Land East of

Park View

Woodstock

Lighting Assessment

June 2022

TERENCE O'ROURKE

EQUATION

3081

LAND EAST OF PARK VIEW

LIGHTING ASSESSMENT

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1. SUMMARY

1.1 The client, Blenheim Estate Homes is submitting an outline planning application for a proposed development on land located immediately to the East of the Park View residential development in Woodstock. A draft allocation masterplan was previously developed through extensive discussion with both key local stakeholders and Cherwell District Council officers. Within a site area of just under 490,000 square metres, the masterplan allows for the construction of up to 500 homes. This will allow for a wide range of dwelling types, sizes and tenures. The proposed masterplan also includes the potential for the provision of flexible community space.

1.2 This Lighting Assessment considers potential light pollution, light trespass and sky glow from the proposed development and its potential to cause a statutory nuisance.

1.3 Planning Practice Guidance states that "Artificial light provides valuable benefits to society.....extending opportunities for sport and recreation, and can be essential to a new development. Equally, artificial light is not always necessary, (and) has the potential to become what is termed 'light pollution' or 'obtrusive light'". Planning guidance also states that "...not all modern lighting is suitable in all locations."

1.4 The existing site is in use as arable land and is currently a dark landscape. The surrounding areas of Woodstock town are predominantly illuminated with high pressure sodium lighting, as is the A44 Oxford Road on the southern boundary of the site. The A4095 Upper Campsfield Road and Shipton Road to the north of the site are currently unlit. A number of retro-fit LED street lights with neutral white 4,000K light sources have been installed immediately adjacent to the Park View residential development which is currently under construction.

1.5 All species of bat are protected by the Wildlife & Countryside Act 1981 (as amended) and the Conservation (Natural Habitats and Species Regulations 2017 (as amended). Ecological surveys have identified parts of the site where there are foraging or 'commuting' bats. Electric light can cause disturbance to bats at roost and can also affect their feeding behaviour. Mitigation of the adverse effects of electric light should therefore be considered in the detailed design of the development. Lighting should be designed in such a way as to avoid isolation of bat colonies. The detailed proposals should ensure the protection of the nocturnal commuting and foraging behaviour of the existing bat population around the entire perimeter of the proposed development is maintained.
Please refer to the ecology consultant report for details of the strategy.

1.6 For the purposes of this assessment, we have assumed that the proposed development will include residential dwellings, roads, footpaths and public open spaces. In most of these areas, electric light will be required for safety, security and general amenity.

1.7 The lighting assessment has considered the potential impact of electric light on the London Oxford Airport and the necessity to avoid lighting installations which could distract pilots or be mistaken for aeronautical ground lights. The Indicative Lighting Strategy (Appendix B) details possible strategies for avoiding such confusion.

1.8 According to the methodology adopted for this Lighting Assessment, the baseline perceived brightness of the existing site is dark. Any permanent external lighting provided for safety and security within the development will therefore be brighter than the baseline. Whilst the magnitude of the change will be significant, the potential adverse impacts of electric light can be mitigated through good design.

1.9 Consequently, the potentially adverse effects of electric light within the proposed development can be mitigated during the design stages of the project by integrating architectural design, landscape design and lighting design elements.

1.10 The use of lighting controls and dimmable LED light sources will enable light intensities to be adjusted during the hours of darkness to further mitigate the potentially adverse impacts.

1.11 The project team consider that once the recommended mitigation measures identified in the report are implemented, the residual impact on identified receptors will be "Neglible".

SITE BOUNDARY

ILLUSTRATION: SITE LOCATION

2. INTRODUCTION

2.1 An assessment of the baseline condition has been carried out which has recorded existing electric lighting installations in the local area and has identified potential receptors which may be impacted by the proposed development.

2.2 There will be permanent lighting installations provided for safety and amenity during the operational phase of development, which will have the potential to impact on the local environment through light spill, light pollution and glare. These lighting installations will include street lights, light spill from the interior of dwellings, lighting for car parks and other amenity areas. Such lighting has the potential to cause sky glow and affect views from sensitive locations such as the Blenheim Palace grounds and also to potentially cause visual conflict with the operation of the adjacent Oxford International Airport.

2.3 The proposed development will also introduce temporary lighting during the construction phase which may temporarily cause adverse impacts which will require mitigation. With appropriate mitigation measures in place it is considered that there will be no adverse impacts to identified receptors or residual effects.

ILLUSTRATION: SITE LOCATION

3. PLANNING APPLICATION

3.1 Blenheim Estate Homes (part of the Blenheim Palace Estate) are seeking outline planning approval from Cherwell District Council in relation to Land East of Park View. The proposed development includes the following:

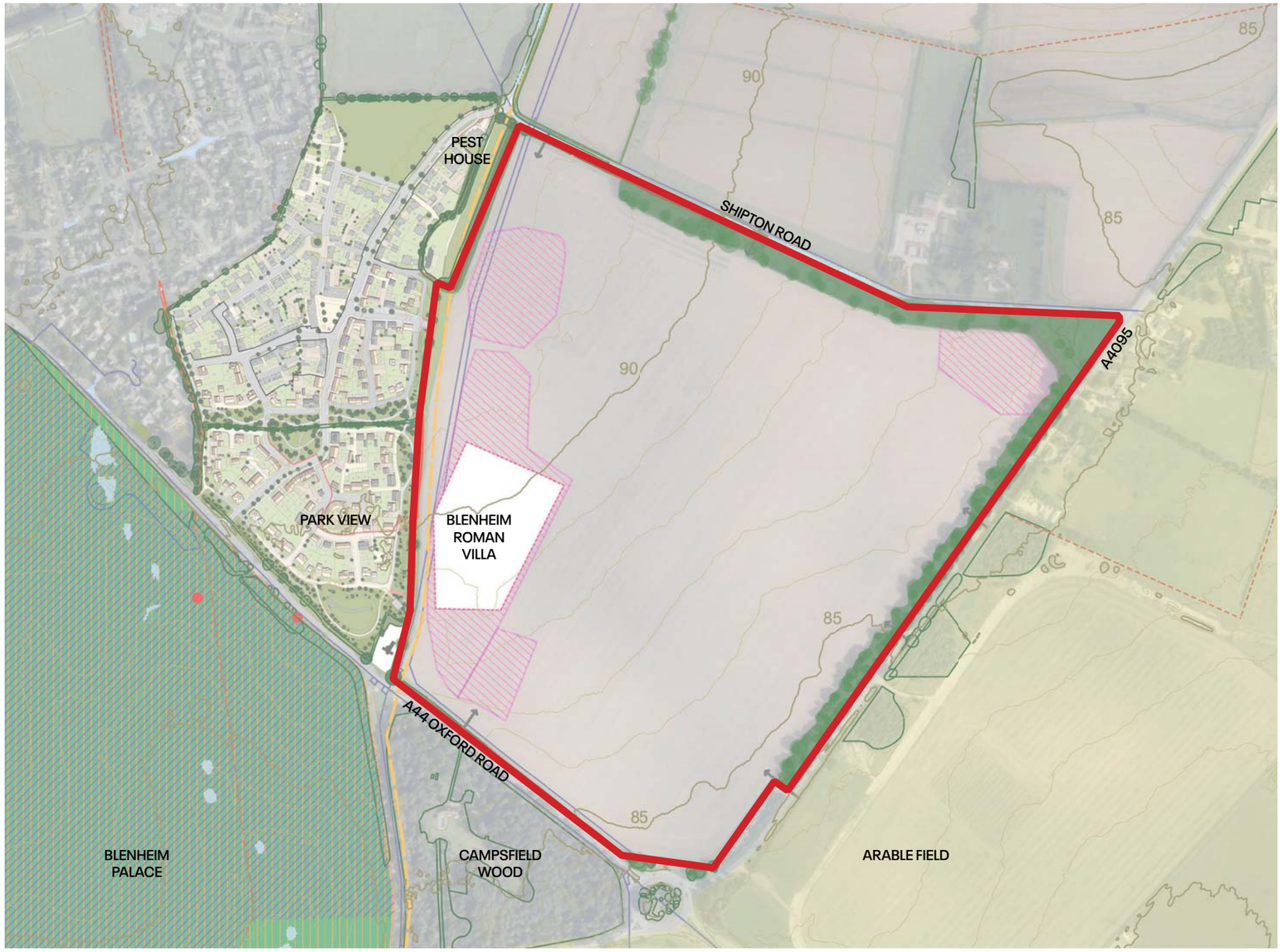
- Up to 500 residential dwellings (including affordable housing)
- Public open space
- Children's play areas
- Landscape planting
- Surface water infiltration basins
- Footpaths and cycleways
- Servicing and utilities, including a foul water pumping station
- Infrastructure works including exterior lighting installations

4. SITE CONTEXT

4.1 The approximately 50 hectare (ha) application site is located to the south east of Woodstock immediately abutting the residential edge of the existing settlement, approximately 13km north of Oxford city centre. The site currently comprises arable land bounded by hedgerows and hedgerow trees. The site is fairly level.

4.2 A scheduled monument, known as Blenheim Villa, the buried remains of a Roman Villa and associated fields and paddocks, is located within the application site. Blenheim Palace, which is a UNESCO World Heritage Site and Grade I registered park and garden, lies beyond the A44 Oxford Road, which forms part of the site's southern boundary.

4.3 The north of the site is bordered by Shipton Road and the east by the A4095. Oxford International Airport is beyond the A4095. An isolated property known as the Pest House, which is accessed by a track off Shipton Road, defines the site's north east boundary and a large open arable field bounds the site to the south east.



5. PLANNING POLICY, LEGISLATION, GUIDANCE & INDUSTRY STANDARDS

Relevant legislation, and key guidance documents and standards relevant to the lighting impact assessment are listed below.

5.1 National Legislation

5.1.1 Environmental Protection Act 1990

An amendment contained within the Clean Neighbourhoods and Environment Act (CNEA), 2005 to Section 79 of the En vironmental Protection Act, 1990 (1) states:

"Artificial light emitted from premises so as to be prejudicial to health and nuisance constitutes a 'Statutory 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 statu tory 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".

5.2 National Planning Policy

5.2.1 National Planning Policy Framework 2012 (NPPF)

The NPPF was first published on 27th March 2012 and up dated on 20 july 2021. It states that:

"..Planning policies and decisions should ensure that new development is appropriate for its location taking into account likely effects (including cumulative effects) of pollutions on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impact that could arise from the development. In doing so they should limit the impact of light pollutions from artificial light on local amenity, intrinsically dark landscapes and nature conservation."
(Source: https://www.gov.uk/guidance/national-planning-policy-framework)

5.2.2 Planning Practice Guidance (PPG) 2019

The national on-line planning guidance looks at when lighting pollution concerns should be considered;

Planning Practice Guidance - Light Pollution (was updated on November 2019. It states that:

". . . Artificial light provides valuable benefits to society, including through extending opportunities for sport and recreation, and can be essential to a new development. Equally, artificial light is not always necessary, has the potential to become what is termed 'light pollution' or 'obtrusive light' and not all modern lighting is suitable in all locations. It can be source of annoyance to people, harmful to wildlife, undermine enjoyment of the countryside or detract from of enjoyment of the night sky. For maximum benefits, the best use of artificial light is about getting the right light, in the right place and provide light at the right time." (Paragraph: 001 Reference ID: 31-001-20191101)

". . . Light intrusion occurs when the light 'spills' beyond the boundary of the area being lit. For example, light spill can result in safety impact related to the impairment or distraction of people (e.g. when driving vehicles), health impacts arising from impaired sleep, cause annoyance to people, compromise an existing dark landscape or adversely effects can usually be avoided with careful lamp and luminaire selection and positioning. "
(Paragraph: 003 Reference ID: 31-003-20191101)

". . . The use of lighting only when the light is required can have a number of benefits, including minimising light pollution, reducing energy consumption, reducing harm to wildlife and improving people's ability to enjoy the night sky. Lighting schemes could be turned off when not needed ('part-night lighting') to reduce any potential adverse effects. Planning conditions could potentially require this where necessary. Lighting could also be dimmed to minimise its visual impact at times of reduced need or increased sensitivity. Impacts on sensitive ecological receptors throughout the year, or at particular times may be mitigated by the design of the lighting or by turning it off or down at sensitive times." (Paragraph: 004 Reference ID: 31-004-20191101)

". . .Consideration can also be given to whether the proposed lighting is purely for decorative purposes as opposed to being needed for functional reasons such as security. The character of the area and the surrounding environment may affect what will be considered an appropriate level of lighting for a development. In particular, lighting schemes for developments in protected areas of dark sky or intrinsically dark landscapes need to be carefully assessed as to their necessity and degree. Glare needs to be avoided, particularly for safety reasons. Glare is the uncomfortable brightness of a light source due to the excessive contrast between bright and dark areas in the field of view. Consequently, the perceived glare depends on the brightness of the background against which it is viewed. It is affected by the quantity and directional attributes of the source. Where appropriate, lighting schemes could include 'dimming' to lower the level of lighting White light, with more blue content or with ultraviolet content, is generally more disruptive to wildlife than, say, yellow/orange light. Similarly, for humans, light intrusion by white/blue light is more disruptive to sleep. Use of modern white light sources that filter out blue or ultraviolet light may mitigate these effects, as well as offering superior directional control. However, whiter light aids people's vision and ability to perceive colour; it also facilitates CCTV use...." (Paragraph: 005 Reference ID: 31-005-20191101)

"Wildlife species differ from humans in their sensitivity to light. The positioning, duration, type of light source and level of lighting are all factors that can affect the impact of light on wildlife. Further advice is available from the DEFRA and Natural England websites on handling the impact on wildlife

5. PLANNING POLICY, LEGISLATION, GUIDANCE & INDUSTRY STANDARDS

– including from artificial light – where Protected Sites or protected species could be affected. The specific nature of any consideration will depend on the features of any protected site or presence of any protected species."
(source: https://www.gov.uk/guidance/light-pollution)

5.2.3 Department for Transport "Manual for Streets" published 2007

The chapter entitled "Context" states the following:

"10.3.11 Lighting should be appropriate to the context. In some locations, such as rural villages, lighting may not have been provided elsewhere in the settlement and therefore it would be inappropriate in a new development. Often, lighting suits highway illumination requirements but is not in keeping with the street environment or the range of uses of that street. " In addition the document states:

"A street audit can be helpful in determining both the level of lighting and the type of equipment used in the area."

5.3 Local Planning Policy

5.3.1 Cherwell local plan 2011-2031

Cherwell local plan 2011-2031 states that:

"New development proposals should limit the impact of light pollution from artificial light on local amenity intrinsically dark landscapes and nature conservation."

5.3.2 Cherwell Adopted Design and Conservation Strategy

"...Understanding and conserving what is special about each place and using this to inform decisions on where and how new development should be accommodated is key to promoting and managing change to create high quality design. Identifying and protecting the special character is an essential starting block, but identifying appropriate locations for and ensuring high quality and inclusive design of new development are also essential in maintaining a high quality environment that is attractive to residents, visitors and investors..."

5.3.3 Cherwell Residencial Design Guide SPG

"... Lighting should be an integral part of the street design process as there is a risk that landscape, parking and other elements are undermined when this is considered retrospectively. Consideration should be given to minimising light pollution and the impact of lighting on ecology. The lighting and tree planting strategy should be considered together at an early stage..."

5.4 Guidance & Industry Standards

5.4.1 ILP Guidance Notes for the Reduction of Obtrusive Light GN01:2021

The Institution of Lighting Professionals (ILP) publication Guidance Notes for the Reduction of Obtrusive Light (GN01:2021) (7) makes recommendations aimed particularly at avoiding nuisance from obtrusive external lighting installations. The guidance advises that this can be achieved by good lighting design through careful selection of light sources, luminaires, and, the method of installation and these recommendations will be considered in the context of the proposed development's lighting design to limit the need for any further mitigation measures.

5.4.2 CIE Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations CIE 150:2017

The purpose of the International Commission on Illumination (CIE) publication Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (CIE 150:2017) is to help formulate guidelines for assessing the environmental impacts of outdoor lighting and to give recommended limits for relevant lighting parameters to contain the obtrusive effects of outdoor lighting within tolerable levels. The guidance given is primarily applicable to new installations; however, some advice is also provided on remedial measures which may be taken for existing installations.

5.4.3 CIE Guidelines for Minimising Sky Glow CIE 126-1997

The International Commission on Illumination (CIE) publication Guidelines for Minimising Sky Glow (CIE 126-1997) gives general guidance for lighting designers and policy makers on the reduction of the sky glow. The report discusses briefly the theoretical aspects of sky glow and it gives recommendations about maximum permissible values for lighting installations in relation to the needs of astronomical observations - casual sky viewing included.

5.4.4 Society of Light & Lighting (formerly CIBSE) Lighting Guides: LG21 Protecting the night-time environment, 2021

The Chartered Institution of Building Services Engineers Guide to Limiting Obtrusive Light (November 2012) outlines the causes and consequences of obtrusive light, and what can be done to minimise obtrusive light generally and in some commonly occurring applications.

5.5 Guidance for Lighting Effects on Bats

5.5.1 The Bat Conservation Trust has published guidance for mitigating the effects of artificial lighting on bats in its publication Landscape and Urban Design for Bats & Biodiversity.

Additional guidance has been previously published in the ILP/ Bat Conservation Trust document entitled Bats and Lighting in the UK.

5. PLANNING POLICY, LEGISLATION, GUIDANCE & INDUSTRY STANDARDS

5.5.2 The guide makes the following recommendations:

- No bat roost (including access points) should be directly illuminated;
- The type of lamp (light source) specified can have an adverse impact on bats foraging and commuting;
- Lighting should be directed to where it is needed and light spill avoided;
- The height of lighting columns in general should be as short as is possible;
- The light should be as low as guidelines permit. If lighting is not needed, don't light;
- The times during which the lighting is operational should be limited to provide some dark periods; and
- Roads or trackways in areas important for foraging bats should contain stretches left unlit to avoid isolation of bat colonies.

5.5.3 Mitigation of artificial lighting impact on bats

- Determine whether bats could be present on site by an ecologist to advise further and conduct surveys, if necessary.
- Determine the presence of -or potential for -roosts, commuting habitat and foraging habitat and evaluate their importance.
- Avoid lighting on key habitats and features altogether.
- Apply mitigation methods to reduce lighting to agreed limits in other sensitive locations - lighting design considerations. The following techniques are often used in combination for best results.

- Dark buffers, illuminance limits and zonation.
- Appropriate luminaire specifications
- Sensitive site configuration
- Screening through soft landscape and the installation of walls, fences and bunding.
- Glazing treatments
- Creation of alternative valuable bat habitat on site.
- Dimming and part-night lighting. A control management system can be used to dim (typically to 25% or less) or turn off groups of lights when not in use.

- Demonstrate compliance with illuminance limits and buffers.

- Design and pre-planning phase
It may be necessary to demonstrate that the proposed lighting will comply with any agreed light - limitation or screening measures set as a result of an ecologist's recommendations and evaluation. This is likely to be requested if planning per mission is required.
Calculations and documentation would need to be prepared in advance of submission for planning permission to enable the LPA ecologist to fully assess impact and compliance.
- Baseline and post-completion light monitoring surveys
It may be useful where existing on-or off-site lighting is sus pected to be acting on key habitats and features and so may prevent the agreed or modelled illuminance limits being achieved. This data can then be use to help isolate which lu minaires might need to be removed, or where screening should be implemented or establish a new illuminance limit reduced below existing levels.
- Post-construction/operational phase compliance checking
Post-completion lighting surveys are often required where planning permission has been obtained on the condition that the proposed lighting levels are checked to confirm they are in fact achieved on site and that the lighting specification (including luminaire heights, design and presence of shielding etc.) is as proposed.

A COMMON PIPISTRELLE BAT IN FLIGHT

SKETCH CROSS SECTION OF EXAMPLE PRIMARY ROUTES AND BAT ACTIVITY

6. METHODOLOGY

6.1 Desk Study

6.1.1 At the outset of the project, briefing information was received from the client and design team which identified the extent of the site. Outline details of the proposed development were provided together with concept masterplan indicating the location of the various land uses (to be updated with reference to the final parameter plans and scheme details once circulated.)

6.1.2 Uses identified within the Terence O'Rourke presentation document included:

- Potential for up to circa 500 new homes, including a significant proportion of family and affordable housing;
- Provision for new local community facilities at the heart of the development;
- Inclusion of green corridors and dedicated cycle and pedestrian links through the development;
- Adoption of a sensitive landscape approach resulting in notable heritage benefits with the enhanced setting for Blenheim Roman Villa;
- Inclusion of a significant area of open space creating a semi-rural character with long grassland meadows and parkland tree planting;
- Provision of community open space within the masterplan, including allotments;
- Enhanced tree belt with native planting.

6.1.3 The proximity of the proposed residential development to the Blenheim Palace World Heritage site and the buried remains of Blenheim Villa, were noted and considered in our lighting assessment.

6.1.4 Using the above information, the Lighting Impacts project team developed a scoping methodology for the site survey taking into account national and local planning guidance and good practice guidelines for carrying out impact assessments. Reference documents included the Department for Communities & Local Government's published guidance on Environmental Impact Assessments (Source:http://planningguidance.planningportal.gov.uk/blog/guidance/environmental-impact-assessment) and Department for Communities & Local Government's "Lighting in the Countryside: Towards Good Practice" published in 1997. In addition, the Institution of Lighting Professionals Guide "PLG 04 – Guidance on Undertaking Environmental Lighting Impact Assessments" 2013 has informed the way in which both the baseline lighting conditions and the potential impacts were impacts were later recorded on site.

6.1.5 Specific guidance on the impact of electric light on bat populations and wildlife habitats was also studied. Details of relevant publications are included on Page 22 "References."

6.1.6 Further research was undertaken using maps and web-based resources to establish the baseline condition in advance of the site survey. Existing land uses and potential receptors were identified. These were later verified during the site survey.

6.2 Results of Desk Study

6.2.1 The first step in the baseline Lighting Impacts Assessment, was to identify any planning policy areas or other statutory requirements that needed to be taken into account during the impact assessment (See Section 5 above)

6.2.2 Relevant lighting codes and standards & best practice lighting design guidelines were determined (See Section 5 & 11 – References).

6.1.9 Locations of receptors and existing land uses were identified on plan. This was later confirmed by the field survey.

6.3 Field Survey

6.3.1 A baseline lighting survey was carried out on Tuesday 26th April 2022 with specific reference to the scope of the outline planning application.

6.3.2 The purpose of the site survey was to record existing artificial lighting installations in the area surrounding the development. The survey confirmed the locations of key receptors and enabled the local topology, landscape features and existing built structures to be corroborated.

6.3.3 The study area was visited during daylight hours and again in the evening. There was partial cloud cover and general visibility was good.

6.3.4 Taking the site itself as a starting point, potential receptors in close proximity were confirmed using information previously prepared during the desk-based study. The survey team then prepared a photographic record of the baseline conditions on the site and in the surrounding area. Existing lighting types were identified and indicative illuminance levels (Lux) were taken of typical areas using calibrated light meters.

6.3.5 Existing electric light installations in the area surrounding the application site were assessed in the following ways:

- Measurement of typical illuminance values in Lux (Lumens per square metre)
- A subjective visual assessment of the lighting type and quality
- A visual assessment of the installed luminaires and lighting columns.

6.3.6 This survey information is recorded in the Baseline Survey report (see Appendix A)

6.3.7 Appendix A also illustrates existing land uses, principal receptors, surrounding landscape elements and existing street lighting types in the area and should be read in conjunction with this chapter.

6. METHODOLOGY

6.4 Results of Field Survey

6.4.1 Land Uses

The proposed development site comprises an arable field, enclosed by mature woodland and mature hedgerows. Surrounding land uses consist primarily of residential dwellings. There is commercial development to the south on Oxford Road and many shops and small businesses located in Oxford Street and Woodstock High Street. Oxford International Airport is located to the east of the site and Marlborough Church of England School to the north. Blenheim Palace Country House and Estate a world heritage site is situated to the south west.

Existing land uses are identified on Page 18 (Appendix A)

6.4.2 Principal Receptors

Principal receptors for potential light spill, light pollution and light trespass were identified as:

- Local Residents (as identified below)
- Pilots taking off and landing at Oxford International Airport
- Ecological Features (Existing Bat Population)
- Motorists, Cyclists and Pedestrians travelling on the A44, A4095 and Shipton Road.
- Heritage (Blenheim Palace & Scheduled Monument)
- Dark Landscapes (Existing site and surrounding area)
- Astronomers (There are no observatories of which the authors are aware in the Oxfordshire area. However, there are amateur astronomy clubs in Chipping Norton and Abingdon for whom increased sky glow from the proposed development could be of concern).

6.4.3 Residential receptors were identified as the dwellings located in Hedge End, Fleming's Road & Plane Tree Way to the North and Churchill Gate and The Covert to the west. Residential properties at the eastern end of Shipton Road such as Perdiswell Farm and properties on the eastern side of the proposed development were also identified. The Pest House lies within the ownership of the Estate and is adjacent to the site boundary. "Littlecote" on Oxford Road (south of site) lies outside the ownership of the Estate and is excluded from the site boundary. Number 21 & Woodstock Boarding Cattery on Upper Campsfield Road (south east of site) lies outside the ownership of the Estate.

6.4.4 To the south, potential receptors are the Cowyards Business Development on Oxford Road, Bladon Chains Caravan Club and additional dwellings such as "Littlecote" on Oxford Road and 21 Upper Campsfield Road.

6.4.5 Blenheim Palace and Park, a World Heritage Site is identified as a receptor. There are no direct views of the site from the house or the gates on Oxford Road. The south east side of the Blenheim Park faces the south western boundary of the site on the A44.

The locations of lighting receptors are shown in Appendix A, Page 27.

6.4.6 The project ecologist (BSG Ecology) has also identified existing bat foraging routes, for which mitigation will be required during the design stages of the project.

6.5 Existing Lighting Installations

6.5.1 The A44 Oxford Road and to the east A44 Woodstock Road are both currently illuminated by high pressure sodium luminaires with a clear glass convex safety lens mounted onto approximately 12 metre tall columns. An average illuminance of approximately 20 Lux was measured on the carriageway at night.

6.5.2 The roundabout at the junction of the A44 and A4095 is illuminated by high pressure sodium luminaires with a clear glass convex safety lens mounted onto approximately 10 metre tall columns located on the outer circumference of the roundabout. An average illuminance of approximately 30 Lux was measured on the roundabout at night.

6.5.3 To the north of the roundabout, the A4095 Upper Campsfield Road is not illuminated for its entire length (up to and including the junction with the A4260 Banbury Road).

6.5.4 Aviation warning lights and light spill from the interior of the administration buildings and aircraft hangers of London Oxford Airport are visible from Upper Campsfield Road at night. A maximum luminance value of 12 cd/m2 was measured from this location during the night time survey.

6.5.5 To the south of the Campsfield Wood roundabout, the A4095 Bladon Road and Grove Road the street is illuminated at regular intervals by high pressure sodium luminaires which are mounted onto telegraph poles. Levels of illuminance are significantly less than on the A44 Oxford Road.

6.5.6 The eastern end of Shipton Road adjacent to Upper Campsfield Road is not lit. The section of Shipton Road from the Marlborough Church of England School to the roundabout at the junction of Banbury Road to the west is illuminated by high pressure sodium lanterns with a downward facing street lighting optic mounted onto 5 metre tall columns. Illuminance levels of between 12 Lux and 45 Lux were measured during the night time survey.

6.5.7 The playing fields of Marlborough Church of England School are not illuminated.

6.5.8 In Woodstock itself, Oxford Street and the High Street are illuminated using wall mounted asymmetric high pressure sodium luminaires mounted at approximately 8 metres from street level. This wall mounted lighting provides good levels of vertical illuminance on both adjacent and opposite wall surfaces. Vertical illuminances of approximately 20 Lux were measured during the survey. Approximately 90 Lux was measured on the pave-

6. METHODOLOGY

ment beneath the wall mounted luminaires.

6.5.9 To the north of Oxford Street, Union Street is lit by Victorian style lanterns on 5 metre tall columns which utilise high pressure sodium lamps. Illuminance levels of 25 Lux were measured directly beneath each lantern.

6.5.10 Adjacent residential streets such as Oxford Road, Cadogan Park, and Churchill Gate are illuminated with high pressure sodium lighting. Average illuminance levels of between 20 Lux and 30 Lux were measured at street level.

6.5.11 Generally, whilst the streets to the South and West of the site are illuminated, areas to the North and East have no electric lighting. There was no visible glare or light spill onto the site itself from the surrounding area which might have an impact on the proposed development in future.

6.512 A summary of the results of the Baseline Survey are included in Appendix A.

A44 OXFORD ROAD TO THE SOUTH OF THE SITE

THE ROUNDABOUT AT THE JUNCTION OF THE A44 AND A4095

SHIPTON ROAD

ADJACENT DEVELOPMENT (PARK VIEW) ENTRANCE ON COWELLS ROAD

7. EVALUATION

7.1 Evaluation of the proposed development has been made with reference to the illustrative masterplan and parameter plans prepared by Terence O'Rourke.

7.2 The existing site has been assessed as being in "Environmental Zone E2" as defined in the Institution of Lighting Professional's "Guidance Notes for the Reduction of Obtrusive Light". As such, the maximum permissible Upward Light Ratio (ULR) of the development should not exceed 2.5% of the total luminous flux of installed luminaires. Light intrusion into windows should not exceed 5 Lux "Pre-Curfew" and 1 Lux "Post Curfew". Luminaire intensity should not exceed 7,500 cd/m2 "Pre-Curfew" and 500 cd/m2 "Post Curfew". In addition, building luminances should not exceed 5cd/m2 "Pre-Curfew". See figure 1 below.

7.3 The design of lighting installations is normally undertaken during the detailed design phase of any project. Detailed information on the lighting design for the Land East of Park View development was therefore unavailable at the time of this study. Consequently, assumptions have been made in order to undertake this Lighting Impact Assessment.

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

TABLE 7.1: ENVIRONMENTAL ZONES *

Light technical parameter	Application conditions	Environmental zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (E_v)	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

TABLE 7.2(CIE 150 TABLE 2): MAXIMUM VALUES OF VERTICAL ILLUMINANCE ON PREMISES*

Light technical parameter	Road classification[1]			
	No road lighting	M6 / M5	M4 / M3	M2 / M1
Veiling luminance[2] (L_v)	0.037 cd/m²	0.23 cd/m²	0.40 cd/m²	0.84 cd/m²
Threshold Increment	15% based on adaption luminance of 0.1 cd/m²	15% based on adaption luminance of 1.0 cd/m²	15% based on adaption luminance of 2.0 cd/m²	15% based on adaption luminance of 5 cd/m²

TABLE 7.3 (CIE 150; TABLE 4): MAXIMUM VALUE OF THRESHOLD INCREMENT AND VIEWING DIRECTION IN THE PATH OF TRAVEL*

* SOURCE: ILP_GN01/21 THE REDUCTION OF OBTRUSIVE LIGHT (2021)

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m²)					
		0<A_p ≤0.002	0.002<A_p ≤0.01	0.01<A_p ≤0.03	0.03<A_p ≤0.13	0.13<A_p ≤0.50	A_p > 0.5
Maximum luminous intensity emitted by luminaire (I in cd)[5]	E0 Pre-curfew Post-curfew	0 0	0 0	0 0	0 0	0 0	0 0
	E1 Pre-curfew Post-curfew	0.29 *d* 0	0.63 *d* 0	1.3 *d* 0	2.5 *d* 0	5.1 *d* 0	2,500 0
	E2 Pre-curfew Post-curfew	0.57 *d* 0.29 *d*	1.3 *d* 0.63 *d*	2.5 *d* 1.3 *d*	5.0 *d* 2.5 *d*	10 *d* 5.1 *d*	7,500 500
	E3 Pre-curfew Post-curfew	0.86 *d* 0.29 *d*	1.9 *d* 0.63 *d*	3.8 *d* 1.3 *d*	7.5 *d* 2.5 *d*	15 *d* 5.1 *d*	10.000 1,000
	E4 Pre-curfew Post-curfew	1.4 *d* 0.29 *d*	3.1 *d* 0.63 *d*	6.3 *d* 1.3 *d*	13 *d* 2.5 *d*	26 *d* 5.1 *d*	25,000 2,500
Aid to gauging A_p Luminaire diameter		2 to 5 cm	5 to 10 cm	10 to 20 cm	30 to 40 cm	40 to 80 cm	>80 cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding A_p representative area (m²)		0.0008	0.004	0.016	0.063	0.251	>0.5

TABLE 7.4 (CIE 150; TABLE 3(AMENDED, LIMITS FOR THE LUMINOUS INTENSITY OF BRIGHT LUMINAIRES*

Light technical parameter	Environmental zones				
	E0	E1	E2	E3	E4
Upward light ratio (ULR) / %	0	0	2.5	5	15

TABLE 7.5(CIE 150 TABLE 5): MAXIMUM VALUE OF UPWARD LIGHT RATIO (URL) OF LUMINAIRES*

Light technical parameter	Type of installation	Environmental zones				
		E0	E1	E2	E3	E4
Upward flux ratio (UFR) / %	Road	n/a	2	5	8	12
	Amenity	n/a	n/a	6	12	35
	Sports	n/a	n/a	2	6	15

TABLE 7.6 (CIE 150; TABLE 6): MAXIMUM VALUE OF UPWARD FLUX RATIO OF INSTALLATION (OF FOUR OR MORE LUMINAIRES)*

Light technical parameter	Application conditions	Environmental zones				
		E0	E1	E2	E3	E4
Building façade luminance (L_b)	Taken as the product of the design average illuminance and reflectance divided by π	< 0.1 cd/m²	< 0.1 cd/m²	5 cd/m²	10 cd/m²	25 cd/m²
Sign luminance (L_s)	Taken as the product of the design average illuminance and reflectance divided by π (pi), or for self-luminous signs, its average luminance	< 0.1 cd/m²	50 cd/m²	400 cd/m²	800 cd/m²	1.000 cd/m²

TABLE 7.7(CIE 150 TABLE 7): MAXIMUM PERMITTED VALUES OF AVERAGE SURFACE ILLUMINANCE*

7. EVALUATION

7.4 The Lighting Assessment is made on the basis that all relevant statutory requirements will be adhered to. In addition, it has been expected that as a minimum requirement the detailed design will be undertaken in accordance with current best practice guidelines. These guidelines will include recommendations from the Institution of Lighting Engineers (ILE) regarding the reduction of light pollution and SLL CIBSE guidelines on lighting in the external environment.

7.5 It is assumed that by following best practice guidelines, the site should not be over lit and that when a specific task stops, then the lighting, if not required for safety and security will be switched off.

7.6 In addition, the Lighting Assessment is made on the basis that energy efficient luminaires and lighting equipment with good optical control will be specified as part of the detailed lighting design for The Site. All luminaires should be aimed and focussed correctly to illuminate specific tasks, avoid glare and minimise any light trespass into residential windows or into the night sky. Recommended limitations on "obtrusive light" and a detailed list of all the relevant lighting design and environmental standards are listed on Page 15.

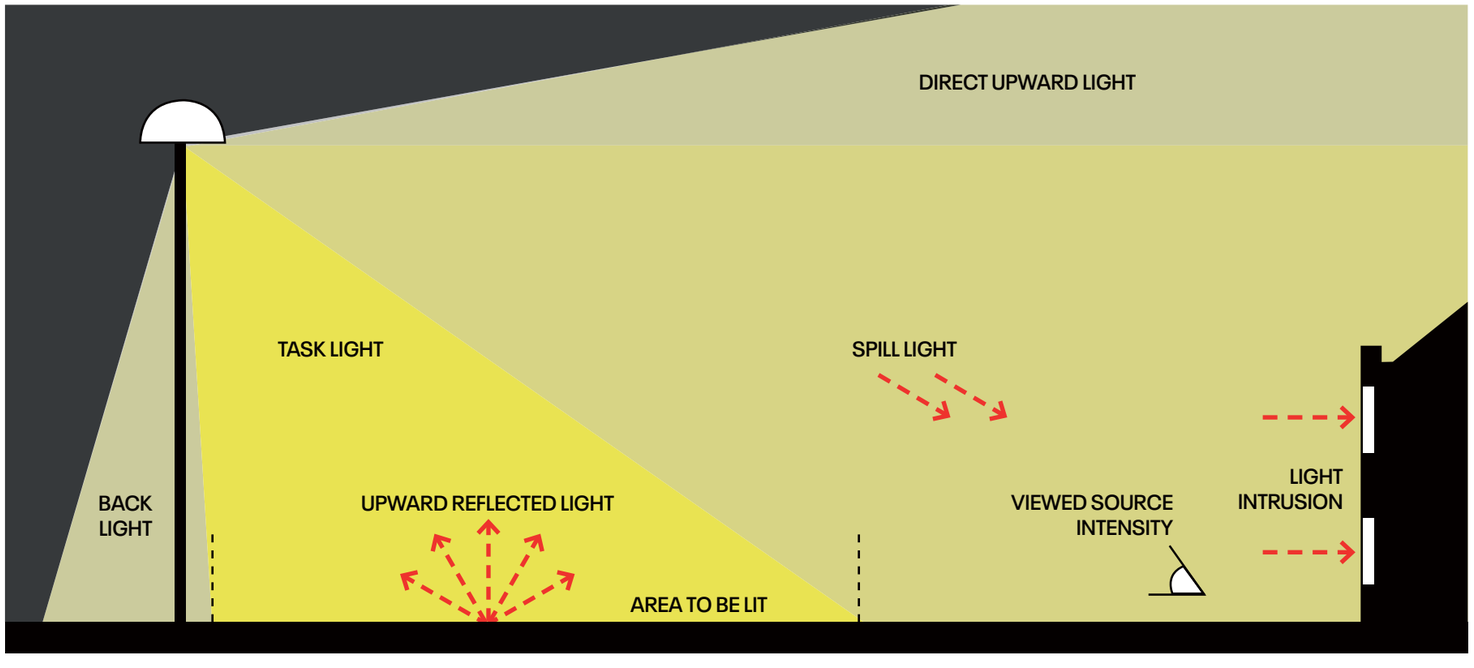


FIGURE 7.1: DIAGRAM SHOWING OBTRUSIVE LIGHT (SOURCE: GIA EQUATION)

ILLUSTRATION: LIGHT SPILL FROM HIGH MAST LUMINAIRES

ILLUSTRATION: SKY GLOW FROM LIGHTING INSTALLATION

8. ASSESSMENT CRITERIA

8.1 A number of criteria were used to determine whether the effects are 'significant'. The assessments took account of the following:

- Likelihood of occurrence
- Geographical extent
- Adherence to legislation and policy
- Adherence to local, national and international standards
- Sensitivity of receiving environment or other receptors
- Value of resource which will be affected
- Temporary or permanence of effect
- Duration of temporary effects; short, medium or long-term
- Reversible or irreversible
- Inter-relationship between effects

8.2 The analysis considered the significance of the effects (both positive and negative), the sensitivity of the receptor and the nature and magnitude of the changes as shown in the Table 8.1 adjacent.

Magnitude of Impact	Description
Major	The proposed development would cause a major change to existing environmental conditions. For example, if the proposed development introduced electric lighting where there is currently none, or if the proposed development creates light spill pollution where there currently none.
Moderate	The proposed development would cause a noticeable change to existing environmental conditions. For example, if there is a significant increase in light spill and light pollution form the proposed development.
Minor	The proposed development would cause a small change to existing developmental conditions. For example, of there is a perceptible increase in light spill and light pollution from the proposed development.
Negligible	The proposed development would cause no discernible change to existing environmental conditions.

TABLE 8.1: ASSESSMENT CRITERIA

8.3 The sensitivity of identified receptors has been assessed with consideration to potential light spill, light trespass, glare and sky glow (Table 8.2).

Receptor Sensitivity/value	Description
Very High	The receptor will be significantly affected by any change to the baseline.
High	The receptor will be noticeable affected by any change to the baseline.
Medium	The receptor will be moderately affected by any change to the baseline.
Low	The receptor is unlikely to be affected by any change to the baseline.

TABLE 8.2: EVALUATION OF RECEPTOR SENSITIVITY

8.4 The significance of the effects of light pollution has been assessed according to the matrix shown in Table 8.3. Significant effects are those considered to be moderate or substantial in nature.

Receptor Sensitivity/ value	Nature of Effect			
	Major	**Moderate**	**Minor**	**Negligible**
Very High	Substantial	Substantial	Moderate	Slight
High	Substantial	Moderate	Slight	Negligible
Medium	Moderate	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible

TABLE 8.3: SIGNIFICANCE MATRIX MITIGATION MEASURES

9. CONSTRUCTION PHASE IMPACTS

9.1 Good practice guidance documents prepared by the Construction Industry Research and Information Association (CIRIA) note that lighting on construction sites is an integral part of the on-site security, and, health and safety requirements. The following sources of electric light are therefore assumed to be present during the construction phase:

- Floodlighting and security lighting within the site compound;
- Security and health and safety lighting associated with any ongoing working areas (particularly when working during the late afternoon in the winter period);
- Internal and external lighting associated with any temporary site office units; and
- Temporary lighting for pedestrians if required.

9.2 For the purposes of the assessment working hours for construction are assumed to be typical of the industry (e.g. 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturday). It is assumed that there will be no working on Sundays or Bank Holidays. Whilst it is assumed that any external building works will be undertaken during daylight hours, it is assumed that security lighting will be required at all times during the hours of darkness.

9.3 It is assumed that the construction period will be approximately eleven years overall; therefore any effects associated with construction lighting are considered to be medium-term in duration and temporary.

10. POTENTIAL SIGNIFICANT EFFECTS

10.1 The site is currently in use as arable land. The site is unlit. The proposed development will therefore primarily introduce street lighting installations in what was a dark landscape.

10.2 Potential significant effects on the identified receptors are light spill, glare and increased increased sky glow from lighting installations within the proposed development, both during construction and in the operational phase of the development.

10.3 The potentially adverse effects of lighting installations on the site can be mitigated through the application of good design and by implementing guidelines for best lighting practice.

A summary of the significant effects is listed in the adjacent tables.

Receptor	Description of Effect	Nature of Effect						Nature of Cumulative Effect	Nature of Residual Effect
		Significance**	+/-	D/I	P/T	R/IR	ST/MT/LT	Significance**	Significance**
PART 1: CONSTRUCTION PHASE									
A. The Pest House	Light Trespass & Glare	Moderate	-	D	T	R	ST	Negligible	Negligible
B. New Dwellings in Park View	Light Trespass & Glare	Moderate	-	D	T	R	ST	Negligible	Negligible
C. Dwelling on main A44 Oxford Rd.	Light Trespass & Glare	Slight	-	D	T	R	ST	Negligible	Negligible
D. Ridge and Partners LLP	Light Pollution	Slight	-	D	T	R	ST	Negligible	Negligible
E. Dwelling on south side of A44	Light Pollution	Slight	-	D	T	R	ST	Negligible	Negligible
F. Woodstock Boarding Cattery	Light Pollution	Slight	-	D	T	R	ST	Negligible	Negligible
G. Oxford International Airport	Light Trespass & Glare	Moderate	-	D	T	R	ST	Negligible	Negligible
H. Existing Bat Population	Light Pollution	Moderate	-	D	T	R	ST	Negligible	Negligible
I. Motorist, Cyclists and Pedestrians	Light Trespass & Glare	Slight	-	D	T	R	ST	Negligible	Negligible
J. Existing Dark Landscape	Light Pollution	Moderate	-	D	T	R	ST	Negligible	Negligible
K. Astronomers	Light Pollution	Moderate	-	D	T	R	ST	Negligible	Negligible

TABLE 10.1: SUMMARY OF SIGNIFICANT EFFECTS

Receptor	Description of Effect	Nature of Effect						Nature of Cumulative Effect	Nature of Residual Effect
		Significance**	+/-	D/I	P/T	R/IR	ST/MT/LT	Significance**	Significance**
PART 2: OPERATIONAL PHASE									
A. The Pest House	Light Trespass & Glare	Moderate	-	D	P	R	LT	Negligible	Negligible
B. New Dwellings in Park View	Light Trespass & Glare	Moderate	-	D	P	R	LT	Negligible	Negligible
C. Dwelling on main A44 Oxford Rd.	Light Trespass & Glare	Slight	-	D	P	R	LT	Negligible	Negligible
D. Ridge and Partners LLP	Light Pollution	Slight	-	D	P	R	LT	Negligible	Negligible
E. Dwelling on south side of A44	Light Pollution	Slight	-	D	P	R	LT	Negligible	Negligible
F. Woodstock Boarding Cattery	Light Pollution	Slight	-	D	P	R	LT	Negligible	Negligible
G. Oxford International Airport	Light Trespass & Glare	Slight	-	D	P	R	LT	Negligible	Negligible
H. Existing Bat Population	Light Pollution	Slight	-	D	P	R	LT	Negligible	Negligible
I. Motorist, Cyclists and Pedestrians	Light Trespass & Glare	Slight	-	D	P	R	LT	Negligible	Negligible
J. Existing Dark Landscape	Light Pollution	Slight	-	D	P	R	LT	Negligible	Negligible
K. Astronomers	Light Pollution	Slight	-	D	P	R	LT	Negligible	Negligible

TABLE 10.2: SUMMARY OF SIGNIFICANT EFFECTS

KEY:
* - = Adverse/ + = Beneficial; D = Direct/ I= Indirect; P=Permanent/ T=Temporary; R=Reversible/ IR=Irreversible; ST= Short term/ MT = Medium term/ LT = Long term
** Negligible /Slight / Moderate/ Substantial

10. POTENTIAL SIGNIFICANT EFFECTS

ILLUSTRATION: PRINCIPAL RECEPTORS

Receptors

A. The Pest House
B. New dwellings in Park view
C. Dwelling on main A44 Oxford Road
D. Ridge and Partners LLP (Commercial properties)
E. Dwelling on south side of A44
F. Woodstock Boarding Cattery
G. Oxford International Airport

11. PROPOSED MITIGATION MEASURES

11.1 Roads

In considering the potential impact of street lighting, a hierarchy of primary, secondary and tertiary routes has been identified. See Appendix B "Proposed Lighting Strategies".

High efficiency flat glass full cut-off lanterns with a shielded downward light distribution should be specified. The scale of the street lighting columns should be significantly smaller in scale than the existing street lighting columns used on the adjoining "A" roads and more in keeping with the rural character of the development.

It is suggested that the primary routes through the development should be illuminated to higher levels of illuminance, with the secondary roads within the residential area lit to reduced levels. Consideration should be given to lighting tertiary routes leading to individual dwellings with high efficiency bollard luminaires rather than typical street lighting columns. The lighting scheme design should endeavour to provide a minimum amount of electric light around the outer boundary of the site to minimise the impact on the surrounding area.

The principal objective of the lighting design for the roads within the development should be to assist the safe and efficient movement of vehicular and pedestrian traffic. Road lighting should be designed to create an even luminance on the road surface as seen by the drivers of vehicles. Reduced levels of uniformity will be acceptable in secondary and tertiary streets where the traffic will be moving more slowly.

Lighting for the development should complement the existing street lighting in Woodstock as a whole. The use of good colour rendering dimmable LED light sources should be considered, to enable the street lighting to be automatically dimmed after an agreed lighting curfew in the late evening.

Views into the site from the surrounding countryside should be considered when developing the design and the appearance of visible lines of street lighting columns avoided.

Receptor	Description of Effect	Proposed Mitigation and Enhancement Measures	Mitigation for Cumulative Effects
Construction Phase			
A. The Pest House	Light spill, glare and Light Pollution	For All Identified Receptors: Care should be taken in the design of the lighting systems to avoid light spill beyond the construction site. Operational hours shall be limited and PIR presence detection used where possible to limit the operation hours of the lighting. The contractor shall put in place a system whereby residents can notify the site on any light trespass or related nuisance.	None required
B. New Dwellings in Park View	Light spill, glare and light pollution into back gardens		None required
C. Dwelling on main A44 Oxford Rd.	Light spill, glare and light pollution into back gardens		None required
D. Ridge and Partners LLP	Light pollution		None required
E. Dwelling on south side of A44	Light pollution		None required
F. Woodstock boarding cattery	Light pollution		None required
G. Oxford International Airport	Glare to pilot, Light pollution, Potential confusion with airfield lighting.		None required
H. Existing Bat Population	Light spill onto foraging routes		None required
I. Motorists, Cyclists and Pedestrians	Light spill, glare and light pollution		None required
J. Existing Dark Landscape	Light pollution and sky glow		None required
K. Astronomers	Light pollution and sky glow		None required

TABLE 11.1: SUMMARY OF PROPOSED MITIGATION AND ENHANCEMENT MEASURES

Receptor	Description of Effect	Proposed Mitigation and Enhancement Measures	Mitigation for Cumulative Effects
Operational Phase			
A. The Pest House	Light spill, glare and Light Pollution	Street lighting dimmed after curfew. No light within adjacent back gardens.	None required
B. New Dwellings in Park View	Light spill, glare and light pollution into back gardens	Street lighting dimmed after curfew. No light within adjacent back gardens.	None required
C. Dwelling on main A44 Oxford Rd.	Light spill, glare and light pollution into back gardens	Street lighting dimmed after curfew.	None required
D. Ridge and Partners LLP	Light pollution	Street light dimmed after curfew.	None required
E. Dwelling on south side of A44	Light pollution	Street light dimmed after curfew.	None required
F. Woodstock boarding cattery	Light pollution	Street light dimmed after curfew.	None required
G. Oxford International Airport	Glare to pilot, Light pollution, Potential confusion with airfield lighting.	Avoid light spill and glare from lighting installations within the proposed development by use of current guidelines and best practise design guides.	None required
H. Existing Bat Population	Light spill onto foraging routes	Environmental criteria guidelines to be followed during design stages to avoid foraging routes.	None required
I. Motorists, Cyclists and Pedestrians	Light spill, glare and light pollution	Street light dimmed after curfew.	None required
J. Existing Dark Landscape	Light pollution and sky glow	Street light dimmed after curfew.	None required
K. Astronomers	Light pollution and sky glow	Street light dimmed after curfew.	None required

TABLE 11.2: SUMMARY OF PROPOSED MITIGATION AND ENHANCEMENT MEASURES

11. PROPOSED MITIGATION MEASURES

11.2 Footpaths

Given that the site is in a rural location, the lighting scheme designer should first consider whether it is necessary to illuminate footpaths at all.

The planning and design of the site should endeavour to minimise the use of electric lighting. Where pedestrians and vehicles occupy a shared space, the lighting should be designed such that drivers of vehicles can clearly see pedestrian users of the space whilst ensuring that light spill into surrounding areas is minimised.

11.3 Oxford International Airport

Care should be taken to avoid potential confusion to pilots taking off and landing at Oxford International Airport. Lights should not be displayed on the site which could distract pilots or be mistaken for aeronautical ground lights.

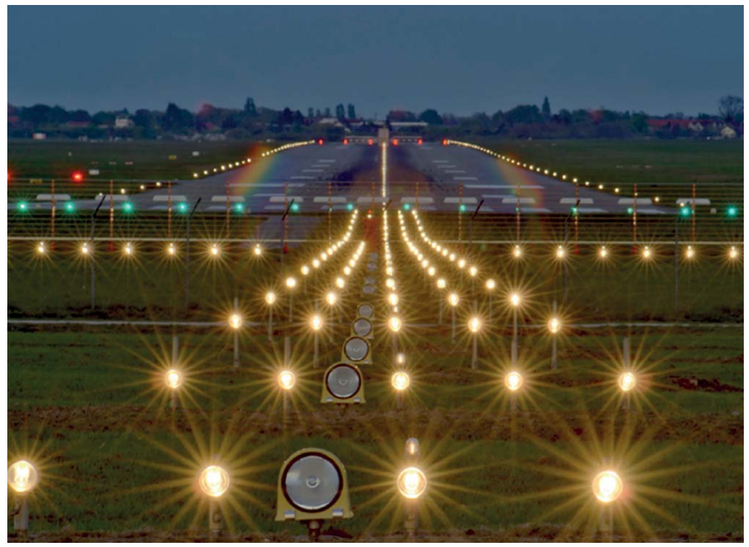


ILLUSTRATION: TYPICAL AIRPORT APPROACH & RUNWAY LIGHTS

The arrangement of street lighting columns on the site should be such that it cannot be mistaken for the airport approach or runway lighting systems. It is recommended that staggered arrays of street lighting columns are used to avoid potential confusion with airport approach and runway lighting systems (as illustrated above). The lighting scheme designer should refer to relevant guidance documents.

The use of coloured marker lights should also be avoided on the site. All street lighting specified should have flat glass, full cut off reflector systems, which emit no light above the horizontal plane. The installation of high structures should also be avoided on The Site. Coloured lighting elements that could be confused with airport signals must not be specified.

Temporary outdoor light shows involving lasers, searchlights or fireworks must be prohibited on The Site.

Designers of all lighting installations on The Site should fully comply with the requirements of CAA Air Navigation Order and regulations 2016, Article 135 "Dangerous Lights" which states that:

"A person shall not exhibit in the United Kingdom any light which:

a. By reason of its glare is liable to endanger aircraft taking off from or landing at an aerodrome; or
b. By reason of its liability to be mistaken for an aeronautical ground light is liable to endanger aircraft."

11.4 Landscape & Open Spaces

In keeping with the rural location of the site and to avoid the excessive exterior lighting, it is recommended that all landscaped areas outside the residential development should not be illuminated.

11.5 Bat Foraging Routes

Identified bat foraging routes should not be illuminated and the use of hedgerows, barrier planting, screening or berms should be considered to create dark corridors on the site. The project ecologist has identified that the entire perimeter of the Land East of Park View is used by bat species for foraging and commuting. This internal perimeter should remain completely dark.

Where foraging and commuting routes cross roads and footpaths, then the street lighting should be omitted to ensure that a dark landscape is maintained. Low level lighting such as bollards with a shielded downward light distribution should be installed when it is absolutely necessary to provide lighting for the safety and security of users.

12. CONCLUSION

12.1 The baseline condition of the site has been assessed as "Dark" and the brightness of the proposed development post construction as "Low District Brightness". Therefore, the magnitude of the potential change is "Minor" and the potential lighting impact "Slight".

This assessment is made on the basis that current best practice design solutions are adopted for the exterior lighting installations.

12.2 As identified in this report, strategies for mitigation can include a variety of different measures, depending on the specific location within the site and the visual task illumination requirements.

It includes clear strategies for mitigation the impact of electric lighting for each identified receptor as described in the Lighting Impact Assessment.

12.3 The use of flat glass, full cut-off dimmable LED street luminaires is proposed throughout The Site to ensure that there is no light spill above the horizontal plane and that an efficient light distribution on the carriageway is achieved with minimal light spill into surrounding areas.

12.4 The use of micro-processor based street lighting management systems and lighting controls and dimmable lighting sources is suggested to enable light intensities to be adjusted post-curfew to avoid potential nuisance to identified receptors.

12.5 The use of louvres to limit light spill and control the light distribution from luminaires has been identified.

12.6 It is recommended that significant parts of the site should remain dark at night if there is no detriment to health and safety or visual amenity.

12.7 The existing mature landscape around the perimeter of The Site provides some screening for electric lighting installations on the site.

12.8 Additional barrier planting is proposed for The Site to shield views of lighting installations in sensitive areas and to mitigate potential light spill into the existing bat foraging routes.

12.9 If appropriate mitigation measures are implemented by lighting scheme designers at the design stages of the project, then the residual impacts have been evaluated as "Negligible"

13. REFERENCES

Planning, Legislation:

Environmental Protection ACT 1990

National Planning Policy Framework 2012 (updated on 20 July 2021)

Planning Practice Guide (PPG) 2019

Department for Transport "Manual for Streets" 2007

Cherwell Local Plan 2011-2031

Cherwell Adopted Design and Conservative Strategy 2012-2015

"Code for Sustainable Homes: Technical Guidance" - November 2010

Relevant British Standards:

British Standards Institution, BS 5489-1: 2020
"Code of practice for the design of road lighting. Lighting of roads and public amenity areas.

British Standards Institution, BS 13201-2 : 2015
"Road Lighting : Performance requirements"

Relevant Best Practice Guidelines:

Society of Light & Lighting (formerly CIBSE) Lighting Guides:
LG6 The Exterior Environment, 2016

Society of Light & Lighting (formerly CIBSE) Lighting Guides:
LG21 Protecting the night-time environment, 2021

Institution of Lighting Professionals:

"Guidance Notes for the Reduction of Obtrusive Light" GN01:2021

"Guidance on Undertaking Environmental Lighting Impact Assessments"
PLG04: 2013

Guidance for Lighting Effects on Bats:

The Bat Conservation Trust
"Landscape & Urban Design for Bats & Biodiversity" August 2012.

Institution of Lighting Professionals/Bat Conservation Trust
"Guidance Note 08/18 Bats and artificial lighting in the UK" 2018

Other Relevant Publications:

Guide for the Lighting Exterior Working Areas (CIE 68: 1998)

Lighting of Roads for Motor and Pedestrian Traffic CIE 115:2010

Urban Sky Glow, A worry for Astronomy
(x8 - Proceedings of a symposium of CIE TC 4.21:1993)

Guidelines for minimizing sky glow, CIE126-1997

Guide on the limitation of the effects of obtrusive lightfrom outdoor lighting installations, CIE150-2017

Construction (Design and Management) Regulations, 2015

Managing Health & Safety in Construction, 2015

Air Navigation Order and regulations, 2016

14. CURRICULUM VITAE

Project Lead – Keith Miller
BA(Hons) MSLL ACIBSE, Ass. IALD

Keith has over 35 years' experience as a lighting consultant. He is a member of the Society of Light & Lighting's Technical & Publications Committee. He was part of the task group responsible for SLL Lighting Guide LG11: "Surface Colour & Reflectance" 2001, task group chairman and principal author of SLL Lighting Guide LG14: "Transport Buildings" published in August 2017 and a principal contributor to the SLL "Lighting Handbook" published in November 2018.

Keith has been responsible for a number of lighting impact assessments, including the Crossrail Line Wide Impacts Assessment and Lighting Impact Assessments for residential developments in Woodstock West Oxfordshire, Botley Road Oxford, Fareham Hampshire, Pinhoe & Chudleigh in Devon, and for the Grosvenor Estate in London.

Lighting Impacts Assessor – Suchada Supantamart
B.Arch, MSc. Light & Lighting, MA. Industrial Design

Suchada has a first degree in Architecture and Master's degree in Light and Lighting from the UCL and Industrial Design from CSM, UAL. She has 10 years experience as a lighting consultant.

She has been involved in the development of lighting design for EC Powisle regeneration development in Warsaw, the International Quarter Stratford public realm lighting and the exterior and landscape lighting for Embassy Gardens. Suchada is currently working on a number of high profile commercial developments in London.

APPENDIX A

BASELINE SURVEY

SITE LOCATION

SURROUNDING LAND USES

PRINCIPAL RECEPTORS

EXISTING STREET LIGHTING LOCATIONS

EXISTING EXISTING ILLUMINANCE LEVELS

ZONE A - WOODSTOCK TOWN EXISTING LIGHTING

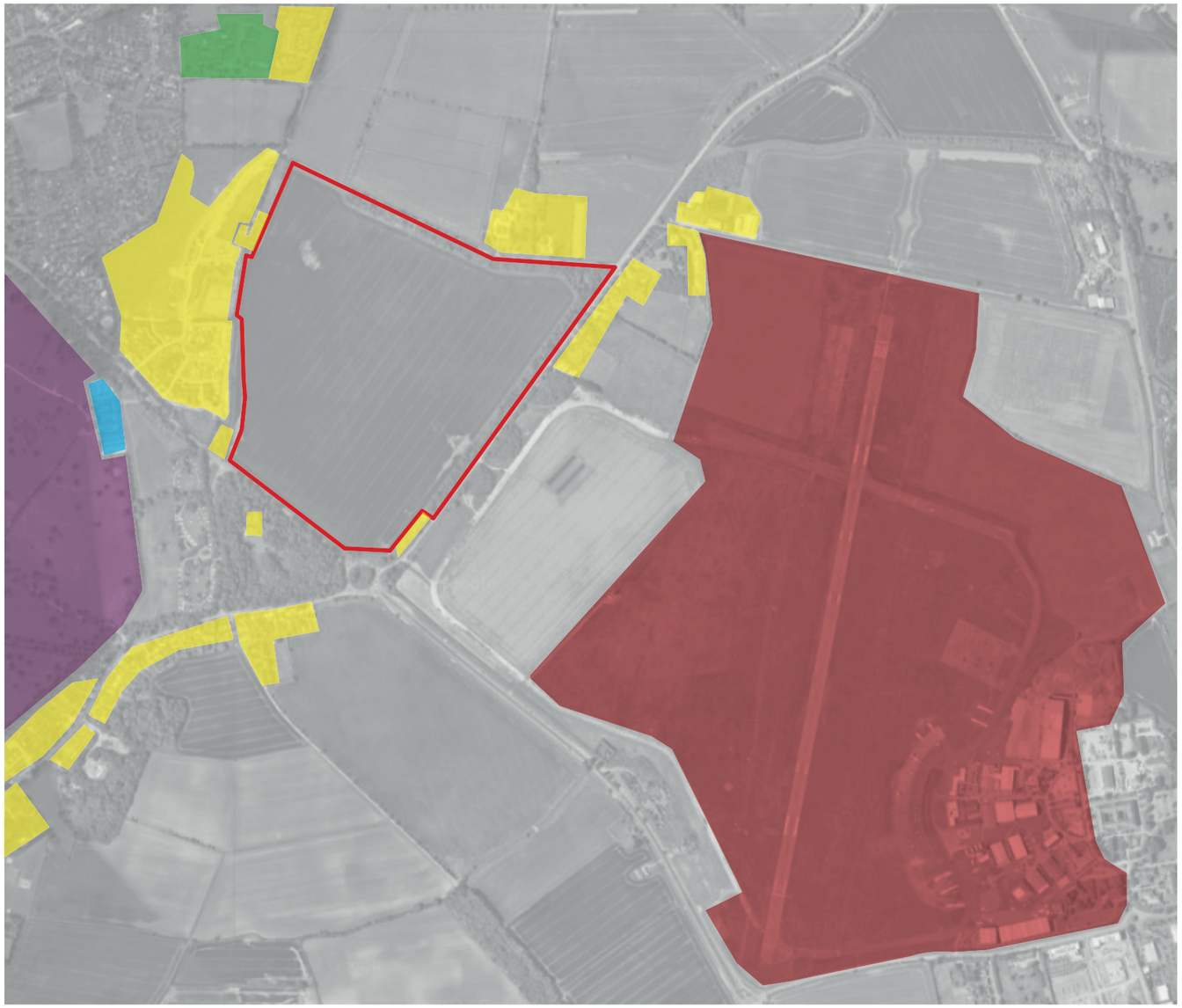
ZONE B - ADJACENT AREAS EXISTING LIGHTING

ZONE C - EXISTING LIGHTING CONDITIONS

BASELINE: SITE LOCATION

Site Boundary

BASELINE: SURROUNDING LAND USES



EXISTING USES

- Residential
- Airport
- Educational
- Commercial
- Heritage

ILLUSTRATION: IDENTIFIED LAND USES

BASELINE: PRINCIPAL RECEPTORS

ILLUSTRATION: PRINCIPAL RECEPTORS

A. THE PEST HOUSE

B. NEW DWELLINGS PARK VIEW DEVELOPMENT

C. DWELLING ON MAIN A44 OXFORD RD

D. RIDGE AND PARTNERS LLP

E. DWELLING ON SOUTH SIDE OF A44

F. WOODSTOCK BOARDING CATTERY

G. OXFORD INTERNATIONAL AIRPORT

PRINCIPAL RECEPTORS

BASELINE: EXISTING STREET LIGHTING LOCATIONS

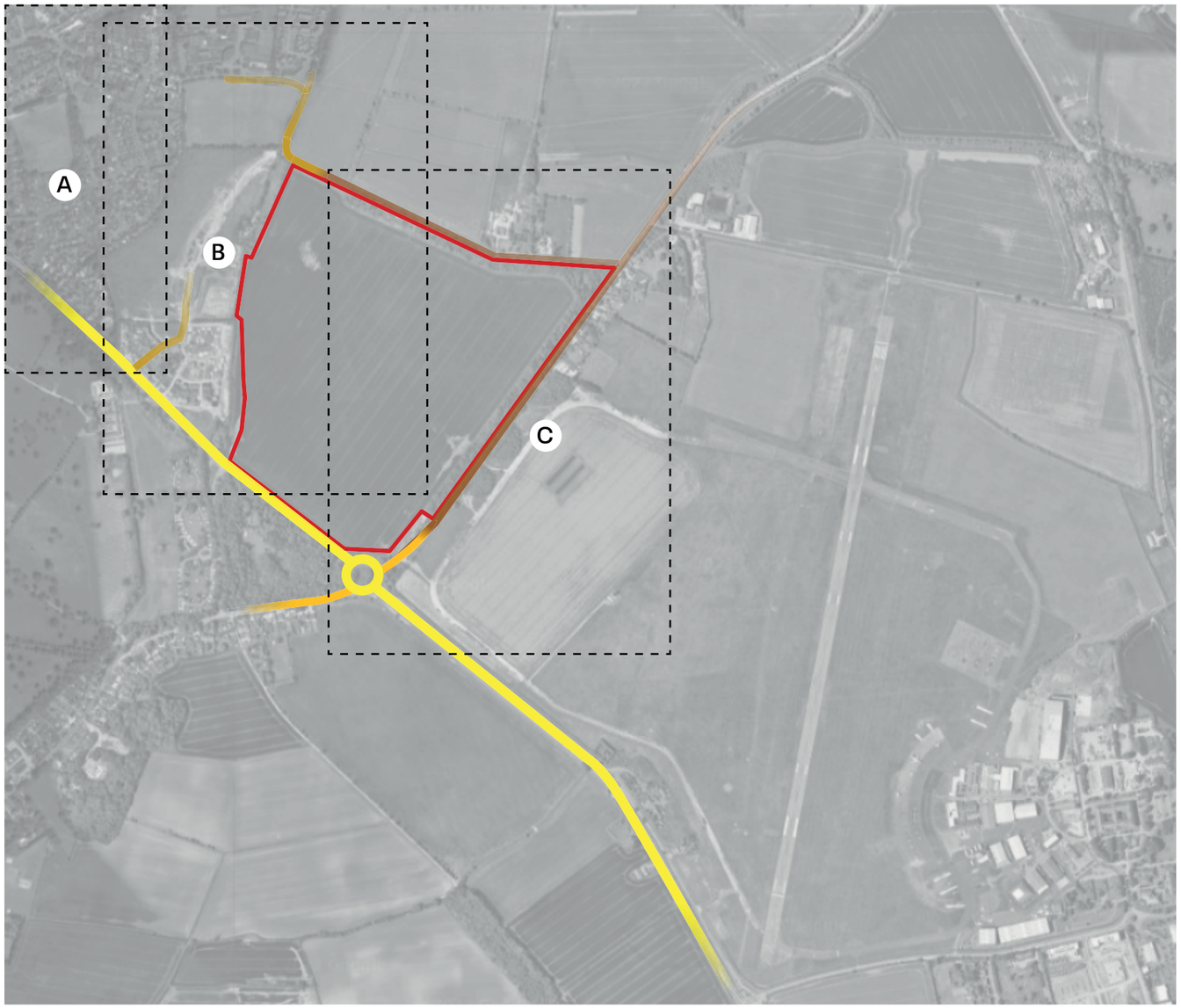
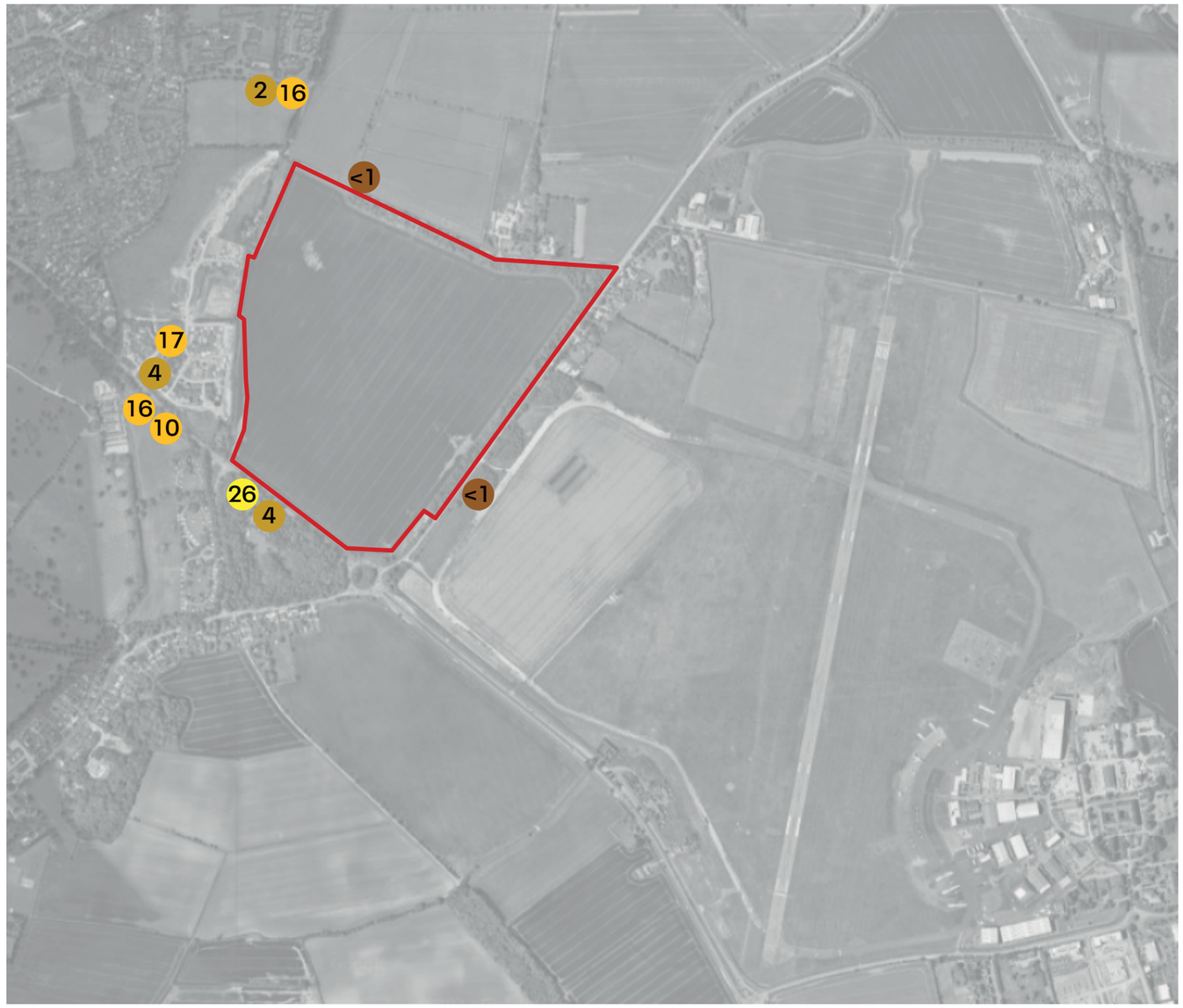


ILLUSTRATION: STREET LIGHTING LOCATION

EXISTING LIGHTING:

- A44 Street Lighting: Average > 20 Lux
- Primary street lighting Average Illuminance 5-20Lux
- Secondary street lighting Average Illuminance 2-5 Lux
- Unlit street Average Illuminance 0 Lux and 0.3 Lux
- Site boundary
- Detail Areas

BASELINE: EXISTING LIGHTING - ILLUMINANCE LEVELS



EXISTING LIGHTING:

- > 20 lux
- 5-20 lux
- 2-5 lux
- <1 lux
- Site boundary

ILLUSTRATION: EXISTING LIGHTING - ILLUMINANCE LEVELS

ZONE A: WOODSTOCK TOWN - EXISTING STREET LIGHTING

LOCATION A1

UNION ST - DAY

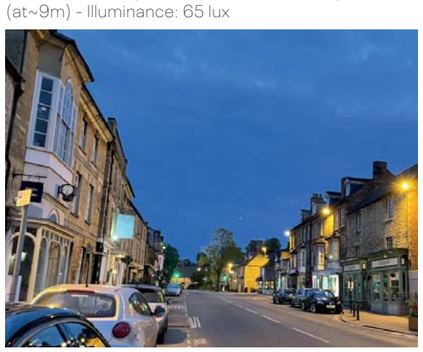
UNION ST - NIGHT
High pressure sodium street light (at ~4.5m)
Illuminance: 25 lux

HENSINGTON - NIGHT
High pressure sodium street light (at ~7m)
Illuminance: 70 lux

LOCATION A2

OXFORD STREET (A44) - DAY

OXFORD STREET (A44) - NIGHT
Wall-mounted high pressure sodium floodlights (at~9m) - Illuminance: 65 lux

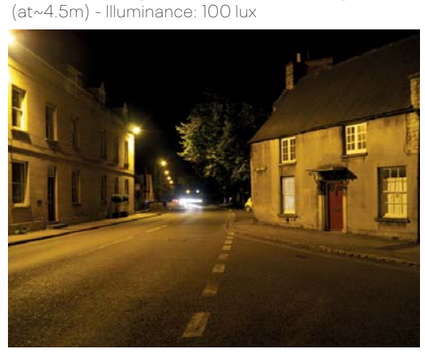


OXFORD STREET - NIGHT
Light trespass from wall-mounted flood lights on neighbouring buildings

LOCATION A3

OXFORD ST / HIGH ST - DAY

OXFORD ST / HIGH ST - NIGHT
Wall-mounted high pressure sodium floodlights (at~4.5m) - Illuminance: 100 lux



OXFORD ST / HIGH ST - NIGHT
Wall-mounted high pressure sodium floodlights (at~7m) - Illuminance: 95 lux

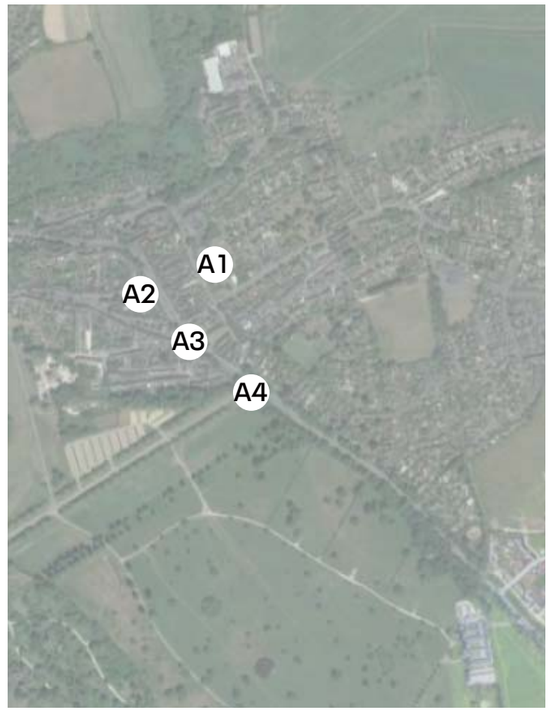
LOCATION A4

OXFORD RD (A44) / BLENHEIM PALACE - DAY

OXFORD RD (A44) - NIGHT
High pressure sodium street light (~10m)
Illuminance: 12 lux

BLENHEIM PALACE ENTRANCE - NIGHT
Light levels from street lights on opposite side of the road -Illuminance: 6 lux

KEYPLAN:



WOODSTOCK TOWN

ZONE B: ADJACENT AREA - EXISTING STREET LIGHTING

LOCATION B1

PARK VIEW DEVELOPMENT

PARK VIEW DEVELOPMENT
LED street light (~8m)
Illuminance: 4-15 lux

LOCATION B2

OXFORD ROAD (A44) - FRONT OF PARK VIEW DEVELOPMENT

OXFORD ROAD (A44) - NIGHT
LED street light, 4000K (~ 12m)
Illuminance : 10-16 lux

LOCATION B3

OXFORD ROAD (A44) ADJACENT TO SITE

OXFORD ROAD (A44) ADJACENT TO SITE
High pressure sodium street light (~12m)
Illuminance: 4-26 lux

LOCATION B4

SHIPTON ROAD

OXFORD ROAD (A44) - NIGHT
High pressure sodium street light (~12m)
Illuminance: 2-16 lux

KEYPLAN:

ADJACENT AREA

ZONE C: EXISTING LIGHTING CONDITIONS

LOCATION C1

OXFORD ROAD (A44) ADJACENT TO SITE

OXFORD ROAD (A44) ADJACENT TO SITE - NIGHT
High pressure sodium street light (~12m)
Illuminance: 4-26 lux

LOCATION C2

SHIPTON ROAD

SHIPTON ROAD - NIGHT
No street light
Illuminance <1 lux

LOCATION C3

UPPER CAMPSFIELD ROAD
OXFORD INTERNATIONAL AIRPORT

UPPER CAMPSFIELD ROAD
OXFORD INTERNATIONAL AIRPORT - NIGHT
No street light
Illuminance 2 lux

LOCATION C4

WOODSTOCK ROAD
OXFORD INTERNATIONAL AIRPORT

WOODSTOCK ROAD
OXFORD INTERNATIONAL AIRPORT - NIGHT
No street light
Illuminance: <1 lux

KEYPLAN:

EXISTING SKY GLOW & LIGHT POLLUTION LEVELS

Current Sky Glow/Light Pollution (radiance) and Zenith Brightness maps have been obtained for the specific site location to aid with the assessment of existing site conditions.

Radiance is a measure of the light being emitted, reflected or transmitted from a surface. When combined with luminance, it can be referred to as 'brightness' of an area or surface.

Zenith brightness is the measurement of the brightness of the night sky and the noticeability of the stars to the observer.

Low zenith brightness indicates that the stars are not readily visible to an observer, as a consequence of light pollution reflecting and refracting off particles within the atmosphere above.

Greater brightness (radiance) of an area will result in higher sky glow/ light pollution and therefore decrease the zenith brightness

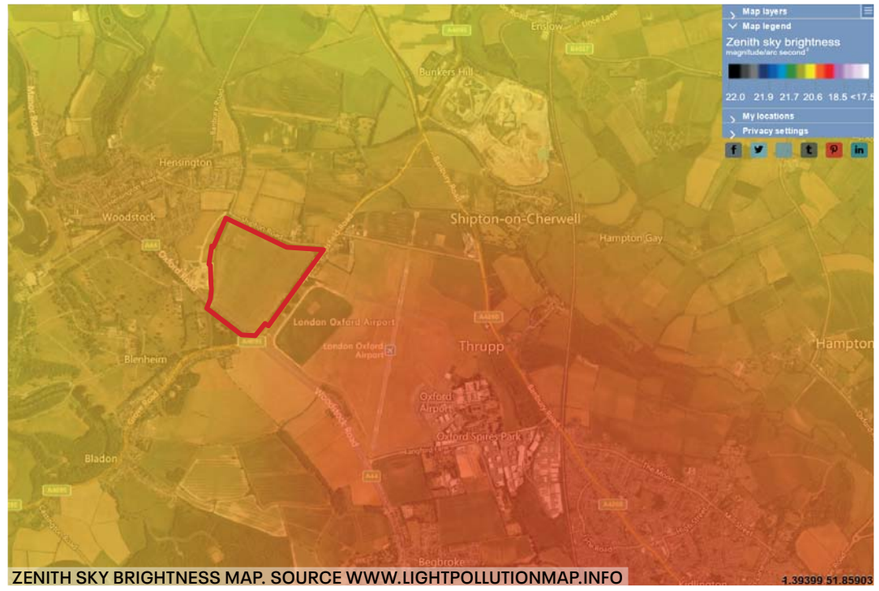
A baseline has been established utilising the Bortle Scale, which assesses the night sky's brightness on a nine-level scale.

"It quantifies the astronomical observability of celestial objects and the interference caused by light pollution"

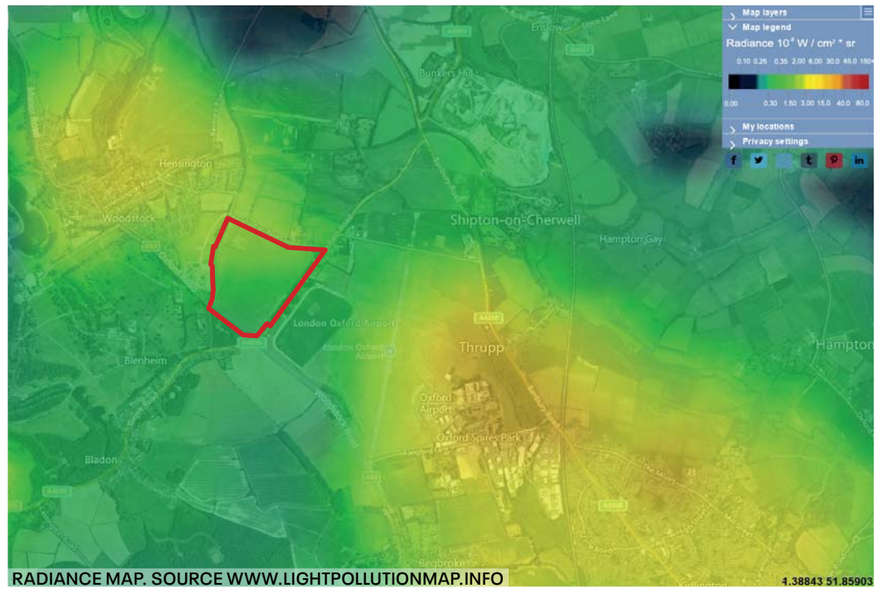
The Bortle scale was created to help astronomers evaluate the potential darkness of an observing site, and secondarily to compare the darkness of observing sites.

Its inclusion in this report aims to corroborate the observations and results obtained from the filed study with an alternative source of data.

Although it does not intend to be an exhaustive tool to assess lighting pollution, it has been deemed useful to illustrate the current site conditions with the use of radiance and zenith brightness maps.



ZENITH SKY BRIGHTNESS MAP. SOURCE WWW.LIGHTPOLLUTIONMAP.INFO



RADIANCE MAP. SOURCE WWW.LIGHTPOLLUTIONMAP.INFO

EXISTING SKY GLOW & LIGHT POLLUTION LEVELS

Based on the analysis tools from the site (www.lightpollutionmap.info) it can be established that the site is identified as being in level 4 of the Bortle scale.

It relates to the sky glow and brightness associated with rural/suburban transition areas. Where:

- Light pollution domes are visible in several directions.
- Sky is noticeable brighter than the terrain
- Clouds are faintly illuminated but dark overhead (zenith)
- The Milky Way, visible well above the horizon, is still impressive but lacks detail.
- Surroundings are clearly visible, even at a distance
- Zodiacal light is still visible but does not extend 45° above horizon at dusk or dawn.

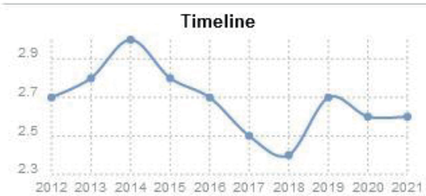
It is worth noting the description of the level 4 conditions above correlate with the observations as captured during the field study on 26/04/2022.

Zenith sky brightness info (2015)

Coordinates	51.84261, -1.33543
SQM	20.64 mag./arc sec^2
Brightness	0.600 mcd/m^2
Artif. bright.	429 µcd/m^2
Ratio	2.51
Bortle	class 4
Elevation	89 meters

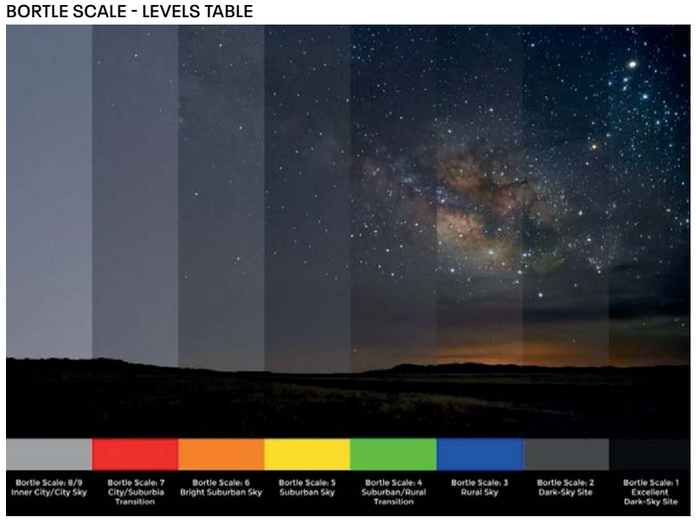
Radiance info (2020)

Coordinates: 51.84139, -1.33522
Value: 2.60
Elevation: 85 meters



Class	Color Key	Naked-eye Limiting Magnitude	Sky Description	Milky Way	Astronomical Objects	Zodiacal Light / Constellations	Airglow and Clouds	Night Time Scene
1		7.6 – 8.0	Excellent, truly dark-skies.	MW shows great detail and light from the Scorpio / Sagittarius region casts obvious shadows on the ground.	M33 (the Pinwheel Galaxy) is a obvious object.	Zodiacal light has an obvious color and can stretch across the entire sky.	Bluish airglow is visible near the horizon and clouds appear as dark blobs againt the backdrop of the stars.	The brightness of Jupiter and Venus is annoying to night vision. Ground objects are barely lit and trees and hills are dark.
2		7.1 – 7.5	Typical, truly dark skies.	Summer MW shouws great detail and has veined appearance.	M33 is visible with direct vision, as are many globular clusters.	Zodiacal light bright enough to cast weak shadows after dusk and has an apparent color.	Airglow may be weakly apparent and clouds still appear as dark blobs.	Ground is mostly dark, but objects projecting into the sky are discernible.
3		6.6 – 7.0	Rural sky.	MW still appears complex, dark voids and bright patches and meandering outline are all visible.	Brightest Globular Clusters are distinct, but M33 is only visible with averted vision. M31 (the Andromeda Galaxy) is obviously visible.	Zodical light is striking in Spring and Autumn, extending 60 degrees above the horizon.	Airglow is not visible and clouds are faintly illuminated, except at the zenith.	Some light pollution eveidnet along the horizon. Ground objects are vaguely apparent.
4		6.1 – 6.5	Rural / suburban transition.	Only well above the horizon does the MW reveal any structure. Fine details are lost.	M33 is a difficult object, even with averted vision. M31 is still readily visible.	Zodiacal light is clearly evident, but extends less than 45 degrees after dusk.	Clouds are faintly illuminated except at the zenith.	Light pollution domes are obvioused in several directions. Sky is noticeably brighter than the terrain.
5		5.6 – 6.0	Suburban sky.	MW appears washed out overhead and is lost completely near the horizon.	The oval of M31 is detectable, as is the glow in the Orion Nebula.	Only nints of zodiacal light in Spring and Autumn.	Clouds are noticibly brighter than the sky, even at the zenith.	Light pollution domes are obvioused to casual observers. Ground objects are partly lit.
6		5.1 – 5.5	Bright, suburban sky.	MW only apparent overhead and appears broken as flanter parts are lost to sky glow.	M31 is detectable only as a faint smudge; Orion Nebula is seldom glimpsed.	Zodiacal light is not visible. Constellations are seen and not lost against a starry sky.	Clouds anywhere in the sky appear fairly bright as they reflect back light.	Sky from horizon to 35 degrees glows with grayish color. Ground is well lit.
7		4.6 – 5.0	Suburban / urban transition.	MW is totally invisible or nearly so.	M31 and the Beehive Cluster are rarely glimpsed.	The brighter constellations are easily recognizable.	Clouds are brilliantly lit.	Entire sky background appears washed out, with a grayish or yellowish color.
8		4.1 – 4.5	City sky.	Not visible at all.	The Pleiades Cluster is visible, but very few other objects can be detected.	Dimmer constellations lack key stars.	Clouds are brilliantly lit.	Entire sky background has an orangish glow and it is bright enough to read at night.
9		4.0 at best	Inner city sky.	Not visible at all.	Only the Pleiades Cluster is visible to all but the most experienced observers.	Only the brightest constellations are discernable and they are missing stars.	Clouds are brilliantly lit.	Entire sky background has a broight glow, even at the zenith.

BORTLE SCALE - LEVELS TABLE



BORTLE SCALE - NIGHT SKY VISIBILITY

MASTERPLAN

KEYS:

1. New roundabout access from A 4095 Upper Campsfield Road
2. Community Square
3. Community Park
4. Green corridors
5. Central public open space
6. Green links
7. Gateway buildings
8. New link road, pedestrian / cycle link connecting to Park View primary street from the proposed development.
9. 3 m hogging path / cycle way connecting to A44 Oxford Road
10. 3 m hogging path / cycle way connecting to Bladon Roundabout
11. 2 m hogging path
12. Green wedges widening green corridor connections out to wider open spaces
13. Area of open space consisting of amenity grassland for informal recreation
14. Retained and enhanced woodland belts with infill tree planting and native scrub scalloped edges
15. New woodland planting
16. A wide expanse of parkland to retain open rural feel and setting to the WHS, consisting of species-rich limestone grassland and few scattered specimen parkland trees.
17. Improved setting to Blenheim Villa scheduled monument with potential for public art
18. Retained Heh Street as 2 m hoggin path
19. Small woodland groups to form sense of enclosure and soften the southern and western development edge and strengthen wildlife corridors
20. Ecological enhancements to retained native hedgerows with infill planting, hedgerow trees, native scrub edges and long grassland margins
21. Residential parcels with perimeter blocks

APPENDIX B

INDICATIVE LIGHTING STRATEGY

DESIGN PRINCIPLES

ECOLOGICAL CONSIDERATIONS

STREET TYPOLOGIES

LIGHTING HIERARCHY

ZONES OF DARKNESS

ROUTE LIGHTING: PRIMARY ROADS

ROUTE LIGHTING: SECONDARY ROADS

ROUTE LIGHTING: TERTIARY ROADS

ROUTE LIGHTING: SAMPLE CALCULATIONS

INTELLIGENT LIGHTING CONTROLS

CONCLUSION

INDICATIVE LIGHTING STRATEGY

DESIGN PRINCIPLES

The following principles should be adopted by lighting designers during the design stages of the project:

- Provide light appropriate for the task
- Avoid light spill and light pollution
- Consider the identified hierarchy of illuminance levels
- Use efficient luminaires and light sources
- Respect the dark areas of the site identified in the master plan
- Use intelligent lighting control systems
- Avoid potential hazard to the adjacent airport
- Consider ecological impacts

Electric light should only be used where necessary on the site in order to provide lighting for safety, security and amenity.

Amenity areas and roads with a greater amount of traffic should be lit to higher levels of illuminance than the quieter residential areas. A hierarchy of illuminance levels is defined in Section 11.

High efficiency optically efficient pole top luminaires with a shielded downward light distribution should be utilised throughout the development. The use of opalescent luminaires or luminaires which have light distribution above the horizontal plane should be avoided.

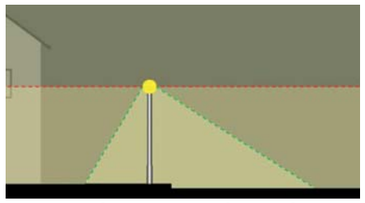
The scale of the street lighting columns specified should be significantly smaller than the existing street lighting columns used on the adjoining "A" roads and in keeping with the rural character of the development as a whole.

Good colour rendering LED light sources (Ra80 and above) mounted within optically efficient reflectors should be specified. The luminaires should have an appropriate light distribution for each application and avoid light spill into surrounding areas.

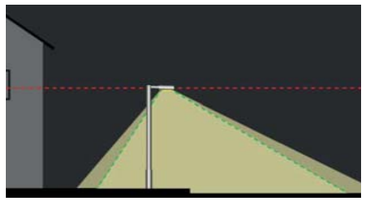
The task area should be lit to suitable levels of illuminance and uniformity as detailed in the lighting master plan.

Flat glass luminaires should be specified and anti-glare cowls and louvres use where necessary.

Significant parts of the site should remain unlit at night in keeping with intrinsically rural character of the development on the surrounding area.



LUMINAIRES THAT EMIT LIGHT ABOVE THE HORIZONTAL PLANE SHOULD NOT BE USED.



LUMINAIRE WITH EFFICIENT DOWNWARD LIGHT DISTRIBUTION

DIMMABLE LED STREET LIGHTS WITH CONTROLLED DOWNWARD LIGHT DISTRIBUTION.

LUMINAIRES UTILISE OPTICALLY EFFICIENT STREET LIGHTING OPTICS TO MINIMISE LIGHT SPILL AND MAXIMISE EFFICIENCY

DIMMABLE LED STREET LIGHTS PROVIDE HIGHER LEVELS OF ILLUMINANCE WHEN TRAFFIC FLOW IS GREATER.

DIMMABLE LED STREET LIGHTS ALLOW ILLUMINANCE LEVELS TO BE REDUCED LATER IN THE EVENING.

INDICATIVE LIGHTING STRATEGY

ECOLOGICAL CONSIDERATIONS

The project ecologist has identified existing bat foraging and commuting routes across the site as part of the Environmental Impact Assessment.

There is a primary route running from the south to the north along existing hedgerows and a secondary route running from east to west as shown on the adjacent diagram. These routes must remain dark in order to avoid disturbance to bat foraging activity. Ideally levels of illuminance should not exceed illuminance levels achieved under a full moon i.e. no greater than 0.5Lux.

For the north/south corridor it is suggested that a continuous dark zone should be created on the site. This could be achieved by planting a hedgerow which would shield light spill from the surrounding areas of the site. The introduction of berms and other landscape features can assist in maintaining a dark zone for the commuting and foraging bat population.

A detailed study has been undertaken to ascertain the levels of illuminance in the vertical plane above the illuminated road surface.

5 metre tall lighting columns utilising LED luminaires with an efficient street lighting optics are proposed to illuminate the primary road. The columns are mounted in a staggered arrangement 15 metres apart.

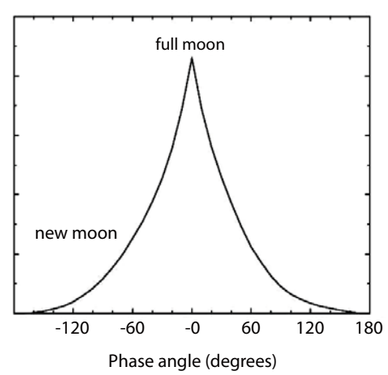
The horizontal illuminance levels achieved on the road surface are in accordance with BS5489.

A vertical calculation surface was inserted in the computer model of the primary road, extending across the full width of the road up to a height of 15 metres from ground level. Illuminance values in the vertical plane were measured. It is estimated that levels of illuminance at 4-5 metres from ground level, at the mid point between lighting columns, are similar to that of the full moon. This is likely to be the height of the tree canopies adjacent to the main road.

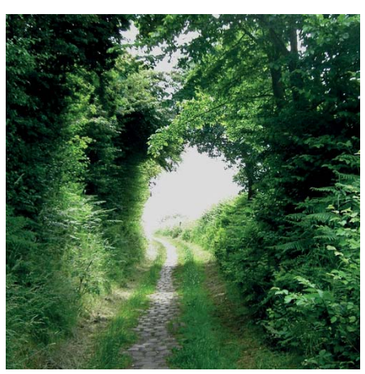
Contd/....

A COMMON PIPISTRELLE BAT IN FLIGHT

THE LOCATION OF EXISTING BAT COMMUTING ROUTES IDENTIFIED IN THE ENVIRONMENTAL IMPACT ASSESSMENT.
PRIMARY ROUTE IN NORTH - SOUTH DIRECTION. SECONDARY ROUTE



EARTH SURFACE ILLUMINANCE FROM THE MOON.



OVERHANGING TREE CANOPIES ENCOURAGE BAT FORAGING

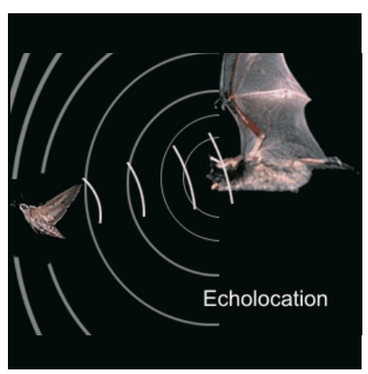


DIAGRAM SHOWING ECHO LOCATION TECHNIQUE OF BATS.

INDICATIVE LIGHTING STRATEGY

ECOLOGICAL CONSIDERATIONS

It is therefore recommended that clusters of trees should be planted at the intersection of the bat commuting route and the main road. The street lighting columns should be set out such that the mid-point between two lighting columns is aligned with the intersection with the bat commuting route.

The diagram opposite illustrates the vertical calculation surfaces used in the computer model and shows the height above the road surface at which acceptably low levels of vertical illuminance are achieved.

In addition, encouraging the tree canopies to grow over the carriageway will further assist in reducing light spill into the bat commuting route.

An alternative strategy which is often adopted in Europe is to simply not illuminate the affected areas of the site. However, initial calculations indicate that it is possible to illuminate the carriageway and achieve acceptably low levels of illuminance on the bat foraging route.

Key to Illuminance Values:

Bright Areas

Acceptable Areas

Dark Areas

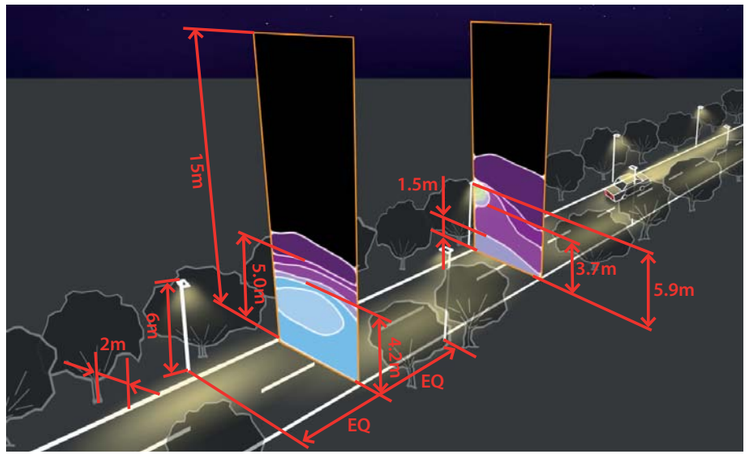


ILLUSTRATION SHOWING VERTICAL CALCULATION SURFACE INSERTED INTO DIALUX COMPUTER MODEL.
(NOTE: FALSE COLOUR RENDERING SHOWS ACCEPTABLE LEVELS OF ILLUMINANCE ABOVE 4.5 METRES)

SKETCH CROSS SECTION SHOWING PROPOSED HEDGEROW WHICH CREATES A DARK COMMUTING ROUTE FOR BATS

SKETCH CROSS SECTION OF "PRIMARY ROAD" AT BAT CORRIDOR

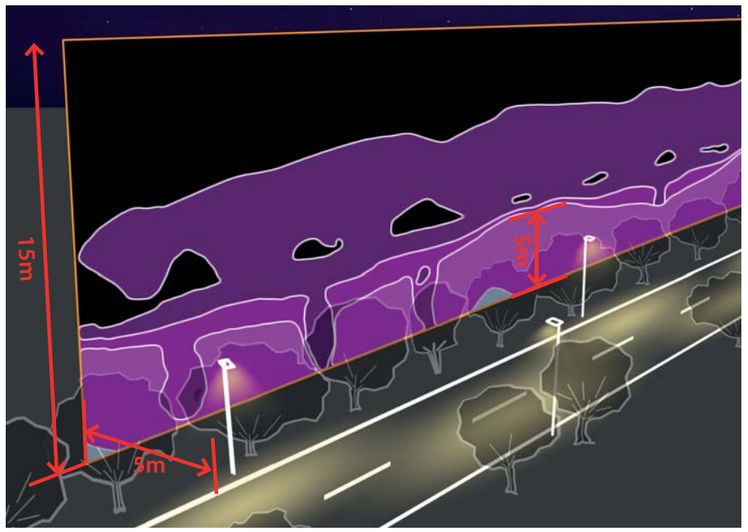


ILLUSTRATION SHOWING VERTICAL CALCULATION SURFACE INSERTED INTO DIALUX COMPUTER MODEL.
(NOTE: FALSE COLOUR RENDERING SHOWS ACCEPTABLE LEVELS OF ILLUMINANCE ABOVE 5 METRES)

INDICATIVE LIGHTING STRATEGY

STREET TYPOLOGIES

It is suggested that roads are classified as either "primary", "secondary" or "tertiary" and different illuminance levels and lighting strategies developed for each. Generic luminaire types are suggested and sample calculations included in this appendix.

A hierarchy of "brightnesses" is proposed according to the uses of each space and it is proposed that significant parts of the site should be left unlit.

The local context and the potential impact on neighbouring properties have been considered in developing the indicative lighting strategy.

Legend:

- Primary Routes
- Secondary Routes
- Tertiary Routes
- Community Square
- Scheduled Monument
- Site Boundary

LIGHTING MASTER PLAN: IDENTIFIED TYPOLOGIES ON THE SITE

INDICATIVE LIGHTING STRATEGY

LIGHTING HIERARCHY

A hierarchy of brightnesses is proposed for Land East of Park View, with the more active areas of the site which have greater traffic flow and pedestrian use illuminated to relatively higher levels than areas which are quieter, such as the residential streets.

The Community Square and the primary route leading from the A4095 Upper Campsfield to Cowells Road should be illuminated to a higher level of illuminance relative to the other streets on the site.

The secondary routes leading from the central spine should be illuminated to a lower level. It is suggested that the residential streets identified as tertiary routes should be lit to the lowest levels of illuminance in the street lighting hierarchy.

Care must be taken to avoid potential hazard to pilots taking off and landing at the adjacent Oxford International Airport. No lighting should be specified that could be confused with airport signal lights, for example, blue taxiway lights. Lighting columns should not be arrayed in such a way that they might be confused with runway approach lighting i.e. columns should not be set out opposite each other, but in a staggered array. The use of high structures should also be avoided on the site.

THE USE OF LIGHTING THAT COULD BE CONFUSED WITH AIRPORT RUNWAY LIGHTING MUST BE AVOIDED ON THE SITE AT ALL TIMES.

Map Legend:

1. Primary Road
2. Secondary Road
3. Tertiary Road
4. Community Square

LIGHTING MASTERPLAN: HIERARCHY OF BRIGHTNESS

INDICATIVE LIGHTING STRATEGY

ZONES OF DARKNESS

It is proposed that significant areas of Land East of Park View should remain unlit.

Areas of darkness have been considered alongside the hierarchy of "brightnesses" proposed for the lit areas of the development.

The existing trees and hedgerows at the perimeter of the development already create a dark boundary. The landscape design for the development is adding more trees and planting elements which will further enhance this feature of the site.

Identified bat commuting routes will be left dark. The central section of the site containing the scheduled monument will also be dark.

Residential gardens which comprise a large area of the site will also be dark at night.

The diagram opposite identifies the unlit areas of the development.

Map Legend:

- Dark boundary
- Bat corridor
- Unlit zone
- Low level lighting zone
- High level lighting zone
- Site boundary
- Bat commuting route

LIGHTING MASTERPLAN: DARK ZONES

INDICATIVE LIGHTING STRATEGY

ROUTE LIGHTING - PRIMARY ROADS

The primary route should be lit with good colour rendering LED street lights mounted onto 6 metre tall columns.

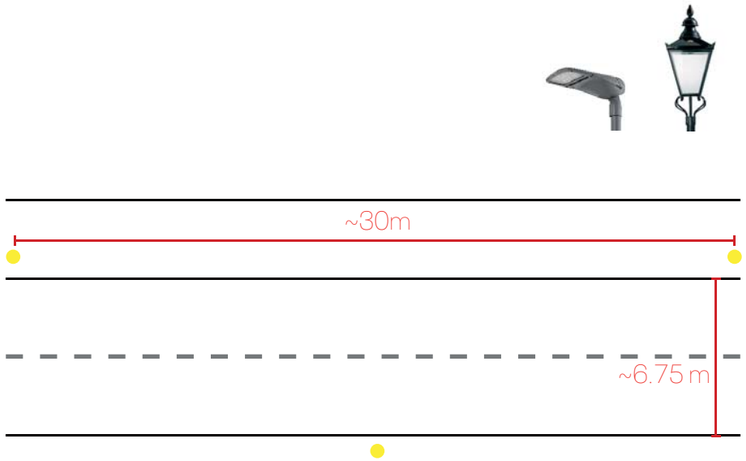
Possible luminaire types are shown opposite. The luminaires specified should have optically efficient street lighting optics with no light spill above the horizontal plane. The luminaire type should have consistence approach to the adjacent developments.

A staggered arrangement of columns is proposed as illustrated on the adjacent plan.

The use of an intelligent lighting control system is proposed as described on page 47

The colour finish of the lighting columns will have a significant impact on the daytime appearance of the scheme. If the installation is to be generally seen against the sky, then lighter colours such as Silver RAL9006 should be specified. Darker colours should be specified when the luminaires and lighting columns will be viewed against vegetation such as trees and hedgerows. (N.B. The final specification of all luminaires is subject to the approval of the local authority).

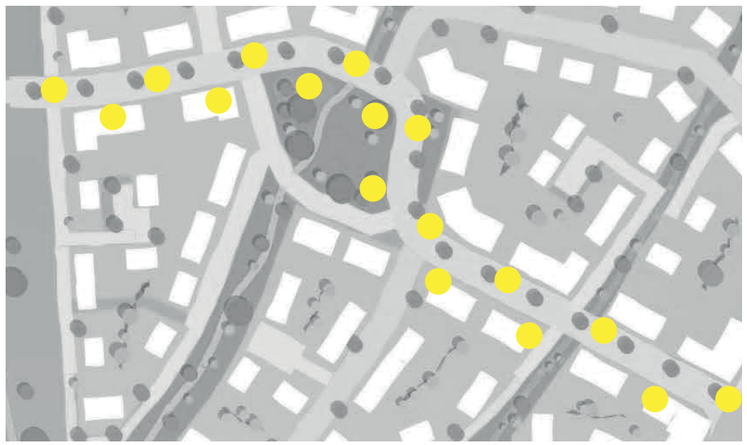
Sample illuminance calculations are included on page 46.



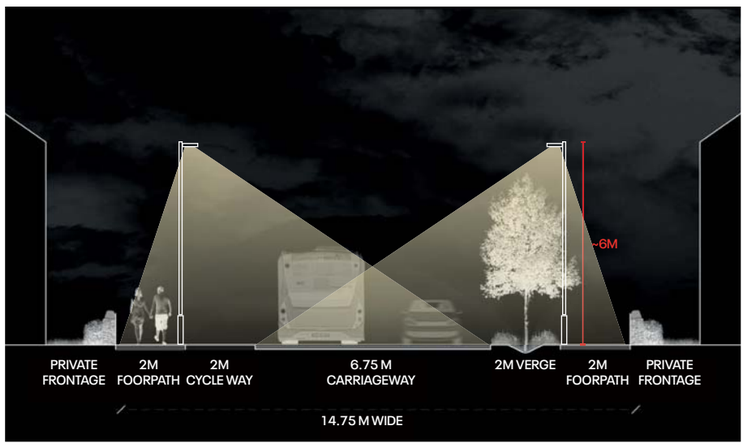
INDICATIVE LUMINAIRE TYPES AND SUGGESTED MOUNTING ARRANGEMENT.

COLUMN POSITIONS COORDINATED WITH TREE LOCATIONS

ROAD SURFACE ILLUMINATED WITH MINIMAL LIGHT SPILL INTO SURROUNDING AREAS.



SKETCH PLAN SHOWING LIGHTING ARRANGEMENT



SKETCH CROSS-SECTION OF PRIMARY ROAD SHOWING INDICATIVE LIGHT DISTRIBUTION FROM LUMINAIRES.

INDICATIVE LIGHTING STRATEGY

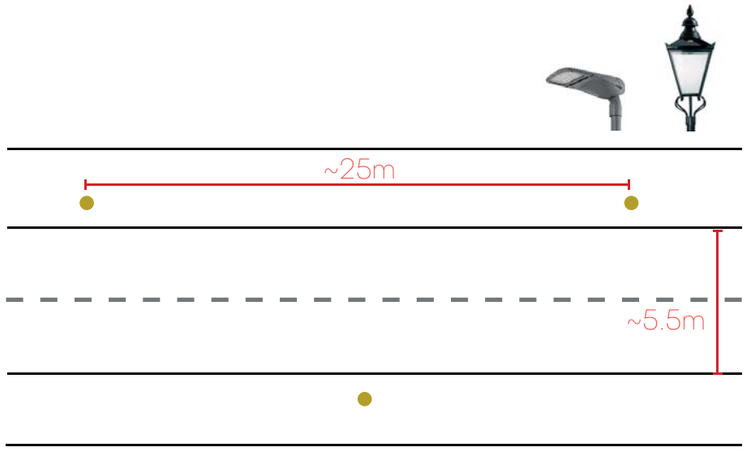
ROUTE LIGHTING - SECONDARY ROADS

The secondary routes should be lit with good colour rendering LED street lights mounted onto 6 metre tall columns, as proposed for the primary road.

Indicative luminaire types are shown opposite. The luminaires specified should have optically efficient street lighting optics with no light spill above the horizontal plane. (N.B. The final specification of all luminaires is subject to the approval of the local authority).

The use of an intelligent lighting control system is proposed. See page 47.

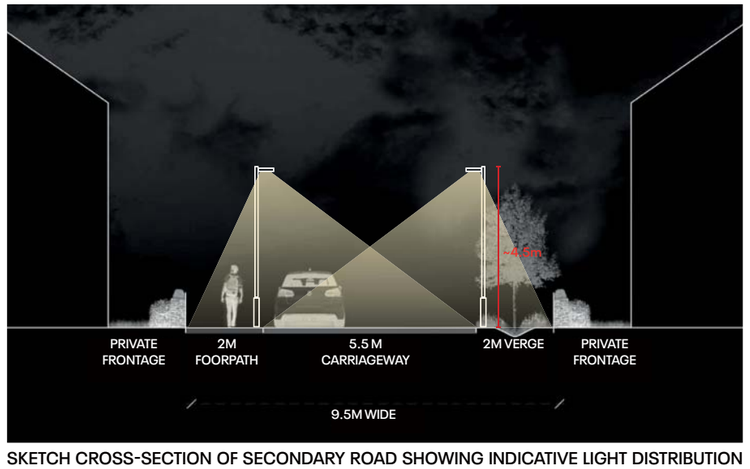
Sample illuminance calculations for the secondary routes are included on page 46.



INDICATIVE LUMINAIRE TYPES AND SUGGESTED MOUNTING ARRANGEMENT.

LIGHTING COLUMNS INSTALLED ON ONE SIDE OF THE SECONDARY ROUTES.

SKETCH PLAN SHOWING LIGHTING ARRANGEMENT FOR SECONDARY



SKETCH CROSS-SECTION OF SECONDARY ROAD SHOWING INDICATIVE LIGHT DISTRIBUTION FROM LUMINAIRES.

INDICATIVE LIGHTING STRATEGY

ROUTE LIGHTING - TERTIARY ROADS

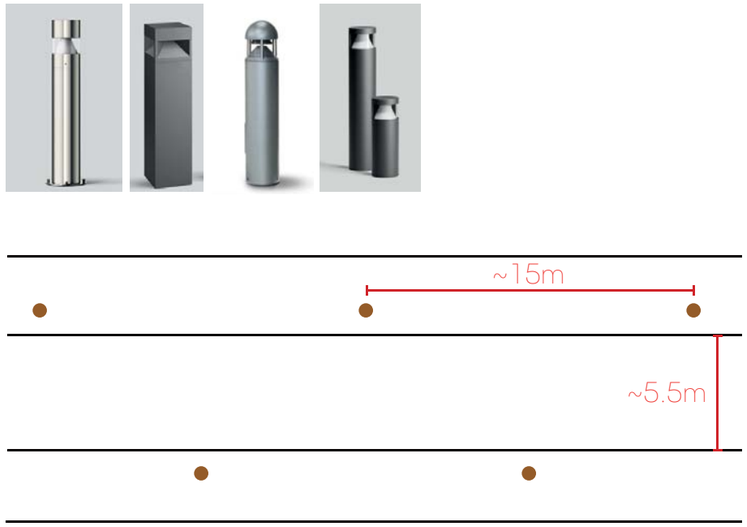
The residential streets will have much less traffic during the hours of darkness than the primary and secondary routes on the site.

It is therefore proposed that lighting bollards with an optically efficient downward light distribution are used in these tertiary areas.

Indicative luminaire types are shown opposite. Luminaire locations should be coordinated with planting elements and the landscape design of each street. (N.B. The final specification of all luminaires is subject to the approval of the local authority).

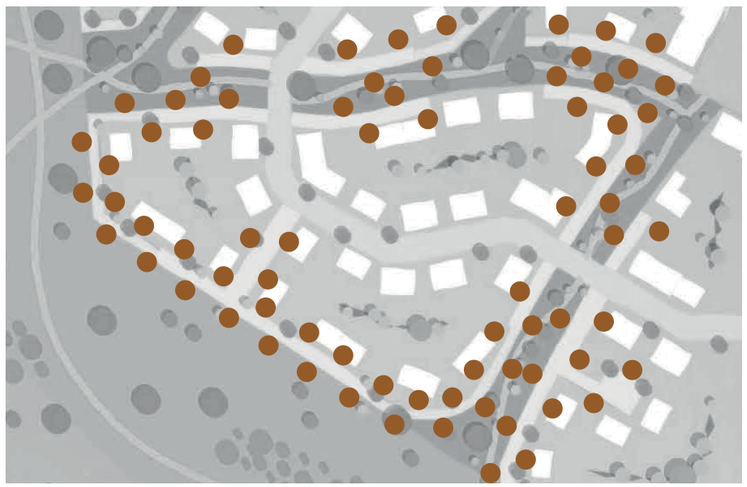
The use of an intelligent lighting control system is proposed as described on Page 47.

Sample illuminance calculations for the tertiary roads are included on page 46.

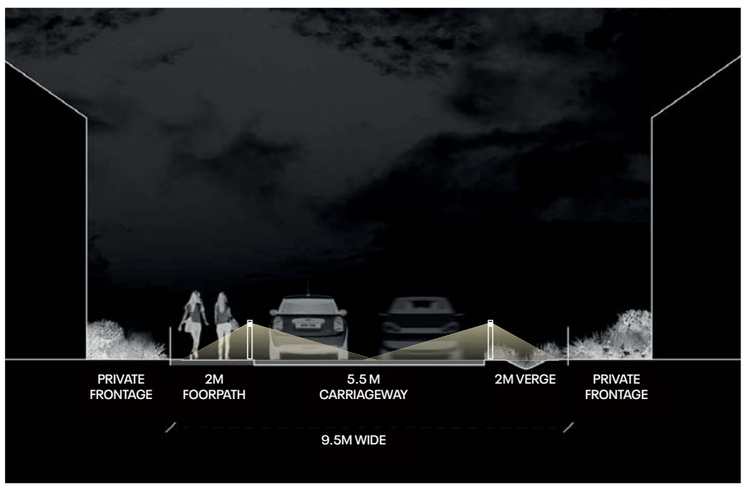


INDICATIVE LUMINAIRE TYPES AND SUGGESTED MOUNTING ARRANGEMENT.

PRECEDENT PROJECT UTILISING LIGHTING BOLLARDS IN RESIDENTIAL AREA.



SKETCH PLAN SHOWING LIGHTING ARRANGEMENT FOR TERTIARY ROADS



SKETCH CROSS-SECTION OF TERTIARY ROAD SHOWING INDICATIVE LIGHT DISTRIBUTION FROM LUMINAIRES.

INDICATIVE LIGHTING STRATEGY

ROUTE LIGHTING - SAMPLE CALCULATIONS

Sample illuminance calculations have been undertaken for sections of the primary, secondary and tertiary routes using high efficacy street optic luminaires and bollards for tertiary routes.

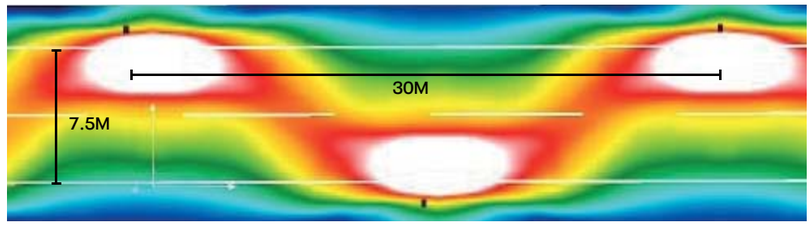
The design illuminances used have were determined by using the methodology published in BS 5489-1:2020 "Code of practice for the design of road lighting. Lighting of roads and public amenity areas". and BS 13201-2:2015 "Road Lighting: Performance requirement"

The target illuminance and uniformity values are summarised in the table below, alongside the actual calculation results.

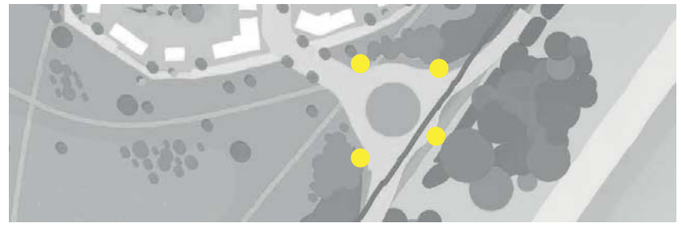
Illuminance levels (lux)

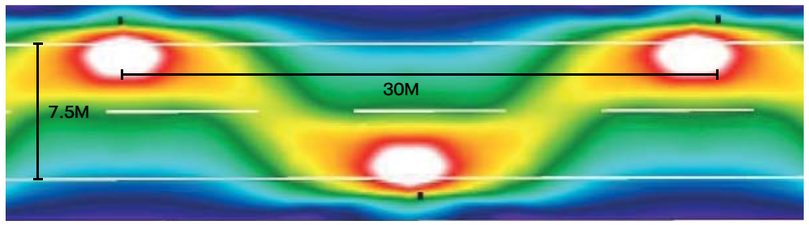
- +20 lux
- 17.5 lux
- 15 lux
- +12.5 lux
- 10 lux
- 7.5 lux
- 5 lux
- 2.5 lux
- 0 lux

BRITISH STANDARDS				
STREET LIGHTING				
	Ave. Illuminance	Min. Illuminance	Uniformity	Disability Glare
Roundabout	15 lux	2 lux	0.4	0.2
Result	15 lux	9 lux	0.6	0.14
Primary Road	10 lux	3 lux	-	0.25
Results	12 lux	7 lux	0.6	0.14
Secondary Road	6.5 lux	2 lux	-	0.3
Results	10 lux	5 lux	0.5	0.22
Tertiary Road	4 lux	1.2 lux	-	0.3
Results	6 lux	1.7 lux	0.27	0.25



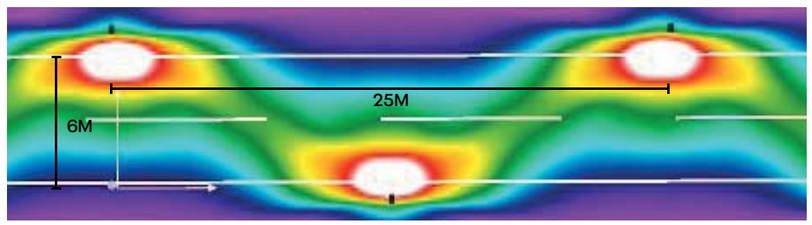
ROAD SURFACE ILLUMINANCE : ROUNDABOUT


PRIMARY ROUTE PLAN



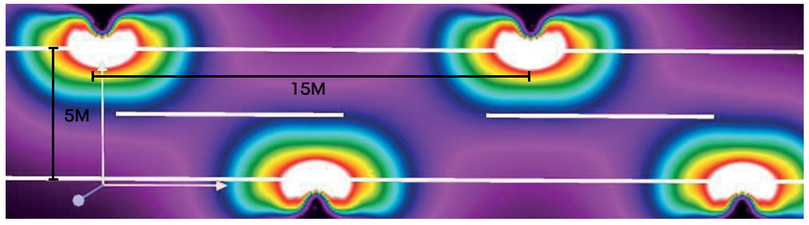
ROAD SURFACE ILLUMINANCE : PRIMARY ROUTE


PRIMARY ROUTE PLAN

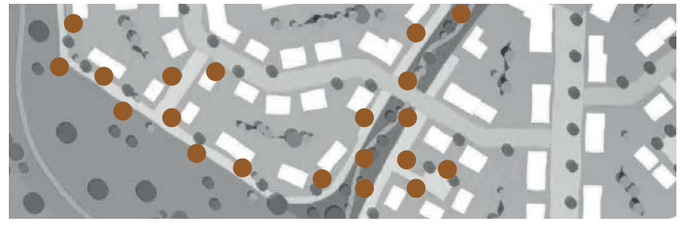


ROAD SURFACE ILLUMINANCE : SECONDARY ROUTE


SECONDARY ROUTE PLAN



ROAD SURFACE ILLUMINANCE : TERTIARY ROUTE


TERTIARY ROUTE PLAN

INDICATIVE LIGHTING STRATEGY

INTELLIGENT LIGHTING CONTROLS

The use of LED light sources in exterior lighting systems is already widespread in the UK. This use of electronics provides significant new opportunities for innovative lighting controls and real-time monitoring of external lighting systems.

As an exemplar development of it's type, it is proposed that Land East of Park View should adopt this technology.

Internet based street lighting management systems can adapt lighting levels to traffic patterns and the time of day. The lighting control system can also provide automatic notifications of faults and luminaire failures.

The use of high efficiency LED luminaires in combination with intelligent lighting controls will substantially reduce energy use overall, ensuring that Land East of Park View is a sustainable development.

Many street lighting manufacturers now offer this technology as a standard specifiable option with minimal additional cost.

SITE PLAN: EXTERIOR LIGHTING IN "ACTIVE" MODE

DIAGRAM: EXTERIOR LIGHTING IN "ACTIVE" MODE

SITE PLAN: EXTERIOR LIGHTING IN "DORMANT" MODE

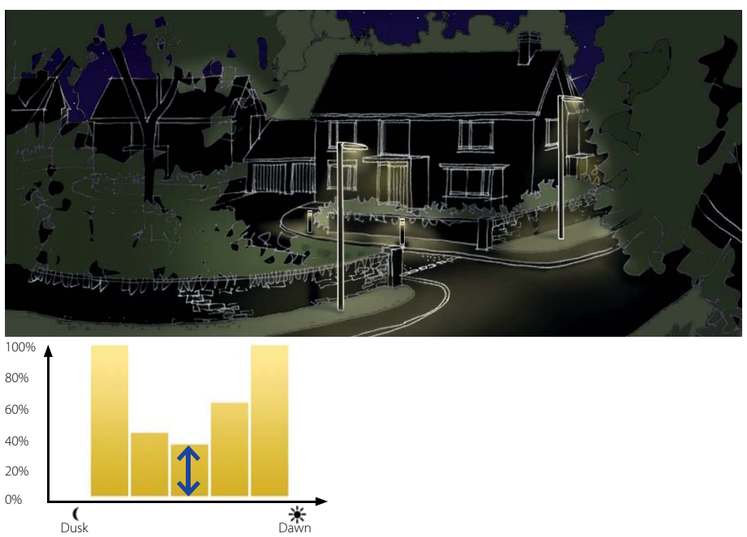


DIAGRAM: EXTERIOR LIGHTING IN "DORMANT" MODE

EQUATION

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QA SYSTEM

REVISION NO:	P4
REVISION DATE:	30.05.2022
REASON FOR ISSUE:	FOR PLANNING SUBMISSION
FILENAME:	3081_Plot PR10_Lighting Assessment_Final
CLIENT NAME:	BLENHEIM ESTATE HOMES
PREPARED BY:	SS/JR
VERIFICATION BY:	KM
PROJECT COORDINATOR:	KM