

Dark skies guidance

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Introduction

Supporting the Norfolk Coast National Landscape (NCNL) Management Plan, this guidance is designed to empower those living and working within and/or around our protected landscapes to understand the importance of dark skies within the NCNL and the impact that light pollution can have on this. This document also sets out why action is needed and what resources are available to support.

Purpose of this guidance:

- Provide clear guidance for understanding and protecting dark skies on the Norfolk coast
- Empower people to act for the protection of dark skies
- Provide best practice examples for lighting different types of development
- Support the Norfolk Coast National Landscape's (NCNL) special qualities through the protection of dark skies

Aimed at:

- Developers
- Planners
- Decision-makers
- Public

Please note: this guidance does not advocate banning artificial lighting but seeks to ensure the correct lighting is in the right place at the right time with the right controls.

The need for protecting dark skies

Dark skies are a defining part of the Norfolk coast. Access to dark skies gives us the ability to connect with nature, evoking a sense of awe and wonder and creating a unique experience. However, the quality of our dark skies is threatened by the rise in artificial light at night (abbreviated as 'ALAN'). Development pressure around the Norfolk coast can erode dark skies, contributing to the urbanisation of the countryside and adversely affecting the health of plants and animals, as well as the quality of life and sense of wellbeing for residents and visitors.

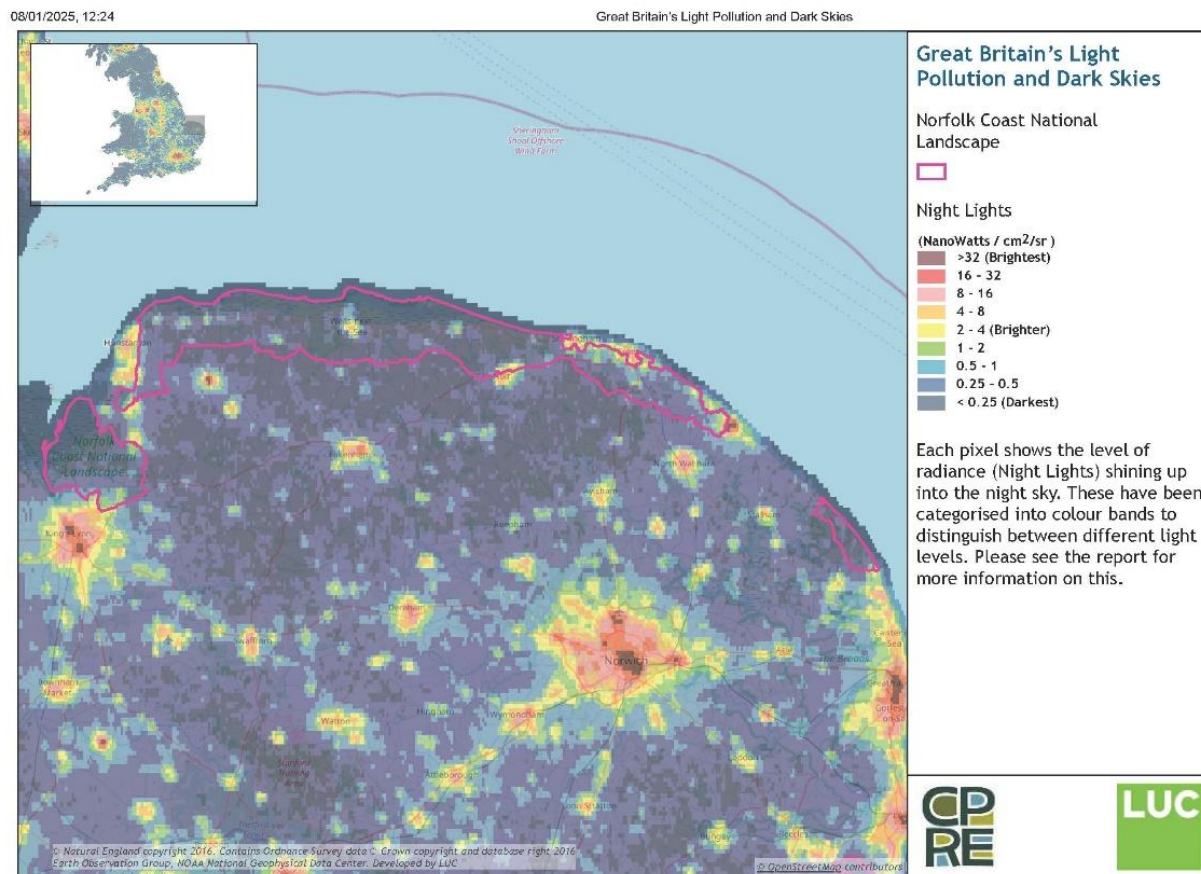
To safeguard our dark skies, this guidance document advocates for the following principles:

- Avoid lighting, unless it is necessary and justifiable

- Reduce existing and new light pollution through good design
- Mitigate any adverse impacts to the greatest reasonable extent

Dark skies in Norfolk

The Countryside Charity CPRE and Land Use Consultants (LUC) use VIIRS data to measure sky quality in the landscape. The map below shows the levels of light at night shining up into the night sky from the ground. Blue black areas show areas of good sky quality, where the Milky Way is visible. Notably, 53% of NCNL is within the highest category.



<https://www.cpre.org.uk/light-pollution-dark-skies-map/print.html?0|6792.618109717609,7708.46552377674,3356.5265057579672,3821.7455659632487,0|thB=1,th0=1,th1=0,th2=0,th3=0,th4=0,th5=0,th6=1,th7=0,th...> 1/1

What is light pollution?

According to [DarkSky International](#), light pollution has three main elements:

Sky Glow: This is the brightening of the night sky which is visible near the horizon in urban areas.

Glare: This is the uncomfortable brightness of a light source when viewed against a contrasting darker background.

Trespass/Intrusion: This is external light spilling where it is not intended or needed.



However, there is a fourth element that is relevant to protecting dark skies:

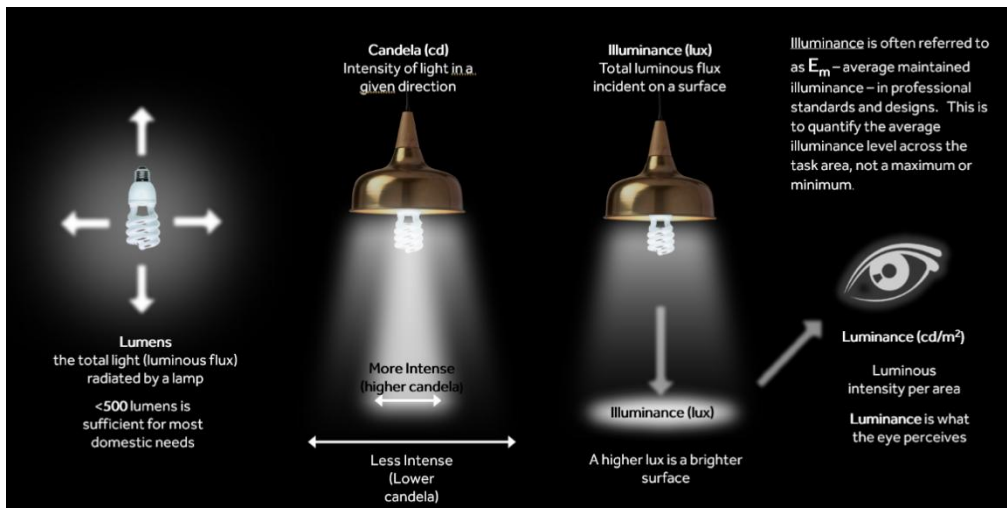
Presence: This is where the presence of light has an undesirable visual impact, particularly in a dark landscape. Even if a lighting scheme were designed to avoid sky glow, glare and trespass, there may still be significant impacts on sensitive landscapes and wildlife, simply due to the presence of artificial light.



Lighting metrics

The character and quality of light is measured using a number of metrics:

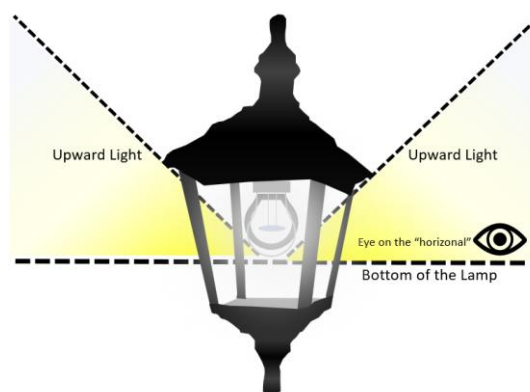
- **Lumens** is how much light from a source is emitted in all directions. Retailers will often state the lumens on the packaging. 500 lumens and less should be appropriate for most domestic purposes.
- **Candela** is the intensity of light in a given direction. It shows how bright the light source is and how far away the object can be seen. High levels of intensity in any direction could contribute to obtrusion and glare issues.
- **Lux** is the amount of light that falls on a surface and represents the illuminance (E) on the ground. Using the correct average illuminance (E_m) for tasks and activities is stated in professional guidance and standards and is key to user-safety and not over lighting.



- **Colour Correlated Temperature (CCT)** is measured in Kelvins (K) and describes the colour appearance of light. The higher the colour temperature, the bluer the light will appear. It is blue-white light that is particularly harmful to wildlife.



- **Upward Light Ratio (ULR)** is the percentage of light emitted upward from a luminaire (the lamp and the physical casing). ULR should be zero. It is often included on luminaire specifications or can be assessed with images or photometry (measuring visible light).



What is the impact of light pollution around the Norfolk coast?

Tranquillity

Tranquillity is a special quality of the NCNL and dark skies contribute to this quality. Areas with starry skies that are relatively free of light pollution contribute to the sense of remoteness and peacefulness in the area.

Wildlife

Light pollution affects wildlife by disrupting the natural functioning of habitats. A number of nocturnal species around the Norfolk coast are dependent on dark skies for feeding, including a variety of bat species, numerous species of night-flying moths (which are [UK Species of Principal Importance](#)), dormice, and other invertebrates, all of which are vital for nature recovery.

Bats

As nocturnal specialists, all bat species are [susceptible to artificial light](#). Due to the decline in numbers, all are protected by the [Wildlife & Countryside Act \(1981\)](#). Lighting in the vicinity of bat roosts could cause disturbance and this would constitute an offence. Refer to the [ILP GN08/23 Guidance Note 8: Bats and Artificial Lighting](#) for specific case studies and recommendations for different types of lighting.

Birds

[Evidence shows](#) that artificial light can reduce sleep in birds, which can disrupt their natural breeding cycle. Birds can also be affected by changes in insect behaviour caused by artificial lights.

Invertebrates

Artificial light [significantly impacts invertebrates](#); it can reduce and fragment populations by disrupting feeding, breeding and movement. It can also reduce pollination rates by 62%. It is estimated that a third of insects that are attracted to lights will die as a result of their encounter.

Plants

Light pollution can disrupt a plant's ability to function naturally. It can affect flowering, dormancy and germination which can also impact pollination efficiency. Under artificial light, photosynthesis, the process by which plants produce oxygen and energy, is reduced and plants will suffer more stress.

Health and wellbeing

It has long been known that [light pollution can disrupt the circadian rhythms \(body clocks\) of people](#). While the impact of lights that shine directly into windows can be immediately understood, the general brightening of the sky can lead to further health issues. Blue-rich lighting (i.e. over 3000K) suppresses production of the hormone melatonin, de-regulating the sleep-wake cycle and thus the body's important repair mechanisms. Poor quality sleep can also lead to loss of attention and increased stress and fatigue.

Light pollution management

[The UK Planning Portal](#) provides guidance on when planning permission is required for lighting. For new developments or non-domestic uses, planning permission may be required.

Light itself and minor domestic fittings are not subject to planning controls but consideration should still be given as to the impacts of the artificial light being installed and whether better design could be utilised.

Development proposals will need to ensure that all relevant planning or lighting policies and other legislation are referenced within a design. The reduction of light pollution is achieved through a combination of:

- planning controls
- street lighting policies from Local Planning Authorities
- statutory duties requiring public bodies to protect NCNL
- legislation; including [Clean Neighbourhoods and Environment Act 2005](#) and [Wildlife and Countryside Act 1981](#)

To avoid impacts on wildlife:

- Do not allow light trespass or glare into ecologically sensitive areas
- Avoid up-lighting or illuminating trees and plants
- Survey area for bat and bird species
- Do not directly illuminate bat roosts, foraging areas, or bird nests
- Avoid illuminating water or reflective surfaces
- Use correlated colour temperature (CCTs) of less than 3000K, ideally 2200K which is the least impactful for invertebrates

Lighting policies

The Development Plans of the relevant Local Authorities within NCNL should be consulted to ensure that lighting is designed in accordance with the planning policy. These can be found below:

- [North Norfolk District Council](#)
- [Borough Council of King's Lynn and West Norfolk](#)
- [Great Yarmouth Borough Council](#)

Do I need a Lighting Designer?

For most minor development proposals, the advice of a specialist Lighting Designer will not be required.

The advice of a Lighting Designer may be required if the lighting needs are new, complex and/or involve a number of lights over different areas. Lighting Designers are often required in most commercial, road, sports and amenity cases, where a recommended level of illuminance needs to be calculated and provided.

Lighting checklist

To help assess the impacts of lighting proposals on dark skies, and to ensure that proposals minimise adverse impacts, the following checklist should be followed:

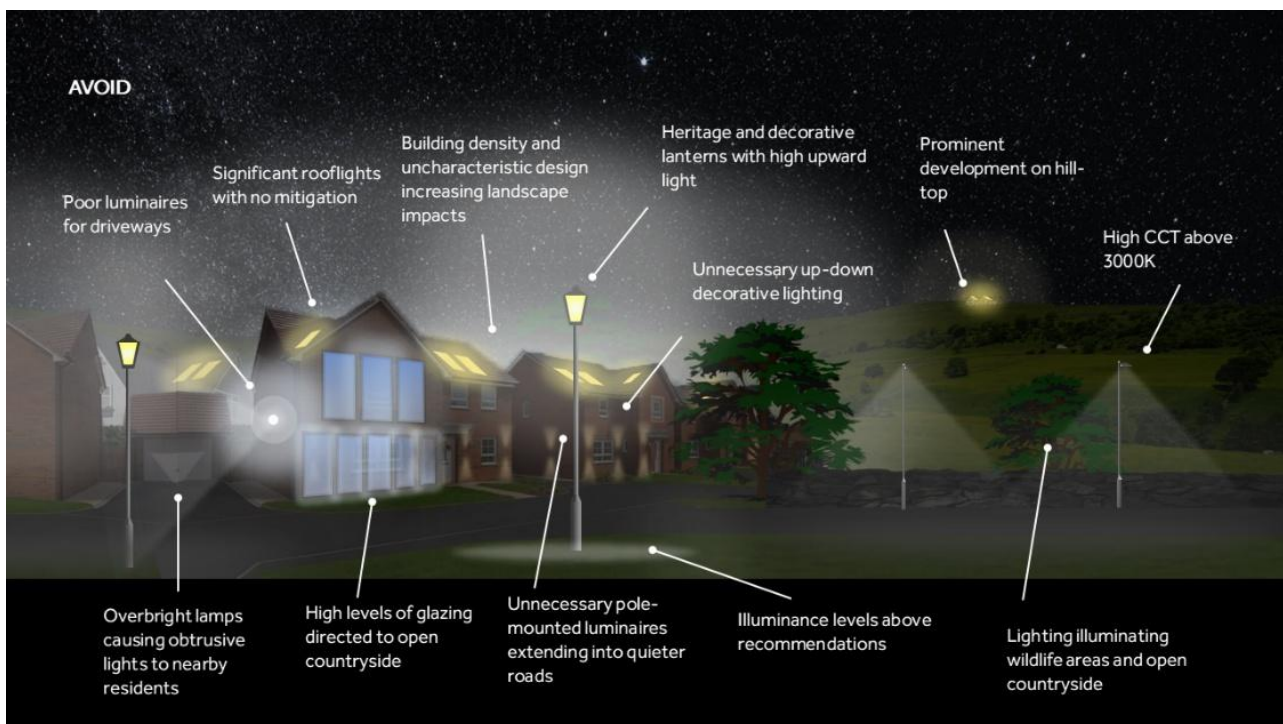
	Useful	■ Is the light needed? ■ Has the design fully justified the use of external lighting and is it appropriate for the area with a clear purpose and benefit? (the reasons should be clear and evident, and essential to the development e.g. access, safety and/or business needs) ■ Has unnecessary aesthetic and decorative lighting been avoided? ■ Is the proposed lighting appropriate in the landscape?
	Low Light	■ Do designs use lowest light levels to achieve illuminance for the task and reference relevant standards e.g. British Standards. ■ Are the fixings installed at the lowest possible height? ■ Are the fixings 'cut-off' or are baffles or shields provided, if necessary?
	Targeted	■ Light should be directed to where it is needed and not spill into neighbouring spaces, or in a direction that causes a nuisance to neighbours, wildlife or the night sky. Upward Light (ULR) should be zero. ■ Do the designs show that all light sources achieve zero upward light (0% ULR) ■ Do the luminaire specifications show compliance with images or photometry? ■ Does the design show that light does not intrude into neighbouring areas? ■ Has the local and wider landscape setting been considered in terms of visibility and impacts of lighting? — landscape features, existing vegetation — nearby sensitive wildlife sites or ancient woodland — introduction, or spread-of, lit elements ■ Has an obtrusive lighting compliance statement been submitted using Institution of Lighting Professionals guidance?
	Colour	■ Has colour temperature for each luminaire been provided? Warm coloured lights less than 3000K should be used to reduce impact on sky glow, wildlife and human health e.g Colour temperature should be ideally 2700K or lower, maximum 3000K. ■ Luminaires should avoid 500nm wavelengths i.e. lighting that emits an ultraviolet component or has a blue spectral content.
	Controls	■ Has information regarding the proposed timing / curfew for proposed lighting been submitted, including turning off lights when not required? ■ Can the controls be adjusted for changes in summer and in winter, and have they been chosen to minimise adverse impact on dark skies and nocturnal wildlife? ■ What are the proposed methods of control, e.g. automated timer or passive infrared sensor?

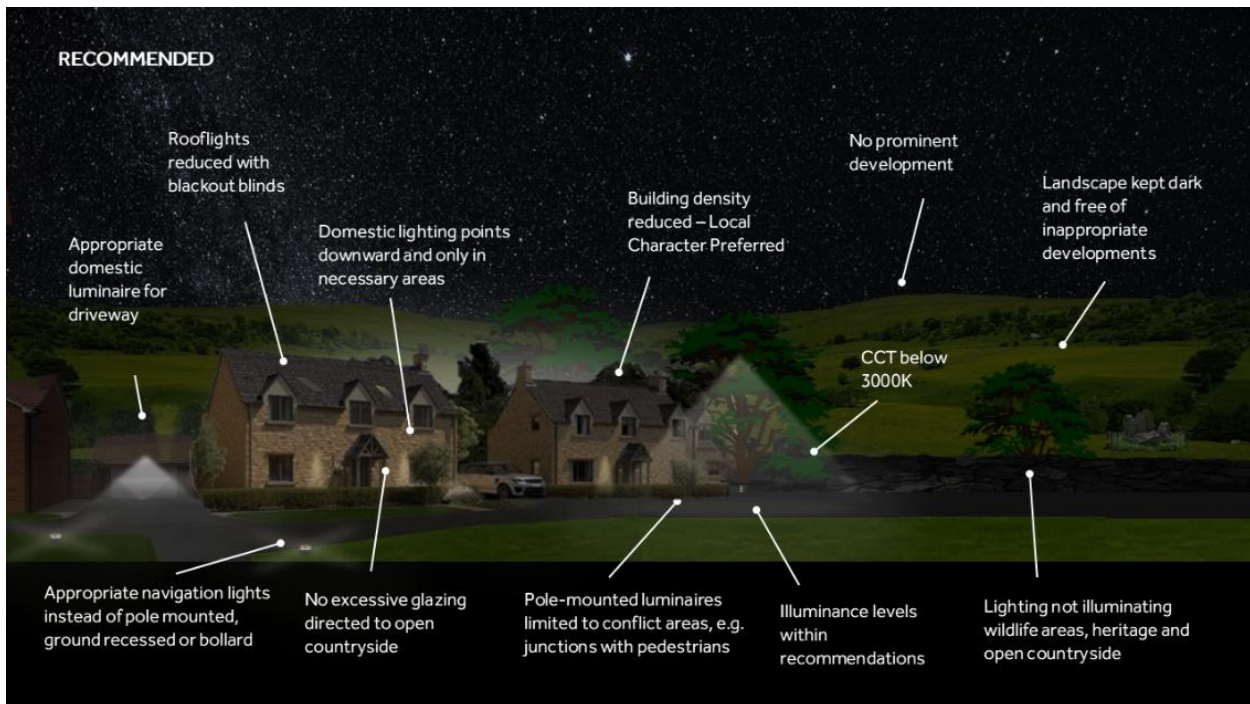
Lighting considerations for different development types

Residential housing

Key considerations

- The size, orientation and layout of any development should be carefully considered at the very earliest stages of site allocation or design to ensure that the need for higher levels of lighting and their prominence is avoided.
- Lighting and glazed surfaces should be oriented to reduce exposure into the wider open landscape.
- While Highways Authorities have a duty of care to the road user, there is no statutory requirement on UK Local Authorities to provide public lighting. New developments that require roads to have street lights should ensure that the relevant Highways Authority design guidance and policies are referenced.
- A colour temperature of 2700K is preferred for streetlights, with a 3000K maximum. This is achievable with many LED amenity lighting options and often will meet Colour Rendering Index (CRI) requirements. CRI requirements can often be achieved using this colour temperature without increasing lighting column numbers or raising energy levels significantly.





Internal light spill

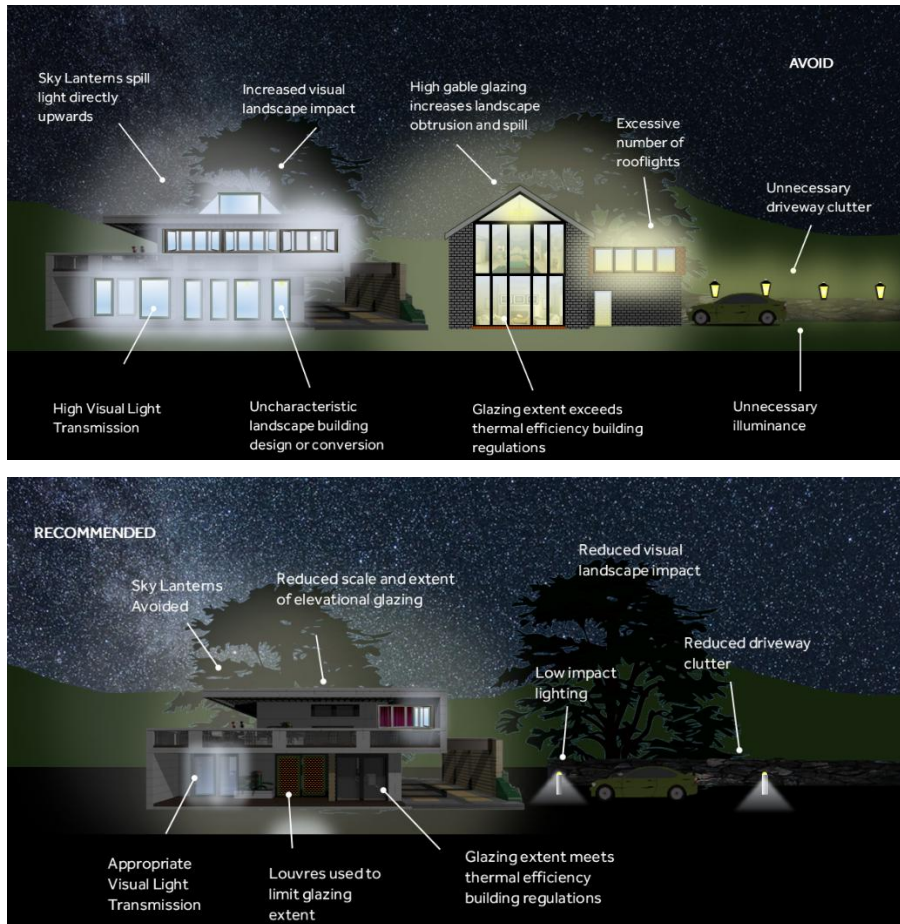
Internal light spill through domestic glazing can have a greater impact on the landscape than external lighting. If glazing is excessive, of poor quality, or points upwards such as rooflights, internal light can present obtrusive light sources that reduce dark skies and disrupt the continuity of the landscape.

Due to the difficulties of control with internal light spill, proposals should look to follow the following general design principles, in order of priority:

- avoid excessive glazing on elevations
- avoid the need for roof lights
- use appropriate visible light transmission
- mitigate with internal control systems

Key considerations

- Excessive glazing: Large continuous areas of glazing can cause obtrusive landscape impacts, particularly when glazing begins to exceed 50% of a single elevation normally fitted with multiple windows. Linear extents with high levels of internal lighting can be highly visible within a landscape, especially from view tops.
- Thermal regulation: Building regulations require that glazing should not exceed 25% of the floor area to meet energy efficiency standards (this does depend on thermal properties of the glass). [See Building Regulations Part L1.](#)
- Visible Light Transmission (VLT): VLT is the amount of light that passes through glazing (%). The VLT level can be selected to reduce the amount of internal spill. For domestic glazing, a VLT of $\sim 0.65 \pm 0.05$ is preferred. These values are within the standard purchasing options for these glazing types.
- Black out blinds: The use of automated black out blinds can considerably reduce the amount of internal light spill from roof lights and should be the last mitigation after other design considerations are met.



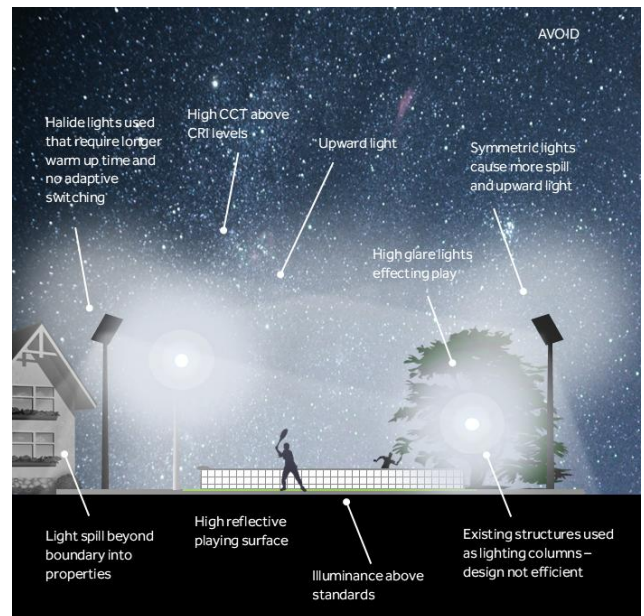
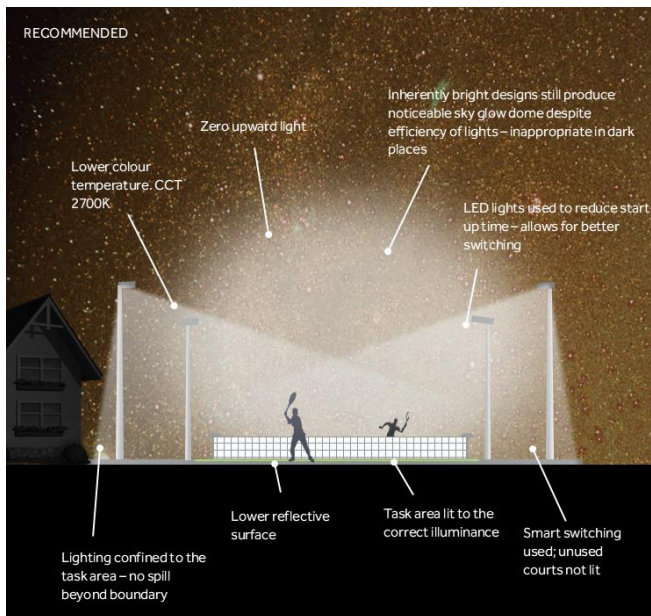
Sports

For most sports developments, the advice of a lighting designer will be required to ensure that the lighting is appropriate, and the level of illuminance is calculated.

N.B. Lighting requirements can be found in the [Sports England Artificial Lighting Guide 2012](#).

Key considerations

- Avoid nuisance to nearby residential areas by using [GN01 ILP \(2021\)](#) *'The reduction of obtrusive light'* which recommends maximum levels of intrusion into windows and boundaries.
- Use asymmetric optics luminaires to ensure light is directed to the playing surface as effectively as possible. They are designed to be installed flat and at the correct lowest height to reduce intensity and upward light.
- Use the lowest colour temperature to achieve appropriate lighting conditions for play. 3000K is achievable for most sports at community levels of competition.
- Illuminance levels should be within 10% of the recommended lux levels within relevant guidance and standards.
- Adopt a suitable curfew and switching off regimes to ensure light is off when not needed.
- Ensure that sports lighting does not introduce an inappropriate lighting presence into a darker area of the landscape.
- Ensure the level of play (and lighting requirements) are appropriate for the competitive level.

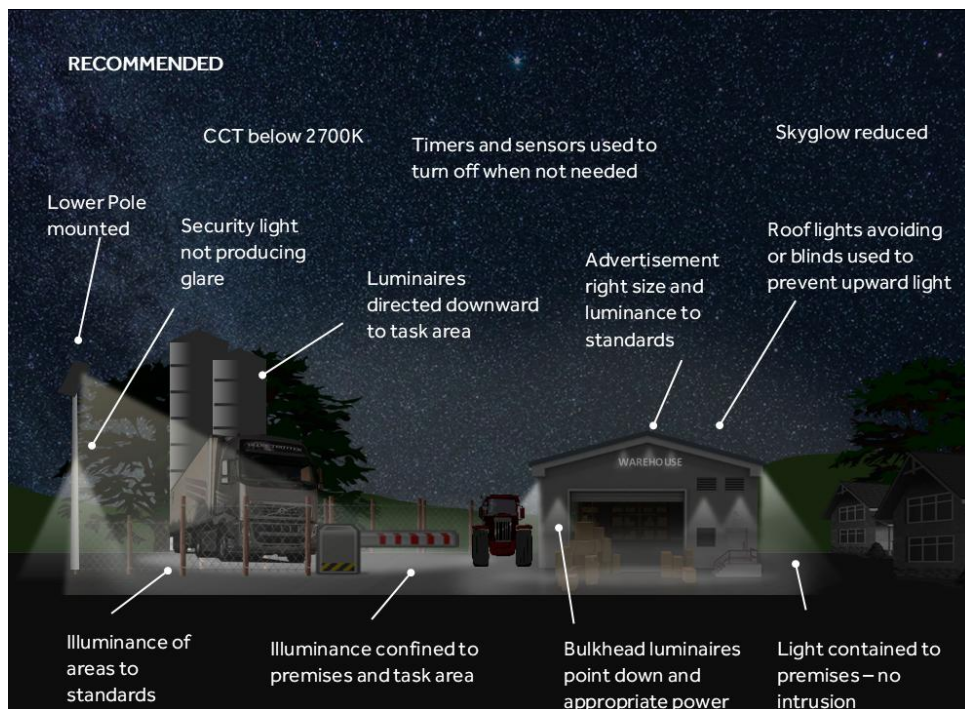
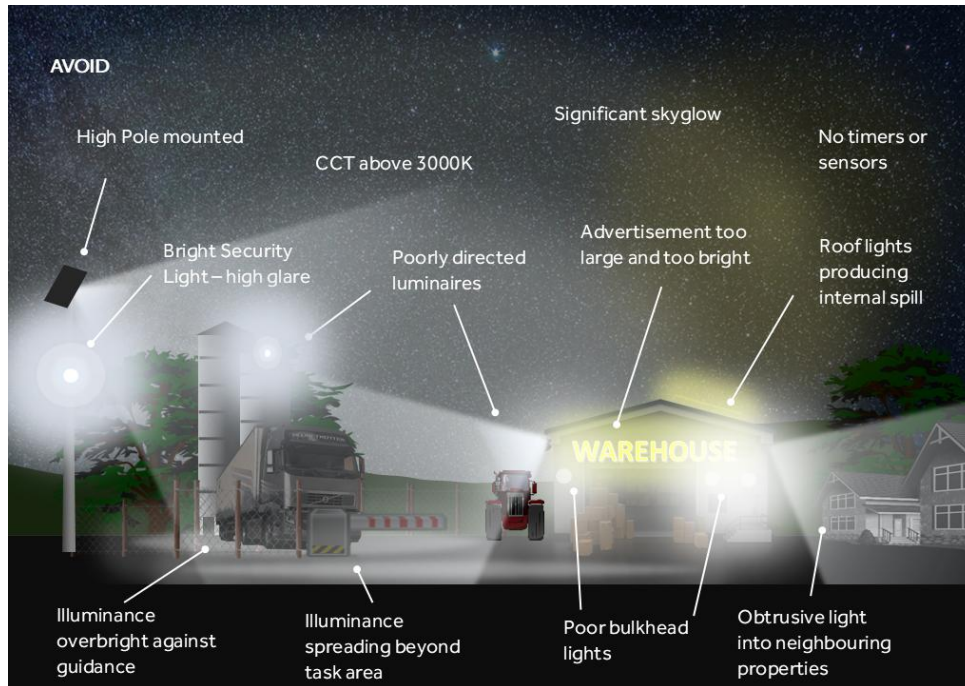


Commercial

Premises that have defined public and amenity areas, such as walk-ways, car parks or trip hazards should consult a lighting designer. Notably, the decision to use a lighting designer is the responsibility of the owner.

Key considerations

- Commercial areas should ideally use a lighting designer to ensure the level of light is appropriate for the purpose. Illumination levels for car parks, walkways, roads and access areas can be found in [BS EN 12464-2:2014](#).
- For smaller areas that use less lights, following the guidance in this document should be sufficient to ensure dark skies are protected. However, you must ensure there is enough light to mitigate any safety concerns – it is your responsibility to keep visitors and users safe.
- Aesthetic lighting should be avoided unless it is required for the business. Up-lighters or bright festoon (string) should be avoided, and any lights should be off at close of business.
- Illuminated adverts should comply with [The Town and Country Planning \(Control of Advertisements\) \(England\) Regulations 2007 \(legislation.gov.uk\)](#). They should ensure that the luminance does not exceed 100 candela per m², and ideally be a single colour, on dark backgrounds.
- Security is an important consideration for a rural business. While there is no direct evidence to show that lighting or lack of it has any effect on crime, the document [Secured By Design – Lighting Guide](#) gives general advice for this type of lighting.



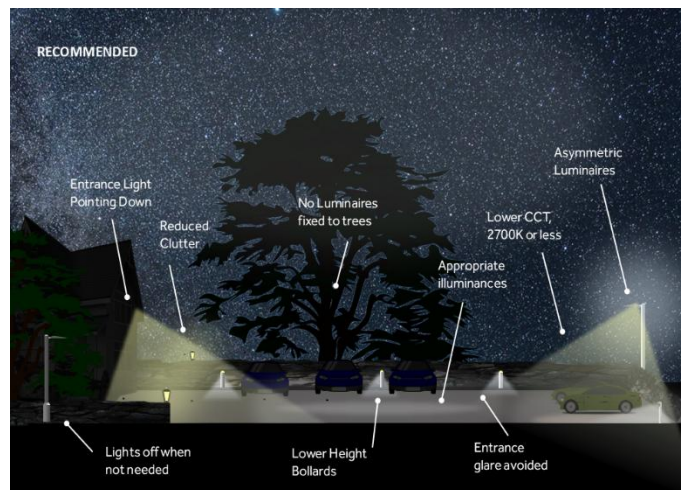
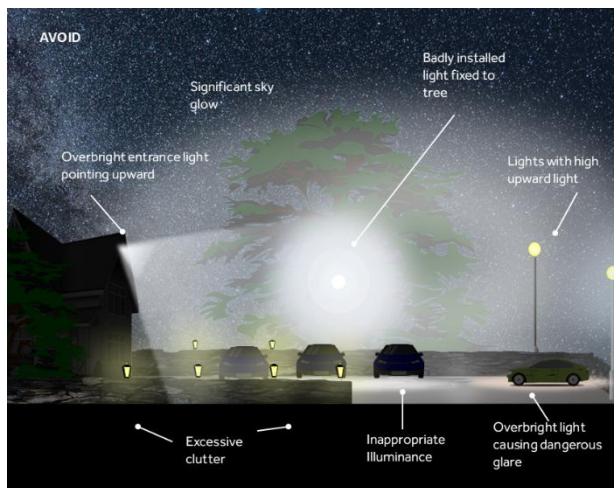
Car parks

Car parks should be illuminated where there is a clear need and ideally led by a risk assessment.

There is no legal requirement to use a Lighting Designer to meet [British Standard illuminance levels](#), but owners should be expected to provide sufficient lighting where there is a safety risk to users.

Key considerations

- Glare: Lights should be installed properly to ensure they do not cause glare to drivers in shared spaces. Pointing lights downwards and using better asymmetrical optics will help this.
- Over lighting: Illuminance levels should be appropriate for the level of use to avoid over lighting.
- Low level bollards or ground recessed lights are an acceptable alternative to pole mounted lights. They can be useful in providing illumination for navigation and general lighting. However, bollards can be susceptible to damage and they do not spread the light as effectively over larger areas as pole mounted lights. Bollards or low-level downward-directional lighting can also be damaging to nearby bat populations (see [ILP GN08](#)).
- British Standards set out there are three general usage levels of lighting for exterior car parks which are:
 - High usage/heavy traffic: 20 lux. Most applicable for large shopping centres, supermarkets or major sport complexes.
 - Medium usage/medium traffic: 10 lux. Most applicable for department stores, office buildings or sports centres.
 - Low usage/light traffic: 5 lux. Most applicable to shop parking, terraced and apartment houses and cycle parks.
- Passive Infra-Red (PIR) sensors can be used to ensure lights are off when not needed.
- Nearby trees should not be used as mounting points to avoid impacts on wildlife.

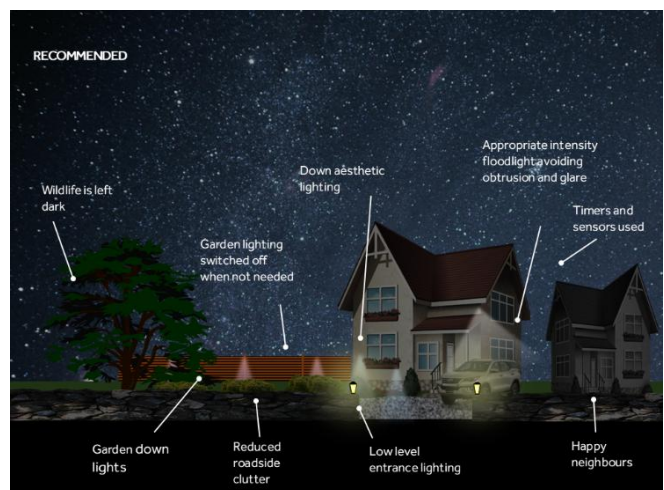
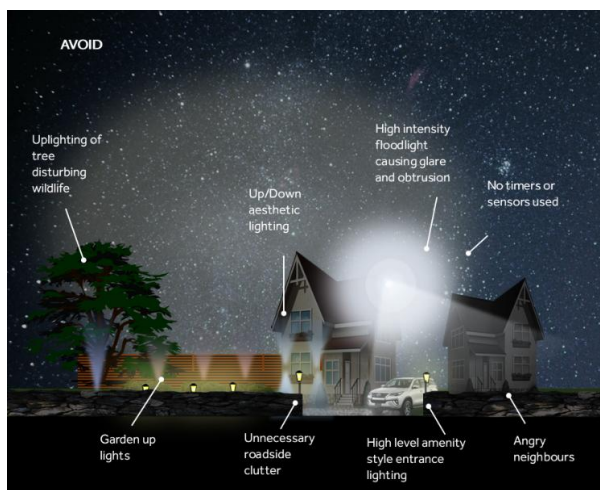


Call to Action

Domestic lights on existing buildings will generally not be subject to planning control, provided they are minor and do not require additional engineering infrastructure to install.

Key considerations

- **Neighbours:** Badly installed lighting can annoy your neighbours. To avoid this, purchase lights under 1000 lumens, ideally 500, point them downwards and away from other properties, and use proximity sensors to turn off when not needed.
- **Over lighting:** While it is tempting to get the best value, many domestic options are over bright and too powerful for most domestic uses. You do not need more than 1500 lumens and 500-1000 will be sufficient for most domestic uses. Residential streetlights operate at their lowest setting ~ 3000 lumens at a height of 5m, so bear this in mind when you install lights
- **Aesthetic lighting:** While it is accepted that exterior lights do change the look and feel of a building or garden, it is important to do this with the 'less-is-more' adage in mind. Mood lighting has a better impact when it can be clearly perceived and appreciated and not lost in unnecessary clutter.
- **Wildlife:** Up lighting of trees should be avoided to benefit wildlife, especially with lights over 500 lumens. If lighting is necessary, red coloured lights are less disruptive to wildlife compared to other colours. Ensure to turn off lights when not needed or install lights with proximity sensors.



Glossary

- **Lumen (or luminous flux)** - a unit of measurement that indicates how bright a source is.
- **Luminaire** - an electrical device that contains a light source and is used to provide artificial lighting in a specific area or space.
- **Luminance** - a measure of how bright light appears to the human eye.
- **Illuminance** - a quantity of how much light falls upon a surface. It is measured in lux (lx), or equivalently in lumens per square metre.
- **Photometry** - science of measuring visible light in terms of its perceived brightness to the human eye
- **Photosynthesis** - the process by which plants change the energy in sunlight to kinds of energy that can be stored for later use.
- **Colour Correlated Temperature (CCT)** - a gauge of how yellow or blue the colour of light from a light bulb appears, measured in the unit 'Kelvin'.

- **Colour Rendering Index (CRI)** - a quantitative measure of the ability of a light source to reveal the true colour of objects in comparison with a natural light source.
- **Light baffle (or louvre)** a component in a light fixture designed to minimise glare by directing light through a textured surface.
- **Upward Light Ratio (ULR)** - a measurement of the percentage of light emitted upwards from a luminaire. It is recommended the ULR be zero in developments.
- **Passive infrared sensor (PIR)** - an electronic sensor that can switch on light when movement is detected.

Further Reading

- [Institution of Lighting Professionals GN01/21 The Reduction of Obtrusive Light](#)
- [HSE – Lighting at Work HGS38](#)
- [Sport England – Design Guidance Notes: Artificial Sports Lighting](#)
- [Bat Conservation Trust and ILP: Bats and artificial lighting in the UK](#)
- [Towards a Dark Sky Standard](#)
- [Clean Neighbourhoods and Environment Act 2005 – Statutory Nuisance](#)
- [BSI - Light and lighting of workplaces: BS EN 12464-2:2014](#)
- [Illuminated Adverts Regulations](#)
- [Bat Conservation Trust and ILP: Bats and artificial lighting in the UK](#)