



· LIGHTING DESIGN · ELECTRICAL · SMART CITIES ·
ENERGY REDUCTION · LIGHTING IMPACT

CHUBB CLOSE

TECHNICAL REPORT

DFL-UK

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Table of Contents

Executive Summary.....	5
1. Introduction	6
1.1. General.....	6
2. Legislative Frameworks and National Policies	8
2.1. Environmental Protection Act 1990 / Clean Neighbourhoods and Environment Act 2005..	8
2.2. National Planning Policy Framework 2024 (Amended 2025).....	8
2.3. Planning Practice Guidance.....	9
3. Local policies.....	10
3.1. Wiltshire Council - Wiltshire Core Strategy (Adopted January 2015).	10
4. British Standards.....	11
5. Guidance	12
5.1. Guidance Notes for the Reduction of Obtrusive Light (Institution of Lighting Professionals GN01/2021).....	12
5.2. GN08/2023 Bats and Artificial Lighting in the UK – Bat Conservation Trust and Institution of Lighting Professionals.	13
6. Desktop Study.....	14
6.1. Site Description and Context.....	14
6.2. Designations.....	15
6.3. Existing lighting	16
6.4. Environmental Zone Classification	18
7. Identified Receptors.....	19
7.1. Ecological	19
7.2. Human Amenity Receptor	20
8. Lighting strategy.....	21
8.1. Summary.....	21
8.2. Private Dwelling Staircase Lighting.....	22
9. Technical Assessment.....	24
9.1. Overview	24
9.2. Architectural Design	24
9.3. 3D Modelling	25
9.4. Obtrusive Light Calculations	25
9.5. Summary of Results – 3D Illuminance Calculations.....	26
9.6. Mitigation by Design (Lighting)	27
9.7. Mitigation by Design (Embedded)	27
10. Conclusion	28
10.1. General	28
Appendix 1	29
Appendix 2	30
Appendix 3	37

Appendix 4	38
Technical Descriptions, Definitions & Abbreviations.....	41

Table of Figures

Figure 1 -Example of lighting zonation near sensitive boundaries and known ecological habitat	13
Figure 2 - The Application Site Location & Boundary	14
Figure 3 - Site Designations within 1 km Study Area	15
Figure 4 - Property Light Fittings (Google Maps, September 2023).....	16
Figure 5 - Existing Lighting on Tetbury Hill (Google Maps, September 2023)	17
Figure 6 - Bat Roost Location.....	19
Figure 7 - Vertical Grid Locations	30
Figure 8 - Horizontal Grid Location	31
Figure 9 - Sensitive Receptors.....	37

Table of Tables

Table 1: Environmental Zone Descriptions.....	12
Table 2: Obtrusive Light Criteria.....	12
Table 3 - Limitations of identified environmental zone.	18
Table 4 - Ecology Receptors (PSER)	19
Table 5 - Potential Human Amenity Receptors (PHAR)	20
Table 6 – Example Equipment – Property Internals	22
Table 7 - Example Equipment - Property internals.....	23
Table 8 - Illuminance calculation results (PSER)	26
Table 9 - Illuminance calculation results (PHAR).....	26
Table 10 - Mitigation Methods (Lighting).....	27
Table 11 - Mitigation Methods (Embedded)	27

EXECUTIVE SUMMARY

This Technical Report addresses the ecology comments relating to the ecology of the Proposed Development. The lighting design has been prepared in accordance with the Lighting Strategy (**Section 7.2**) and assessed against relevant guidance (**Section 9**).

The report achieves this by detailing the lighting design approach for the staircase lighting of the Proposed Development and demonstrating its compliance with local policy and industry guidance.

Key element of the report include:

- > Liaison with the project ecologist has determined where ecological receptors are present in and around the Application Site (**Section 7.1**).
- > Compliance with light spill limits: Vertical light spill at the identified human receptor remains within the ILP GN01:2021 limits for an E2 environmental zone (10 Lux pre-curfew and 2 Lux post-curfew, as well as complying to E1 environmental zone guidance limits.
- > Vertical light spill and horizontal calculations grids at the identified ecology receptor remain within limits within the Bat Conservation Trust (BCT) and ILP GN08:2023 guidance requirements for ≤ 0.4 Lux.
- > Horizontal and vertical illuminance calculations (**Section 9.4, Appendix 1**) and lighting specification (**Table 6** and **Table 7**).

The assessment demonstrates that the staircase lighting for the Proposed Development will operate within acceptable environmental parameters and will not cause adverse effects on nearby receptors or the wider area.

1. INTRODUCTION

1.1. General

1.1.1. This Technical Report has been written by DFL (Designs for Lighting Ltd¹), a lighting design consultancy specialising in Lighting Impact Assessments, obtrusive light mitigation, and detailed lighting design.

1.1.2. The Technical Report seeks to address the ecology comments in regard to the bat roost on the southern elevation of the Proposed Development:

“The roost entrance and the roost location within the soffit box are being retained with the proposals, so there is no direct impact on the roost entrance or the roost location. However, as shown at figure 5, the proposals for the south elevation include the provision of a stairwell window which is considerably larger than the existing window (figure 4). This has the potential to result in an increase in light spill from the window onto the roost entrance and the roost access/commuting path. Whilst Serotine bats are less inhibited by artificial lighting² than some bat species, a significant increase in artificial light could have a negative impact on the roost.

This has been discussed with the project architect and a lighting consultant (DFL), who have advised the following:

- > Lighting of the staircase shall be designed sensitively so as not to give rise to adverse levels of light spill, through a combination of low-level internal lighting of the treads, supported by wall mounted directional lighting that shall be motion sensor controlled. Due to the design of the staircase, there is no potential for pendant lighting to be installed, thus minimising the impact of the staircase lighting.*
- > A 3D light spill model will be prepared to demonstrate that light spill from the staircase picture window will not give rise to adverse light spill levels onto the roof apex bat roost, or onto the flight paths for bats accessing the roost. Modelling will be undertaken in accordance with ILP GN08/2023 (Guidance for Bats and Artificial Lighting in the UK).”*

1.1.3. Lighting associated with the Proposed Development will comply with relevant local policy and Institution of Lighting Professionals (ILP) guidance to ensure obtrusive light is minimised in accordance with best practice.

1.1.4. The Technical Report is intended to set out a minimally obtrusive approach to the lighting, whilst ensuring it is necessary and considers the sensitivity of the adjacent ecology receptor.

1.1.5. This report outlines the following:

¹ <https://www.dfl-uk.com/about/>

- Relevant obtrusive light policies in direct relation to the Proposed Development;
 - Relevant National and Local Policies;
 - Relevant Guidance from ILP;
 - Why the Proposed Development requires artificial lighting;
 - Desktop Assessment of the Application Site;
 - Details as to how lighting will be implemented for the Proposed Development;
 - A Technical Assessment; and,
 - Concluding how the Proposed Lighting will be compliant with the relevant policies, and industry guidance.
- 1.1.6. Through careful design and mitigation, the Lighting Strategy ensures the lighting installation at the Proposed Development will be in accordance with Guidance and Local Policy.

2. LEGISLATIVE FRAMEWORKS AND NATIONAL POLICIES

2.1. Environmental Protection Act 1990 / Clean Neighbourhoods and Environment Act 2005

- 2.1.1. Since 2005, artificial light has been incorporated as a potential statutory nuisance. An amendment to section 79 of the Environmental Protection Act 1990, contained within the Clean Neighbourhoods and Environment Act 2005 states: ²

“The following matters constitute “statutory nuisances” for the purposes of this Part, that is to say— [....]

[....] artificial ³light emitted from premises so as to be prejudicial to health or a nuisance;

[....]and it shall be the duty of every local authority to cause its area to be inspected from time to time to detect any statutory nuisances which ought to be dealt with under section 80 and, where a complaint of a statutory nuisance is made to it by a person living within its area, to take such steps as are reasonably practicable to investigate the complaint”.

2.2. National Planning Policy Framework 2024 (Amended 2025)

- 2.2.1. The National Planning Policy Framework (NPPF) sets out the government’s planning policies for England and how they are expected to be applied and provides a framework for local plans. With regard to light pollution, the NPPF was updated in February 2025 and states that the following elements are to be considered⁴:

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- > mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- > identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- > limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”*

² <https://www.legislation.gov.uk/ukpga/1990/43/part/III/crossheading/statutory-nuisances-england-and-wales> Section 79, paragraph 1,

³ 2005 Section 102 relating to section 79, Indent reference (fb)

⁴ Paragraph 198 NPPF 2024 page 57

2.3. Planning Practice Guidance

2.3.1. Guidance for assessing the effects of proposed artificial lighting is outlined in the planning practice guidance (PPG). The guidance states:⁵

“Does an existing lighting installation make the proposed location for a development unsuitable, or suitable only with appropriate mitigation? For example, this might be because:

- *the artificial light has a significant effect on the locality; and/or*
- *users of the Proposed Development (e.g., a hospital) may be particularly sensitive to light intrusion from the existing light source.*

Where necessary, development proposed in the vicinity of existing activities may need to put suitable mitigation measures in place to avoid those activities having a significant adverse effect on residents or users of the proposed scheme, reflecting the agent of change principle. Additional guidance on applying this principle is set out in the planning practice guidance on noise.

- *Will a new development, or a proposed change to an existing site, be likely to materially alter light levels in the environment around the site and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?*
- *Will the impact of new lighting conflict with the needs of specialist facilities requiring low levels of surrounding light (such as observatories, airports and general aviation facilities)? Impacts on other activities that rely on low levels of light such as astronomy may also be a consideration but will need to be considered in terms of both their severity and alongside the wider benefits of the development.*
- *Is the development in or near a protected area of dark sky or an intrinsically dark landscape where new lighting would be conspicuously out of keeping with local nocturnal light levels, making it desirable to minimise or avoid new lighting?*
- *Would new lighting have any safety impacts, for example in creating a hazard for road users?*
- *Is a proposal likely to have a significant impact on a protected site or species? This could be a particular concern where forms of artificial light with a potentially high impact on wildlife and ecosystems (e.g. white or ultraviolet light) are being proposed close to protected sites, sensitive wildlife receptors or areas, including where the light is likely to shine on water where bats feed.*
- *Does the Proposed Development include smooth, reflective building materials, including large horizontal expanses of glass, particularly near water bodies? (As it may change natural light, creating polarised light pollution that can affect wildlife behaviour.)”*

⁵ <https://www.gov.uk/guidance/light-pollution>, Paragraph 002 Ref ID: 31-002-20191101 revision 01 11 2019

3. LOCAL POLICIES

3.1. Wiltshire Council - Wiltshire Core Strategy (Adopted January 2015).

- 3.1.1. The relevant Local Planning Authority (LPA) for the Proposed Development is Wiltshire Council. The planning policies relevant to the Proposed Development can be found in the Wiltshire Core Strategy (Adopted January 2015).
- 3.1.2. The Applicable policies are:

Core Policy 50: Biodiversity and geodiversity

It is vital that all stages of sustainable development are informed by relevant ecological information, from site selection and design to planning decisions and long term management. All effects should be considered, including positive and negative, direct and indirect, cumulative, and on and offsite impacts over the lifetime of the development (including construction, operational and restoration phases), also giving consideration to disturbance effects such as noise, lighting, recreational pressures, trampling, traffic, domestic pets, vandalism etc.

Core Policy 57: Ensuring high quality design and place shaping

iii "Site lighting details are designed to avoid harm to nature conservation interests; including habitat connectivity and function as part of an ecological corridor"

4. BRITISH STANDARDS

- 4.1.1. Lighting associated with the Proposed Development is the internal lighting only for private residential dwellings. As such, there are no applicable British Standards which define light levels for this usage. Therefore, lighting has been designed to minimise potential effects of light on sensitive receptors while providing a safe and comfortable level of light for those living within the dwellings.

5. GUIDANCE

5.1. Guidance Notes for the Reduction of Obtrusive Light (Institution of Lighting Professionals GN01/2021)

- 5.1.1. The Lighting Strategy is informed by industry guidance notes which aim to reduce the potential for obtrusive light to occur, which is typically caused by poorly designed and installed exterior artificial lighting. The Lighting Strategy is informed by the most relevant sections of GN01/2021 that has been published to reduce the potential for obtrusive light from a wide range of exterior lighting applications.

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA Dark Sky Parks.
E1	Natural	Intrinsically dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, etc.
E2	Rural	Low district brightness (SQM ~ 15 to 20)	Sparsely inhabited rural areas, Village or relatively dark outer suburban locations.
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres or suburban locations.
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity.

Table 1: Environmental Zone Descriptions

Environmental Zones	Sky Glow ULR ⁶ (Max %)	Light Trespass (Into Windows) E _v (lux)		Building Luminance Average, Pre-curfew
		Pre- Curfew	Post-Curfew ⁷	Average L (cd/m ²)
E0	0	0	0	0
E1	0	2	0.1 (1 ⁸)	0
E2	2.5	5	1	5
E3	5	10	2	10
E4	15	25	5	25

Table 2: Obtrusive Light Criteria

⁶ ULR (Upward Light Ratio) is the maximum permitted percentage of luminaire flux that goes directly into the sky.

⁷ Curfew refers to a time when the local planning authority has agreed that the lighting installation should be switched off; this typically refers to 23h00 – 07h00

⁸ If the installation is for public (road) lighting, then this may be up to 1 lx

5.2. GN08/2023 Bats and Artificial Lighting in the UK – Bat Conservation Trust and Institution of Lighting Professionals.

- 5.2.1. This document is aimed at lighting professionals, lighting designers, planning officers, developers, bat workers/ecologists and anyone specifying lighting. It is intended to raise awareness of the impacts of artificial lighting on bats, and mitigation is suggested for various scenarios. However, it is not meant to replace site-specific ecological and lighting assessments, which states the following.

"It is acknowledged that, especially for vertical calculation planes, very low levels of light (<0.5 lux) may occur even at considerable distances from the source if there is little intervening attenuation. It is therefore very difficult to demonstrate 'complete darkness' or a 'complete absence of illumination' on vertical planes where some form of lighting is proposed on site despite efforts to reduce them as far as possible and where horizontal plane illuminance levels are zero. Consequently, where 'complete darkness' on a feature or buffer is required, it may be appropriate to consider this to be where illuminance is below 0.2 lux on the horizontal plane and below 0.4 lux on the vertical plane. These figures are still lower than what may be expected on a moonlit night and are in line with research findings for the illuminance found at hedgerows used by lesser horseshoe bats, a species well known for its light adverse behaviour (Stone, 2012)."

"A warm white light source (2700Kelvin or lower) should be adopted to reduce blue light component."

"A buffer zone subdivided to into smaller zones of increasing illuminance limit further away from the Supporting Habitat would ensure light levels (illuminance - measured in lux) do not exceed certain defined limits. This has the effect of a gradual decrease in lighting from the developed zone, rather than a distinct cut-off, which may provide useable area for the project which also limits lighting impacts on less sensitive species, or less well-used habitat." (see Figure 1)."

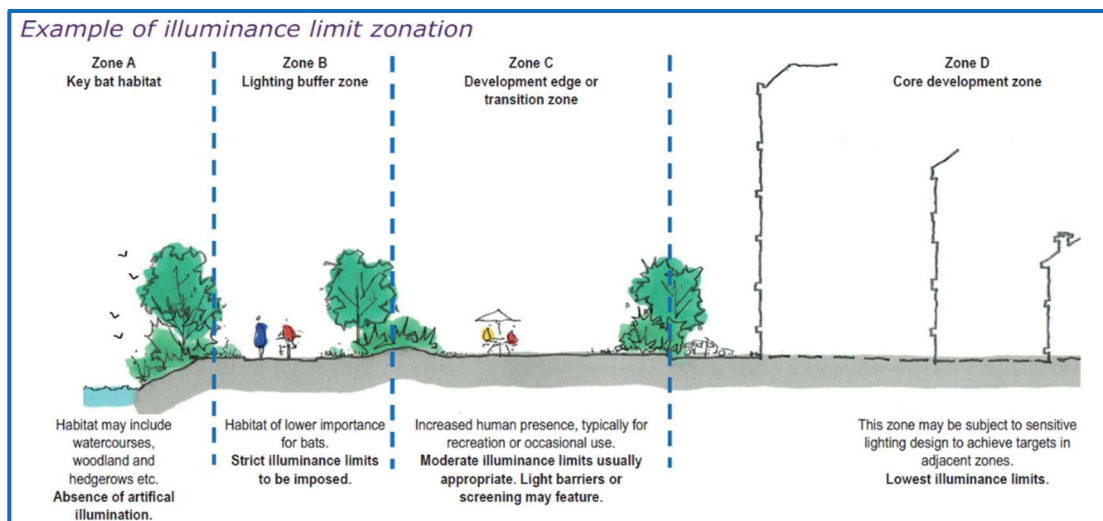


Figure 1 -Example of lighting zonation near sensitive boundaries and known ecological habitat

6. DESKTOP STUDY

6.1. Site Description and Context

- 6.1.1. A desktop assessment was completed of the Application Site to understand its position within the current lit environment.
- 6.1.2. The Application Site is an existing dwelling located along Chubbs Close, Malmesbury. The Application Site is located within the town of Malmesbury.
- 6.1.3. The Proposed Development is:
- > Demolition of existing conservatory;
 - > Significant internal alterations / remodelling to ground and first floor including new window openings;
 - > Single storey rear extension to form new family living space;
 - > Loft conversion with two pitched dormers (to be undertaken through permitted development rights);
 - > New aluminium / timber composite framed triple glazed windows and sliding glass doors;
 - > New landscaped terraces to rear.
- 6.1.4. The Application Site boundary and Proposed Development layout can be seen in **Figure 2**.



Figure 2 - The Application Site Location & Boundary

6.2. Designations

- 6.2.1. There are no Special Areas of Conservation (SACs) or Sites of Specific Scientific Interest (SSSI) within a 1 km radius of the Application Site, shown using a 1 km study area in **Figure 3**.
- 6.2.2. The Application Site is approximately 820 metres from the nearest Local Nature Reserve (LNR) Conygre Mead.
- 6.2.3. The Application Site is approximately 776 metres from the Cotswold National Landscape boundary.
- 6.2.4. The Application Site is also approximately 1.6km from Ancient Woodland Long Wood.

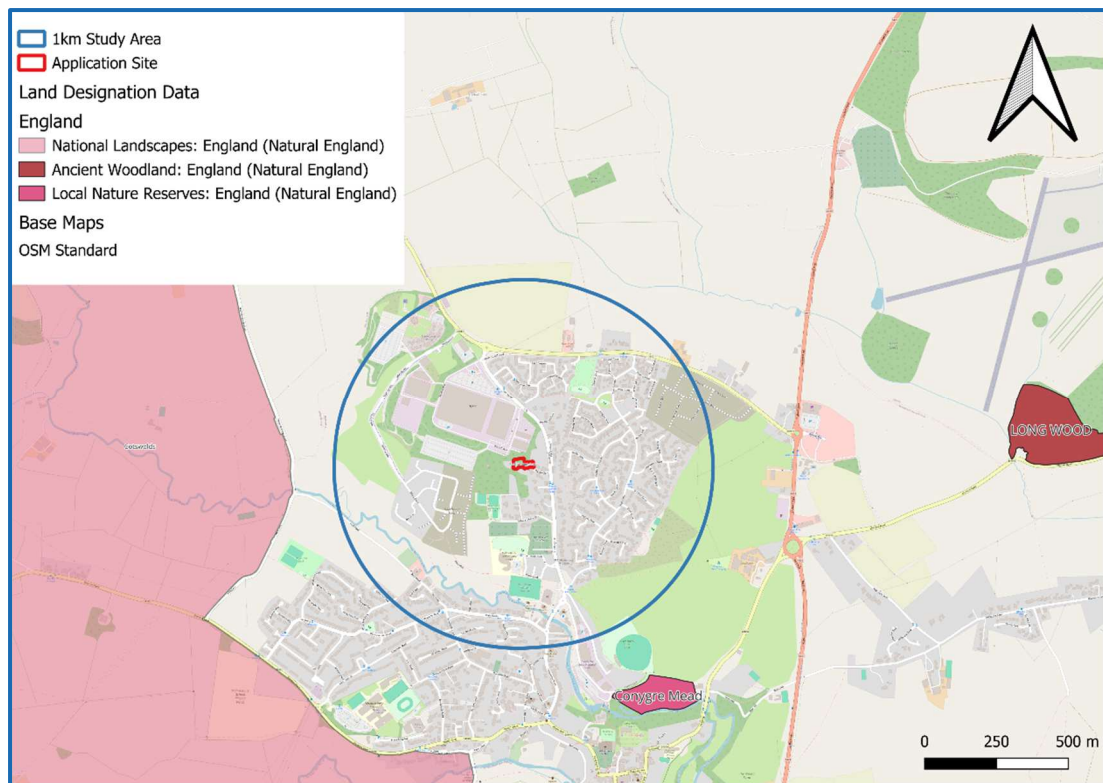


Figure 3 - Site Designations within 1 km Study Area

6.3. Existing lighting

- 6.3.1. The roadway Chubb Close in which the Application Site sits on, is only lit with property wayfinding wall mounted fittings (**Figure 4**)



Figure 4 - Property Light Fittings (Google Maps, September 2023)

6.3.2. Tetbury Hill, which connects to Chubb Close, is lit using streetlighting. This can be seen in **Figure 5**.



Figure 5 - Existing Lighting on Tetbury Hill (Google Maps, September 2023)

6.4. Environmental Zone Classification

- 6.4.1. Based on the evidence of the existing lighting (seen in **Section 6.3**) and the description of the surrounding environment (**seen in 6.2**) the environmental zone is assessed as E2.
- 6.4.2. The Environmental Zone criteria detailed within **Table 1** and **Table 2** informs the basis of the Lighting Strategy.
- 6.4.3. The Application Site and the surrounding area is semi-rural and is considered to be within two environmental zones, due to its vicinity to residential and industrial surroundings, however, fits the description *"Sparsely inhabited rural areas, village or relatively outer suburban locations"*.
- 6.4.4. Therefore, in reference to ILP GN01:2021, the most rigorous zone is to be applied (E2).

Zone	Surrounding	Examples	Limitations		Sky Glow ULR (Max)
			Pre-curfew	Post-curfew	
E2	Rural	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, etc.	5	1	2.5%

Table 3 - Limitations of identified environmental zone.

7. IDENTIFIED RECEPTORS

7.1. Ecological

7.1.1. Through Liaison with the project ecologist, an ecological receptor (**Appendix 3**) has been identified on the apex of the roof, in the form of a bat roost. Therefore, this Technical Report has been written in accordance with ILP GN08:2023. This can also be seen below in **Figure 6**.

Receptor Type	Receptor No. (Appendix 1)	Description
Ecology	PSER 001	Ecology Bat Roost as seen in Figure 6

Table 4 - Ecology Receptors (PSER)

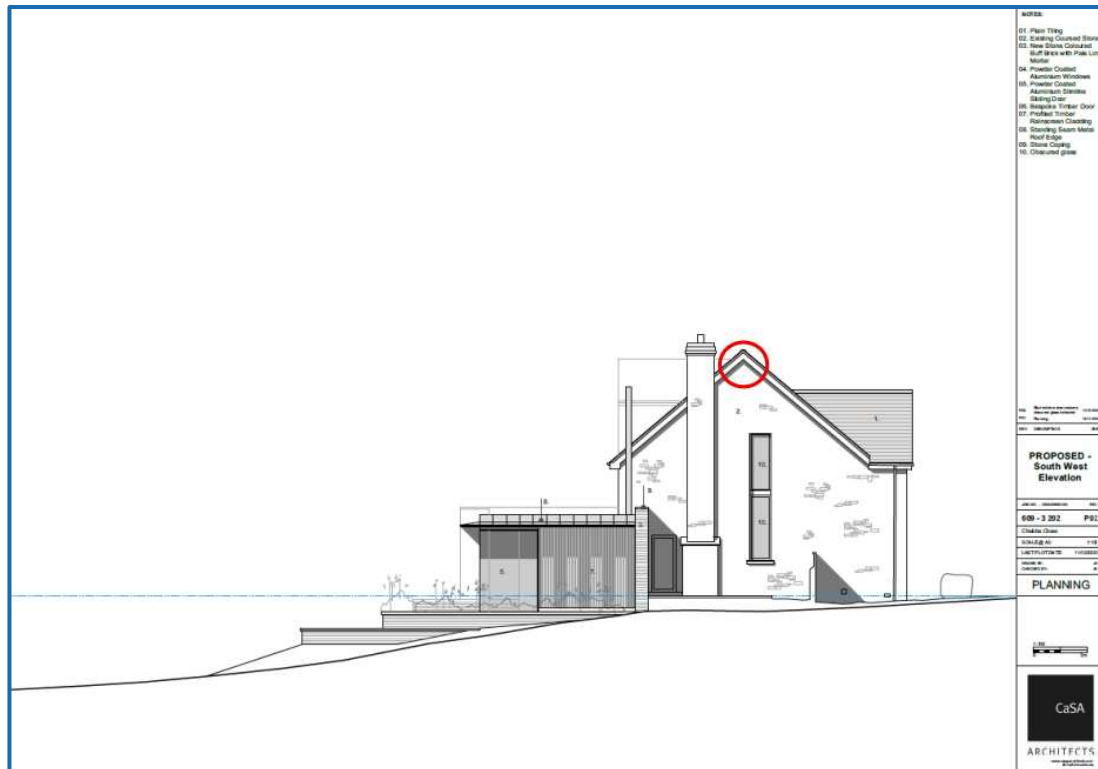


Figure 6 - Bat Roost Location

7.2. Human Amenity Receptor

- 7.2.1. To the South of the Application Site, Potentially Sensitive Human Receptors have been identified as shown in **Appendix 3**. Therefore, this Technical Report has been written in accordance with ILP GN01:2021.

Receptor Type	Receptor No. (Appendix 3)	Description
Human Amenity	PHAR 001	Residential Dwelling (South)

Table 5 - Potential Human Amenity Receptors (PHAR)

8. LIGHTING STRATEGY

8.1. Summary

- 8.1.1. Due to ecological sensitivity of the bat roost in the apex of the roof, no external lighting is proposed as part of the development on this elevation, as is advised by the project ecologist.
- 8.1.2. The Proposed Development will require internal lighting for the comfort of those living within the dwelling, and to enable them to use the dwelling in the evening hours and in the winter.
- 8.1.3. This Lighting Strategy is only for the task area of the staircase lighting within the Proposed Development.
- 8.1.4. All internal luminaires will utilise integrated LED technology, with photometric data available from the manufacturer. This ensures that the light distribution can be accurately modelled to limit potential light spill.
- 8.1.5. The following criteria seeks to ensure that the lighting is not outside of the obtrusive light limits for an E2 Environmental Zone in which the Application Site is located, is sensitive to the area, and provides a recognised standard level of lighting for all areas requiring illumination. Luminaires will distribute light downwards only to reduce the potential for light spill onto the boundaries surrounding the buildings and upwards towards the sky.
- 8.1.6. All lighting unless otherwise stated is to emit a warm white colour temperature (2700 Kelvin or less) to reduce the effects onto the sensitive receptors.
- 8.1.7. Lighting will be required in the following areas:
 - Private Dwelling Staircase Lighting

8.2. Private Dwelling Staircase Lighting

- 8.2.1. Internal Staircase Lighting layout is to be designed sensitively to reduce light spill on the boundaries of the Application Site
- 8.2.2. The Staircase lighting is to use linear led strip along each tread of the stair. These are all set to point downwards to minimise any upward light that could spill through the window.
- 8.2.3. Wall mounted fittings with downward directional optics are to be used on the tops of each floor.

Example Equipment

Equipment Specification	
Application Area	Staircase Lighting
Correlated Colour Temperature (Kelvin)	≤2700K Warm White
Height	≤0.2m
Mounting Arrangement	Within staircase tread projecting downwards
Luminaire Tilt	0°
Upward Light Output Ratio E1 < 0%	0%
Luminaire Manufacturer	IGuzzini (Or Similar Approved)
Luminaire family	Underscore InOut (Or Similar Approved)
Example Luminaire Image	
Controls ⁹	Internal Switching PIR Sensor

Table 6 – Example Equipment – Property Internals

⁹ Dimming: when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

Equipment Specification	
Application Area	Staircase Lighting
Correlated Colour Temperature (Kelvin)	≤2700K Warm White
Height	≤1.5m
Mounting Arrangement	Wall mounted
Luminaire Tilt	0°
Upward Light Output Ratio E1 < 0%	0%
Luminaire Manufacturer	BEGA (Or Similar Approved)
Luminaire family	78047.1K27 (Or Similar Approved)
Example Luminaire Image	
Controls ¹⁰	Internal Switching PIR Sensor

Table 7 - Example Equipment - Property internals

¹⁰ Dimming; when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

9. TECHNICAL ASSESSMENT

9.1. Overview

- 9.1.1. The purpose of this technical assessment is to evaluate the calculations of the internal staircase lighting that have been completed for the Proposed Development and to assess this based on the identified ecology and human receptors, outlined in **Section 7.1**.
- 9.1.2. 3D illuminance calculations have been completed based on the architectural drawings received to assess the obtrusive light criteria for recommended limitations from ILP GN01:2021 for an E2 environmental zone and ecology requirements from the Bat Conservation Trust (BCT) and ILP GN08:2023.
- 9.1.3. To ensure worst case scenario has been modelled, the highest potential light levels have been modelled / presented in the light spill diagram and vertical light spill calculation results. With the project maintenance factors set at $MF = 1.0$. This demonstrates the light levels at their highest (initial light levels at the start of luminaire life).

9.2. Architectural Design

- 9.2.1. The architectural design of the Proposed Development has been designed to ensure it does not encroach on the adjacent bat roost.
- 9.2.2. This includes:
 - > The dimensions of the window and exterior panelling to minimise the potential light spill.
 - > Obscure glass with a light transmission of 58% has been added to further minimise any potential light spill.
- 9.2.3. This has all been inputted into the 3D modelling of the proposed dwelling.

9.3. 3D Modelling

- 9.3.1. 3D light spill modelling has been conducted for the Proposed Development using the industry software Dialux evo.
- 9.3.2. The staircase itself is the only lit area within the internal space of the Proposed Development.
- 9.3.3. No vegetation has been modelled (existing or proposed) to ensure the worst-case scenario when calculating the obtrusive light levels.
- 9.3.4. The surface material of the Proposed Development has been modelled untextured but with reflectance values from CIBSE LG21:2021 Table 3.1.

9.4. Obtrusive Light Calculations

- 9.4.1. Vertical light spill calculations have been positioned based on the identified human and ecological receptors (**Appendix 2**) to evaluate the impact of light spill.
- 9.4.2. Four calculations grids have been used for the ecology receptors. 3 vertical illuminance grids that surround the window and 1 horizontal grid facing downwards to assess any vertical light spill onto the bat roost.
- 9.4.3. All calculation results have been conducted using a maintenance factor of 1.0.

9.5. Summary of Results – 3D Illuminance Calculations

Ecology

- 9.5.1. Where ecological receptors are sensitive to vertical light spill, vertical illumination grids have been modelled, as shown in **Appendix 2**. The light levels based on the modelling do not exceed (and are significantly less than) 0.4 Lux, keeping the light levels within the guidance given within the Bat Conservation Trust (BCT) and ILP GN08:2023.
- 9.5.2. The results of the illuminance calculations for the ecological receptors can be seen in **Table 8**.

Receptor No	GN08/2023 requirements	Maximum vertical Illuminance (Lux)
PSER 001	≤0.40	0.15
		0.38
		0.13
		0.065

Table 8 - Illuminance calculation results (PSER)

Human Amenity

- 9.5.3. In reference to **Appendix 2**, the vertical light spill calculation does not exceed the guidance given within ILP GN01:2021 for an E1 environmental zone.
- 9.5.4. The results of the illuminance calculations for the human receptor can be seen in **Table 9**.

Receptor No	GN01/2021 requirements		Maximum vertical Illuminance (Lux)
	Pre-curfew	Post Curfew	
PHAR 001	10 Lux	2 Lux	0.048

Table 9 - Illuminance calculation results (PHAR)

9.6. Mitigation by Design (Lighting)

- 9.6.1. Careful design ensures the lighting has been minimised onto sensitive receptors in accordance with local policy and industry guidance.
- 9.6.2. The detailed design is to be completed by a competent person or persons in accordance with the details within this Lighting Strategy (**Section 7.2**).
- 9.6.3. Mitigation methods are detailed in **Table 10** and **Table 11**.

Mitigation/Enhancement	Method	Installation Location
Restricting the Upward Light output Ratio	All luminaires will have an Upward Light Output Ratio of 0% and will be certified by Darksky.org.	Whole Proposed Development

Table 10 - Mitigation Methods (Lighting)

9.7. Mitigation by Design (Embedded)

Mitigation/Enhancement	Method	Installation Location
Obscure Glass	The use of obscure glass for the Proposed Development contributes to a lesser amount of light being able to pass through the glass. This value has been set to 57% Light Transmission	Staircase Window

Table 11 - Mitigation Methods (Embedded)

10. CONCLUSION

10.1. General

10.1.1. The staircase lighting associated with the Proposed Development shall be designed in accordance with the Lighting Strategy for the Application Site outlined in **Section 8**.

10.1.2. Due to the results of the technical assessment in **Section 9**, it is concluded that the proposed staircase lighting will result in:

- > Vertical and horizontal Light Spill calculations for the identified ecological receptor do not exceed the ≤ 0.4 Lux guidance requirement from the Bat Conservation Trust (BCT) and ILP GN08:2023 (**Table 8** and **Appendix 3**).
- > Vertical Light Spill calculations for the identified human receptor do not exceed the pre-curfew requirements of 5 Lux or the post-curfew requirements of 1 Lux, as shown in the guidance requirements from ILP GN01:2021 for an E2 environmental zone. This is also within compliance for an E1 environmental zone for pre and post curfew limits.

10.1.3. This Technical Report responds to the ecology comments through the following elements within the report:

- > Liaison with the project ecologist and ecological documentation (**Section 7.1** and **Appendix 3**) which has identified and highlighted the ecological concerns of the Application Site, as well as lighting mitigative measure to implement into the Lighting Strategy.
- > Horizontal and vertical illuminance calculations (**Section 9.4** and **Appendix 1**) to ensure that the bat roost is not illuminated above the guidance requirements from the Bat Conservation Trust and ILP GN08:2023.
- > Equipment specification (**Table 6**) highlight specifications that align with the ecological requirements. This includes 2700K colour temperature, downwards directional optics and timed sensors.

APPENDIX 1

Light Spill Diagram

**Due to the low-level lighting approach for the staircase lighting, the horizontal light spill from the window is <0.1 Lux, which is below natural levels of variation.*

APPENDIX 2

Vertical Light Spill Calculations

Vertical Grid Locations

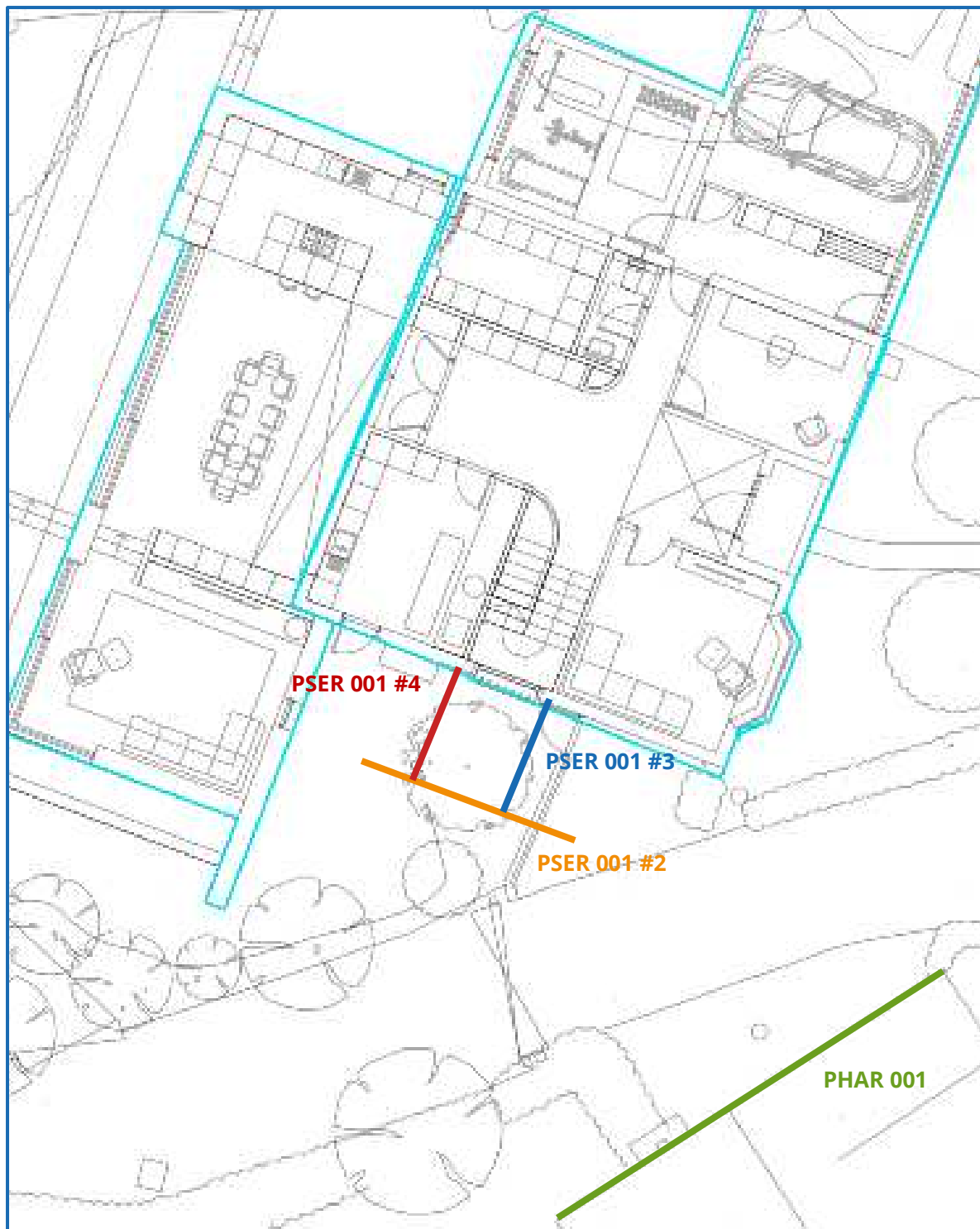


Figure 7 - Vertical Grid Locations

Horizontal Grid Location

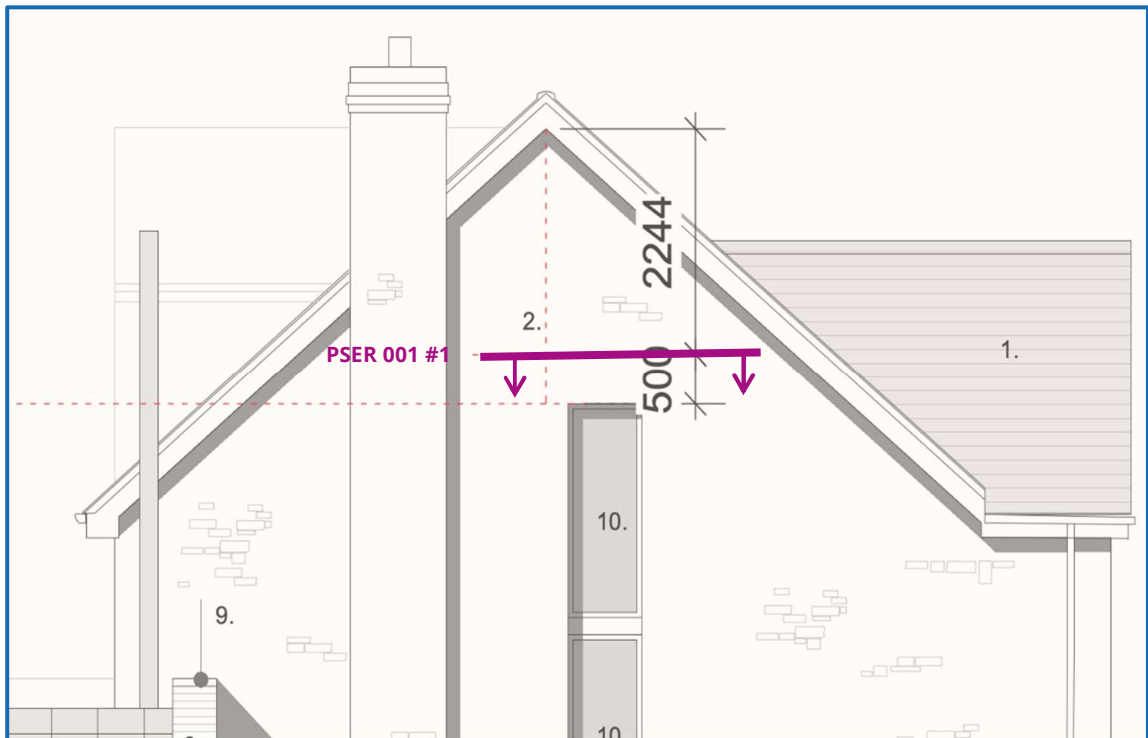
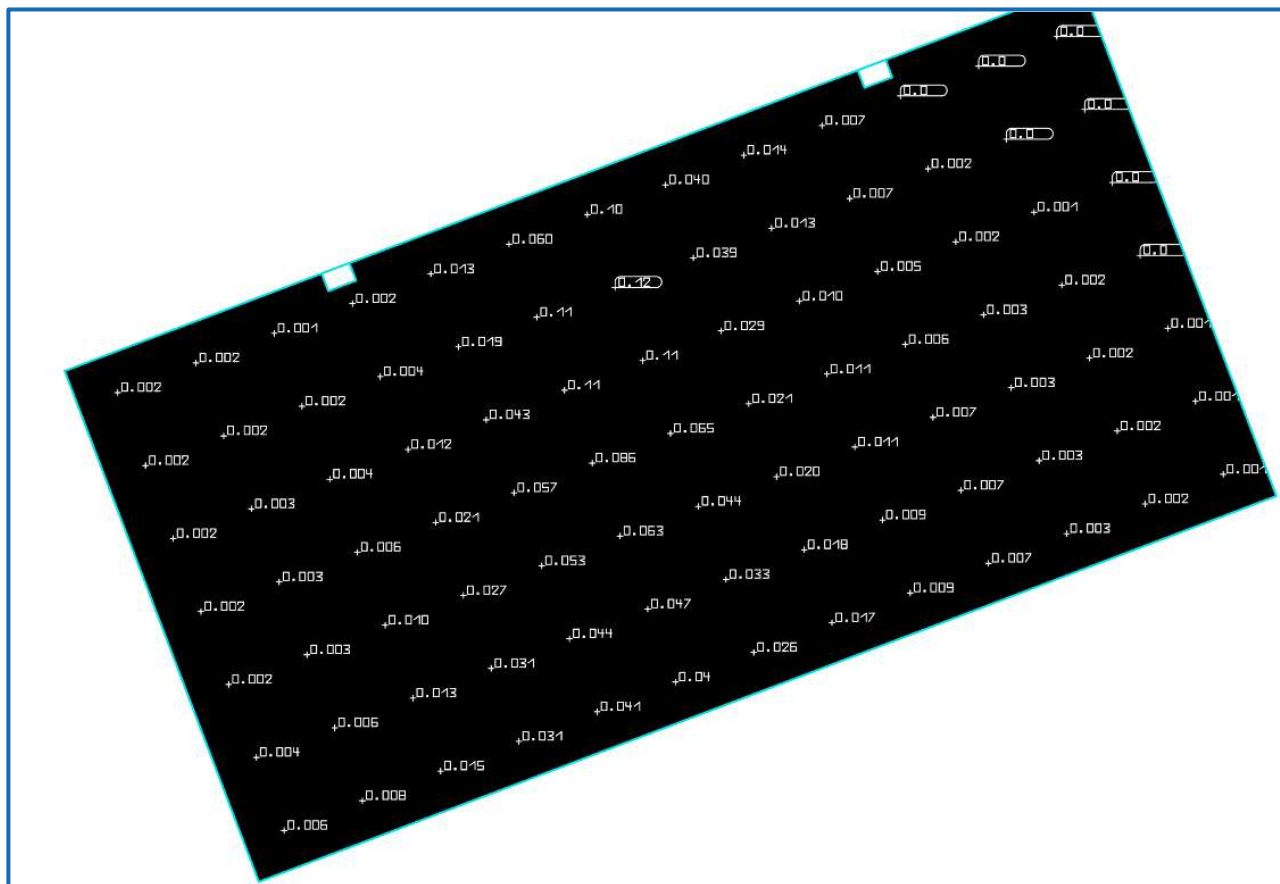


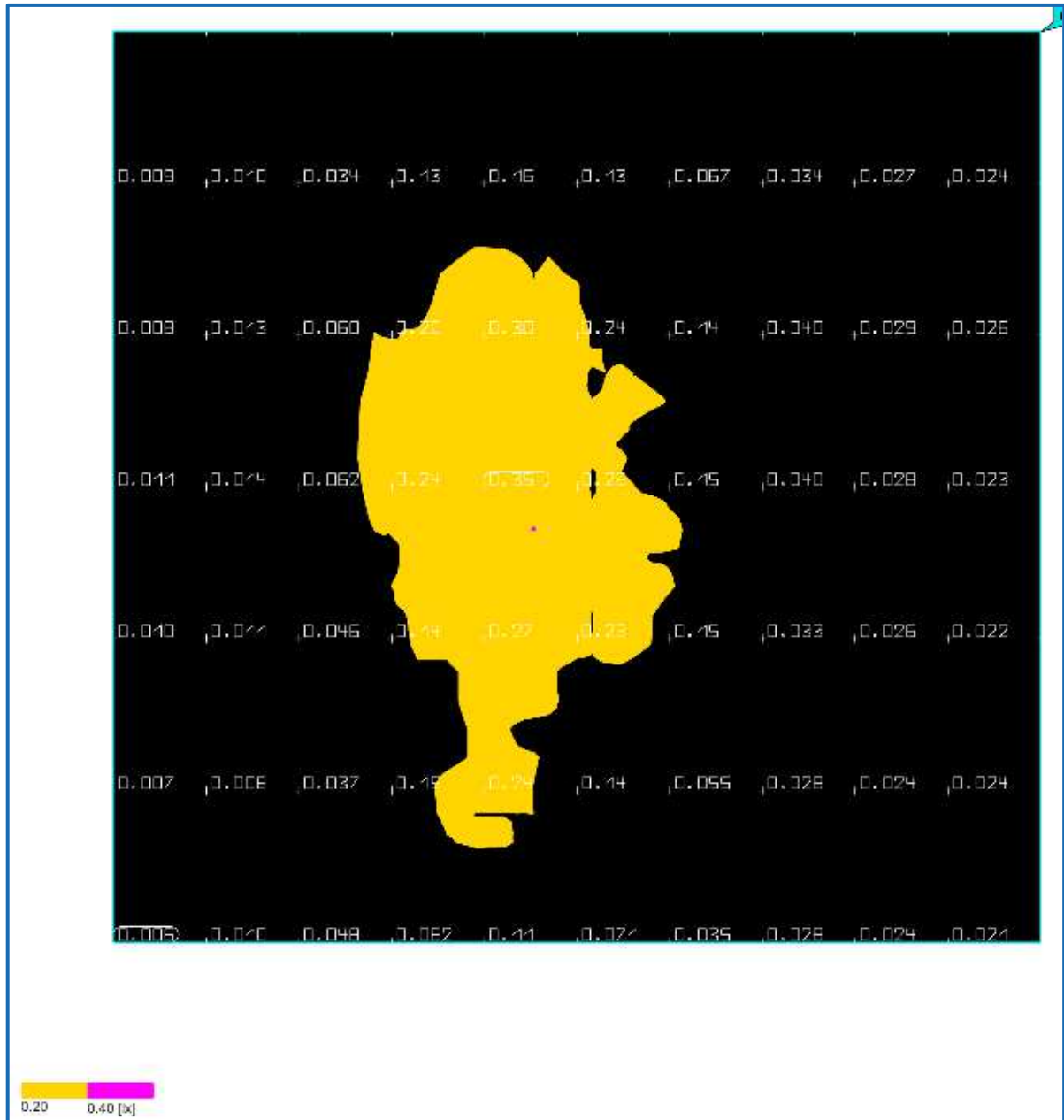
Figure 8 - Horizontal Grid Location

10.1.4. **Figure 8** below shows the distance from the window the horizontal grid has been placed, which achieves a maximum of 0.18 Lux. Therefore, anything at or above 500mm above the top of the window will be below the requirements from the Bat Conservation Trust and ILP GN08:2023.

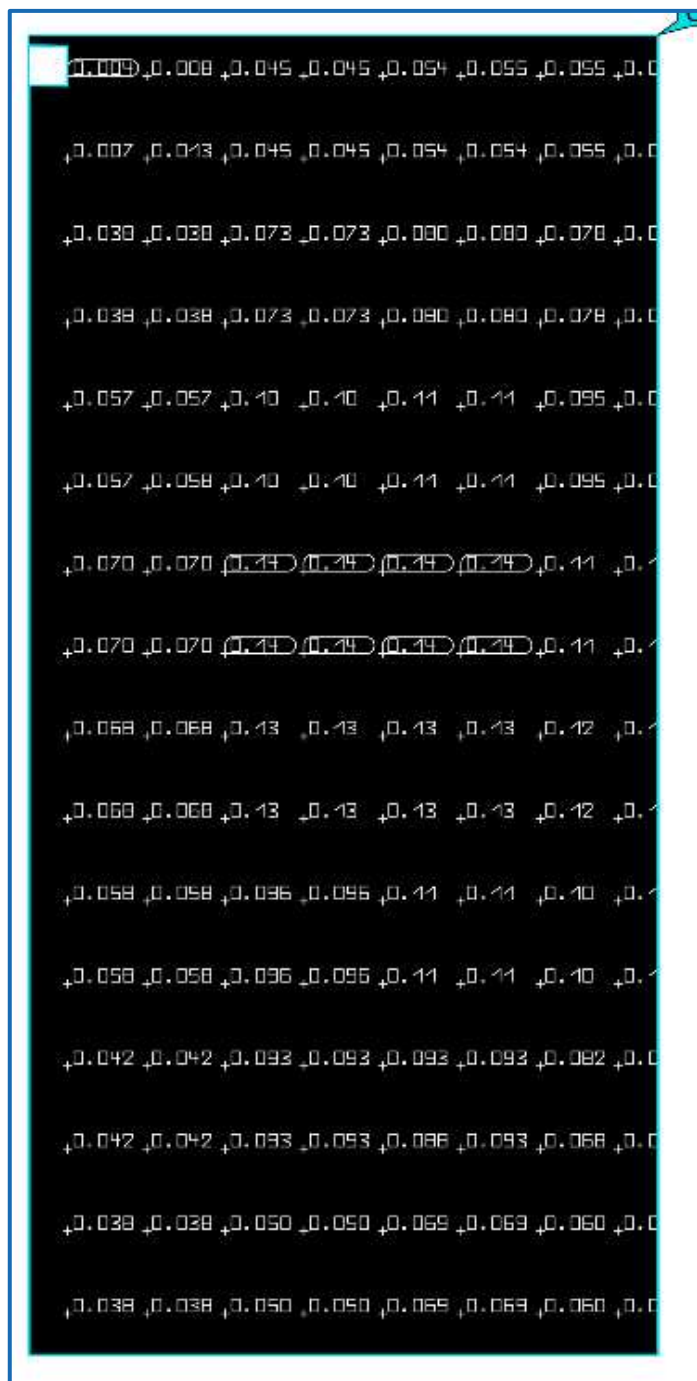
Ecology Receptors



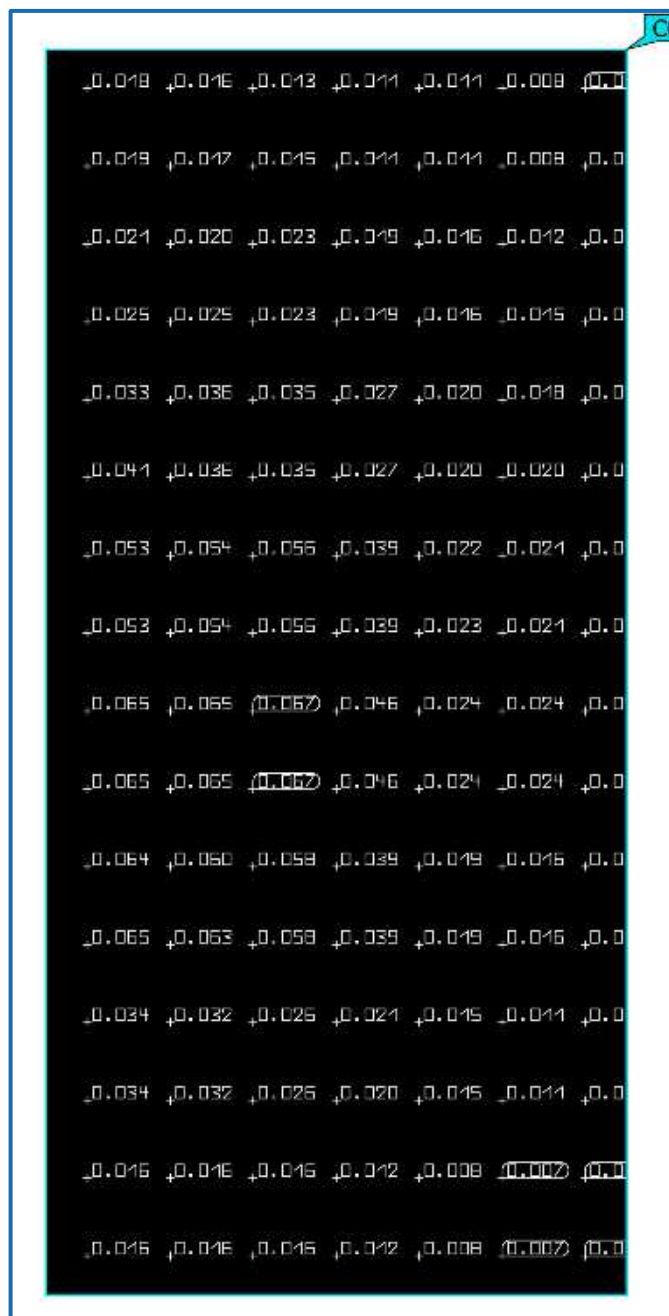
Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
PSER 001 #1	0.022 lx	0.000 lx	0.15 lx	0.00	0.00	CG2
Perpendicular illuminance (adaptive)						
Height: 6.406 m						



Properties	$\bar{E}$	E_{min}	E_{max}	$U_0 (g_1)$	g_2	Index
PSER 001 #2	0.084 lx	0.006 lx	0.38 lx	0.071	0.016	CG1
Perpendicular illuminance (adaptive)						
Height: 3.998 m						

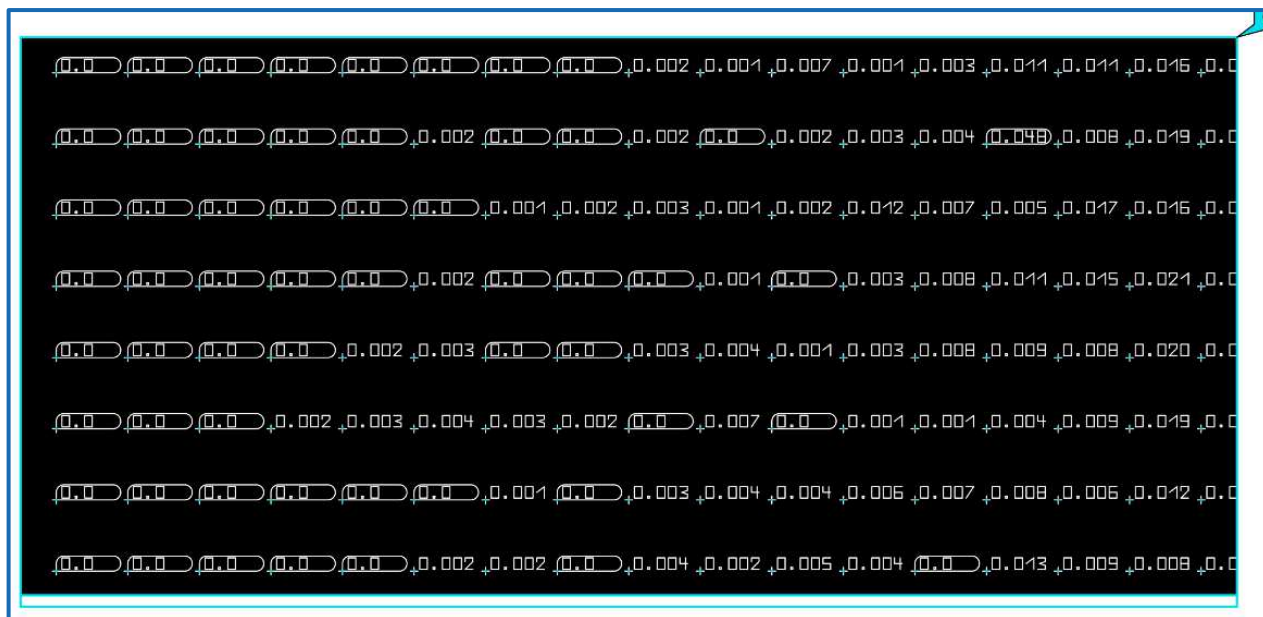


Properties	E	E _{min}	E _{max}	U _o (g ₁)	g ₂	Index
PSER 001 #3	0.081 lx	0.004 lx	0.13 lx	0.049	0.031	CG4
Perpendicular illuminance (adaptive)						
Height: 3.998 m						



Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
PSER 001 #4 Perpendicular illuminance (adaptive) Height: 3.998 m	0.027 lx	0.007 lx	0.065 lx	0.26	0.11	CG3

Human Receptor



Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
PHAR 001 Perpendicular illuminance Height: 2.400 m	0.005 lx	0.000 lx	0.048 lx	-	0.00	CG5

APPENDIX 3

Sensitive Receptors

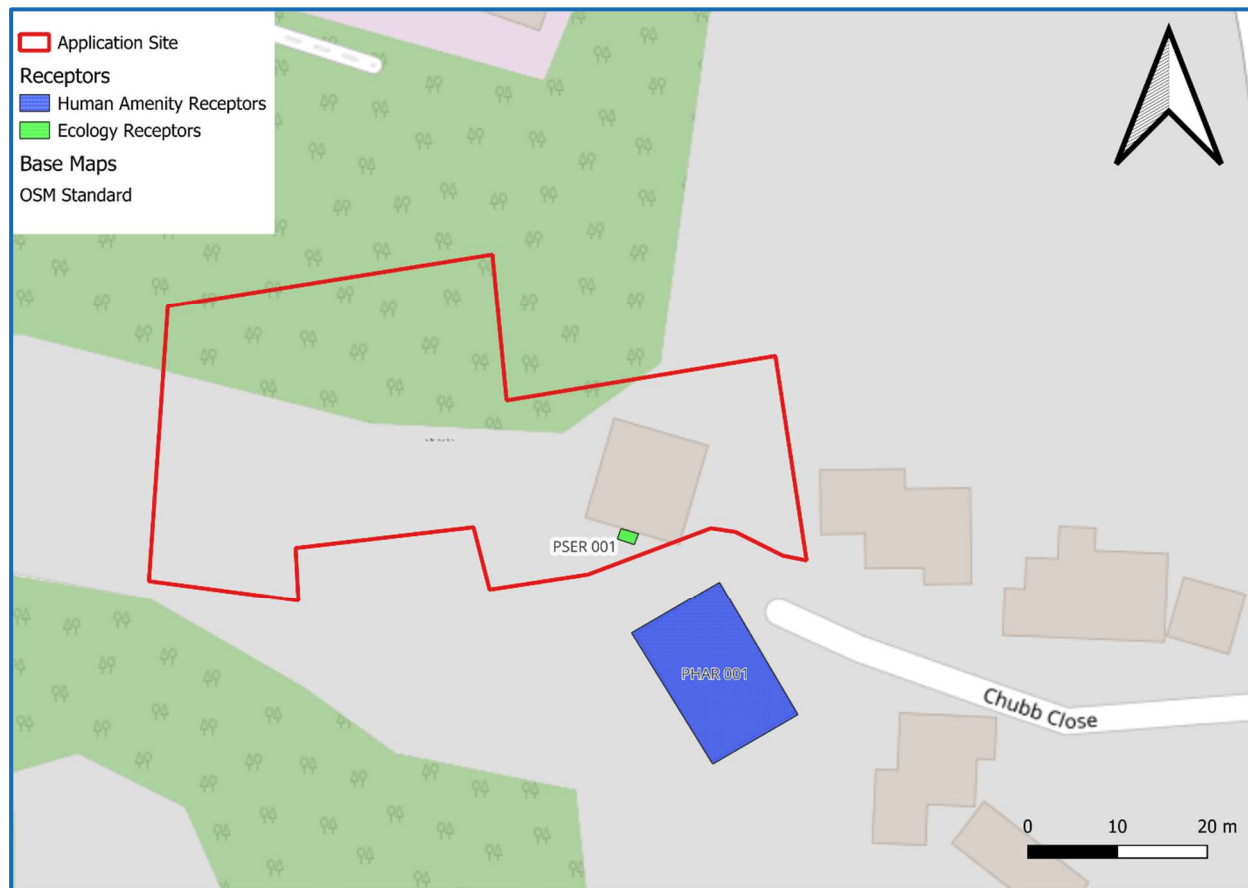
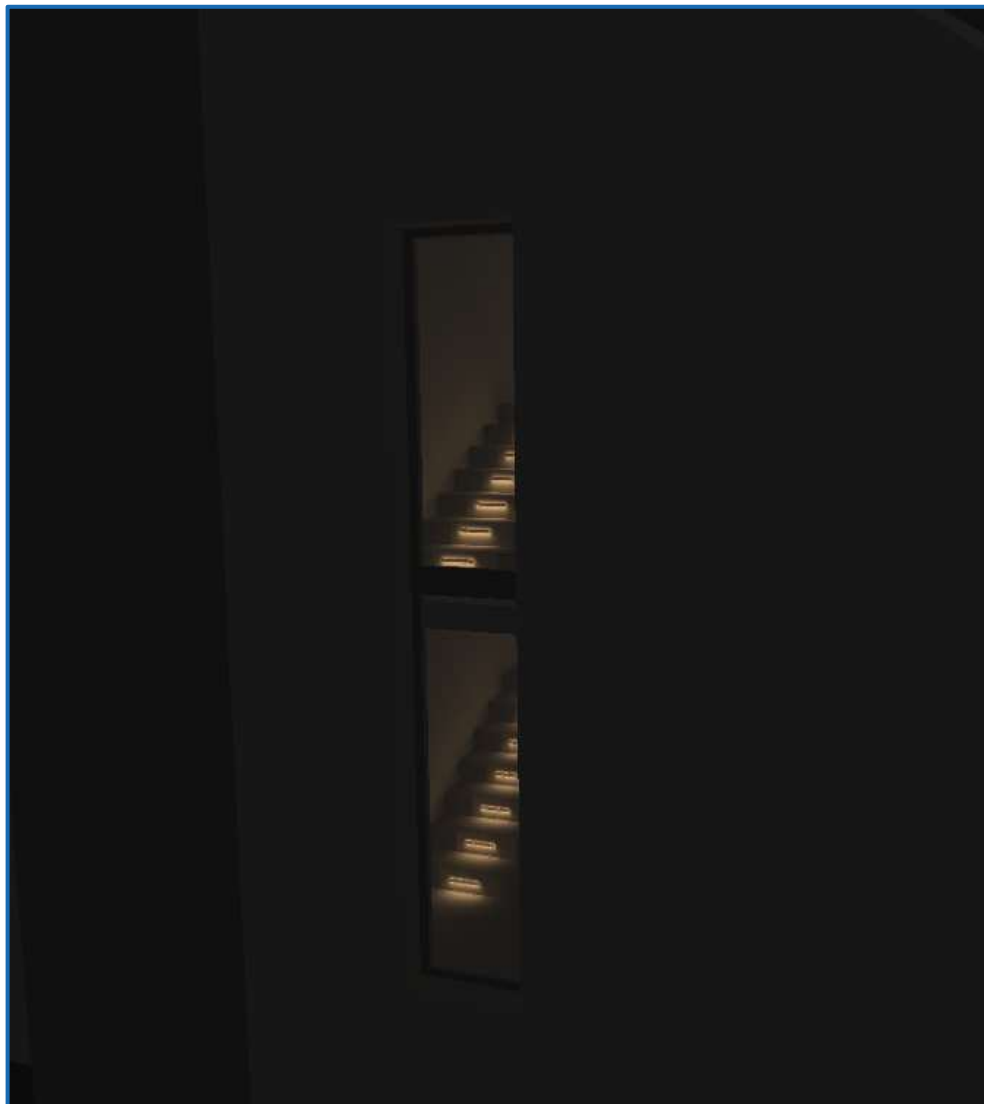


Figure 9 - Sensitive Receptors

APPENDIX 4

3D Model Images







TECHNICAL DESCRIPTIONS, DEFINITIONS & ABBREVIATIONS

PHAR: is an abbreviation for a potential human amenity receptor, a location where an observer could have the potential to be affected by the proposed lighting to be installed [Abbreviation used by DFL LI and P.](#)

PSER: is an abbreviation for an area identified as or treated as a location that may host a potentially sensitive ecological receptor. This is generally used where light sensitive bats have the potential to live, forage or use as a flight path, other ecologically sensitive receptors such as (but not limited to) the Great Crested Newt may also be identified by this term. [Abbreviation used by DFL LI and P.](#)

PSR: is an abbreviation for an area where an individual maybe susceptible to light brightness (Light intensity) which may have the potential to cause a hazardous situation. [Abbreviation used by DFL LI and P.](#)

Obtrusive Light: refers to excessive or bothersome artificial light that goes where it shouldn't, causing discomfort and disruption. *Spill light which because of quantitative, directional or spectral attributes in a given context gives rise to annoyance, discomfort, distraction or reduction in the ability to see essential information.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

Sky glow: When lights are directed upwards or light is scattered by particles in the air, like dust or water droplets, it creates a glow that makes it hard to see stars. *The increase in diffuse illuminance of the night sky above that produced by natural sources such as the moon and visible star.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

Vertical Illuminance: is how much light lands on upright surfaces like walls. It's measured in lux or footcandles and matters for places where the view from a vertical angle is important. *Lighting of vertical surfaces such as walls, windows, statues, sculptures and people's faces.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

Correlated colour temperature (CCT): the appearance of light emitted by a light source measured in Kelvin (K), Lower CCT values such as 2700K represent warmer, more yellowish light, *similar to the light from older incandescent lamps. (Tcp)The temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions, measured in absolute temperature on the kelvin (K) scale.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

Lux: measures the brightness of light as perceived by the human eye at a specific point on a surface. *The SI derived unit of illuminance, measuring luminous flux per unit area (1 lux =1 lumen/m²).* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

Lumens: measure how bright a light appears to our eyes. The SI derived unit of luminous flux; a measure of the total quantity of visible light emitted by a source or received by a surface (unit: lumen). [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

Glare: refers to an excess of bright light that makes you uncomfortable or hinders your vision. It happens when there's a big difference between a bright light and the rest of the surroundings. *Glare: condition of vision in which there is discomfort or a reduction in the ability to see details or objects, caused by an unsuitable distribution or range of luminance, or by extreme contrasts.* [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.1.8](#)

Luminous intensity: is light brightness or how intense the light source is. Light intensity is how intense a light source is emitted or received in a particular direction, this is measured in candelas and is termed as luminous intensity I_v <of a source, in a given direction> quotient of the luminous flux, $d\Phi_v$, leaving the source and propagated in the element of solid angle $d\Omega$ containing the given direction, by the element of solid angle (unit: $cd = lm \cdot sr^{-1}$). [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.2.](#)

Candela: is a measurement for the brightness of a light source, taking into account the direction in which the light is emitted. *Base unit of luminous intensity in the International System of Units (SI); the luminous power per unit solid angle emitted by a point light source in a particular direction.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

Uniformity (Uo): is an explanation for the even distribution of light across an area or surface. The overall uniformity shall be calculated as the ratio of the lowest luminance, occurring at any grid point in the field of calculation, to the average luminance. [BS EN 13201-3-2015, Calculation of Performance Section 8.3.](#)

Luminance: is how bright a surface appears to our eyes. It considers the light coming from or reflected by an object. L_v <in a given direction, at a given point of a real or imaginary surface> quantity defined by the formula (unit: $cd \cdot m^{-2} = lm \cdot m^{-2} \cdot sr^{-1}$) [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.3.](#)

Illuminance is how much light lands on a surface per square meter. It's measured in lux. More lux means a brighter area. E_v (unit: $lx = lm \cdot m^{-2}$) 1. <at a point of a surface> quotient of the luminous flux $d\Phi_v$ incident on an element of the surface containing the point, by the area dA of that element 2. <at a point of a surface> equivalent definition: integral, taken over the hemisphere visible from the given point, of the expression. [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.10.](#)

Luminaire: a light fixture, this is also sometimes referred to as a lantern or a light fitting, is a product that produces artificial light. *apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply* [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.3.3](#)

ULOR: upward light output ratio or ULOR refers to the amount of light the light fixture will produce upwards as a percentage of its total light output. *RULO <of a luminaire> ratio of the upward luminous flux of the luminaire, measured under specified practical conditions with its own lamp(s) and equipment, to the sum of the individual luminous fluxes of the same lamp(s) when operated outside the luminaire with the same equipment, under specified conditions* [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.3.12.](#)

Maintenance factor (MF): is an allowance for how well the lights keep working overtime. It considers things like dirt on the light fittings and "wear and tear". *DEPRECATED: light loss factor ratio of illuminance produced by the lighting installation after a certain period to the illuminance produced by the installation when new* Note 1 to entry: The term depreciation factor has been formerly used to designate the reciprocal of the above ratio. Note 2 to entry: The maintenance factor takes into account light losses caused by dirt accumulation on luminaires and room surfaces (in interiors) or other relevant surfaces (in exteriors, where appropriate), and the decrease of the luminous flux of lamps. [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.5.18.](#)

Tilt: is how much the luminaire is lifted based on the fitting facing flat to the ground.

Outreach: how far away the fitting is from the column/wall its mounted on to the light source.

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