J Murphy & Sons

OLLERTON DEPOT

Lighting Strategy

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DECEMBER 2023

CONFIDENTIAL

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1 INTRODCUTION & PROJECT DESCRIPTION

1.1 BACKGROUND

1.1.1. This document is provided with regards to the submission of a planning application on behalf of J Murphy & Sons Limited (the Applicant) for the relocation and redevelopment of the existing Ollerton Depot located on off Newark Road, New Ollerton, Newark, NG22 9QG.

1.1.2. The Applicant is seeking to relocate existing workshop facilities to land directly east of their current location. The redevelopment of the land and existing facilities is seeking to provide:

- New office and training building/facilities
- New workshop facilities
- New staff and visitor's car parking
- HGV parking
- Reconfiguration of existing open storage areas (no plans for additional lighting beyond the existing provision)

1.2 PROJECT DESCRIPTION

The Application Site

The application site is as indicated in Figure 1-1.

Figure 1-1 - Application site red line boundary

1.2.1. The application site consists of the existing J Murphy & Sons Limited depot, workshops and open storage areas, with existing farm land located immediately to the east which is being proposed to accommodate the relocated workshops, offices and new training facilities.

1.2.2. The site is bounded by the East Midlands Railway, New Ollerton and Ollerton Pit Wood to the north. Dense woodland to the east. To the south there is open farmland, farm buildings and the Village of Wellow. Immediately to the west is Newark Road, the Beacon Court Trading Estate and a number of residential dwellings located off Beacon View, St Stephens Road and Kelsey Avenue.

1.3 AIM OF THIS DOCUMENT

1.3.1. We have been appointed to create a lighting strategy for the infrastructure associated with new lighting to be proposed for illumination of the various areas of the planned redevelopment of the existing Ollerton depot.

This document outlines:

- Legislation, planning policies and guidance applicable to the type and location of the Proposed Development;
- The existing lighting conditions within and surrounding the Application Site;
- The background to artificial light pollution and associated guidance;
- Environmental limitations that may be placed on the lighting of the Proposed Development, in accordance with current standards and guidance;
- Expected levels of illumination for the activities proposed for the development; and
- Equipment performance requirements that are likely to achieve compliance with both lighting and environmental guidance.

2 IMPACTS OF ARTIFICIAL LIGHT

2.1 POTENTIAL NEGATIVE EFFECTS

2.1.1. A well-designed lighting installation may transform a space after dark; allowing it to be used safely, effectively and for uses that may not otherwise be possible. While road lighting tends to be the dominant type of lighting in most developments, lighting can also consist of public amenity lighting in core spaces, sports lighting, decorative lighting, functional (task) lighting and security lighting across a range of different applications.

2.1.2. The recommended lighting levels for different tasks are outlined in national and international standards, as well as industry standards and guidance documents. Typically, the more complex a task, the greater the required level of illumination and the higher the levels of uniformity in lighting levels required.

2.1.3. Levels of lighting must be carefully selected to ensure that they are suitable for the task being undertaken whilst ensuring that they are not excessive. Excessive levels of lighting lead to wasted energy, as well as having the potential to negatively impact local ecological receptors, human amenity receptors, and the safety of the surrounding area. In extreme cases, poor lighting may make the task it is provided for more difficult to accomplish and constitute a statutory nuisance on nearby receptors. In the context of light sensitive species (specifically bats) excessive lighting levels may lead to changes in feeding and commuting behaviour, increased risk of predation, or roost abandonment.

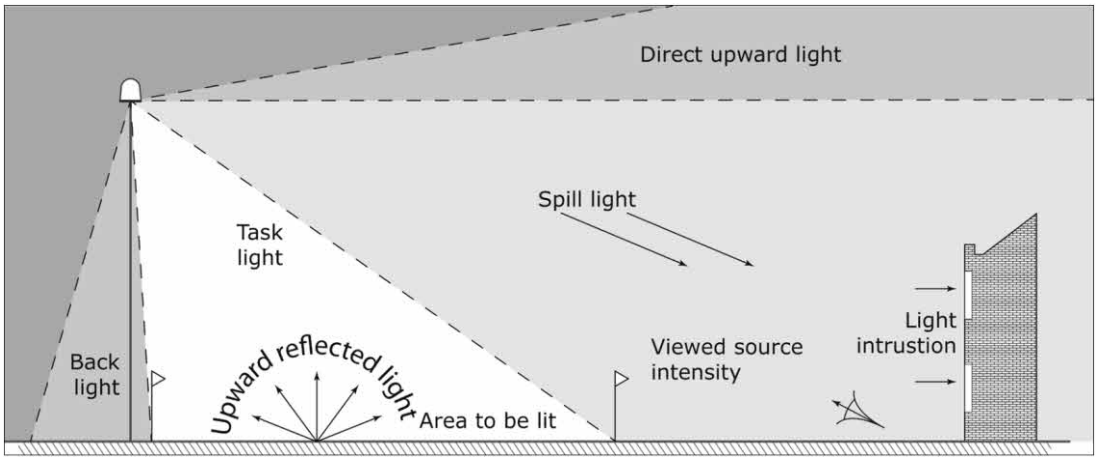
Figure 2-1 - Example of various poorly controlled lighting installations

2.1.4. The incorrect application of lighting can have a negative effect on the local environment, in the form of light pollution and nuisance light. Light pollution is defined as emitted light that is serving no useful purpose as it falls outside of the area required to be illuminated. This can take several forms:

- Light Spill – Light falling outside of the extents of a site, building or event which falls onto areas not intended for illumination.
- Sky Glow – The emission of upward light into the atmosphere that limits the visibility of the night sky. The cumulative effects of sky glow may be noticeable above urban areas, where several poorly controlled sources combine to create a brightening of the horizon and night sky.
- Glare – The uncomfortable brightness of a light source when viewed against a darker background. Poorly oriented lighting units may exhibit glare and, while the disabling effects of glare diminish with distance, lighting may still cause a nuisance over several hundred metres.

2.1.5. A graphical representation of the types of lighting nuisance is provided in **Figure 2-2**:

Figure 2-2 - Types of light nuisance (ILP GN01:2021)



ILP GN01:2021

2.2 STATUTORY REQUIREMENTS AND POLICIES

2.2.1. Details of the pertinent statutory requirements and policies relevant to the Proposed Development are included within this section. These requirements and policies are considered further in **Section 3** which details the baseline lighting conditions and **Section 4** which sets out how lighting should be installed appropriately.

2.2.2. The following information is not exhaustive and further statutory requirements and polices may be applicable.

2.3 LEGISLATION

Clean Neighbourhoods and Environment Act (2005)

2.3.1. The Clean Neighbourhoods and Environment Act 2005 (the 'CNEA') gives local authorities powers to deal with artificial lighting by classifying artificial light emitted from defined premises as a statutory nuisance. The CNEA amends Section 79 of the Environmental Protection Act 1990 (the 'EPA') to extend the statutory nuisance regime to include light spill and glare (emitted from certain premises), defined as "*artificial light emitted from premises so as to be prejudicial to health or a nuisance*".

Several defined types of premises are exempt from this provision, including premises where higher levels of lighting are to be expected for the purposes of safety, such as airports and lighthouses.

2.3.2. Guidance produced by the Department of Environment, Food and Rural Affairs (DEFRA) on Sections 101 to 103 of the CNEA extends the duty on local authorities to ensure their areas are checked periodically for existing and potential sources of statutory nuisances, including situations where a nuisance arises from the use of artificial lighting.

2.4 NATIONAL POLICIES

National Planning Policy Framework (2021)

2.4.1. The National Planning Policy Framework (NPPF), prepared by the Ministry of Housing, Communities and Local Government (now Department of Levelling Up, Housing & Communities), July 2021 states:

'*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: …*

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.' (NPPF, Paragraph 185, 2021)

Planning Practice Guidance (2019)

2.4.2. The Ministry of Housing, Communities and Local Government provides guidance on light pollution on the gov.uk website (https://www.gov.uk/guidance/light-pollution) and details the following which have been considered during the development of the lighting strategy for Haxby Station:

- What light pollution consideration does planning need to address?
- What factors can be considered when assessing whether a development proposal might have implications for light pollution?
- What factors are relevant when considering where light shines?
- What factors are relevant when considering when light shines?
- What factors are relevant when considering how much the light shines?
- What factors are relevant when considering possible ecological impacts of lighting?
- What other information is available that could inform approaches to lighting and help reduce light pollution?

2.5 LOCAL POLICIES

A search of both the Newark & Sherwood District (NSD) and Nottinghamshire County Council (NCC) Planning Portals revealed that there are currently no specific policies in current planning policy documentation directly relating to lighting, light pollution or Artificial Lighting at Night (ALAN). This was subsequently confirmed by NSD Environmental Health Officer.

2.6 GUIDANCE FOR IMPLEMENTATION

2.6.1. Applicable guidance for lighting designers regarding obtrusive light is predominantly covered by the following international documents:

- CIE 150:2017 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (International Commission on Illumination, 2017)
- CIE 126:1997 Guidelines for Minimizing Sky Glow (International Commission on Illumination 1997)

2.6.2. National guidance for the United Kingdom is produced by the Institution of Lighting Professionals (ILP) in the following documents:

- Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (PLG04) (ILP, 2013)
- Guidance Note 01/21 Guidance Notes for the Reduction of Obtrusive Light (GN01) (ILP, 2021)
- Bat Guidance Note 08/23 Bats and Artificial Lighting at Night (ILP & The Bat Conservation Trust, 2023)

2.6.3. Further guidance has been produced by the Society for Light & Lighting (SLL), with the following documents outlining good lighting practice that will inform the design:

- SLL Lighting Handbook (2018)
- SLL Lighting Guide 6: The Exterior Environment (2016)

ILP GN01:2021 Guidance notes for the reduction of obtrusive light

2.6.4. Guidance Notes outlined in ILP GN01:2021 sets out what constitutes Obtrusive Light, how it can be limited through the implementation of best practice, and what limits should be imposed upon lighting depending upon the Environmental Zone in which the Application Site is located. GN01 is a distillation of CIE150:2017.

2.6.5. ILP GN01:2021 Table 2 (Table 2-1 below) sets out the Environmental Zones against which lighting should be considered (refer to 3.4.9 for site specific details):

Table 2-1 – GN01 Table 2: Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones 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 of suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity

ILP GN01:2021

2.6.6. ILP GN01:2021 Table 3 (CIE 150 Table 2) (Table 2-2 below) sets out the maximum values for vertical illuminance onto nearby premises, depending upon the Environmental Zone in which the premises is located. This limitation is typically considered at windows and apertures, with a focus on bedroom windows (typically at 3.8m and above).

Table 2-2 – ILP GN01 Table 3 (CIE 150 Table 2): Maximum values of vertical illuminance on premises

Light Technical Parameter	Application conditions	Environmental Zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (Ev)	Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
	Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

ILP GN01:2021

2.6.7. ILP GN01:2021 Table 4 (CIE 150 Table 3) (Table 2-3 below) sets out the limits on the luminous intensity of luminaires, to control glare.

Table 2-3 – ILP GN01 Table 4 (CIE Table 3): Limits for the luminous intensity of bright luminaires

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m^2)					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.5$	$A_p > 0.5$
Maximum luminous intensity emitted by luminaire (*I* in cd)	E0						
	Pre-curfew	0	0	0	0	0	0
	Post-curfew	0	0	0	0	0	0
	E1						
	Pre-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
	Post-curfew	0	0	0	0	0	0
	E2						
	Pre-curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10 *d*	7,500
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500
	E3						
	Pre-curfew	0.86 *d*	1.9 *d*	3.8 *d*	8.5 *d*	15 *d*	10,000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	1,000
	E4						
	Pre-curfew	1.4 *d*	3.1 *d*	6.3 *d*	13 *d*	26 *d*	25,000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500

ILP GN01:2021

2.6.8. ILP GN01:2021 Table 6 (CIE 150 Table 5) (Table 2-4 below) sets out the maximum upward light ratio (ULR) for luminaires depending upon the Environmental Zone in which they are to be used.

Table 2-4 – ILP GN01:2021 Table 6 (CIE 150 Table 5): Maximum values of upward light ratio (ULR) of luminaires

Light Technical Parameter	Environmental Zones				
	E0	E1	E2	E3	E4
Upward light ratio (ULR) / %	0	0	2.5	5	15

ILP GN01:2021

ILP GN08:2023 BATS AND ARTIFICIAL LIGHTING IN THE UK

2.6.9. ILP GN08:2023 is a document intended to raise awareness of the impacts of artificial lighting on bats and outline mitigation options for various scenarios. Work on site should always be informed by site-specific ecological information and lighting assessments.

2.6.10. Whilst the document does not set out a prescriptive limit for light spill onto bat commuting routes, feeding grounds and roosts, it states:

"N.B. It is acknowledged that, especially for vertical calculation plans, 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 plants 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 averse behaviour (Stone, 2012)."

3 RECEPTOR AND BASELINE ASSESSMENT

3.1 METHODOLOGY

3.1.1. A desktop assessment of the Application Site has been prepared to examine the existing baseline lighting conditions both within the Application Site boundary and in the immediate surrounds. This assessment involved the review of publicly available mapping data, sky glow information, environmental sensitivities, and consultation with relevant disciplines to build up a picture of the area.

3.1.2. A baseline survey of the Application Site has not been carried out as agreed with Newark and Sherwood District Council Environmental Health Officer. Sufficient information can be gathered from publicly available sources to build up a picture of the baseline conditions.

3.2 POTENTIALLY SENSITIVE HUMAN RECEPTORS

3.2.1. Potentially sensitive human receptors to changes in lighting can be split into two categories:

- Human Amenity – Receptors that are sensitive to changes in lighting that can affect the amenity of spaces. E.g. Residential receptors
- Human Safety – Receptors that are sensitive to changes in lighting that can affect the safety of users. E.g. Public highways, Railway lines.

3.2.2. Table 3-1 and Figure 3-1 highlight the human and residential receptors that have the potential to be affected by the presence of artificial light.

Table 3-1 – Potentially Sensitive Human Receptors

Receptor No.	Receptor Name	Description	Receptor Type	Receptor Sensitivity
1	Kelsey Avenue	Residential properties adjacent to the existing and proposed redeveloped depot	Human Amenity	Medium
2	Railway	East Midlands Railway line located along the northern boundary of the site	Human Safety	Low
3	Newark Road	Residential properties located directly opposite depot	Human Amenity	Low
4	Sherwood Forest Crematorium	Crematorium located on the opposite side of existing tree belt to the south west of the site.	Human Amenity	Low

Figure 3-1 - Potentially Sensitive Human Receptor Map

Google Earth (2023)

3.3 POTENTIALLY SENSITIVE ECOLOGICAL RECEPTORS

3.3.1. Potentially sensitive ecological receptors to changes in lighting consist of flora and fauna which may be affected by changes in lighting levels, periods of illumination, sky glow or glare. For example, certain species of bats are known to change their commuting behaviour or the times at which they emerge in the evening depending upon levels of artificial lighting.

3.3.2. An initial ecological assessment has been undertaken by Delta Simons. The primary potential sources of ecological sensitivity have been identified in the assessment as being sensitive to light are as follows:

- Bats (Brown Long-ears and Myotis).
- Owls recoded as foraging.

[redacted]

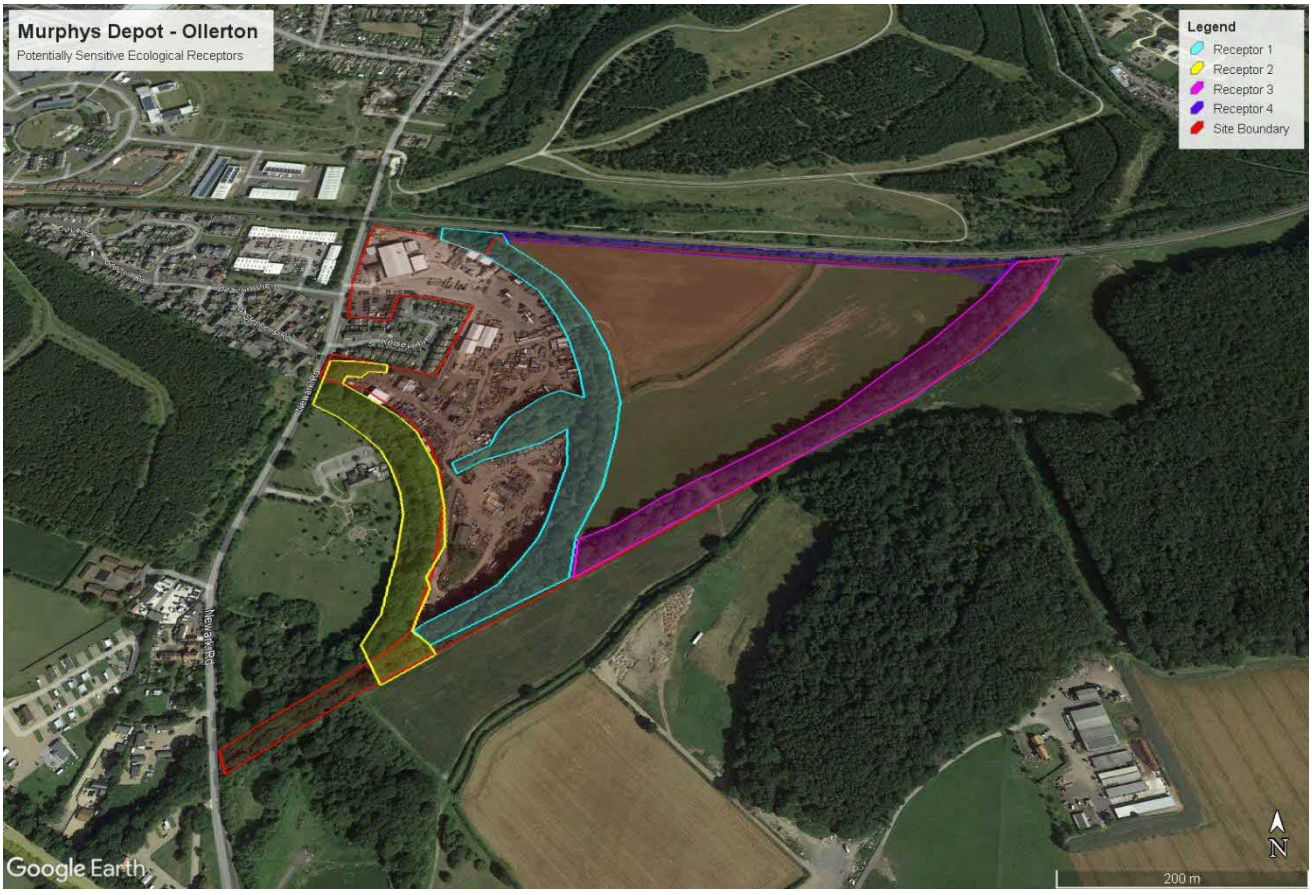
3.3.3. The tree belts and areas of vegetation highlighted in Figure 3-2 have not been identified as being suitable for bat roost habitat but have been identified as suitable for foraging and commuting corridors.

3.3.4. Table 3-2 and Figure 3-2 highlight the ecological receptors that have the potential to be affected by the presence of artificial light.

Table 3-2 – Potentially Sensitive Ecological Receptors

Receptor No.	Receptor Name	Description	Receptor Type	Receptor Sensitivity
1	Existing Embankment (SINC)	Existing embankment identified as SINC and an existing bat corridor	Ecology	Medium
2	Existing Tree belt	Existing tree belt with possible foraging and commuting route for bats	Ecology	Medium
3	Existing Tree Belt	Existing tree belt with possible foraging and commuting route for bats	Ecology	Medium
4	Existing Tree Belt	Existing tree belt	Ecology	Medium

Figure 3-2 - Potentially Sensitive Ecological Receptor Map



Google Earth (2023)

3.3.5. Lighting should be implemented in such a way as to limit the potential impacts upon ecology in the vicinity of the Application Site.

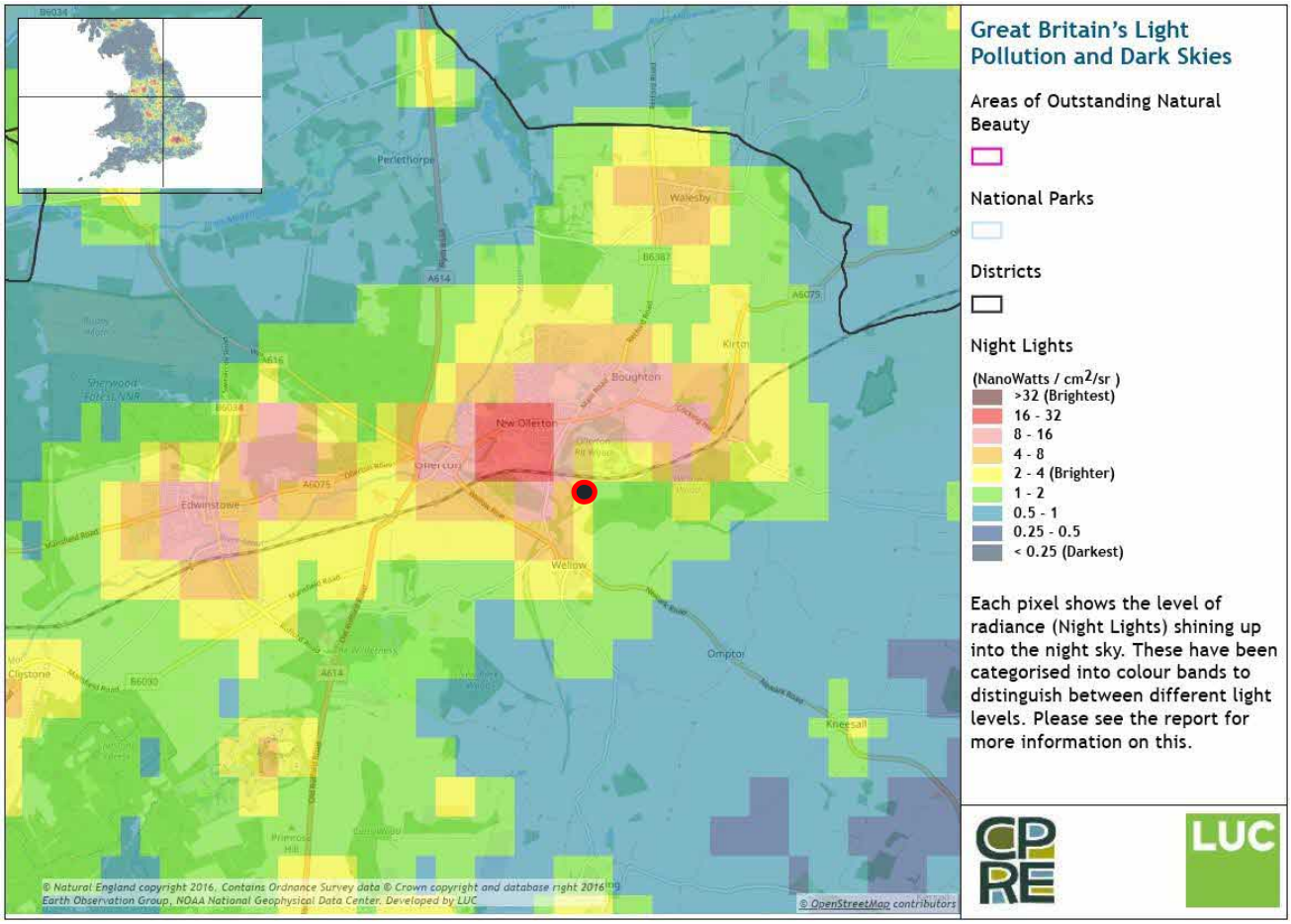
3.4 SITE CLASSIFICATION & BASELINE ASSESSMENT

3.4.1. The classification of the Environmental Zone is made in accordance with the criteria set out in Table 2-1**,** taken from ILP GN01:2021.

3.4.2. The character of the area surrounding the Application Site is predominantly rural to the east and south including the village of Wellow to the south. West and north are more urban in nature with the commercial and residential properties to the west and the towns of New Ollerton and Boughton to the north.

3.4.3. Sky glow mapping prepared by the CPRE in 2016 indicates that the skies above the Application Site are currently relatively bright, with some light pollution from the towns of New Ollerton and Boughton. A screenshot from the CPRE Night Blight Map is shown in Figure 3-3.

Figure 3-3 - CPRE Night Blight Mapping (Application Site shown by Red/Black mark)



CPRE (2023)

3.4.4. The Application Site is a mix of developed (existing depot) and undeveloped agricultural land, therefore has a clear split between lit and relatively dark landscapes which abut each other.

3.4.5. The existing depot located on the Application site is currently illuminated in some but not all areas by a combination of column and building mounted luminaires as shown in Figures 3-4 and 3-5.

Figure 3-4 - Building mounted luminaires within the existing depot

Figure 3-5 - Buliding and column mounted lumianires within the existing depot

3.4.6. The lit areas in the immediate area surrounding the Application Site are a mix of highway lighting provision in the form of LED column mounted luminaires for roads and residential areas such as those located along Newark Road Figure 3-6 and Kelsey Avenue Figure 3-7, along with lighting associated with commercial areas such as Beacon Court.

3.4.7. There is likely to be domestic residential security lighting associated with a number of properties in the immediate and wider surrounding areas which will contribute to the overall brightness of the wider immediate and wider area. Such lighting is often poorly controlled resulting in increased levels of light outside of the area intended to be illuminated.

Figure 3-6 - LED Highway lighting along Newark Road

Figure 3-7 - Residential area column mounted LED luminaires in Kelsey Avenue

3.4.8. The character of the Application Site and its immediate surrounds is considered to be mixed ‘Rural’ area of a ‘Low District Brightness, abutting the ‘Suburban’ ‘Medium District Brightness’ area of New Ollerton and Boughton. Both classifications are as outlined within ILP GN01:2021 (Table 2-1 within this document).

3.4.9. As such the Application Site is classified as being within an E2/3 Environmental Zone and abutting E2 and E3 Environmental Zones. It is therefore recommended that the future lighting design for the depot be designed to the parameters of an E2, this being the more onerous of the identified environmental zones.

3.5 SITE LIMITATIONS

3.5.1. The limitations imposed upon the exterior lighting within an E2 Environmental Zone are provided in the tables below, extracted from ILP GN01:2021. Further guidance on limitations and how these are calculated is provided in CIE 150:2017.

3.5.2. The following tables are extractions of parameters which are applicable to the lighting design for the Proposed Development, with every effort to implement best design practice being taken in order to ensure a design that is compliant with the outlined parameters as far as is reasonably practicable.

Table 3-3 - Limitation on Illuminance in the Vertical Plane (E2 Environmental Zone)

Light Technical Parameter	Application conditions	E2
Illuminance in the vertical plane (Ev)	Pre-curfew	5 lx
	Post-curfew	1 lx

ILP GN01:2021

Table 3-4 - Limitation on Luminous Intensity (E2 Environmental Zone)

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m^2)					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.5$	$A_p > 0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	E2						
	Pre-curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10 *d*	7,500
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500

ILP GN01:2021

Table 3-5 - Limitation on Upward Light (E2 Environmental Zone)

Light Technical Parameter	E2
Upward light ratio (ULR) / %	2.5

ILP GN01:2021

3.5.3. Proposals do not include the intentional illumination of building facades for architectural purposes, and as such, limitations on building façade luminance are not relevant to the Proposed Development.

3.5.4. Where a curfew is included, this refers to the time after which stricter requirements for the control of obtrusive light will apply, as stipulated by the Local Planning Authority. Unless otherwise stated, this is typically considered to be between the hours of 23:00 and 05:00.

3.5.5. Curfews, dimming and switch off should be discussed with NSD at the detailed design phase, in addition to considering the use of other lighting technologies such as PIR (Passive Infrared) control.

3.5.6. The above outlined criteria are desirable guidance which should be considered as the basis of any good practice design to minimise the effects of artificial lighting to the immediate surrounding environment. There may be instances where this is not fully achievable for Health and Safety operational reasons relating to activities within the site and should be discussed with NSD.

4 LIGHTING DESIGN STRATEGY

4.1 ENVIRONMENTAL PRINCIPLES

4.1.1. As stated at the outset of this document, the areas being considered as part of the lighting strategy cover the existing depot area which is currently proposed to be redeveloped and the existing farmland to the east of the existing depot which is currently proposed to be developed to accommodate new workshop, office and training facilities.

4.1.2. All lighting should be designed with the key principles of good lighting design outlined in ILP GN01:2021 which states:

"Good Lighting practice is the provision of the right light, at the right time, in the right place, controlled by the right system."

This means:

- **Right Light**: Look to the correct application of the lighting standards, defining the required lighting levels dependent on the task being undertaken and the level of activity and risk. Right light refers to the correct selection of light source, with due consideration of the most energy efficient modern sources, such as LED. Balanced against these requirements is the need to consider the impact of lighting on local sensitive flora and fauna, especially bats.
- **Right Time**: The lighting standards permit levels to be adjusted dependent on the use of an area, such as when traffic or pedestrian activity falls. Lowering levels to the minimum required for safety and security, or even full switch-off regimes may be considered at certain times. Such an approach may be across the Proposed Development or suitably zoned.
- **Right Place**: Ensure that only the areas required are illuminated. Reductions in spill and obtrusive light to at least the constraints imposed by the applicable Environmental Zone should be achieved through the careful consideration of luminaires and how they are installed.
- **Right System**: The most energy efficient lighting installations require a suitable control system. Dependent on the operator and operating regime, a system that allows monitoring and control may be considered.

4.2 LIGHTING DESIGN STANDARD CLASSIFICATION

4.2.1. The applicable standard for the provision of lighting to the various operational areas of the proposed depot is BS EN 12464-2:2014 Lighting of work places – Outdoor work places. This standard provides recommendations for general target levels of illumination and uniformity for generic areas within broad areas of industry and serve well as a guide for the purpose of this strategy. Industry specific or client policy relating to specific levels of illumination would be agreed upon at the detailed design stage.

4.2.2. Figure 4-4 demonstrates the applicable standard to be applied to the identified areas of the site that will require lighting during the hours of darkness. Each shaded area relates to a specific standard which is the summarised in the subsequent table extracted from BS EN 12464-2:2014.

4.2.3. Where an area has not been shaded it shall be assumed to be unlit as part of the proposed development of the depot or to remain in its existing lit or unlit scenario.

4.2.4. Figure 4-1 is Table 5.1 extracted from BS EN 12464-2:2014 is proposed for areas that are exclusively for pedestrians that require lower levels of illumination (Ref. No. 5.1.1) and/or areas where there is a lilkeyhood that pedestrians and vehicles will interact with each other during circulatory and loading/offloading activities (Ref. No. 5.1.2 and 5.1.4)

Figure 4-1 - Table 5.1 extracted from BS EN 12464-2:2014.

Table 5.1 — General requirements for areas and for cleaning at outdoor work places

Ref. no.	Type of area, task or activity	$\overline{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.1.1	Walkways exclusively for pedestrians	5	0,25	50	20	
5.1.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	0,40	50	20	
5.1.3	Regular vehicle traffic (max. 40 km/h)	20	0,40	45	20	At shipyards and in docks, R_{GL} may be 50
5.1.4	Pedestrian passages, vehicle turning, loading and unloading points	50	0,40	50	20	
5.1.5	Cleaning and servicing	50	0,25	50	20	All relevant surfaces

4.2.5. Figure 4-2 is Table 5.7 extracted from BS EN 12464-2:2014 is proposed for areas that require short term handling, loading and unloading of goods and materials (Ref. No. 5.7.1).

Figure 4-2 - Table 5.7 extracted from BS EN 12464-2:2014.

Table 5.7 — Industrial sites and storage areas

Ref. no.	Type of area, task or activity	$\overline{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.7.1	Short-term handling of large units and raw materials, loading and unloading of solid bulk goods	20	0,25	55	20	
5.7.2	Continuous handling of large units and raw materials, loading and unloading of freight, lifting and descending location for cranes, open loading platforms	50	0,40	50	20	
5.7.3	Reading of addresses, covered loading platforms, use of tools, ordinary reinforcement and casting tasks in concrete plants	100	0,50	45	20	
5.7.4	Demanding electrical, machine and piping installations, inspection	200	0,50	45	60	Use local lighting

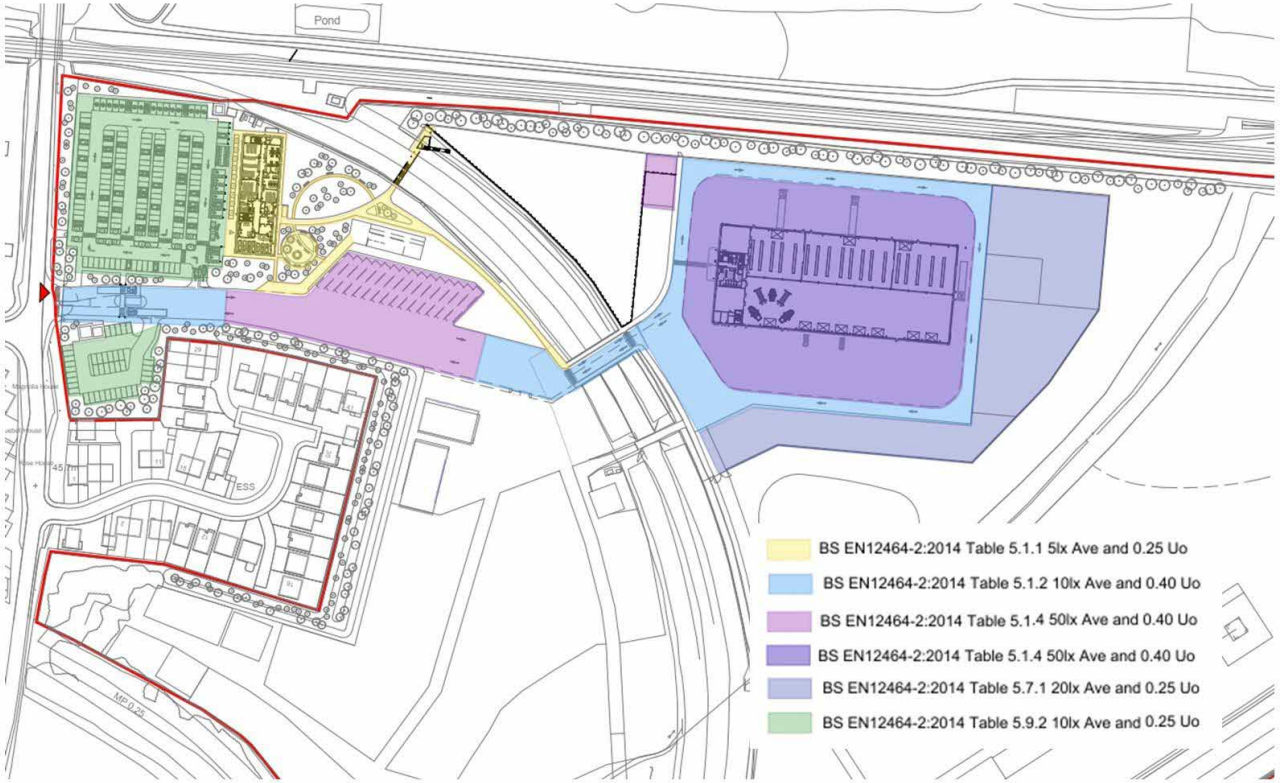
4.2.6. Figure 4-3 is Table 5.9 extracted from BS EN 12464-2:2014 is proposed for areas identified for car parking, both open and covered (Ref. No. 5.9.2). It should be note that there is scope within the standards to a make provision for the lighting levels to be dimmed or switched off during hours of low occupancy.

Figure 4-3 - Table 5.9 extracted from BS EN 12464-2:2014.

Table 5.9 — Parking areas

Ref. no.	Type of area, task or activity	$\overline{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.9.1	Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	0.25	55	20	
5.9.2	Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	0,25	50	20	
5.9.3	Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose building complexes	20	0,25	50	20	

Figure 4-4 - Proposed levels of illumination by area



MITIGATION BY DESIGN – HUMAN RECEPTORS

4.2.7. The impacts of lighting upon potentially sensitive human receptors can be effectively mitigated through lighting design, luminaire selection and minimising the levels of lighting used.

4.2.8. The following measures will be employed to reduce the potential impact of lighting:

Equipment

- Levels of illumination shall be suitable to adequately light the task area and in keeping with the surrounding environment, but not at the expense of Health and Safety for complex tasks that require higher levels of illumination, but a balance shall be sought;
- Column and luminaire optimal mounting height not to exceed 8 to 10 metres, preferably lower where the situation and levels of required illumination can be achieved without introducing a significant number of lighting points;
- Light spill to the surrounding area shall be kept to the levels identified within this strategy i.e. environmental zone E2 requirements such as 5 lux maximum light intrusion into windows pre-curfew;
- LED shall be the preferred light source with a Ra equal to or greater than 60;
- LEDs shall have a neutral to warm colour temperature (2,700k to 3,000k);
- Luminaires shall be full cut-off with as high a G rating as practicable, i.e. G4 to G6 to minimise the amount of upward light being projected in to the sky contributing to light pollution issues;
- CMS and variable levels of lighting shall be considered to adapt the lighting in accordance with the level of usage of an area throughout the hours of darkness. Where practicable, the operational areas of the depot shall be zoned and controlled manually to only be illuminate when in use;
- Consider using PIR switching for areas of the site where occupancy is likely to be low during the hours of darkness;
- Where lighting is required, it shall be focused to illuminate the task area only. Spill light shall be kept to a minimum and where practicable eliminated through use of shields, louvres and baffles;
- Landscaping features such as shrubs and trees should be retained or enhanced where possible to limit the potential impact of artificial lighting by blocking light spill, for example the aera adjacent to Kelsey Avenue;
- Avoid lighting where possible. If areas of the site are deemed to only be subject to occasional use throughout the hours of darkness; such as the training area, consideration should be given to the use of temporary mobile lighting towers. However, their use should still ensure compliance with the parameters outlined in this strategy document.

Correlated Colour Temperature (CCT)

4.2.9. All light sources have an associated colour temperature. This is a measure of how cool or warm the colour appears when viewed and is measured in Kelvin. Lighting which appears warm has a lower colour temperature and lighting which appears cool has a higher colour temperature.

4.2.10. Generally, the higher the colour temperature, the bluer the light (shorter wavelength) is present in the distribution. The amount of power emitted at each wavelength by a light source is known as the spectral power distribution and is discussed in more detail below.

Figure 4-5 - LED colour temperature

Lightingdesign|Studio (2023)

Lighting Controls

4.2.11. Lighting will be suitably controlled depending upon the application area to limit the hours of illumination to those needed for the intended use.

4.2.12. Lighting should be dimmed and switched off outside of the hours of use to ensure that lighting is not provided when not in use.

4.2.13. Whilst dimming and switching will further reduce the potential impacts of lighting within the landscape, it is not anticipated that the dimming/switching is a necessary measure to achieve the Environmental Zone limitations for the Environmental Zone in which the Application Site is located.

MITIGATION BY DESIGN – ECOLOGICAL RECEPTORS

4.2.14. Ecological guidance for the site has identified potentially sensitive receptors that are outlined in **Section 3**. Further detail on ecological constraints associated with the site should be sought from relevant ecology professionals associated with the project as the design progresses.

4.2.15. Artificial lighting has the potential to affect sensitive fauna at habitats for light sensitive species, including impacting roosts, commuting routes and dark corridors. It is useful in most situations to establish primary mitigation by assessing the impact of lighting proposals on the most sensitive local fauna, typically bats. If a lighting scheme can be developed that is sensitive to the most sensitive fauna, it is likely that the proposed installation will not present additional harm to other species.

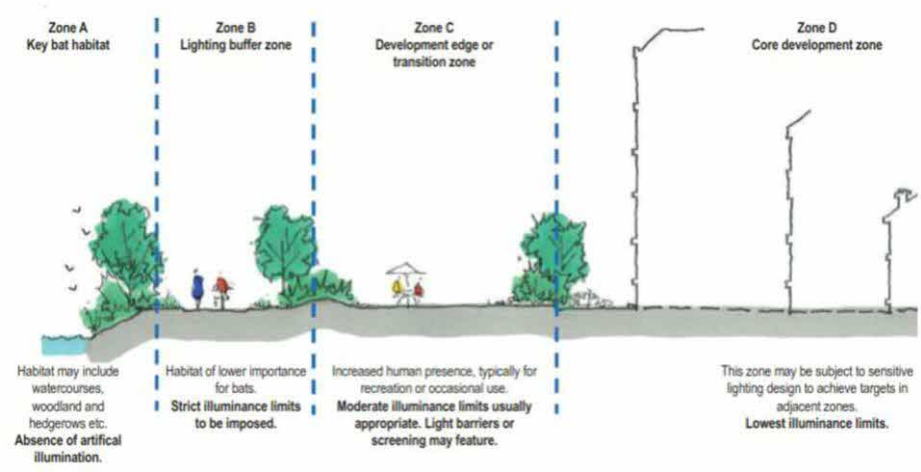
4.2.16. Different species are affected by lighting in different ways. Reducing the spectral output of proposed units is an effective method of reducing the number of species that are affected by changes in lighting. In addition, shorter wavelength sources should be avoided. Therefore, the use of warmer white LED sources, which may inherently have a more limited spectral distribution and naturally limit shorter wavelength outputs, is recommended.

4.2.17. In addition to the measures outlined for reduction of impacts on Human Receptors, the following measures should be implemented to reduce impacts upon Ecological Receptors:

- LEDs shall have a neutral to warm colour temperature of 2,700k to 3,000k or reduced to 2,200k in areas of particular light sensitivity where lighting cannot be avoided for health and safety reasons;
- Luminaires shall be full cut-off with as high a G rating as practicable, i.e. G4 to G6 preferable in sensitive areas such as boundary hedgerows and planned planting areas which have potential to provide foraging opportunities for bats and other fauna;
- Consideration of special measures to ensure existing sensitive habitats are not directly illuminated, such as introducing additional screening or dark buffer zones/corridors to ensure that existing commuting routes are retained, or new ones can be created. An example of illuminance limit zonation is shown in **Figure 4-6**, extracted form ILP GN08/23.
- Where lighting is required, it shall be focused to illuminate the task area only. Spill light shall be kept to a minimum and where practicable eliminated through use of shields, louvres and baffles.
- Light spill onto confirmed, suspected or introduced roosts, boxes and other key light sensitive ecological features should be avoided, primarily through good lighting design and by the implementation of shields where necessary.
- Light spill onto trees and hedgerows should be limited through good lighting design and by the implementation of shields where necessary.
- A ‘buffer zone’ of very low illuminance (if any) should be created where necessary to limit the potential impacts of artificial lighting on potentially sensitive receptors.
- Landscaping features such as shrubs and trees should be retained where possible to limit the potential impact of artificial lighting by blocking light spill.
- Special consideration shall be given to the SINC running through Application site. It is recognised that an access through the SINC will be required to access the proposed area of the depot, but it is recommended that lighting on the approach and within the SINC area is the absolute minimum required for safety but shall remain off when not in use through the use of PIR sensors.

4.2.18. To minimise the effects on foraging and commuting bats (and other nocturnal species) as a result of light spill, a lighting design will be prepared at the detailed design stage, incorporating measures to reduce the effects of lighting on bats. This will be reviewed by a suitably qualified ecologist to ensure that effects on sensitive habitats are avoided.

Figure 4-6 - Buffer Zones (ILP GN08:2023)



ILP GN08:2023

4.2.19. Further advise on limiting the impact of lighting on bats is provided in Bat Conservation Trust and ILP Guidance Note 08/23 Bats and Artificial Lighting at Night (ILP, 2023).

EXAMPLES OF SUITABLE LIGHTING EQUIPMENT

Functional LED Luminaires

4.2.20. There are a large number of LED luminaire manufacturers available to the lighting designer that can be utilised to meet the design requirements and environmental parameters outlined in this lighting strategy document. Standard functional road and area lighting luminaires can be utilised for areas that require higher levels of illumination such as those associated with loading/unloading activities or areas where there are likely to be instances of vehicle and operative interaction. Examples shown in Figure 4-7.

Figure 4-7 - DW Windsor Kirium Pro (left) and Sabre performance flood (right)

DW Windsor (2023)

4.2.21. For areas exclusively for pedestrians where levels of illumination are lower, consideration should be given to using low level bollards. Where practicable a bollard shall be selected that provides light the footpath only, with minimal back spill and upward light, an IDA (International Dark Skies Association) compliant fitting is recommended. Examples show in Figure 4-8.

Figure 4-8 - Thorn Urba bollard

4.3 SUMMARY

4.3.1. We have developed a lighting strategy and undertaken a high-level lighting impact assessment of the sensitive human and ecological receptors that have the potential to be affected by the introduction of artificial light.

4.3.2. Lighting will only be required during hours of darkness where needed for safety and security with levels of illumination in keeping with the wider landscape. Lighting is anticipated to be provided for areas such as construction activities, vehicle and pedestrian routes, parking areas and working areas.

4.3.3. The strategy sets out an outline performance specification of luminaires to be used as part of the lighting scheme, as well as specification points such as mounting heights, control systems and correlated colour temperature that are relevant to the levels of light pollution generated by the scheme.

4.3.4. The measures implemented in this strategy seek to ensure that the scheme is implemented in a responsible way, that responds to the challenges of the environment and ensures that the design does not generate obtrusive light.

4.3.5. As the Proposed Development progresses to detailed design, lighting calculations should be carried out along with further assessment of anticipated effects to ensure that lighting limitations are not exceeded and the environmental principles are implemented, so that long term environmental lighting impacts are minimised.

4.3.6. The design aspect is not sufficient alone and too many good designs fail when they are not installed correctly. It is therefore important that the lighting is installed to the design requirements and checked / signed off on site by the designer. All fittings should be carefully installed, visually checked and any required adjustments made at the time of commissioning where practicable.

5 GLOSSARY OF TERMS AND ABBREVIATIONS

5.1 GLOSSARY OF TERMS

Term	Definition
Colour rendering	Colour rendering (as per BS EN 12665:2002) - Effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminant.
High intensity discharge lamp	An electric discharge lamp in which the light producing arc is stabilised by wall temperature and the arc has a bulb wall loading in excess of 3 watts per square centimetre. HID lamps include high pressure mercury, metal halide, high pressure sodium and cosmopolis lamps.
High Pressure Sodium lamp	A high intensity discharge lamp in which the major portion of the light is produced, directly or indirectly, by radiation from sodium operating at a partial pressure in excess of 10 kilopascals. Note: The term covers lamps with clear or diffusing bulbs.
Illuminance	Quotient of the luminous flux ($d\phi$) incident on an element of the surface containing the point, by the area (dA) of that element. Equivalent definition: Integral, taken over the hemisphere visible from the given point, of the expression Unit: L x cos ^{e} x $d\Omega$. Where L is the luminance at the given point in the various directions of the incident elementary beams of solid angle $d\Omega$; and ^{e} is the angle between any of these beams and the normal to the surface at the given point. Unit Lx (lux) or lumens per metre2 (lm/m2)
Illuminance Uniformity (Uo)	Ratio of minimum illuminance to average illuminance on a surface. Note: Use is also made of the ratio of minimum illuminance to maximum illuminance, in which case, this should be specified explicitly.
Lamp	Source made in order to produce optical radiation, usually visible. Note: This term is also sometimes incorrectly used for certain types of luminaires.
Light Pollution	The spillage of light into areas where it is not desired.
Luminaire	Apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply. Note: The term 'light fitting' is deprecated.
Maintained illuminance (Em or Eav)	Value below which the average illuminance on the specified area should not fall. It is the average illuminance at the time during which maintenance should be carried out. Unit: Lx (Lux) or lm/m2
Minimum illuminance	Lowest illuminance at any relevant point on the specified surface. Unit: Lx or lm/m2 Note: The relevant points at which the illuminances are determined shall be specified in the appropriate application standard.
Obtrusive / Nuisance Light	Light, outside the area to be lit, which, because of quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information, e.g. at signal lights.

5.2 ABBREVIATIONS

Abbreviation	Definition
ACPO	Association of Crime Prevention Officers
ADT Flow	Average Daily Traffic flow
CIBSE	Chartered Institution of Building Services Engineers
CIHT	Chartered Institute of Highways and Transportation
CMS	Central Management System
CRI	Colour Rendering Index
CSS	County Surveyor's Society
DMRB	Design Manual for Roads and Bridges
ILP	Institution of Lighting Professionals
LED	Light Emitting Diode
PIR	Passive Infrared
PECU	Photo Electronic Cell Unit

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