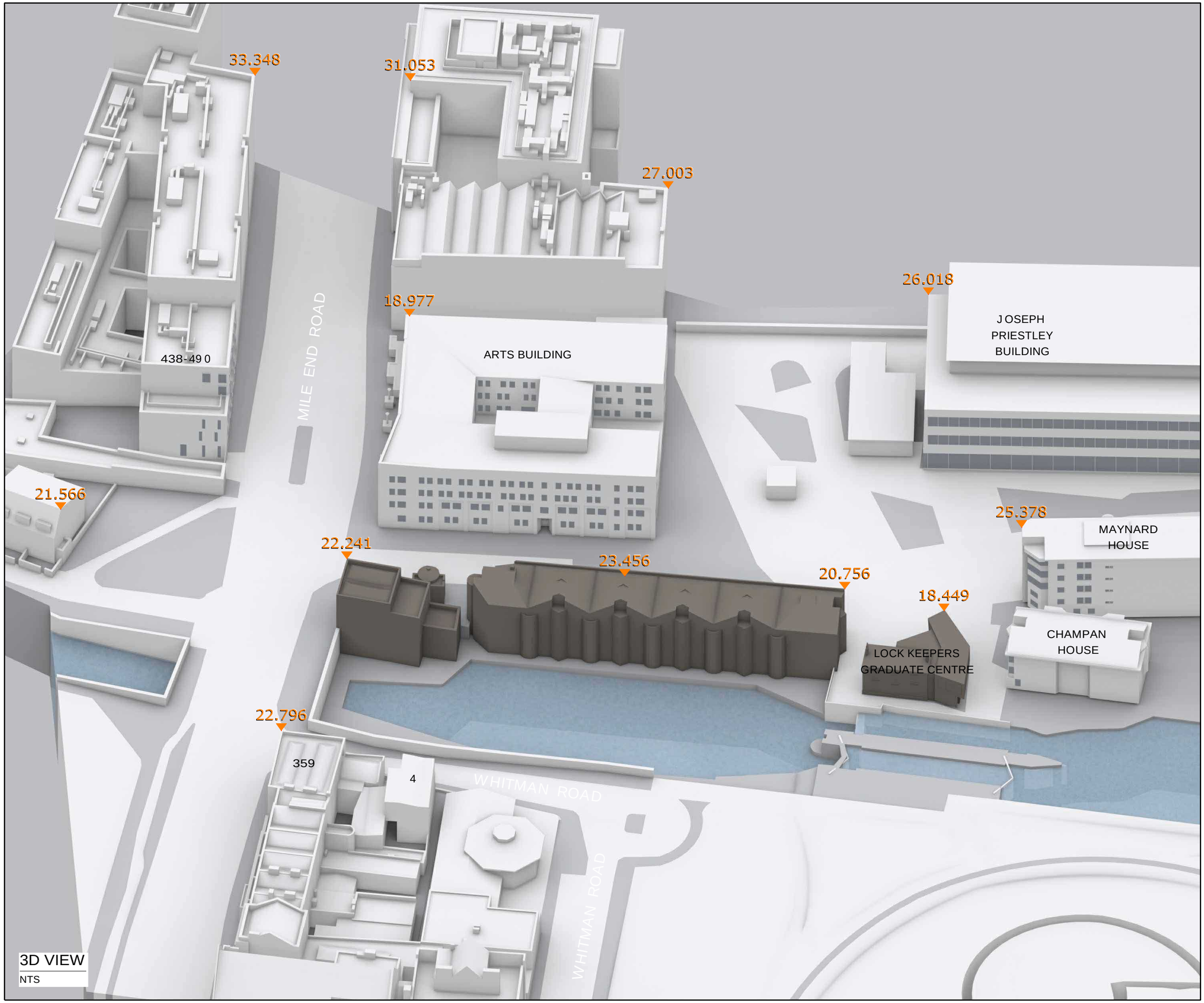

3D VIEW
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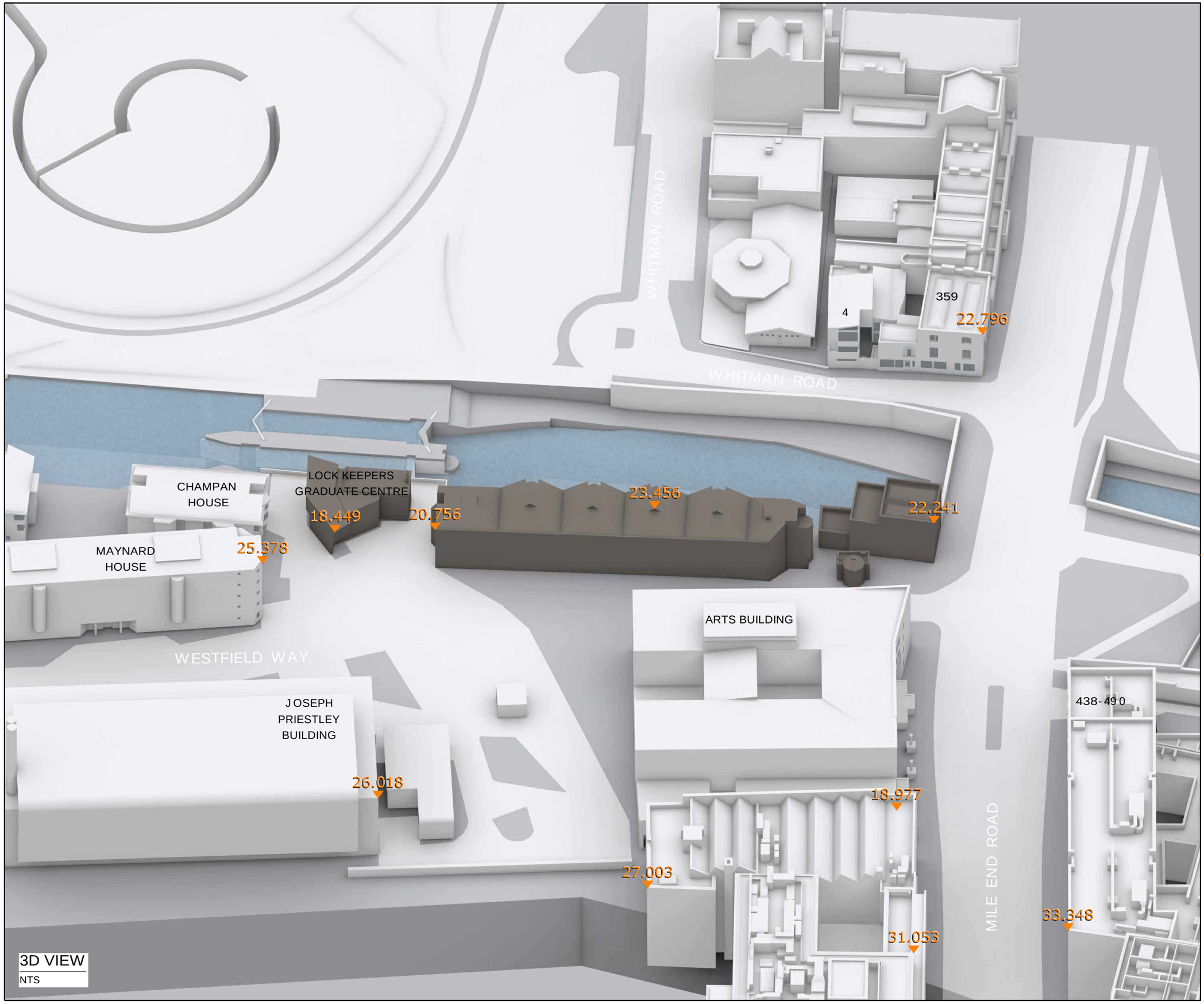

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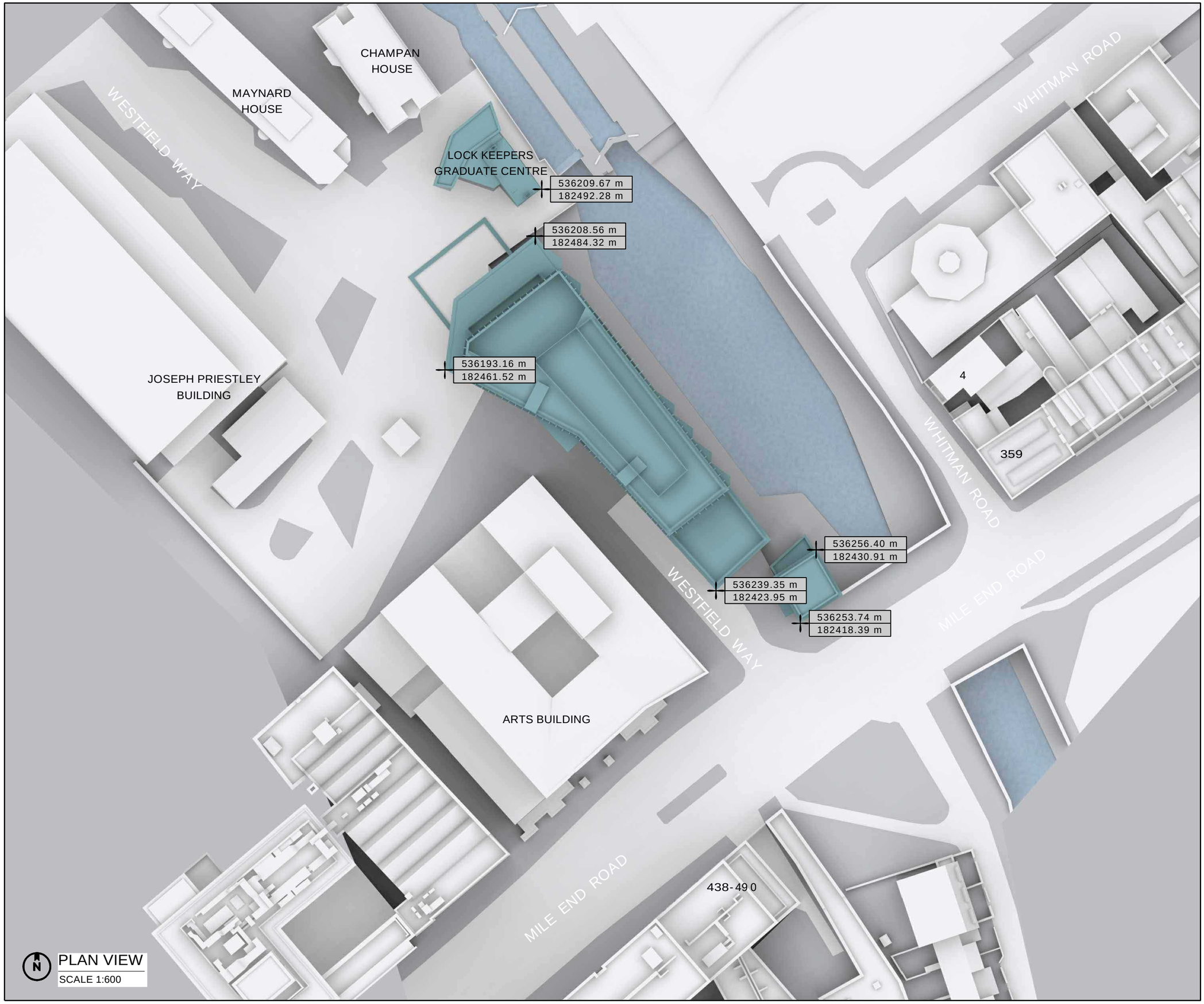

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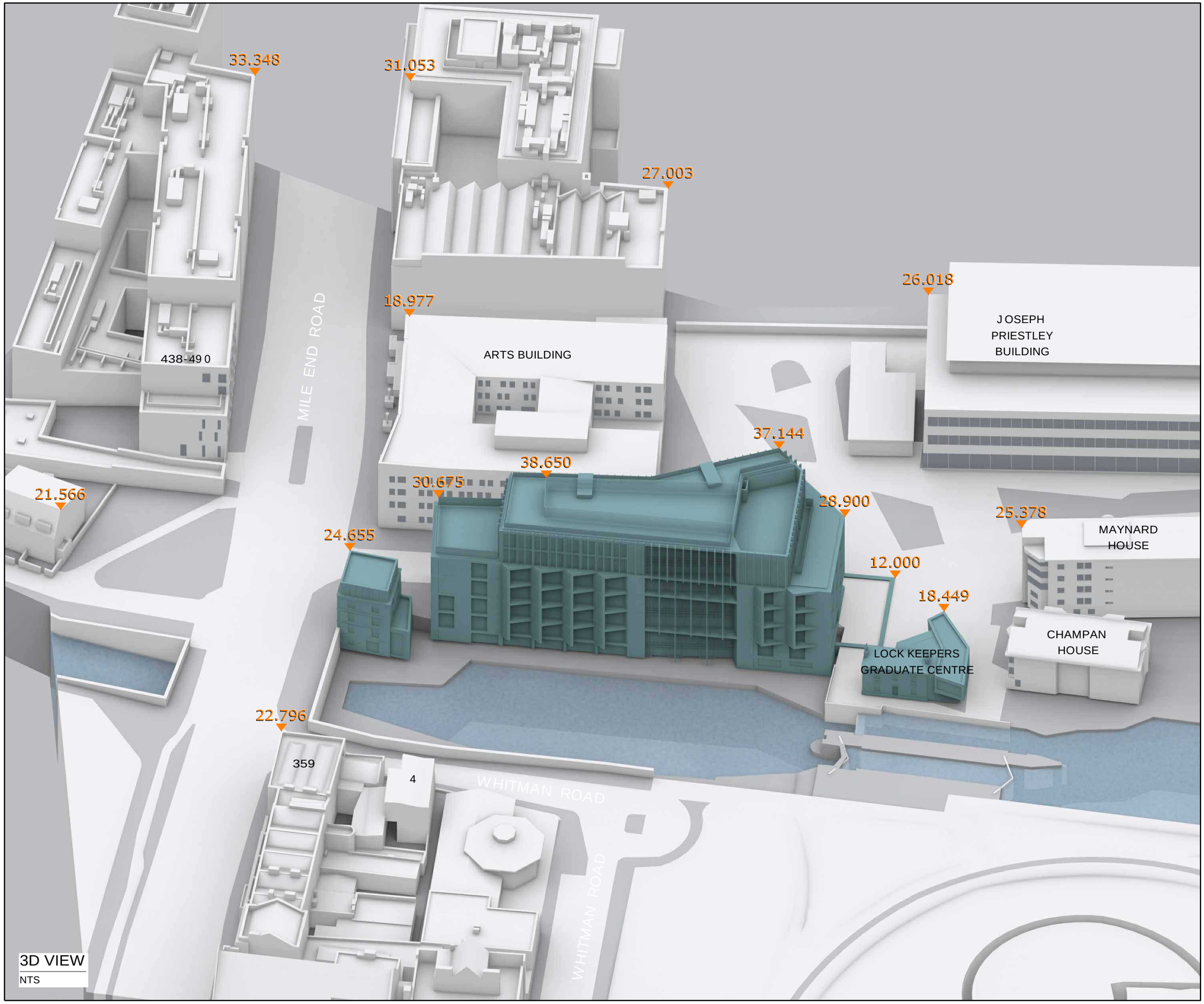

3D VIEW
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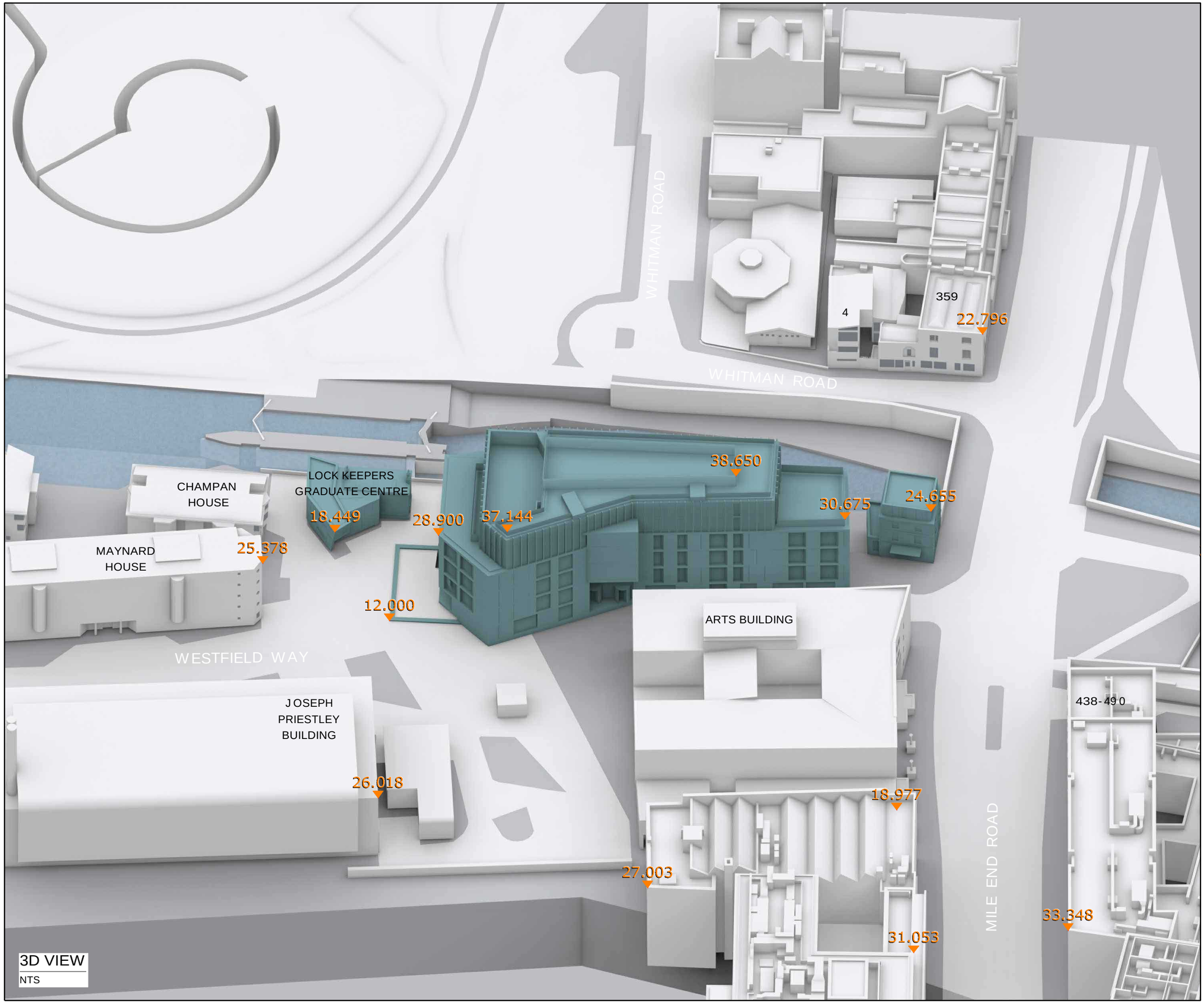

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Appendix 03

Daylight & Sunlight Results

Vertical Sky Component (VSC)
No Sky Line (NSL)
Annual Probable Sunlight Hours (APSH)

								VSC (WINDOW)				VSC (ROOM)				NSL				APSH (WINDOW)						APSH (ROOM)					
FLOOR	ROOM	PROPERTY	ROOM	ROOM	INFO	WINDOW	WINDOW	EX.	PR.	LOSS	LOSS	EX.	PR.	LOSS	LOSS	EX.	PR.	LOSS	LOSS	EX.		PR.		LOSS %		EX.		PR.		LOSS %	
		TYPE	USE	NOTES	USED		NOTES	%	%		%	%	%		%	%	%	SQM	%	ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER
359 MILE END ROAD																															
First	R1	RESIDENTIAL	BEDROOM			W1/ First		39.3	39.3	0	0.0%	37.7	36.5	1.2	3.2%	98.6	98.6	0.0	0.0%	82	28	82	28	0.0%	0.0%	99	29	95	29	4.0%	0.0%
			BEDROOM			W2 / First		35.9	33.4	2.5	7.0%									62	21	58	21	6.5%	0.0%						
	R2	RESIDENTIAL	BEDROOM			W3/ First		36.7	33.7	3	8.2%	36.7	33.7	3	8.2%	94.1	94.1	0.0	0.0%	66	22	61	21	7.6%	4.5%	66	22	61	21	7.6%	4.5%
Second	R1	RESIDENTIAL	BEDROOM			W1/ Second		38	35.9	2.1	5.5%	38	35.9	2.1	5.5%	95.2	95.2	0.0	0.0%	68	24	65	23	4.4%	4.2%	68	24	65	23	4.4%	4.2%
MAYNARD HOUSE																															
Ground	R1	RESIDENTIAL	BEDROOM			W1/ Ground		17.9	17.8	0.1	0.6%	17.9	17.8	0.1	0.6%	35.3	35.3	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R2	RESIDENTIAL	BEDROOM			W2 / Ground		16.8	16.7	0.1	0.6%	16.8	16.7	0.1	0.6%	34.3	34.3	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R3	RESIDENTIAL	BEDROOM			W3/ Ground		16.1	15.9	0.2	1.2%	16.1	15.9	0.2	1.2%	31.6	31.6	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	KD			W4/ Ground		27.1	24.1	3	11.1%	28.1	25.1	3	10.7%	76.8	76.6	0.0	0.3%	45	13	40	9	11.1%	30.8%	78	19	73	16	6.4%	15.8%
			KD			W5 / Ground		30.4	27.2	3.2	10.5%									75	19	69	15	8.0%	21.1%						
First	R1	RESIDENTIAL	BEDROOM			W1/ First		16.1	16.1	0	0.0%	21.4	21.4	0	0.0%	73.3	73.2	0.0	0.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			BEDROOM			W2 / First		22.4	22.4	0	0.0%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W3/ First		21.9	21.9	0	0.0%	21.9	21.9	0	0.0%	69.7	69.7	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R3	RESIDENTIAL	BEDROOM			W4/ First		22.6	22.4	0.2	0.9%	22.6	22.4	0.2	0.9%	43.7	43.7	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	KD			W5/ First		31.3	28.3	3	9.6%	31.5	28.5	3	9.5%	79.3	78.3	0.2	1.2%	47	13	43	9	8.5%	30.8%	80	20	77	17	3.8%	15.0%
			KD			W6 / First		32.2	29.2	3	9.3%									76	20	71	16	6.6%	20.0%						
Second	R1	RESIDENTIAL	BEDROOM			W1/ Second		22.1	22.1	0	0.0%	27.8	27.8	0	0.0%	96.1	96.1	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			BEDROOM			W2 / Second		28.9	28.9	0	0.0%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W3 / Second		28.7	28.7	0	0.0%	28.7	28.7	0	0.0%	96.8	96.8	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R3	RESIDENTIAL	BEDROOM			W4/ Second		30.8	30.6	0.2	0.6%	30.8	30.6	0.2	0.6%	85.9	85.9	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	KD			W5/ Second		25	24.8	0.2	0.8%	31.7	29.2	2.5	7.9%	92.2	92.2	0.0	0.0%	25	3	25	3	0.0%	0.0%	86	25	83	22	3.5%	12.0%
			KD			W6 / Second		35.2	32.4	2.8	8.0%									49	15	45	11	8.2%	26.7%						
			KD			W7/ Second		28	23.6	4.4	15.7%									40	9	35	4	12.5%	55.6%						
			KD			W8 / Second		33.9	31.2	2.7	8.0%									82	25	77	20	6.1%	20.0%						
Third	R1	RESIDENTIAL	BEDROOM			W1/ Third		27.1	27.1	0	0.0%	33.2	33.1	0.1	0.3%	96.1	96.1	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			BEDROOM			W2 / Third		34.3	34.2	0.1	0.3%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W3 / Third		34.1	34.1	0	0.0%	34.1	34.1	0	0.0%	96.8	96.8	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R3	RESIDENTIAL	BEDROOM			W4/ Third		36.5	36.4	0.1	0.3%	36.5	36.4	0.1	0.3%	97.4	97.4	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	KD			W5/ Third		29.2	29	0.2	0.7%	34	31.8	2.2	6.5%	98.7	98.7	0.0	0.0%	26	4	25	3	3.8%	25.0%	88	26	86	24	2.3%	7.7%
			KD			W6 / Third		37.4	34.9	2.5	6.7%									49	15	46	12	6.1%	20.0%						
MAYNARD HOUSE (CONTINUED)																															
			KD			W7/ Third		28.6	24.7	3.9	13.6%									42	10	38	6	9.5%	40.0%						
			KD			W8 / Third		35.6	33.2	2.4	6.7%									83	26	78	21	6.0%	19.2%						
Fourth	R1	RESIDENTIAL	BEDROOM			W1/ Fourth		29.9	29.9	0	0.0%	35.6	35.5	0.1	0.3%	96.2	96.2	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			BEDROOM			W2 / Fourth		36.6	36.5	0.1	0.3%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W3/ Fourth		36.5	36.5	0	0.0%	36.5	36.5	0	0.0%	96.8	96.8	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R3	RESIDENTIAL	BEDROOM			W4/ Fourth		39.2	39	0.2	0.5%	39.2	39	0.2	0.5%	97.4	97.4	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	KD			W5/ Fourth		24	23.8	0.2	0.8%	26.3	24.4	1.9	7.2%	100	100	0.0	0.0%	19	4	18	3	5.3%	25.0%	89	27	88	26	1.1%	3.7%
			KD			W6 / Fourth		27.3	25.1	2.2	8.1%									31	9	30	8	3.2%	11.1%						
			KD			W7/ Fourth		22.5	19.2	3.3	14.7%									38	10	36	8	5.3%	20.0%						
			KD			W8 / Fourth		37	35.1	1.9	5.1%									84	27	80	23	4.8%	14.8%						
438-490 MILE END ROAD																															
First	R1	RESIDENTIAL	LKD			W1/ First		37.5	36.7	0.8	2.1%	33.4	32.5	0.9	2.7%	99.4	99.4	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			LKD			W2 / First		37.4	36.5	0.9	2.4%									N/A	N/A	N/A	N/A	N/A	N/A						
			LKD			W3 / First		31.6	30.6	1	3.2%									N/A	N/A	N/A	N/A	N/A	N/A						
			LKD			W4/ First		31.4	30.6	0.8	2.5%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W5/ First		31.3	30.7	0.6	1.9%	31.3	30.7	0.6	1.9%	99.3	99.3	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) KITCHEN SMALLER THAN 13m2

(2) INC\HZ = SKY COMPONENT (INCLINED\HORIZONTAL WINDOWS)

(3) SINGLE ASPECT ROOM DEEPER THAN 5m

								VSC (WINDOW)				VSC (ROOM)				NSL				APSH (WINDOW)						APSH (ROOM)					
FLOOR	ROOM	PROPERTY TYPE	ROOM USE	ROOM NOTES	INFO USED	WINDOW	WINDOW NOTES	EX. %	PR. %	LOSS %	LOSS %	EX. %	PR. %	LOSS %	LOSS %	EX. %	PR. %	LOSS SQM	LOSS %	EX. ANNUAL	EX. WINTER	PR. ANNUAL	PR. WINTER	LOSS % ANNUAL	LOSS % WINTER	EX. ANNUAL	EX. WINTER	PR. ANNUAL	PR. WINTER	LOSS % ANNUAL	LOSS % WINTER
	R3	RESIDENTIAL	BEDROOM			W6 / First		31.2	30.7	0.5	1.6%	31.2	30.7	0.5	1.6%	99.1	99.1	0.0	0.0%												
	R4	RESIDENTIAL	BEDROOM			W7/ First		31.2	30.7	0.5	1.6%	31.2	30.7	0.5	1.6%	96	96	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R5	RESIDENTIAL	BEDROOM			W8 / First		31.3	30.9	0.4	1.3%	31.3	30.9	0.4	1.3%	96.4	96.4	0.0	0.0%												
	R6	RESIDENTIAL	BEDROOM			W9 / First		31.3	31	0.3	1.0%	31.3	31	0.3	1.0%	98.6	98.6	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R7	RESIDENTIAL	BEDROOM			W10/ First		31.3	31	0.3	1.0%	31.3	31	0.3	1.0%	99.2	99.2	0.0	0.0%												
Second	R1	RESIDENTIAL	LKD			W1/ Second		38.4	37.6	0.8	2.1%	35.2	34.3	0.9	2.6%	99.6	99.6	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			LKD			W2 / Second		38.4	37.5	0.9	2.3%																				
			LKD			W3 / Second		34.1	33.1	1	2.9%									N/A	N/A	N/A	N/A	N/A	N/A						
			LKD			W4/ Second		34.1	33.1	1	2.9%									N/A	N/A	N/A	N/A	N/A	N/A						
			LKD			W5 / Second		34	33.1	0.9	2.6%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W6 / Second		34	33.2	0.8	2.4%	34	33.2	0.8	2.4%	98.4	98.4	0.0	0.0%												
	R3	RESIDENTIAL	BEDROOM			W7/ Second		33.9	33.2	0.7	2.1%	33.9	33.2	0.7	2.1%	96.5	96.5	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	BEDROOM			W8 / Second		33.8	33.2	0.6	1.8%	33.8	33.2	0.6	1.8%	96	96	0.0	0.0%												
	R5	RESIDENTIAL	BEDROOM			W9 / Second		33.9	33.3	0.6	1.8%	33.9	33.3	0.6	1.8%	99.1	99.1	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
438-490 MILE END ROAD (CONTINUED)																															
	R6	RESIDENTIAL	BEDROOM			W10 / Second		33.9	33.4	0.5	1.5%	33.9	33.4	0.5	1.5%	95.7	95.7	0.0	0.0%												
	R7	RESIDENTIAL	BEDROOM			W11/ Second		33.9	33.4	0.5	1.5%	33.9	33.4	0.5	1.5%	98.9	98.9	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Third	R1	RESIDENTIAL	BEDROOM			W1/ Third		38.3	37.5	0.8	2.1%	37.3	36.4	0.9	2.4%	98.6	98.6	0.0	0.0%												
			BEDROOM			W2 / Third		36.4	35.4	1	2.7%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W3/ Third		36.3	35.4	0.9	2.5%	36.3	35.4	0.9	2.5%	99.1	99.1	0.0	0.0%												
	R3	RESIDENTIAL	BEDROOM			W4/ Third		36.2	35.4	0.8	2.2%	36.2	35.4	0.8	2.2%	99	99	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	BEDROOM			W5/ Third		36.2	35.4	0.8	2.2%	36.2	35.4	0.8	2.2%	96.4	96.4	0.0	0.0%												
	R5	RESIDENTIAL	BEDROOM			W6 / Third		36.2	35.5	0.7	1.9%	36.2	35.5	0.7	1.9%	98.6	98.6	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R6	RESIDENTIAL	BEDROOM			W7/ Third		36.1	35.4	0.7	1.9%	36.1	35.4	0.7	1.9%	99.2	99.2	0.0	0.0%												
Fourth	R1	RESIDENTIAL	BEDROOM			W1/ Fourth		39.3	38.7	0.6	1.5%	38.6	37.8	0.8	2.1%	99	99	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			BEDROOM			W2 / Fourth		38.8	38.1	0.7	1.8%																				
			BEDROOM			W3 / Fourth		37.8	36.7	1.1	2.9%									N/A	N/A	N/A	N/A	N/A	N/A						
	R2	RESIDENTIAL	BEDROOM			W4/ Fourth		38.2	37.2	1	2.6%	38.2	37.2	1	2.6%	99.2	99.2	0.0	0.0%												
	R3	RESIDENTIAL	BEDROOM			W5/ Fourth		38.2	37.2	1	2.6%	38.2	37.2	1	2.6%	99.1	99.1	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R4	RESIDENTIAL	BEDROOM			W6 / Fourth		38.1	37.2	0.9	2.4%	38.1	37.2	0.9	2.4%	99	99	0.0	0.0%												
	R5	RESIDENTIAL	BEDROOM			W7/ Fourth		38.1	37.2	0.9	2.4%	38.1	37.2	0.9	2.4%	95.7	95.7	0.0	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R6	RESIDENTIAL	BEDROOM			W8 / Fourth		38	37.2	0.8	2.1%	38	37.2	0.8	2.1%	96.3	96.3	0.0	0.0%												
4 WHITMAN ROAD																															
Ground	R1	RESIDENTIAL	BEDROOM			W1/ Ground		34.9	30.2	4.7	13.5%	12.8	11.0	1	7.8%	91.2	89.8	0.3	1.5%	65	21	56	20	13.8%	4.8%	65	21	56	20	13.8%	4.8%
			BEDROOM			W2 / Ground		6.7	6.7	0	0.0%									9	0	9	0	0.0%	0.0%						
	R2	RESIDENTIAL	BEDROOM			W3/ Ground		9.7	8.6	1.1	11.3%	9.7	8.6	1.1	11.3%	53.3	45.9	1.0	14.0%	15	2	13	1	13.3%	50.0%	15	2	13	1	13.3%	50.0%
First	R1	RESIDENTIAL	LKD			W1/ First		25.6	21.2	4.4	17.2%	23	19.6	3.4	14.8%	98.7	98.7	0.0	0.0%	50	19	43	18	14.0%	5.3%	69	20	61	18	11.6%	10.0%
			LKD			W2 / First		14.1	14.1	0	0.0%									41	12	40	11	2.4%	8.3%						
	R2	RESIDENTIAL	BEDROOM			W3/ First		13.1	11.6	1.5	11.5%	13.1	11.6	1.5	11.5%	54.3	49.8	0.6	8.2%	25	2	23	1	8.0%	50.0%	25	2	23	1	8.0%	50.0%
Second	R1	RESIDENTIAL	LKD			W1/ Second		37	32.9	4.1	11.1%	35.1	32.1	3	8.5%	100	100	0.0	0.0%	66	22	61	21	7.6%	4.5%	89	27	83	24	6.7%	11.1%
			LKD			W2 / Second		37.7	34.1	3.6	9.5%									69	25	63	22	8.7%	12.0%						
			LKD			W3 / Second		29.3	29.3	0	0.0%									65	22	65	22	0.0%	0.0%						
CHAPMAN HOUSE																															
Ground	R1	RESIDENTIAL	BEDROOM			W1/ Ground		11	10.7	0.3	2.7%	14.9	12.9	2	13.4%	53	53	0.0	0.0%	28	14	26	12	7.1%	14.3%	34	16	31	13	8.8%	18.8%
CHAPMAN HOUSE (CONTINUED)																															
			BEDROOM			W2 / Ground		16.8	13.9	2.9	17.3%									34	16	31	13	8.8%	18.8%						
	R2	RESIDENTIAL	BEDROOM			W3/ Ground		16	15.6	0.4	2.5%	21.9	20.4	1.5	6.8%	94.9	94.9	0.0	0.0%	37	17	34	14	8.1%	17.6%	64	19	61	16	4.7%	15.8%
			BEDROOM			W4/ Ground		27.8	25.2	2.6	9.4%									64	19	60	15	6.3%	21.1%						

(1) KITCHEN SMALLER THAN 13m2

(2) INCIHZ = SKY COMPONENT (INCLINED\HORIZONTAL WINDOWS)

(3) SINGLE ASPECT ROOM DEEPER THAN 5m

								VSC (WINDOW)				VSC (ROOM)				NSL				APSH (WINDOW)						APSH (ROOM)					
FLOOR	ROOM	PROPERTY TYPE	ROOM USE	ROOM NOTES	INFO USED	WINDOW	WINDOW NOTES	EX. %	PR. %	LOSS	LOSS %	EX. %	PR. %	LOSS	LOSS %	EX. %	PR. %	LOSS SQM	LOSS %	EX.		PR.		LOSS %		EX.		PR.		LOSS %	
																				ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER	ANNUAL	WINTER
	R4	RESIDENTIAL	KITCHEN (1)			W6 / Ground		24.2	23.8	0.4	1.7%	30.5	30.3	0.2	0.7%	98.8	98.8	0.0	0.0%	51	11	51	11	0.0%	0.0%	56	11	56	11	0.0%	0.0%
			KITCHEN (1)			W7/Ground		36.8	36.7	0.1	0.3%									24	5	24	5	0.0%	0.0%						
First	R1	RESIDENTIAL	BEDROOM			W1/ First		12.8	12.5	0.3	2.3%	14.1	13.1	1	7.1%	76.2	76.2	0.0	0.0%	29	14	27	12	6.9%	14.3%	32	16	29	13	9.4%	18.8%
			BEDROOM			W2 / First		16.7	14.1	2.6	15.6%									32	16	29	13	9.4%	18.8%						
	R2	RESIDENTIAL	BEDROOM			W3/ First		18.6	18.2	0.4	2.2%	25.4	23.1	2.3	9.1%	93.5	93.5	0.0	0.0%	40	17	38	15	5.0%	11.8%	69	22	64	17	7.2%	22.7%
			BEDROOM			W4/ First		32.3	28	4.3	13.3%									69	22	64	17	7.2%	22.7%						
	R3	RESIDENTIAL	KITCHEN (1)			W5/First (dup.)		31.4	27.9	3.5	11.1%	31.7	28.6	3.1	9.8%	94.8	71.5	1.9	24.6%	72	24	66	18	8.3%	25.0%	77	24	71	18	7.8%	25.0%
			KITCHEN (1)			W6/First (dup.)		32	29.4	2.6	8.1%									62	19	55	12	11.3%	36.8%						
	R5	RESIDENTIAL	DINING ROOM			W5/ First		31.4	27.9	3.5	11.1%	31.7	28.6	3.1	9.8%	100	100	0.0	0.0%	72	24	66	18	8.3%	25.0%	77	24	71	18	7.8%	25.0%
			DINING ROOM			W6/First		32	29.4	2.6	8.1%									62	19	55	12	11.3%	36.8%						
	R6	RESIDENTIAL	BEDROOM			W7/ First		30.1	28	2.1	7.0%	33	31.9	1.1	3.3%	99.6	99.6	0.0	0.0%	62	17	60	15	3.2%	11.8%	62	17	60	15	3.2%	11.8%
			BEDROOM			W8 / First		35.8	35.8	0	0.0%									24	5	24	5	0.0%	0.0%						
Second	R1	RESIDENTIAL	BEDROOM			W1/ Second		12	11.8	0.2	1.7%	12.9	12	0.9	7.0%	75.7	75.7	0.0	0.0%	24	14	23	13	4.2%	7.1%	31	15	30	14	3.2%	6.7%
			BEDROOM			W2 / Second		14.5	12.4	2.1	14.5%									27	15	26	14	3.7%	6.7%						
	R2	RESIDENTIAL	BEDROOM			W3 / Second		18.5	18.1	0.4	2.2%	26.4	23.8	2.6	9.8%	96	96	0.0	0.0%	37	18	35	16	5.4%	11.1%	75	25	70	20	6.7%	20.0%
			BEDROOM			W4/ Second		32.1	28	4.1	12.8%									70	25	65	20	7.1%	20.0%						
	R3	RESIDENTIAL	KITCHEN (1)			W5/Second (dup.)		31.2	27.6	3.6	11.5%	32	28.6	3.4	10.6%	94.8	73.3	1.7	22.8%	73	26	68	21	6.8%	19.2%	78	26	74	22	5.1%	15.4%
			KITCHEN (1)			W6/Second (dup.)		32.7	29.7	3	9.2%									57	21	53	17	7.0%	19.0%						
	R5	RESIDENTIAL	DINING ROOM			W5/ Second		31.2	27.6	3.6	11.5%	32	28.6	3.4	10.6%	99.9	99.9	0.0	0.0%	73	26	68	21	6.8%	19.2%	78	26	74	22	5.1%	15.4%
			DINING ROOM			W6/Second		32.7	29.7	3	9.2%									57	21	53	17	7.0%	19.0%						
	R6	RESIDENTIAL	BEDROOM			W7/ Second		32.5	29.1	3.4	10.5%	33.1	31.1	2	6.0%	99.7	99.7	0.0	0.0%	68	24	65	21	4.4%	12.5%	68	24	65	21	4.4%	12.5%
			BEDROOM			W8 / Second		33.9	33.9	0	0.0%									5		5									
CHESNEY HOUSE																															
Ground	R1	RESIDENTIAL	BEDROOM			W1/ Ground		16.5	16.4	0.1	0.6%	21.1	20.9	0.2	0.9%	80.7	75.5	0.5	6.4%	32	3	32	3	0.0%	0.0%	61	4	61	4	0.0%	0.0%
			BEDROOM			W2 / Ground		24.7	24.3	0.4	1.6%									51	4	51	4	0.0%	0.0%						
	R2	RESIDENTIAL	BEDROOM			W3 / Ground		27.6	27.6	0	0.0%	24.2	24.2	0	0.0%	88.3	88.3	0.0	0.0%	63	11	63	11	0.0%	0.0%	63	11	63	11	0.0%	0.0%
			BEDROOM			W4/ Ground		21.6	21.6	0	0.0%									5		5									
CHESNEY HOUSE (CONTINUED)																															
	R3	RESIDENTIAL	BEDROOM			W5/ Ground		28.4	28.4	0	0.0%	33.4	33.4	0	0.0%	96	96	0.0	0.0%	54	12	54	12	0.0%	0.0%	55	13	55	13	0.0%	0.0%
			BEDROOM			W6 / Ground		38.3	38.3	0	0.0%									5		5									
First	R1	RESIDENTIAL	BEDROOM			W1/ First		19.8	19.8	0	0.0%	23.1	22.8	0.3	1.3%	81.9	81.9	0.0	0.0%	36	5	36	5	0.0%	0.0%	72	11	72	11	0.0%	0.0%
			BEDROOM			W2 / First		26.4	25.9	0.5	1.9%									58	11	58	11	0.0%	0.0%						
	R2	RESIDENTIAL	BEDROOM			W3/ First		30.9	30.9	0	0.0%	25.6	25.6	0	0.0%	99.5	99.5	0.0	0.0%	70	16	70	16	0.0%	0.0%	70	16	70	16	0.0%	0.0%
			BEDROOM			W4/ First		21.7	21.7	0	0.0%									13		13									
	R3	RESIDENTIAL	BEDROOM			W5/ First		30.8	30.8	0	0.0%	33.9	33.9	0	0.0%	100	100	0.0	0.0%	61	17	61	17	0.0%	0.0%	61	17	61	17	0.0%	0.0%
			BEDROOM			W6 / First		36.9	36.9	0	0.0%									5		5									
Second	R1	RESIDENTIAL	BEDROOM			W1/ Second		20.4	20.4	0	0.0%	23.2	22.9	0.3	1.3%	95.8	95.8	0.0	0.0%	38	9	38	9	0.0%	0.0%	78	15	78	15	0.0%	0.0%
			BEDROOM			W2 / Second		26.1	25.4	0.7	2.7%									55	15	55	15	0.0%	0.0%						
	R2	RESIDENTIAL	BEDROOM			W3 / Second		30.4	30.2	0.2	0.7%	24.4	24.3	0.1	0.4%	99.4	99.4	0.0	0.0%	65	20	65	20	0.0%	0.0%	65	20	65	20	0.0%	0.0%
			BEDROOM			W4/ Second		19.9	19.9	0	0.0%									13		13									
	R3	RESIDENTIAL	BEDROOM			W5/ Second		29	28.7	0.3	1.0%	31.2	31	0.2	0.6%	99.9	99.9	0.0	0.0%	61	21	61	21	0.0%	0.0%	61	21	61	21	0.0%	0.0%
			BEDROOM			W6 / Second		33.3	33.3	0	0.0%									5		5									

(1) KITCHEN SMALLER THAN 13m2

(2) INCIHZ = SKY COMPONENT (INCLINED\HORIZONTAL WINDOWS)

(3) SINGLE ASPECT ROOM DEEPER THAN 5m