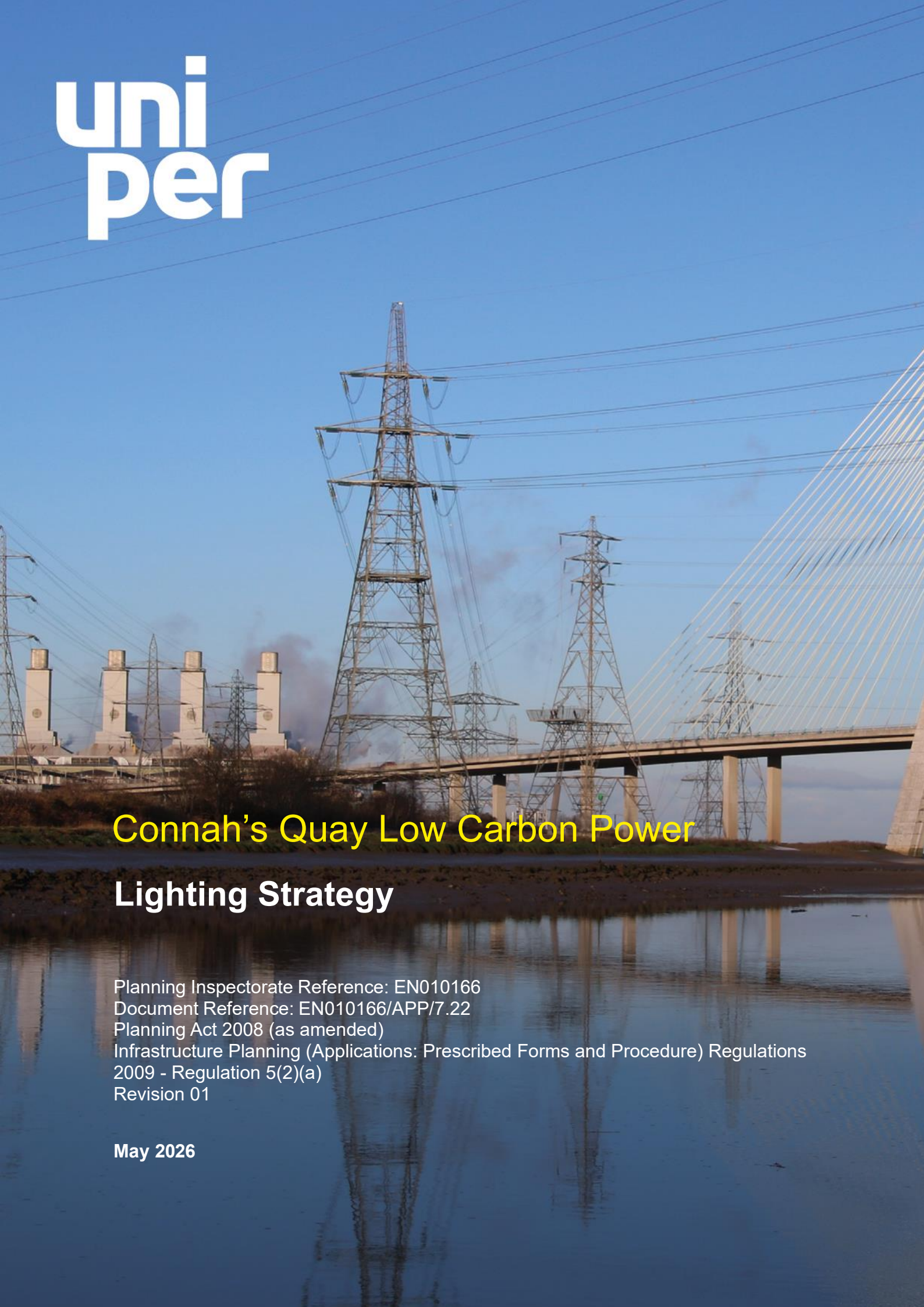

Connah's Quay Low Carbon Power

Lighting Strategy

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Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)
Revision 01

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Prepared for:
Uniper UK Limited

Prepared by:
AECOM Limited

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1. Introduction

1.1 Overview of the Proposed Development

1.1.1 The Applicant is a UK-based company, wholly owned by Uniper SE (Uniper) through Uniper Holding GmbH. Uniper is a European energy company with global reach and activities in more than 40 countries. With around 7,500 employees, the company makes an important contribution to security of supply in Europe, particularly in its core markets of Germany, the UK, Sweden, and the Netherlands. In the UK, Uniper owns and operates a flexible generation portfolio of power stations, a fast-cycle gas storage facility and two high pressure gas pipelines, from Theddlethorpe to Killingholme and from Blyborough to Cottam.

1.1.2 Uniper is committed to investing around €8 billion (~£6.9 billion) in growth and transformation projects by the early 2030s and aims to be carbon-neutral by 2040. To achieve this, the company is transforming its power plants and facilities and investing in flexible, dispatchable power generation units. Uniper is one of Europe's largest operators of hydropower plants and is helping further expand solar and wind power, which are essential for a more sustainable and secure future. Uniper is gradually adding renewable and low-carbon gases such as biomethane to its gas portfolio and is developing a hydrogen portfolio with the aim of a long-term transition. The company plans to offset any remaining carbon dioxide (CO_2) emissions by high-quality CO_2-offsets.

1.1.3 The Applicant is seeking a Development Consent Order (DCO) for the construction, operation (including maintenance) and decommissioning phases of a Connah's Quay Combined Cycle Gas Turbine (CCGT) with Carbon Capture Plant (CCP) (hereafter referred to as the Proposed Development), on land at, and in the vicinity of, the existing Connah's Quay Power Station (Kelsterton Road, Connah's Quay, Flintshire, CH6 5SJ), North Wales (the Order limits).

1.1.4 The Proposed Development would comprise up to two CCGT with CCP units (and supporting infrastructure) achieving a net electrical output capacity of more than 350 megawatts (MW; referred to as MWe for electrical output) and up to a likely maximum of 1,380 MWe (with CCP operational) onto the national electricity transmission network.

1.1.5 Through a CO_2 pipeline, comprising existing and new elements the Proposed Development would make use of CO_2 transport and storage networks owned and operated by Liverpool Bay CCS Limited, currently under development as part of the HyNet Carbon Dioxide Pipeline project (referred to as the 'HyNet CO_2 Pipeline Project'), that will transport CO_2 captured from existing and new industries in North Wales and North West England, for offshore storage (Ref 1). The captured CO_2 will be permanently stored in depleted offshore gas reservoirs in Liverpool Bay.

1.1.6 For the purposes of the electrical connection, National Grid Electricity Transmission plc (NGET), which builds and maintains the electricity

transmission networks, is responsible for the operation and maintenance of the existing 400 kV NGET Substation.

1.1.7 A description of the Proposed Development, including details of maximum parameters, is set out in **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**), of the **Environmental Statement** (**ES**). At this stage in the development, the design of the Proposed Development incorporates a necessary degree of flexibility to allow for ongoing design development.

1.1.8 The Proposed Development is located approximately 0.6 kilometres (km) north-west of Connah's Quay in Flintshire, North East Wales. The Main Development Area is centred approximately at national grid reference 327347, 371374, and, together with the Proposed CO_2 Connection Corridor, Repurposed CO_2 Connection Corridor, Electrical Connection Corridor, Water Connection Corridor, Construction and Indicative Enhancement Area (C&IEA), and ancillary works to access roads and minor assets, is wholly within the administrative area of Flintshire County Council (FCC).

1.1.9 The Order limits, as shown in **Figure 1-2: Order limits** (**EN010166/APP/6.3**) of the **ES**, encompass a total area of approximately 105 hectares (ha).

1.1.10 Around 86.1 ha of the Order limits is focused on the 'Construction and Operation Area', comprising the Main Development Area, construction areas and connection corridors necessary for the construction and operation of the Proposed Development shown in **Figure 1-2: Order limits** (**EN010166/APP/6.3**) of the **ES**. A further 18.8 ha of land included for the 'Accommodation Works Areas', comprising areas of works required to facilitate the movement and temporary storage of Abnormal Indivisible Loads (AIL) during construction of the Proposed Development. Further information on the Order limits is provided in **Chapter 3: Location of the Proposed Development** (**EN010166/APP/6.2.3**) of the **ES**.

1.2 Purpose and Structure of this Document

1.2.1 The Proposed Development will require the installation of a number of luminaires to provide visual comfort, safety and operational performance, which in turn will have the potential to result in obtrusive light at receptor locations.

1.2.2 At the time of submission, the engineering, procurement and construction contractor has not yet been appointed and detailed design work for the Proposed Development has not yet been carried out. Therefore, detailed information on the lighting to be used at the Proposed Development is not yet available. Nevertheless, to prevent potential nuisance from lighting, the Application sets out general proposals as to the purposes, types and levels of lighting required, to allow an appropriate level of control to be secured within the DCO.

1.2.3 This Lighting Strategy (the 'Strategy') has been developed to identify context sensitivities and lighting approaches relevant to both the construction and operation of the Proposed Development.

1.2.4 The Strategy has been prepared with consideration of technical and environmental requirements. Environmental requirements focus on limiting

the effects of 'obtrusive light' and technical requirements advise the overarching operational lighting requirements.

1.2.5 The aims of the Strategy are to:

- identify the requirements of relevant guidance and standards;
- identify design principles that will guide the detailed design of the Proposed Development;
- provide an overview of the existing conditions within the Order limits (focused on the Main Development Area);
- identify relevant light sensitive receptors; and
- provide technical and environmental recommendations for lighting during construction and operation of the Proposed Development.

1.2.6 Lighting controls associated with the decommissioning of the Proposed Development would be detailed in the Decommissioning Environmental Management Plan and would accord with relevant standards and guidance at that time.

1.2.7 An assessment of the lighting effects on human receptors associated with the construction and operation of the Proposed Development are considered in **Chapter 15: Landscape and Visual Amenity** (**EN010166/APP/6.2.15**), of the **ES**.

1.2.8 An assessment of the lighting effects on ecological receptors associated with the construction and operation of the Proposed Development are considered in **Chapter 13: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.13**), of the **ES**. In addition, the **Report to Inform Habitats Regulations Assessment** (**EN010166/APP/6.12**), of the **ES**, considers the impacts of the construction and operation of the Proposed Development on the National Site Network as required under the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations') (Ref 2).

1.2.9 It should be noted that although light has the potential to cause statutory nuisance (see also the **Statutory Nuisance Statement** (**EN010166/APP/7.1**) no prescriptive limits or rules are set for impact assessment purposes. Institution of Lighting Professionals (ILP) guidance GN01/21 (Ref 3) is a recognised guidance within the lighting industry that provides methodology and recommendations that support assessment, therefore, been used in developing appropriate limiting criteria for the lighting strategy.

2. Obtrusive Light Standards and Guidance

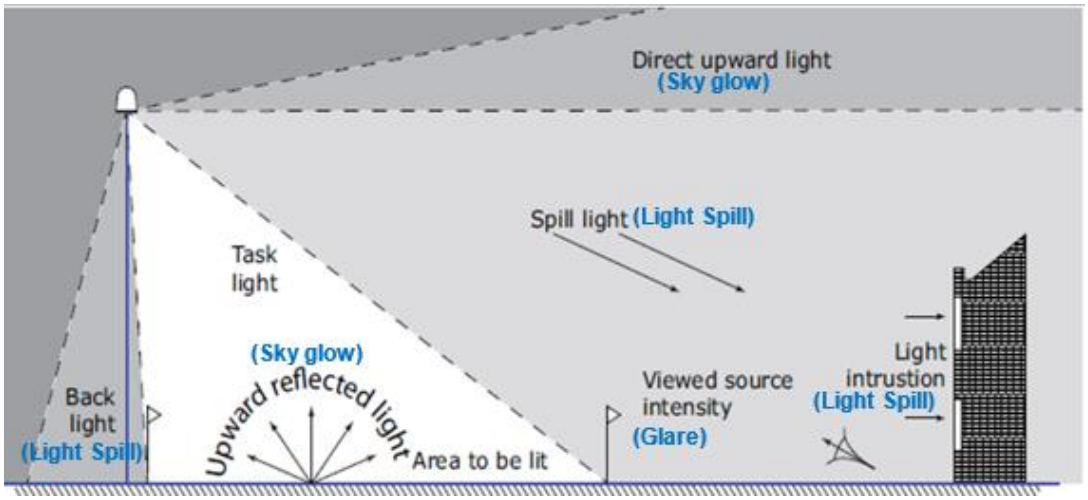
2.1 Definition of Obtrusive Light

2.1.1 Obtrusive light, whether it keeps someone awake through a bedroom window or impedes their view of the night sky, is a form of pollution, which may also be a nuisance in law, and which can be substantially mitigated without detriment to the lighting requirements of the task.

2.1.2 Obtrusive light (sometimes referred to as light pollution) is considered to have three direct components which relate to causing nuisance to others, adversely affect fauna and flora, and wasting money and energy. The three components of obtrusive light are as outlined below and illustrated on **Plate 1**, adapted from Figure 1 of 'Guidance Note 01: Guidance Notes for the Reduction of Obtrusive Light' (GN01/21) produced by the ILP (Ref 3):

- sky glow – light that contributes to the brightening of the night sky which may consist of direct upward light and upward reflected light;
- glare – the uncomfortable brightness of a light source when viewed against a darker background which is considered to be the viewed source intensity; and
- light spill or light intrusion – consists of spill light or the spilling of light beyond the boundary of the property or area being lit.

Plate 1: Types of Intrusive Light (adapted from Figure 1 in ILP GN01 (Ref 3))



2.2 Legislative Background

2.2.1 Light pollution was first defined in law within the Clean Neighbourhoods and Environment Act (CNEA) 2005 (Ref 4) as a form of statutory nuisance under the Environmental Protection Act 1990 (the 'EPA') (Ref 5) which was amended in 2006 to include the following nuisance definition:

'artificial light emitted from premises so as to be prejudicial to health or nuisance'

2.2.2 Although the CNEA describes light as having the potential to cause statutory nuisance, no prescriptive limits or rules were set for impact assessment purposes. ILP GN01/21 (Ref 3) has, therefore, been referred to for the purposes of this Strategy.

2.2.3 Guidance produced by Department for Environment, Food and Rural Affairs within the document Statutory Nuisance from Insects and Artificial Light (Ref 5) on Section 101 to Section 103 of the CNEA (2005) (Ref 4) places a duty on local authorities to ensure that their areas are checked periodically for existing and potential sources of statutory nuisances – including nuisances arising from artificial lighting.

2.2.4 Local authorities must take reasonable steps to investigate complaints of such nuisances from artificial light. Once satisfied that a statutory nuisance exists or may occur or reoccur, local authorities must issue an abatement notice (in accordance with Section 80(2) of the EPA 1990 (Ref 5)), requiring that the nuisance cease or be abated within a set timescale.

2.2.5 It is a requirement of the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations') (Ref 2) that plans, and projects consider the potential for likely significant effects associated with lighting (as relevant) on the National Site Network and their designations.

2.3 Planning Policy Context

National Policy Statements

2.3.1 The Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy Security and Net Zero, 2024) (Ref 7) advises:

'During the construction, operation and decommissioning of energy infrastructure there is potential for the release of a range of emissions such as… artificial light … . All have the potential to have a detrimental impact on amenity or cause a common law nuisance or statutory nuisance under Part III, Environmental Protection Act 1990. However, they are not regulated by the environmental permitting regime, so mitigation of these impacts will need to be included in the Development Consent Order.'

2.3.2 The NPS also states:

'*The applicant should assess the potential for…artificial light to have a detrimental impact on amenity, as part of the Environmental Statement. In particular, the assessment provided by the applicant should describe:*

a) the type, quantity and timing of emissions;

b) aspects of the development which may give rise to emissions;

c) premises or locations that may be affected by the emissions;

d) effects of the emission on identified premises or locations; and

e) measures to be employed in preventing or mitigating the emissions.'; and

'The Secretary of State should satisfy itself that:

a) an assessment of the potential for artificial light…to have a detrimental impact on amenity has been carried out; and

b) that all reasonable steps have been taken, and will be taken, to minimise any such detrimental impacts.'

2.3.3 This Strategy considers the lighting requirements with reference to relevant standards and guidance, and measures to avoid adverse effects on sensitive receptors, as required by NPS EN-1 (Ref 7).

International Guidance

2.3.4 The Commission Internationale De L'Eclairage (CIE) 150 (2017) (Ref 8): Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations refers to the potentially adverse effects of exterior lighting on both natural and man-made environments. The purpose of CIE 150 is to aid in formulating guidelines for assessing the environmental effects of exterior lighting and to provide limits for relevant lighting parameters to control the obtrusive effects of exterior lighting to tolerable levels.

2.3.5 CIE 126: Guidelines for Minimising Sky Glow (1997) (Ref 9) gives general guidance for lighting designers and policy makers on the reduction of sky glow. CIE 126 gives recommendations about maximum permissible values of upward light output for exterior lighting installations which are regarded as limiting values. The values focus on dark settings and sky viewing, and should be considered alongside recommendations set out in the current ILP guidance. Lighting designers should strive to meet the lowest criteria for the design. Practical implementation of the general guidance is left to national regulations.

National Guidance

2.3.6 The ILP Guidance Notes (Ref 3) provides lighting guidance and criteria for local authorities with a recommendation that these are incorporated at the local plan level. The ILP Guidance Notes (Ref 3) define various forms of light pollution and describe a series of environmental zones. The ILP Guidance Notes (Ref 3) provide suitable criteria against which the effects of artificial lighting can be assessed. This Strategy has been based upon these criteria.

2.3.7 The ILP also provides guidance on lighting and effects on bat species within 'Guidance Note 08: Bats and artificial lighting in the UK' (GN08/23) (Ref 10) which is intended to raise awareness of the impacts of artificial lighting on bats and provides potential solutions to avoid and reduce this harm. This is considered further in **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**), of the **ES**.

2.3.8 The Chartered Institute of Building Services Engineers (CIBSE) Society for Light and Lighting (SLL) provide further guidance in terms of the standard of road lighting used and population density within their guidance document Guide to Limiting Obtrusive Light (LOL, 2012) (Ref 11). This provides a more qualitative common-sense consideration for the interpretation of the character of illuminated areas.

3. Lighting Design Standards and Guidance

3.1.1 The British Standards Institute (BSI) provides published standards and guidance for most lighting tasks, adherence to which will help mitigate obtrusive lighting aspects. These are referred to in establishing the expected lighting requirements for the Proposed Development during construction and operational phases.

3.1.2 Described below are relevant extracts of standards and guidance expected to be used when implementing the use of construction lighting and developing the detailed exterior lighting design for the operation of the Proposed Development.

3.2 British Standards

BS EN 12464-2 'Light and lighting – Lighting of workplaces. Part 2: Outdoor work places'

3.2.1 BS EN 12464-2 (2024) (Ref 12) specifies lighting requirements for outdoor work places, which meet the needs for visual comfort and performance. Requirements set out within BS EN 12464-2 will provide the minimum lighting requirements for Health & Safety unless more rigorous design parameters have been established to support operational requirements.

BS EN 5266-1 'Emergency Lighting – Part 1: Code of practice for the emergency lighting of premises'

3.2.2 BS EN 5266-1 (2025) (Ref 13) provides a code of practice for emergency lighting of premises, setting out recommendations and guidance on the design, installation and wiring of emergency lighting systems to ensure safety in the event of a failure of the normal lighting supply.

BS EN 1838 'Lighting applications – Emergency lighting for buildings'

3.2.3 BS EN 1838 (2024) (Ref 14) sets out a standard for emergency lighting to provide sufficient illumination for the safe evacuation, visibility of exits, and orientation during power outages or emergencies.

3.3 The Society of Light and Lighting

The Society of Light and Lighting – Lighting Handbook

3.3.1 Aimed at lighting practitioners, specifiers and students of lighting, the 'Society of Light and Lighting (SLL) Handbook' (2018) (Ref 15) summarises the fundamentals of light and vision, the technology of lighting and guidance on a wide range of applications, both interior and exterior. It is intended to act as a link between the SLL 'Code for Lighting' (2012b) (Ref 16) and the SLL Lighting Guides (such as the SLL LOL, 2012c) (Ref 11). The Handbook also includes a chapter dedicated to exterior workplace lighting (Chapter 24)

which expands on criteria set out in the previous BS EN and has been referred to in the preparation of this Strategy.

3.3.2 Criteria contained within these documents include recommendations for light levels, uniformity, glare and light colour. Additional information is provided for specific requirements linked to particular areas, tasks or activities.

3.3.3 It is noted that the SLL Code for Lighting (Ref 16) which is referenced by the has since been updated and replaces the 2012b revision of the document, and the SLL LOL guide (Ref 11) has been superseded by Lighting Guide 21 (2021) 'Protecting the night-time environment' (Ref 17). Please note that superseded guidance is not explored in detail and the current versions of these documents are set out below.

The Society of Light and Lighting - Code for Lighting

3.3.4 The SLL Code for Lighting (2022) (Ref 16) provides information on three areas of lighting practice and complements the SLL Lighting Handbook (Ref 13). This includes:

- a summary of the effects of lighting on task performance, behaviour, safety, perception, health, and its financial and environmental costs;
- a compendium of lighting recommendations relevant to the United Kingdom (UK); and
- detailed descriptions of the calculations required for quantitative lighting design.

3.3.5 The lighting requirements for workplaces as set out in the SLL Code (Ref 16) are very much aligned with those as set out in BS EN 12464-2: 2024 (Ref 12) and so are not expanded on in this section.

The Society of Light and Lighting - Lighting Guide 21

3.3.6 The SLL Lighting Guide 21 (2021) (Ref 17) outlines the causes and consequences of obtrusive light and discusses how good design can minimise obtrusive effects to improve conditions for people as well as the wider nocturnal environment. It's address of the harmful effects of outdoor lighting at night are divided into three categories:

- sky glow;
- light intrusion / light spill (nuisance effects); and
- glare.

3.4 Aviation Lighting Requirements

3.4.1 The details of aviation lighting requirements are set out in legislation and Civil Aviation Authority (CAA) guidance and are secured by a requirement of the **Draft DCO** (**EN010166/APP/3.1**). Whilst aviation lighting is not discussed further in this Strategy, the current legislative requirements are identified below.

Civil Aviation Authority Policy Statement 'Lighting of En-Route Obstacles and Onshore Wind Turbines'

3.4.2 The CAA Policy Statement (2010) (Ref 18) provides an overview of the need for aviation warning lighting on 'tall structures' and onshore wind turbines as set out at Article 219 of the UK Air Navigation Order 2009 (UK Government, 2009) (Ref 19) (superseded by Article 222 within UK Air Navigation Order 2016). The CAA Policy Statement clarifies, 'Notwithstanding the Article 219 (now Article 222 within UK Air Navigation Order 2016) requirements, some structures of a height of less than 150 metres might need aviation warning lights'. Whilst structures of such heights are not routinely lit for civil aviation purposes, it is possible that aviation stakeholders, including the CAA, may make a case for aviation warning lighting where a structure is considered, by virtue of its location and nature, a significant navigational hazard.

The Air Navigation Order 2016 (UK Government, 2016)

3.4.3 Article 222 of the Air Navigation Order (Ref 19) sets out the requirements for the lighting of en-route obstacles and is reproduced below:

'(1) The person in charge of an en-route obstacle must ensure that it is fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle and at intermediate levels spaced so far as practicable equally between the top lights and ground level with an interval of not more than 52 metres.

(2) The person in charge of an en-route obstacle must, subject to paragraph (3), ensure that by night the lights required to be fitted by this article are displayed.

(3) In the event of the failure of any light which is required by this article to be displayed by night the person in charge must repair or replace the light as soon as reasonably practicable.

(4) At each level on the obstacle where lights are required to be fitted, sufficient lights must be fitted and arranged so as to show when displayed in all directions.

(5) In any particular case the CAA may direct that an en-route obstacle must be fitted with and must display such additional lights in such positions and at such times as it may specify.

(6) A permission may be granted for the purposes of this article for a particular case or class of cases or generally.

(7) This article does not apply to any en-route obstacle for which the CAA has granted a permission to the person in charge permitting that person not to fit and display lights in accordance with this article.

(8) In this article, an "en-route obstacle" means any building, structure or erection, the height of which is 150 metres or more above ground level, but it does not include a building, structure or erection:

(a) which is in the vicinity of a national licensed aerodrome or an EASA certificated aerodrome; and

(b) to which section 47 of the Civil Aviation Act 1982 (warning of presence of obstructions near licensed aerodromes) applies.'

3.4.4 Article 224 of the Air Navigation Order (Ref 19) sets out the restrictions on lights liable to endanger and is reproduced below:

(1) A person must 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 landing at an aerodrome; or

(b) by reason of its liability to be mistaken for an aeronautical ground light is liable to endanger aircraft.

(2) If any light which appears to the CAA to be a light described in paragraph (1) is exhibited, the CAA may direct the person who is the occupier of the place where the light is exhibited or who has charge of the light, to take such steps within reasonable time as are specified in the direction:

(a) to extinguish or screen the light; and

(b) to prevent in the future, the exhibition of any other light which may similarly endanger aircraft.

(3) The direction may be served either personally or by post, or by affixing it in some conspicuous place near to the light to which it relates.

(4) In the case of a light which is or may be visible from any waters within the area of a general lighthouse authority, the power of the CAA under this article must not be exercised except with the consent of that authority'

3.4.5 Article 225 of the Air Navigation Order (Ref 19) sets out restrictions on lights which dazzle or distract and states that *'a person must not in the United Kingdom direct or shine any light at any aircraft in flight so as to dazzle or distract the pilot of the aircraft'.*

Civil Aviation Publication 393: Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016

3.4.6 Civil Aviation Publication (CAP) 393 (2015) (Ref 20) provides an overview of the Civil Aviation Act 1982 and the Air Navigation Order 2016 and was highlighted for reference by the CAA during consultation. This will be considered within the detailed design of the Proposed Development Site lighting.

CAP 1096: Guidance to Crane Operators on Aviation Lighting and Notification

3.4.7 CAP 1096 (2021) (Ref 21) sets out the requirements for aviation warning lighting to cranes and sets out the potential requirement for crane activity to be notified to the aviation community which the Proposed Development would follow. This requirement is captured in the **Framework CEMP** including **SWMP** (**EN010166/APP/6.5**) of the **ES**.

4. Design Principles and Obtrusive Light Impact Avoidance Measures

4.1.1 In accordance with the relevant legislation, standards and guidance noted in Sections above, the main overarching lighting design principles for the Proposed Development are:

- to ensure the health and safety of employees and visitors performing normal working duties;
- to ensure the safe movement of vehicular and pedestrian traffic around the Order limits and access roads during the hours of darkness;
- to minimise light pollution in terms of light trespass, sky glow and glare to the identified sensitive receptors; and
- to ensure the security of the working areas within the Order limits and its occupants including lighting suitable for the correct functioning of the preferred Closed Circuit Television (CCTV) system (if necessary).

4.1.2 The overarching philosophy underpinning the design of the lighting for the Proposed Development is to have the minimal amount of lighting required to be provided. Lighting would be restricted to focussed point use, where reasonably practicable. Permanent lighting would be for general pedestrian movement, safety and security purposes only. Any lighting that may be required for maintenance purposes would be produced by temporary-use lighting which may be included as part of the proposals that are installed for and to the minimum specifications necessary for the required task or consist of mobile task lighting that can be used as needed and removed once required tasks are complete. Lighting shall be further reduced to only critical lighting from 23:00 to 05:00 hours, where lighting not required for safety or security is dimmed or turned off to reduce the impact of obtrusive lighting on the local environment (i.e. 23:00 hrs as per recommendation from the ILP GN01/21 (Ref 17) and 05:00 hrs as per the usual recommendation from local authorities and the Planning Practice Guidance (PPG) (Ref 22)).

4.1.3 Lighting would be designed so as not to illuminate existing light sensitive receptors including habitats adjacent to the Order limits, residential properties and other development types which may be sensitive to a change in lighting condition.

4.1.4 Lighting required during the construction and operation stages of the Proposed Development would be designed to reduce unnecessary light spill outside of the Order limits in addition to managing glare and sky glow.

4.1.5 External operational lighting has potential to affect bats where it coincides with their foraging and commuting habitats. This Lighting Strategy outlines recommendations from BS EN 12464-2 (Ref 12) and the ILP GN08 (Ref 10) which would be followed to minimise the impact of lighting adjacent habitats. Such recommendations include:

- the types of lighting to minimise upwards spread of light;
- the mounting heights and angles to minimise obtrusive glare; and

- guidance on light limitations for different environments.

4.1.6 All luminaires would have the necessary optical control and be appropriately aimed to minimise direct upward light emission. The lighting design would utilise Light Emitting Diode (LED) lanterns which provide safety (reduced maintenance) and environmental advantages (more control than conventional light sources). Advantages of LED luminaires are:

- low power consumption and long and predictable lifetime;
- high colour rendering;
- quick turn on and off;
- reduced energy consumption (cost saving); and
- reduced carbon footprint.

4.1.7 The luminaires chosen would, wherever practicable, have no light emitted above the horizontal to ensure the lighting is well controlled and will not directly contribute to any sky glow or cause light pollution/ obtrusive light.

4.1.8 Luminaires shall also be positioned and aimed so that peak light intensities from any fitting do not unintentionally illuminate any building or structural façade.

4.1.9 Where overhead lines are present in the vicinity of any proposed lighting, lighting columns would be hinged to be lowered for maintenance purposes.

4.1.10 The following design principles would be followed:

- adopting a lighting control strategy that turns lights off or dims as necessary for site safety and security;
- using photocells as a primary means of control to prevent light from being used when sufficient daylight is available;
- where possible, adopting LED luminaires to control obtrusive light due to their high directionality and accordingly the achievable ratio of useful light to spill light;
- lighting would be designed not to affect aviation activity and where required the Proposed Development would include aviation warning lighting, subject to discussion and confirmation it is required by the CAA;
- careful consideration of placement of lighting column and luminaire positioning;
- adopting luminaires with minimal upward lighting ratio and full cut-off, where possible;
- not tilting luminaires to have uplift above the horizontal, if this is not possible add shielding, hoods baffles, louvres as necessary to ensure potential upward light is controlled;
- optimising column heights to allow for sufficient light coverage and minimal tilt of luminaires;
- minimising building mounted luminaire heights;
- adopting lamps with similar correlated colour temperatures;

- using lamps with a limited Ultraviolet (UV) spectrum in locations which might affect ecological receptors;
- using shields and baffles to luminaires;
- lighting the site boundaries with low power periphery lighting with an asymmetric forward optic having good back-light cut-off characteristics; and
- directing luminaires away from ecologically sensitive receptors.

5. Baseline Conditions

5.1.1 The CQLCP Abated Generating Station, comprising the majority of permanent development for the Proposed Development, and the majority of the Order limits are located to the south of the River Dee with a small extension into the River Dee itself for the Water Connection Corridor. A small area of the Order limits extending over the river and to the north, comprising temporary works for the facilitation of AIL deliveries (referred to as 'Accommodation Works'). The Main Development Area is located directly to the north and west of Connah's Quay.

5.1.2 Connah's Quay has a predominantly suburban residential character, which extends to the neighbouring areas of Wepre and Shotton to the south and east. There are smaller pockets of development to the north and west toward Oakenholt.

5.1.3 The land along the River Dee presents a mixture of habitat and industrial development toward the north-east and east of the Main Development Area, with industrial development comprising the Deeside Industrial Park and Tata Steel UK Limited.

5.1.4 Land directly to the north and west of the Main Development Area is associated with the Connah's Quay Nature Reserve, alongside land to the north across the River Dee. Agricultural land is located toward the south across Chester Road which are unlit.

5.1.5 Given the mixture of nature focused conservation and agricultural areas, residential-led suburban development and industrial development, in addition to the existing lighting used for the existing Connah's Quay Power Station. Existing development in these areas will be the key local sources of light and overall and a corresponding mixture of lighting character.

5.2 Receptors

5.2.1 Lighting may have a variable range of influence depending on how much light is used, where it is used and when it is used. The greatest potential for obtrusive or nuisance effects to occur is within 100 m of the Order limits.

5.2.2 Receptors are identified which fall within 100 m of the Order limits which need to be considered so that the right light is provided in the right place, at the right time. These consist of residential, agricultural, recreational, ecological and transport system receptors that could be affected by a change in lighting condition.

5.2.3 While not identified within the 100 m zone, an unlicensed airfield (Hawarden Airport) has been identified within 10 km from the Order limits. The distance is assessed as being sufficient to offset obtrusive lighting effects including light spill, sky glow and glare. However, the proximity of the airfield to the Order limits may warrant the use of aviation warning lighting and considerations for this are presented in Section 3.4, subject to discussions and confirmation it is required by the CAA.

Residential Receptors

5.2.4 The closest residential receptors with the potential for direct views of the Proposed Development are set out in **Table 1** below with a high-level overview of lighting they are likely to experience under existing conditions.

Table 1: Residential Receptors

Receptor	Location	Existing Lighting
R1	A row of properties to north of Kelsterton Road and to the south of the rail lines, approximately 100 m south of the Order limits. Properties located on Kelsterton Road to the south which are spread along the length of the Order limits.	Street lighting is present along Kelsterton Road to the south of the properties and to the north along Chester Road / A548. Existing high mast floodlighting is used at Deeside Stadium across Kelsterton Road. There will also be some degree of exposure to ad-hoc lighting associated with the properties themselves and lighting associated with the existing Connah's Quay development to the north. In general, there are expected to be medium levels of night-time lighting to these properties.
R3, R4, R5	Clusters of properties to the north and south of Kelsterton Road and to the south of the rail lines, approximately 30 – 60 m south of the Order limits.	Street lighting is present along Kelsterton Road to the north of the properties and to the south along Chester Road / A548. There will also be some degree of exposure to ad-hoc lighting associated with the properties themselves and with the existing Connah's Quay development to the north/north-east. In general, there are low levels of night-time lighting to these properties.
R2	A cluster of properties immediately to the north of Church Street and to the south of the rail lines, approximately 60 m south of the Order limits.	Street lighting is present along Church Street to the south. There may be some views of lighting associated with the existing Connah's Quay; however, they will have a higher exposure to ad-hoc lighting associated with the properties themselves. In general, there are expected to be overall low levels of night-time lighting to these properties.
R6, R7	Clusters of properties along Chester Road, where R6 is approximately 35 m south of the Order limits	Street lighting is present along Chester Road to the south. There may be some more distant views of lighting associated with the existing

Receptor	Location	Existing Lighting
	and R7 is located along the Order limits.	Connah's Quay; however, they will have a higher exposure to ad-hoc lighting associated with the properties themselves and local businesses. In general, there are expected to be overall low levels of night-time lighting to these properties.
R8	A cluster of properties along Leadbrook Drive approximately 110 m to the west of the Order limits.	Street lighting is present along Leadbrook Drive to the west and Chester Road to the north. There may be some exposure from local businesses to the east and ad-hoc lighting associated with the properties themselves. In general, there are expected to be overall low levels of night-time lighting to these properties.
R9	A cluster of properties along Leadbrook Drive approximately 45 m to the west of the Order limits and south of residential cluster R8.	Street lighting is present along Leadbrook Drive to the west. There may be some exposure from ad-hoc lighting associated with the properties themselves. In general, there are expected to be overall low levels of night-time lighting to these properties.
R10	Properties between Allt-Gach Road and Leadbrook Drive approximately 70 m to the south of the Order limits.	There is minimal lighting associated with these properties and the local road is unit. There are overall low levels of night-time lighting at this location.

Agricultural Receptors

5.2.5 The closest agricultural receptors are set out in **Table 2** below with a high-level overview of lighting they are likely to experience under existing conditions.

Table 2: Agricultural Receptors

Receptor	Location	Existing Lighting
F1	Farmhouse and ancillary buildings on Leadbrook Drive approximately 15 m south of the Order limits.	There is minimal lighting associated with this property and the local road is unit. There may be some views of light from nearby properties and Chester Road. There are overall low levels of night-time lighting at this location.

Receptor	Location	Existing Lighting
F2	Farmhouse and ancillary buildings in Llwyn Onn which is adjacent to the Order limits to the north-west.	There is minimal lighting associated with this property and the local road is unit. There are overall low levels of night-time lighting at this location.

Ecological Receptors

5.2.6 Ecology data identifies International Designated Sites, National Statutory Designated Sites, Priority Habitats and Ancient Woodlands within 2 km of the Order limits. The closest, relevant ecological receptors within 100 m are set out in **Table 3** below with a high-level overview of lighting they are likely to experience under existing conditions.

Table 3: Ecological Receptors

Receptor	Location	Existing Lighting
W1, W2	Aquatic habitat north of Chester Road and to the west of the Order limits which has been identified as being a potential habitat for newts.	There is no lighting immediate to these water bodies. There may be some low exposure to light associated with ad-hoc lighting and street lighting associated with Chester Road to the south. There are overall low levels of night-time lighting at this location.
C1, C2, C3, C4	Wetlands areas along the River Dee within a designated Conservation Area adjacent to the site that has been identified as a habitat for a number of waterbirds.	C1 has no lighting immediate to it, while C2 and C3 will have some degree of exposure to lighting associated with the existing Connah's Quay development. C4 is likely to have some minor exposure to ad-hoc lighting associated with residential properties and street lighting along Church Street. There are overall low levels of night-time lighting at this location.

Transport System Receptors

5.2.7 The closest transport system receptor to the Order limits consists of the existing rail lines directly to the south/south-west of the Main Development Area.

6. Proposed Obtrusive Light Limits

6.1 Environmental Zone Classification

6.1.1 The obtrusive lighting constraints for the Proposed Development are based on statutory guidance issued by the Department for the Environment, Food and Rural Affairs (Ref 5) to support the implementation of the CNEA 2005 (Ref 4) and non-statutory guidance on obtrusive light limits published by the ILP. The limits are set out in the ILP Guidance Notes (Ref 3).

6.1.2 The ILP has developed an Environmental Zone classification system for the categorisation of receptor locations. This is summarised in **Table 4** below.

Table 4: ILP Environmental Zone Classifications (Table 1, ILP (Ref 3))

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

6.1.3 For each Environmental Zone, obtrusive light limits for exterior lighting installations are specified. These are intended to support decision makers in establishing whether obtrusive lighting is detrimental to local amenity or a potential statutory nuisance.

Table 5: Maximum Vertical Illuminance (Light Spill) on Surrounding (Table 3, ILP (Ref 3))

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 6: Luminaire Brightness in the Field of View (Glare) (ILP Guidance Notes (Table 4, ILP (Ref 3))

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m²)					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p > 0.5$
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

Table 7: Limitations of Direct Upward Light (Sky Glow, ULR) (Table 6, ILP (Ref 3))

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

Table 8: Limitations of Direct/Indirect Upward Light (Sky Glow, UFR) (Table 7, ILP (Ref 3))

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 9: Limitations of Effects on Transport Systems (Table 5, ILP GN01 (Ref 3))

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

6.1.4 There is no definite time beyond which the lighting needs at the Proposed Development would reduce for the remainder of the night, as certain construction could continue into the night. There would therefore be the occasional need to provide visual comfort and performance throughout an entire period of darkness or reduced daylighting. For this reason, it is considered that imposing a lighting curfew for obtrusive lighting would be unreasonable and would have the potential to conflict with achieving the required visual performance at the Proposed Development for safety, security and operational reasons. This is in line with the ILP Obtrusive Light Guidance (Ref 3), which states:

'the notes are therefore no substitute for professionally assessed and designed lighting, undertaken and assessed by a competent lighting professional, where the various and maybe conflicting visual requirements need to be balanced'.

BS EN 12464-2: 2024 (Ref 12) states the following with regard to obtrusive illuminance pre and post curfew regulations:

'In case no curfew regulations are available, the higher values shall not be exceeded, and the lower values should be taken as preferable limits'.

6.1.5 However, it is considered that a part-lighting approach would be suitable for the Proposed Development. This would result in reduced impact of obtrusive lighting and will also reduce energy usage.

6.1.6 There are also criteria within the ILP Guidance Notes (Ref 3) relating to limiting levels of luminance to buildings. However, during the construction period, there would not be any buildings which are intentionally lit by design and so the luminance criteria are not applicable in this case. As a matter of good lighting design practice however, lighting would be selected, positioned and aimed such that any building luminance is limited.

6.1.7 It is considered appropriate for the purposes of controlling obtrusive light affecting residential and ecological receptors that suitable obtrusive lighting level limits with regard to the ILP Environmental Zone for the areas surrounding the Order limits would be those as set out in Zone E2 i.e. a rural area of low district brightness.

6.1.8 Lighting would be restricted to focused point-use where reasonably practicable to reduce illumination on adjoining sensitive habitats to minimise effects on receptors sensitive to light impacts where practicable.

6.2 Residential Receptors

6.2.1 Proposed obtrusive limits to residential receptors should be limited to at most a zone E2.

6.2.2 These should also be applied to agricultural receptors for a consistent night-time environment.

6.3 Ecological Receptors

6.3.1 Ecological receptors should target limiting criteria associated with a zone E1 or lower, or as advised by the project ecologist to create minimal disturbance.

6.4 Transport Receptors

6.4.1 Light spill and sky glow would typically have little influence on transport systems, however the effects of glare would need to be carefully considered to avoid contributing to visual discomfort or visual disability for drivers.

7. Site Lighting Requirements during Construction

7.1 Design Overview

7.1.1 A variety of construction activities would be required across the Order limits to support on-site security, and health and safety requirements, in addition to undertaking specific tasks safely, efficiently and accurately, and providing for a secure site when insufficient daylight is available.

7.1.2 The quality of light would be as important as the quantity of light provided to task areas, meaning that there would be advisable average light levels and uniformities that should be provided to support visual comfort, task visibility and eye adaptation.

7.1.3 The associated potential obtrusive light effects towards surrounding receptors would be minimised through the controlled application of lighting in accordance with current best practice.

7.2 Recommended Lighting Values

7.2.1 Recommendations for maintained average light levels, uniformity, glare and light colour are provided for Outdoor Workplaces in British Standard BS EN 12464-2 (Ref 12) for different areas, tasks and activities.

7.2.2 Please note that the light levels provided are the industry standard minimum required for the activity or task to prevent overlighting and contributing to obtrusive effects.

7.2.3 The following extracts may apply to construction sites and construction activities.

Table 10: General Requirements for Areas and Cleaning of Outdoor Workplaces (Table 7, BS (Ref 12))

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx		U_o	R_{GL}	R_a	Specific requirements
		required[a]	modified[b]				
7.1	Walkways exclusively for pedestrians	5	–	0,20	50	70	
7.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	–	0,40	50	70	
7.3	Regular vehicle traffic (max. 40 km/h)	20	–	0,20	45	70	At shipyards and in docks, R_{GL} may be 50.
7.4	Mixed traffic areas, vehicle turning, stationary loading and unloading points	50	–	0,40	50	70	When the area is non-occupied $\bar{E}_m$ required may be reduced to 5 lx. Pay attention to the illuminance levels of the surrounding and adjacent areas.
7.5	Cleaning and servicing	50	–	0,25	50	70	At all relevant surfaces
7.6	Recycling centers - areas with rubbish bins and sorting of waste	30	–	0,25	50	70	

[a] Required: minimum value.

[b] Modified: considers common context modifiers in 5.3.3.

Table 11: Building Sites (Table 13, BS (Ref 12))

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx		U_o	R_{GL}	R_a	Specific requirements
		required[a]	modified[b]				
13.1	Clearance, excavation and loading	20	30	0,25	55	70	
13.2	Construction areas, drain pipes mounting, transport, auxiliary and storage tasks	50	75	0,40	50	70	
13.3	Framework element mounting, light reinforcement work, wooden mould and framework mounting, electric piping and cabling	100	150	0,40	45	70	
13.4	Element jointing, demanding electrical, machine and pipe mountings	200	300	0,50	45	70	Can be met with use of local mobile lighting.

[a] Required: minimum value.

[b] Modified: considers common context modifiers in 5.3.3.

7.3 Recommended Lighting Typologies

Lighting Construction

7.3.1 The choice of luminaire should be carefully considered so that the optimal distribution of light from the fitting is provided at the right mounting location and height.

7.3.2 The use of full horizontal cut-off luminaires installed at 0° tilt with flat glass lenses, back reflectors and internal baffles designed to limit views of the lamp and glare and direct light in a controlled pattern are recommended.

7.3.3 Where full cut-off type luminaires installed at a 0° tilt are not suitable for a particular application, such as floodlighting over large areas, it is recommended to use shields, hoods, cowls, or baffles to aid in controlling how light is distributed.

Light Sources

7.3.4 LED lighting is recommended over traditional light sources. It is prevalent for the majority of lighting types and is typically an efficient source of light, having a good lumen to Watt ratio.

7.3.5 LED may also more easily support different lighting control scenarios where dimming is required.

7.3.6 LED presents a greater potential to control the spectral composition of emitted light, such as the reduction of blue wavelengths which could have a negative impact on insects and wildlife.

Light Colour

7.3.7 Light colour and spectral composition should respond to area character and ecology recommendations. It is expected that this will involve a warmer white, at a maximum of 3000K, although 2700K may be more desirable near areas of particular sensitivity to reduce the overall UV component of new installations through limiting blue spectrum light.

7.3.8 The colour of the light and spectral composition is traditionally considered to be less visually intrusive, as well as have a more restricted UV spectrum which limits potential effects to local wildlife or their food sources.

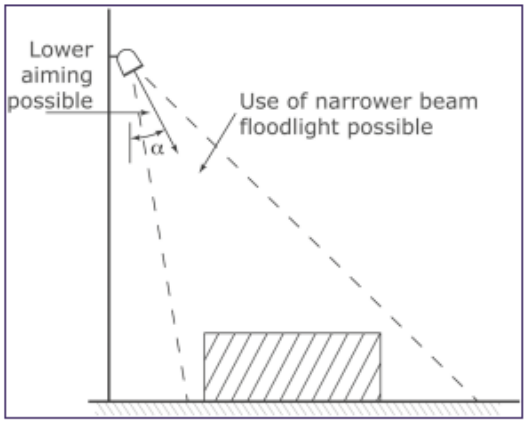
7.3.9 In some cases, a whiter light in the region of 4000K may be necessary in areas which have strict requirements for working or space use during the hours of darkness.

7.4 Recommended Installation Approaches

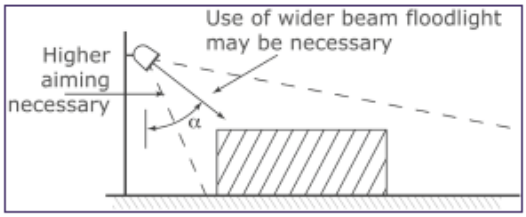
Mounting Height

7.4.1 Using as high a mounting height as possible is normally desirable so that aiming angles to provide sufficient light coverage to task areas without contributing to light spill, sky glow or glare.

Plate 2: Recommended Mounting Height Configuration (ILP (Ref 3))



✔ *Figure 2a: Higher mounting height – less spill light and glare*



✖ *Figure 2b: Lower mounting height – more spill light and glare*

Aiming and Orientation

7.4.2 The correct aiming and orientation of lighting ensures that obtrusive lighting effects can be controlled and reducing the potential for light spill, sky glow and glare.

7.4.3 Luminaires should normally be mounted with no or minimal angle (or tilt) above the horizontal to ensure that all light is provided to task areas, and reducing the potential for light to be contributed to the sky.

7.4.4 It is recognised that this may not be possible in all situations and an aiming angle of no more than 70 degrees from a direct downward orientation is recommended so that light potentially reaching above the horizontal is minimised.

7.4.5 Where an angle is necessary, shields, hoods, cowls, or baffles may be necessary.

Plate 3: Recommended Aiming Angles (ILP (Ref 3))

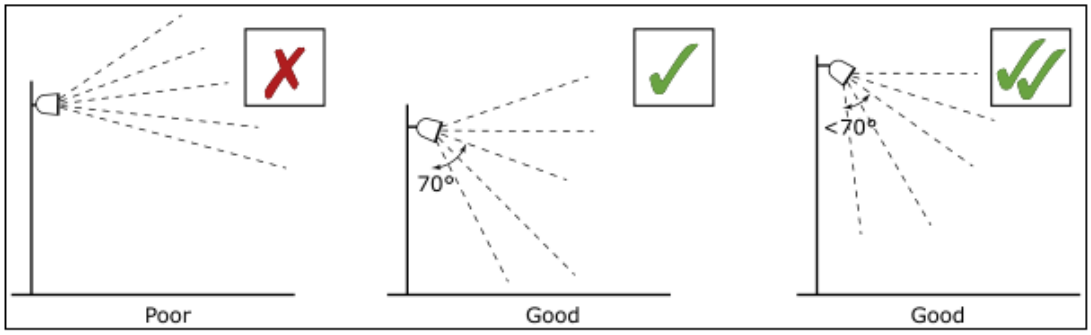


Figure 3: Luminaire aiming angles

8. Site Lighting Requirements during Operation

8.1.1 A variety of operational activities would be required across the Order limits, although it is expected that the majority of normal-use lighting would be restricted to the central portion of the Main Development Area with existing development and the area of the Main Development Area which sit toward the north and west within the Order limits. Provision will also be made for emergency and safety lighting arrangements to ensure sufficient lighting is available during any power failure of normal-use lighting.

8.1.2 As with construction lighting requirements, operational lighting is needed to support safe site access and egress, in addition to undertaking specific tasks safely, efficiently and accurately when insufficient daylight is available.

8.1.3 The quality of light would be as important as the quantity of light provided to task areas, meaning that there would be advisable average light levels and uniformities that should be provided to support visual comfort, task visibility and eye adaptation.

8.2 Recommended Lighting Values

8.2.1 Recommendations are provided for Outdoor Workplaces in British Standard BS EN 12464-2 (Ref 12) for different areas, tasks and activities.

8.2.2 The following extracts may apply for outdoor operational requirements:

Table 12: General Requirements for Areas and Cleaning of Outdoor Workplaces (Table 7, BS (Ref 12))

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx		U_o	R_{GL}	R_a	Specific requirements
		required[a]	modified[b]				
7.1	Walkways exclusively for pedestrians	5	–	0,20	50	70	
7.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	–	0,40	50	70	
7.3	Regular vehicle traffic (max. 40 km/h)	20	–	0,20	45	70	At shipyards and in docks, R_{GL} may be 50.
7.4	Mixed traffic areas, vehicle turning, stationary loading and unloading points	50	–	0,40	50	70	When the area is non-occupied $\bar{E}_m$ required may be reduced to 5 lx. Pay attention to the illuminance levels of the surrounding and adjacent areas.
7.5	Cleaning and servicing	50	–	0,25	50	70	At all relevant surfaces
7.6	Recycling centers - areas with rubbish bins and sorting of waste	30	–	0,25	50	70	

[a] Required: minimum value.

[b] Modified: considers common context modifiers in 5.3.3.

Table 13: Parking Areas (Table 8, BS (Ref 12))

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx		U_o	R_{GL}	R_a	Specific requirements
		required[a]	modified[b]				
8.1	Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	–	0,25	55	70	
8.2	Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	–	0,25	50	70	
8.3	Car charging station points in lit areas	20	–	0,25	50	70	At the relevant area approx. up to 3 m from charging point. If the display is not self illuminated, a vertical illuminance of $\bar{E}_m$ = 50 lx at the charging poles should be provided for the time of reading. Vertical illuminance on the car should be considered.
8.4	Car charging station points in unlit areas	10	–	0,25	50	70	If the display is not self illuminated, a vertical illuminance of $\bar{E}_m$ = 50 lx at the charging poles should be provided for the time of reading.
8.5	Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose building complexes	20	–	0,25	50	70	

[a] Required: minimum value.

[b] Modified: considers common context modifiers in 5.3.3.

Table 14: Industrial Sites and Storage Areas (Table 17, BS (Ref 12))

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx		U_o	R_{GL}	R_a	Specific requirements
		required[a]	modified[b]				
17.1	Short-term handling of large units and raw materials, loading and unloading of solid bulk goods	20	–	0,25	55	70	When the area is non-occupied $\bar{E}_m$ required may be reduced to 5 lx.
17.2	Continuous handling of large units and raw materials, loading and unloading of freight, lifting and descending location for cranes, open loading platforms	50	–	0,40	50	70	When the area is non-occupied $\bar{E}_m$ required may be reduced to 5 lx.
17.3	Reading of addresses, covered loading platforms, use of tools, ordinary reinforcement and casting tasks in concrete plants	100	–	0,50	45	70	Movement detection control preferred for energy savings.
17.4	Demanding electrical, machine and piping installations, inspection	200	–	0,50	45	70	Can be met with use of local mobile lighting.

[a] Required: minimum value.

[b] Modified: considers common context modifiers in 5.3.3.

Table 15: Oil and Other Chemical Industries (Table 20, BS (Ref 12))

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx		U_o	R_{GL}	R_a	Specific requirements
		required[a]	modified[b]				
20.1	Handling of servicing tools, utilization of manually regulated valves, starting and stopping motors, lighting of burners	20	30	0,25	55	70	
20.2	Filling and emptying of container trucks and wagons with risk free substances, inspection of leakage, piping and packing	50	75	0,40	50	70	
20.3	Filling and emptying of container trucks and wagons with dangerous substances, replacements of pump packing, general service work, reading of instruments	100	150	0,40	45	70	
20.4	Fuel loading and unloading sites	100	150	0,40	45	70	
20.5	Repair of machines and electric devices	200	300	0,50	45	70	Can be met with use of local mobile lighting.
20.6	Vehicle storage areas in petrochemical and other hazardous industries	20	–	0,25	55	70	
20.7	Oil stores in power plants, petrochemical and other hazardous industries	50	–	0,40	50	70	

[a] Required: minimum value.
[b] Modified: considers common context modifiers in 5.3.3.

Table 16: Power, electricity, gas and heat plants (Table 21, BS (Ref 12))

Ref. no.	Type of area, task or Activity	Average Em lx	U_o	R_{GL}	R_a
21.1	Pedestrian movements within electrically safe areas	5	0.25	50	20
21.2	Handling of servicing tools, coal	20	0.25	55	20
21.3	Overall inspection	50	0.40	50	20
21.4	General servicing work and reading of instruments	100	0.40	45	40
2.15	Repair of electric devices	200	0.50	45	60

8.3 Recommended Lighting Typologies

Lighting Construction

8.3.1 The choice of luminaire should be carefully considered so that the optimal distribution of light from the fitting is provided at the right mounting location and height.

8.3.2 The use of full horizontal cut-off luminaires installed at 0° tilt with flat glass lenses, back reflectors and internal baffles designed to limit views of the lamp and glare and direct light in a controlled pattern are recommended.

8.3.3 Where full cut-off type luminaires installed at a 0° tilt are not suitable for a particular application, such as floodlighting over large areas, it is recommended to use shields, hoods, cowls, or baffles to aid in controlling how light is distributed.

Light Sources

8.3.4 LED lighting is recommended over traditional light sources. It is prevalent for the majority of lighting types and is typically an efficient source of light, having a good lumen to Watt ratio.

8.3.5 LED may also more easily support different lighting control scenarios where dimming is required.

8.3.6 LED presents a greater potential to control the spectral composition of emitted light, such as the reduction of blue wavelengths which could have a negative impact on insects and wildlife.

Light Colour

8.3.7 Light colour and spectral composition should respond to area character and ecology recommendations. It is expected that this would involve a warmer white, at a maximum of 3000K, although 2700K may be more desirable near areas of particular sensitivity to reduce the overall UV component of new installations through limiting blue spectrum light.

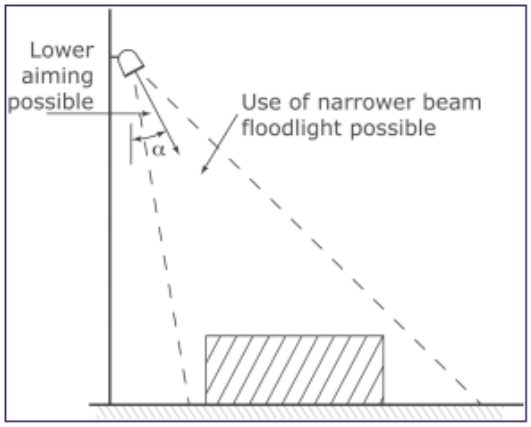
8.3.8 The colour of the light and spectral composition is traditionally considered to be less visually intrusive, as well as have a more restricted UV spectrum which limits potential effects to local wildlife or their food sources.

8.3.9 In some cases, a whiter light in the region of 4000K may be necessary in areas which have strict requirements for working or space use during the hours of darkness.

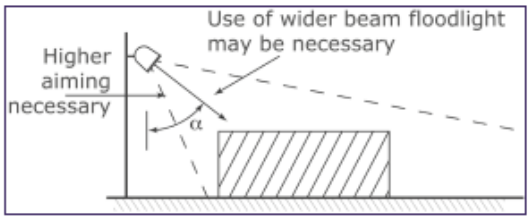
8.4 Recommended Installation Approaches

Mounting Height

Plate 4: Recommended Mounting Height Configuration (ILP (Ref 3))



✔ *Figure 2a: Higher mounting height – less spill light and glare*



✖ *Figure 2b: Lower mounting height – more spill light and glare*

8.4.1 Using as high a mounting height as possible is normally desirable so that aiming angles to provide sufficient light coverage to task areas without contributing to light spill, sky glow or glare.

Aiming and Orientation

8.4.2 The correct aiming and orientation of lighting ensures that obtrusive lighting effects can be controlled and reducing the potential for light spill, sky glow and glare.

8.4.3 Luminaires should normally be mounted with no or minimal angle (or tilt) above the horizontal to ensure that all light is provided to task areas, and reducing the potential for light to be contributed to the sky.

8.4.4 It is recognised that this may not be possible in all situations and an aiming angle of no more than 70 degrees from a direct downward orientation is recommended so that light potentially reaching above the horizontal is minimised.

8.4.5 Where an angle is necessary, shields, hoods, cowls, or baffles may be necessary.

Plate 5: Recommended Aiming Angles (ILP (Ref 3))

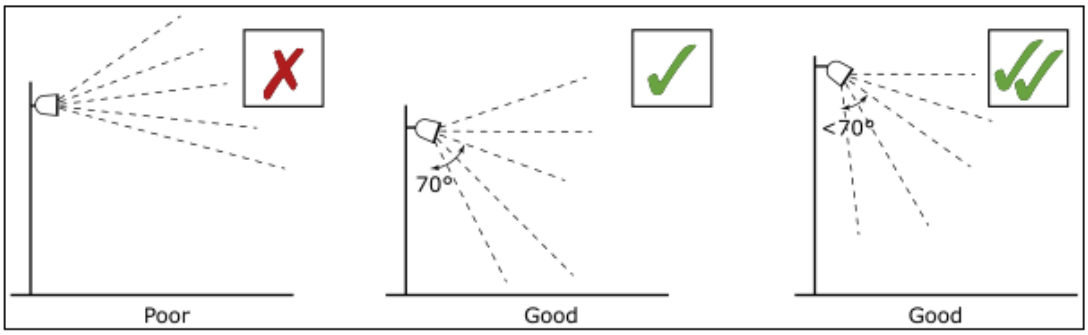


Figure 3: Luminaire aiming angles

8.5 Emergency and Safety Lighting

8.5.1 Emergency lighting may be required to support safe evacuation of buildings and movement through the site in the event of a main supply failure.

8.5.2 A strategic selection of the existing operational fittings will be used to provide lighting for emergency conditions that will comply with Part B of the Building regulations for providing a means of escape and allow for egress to muster points via the emergency power system.

8.5.3 Safety lighting will provide illumination during a total power failure. This will provide sufficient illumination to enable the safe egress and safe evacuation. Safety lighting will also enable the continued operation of communication systems.

8.5.4 Emergency and safety lighting will be designed in alignment with relevant British Standards and client requirements.

9. Summary and Conclusions

9.1.1 This Strategy has been prepared in order to support the Application for the Proposed Development.

9.1.2 At the time of submission, the contractor(s) has not been appointed and detailed design work for the Proposed Development has not been carried out. Therefore, detailed information on the lighting to be used at the Proposed Development is currently unknown. Nevertheless, it is recognised that potential nuisance from lighting of the Proposed Development may be a concern for local communities and certain consultees. Therefore, the Applicant has commissioned this strategy in order to provide some definition to the type and level of lighting that will be employed at the Proposed Development.

9.1.3 This document therefore sets out the Lighting Strategy in the form of an outline lighting requirements specification for Proposed Development lighting under construction and operational phases. It also addresses obtrusive lighting by means of specifying off-site obtrusive lighting constraints. The report also identifies potential measures and guidance that may be taken to control obtrusive light through the detailed design of the Proposed Development lighting scheme and management of lighting used during the construction phase. At the detailed design stage, a computational light modelling exercise will be undertaken. This would ensure that the relevant sections of the Order limits are adequately lit and that obtrusive light is suitably controlled, in accordance with this Strategy.

9.1.4 In summary, it is concluded that this Strategy provides an appropriate outline of the lighting requirements for the Proposed Development as part of the Application and identifies measures which can be employed as required and which would adequately control obtrusive light through detailed design of the lighting scheme.

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Glossary

Term	Definition
Candela (cd)	the SI unit of luminous intensity. One candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540 × 10 Hz and that has a radiant intensity in that direction of 1/683 watt per steradian
Environmental zones	The assessment of intrusive light and light emissions depends on the environment of the lighting installation. Depending on the standard, 4-6 different zones are defined, ranging from highly protected areas in natural settings to urban areas, commercial zones, and industrial zones.
Glare (Rg)	The glare directly caused by luminaires of an outdoor lighting installation is determined using the CIE Glare Rating (RG) method. To calculate this, the equivalent veiling luminance of the surroundings is needed. There are four options for determining this: • An exact calculation according to CIE 112, based on the scene area. • A simplified method according to EN 12464-2, based on the scene area. • Using a custom calculation area to determine the equivalent veiling luminance. • Specifying a fixed value for easy comparability
Illuminance (Lux)	Describes the ratio of the luminous flux that strikes a certain surface to the size of this surface (lm/m² = lx). The illuminance is not tied to an object surface. It can be determined anywhere in space (inside or outside). The illuminance is not a product feature because it is a recipient value. Luxometers are used for measuring. • Unit: Lux • Abbreviation: lx • Formula symbol: E
Light Spill	Unwanted transmission of light onto adjacent areas which strays away from the area intending to be lit; light spill may affect sensitive receptors such as residential properties or ecological sites
Luminance	Dimension for the "brightness impression" that the human eye has of a surface. The surface itself can emit light thereby or light striking it can be reflected (emitter value). It is the only photometric value that the human eye can perceive. • Unit: Candela per square metre • Abbreviation: cd/m²

Term	Definition
	• Formula symbol: L
Luminous intensity	Describes the intensity of the light in a certain direction (emitter value). The luminous intensity is a matter of the luminous flux Φ that is emitted in a certain spherical angle Ω. The radiation characteristics of a light source are presented graphically in a light distribution curve (LDC). The luminous intensity is an SI base unit. • Unit: Candela • Abbreviation: cd • Formula symbol: I
Obtrusive light/Light emission	To protect the nocturnal environment and minimise problems for humans, flora, and fauna, it is necessary to limit obtrusive light (also known as light pollution), which can cause serious physiological and ecological issues for individuals and the environment. Light emission refers to the disturbing influence of emitted light from artificial light
Upward flux ratio (Sky glow, direct/indirect)	The ratio of the luminous flux emitted directly or reflected above the horizontal plane to the luminous flux that cannot be avoided under ideal conditions to achieve the illuminance level on a deliberately illuminated area
Upward light ratio (Sky glow, direct)	The ratio of the luminous flux emitted above the horizontal plane to the luminous flux of a luminaire or lighting installation in its operational position. The luminaire efficiency is considered in this calculation

Abbreviations

Abbreviation	Term
AIL	Abnormal Indivisible Load
BSI	British Standards Institute
C&IEA	Construction and Indicative Enhancement Area
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CCGT	Combined Cycle Gas Turbine
CCP	Carbon Capture Plant
CCTV	Closed Circuit Television
Cd	Candela
CEMP	Construction Environmental Management Plan
CIBSE	Chartered Institute of Building Services Engineers
CIE	Commission Internationale De L'Eclairage / International Commission on Illumination
CNEA	Clean Neighbourhoods and Environment Act
CO_2	Carbon dioxide
DCO	Development Consent Order
EN-1	The Overarching National Policy Statement for Energy
EPA	Environmental Protection Act
ES	Environmental Statement
FCC	Flintshire County Council
GN	Guidance Note
ha	hectare
ILP	Institute of Lighting Professionals
km	kilometre
HMSO	His Majesties Stationery Office
LED	Light Emitting Diode (light source)
LOL	Limiting Obtrusive Light
Lx	Lux
MH	Mounting Height
MW	megawatt
MWe	megawatt electrical output
NGET	National Grid Electricity Transmission plc

NPS	National Policy Statement
PPG	Planning Practice Guidance
SLL	Society of Light and Lighting
SWMP	Site Waste Management Plan
UK	United Kingdom
UV	Ultraviolet