Gravity

Smart Campus

Gravity LDO Environmental Statement

Volume 2 – Appendices

Appendix 14.5 Lighting Assessment

Gravity Local Development Order

Lighting Assessment

On behalf of This is Gravity and Sedgemoor District Council

Project Ref: 25134/3008 | Rev: V1 | Date: August 2021

Registered Office: Buckingham Court Kingsmead Business Park, London Road, High Wycombe, Buckinghamshire, HP11 1JU
Office Address: 11 Prospect Court, Courteenhall Road, Blisworth, Northampton NN7 3DG
T: +44 (0)1604 878 300 E: Northampton.uk@stantec.com

Document Control Sheet

Project Name: Gravity

Project Ref: 332310102

Report Title: Lighting Assessment

Doc Ref: 3016

Date: August 2021

	Name	Position	Signature	Date
Prepared by:	Tara Shahkarami	Graduate Environmental Planner	*TS*	September 2021
Reviewed by:	Neil Young	Associate Environmental Scientist	*NY*	September 2021
Approved by:	Jonathan Riggall	Director	*JR*	September 2021
For and on behalf of Stantec UK Limited				

Revision	Date	Description	Prepared	Reviewed	Approved
V1	September 2021	Draft for consultation	TS	NY	JR

Contents

Figures

Tables

Appendices

1 Introduction

1.1 Background

1.1.1 Stantec have been appointed by This is Gravity and Sedgemoor District Council (SDC) (from here on in referred to as 'the applicant') to prepare a Lighting Assessment to support a Local Development Order (LDO) for a Site known as Gravity, to the east of Junction 23 of the M5, in Sedgemoor, Somerset (referred to as 'the Site') to grant a flexible consent for the Gravity Smart Campus and Community, to serve as a marketing tool to attract international investment.

1.1.2 Part of the Site, formerly known as Huntspill Energy Park, received hybrid planning permission for an Energy Park in November 2017 (the '2017 Planning Consent'). Prior to determination of that application, the Site secured Enterprise Zone status in April 2017. Some elements of the 2017 Planning Consent, including the new road access onto the A39, and the Site remediation consent, have already been implemented.

1.1.3 An LDO is sought for the development of the Gravity Smart Campus and Community, consisting of a mix of commercial buildings and up to 750 homes (referred to as 'the Proposed Development').

1.1.4 This is informed by the ambition to shape and create a clean and inclusive campus that achieves sustainable jobs and has a progressive approach to reducing carbon emissions.

1.2 Site Location

1.2.1 The Site is located between the villages of Puriton and Woolavington, approximately 6 km north east of Bridgwater. The Site lies 2 km to the east of Junction 23 of the M5 motorway.

1.2.2 A Lighting and Constraints plan showing the Site Location is included in **Appendix A.**

1.3 Aims of the Lighting Assessment

1.3.1 This report provides an assessment of the potential effects from obtrusive light that may arise from the artificial lighting associated with the construction and operation of the Proposed Development.

1.3.2 The specific aims of this Lighting Assessment are to:

- Identify national and local planning policy and guidance that is relevant to lighting for the Proposed Development;
- Determine the existing lighting conditions within the Site and wider study area including an interpretation of how this will change in future;
- Establish the minimum lighting levels required to construct and operate a safe and secure development;
- Assess the potential effects of the minimum levels of lighting required for the Proposed Development on sensitive receptors and night-time views; and
- Establish mitigation measures to minimise obtrusive light from the remainder of development at the Proposed Development to within guideline levels.

1.3.3 It should be noted that the terms "light pollution" and "obtrusive light" are used interchangeably to mean light shining where it is not intended or wanted.

1.4 Report Structure

1.4.1 The structure of the Lighting Assessment report is set out below:

Chapter 2 – Describes the Site and Proposed Development;

Chapter 3 – Sets out legislation, planning policy and guidance relevant to obtrusive light;

Chapter 4 – Details the methodology of the assessment;

Chapter 5 – Outlines existing baseline conditions of the Site, as well as the 2032 'future baseline' conditions, including light sensitive receptors within the study area;

Chapter 6 – Outlines the minimum lighting requirements for those land uses within the Proposed Development that fall outside of the 2017 Permission for the Huntspill Energy Park;

Chapter 7 – Identifies any potential effects from the Proposed Development on the 2032 future baseline scenario, on sensitive receptors (identified in **Chapter 5**);

Chapter 8 – Details measures to mitigate potential impacts (identified in **Chapter 7**) on sensitive receptors (identified in **Chapter 5**); and

Chapter 9 – Sets out the residual effects after mitigation and provides conclusions.

2 The Site and Proposed Development

2.1 The Site and Study Area

2.1.1 The Site comprises 261.54 hectares of land, of which approximately 250 hectares was part of the former Royal Ordnance Factory (ROF) which closed in 2008. The majority of the Site, associated with the ROF, is brownfield, previously developed land which has been primarily utilised by a single industrial unit. Land on the edges of the Site, in particular to the south and east, is currently greenfield agricultural land.

2.1.2 The area of the Site relating to the former ROF has been remediated to ensure that any residual contamination does not pose an unacceptable risk to the health of future occupants or the environment.

2.1.3 The Site also includes a new access road, part of the 2017 Planning Consent, which is due to be completed in late Summer 2021.

2.1.4 The village of Puriton lies immediately to the south west of the Site and the village of Woolavington lies immediately to the south east. Beyond Puriton, approximately 2 km west of the Site, lies junction 23 of the M5 motorway and the motorway runs in north-south orientation.

2.1.5 As well as the M5 motorway, the closest roads are Woolavington Road which runs in an east-west direction between the villages of Woolavington and Puriton to the south of the Site, the B3141 Causeway which runs in a north south direction between the villages of East Huntspill and Woolavington to the east of the Site.

2.2 Proposed Development

2.2.1 The description of development is as follows:

"*Any operations or engineering works necessary to enable the development of the Site, including demolition, excavation and earthworks, the formation of compounds for the stockpiling, sorting and treatment of excavated materials, import of material to create development platforms, piling, and any other operations or engineering necessary for Site mobilisation, office and worker accommodation, communications, drainage, utilities and associated environmental, construction and traffic management.*

the development of a smart campus including:

i) commercial building or buildings with a total Gross External Area of up to 1,000,000m^2 which would sit within current Use Classes E(a) - (g), B2, B8 and sui generis floorspace uses; and
ii) a range of buildings up to 100,000m^2 within Use Classes C1, C2, E (a) – (g), F, B8 including restaurants / cafes, shops, leisure, education and sui generis uses; and
iii) up to 750 homes in Use Class C3,

together with associated infrastructure including restoration of the railway line for passenger and freight services, rail infrastructure including terminals, sidings and operational infrastructure and change of use of land to operational rail land, multi-modal transport interchange, energy generation, energy distribution and management infrastructure, utilities and associated buildings and infrastructure, digital infrastructure, car parking, a Site wide sustainable water management system and associated green infrastructure, access roads and landscaping".

2.2.2 The Proposed Development is shown in a selection of Parameter Plans in **Appendix B**.

3 Legislation, Policy and Guidance

3.1 Introduction

3.1.1 This Chapter provides a review of legislation, policy and guidance relevant to the assessment of obtrusive light in relation to the Proposed Development. It should not be read as a complete guide to all legislation, policy and guidance on lighting.

3.2 Legislation

Clean Neighbourhoods and Environment Act

3.2.1 The Clean Neighbourhoods and Environment Act 2005 (CNEA) amended Section 79 of the Environmental Protection Act 1990 by extending the statutory nuisance regime to include light nuisance, by stating the following:

"…artificial light emitted from premises so as to be prejudicial to health or a nuisance…"

"Subsection (1) does not apply to artificial light emitted from (a) an airport; (b) harbour premises; (c) railway premises, not being relevant separate railway premises; (d) tramway premises; (e) a bus station and any associated facilities; (f) a public service vehicle operating centre; (g) a goods vehicle operating centre; (h) a lighthouse; (i) a prison."

3.2.2 Therefore, since 6 April 2006, artificial light can be considered to be a statutory nuisance unless it is from exempt premises. It should be noted that road lighting is not exempt from the CNEA, although it is unlikely to qualify as a statutory nuisance as road lighting is not strictly located on a premise.

3.2.3 Guidance produced by the Department of Environment, Food and Rural Affairs (DEFRA) in April 2006, on Section 101 to 103 of the CNEA, extends the duty on local authorities to ensure their areas are checked periodically for existing sources of statutory nuisances.

3.2.4 If a light nuisance is considered by a local authority to exist, the local authority must serve a notice on the person responsible requiring the abatement of the nuisance, and/or restricting or prohibiting its recurrence.

3.2.5 Section 103 extends the defence of 'best practical means' to those statutory nuisances where light is emitted from industrial, trade or business premises and also from relevant outdoor sports facilities.

3.3 National Policy

National Planning Policy Framework

3.3.1 The National Planning Policy Framework (NPPF) was last updated on 20th July 2021. This supersedes the existing policy within the first issue of the NPPF (published in March 2012, with updates in July 2018, February 2019 and June 2019). The NPPF includes the following reference in relation to artificial lighting at Paragraph 180:

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

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation." (Page 53).

National Planning Practice Guidance

3.3.2 The Government's Planning Practice Guidance (2014) web-based resource presents specific guidance on light pollution (obtrusive light) presented in Paragraph: 001 – 006. **Table 3.1** sets out how these paragraphs are relevant to the assessment of the Proposed Development, and how each has been considered.

Table 3.1: Planning Practice Guidance on Obtrusive Light (Light Pollution)

NPPG Guidance	How the guidance has been considered in this Lighting Assessment
Paragraph 1: What light pollution considerations does planning need to address?	There is potential for light from the Proposed Development to be obtrusive to people and wildlife or detract from the enjoyment of the night sky. Therefore, obtrusive light from the Proposed Development has been considered further within this report.
Paragraph 2: What factors can be considered when assessing whether a development proposal might have implications for light pollution?	This report considers where, when and how the light shines, as the Proposed Development has the potential to adversely affect the use or enjoyment of nearby buildings or open spaces.
Paragraph 3: What factors are relevant when considering where light shines?	This report considers the potential for light intrusion affecting receptors outside the Site boundary which can lead to annoyance to people, compromise existing dark landscapes, and affect natural systems (**Chapter 7**).
Paragraph 4: What factors are relevant when considering when light shines?	This report considers the potential for lighting including when it may be required (**Chapter 6** sets out the anticipated Lighting Requirements).
Paragraph 5: What factors are relevant when considering how much the light shines?	This report considers the minimum requirements to construct and operate the Proposed Development safely and securely (**Chapter 6**). The Environmental Zone of the Site is established to make sure there is an appropriate level of lighting for the ambient lighting conditions. A framework of mitigation has been established so the light source and its spectral attributes would be considered further during the technical design process.
Paragraph 6: What factors are relevant when considering possible ecological impacts of lighting?	This report considers the effects obtrusive lighting may have on ecological receptors (under ecological receptors in **Chapter 7**). Ecological assessment associated with lighting is provided in the Environmental Statement.

3.4 Local and Regional Policy

Somerset County Council - Reduction of Street Lighting

3.4.1 Somerset County Council identified that historically light pollution is on the rise in Somerset and satellite data shows that between 1993-2000, there was a 20% increase in light pollution. Also, Somerset's streetlights and illuminated boards equate to approximately 12,000 tonnes of CO^2.This is not only significant in terms of energy consumption, but also imposes risk toward human health effects, views of the night sky and impacts on ecology and wildlife within the area.

3.4.2 In order to reduce the environmental impacts of street lighting in Somerset, the Council are currently running a street light reduction project, where the number of streetlights left on at night are reduced. This includes the following approach:

- Part night lighting, which means switching off lights in identified areas between 0:00 midnight and 5.30am
- Light dimming, which involves a reduction of light levels in identified areas by 50%
- Converting lamps to LED, which provides more efficient direct lighting

3.4.3 Street lighting in the following areas will not be affected by part night lighting:

- Most main traffic routes (although some lights may be dimmed)
- Location with a significant night-time road traffic accident record
- Areas with above average record of crime
- Areas provided with CCTV local authority / police surveillance equipment
- Areas with 24 hr operational emergency services Sites including hospitals
- Formal pedestrian crossings, subways, and enclosed footpaths and alleyways where one end links to a street that is lit all night
- Where there are potential hazards on the highway (roundabouts, central carriageway islands, chicanes, speed humps)

3.4.4 There is no formal planning policy from SCC with relation to lighting and new developments. However due to the location of the Proposed Development, SCC's lighting reduction scheme has been identified as relevant to the assessment.

Sedgemoor District Local Plan (2011-2032)

3.4.5 The Sedgemoor Local Plan 2011-2032 was adopted on the 20th of February 2019. It forms part of the development plan for the district and is a main consideration in the determination of planning applications. The Local Plan relates to the whole District and provides a strategy for delivering growth up to 2032. Within the District Local Plan, there are a number of District wide policies relating to lighting:

3.4.6 Policy D13 - **Sustainable Transport and Movement** states that proposals will contribute to reducing adverse environmental issues, including air, **light** and noise pollution, vibration, and surface water run-off, through appropriate mitigation measures, including tree planting along road corridors for shade, amenity, and air quality;

3.4.7 Policy D24 – **Pollution Impacts of the Development** states that development proposals that are likely to result in levels of light that would be unacceptably harmful to other land uses, human health, tranquillity, or the built and natural environment will not be supported. Where there are reasonable grounds to suggest that a development proposal may result in a significant adverse environmental impact, taking into account the sensitivity of the location, the Council will require planning applications to be supported by assessments relating to light pollution. Where it is demonstrated that it is possible to manage the potential adverse impacts of the development proposal through its design or mitigation measures, the Council will, by means of condition or legal agreement, seek to ensure such measures are effective.

3.5 Guidance

Obtrusive Light

3.5.1 A summary of relevant guidance reports on obtrusive light has been provided in the following sections:

ILP Professional Lighting Guide 01: Guidance Notes for the Reduction of Obtrusive Light, 2020

3.5.2 This guidance provides advice on lighting including the recommendation to local planning authorities to specify Environmental Zones for exterior lighting based on the existing external ambient lighting levels in the area. These documents also provide design guidance including maximum obtrusive lighting (lighting pollution) level limits for each Environmental Zone – focusing on reflected light and glare in particular.

ILP Professional Lighting Guide 04: Guidance on Undertaking Environmental Lighting Impact Assessments, 2013

3.5.3 This guidance outlines good practice in lighting design and provides practical guidance on the production and assessment of lighting impacts within new developments. The guide covers guidance on undertaking lighting surveys, taking photographs and measurements at night and what to cover in a Lighting Assessment Report.

ILP Professional Lighting Guide 05 – The Brightness of Illuminated Advertisements, 2014

3.5.4 Defines an illuminated advertisement as “An advertisement which is designed to be illuminated” and provides guidance on their installation.

ILP Professional Lighting Guide 09 – Domestic Exterior Lighting: Getting It Right, 2019

3.5.5 GN09 advises on how best to install domestic exterior lighting to ensure it serves the required purpose and provides the correct level of illumination.

ILP Professional Lighting Guide 10 – Night-Time Photography, 2019

3.5.6 Guidance Note 10 Night-Time Photography focuses on ways to carry out night-time photography with an electronic camera in a consistent manner.

Ecology

3.5.7 A summary of guidance reports prepared by the Bat Conservation Trust on obtrusive light in relation to bats is provided in the following sections:

Bat Conservation Trust – Bats and Artificial Lighting in the UK, 2018

3.5.8 Bats and Artificial Lighting in the UK (August 2018) provides guidance on general principles of lighting to mitigate adverse effects on areas where bats are known to be present and / or commuting to feeding areas. The document sets out advice for bat workers and lighting professionals to ensure that both parties work together to achieve the most effective solution in delivering an appropriate artificial lighting solution whilst reducing the adverse effects on bats.

Landscape and Urban Design for Bats and Biodiversity, 2012

3.5.9 Landscape and Urban Design for Bats and Biodiversity (2012). This document provides advice primarily to landscape architects and ecologists on the design of habitat for bats. It provides design strategies to reduce the potential impact of lighting on bats.

3.6 Standards and Design Guides

British Standards

3.6.1 *BS EN 13201-2:2015 Road lighting - Performance requirements (Revised February 2020)*: Defines performance requirements which are specified as lighting classes for road lighting aiming at the visual needs of road users, and it considers environmental aspects of road lighting.

3.6.2 *BS EN 5489-1:2020 Design of road lighting. Lighting of roads and public amenity areas*: BS 5489-1 is a revision of the British Standard for road lighting design. This document provides recommendations on the general principles of road lighting including aesthetic and technical aspects, operation and maintenance, means of minimising energy consumption and limiting the impact on the environment. The guidance provides recommendations for the design of lighting for urban centres, public amenity areas and smart cities.

3.6.3 *BS EN 12464-2:2014 Light and lighting – Lighting of work places Part 2*: Outdoor work: sets out lighting design criteria for different work places, including industrial Sites and parking areas.

3.6.4 *BS EN 12193:2007 Light and lighting – Sports lighting*: provides recommendations and specify requirements for good quality sports lighting.

3.6.5 *CIBSE 'Lighting Guide 05: Lighting for Education' 2011:* provides a comprehensive guide to lighting for building services engineers designing for education related development.

3.6.6 *CIBSE Lighting Guide 06: The Outdoor Environment 2016*: The Chartered Institute of Building Services Engineers (CIBSE) Lighting Guide 06 (2016) provides general and specific lighting design criteria for the outdoor environment. The guide covers many technical aspects which are likely to be of interest to designers and specifies lighting equipment in outdoor situations.

4 Methodology

4.1 Introduction

4.1.1 This Chapter provides an outline of the methods and procedures that were followed when undertaking the Lighting Assessment including how the baseline lighting conditions were determined and the assessment process undertaken.

4.2 Baseline Conditions

Desk Based Information

4.2.1 A desk-based review of publicly available information was undertaken, in order to inform the existing lighting conditions, and to understand the context of the Proposed Development within its existing environmental setting.

4.2.2 The following sources of publicly available information were reviewed:

- Ordnance Survey mapping and aerial photography (2020);
- Google Street View (2009 to 2021); and
- Defra Multi-Agency Geographic Information for the Countryside (MAGIC) Map Application (2017).

4.2.3 The desk-based review provided an initial indication of the existing lighting conditions and potential light sensitive receptors in and surrounding the Site. However, in order to have a definitive understanding of the existing lighting conditions around the Site a lighting survey was undertaken, the methodology of which is explained further in the following sections.

Lighting Survey

4.2.4 To establish the existing lighting conditions of the Site, a lighting survey was undertaken. The survey recorded daytime and night-time views in a series of photographs at different viewpoints (**Appendix A**). The view was studied to record principal lighting features, obtrusive light and comment on light sources not visible in the photographs. Due regard was given to ILP Guide 10 (2019).

4.2.5 The first daytime survey was undertaken on Tuesday 22nd June 2021 between approximately 14:00-17:00. Weather conditions were dry with a light breeze and the temperature was 19°C.

4.2.6 The second daytime survey was undertaken Wednesday 23rd June 2021 between approximately 11:30-17:00. Weather conditions were dry and sunny. The temperature was 22°C.

4.2.7 The first night-time survey was undertaken on Tuesday 22nd June 2021 between approximately 23:00 - 02:00. The moon phase at the time of the survey was recorded (almost full moon), as well as the weather conditions (clear skies with a light breeze and a temperature of 8°C). There were clearly visible stars.

4.2.8 The second night-time survey was undertaken on Wednesday 23rd June 2021 between approximately 23:00-03:00. The moon phase at the time of the survey was recorded (almost full, visible at times, patchy clouds covering it at times), as well as the weather conditions (dry, but cloudy and a temperature of 11°C). Stars were not visible.

4.2.9 A calibrated light meter (Extech LT300) was also used to measure ambient illuminance at each viewpoint to understand the existing ambient lighting on Site and experienced by

sensitive ecological receptors in this area. When measuring illuminance, the light meter was placed on an even surface, free from obstructions and facing horizontal (directly upwards). Illuminance was also measured at each viewpoint location as additional evidence of the baseline lighting conditions from surrounding visual receptors.

4.2.10 The methodology for the lighting survey was agreed with the Environmental Health Officer (EHO) at SDC Nicola Gardner on 9th February 2021, and with Landscape Officer at SDC Janette Burton on 11th February 2021. This was also confirmed by Landscape Officer at SCC Leanne Butt, on 17th June 2021 via email (**Table 4.2)**.

Sensitive Receptors

4.2.11 Sensitive receptors within and immediately surrounding the Site have been identified taking into account the recommendations in ILP Guide 04 (2013) and drawing on the baseline study of this report.

4.2.12 The ILP Guide 04 (ILP, 2013) recommends consideration of any of the following sensitive areas in or near the Development Site through the assessment:

- A World Heritage Site;
- Dark Sky Core or Buffer Zones;
- National Park Area;
- Area of Outstanding Natural Beauty (AONB);
- Sites of Specific Scientific Interest (SSSI);
- Ramsar Sites;
- Conservation Areas; or
- Vulnerable Wildlife Habitats (e.g., supporting habitat for bats).

ILP Environmental Zone

4.2.13 The ILP have established Environmental Zones for exterior lighting based on the existing ambient lighting levels of the Site (**Table 4.1**). The ILP Environmental Zone classification determines the obtrusive light limitations for exterior lighting installations.

4.2.14 The ILP Environmental Zone classification for the Site, Zone E2 (Rural) has been determined by professional judgement using the baseline lighting information gathered during the desk-based study and subsequent lighting survey, this has been agreed with the SDC via email communication.

4.2.15 Light limitations for Environmental Zones, as set out by the ILP can be found in **Appendix E**.

Table 4.1: Environmental Zone Classifications, ILP 2020

Environmental Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places.

Environmental Zone	Surrounding	Lighting Environment	Examples
E1	Natural	Intrinsically dark	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness	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.

Future Baseline Assessment

4.2.16 To be consistent across the planning application, a future baseline year of 2032 has been used to assess effects from lighting. The year 2032 has been identified as it is the end of the current Local Plan period and a date by which it is reasonable to assume that the development approved by the 2017 Permission will have been delivered.

4.2.17 The following elements that are relevant to the lighting assessment will therefore be included in the 2032 Baseline:

- The implemented 2017 Planning Consent including parameters. The safeguarded land uses will not be included in the 2032 baseline as they have not been granted consent (i.e., they were safeguarded only and would require a new planning permission or consent to progress).
- Landscaping associated with the link road, which is due to be implemented from autumn 2021.
- Other existing and approved development in the surrounding area. This includes development that has been allocated in the Local Plan 2011-2032.
- Likely changes to the l environment between now and 2032 including natural changes such as growth in vegetation, especially of landscaping. It will also include anthropogenic changes such as changes to luminaires and the transition to LED, particularly on the highway.

4.2.18 The current conditions at the Site and in the surrounding area have been factored forward to predict likely conditions at the Site in 2032 to enable the effects of the LDO to be considered against a ‘do nothing’ scenario.

4.2.19 The future baseline has been determined through reference to existing design and assessment reports for the 2017 Permission and new access road, reasonable assumptions on what lighting is required for each land use and professional judgement on how the existing conditions may change. This future baseline is described in **Chapter 5**.

Consultation

4.2.20 Prior to the lighting survey being conducted, consultation was carried out with relevant bodies concerned with the Proposed Development. This was to confirm that a correct methodological

approach was agreed amongst all concerned parties before commencement of the survey. A summary of correspondence is displayed in Table 4.2.

Table 4.2: Key email correspondence regarding assessment methodology

Consultee Organisation	Consultee Name	Date query issued	Nature of Query	Date response received	Nature of response
SDC	Janette Burton	02.02.2021	Methodology for lighting assessment.	11.02.2021	Methodology was agreed as appropriate, including the viewpoints for the survey. It was noted that any potential impacts on bats from the survey, must be taken into account and this approach will be supported by discussions with the County Ecologist.
SDC	Nicola Gardner (EHO)	02.02.2021	Methodology for lighting assessment.	09.02.2021	Agreement that proposed methodological approach is appropriate. This is subject to what may be found when carrying out the survey. It was noted that any queries regarding biodiversity and/or landscaping, should be directed to the correct colleagues within SDC for guidance.
SCC	Leanne Butt	09.06.2021	Methodology for lighting assessment.	17.06.2021	Proposed methodology was agreed. Suggested reference to Guidance Note 8 - Bats and Artificial Lighting (2018) from the ILP, as well as reference to the Bat Conservation Trust, to best inform assessment.

4.3 Assessment

Qualitative Assessment

4.3.1 The lighting impact assessment of the Proposed Development has followed the Institution of Lighting Professionals' (ILP's) Professional Lighting Guide 01: Guidance on undertaking Environmental Lighting Impact Assessments (2013).

4.3.2 This report presents a qualitative assessment of the effects of construction and operational lighting from the Proposed Development on sensitive receptors against the existing baseline lighting conditions. The assessment accounts for in-built mitigation designed into the parameters of the planning application, such as soft landscaping.

4.3.3 The qualitative assessment considers:

- The change in views as a result of the introduction of external lighting at night-time; and

- The effects of obtrusive light on sensitive receptors.

4.3.4 A quantitative assessment has not been undertaken as the design information required to prepare a lighting design and then model the lux levels is not available due to the parameter led nature of the outline planning application.

Obtrusive Light

4.3.5 The components of obtrusive light considered in the qualitative assessment are shown in **Figure 4.1** and listed below:

- **Sky glow** – this is the general illumination of the night sky above conurbations and any areas where there are large amounts of artificial light. It comprises aspects of reflected light from illuminated surfaces, direct upward light from lighting installations and intrusion light, which is light which falls outside the specific area to be lit.

- **Glare** – this is the brightness of a light source when viewed against a dark background. Most often experienced when the light source itself (i.e. the bulb or tube) is directly visible and is not covered by a shield, cowl, or directed by a suitable lens / reflector arrangement.

- **Light Intrusion (or 'trespass')** – this is light which affects areas beyond those which are supposed to be lit by a particular source and which, depending on the nature of the receptor effected, has the potential to cause nuisance and disturbance.

4.3.6 The ILP PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessment (2013) provides guidance on undertaking lighting assessment. It should be noted that this guidance has been used to inform the lighting assessment undertaken in this report, however it does not comprise part an Environmental Impact Assessment.

4.3.7 The impacts of lighting effects during construction and operation are assessed against the criteria outlined in **Table 4.3** which is taken from the ILP PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessment (2013). Level of effect has been determined using this criterion based on professional judgement and giving consideration to both positive and negative lighting effects associated with the Proposed Development.

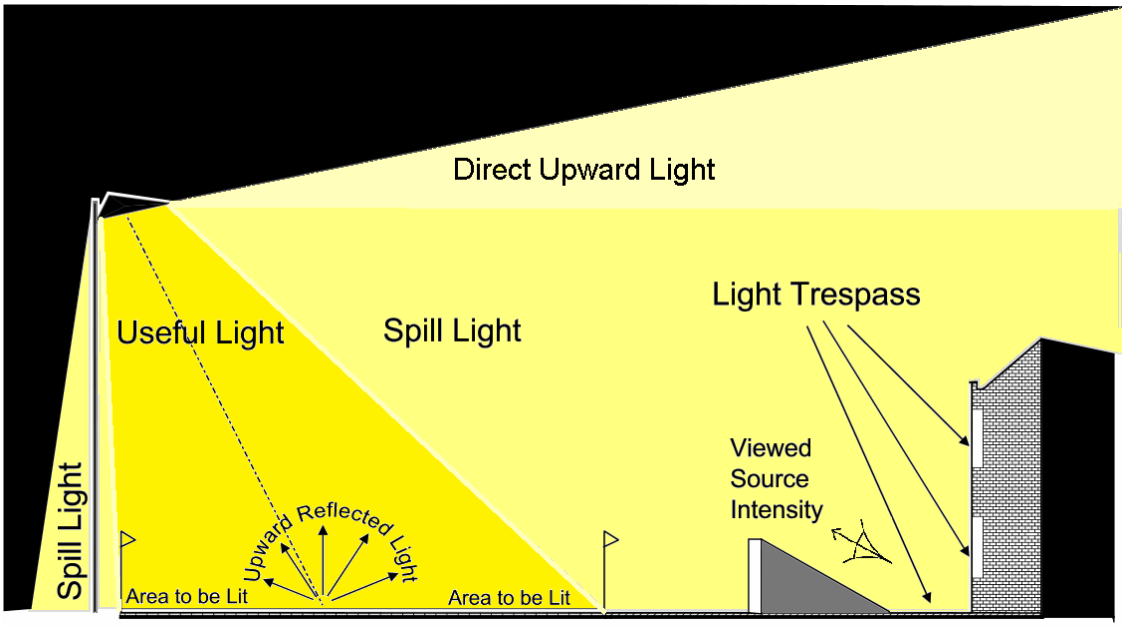

Figure 4.1: Obtrusive light (Source: ILP guidance 2011)

Table 4.3: Lighting Assessment Criteria (Source: ILP PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessment (2013))

Nature	Level	Description
Positive	Major/ substantial beneficial effects	Significant improvement in night environment and/or reductions in glare, spill light and sky glow etc
	Moderate beneficial effects	Noticeable improvement in night environment and/or reductions in glare, spill light and sky glow etc
	Minor beneficial effects	Slight improvement in night environment and/or reductions in glare, spill light and sky glow
Neutral	None/ negligible	No significant effect or overall effects balancing out
Negative	Minor adverse effects	Slight increase in visibility of Site, glare, and sky glow etc
	Moderate adverse effects	Noticeable increase in visibility of Site, glare, and sky glow etc
	Major adverse effects	Significant problems with increase in visibility of Site, glare, and sky glow etc

4.4 Mitigation

4.4.1 This Lighting Assessment provides general principles and recommendations to mitigate any adverse effects of obtrusive light on sensitive receptors that have been identified following the guidance established in ILP Guide, 2020.

4.4.2 The principles and recommendations should be considered as part of the subsequent lighting designs for each phase of the Proposed Development that may be brought forward for approval in order to deal with obtrusive light, and to protect the sensitive receptors that have been identified within and surrounding the Site.

4.4.3 In addition, any recommendations in relation to road lighting would need to be considered with the results of a Road Safety Audit.

4.5 Limitations

4.5.1 In the absence of statutory guidance, the ILP ‘Guidance Notes for the Reduction of Obtrusive Light’ has been used as criteria against which to assess the effects of artificial lighting, in accordance with best practice.

4.5.2 The lighting survey was carried out beyond standard working hours when more lighting is required. In addition, the survey was partially carried out during Somerset Councils part-night lighting or dimming policy for street lighting (00.00 to 05.30). This means that some of the night-time photographs may not have recorded all operational lighting from surrounding land uses.

4.5.3 The lighting survey was undertaken during May and therefore deciduous trees were in leaf and vegetation in full growth. This shows the extent of natural screening to the Site compared to what would be expected in autumn/winter when they are bare.

5 Baseline Conditions

5.1 Introduction

5.1.1 This Chapter describes the existing and future baseline lighting conditions of the Site in its context.

5.2 Existing Lighting Conditions

Qualitative Description

5.2.1 The Royal Ordnance Factory was previously located on part of the Site and contained a range of buildings with artificial lighting (including road and flood lighting) prior to the ceasing of operations in 2008. Since this time, the Site has largely been cleared and the majority of the buildings on Site have been demolished. Therefore, during the survey no lighting was identified within the Site.

5.2.2 To the north and east of the Site, the area is predominantly agricultural with individual residential dwellings and farms and the small village of East Huntspill. There are a small number of sources of artificial lighting associated with security and amenity (LED and halogen) use in these areas. There is also some street lighting (LED and HPS) present within East Huntspill.

5.2.3 To the south east and south west of the Site are the villages of Woolavington and Puriton, respectively, which also contain street lighting (LED and HPS) and sources of lighting associated with residential and commercial uses. Beyond Puriton to the south west, is Woodlands Court Business Park which includes large employment and storage and distribution units (such as Morrison's). Further south of this again is the large urban area of Bridgwater.

5.2.4 Construction is ongoing on a new Site access road which connects the southern boundary of the Site to the A39. This road will be lit with approximately 8 m tall column mounted LED luminaires. It is anticipated that this will be complete by Summer 2021.

5.2.5 In summary, the Site has hosted a previous industrial land use and has permission for re-development, however it is currently predominantly dark with no light sources. The surrounding area is characterised by relatively dark rural areas with lighting from nearby settlements including Purton, Bridgwater and Woolavington.

Quantitative Description

5.2.6 No light sources were identified on Site during the desk-based review of Site information and so no measurements were undertaken on the Site.

5.2.7 Illuminance was measured around the Site at each viewpoint to give an indication of the existing light levels in these locations to define the baseline conditions.

5.2.8 The results are presented in **Table 5.1** below and the locations are shown in **Appendix A**.

Table 5.1: Illuminance Levels

Location Reference	Illuminance (lux)
F	0.04

Location Reference	Illuminance (lux)
O	0.02
D	0.01
K	0.02
G	0.02
B	0.06
H	4.35
Q	0.04

5.2.9 **Table 5.2** below presented examples of illuminance levels associated with different lighting conditions. From the table below, it is shown that the Site's lux levels correlate to lighting conditions found in typical moonlight/cloudy sky. This is supported by the qualitative description of the baseline conditions found during the lighting survey, in that that there were limited artificial light sources at each viewpoint.

Table 5.2: Example Illuminance Levels[1]

Lighting Condition	Illuminance (Lux)
British summer sunshine	50,000
Overcast sky	5,000
Well-lit office	500
Minimum for easy reading	300
Passageway or outside working area	50
Good main road lighting	5-20
Sunset	10
Typical side road lighting	5
Minimum security lighting	2
Twilight	1
Clear full moon	0.25 to <1
Typical moonlight/cloudy sky	0.1
Typical starlight	0.001
Poor starlight	0.0001

[1] Reproduced from the Bat Conservation Trust and ILP Guidance Note 08/18: Bats and Artificial Lighting in the UK (2018).

5.3 Lighting Designation – ILP Guidance

5.3.1 In the context of the existing lighting conditions of the Site identified through a lighting survey and in the context of the surrounding area, it has been concluded that the Site lies within ILP Environmental Zone E2 (**Table 4.1**), due to it being on the edge of an area of urban development and the low levels of district brightness identified during the lighting survey.

5.4 Existing Night-time Views

5.4.1 The lighting survey recorded night-time views in a series of photographs from viewpoints that were pre-agreed with the local authority (as set out in the methodology, shown in **Chapter 4**).

5.4.2 A summary of the existing lighting conditions based on night-time views from locations surrounding the Site is provided below with the supporting panoramic photographs provided at **Appendix D**.

- Viewpoint B – View looking east from the Site from Batch Road, approximately 500m from the Main Site. The general topography in the foreground of the viewpoint screens the view of the Site. There is no lighting present from the nearby M5 motorway, or from the two smaller roads close to the viewpoint. It is possible to see road signs reflecting lights from vehicles on the M5. Sky glow is visible toward Puriton in the northeast direction from the viewpoint. Gaps in vegetation in the background of the viewpoint show LED column mounted lights on the new Gravity ring road in the distance. HPS road lighting is also visible from Puriton in the distance.

- Viewpoint D – View looking north-east across the Site from the Woolavington Road adjacent to Martlands Farm. There are temporary traffic lights along Woolavington Road, where the viewpoint is located (red, yellow, green lights). There are pylons visible on Site in the distance which are not illuminated. There is no lighting on the nearby Woolavington Road (aside from traffic lights) or any of the surrounding roads. A Site cabin existing across the road from the viewpoint is a potential source of light however no light was recorded during the night survey. This was the same case for residential buildings on either side of the road opposite to the Site, as well as commercial buildings. All of which are potential light sources, however no lighting was noted during at these locations during the night-time survey. Skyglow is visible to the northwest of the viewpoint, toward from Hinkley. Glare from Hinkley is screened from vegetation and topography.

- Viewpoint F – View looking west from the Causeway towards the Site, approximately 560 m away from Main Site. No street lighting on road where viewpoint is located. No light source were identified from the security cabin that is located within the Site and visible from the viewpoint. High Pressure Sodium (HPS) and LED road lighting were present from Woolavington in the distance. There is skyglow in the area above Hinkley in the northeast direction in the background of the view.

- Viewpoint G – View looking west from Withy Road approaching East Huntspill, approximately 1.9 km from the Main Site. Unilluminated pylons are visible in the background of the viewpoint, to the north of the Site. To the right end of the viewpoint are two residential properties, where small amenity halogen lighting is noted through the windows. No lights are noted externally to these properties. There is no lighting on the roads surrounding the viewpoint. Sky glow is visible to the south direction, toward from Hinkley and Bridgwater.

- Viewpoint H – View looking north along footpath, to the east of Puriton. The viewpoint is approximately 200 m from the Site. Unilluminated pylons are in the background of the viewpoint in the distance. Halogen lighting is visible from nearby residential buildings close to the viewpoint in Puriton. HPS/LED street lighting is also visible from the Puriton

area, west from the viewpoint. LED road lighting is visible from the newly constructed Gravity link road. LED and halogen lighting also visible from the Gravity construction premises close to the viewpoint, including from the on-Site security cabin. Red/yellow lighting is visible in the distance toward Weston Super Mare in the northwest direction. Skyglow is visible in the north toward the M5 in the distance.

- Viewpoint K - The Site is visible in background of the viewpoint, which is approximately 440 m from the Site. Tall silos and farm buildings were visible in the background from the viewpoint, however no light sources were recorded during the visit. Residential buildings which were visible to the right side behind the viewpoint, where a small amount of LED/halogen light sources were noted. Bright lighting is visible from Hinkley Power Station to the north beyond the Site. There is an aircraft warning tower with lights (red flashing) to the north of the Site. Glare and skyglow is visible in all directions, but predominantly to the north towards Hinkley Power Station.

- Viewpoint O – View looking north east from the Lydeard Hill within the Quantocks AONB. The Site is distantly visible, approximately 17 km from the viewpoint. There were no lights within AONB/ immediately adjacent to the viewpoint, but distant lighting from Bridgwater and surrounding areas were visible. No light intrusion on the AONB was identified at the viewpoint. Glare is present from Hinkley in the west and Bridgwater to the northeast. Sky glow was visible from all directions apart from the west/south west.

- Viewpoint Q – The viewpoint is approximately 15 km from the Site, which is distantly visible. Car lights and LED motorway lights are visible from the M5 in the north direction of the viewpoint. A small amount of sky glow was visible from the nearby M5 close to the viewpoint. In the distance are several scattered lights originating from buildings in the distance. These are a mix of lighting types, including HPS. MH and LED. There is also a small amount of lighting visible from nearby villages in the east direction, potentially Cross and Lower Wear. This however was not too prominent, and the most likely cause was LED residential security lighting, rather than street lighting.

- Viewpoint A – Due to land access restrictions and safety concerns, Viewpoint A was not visited during the night-time survey. An informed assessment using existing available information was therefore deemed an appropriate alternative as the motorway surrounds the viewpoint location, so an alternative viewpoint location was not possible. To inform the assessment, desk-based information was used including daytime photography from the Landscape and Visual Impact Assessment. Based on the information that was available, no potential receptors were identified aside from M5 road users. From looking at Google Maps around the viewpoint area, no immediate light sources were identified. Based on the Landscape and Visual Impact Assessment photos, the Site was not visible at night from the viewpoint.

5.5 Sensitive Receptors

5.5.1 The existing light sensitive receptors within and surrounding the Site that have the potential to be affected by obtrusive lighting from the construction and operation of the Proposed Development are presented in **Table 5.3**. The future light sensitive receptors that are proposed within the development are presented in **Table 5.4**. Sensitive receptors were identified in accordance with the methodology set-out in **Chapter 4**.

Table 5.3: Existing Sensitive Receptors

Receptor	Description
Residents	■ Withy Grove Road (~750m west of the Site) ■ East Huntspill (~1 km north of the Site) ■ Woolavington (adjacent to south eastern boundary) ■ On Woolavington Road (adjacent to southern boundary) ■ Puriton (~50m from southern boundary)
Road Users	■ Woolavington Road (within the boundaries of, and adjacent to, the Site) ■ M5 (adjacent to the western Site boundary) ■ Batch Road/Puriton Road (adjacent to the Site) ■ B3141 Causeway (adjacent to the eastern Site boundary) ■ A39 (adjacent to the southern Site boundary)
Visual Amenity	■ Quantock Hills AONB (~11 km south west of the Site, some smaller villages in between, mostly greenfield.) ■ Mendip Hills AONB (~16 km north west, mostly greenfield, some smaller villages)
Ecology	Existing light sensitive species and habitats on and in close proximity to the Site, including bats and associated foraging and commuting corridors.

Table 5.4: Future Sensitive Receptors (within the Site)

Receptor	Description
Residential	New residential receptors located on Site as part of the proposed development.
Road Users	New internal roads within the Proposed Development
Railway	New railhead and track provided as part of the Proposed Development.
Ecological	Retained and proposed habitats provided on Site.

5.6 Future Lighting Conditions

5.6.1 As explained in **Chapter 4** of this report, the year 2032 is being used as the 'future baseline' and therefore this section sets out the reasonable assumptions that have been made as to what the future lighting conditions will be within the Site.

2017 Permission

5.6.2 The Lighting Impact Assessment prepared for the 2013 ES and subsequent 2017 ES Addendum for Huntspill Energy Park identified that lighting likely to be required as part of the development would include:

- column mounted road and car park lighting (Light Emitting Diode (LED luminaries);
- approach road (sodium luminaries);
- column and building mounted luminaries at loading bays and industrial yards (LED or metal halide);
- low level bollard lighting or columns along footpaths; and
- low level lighting and building mounted lighting at recreational facilities.

5.6.3 The ES and ES addendum also identified that there may be internal light egress from office, warehouse, and industrial buildings (e.g., through skylights) which may have a visual impact.

5.6.4 The location of the lighting likely to be required is linked to the proposed land uses identified in the parameter plans that define the 2017 Permission. **Table 5.5** sets out reasonable assumptions of lighting proposed under the 2017 Planning Permission.

5.6.5 Given the proposed uses and lighting strategy associated with the Huntspill Energy Park (as identified in the 2012 ES and 2017 ES Addendum), the future 2032 baseline of the Site would be classified as E2 – Rural across areas with lower intensity/ no lighting (e.g., landscaping), with areas of greater illumination associated with the land uses classes classified as E3 – Suburban.

Table 5.5: Reasonable Assumptions of Lighting Proposed under the 2017 Planning Permission

Plot	Land Use from Parameters Plan under the 2017 Planning Permission	Reasonable Assumptions of Lighting Proposed under the 2017 Planning Permission
A, D , F	Storage/Distribution	Column mounted road and car park lighting (Light Emitting Diode (LED luminaries) Column and building mounted luminaries at loading bays and industrial yards (LED or metal halide); Low level bollard lighting or columns along footpaths;
B1	Offices/R&D/Light Industry	
B2, H	Manufacturing/General Industry	
C1+2	Offices/R&D/Light Industry	

Aviation Lighting

5.6.6 Under the 2017 Consent, there was a CCGT stack of 65 metres an EFW stack of 105 metres and a Biomass CHP stack of 50 metres in heights.

5.6.7 Within the technical report on energy generation for the 2017 Consent, it was noted:

"Under Article 219 of UK Air Navigation Order (ANO) 2009, there is a mandatory lighting requirement for structures of 150m or more in height, however structures of lesser height may need to be lit if they constitute a hazard to air navigation. The Article 219 specification requires that medium intensity (2000 candela) steady red lights be mounted as close as possible to the top of the structure and at intermediate levels not exceeding 52m. Such lighting should be displayed at night and be visible from all directions. In addition, the location of a tall structure

may also be a potential hazard to aviation. Comment should be sought from the Directorate of Airspace Policy (DAP) of the CAA for all proposals over 90m in height."

Gravity Link Road

5.6.8 The Gravity Link Road is a new road as part of the Proposed Development, which connects the south of the Site to Junction 23 of the M5. The road is due for completion in Summer 2021. As well as motorway accessibility, the road also provides links between the residential areas of Puriton and Woolavington.

5.6.9 A scheme for the approach road has been generated by Peter Brett Associates based on Urbis luminaires. The roadway is illuminated from the roundabout junction with the A39 to the junction with Hillside. From Hillside to the roundabout with Woolavington Road the road is unlit.

5.6.10 At the junction with Woolavington road lighting is re-started and continues into the Site. The scheme broadly consists of 10-metre-high columns at between 26 and 38 metres spacing. Lamps are currently SON resulting in an orange light source. In the context of Puriton (which is currently predominantly illuminated by SON) this is acceptable as it will blend the roadway with its surrounding area.

5.6.11 On the first section of the roadway lighting is partially shielded by planting (which will increase in shielding as it matures). On the lower section of the roadway the lighting is not contained within trees or high-level planting.

5.6.12 The luminaire proposed is fully cut-off (even when mounted at a 5-degree inclination). This inclination will marginally increase the visibility of the lamp source however the optics are such that they provide controlled lighting to the roadway with very limited spill lighting. No direct upward lighting will occur.

Other Approved Developments

5.6.13 A search for any committed developments within a 3 km study area from the Site was carried out. Four developments were shortlisted for inclusion and out of these four, two were not considered relevant to the lighting assessment due to their location with relevance to having effect on lighting. Committed developments that are relevant to the Proposed Development are described in **Table 5.6.**

Table 5.6: Committed Developments

Application Reference	Distance from the Site	Description of Development	Proposed Lighting
42/20/00014	0.5km	Outline application with some matters reserved for the erection of up to 120 dwellings with public open space, structural planting and landscaping, surface water flood mitigation and attenuation, and vehicular access point from Woolavington Road (all matters reserved except access)	The proposal is for a medium density residential development with associated lighting. The development is not anticipated to give rise to any abnormal night time effects and will result in a small increase in background lighting levels which will be seen in the context of existing lighting within the neighbouring residential area.

Application Reference	Distance from the Site	Description of Development	Proposed Lighting
54/19/00008	1.47km	Hybrid (full and outline) application. Full application for the erection of 100 dwellings including 30 affordable homes and associated infrastructure. Outline application with some matters reserved for the erection of up to 75 dwellings and associated infrastructure.	No lighting description found in the planning application
54/20/00009	1.24km	RESUBMISSION OF 54/18/00008 WHILE AT APPEAL Outline planning application with some matters reserved for the erection of up to 125 dwellings with public open space, landscaping, sustainable drainage system (SuDS), formation of vehicular access and offsite improvements to the A39/ B3141 Woolavington Hill junction.	It is considered that whilst there would be some illumination from the Proposed Development, it would be observed in the context of Woolavington which is lit. The perimeter and internal framework of hedges and trees would help to reduce illumination and light spill. It is concluded that the lighting effects would not result in a significant harmful effect on the overall night time skies landscape. Effects are judged to be minor adverse at Year 0 and these would reduce to negligible-minor adverse at Year 10 due to the maturing landscape framework that would further restrict light emissions.
54/20/00010	0.74km	RESUBMISSION OF 54/19/00011 WHILE AT APPEAL Outline application with some matters reserved, for the demolition of stable buildings and the erection of up to 95 dwellings with public open space, landscaping, and sustainable drainage system (SuDS), vehicular access point from Woolavington Road and the erection of	No lighting description found in the planning application

Application Reference	Distance from the Site	Description of Development	Proposed Lighting
		a double garage with associated access at Westfield Farm	

6 Lighting Requirements

6.1 Introduction

6.1.1 This Chapter outlines the minimum lighting requirements to safely and securely construct and operate each land use identified within the parameter plans of the Proposed Development.

6.1.2 The lighting requirements of the future baseline which includes the 2017 Permission, link road and other approved development is set out in **Chapter 5**.

6.2 Construction Lighting Requirements

6.2.1 The construction proposals will allow for any operations or engineering works necessary to enable the development of the Site.

6.2.2 The general lighting requirement is predictable for fixed elements of the construction works such as formation of compounds for the stockpiling, sorting and treatment of excavated materials; and any other operations or engineering necessary for Site mobilisation, office and worker accommodation, communications, drainage, utilities, parking areas, fuel storage areas, and plant storage areas.

6.2.3 Task specific lighting to maintain safety around demolition, excavation and earthworks areas including other specific activities such as concrete pouring, piling and traffic management will vary according to weather conditions, programme, and the particular tasks being undertaken.

6.2.4 Construction lighting tends to lead to more significant adverse effects than operational lighting because of its temporary nature, and the type of lighting equipment used. For ease of deployment and use, construction lighting tends to be mobile, and focus on providing the widest coverage of light from the fewest possible units in order to minimise time spent maintaining and installing the equipment. This, along with the fact that it can be poorly directed or installed, can result in problems with glare, light intrusion and sky glow.

6.2.5 Lighting may also be present from construction vehicles and plant which often deploy flashing lights and strobes when operating which can cause additional adverse effects to occupied residential areas.

6.2.6 There will be no night-time working outside of the agreed standard working hours unless otherwise agreed with Sedgemoor District Council (SDC) for the Proposed Development. Work during darkness is therefore more likely during the winter months when the days are short, and lighting is required. It is assumed that standard working hours are:

- Monday to Friday: 7.30am to 6pm;
- Saturday: 8am to 1pm; and
- Sunday and bank holidays: no working.

6.3 Operational Lighting Requirements

Overview

6.3.1 Operational lighting is required throughout the Proposed Development to provide the minimum level of lighting to complete activities safely, to prevent crime, and to meet highway safety standards.

6.3.2 This section provides an overview of the likely lighting requirements that will emerge in relation to the Proposed Development, although this will be further defined through the next stage of

the design process when a lighting design will be prepared and submitted to the SDC for approval as a condition of the LDO.

Standards and Guidance

6.3.3 The following standards and guidance are applicable to the proposed uses and external artificial lighting requirements for the Proposed Scheme. Further information is provided in **Chapter 3**.

- The ILP Guidance Notes for the Reduction of Obtrusive Light (2020)
- ILP Professional Lighting Guide 05 – The Brightness of Illuminated Advertisements (2014)
- ILP Professional Lighting Guide 09 – Domestic Exterior Lighting: Getting It Right.
- Bat Conservation Trust and ILP Guidance Note 08/18: Bats and Artificial Lighting in the UK (2018)
- BS EN 5489-1:2020 Design of road lighting. Lighting of roads and public amenity areas - BS 5489-1 (2020)
- BS EN 13201-2:2015; Road lighting – Performance requirements; requirements for good quality sports lighting (2015).
- BS EN 12464-2:2014 Light and lighting - Lighting of work places Part 2: Outdoor work (2014)
- BS EN 12193:2007 Light and lighting – Sports lighting: provides recommendations and specify requirements for good quality sports lighting.
- CIBSE 'Lighting Guide 05: Lighting for Education' (2011).
- CIBSE 'Lighting Guide LG6: The Outdoor Environment' (2016).

General Lighting Strategy

6.3.4 In addition to the standard and guidance outlined above, **Table 6.1** below outlines parameters that will be used to guide the future lighting designs so there is a consistent approach to lighting design across the LDO.

Table 6.1: Lighting Design Parameters

Design Parameter	Indicative Design	Notes
ILP environmental zone	As outlined within **Section 1.2**, the Site is classified as being within Environmental Zone E2 Lighting provided on Site will be designed to be within the light limitation thresholds of the E2 zone where practically and economically feasible.	
Average Illuminance	General external lighting will be provided to the minimum average illuminance identified in the standards identified above.	Future tenants may have differing requirements. These would be agreed during submission of lighting design to discharge a planning condition.

Design Parameter	Indicative Design	Notes
	This will require a staged approach to lighting classification of each task area with lower risk area in terms of safety and security will required lower levels of average illuminance.	
Operating hours	Operational hours of lighting will depend on the land use. In areas which are not used 24 hours a day lighting will be dimmed or switched off by curfew[2]. In some instance, operations will be undertaken 24 hours a day. Where safety or security lighting is provided and will be used between 23:00 and 07:00, this part of the lighting system will comply with the lower levels of lighting recommended during these hours as outlined in Table 3 of the ILP Guidance 2020.	
Luminaire source	LED	Other luminaire sources considered if impractical to meet required illuminance levels for safety (e.g., railway) and would be agreed with SDC.
Maximum tilt angles	Columns – Zero tilt Buildings – Zero tilt	All luminaires will be horizontal and will not be tilted. All luminaries have optics devised to perform tasks without having to tilt them.
Maximum ULR	Maximum ULR - 2.5% (threshold for Environmental Zone E2)	
Maximum Glare	Maximum luminous intensity emitted by luminaire (I in cd) where the projected area (Ap) >0.5 $m^{2:}$ Pre-curfew = 7,500 Post-curfew = 500 (Thresholds for Environmental Zone E2 – see **Appendix C** Table C for further details and Ap sizes)	Specifically illuminated bollards should contain internal optical controls or external louvres to direct light downwards to protect drivers from discomfort or disability glare.
Maximum Correlated Colour Temperature (for sensitive ecological areas)	3000K	3000K has been selected through consultation with the project ecologist. Using warmer colour temperatures is considered to cause less impact on bats**Error! Bookmark not defined.**.

[2] Curfew is assumed to be 23:00

Design Parameter	Indicative Design	Notes
		. ILP GN08/18 cites Stone (2012, 2015a, 2015b) who states that "*warm white (more yellow/orange colour) at around 3000°K and as low as 2700°K can now be used with little reduction in lumen output.*
Control system	A centralised control system shall be put in place to meet the occupiers' requirements that will use sensors to minimise lighting e.g., time switch, photocell and presence detection. The controls shall allow independent switching for different task areas. Presence detection will also be used in areas of intermittent pedestrian traffic. For security lighting, the use of infrared lighting and cameras should be considered where possible to reduce the need for visible lighting outside working hours.	
Maintenance Factor	All lighting design information should present the initial light output of the designed installation (i.e., M.F of 1.0).	
Maximum luminance of illuminated signage	Illuminated signage provided on Site will be within the ILP maximum permitted recommended luminance for Environment Zone E2 which is: Illuminated area up to $10m^2$ = 400 cdm^{-2} Illuminated area over $10m^2$ = 200 cdm^{-2}	
Illuminance onto boundary features	The following should be observed when producing or assessing illuminance contour plans. • A horizontal calculation plane representing ground level should always be used. • Vertical calculation planes should be used adjacent to boundary features to show the illumination directly upon the vertical faces of the boundary. • A 1 lux contour should be included as a minimum.	

Lighting for Proposed Land Uses

6.3.5 Building on the general lighting strategy, reasonable assumptions on the operational lighting for each of proposed land uses within the Parameter Plan (see **Appendix B**) is defined further in the following sections.

Commercial (Advanced Manufacturing)

6.3.6 The Proposed Development is anticipated to provide a 1,000,000 sqm commercial building or buildings under land use Classes E(a) - (g), B2, B8 and sui generis

6.3.7 The operator(s) of this advanced manufacturing facility is expected to develop the lighting design within the general lighting strategy identified above but the lighting installation will respond to its own operational requirements and preserve brand identity.

6.3.8 External areas such as vehicle access, internal roads, and vehicle parking, should consider the minimum lighting requirements set out in BS 5489-1:2020 Design of road lighting. Lighting of roads and public amenity areas.

6.3.9 Other external areas including loading bays, service yards, external storage, waste management and pedestrian routes should consider minimum lighting requirements set out in BS EN 12464-2:2014 Light and lighting - Lighting of work places Part 2: Outdoor work and CIBSE 'Lighting Guide LG6: The Outdoor Environment'.

6.3.10 For those elements that do not require 24-hr operation, external lighting is most likely to be required during standard trading hours. A lighting curfew would therefore function that would reduce the level of external lighting post-curfew, either through dimming or part night-time lighting through a control system.

6.3.11 Any signage or advertisements would need to meet illuminance levels set out within ILP Professional Lighting Guide 05 – The Brightness of Illuminated Advertisements (2014) guidance document. See section 6.3.3 of this report where lighting guidance is discussed.

Rail (passenger station, freight station and associated infrastructure)

6.3.12 The railway line will be restored for passenger and freight services but will not be illuminated as this is not expected to be required for safety purposes.

6.3.13 The rail infrastructure including terminals, sidings and multi-modal transport interchange will be illuminated in order to maintain safety for passengers and operators using these facilities.

6.3.14 Lighting will be designed to the latest standard provided by the Railway Safety and Standards Board (RSSB) including *RIS-7702- INS Rail Industry Standard for Lighting at Stations Issue One* in June 2013. Other railway infrastructure would need to be designed to other available British Standards or CIBSE guides provided for working in the outdoor environment.

6.3.15 Lighting for the rail uses will be provided from gantry cranes, with the underside of these carrying downlighting units to illuminate the working area beneath the crane. The remainder of the area will be lit from perimeter lighting columns, with the assumption that they will be between 18-20 meters in height, and they may stay on throughout the night.

Education

6.3.16 Education uses will be brought forward to respond to operator(s) demand and will be linked to the employment uses and workforce on Site, for example a campus training facility to deliver training and development specific to the demands of occupiers. If demand requires, a nursery/day care facility will be provided.

6.3.17 There are a number of types of lighting required for education facilities including general lighting (for security and amenity); floodlighting for sports and multi-purpose sports playing fields; lighting for car and bicycle parking and service areas.

6.3.18 CIBSE 'Lighting Guide 05: Lighting for Education' (2011) sets out recommendations for the use of external lighting on school premises, with an emphasis on safety and security. This

guidance will be considered in the detailed design of external lighting for the new training centre.

6.3.19 The lighting design for the external areas of the new schools will be designed in accordance with BS EN 12464-2:2014, and any sport pitches requiring lighting at the new schools will be designed in accordance with BS EN 12193:2007.

Hotel

6.3.20 The hotel and conference facilities are likely to require external lighting. External areas such as vehicle access and parking, should consider the minimum lighting requirements set out in BS 5489-1:2020 Design of road lighting. Lighting of roads and public amenity areas.

6.3.21 Other external areas including loading bays, external storage, waste management and pedestrian routes should consider minimum lighting requirements set out in BS EN 12464-2:2014 Light and lighting - Lighting of work places Part 2: Outdoor work and CIBSE 'Lighting Guide LG6: The Outdoor Environment'.

6.3.22 Lighting is required at all hours as the campus operates on a 24/7 basis.

6.3.23 Any signage or advertisements would need to meet illuminance levels set out within ILP Professional Lighting Guide 05 – The Brightness of Illuminated Advertisements (2014) guidance document.

Energy Distribution and Management

6.3.24 The 'Energy Distribution and Management Infrastructure' will comprise infrastructure to assist with Site-wide energy management including for renewable and low carbon energy solutions within the Proposed Development.

6.3.25 External lighting is expected to be limited but will be required for safety and security associated with access, car parking and pedestrian routes throughout the Site. This external lighting will consider the minimum lighting requirements set out in BS EN 12464-2:2014 Light and lighting - Lighting of work places Part 2: Outdoor work and CIBSE 'Lighting Guide LG6: The Outdoor Environment'.

6.3.26 For the purpose of assessment, it has also been assumed that all stacks or flues above 15 m associated with energy generation, would be lit with a 'medium intensity red aviation light'.

Residential

6.3.27 Residential built development would be equipped with external amenity and security lighting to illuminate particular areas around the building. This may for example be at all external doors, external amenity, car parking and footpaths leading to buildings.

6.3.28 Any residential blocks provided may be equipped with external amenity and security lighting to illuminate communal areas, footpaths, signage, storage areas and parking areas. Residential areas will also include community waste management facilities such as drop points which may be lit with column mounted or low-level lighting (e.g., bollards).

6.3.29 Any external lighting will follow ILP Professional Lighting Guide 09 – Domestic Exterior Lighting: Getting It Right, 2019.

Sports, Leisure and Community Facilities

6.3.30 External areas such as vehicle access, internal roads and vehicle parking, should consider the minimum lighting requirements set out in BS 5489-1:2020 Design of road lighting. Lighting of roads and public amenity areas.

6.3.31 It has been assumed that selected sports pitches are likely to be fitted with floodlighting designed to BS EN 12193:2007 Sports Lighting (or later version if released) and the Sport England design guide suitable to the sport that is selected.

Open Spaces and Biodiversity Zones

6.3.32 The open spaces and biodiversity zones consist of surface water attenuation features, watercourses, woodland, hedgerows and trees, utilities, and occasional vehicular routes.

6.3.33 No external lighting is proposed for these land uses.

Access and Roads

6.3.34 To safely and securely operate new vehicular accesses (including primary, secondary and emergency access) new road lighting will be required and this will be designed in accordance with the requirements set in BS EN 13201-2:2015 and BS 5489-1:2013 for the specific road classification and use and will also be consistent with the latest specification published by SCC.

Aviation Lighting

6.3.35 The building heights parameters plans assumes that flues for the Energy Centre are typically 3 m higher than adjacent buildings. Overall, an additional 25 m above the 35 m ridge height is permitted for stacks. All stacks and flues of heights down to 15 meters, will be lit with a medium intensity red aviation light.

7 Potential Effects

7.1 Introduction

7.1.1 This Chapter identifies any potential effects from the minimum level of exterior lighting which will be required to construct and operate the Proposed Development (as identified in **Chapter 6**), on sensitive receptors based on the future lighting conditions that have been interpreted for 2032 (as identified in **Chapter 5**).

7.2 Construction

7.2.1 There may be night-time working subject to the programme needs of occupiers.

7.2.2 Work during darkness lighting is required for safety and security.

7.2.3 The general lighting requirement is predictable and temporary for fixed elements of the construction works such as Site offices, compounds, welfare facilities, parking areas, fuel storage areas and plant storage areas.

7.2.4 Task specific lighting to maintain safety around excavation areas, concrete pour Sites and other specific activities will vary according to weather conditions, programme and the particular tasks being undertaken.

7.2.5 Construction lighting tends to lead to more significant adverse effects than operational lighting because of its temporary nature, and the type of lighting equipment used. For ease of deployment and use, construction lighting tends to be mobile, and focus on providing the widest coverage of light from the fewest possible units in order to minimise time spent maintaining and installing the equipment. This, along with the fact that it is often poorly directed or installed, can result in problems with glare, light intrusion, and sky glow if good practice measures are not employed.

7.2.6 Lighting may also be present from construction vehicles and plant on Site, which often deploy flashing lights and strobes when operating which can cause additional adverse effects to occupied residential areas. Existing residents close to the Site boundary that may be affected include those of Woolavington in the south east and Puriton in the south west direction.

7.2.7 Due to the nature of the scheme, the Proposed Development will be constructed on a phased basis. Depending on the individual occupier timescales, some plots may be completed before others have begun the construction phase. Therefore, potential effects of temporary construction lighting may therefore affect both existing sensitive receptors outside the Proposed Development and future sensitive receptors within the remainder of the Proposed Development.

7.2.8 It is anticipated that any potential effects from obtrusive light associated with construction phase lighting would be temporary and can be mitigated through employment of appropriate mitigation measures. These measures to address obtrusive light from temporary construction lighting are presented in **Chapter 8** and would be secured through a Construction Management Plan. In order to avoid often poorly directed or installed lighting, which can result in problems with glare, good practice measures will be employed.

7.2.9 In summary, there is potential for temporary Negligible to Minor Adverse effects to receptors listed in Tables 5.3 and 5.4 from obtrusive light due to a slight increase in visibility of the Site and obtrusive light (intrusion, glare, and sky glow).

7.3 Operation

Existing Residents (adjacent to the Site)

Withy Grove Road

7.3.1 The residents at Withy Grove are sensitive to obtrusive light (intrusion, glare and sky glow). The residents, who are ~750m west of the Site, currently have direct partial views of the Site which is in the southeast direction. There are, however, some trees and shrubs in the front gardens of the properties which would provide partial screening. The residents are surrounded by farm buildings of varying heights. The environmental zone of the residential area is E2.

7.3.2 In the future baseline scenario (2032), the lighting conditions are largely expected to remain the same as defined by the existing conditions described above, as any lighting from the 2017 Permission (from storage and distribution) will be screened by new landscaping on the northern boundary of the Site. The 2017 permission is expected to result in some residual upward light due to reflected light from the ground which could lead Withy Grove residents experiencing sky glow with views across the Site. Under the 2017 Consent, a CCGT stack of 65 metres, an EFW stack of 105 metres and a Biomass CHP stack of 50 metres in height are lit with a medium intensity red aviation light.

7.3.3 The Proposed Development includes commercial, and rail uses to the south of Withy Grove. Therefore, there is potential for a change to the night-time views (due to glare and sky glow) for the residents, compared to the 2017 Permission. This is because there would be additional external lighting from rail and commercial land uses (see **Chapter 6**) which are closer to the northern boundary of the Site. Lighting for the rail uses will be provided from gantry cranes and columns (18-20 m in height) that will stay on throughout the night. There will, however, be retained and new structural tree planting along the northern boundary of the Proposed Development, so, any views of the external lighting that may result in glare are expected to be partially screened from view.

7.3.4 The Proposed Development could include stacks of varying heights subject to occupiers' needs and lit with a medium intensity red aviation light. Lighting associated with these stacks may therefore be visible to surrounding existing residents in Withy Grove Road. However, this is expected to be negligible compared to the future baseline scenario.

7.3.5 There is potential for lighting from the proposed land uses in the north area of the Proposed Development to result in sky glow. However, the obtrusive light will be designed to E2 Zone and therefore will be minimised to fall within guideline levels. There is expected to be residual upward light due to reflected upward light from the ground, but this is considered to be negligible in comparison to the 2032 baseline.

7.3.6 In conclusion there is considered to be a **Moderate Adverse** effect to residents at Withy Grove due to change in night-time views due to gantry crane and column lighting associated with rail uses. There is anticipated to be a **Negligible** effect due to obtrusive light from residual upward light leading to sky glow.

East Huntspill

7.3.7 The residents at East Huntspill are sensitive to obtrusive light (intrusion, glare and sky glow). The residents of East Huntspill who are ~1 km north of the Site are represented by views from Viewpoint G. There are trees and hedgerows between East Huntspill and the Site. In addition, the boundary of the Huntspill River which runs between the Site and the residential area, there are trees and hedgerows that provide further screening to the residents. The environmental zone of the residential area is E2.

7.3.8 In the future baseline scenario (2032), the lighting conditions are expected to largely remain the same as defined by the existing conditions described above. Although, there is potential

for some sky glow due to reflected light from the ground associated with the 2017 Permission. Under the 2017 Consent, a CCGT stack of 65 metres, an EFW stack of 105 metres and a Biomass CHP stack of 50 metres in height are lit with a medium intensity red aviation light.

7.3.9 The land uses within the Proposed Development nearest to East Huntspill are commercial and rail uses that would require external lighting (see **Chapter 6**). Lighting for the rail uses will be provided from gantry cranes and columns (18-20 m in height) that will stay on throughout the night. Retained and new structural tree planting will provide additional screening of the Site, however as new plating will take time to mature, there may be partial views of the Site, especially in winter months. As the residents of East Huntspill are approximately 1.91 km from the Site, any glare/light obtrusion from the rail uses are likely to be negligible although there is potential for a change in view associated with the tall gantry cranes and columns.

7.3.10 The Proposed Development will also include stacks of varying heights and lit with a medium intensity red aviation light. Lighting associated with these stacks may therefore be visible to surrounding existing residents in East Huntspill. However, this is expected to be negligible compared to the future baseline scenario.

7.3.11 There is potential for lighting from the proposed land uses in the north area of the Proposed Development to result in sky glow. However, the obtrusive light will be designed to E2 Zone and therefore will be minimised to fall within guideline levels. There is expected to be residual upward light due to reflected upward light from the ground, but this is considered to be negligible in comparison to the 2032 baseline.

7.3.12 In conclusion there is considered to be a **Minor Adverse** effect to the night-time view of residents at East Huntspill due to gantry crane and column lighting associated with rail uses. There will be a **Negligible** effect to residents at East Huntspill due to residual upward light leading to sky glow.

Woolavington

7.3.13 The residents of Woolavington are sensitive to obtrusive light (intrusion, glare and sky glow). Woolavington is adjacent to the south-eastern boundary of the Site, with residents having direct views of the Site as represented by Viewpoint D and Viewpoint K. The residential area is considered to be in Environmental Zone E3. Partial screening is provided by hedgerows and trees but there are still views across the Site where the existing lighting conditions are dark with very little lighting from other land uses.

7.3.14 In the future baseline scenario (2032), the lighting conditions are expected to change compared to the existing conditions described above. The storage & distribution and manufacturing/general industry land uses will be in place under the 2017 Permission so there is expected to be partial views of lighting from this location. Any glare would be controlled through good lighting design, although there is potential for some sky glow due to reflected light from the ground associated with the 2017 Permission. Under the 2017 Consent, a CCGT stack of 65 metres, an EFW stack of 105 metres and a Biomass CHP stack of 50 metres in height are lit with a medium intensity red aviation light.

7.3.15 In the future baseline scenario, planning application 54/20/00010 will have been built out, providing residential land use. There is no information available on what lighting will be required but it is anticipated that it will include street lighting that will be visible from residents at Woolavington and therefore change night-time views of the Site.

7.3.16 The land uses nearest to Woolavington at the south-eastern point of the Proposed Development are residential and associated community uses, as well as energy distribution and management, which involves non-traditional B8 land uses, such as Electric Vehicle (EV) battery manufacturing and data centres. These conditions would mean a change in night-time views for the residents of Woolavington, compared to those night-time views expected with the 2017 Permission. This is because external lighting associated with these uses would be less

intense and any street lighting column partially screened by the existing built form. Therefore, there would be less lighting visible compared to the future baseline conditions. There is also retained and new structural tree planting along the south-eastern boundary of the Site, which will provide additional screening of the light for nearby residential areas.

7.3.17 The Proposed Development will also include stacks of varying heights and lit with a medium intensity red aviation light. Lighting associated with these stacks may therefore be visible to surrounding existing residents from Woolavington. However, this is expected to be negligible compared to the future baseline scenario.

7.3.18 There is the potential that lighting from the intended land uses in the south-eastern area of the Proposed Development may cause sky glow. However, any obtrusive light will be designed to E2 Zone and will therefore obtrusive light would be minimised to fall within guideline levels. There is expected to be residual upward light due to reflected upward light from the ground and this is considered to be Minor Adverse in comparison to the 2032 baseline as the land uses are closer to these residents.

7.3.19 In conclusion there is considered to be a **Negligible** effect to the night-time view of residents at Woolavington and a **Negligible** effect to residents at Woolavington due to residual upward light leading to sky glow.

Woolavington Road

7.3.20 The residents of Woolavington Road are sensitive to obtrusive light (intrusion, glare and sky glow). Woolavington Road is adjacent to the southern boundary of the Site, with residents having a direct view of the Site in the north represented by Viewpoint D. Partial screening is provided by trees and hedgerows along each side of the road and within the Site which limits views into the Site. The residential area on Woolavington Road is in Environmental Zone E2.

7.3.21 In the future baseline scenario (2032), the night-time view and the level of obtrusive light is expected to remain largely the same as defined by the existing conditions described above due to the level of existing screening provided to existing residents to the south of Woolavington Road. Although there is potential for some sky glow due to reflected light from the ground associated with the office/R&D/light industry, manufacturing/general industry and storage & distribution land uses in the 2017 Permission. Under the 2017 Consent, a CCGT stack of 65 metres, an EFW stack of 105 metres and a Biomass CHP stack of 50 metres in height are lit with a medium intensity red aviation light.

7.3.22 The land uses along the southern boundary of the Proposed Development are sports, leisure and community facilities, commercial, leisure, education, hotel, residential and energy generation, as well as residential and associated community uses. EV battery manufacturing and data centres will be associated with the non-traditional B8 land uses to the south of the Site. There will be a green edge to Woolavington Road providing landscaping, but there is expected to be a change in night-time views for the residents of Woolavington Road, compared to those night-time views expected with the 2017 Permission. This is because the additional lighting for these land uses (see **Chapter 6**) would be visible.

7.3.23 The Proposed Development will also include stacks of varying heights and lit with a medium intensity red aviation light. Lighting associated with these stacks may therefore be visible to surrounding existing residents from Woolavington Road. However, this is expected to be negligible compared to the future baseline scenario.

7.3.24 There is the potential that lighting from the intended land uses in the southern area of the Proposed Development may cause glare and sky glow. However, any obtrusive light will be designed to E2 Zone and will therefore be minimised to fall within guideline levels. In addition, the existing and proposed screening on the southern boundary of the Proposed Development will also serve to further minimise impacts from any glare experienced. There is expected to be residual upward light due to reflected upward light from the ground and this is considered

to be Minor Adverse in comparison to the 2032 baseline as the land uses are closer to these residents.

7.3.25 In conclusion there is considered to be a **Minor Adverse** effect to the night-time view of residents at Woolavington Road and a **Negligible** effect to residents at Woolavington Road due to residual upward light leading to sky glow.

Puriton

7.3.26 The residents of Puriton are sensitive to obtrusive light (intrusion, glare and sky glow). Puriton, which is approximately 50 m from the southwest boundary of the Proposed Development, has direct views of the Site in the northeast direction as represented by Viewpoint H. Partial screening is provided by trees and hedgerows and the night-time view remains dark with limited highway lighting recorded. The residential area at Puriton is Environmental Zone E3.

7.3.27 In the future baseline scenario (2032) the lighting conditions associated with the link road are expected to remain largely the same as defined by the existing conditions described above, as lighting from one of the illuminated junctions of the link road is recorded within the view. There is also potential for some additional sky glow within the view due to reflected light from the ground associated with the office/R&D/light industry land uses in the 2017 Permission. Under the 2017 Consent, a CCGT stack of 65 metres, an EFW stack of 105 metres and a Biomass CHP stack of 50 metres in height are lit with a medium intensity red aviation light.

7.3.28 However, most noticeably in the view, permitted development 42/20/00014 will have been constructed and any external lighting for this residential land use (e.g., street and amenity lighting), will be visible within Viewpoint H from Puriton.

7.3.29 The land uses along the southeast edge of the Proposed Development are sports, leisure and community facilities. There will also be the presence of non-traditional B8 land uses, such as EV battery manufacturing and data centres. However, this would not change the night-time views of the Proposed Development, compared to those expected with the 2017 Permission as the view would be screened by the built form of development 42/20/00014.

7.3.30 The Proposed Development will also include stacks of varying heights and lit with a medium intensity red aviation light. Lighting associated with these stacks may therefore be visible to surrounding existing residents from Puriton. However, this is expected to be negligible compared to the future baseline scenario.

7.3.31 Further north in Puriton there is potential for obtrusive light effects (glare and sky glow) due to external lighting (see **Chapter 6**) associated with sports, leisure and community facilities. However, along the southeast border of the Site there is retained and proposed new structural tree planting which will provide screening of views of the Site and therefore limit the impact of glare to local residents. In addition, any obtrusive light will be designed to E2 Zone and will therefore be minimised to fall within guideline levels. There is expected to be residual upward light due to reflected upward light from the ground and this is considered to be Minor Adverse in comparison to the 2032 baseline as the land uses are closer to these residents.

7.3.32 In conclusion there is considered to be a **Negligible** effect to the night-time view of residents at Puriton and a **Minor Adverse** effect to residents at Puriton due to residual upward light leading to sky glow.

Road Users (Motorists, Cyclists and Pedestrians)

Overview

7.3.33 Users of existing roads close to the Site could, without mitigation, potentially be affected by glare from the Proposed Development. Road users are particularly sensitive to glare as it can create a safety hazard by dazzling or distraction. Given that road users are not sensitive to sky

glow or light intrusion, it is considered that any effects from these on road users, will be negligible.

7.3.34 Where road users may be affected are limited to those immediately adjacent to or within the Site boundary as listed below. Glare can also impact pedestrians, cyclists, and pedestrians although this is not as critical as for motorists, because speed of movement is much lower, giving a greater reaction time.

M5

7.3.35 The section of the M5 that is nearby to the Proposed Development is currently unlit. Therefore, road users are sensitive to any change in lighting in this area.

7.3.36 There is currently limited visual connectivity between the motorway and views of The Site. In the direction of the Site, along the edge of the motorway, there is the presence of hedgerows which provides partial screening.

7.3.37 The parameter plans for the 2017 Permission shows land safeguarded for rail reinstatement which would be unlit, but this did not form part of the consent and so for clarity does not form part of the future baseline for this assessment.

7.3.38 The parameter plans for the Proposed Development does now seek permission for a reinstated rail corridor that is located near to the M5 in one location. However, due to the distance between the M5 and the proposed land use (approximately 800 meters) and the railway in this location is unlit, it is not anticipated that the rail reinstatement will cause glare issues for road users on the M5.

7.3.39 In conclusion, there would be **negligible** effects to road users on the M5 due to the Proposed Development.

Woolavington Road

7.3.40 There is currently no lighting present on Woolavington Road although security and amenity lighting can be seen sequentially travelling down the road from adjacent commercial and residential land-uses. Therefore, road users are sensitive to any change in lighting in this area.

7.3.41 Within the future baseline, plots B, C1 (Offices/R&D/Light Industry), D (Storage & Distribution) and H (Manufacturing/General Industry) are closest to Woolavington Road. However, road users are unlikely to experience any glare from these land uses as any lighting in these areas will be controlled through good design measures and intermittent screening provided by landscape planting along the boundary. In addition, they are at least 100 m distance from the Site along the majority of the road. Any glare present is likely to diminish by the time it reaches road users.

7.3.42 Within the future baseline, the construction of the new Link Road will be in place. Any lighting required for this will follow Somerset's design standards, therefore any glare produced will be controlled within limitations of the standard.

7.3.43 The Proposed Development will introduce new land uses directly adjacent to Woolavington Road, which will require new external lighting (see **Chapter 6**). These uses are:

- Sports and leisure, community facilities
- Commercial, leisure, education, hotel, residential, energy generation
- Residential and associated community uses

7.3.44 Any lighting that is required for these land uses will need to conform to the obtrusive light limitations associated with Environmental Zone E2. Any floodlighting required for leisure land-uses would require a buffer to be incorporated within detailed designed phase. Therefore, in terms of potential glare, impacts to road users will be negligible.

7.3.45 In conclusion, there would be **negligible** effects to road users on Woolavington Road due to the Proposed Development.

B3141 (Causeway)

7.3.46 The existing conditions of the B3141 (Causeway) is unlit and there is currently no experience of glare for road users as the road is adjacent to agricultural land uses.

7.3.47 Within the future baseline scenario, road users are unlikely to experience glare from the manufacturing/general industry land uses which are located 500 m to the west of the road and therefore any glare would have diminished to acceptable levels.

7.3.48 The Proposed Development will introduce a secondary access route for emergency / service use only and any lighting would be designed in accordance with relevant industry standards (see **Chapter 6**). In addition, the nearest land use from the Proposed Development is energy management and distribution infrastructure which is located 500 m to the west of the road and therefore any glare would have diminished to acceptable levels.

7.3.49 In conclusion, there would be **negligible** effects to road users on the B3141 due to the Proposed Development.

Visual Amenity

Quantock Hills AONB

7.3.50 The Quantock Hills AONB is located approximately 17 km south west of the Site and is sensitive to change in night-time views as it is intrinsically dark.

7.3.51 The existing night-time views are represented by Viewpoint O but distant lighting from Bridgwater and surrounding areas was visible with glare and sky glow clearly visible. This obtrusive light is in the foreground of the view so creates a visual screen at night-time so any additional lighting from the extant 2017 Permission (in the future baseline) and the Proposed Development would not be noticeable in the view.

7.3.52 In conclusion, there would be **negligible** effects to night-time views due to the Proposed Development.

Mendip Hills AONB

7.3.53 The Mendip Hills AONB is located approximately 15 km north west of the Site and is sensitive to change in night-time views as it is intrinsically dark.

7.3.54 The existing night-time views are represented by Viewpoint Q and show that large parts of the view in the foreground is unlit reflecting the undeveloped nature of the plain south of the Mendip Hills. At more distant positions, existing lighting is visible from Junctions on the M5, and other street lighting from settlements such as Mark, The Causeway, Cross and East Huntspill.

7.3.55 The future baseline is expected to including lighting from the 2017 Permission, link road and other committed development. The lighting from these land uses will be well designed and largely screened by structural landscaping so it is not anticipated will form a prominent

position in the night-time view from the AONB. There is potential for increased sky glow, but this would be minimised through design and not expected to be prominent.

7.3.56 Under the 2017 Consent, a CCGT stack of 65 metres, an EFW stack of 105 metres and a Biomass CHP stack of 50 metres in height are lit with a medium intensity red aviation light. It is expected that if any red aviation lighting were visible in the future baseline scenario, the effects from red aviation lighting associated with the Proposed Development would be negligible.

7.3.57 The Proposed Development will introduce a new rail corridor to the north of the Site and will require flood lighting to safely operate associated infrastructure such as rail station and sidings. Lighting for the rail uses will be provided from gantry cranes and columns (18-20 m in height) that will stay on throughout the night. However, this will be designed in accordance with the general lighting strategy (see **Chapter 6**) that will limit any obtrusive light (glare and sky glow).

7.3.58 In conclusion, there would be **negligible** effects to night-time views due to the Proposed Development when compared to the future baseline.

Ecological Receptors (protected species)

7.3.59 The existing boundary habitats/features located across the Site will be retained to provide important connectivity for bats:

- The eastern edge of the development will provide north-south connectivity for bats around the Site using existing reedbed and rhynes habitats. The eastern edge will also retain three existing bat roost lofts that will be within the bat movement corridor.

- Due to the nature of lighting to the north of the Site (24-hour, high lighting) it is proposed that the southern boundary is used for east-west connectivity. The southern boundary will provide connectivity through the greenspace, parkland, and landscape corridor, that will be less intensively lit compared with the northern and western boundaries.

7.3.60 Under the existing conditions, these habitats are not illuminated, and so dark corridors have been retained.

7.3.61 In the future baseline scenario where the 2017 Permission has been built out, the northern boundary is over 400 m from the nearest land use (Storage and Distribution and Manufacturing/General Industry) and therefore there would not be any light intrusion to this corridor. The eastern boundary is adjacent to Manufacturing/General Industry land use and the western boundary is adjacent to Storage and Distribution land use. In the future baseline scenario, it has been assumed that a lighting design would be in place to limit light intrusion to these important boundary features so they would remain dark. There was however no commitment to the restrict the colour temperature of lighting adjacent to these features to reduce the impact on bats using this habitat.

7.3.62 The Proposed Development will introduce significant external lighting adjacent to the northern and western boundaries compared to the future baseline and this is associated with the rail corridor. The railway itself will be unlit but the stations, sidings and other infrastructure will require lighting, as set out in **Chapter 6**.

7.3.63 The Proposed Development will also introduce land uses either side of the western boundary including commercial and energy distribution and management infrastructure that will require lighting, as set out in **Chapter 6**. This provides a narrow landscape corridor where habitats will be retained and will need to remain dark for use by protected species (e.g., bats).

7.3.64 An artificial Badger sett is to be created to the far western boundary, between North Mead Drove and the western boundary of the rail corridor. This feature will be protected locally from light impacts.

7.3.65 Three existing bat roost lofts towards the eastern boundary of the Site will be retained within the dark corridors so effects from lighting are not anticipated.

7.3.66 There is potential for bats, to be impacted by light intruding from the development without mitigation. However, as a result of incorporating a sensitive lighting strategy as set-out in **Chapter 6**, potential effects to bat corridors will be mitigated through design. It is therefore anticipated that there may be a **minor negative** adverse effect on these ecological receptors from lighting.

7.4 Future Sensitive Receptors

Residents within the Site

7.4.1 Lighting from the Proposed Development, without suitable mitigation, could affect future residents through glare, sky glow, and light intrusion associated with adjacent land uses.

7.4.2 Residential use was not proposed under the 2017 Permission, but land uses including Storage/Distribution and Offices/R&D/Light Industry would be located adjacent to residential land uses identified under the Proposed Development in a future baseline scenario.

7.4.3 The Proposed Development is for different land uses adjacent to new residential land use, including manufacturing land use to the north; sport, leisure, and community facilities to the west and further residential and community uses to the east. These land uses still require significant external lighting as set-out in **Chapter 6** but are considered more appropriate.

7.4.4 The residents have the potential to be affected by lighting through operation of the above land uses. However, embedded mitigation in the form of landscaping and proposed built form will provide some screening. Lighting will also be designed within the lighting strategy identified in **Chapter 6** and meet the obtrusive light limitations for Environmental Zone E2.

7.4.5 It is therefore anticipated that there would be **negligible** effect on new residential receptors.

Road Users (Motorists, Cyclists and Pedestrians)

7.4.6 Any new roads within the Proposed Development will be lit in accordance with street lighting guidance levels (as outlined in **Chapter 6**), and therefore the potential impact to motorists, cyclists & pedestrians is expected to be within guideline levels.

7.4.7 It is therefore anticipated that there may be a **negligible** effect on these road users.

Rail Operators

7.4.8 There are no existing sources of light adjacent to the proposed new rail corridor and associated rail infrastructure in the existing and future baseline. All new lighting associated with adjacent land uses will be designed to meet rail standards and obtrusive light limitations for Environmental Zone E2 and therefore the potential impact to rail operators is expected to be within guideline levels.

8 Mitigation Measures

8.1 Introduction

8.1.1 This Chapter sets out secondary measures to mitigate potential impacts on sensitive receptors (identified in **Chapter 5**) that have not already been identified through the lighting requirements (identified in **Chapter 6**).

8.2 Construction

8.2.1 The potential effects resulting from artificial lighting during construction can be mitigated through a range of design and control measures, including the use of shields and hoods on luminaires, appropriate working hours as defined in section 6.2.6 and operation of security lighting, as well as consideration of the orientation of luminaires, and the avoidance of 'over-lighting'.

8.2.2 To secure the implementation of these control measures to mitigate obtrusive light, they should be included in a Construction and Environmental Management Plan (CEMP) that will form a planning condition.

8.2.3 General principles to mitigate the adverse effects of lighting associated with construction of the Proposed Development are listed below:

- Construction lighting should be directed so it does not create light intrusion outside of the immediate working area;
- Sufficient lighting units used to avoid the need for tall, wide beam lighting units to illuminate large areas;
- Vehicle lights should be properly directed, and lenses must be intact to prevent un-necessary glare and breakout of obtrusive light (this is also an MOT requirement);
- Lighting should be reduced when not required for safety purposes. Security lighting should be kept at the minimum level needed for visual and security protection;
- If appropriate, to reduce the need for fixed visible lighting outside working hours, the use of infrared flood lighting and CCTV systems should be considered for security;
- All lighting related to the works will be designed and fitted to minimise light intrusion onto any sensitive habitat such as hedgerows, mature trees and woodland;
- The use of visual screening, such as hoardings between more sensitive visual receptors and construction light sources in proximity to the Site;
- Dark corridors should be maintained during the evening, overnight or early morning (i.e. outside approximately one hour before dusk and one hour after dawn) along hedgerows, watercourses and any other linear features by avoiding light intrusion on these areas. This will avoid the fragmentation of habitat used by species such as bats, as well as avoiding disturbance of roosting features used by bats; and
- Consideration will also need to be given to the effect construction lighting will have on new residents on the Site, preventing obtrusive light affecting the adjoining hedgerows and trees beyond the Site boundary.

8.3 Operation

Overview

8.3.1 Potential effects on sensitive receptors during operation of the completed scheme can be avoided through appropriate lighting design. An operational lighting strategy has been prepared (see **Chapter 6**) as primary mitigation to guide how obtrusive light will be controlled within the lighting design when it comes forward.

8.3.2 Secondary measures to mitigate potential obtrusive light effects (such as sky glow, glare, or light intrusion) is therefore limited to the following items identified below.

Lighting Design

8.3.3 The central principle of primary mitigation for operational lighting of the Proposed Development is that any future lighting design would confirm light levels are kept within the limitations for obtrusive light set by ILP Environmental Zone E2 (**Appendix C**).

8.3.4 A lighting design showing horizontal lux contour lines and vertical lux calculation grids for sensitive receptors will be submitted as a condition of planning. Further requirements for ecological receptors are also identified in the strategy. This will be required for any external lighting (excluding emergency lighting) to demonstrate that the lighting levels will be kept within the thresholds of ILP Environmental Zone E2, where technically viable.

8.3.5 Secondary mitigation may also be available in the form of louvres and shields to prevent undesirable light break-out from luminaires. If photometric data for the luminaire with a louvre or shield is available from the manufacturer, then this will be included as part of the lighting design submitted for approval.

Ecology

8.3.6 The assessment of potential effects to foraging and commuting bats is provided in **Chapter 12 (Biodiversity)** of the Environmental Statement. A strategy to mitigate potential effects to foraging and commuting bats using retained and new habitats on the Proposed Development has been identified on the Lighting Constraints Plan (**Appendix A**). This shows 'low energy corridors' where detailed lighting scheme design will be sensitive to the need to minimise lighting levels and the illumination of habitat features, such that they hold value for bat foraging and movement.

8.3.7 As part of this strategy, a pallet of additional measures to mitigate potential adverse effects to bats using the 'low energy corridors' have been put forward and a range of such measures will be implemented along primary roads, secondary access points and vehicle crossings that come into conflict with the bat foraging and movement corridors. Such measures will be of benefit to bats and also dove tail with the concepts of sustainability and lower energy consumption. The measures are subject to a road safety audit at detailed design but include:

- Potential gaps in lighting columns to reduce illumination along sections of roads which cross bat foraging areas and movement corridors;
- Implementation of a variable lighting regime to limit the time at which some lights are used (i.e., roads or road sections, lit for only part of the night).
- Reduce the intensity or dim lighting at certain times.
- External highway lighting in sensitive areas of the Site to be centrally controlled through internal programming or a Central Management System (CMS) for new roads as an acknowledged measure to reduce effects on wildlife.

- Use of LED lighting. 3000K to be selected in preference to neutral-white LEDs (around 4000 K), wherever appropriate to do so.

- Lighting louvers/shields can be used to restrict light spill outside of the highway.

- Where roads cross landscape planting and the green edge, bat hop-overs should be considered to mitigate the severance effects upon bats. The following principles will guide design:

  - Minimise the footprint of the carriageway, drainage, and earthworks in this location;

  - Position proposed extra heavy standard trees as close to the edge of the carriageway as possible, noting below ground constraints of pipes, root protection areas of retained trees and the drainage design; and

  - Provide tall roadside vegetation for the hop-over to increase effectiveness of the hop over.

8.3.8 A detailed lighting strategy will be prepared at the detailed design stage as a condition of approval for any external lighting that could intrude on light sensitive habitats, including key bat foraging and movement corridors.

8.3.9 As part of the detailed lighting strategy, a plan showing horizontal lux contour lines of the Proposed Development will be produced (a predicted post-development light distribution plan), that would demonstrate that light levels will not deter use by bats within key bat foraging and movement corridors, remaining under 1 lux where possible or not exceed current baseline levels.

8.3.10 Where possible, lighting columns will be fitted with louvers/ shields where there is potential for light spill onto key bat foraging and commuting corridors. Lowering the fitting height of the columns and spacing of the lighting columns are both measures to reduce and eliminate light intensity in ecologically sensitive areas. The latter is the preferred and more effective option for the proposed scheme in terms of human safety.

8.3.11 The type of LEDs available should be explored around ecologically sensitive areas during the design process. At the time of writing neutral-white LEDs (around 4000 Kelvin) are generally preferred over warm-white LEDs from a safety perspective as they appear brighter to the human eye. Although research (Stone E.L., 2013) indicates that white LED's may have a medium negative-impact on bats and therefore, from an ecological perspective recommends warm-white LED lighting rather than white LED. ILP GN08/18 cites Stone (2012, 2015a, 2015b) who states that "warm white (more yellow/orange colour) at around 3000°K and as low as 2700°K. Therefore, the outline lighting strategy recommends 3000K to be selected with further consultation with the project ecologist.

8.3.12 Further mitigation measures that will be reviewed to minimise light spill include designing to minimise road lighting where possible, effective building layout to have roads buffered by buildings, and suitable landscaping such as heavy trees in areas of sensitivity and around Site boundary areas to minimise light spill from the Site.

9 Residual Effects and Conclusions

9.1 Introduction

9.1.1 This Chapter identifies the residual effects of the lighting assessment after the implementation of secondary mitigation and any final conclusions.

9.2 Residual Effects

9.2.1 The residual construction lighting effects after the implementation of mitigation identified in **Chapter 8** are considered to be temporary Negligible to Minor Adverse.

9.2.2 The residual effects to sensitive receptors during operation are outlined in **Table 9.1**.

Table 9.1: Residual Operational Effects

Receptor	Assessment parameter	Residual Effect (with the implementation of mitigation)	Comments
Residential			Residual effects consider the mitigation in **Chapter 8** in relation to lighting design.
Withy Grove Road	Night-time View Obtrusive Light	Moderate Adverse Negligible	
East Huntspill	Night-time View Obtrusive Light	Minor Adverse Negligible	
Woolavington	Night-time View Obtrusive Light	Negligible Negligible	
Woolavington Road	Night-time View Obtrusive Light	Minor Adverse Negligible	
Puriton	Night-time View Obtrusive Light	Negligible Minor Adverse	
Road Users	Obtrusive Light	Negligible	
Mendips AONB	Night-time View	Negligible	
Quantocks AONB	Night-time View	Negligible	

Receptor	Assessment parameter	Residual Effect (with the implementation of mitigation)	Comments
Ecology	Obtrusive Light	Minor Negative	

9.3 Conclusions

9.3.1 The development will introduce new sources of light into a presently relatively dark area of low district brightness (ILP Environmental Zone 2 (Rural)). This, however, is on a previous industrial Site with existing consent to redevelopment.

9.3.2 The aspiration is for high standards of lighting design that will seek to be:

- Efficient;
- Safe and secure for people moving in and around the Proposed Development; and
- Meet the recognised standards and guidance.

9.3.3 These aspirations will be met whilst minimising obtrusive light onto sensitive receptors to within guideline levels established by the ILP and a general lighting strategy has been developed to secure this as part of the LDO.

9.3.4 A lighting design for externally lit areas of the scheme (excluding emergency lighting) can be prepared once further details and operational requirements of the development are known. This will be secured by a planning condition to the LDO and will aim to keep lighting levels within the thresholds of ILP Environmental Zone E2.

9.3.5 On the basis of this assessment and subject to the incorporation of the recommendations set out in this report, it is considered that obtrusive lighting would not pose a material constraint to the development and that lighting will need to be carefully considered throughout the next stages of planning.

Appendix A Lighting Constraints and Viewpoint Plan

Appendix B Parameter Plans

Appendix C ILP Lighting Specifications

Table D.1 - Obtrusive Light Limitations for Exterior Lighting Installations – General Observers

Environmental Zone	Sky Glow Maximum values of upward light ratio (ULR) [URL/%] (1)	Maximum values of vertical illuminance on properties Illuminance in the vertical plane (Ev) [Lux]		Maximum permitted values of average surface Luminance(cd/m²) (2)	
		Pre-Curfew	Post Curfew	Building façade luminance	Sign luminance
E0	0	n/a	n/a	<0.1	<0.1
E1	0	2	<0.1*	<0.1	50
E2	2.5	5	1	5	400
E3	5.0	10	2	10	800
E4	15	25	5	25	1,000**

Definitions

ULR = **Upward Light Ratio of the Installation** is the maximum permitted percentage of luminaire flux for those goes directly into the sky.

Ev = **Vertical Illuminance in Lux** and is measured flat on the glazing at the centre of the window

L = **Luminance in Candelas per Square Metre Cd/m²**

Curfew = The time after which stricter requirements (for the control of obtrusive light) will apply; often a condition of use of lighting applied by the local planning authority.

(1) This does not take into account the effect of light reflected upwards from ground that also contributes to sky glow. This is the traditional method to limit sky glow and is suitable to compare different single luminaires.

(2) The values apply to both pre- and post-curfew, except that in zones 0 and 1 the values shall be zero post curfew. The values for signs do not apply to signs for traffic control purposes

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

***This figure has been amended to correct the decimal noted in the guidance document

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2020

Table D.2 - Obtrusive Light Limitations for Exterior Lighting Installations (Upward Flux Ration) – General Observer

Environmental Zone	Type of Installation		
	Road	Amenity	Sport
E0	n/a	n/a	n/a
E1	2	n/a	n/a
E2	5	6	2
E3	8	12	6
E4	12	35	15

This table allows the effect of both direct and reflected upward components of a whole installation to be taken into account. The factor being the upward flux ratio (UFR) and CIE 150 suggests that table 7 is used for all installations consisting of four or more luminaires. Clauses 6.4.2 and 6.4.3 of CIE 150:2017 describe the calculation methods for both ULP and UFR. Light emitted just above the horizontal in a zone between 90º and 110º is extra critical for sky glow in large open areas around observatories. An additional measure in these areas limits the luminous intensities (I_{90} – I_{110}) as follows:

• between 90° and 100° < 0.5 cd/1000lm;

• between 100° and 110° 0 cd.

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2020

Table D.3 – Obtrusive Light Limitation for Exterior Lighting Installations – Limits for the Luminous Intensity of Bright Luminaires - General Observer

Light technical parameter	Application Conditions	Luminaire group (projected area Ap in m2)					
		0< Ap ≤ 0.002	0.002 <Ap ≤ 0.01	0.01 <Ap ≤ 0.03	0.03 <Ap ≤ 0.13	0.13 <Ap ≤ 0.50	Ap ≥0.5
Maximum luminous intensity emitted by luminaire (I in cd)	E0 Pre-Curfew	0	0	0	0	0	0
	Post Curfew	0	0	0	0	0	0
	E1 Pre-Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
	Post Curfew	0	0	0	0	0	0
	E2 Pre-Curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10.0 *d*	7,500
	Post Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500
	E3 Pre-Curfew	0.86 *d*	1.9 *d*	3.8 *d*	7.5 *d*	15 *d*	10,000 *
	Post Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	1,000
	E4 Pre-Curfew	1.4 *d*	3.1 *d*	6.3 *d*	13 *d*	26 *d*	25,000
	Post Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
Aid to gauging Ap		2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding Ap representative area (m^2)		0.0008	0.004	0.016	0.063	0.251	>0.5
Notes: 1. d is the distance between the observer and the glare source in metres;							

2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut-off in the designated directions;

3. Ap is the apparent surface of the light source seen from the observer position

4. For further information refer to Annex C of CIE 150

5. Upper limits for each zone shall be taken as those with column Ap>0.5

*This figure has been amended to correct the decimal noted in the guidance document

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2020

Table D.4 – Obtrusive Light Limitation for Exterior Lighting Installations – Road Users

Road Classification (1)	Threshold Increment (TI)	Veiling Luminance (L_v) (2)
No road lighting	15% based on adaptation luminance of 0.1cd/m^2	0.037 cd/m^2
M6/M5	15% based on adaptation luminance of 1.0cd/m^2	0.23 cd/m^2
M4/M3	15% based on adaptation luminance of 2.0cd/m	0.40 cd/m^2
M2/M1	15% based on adaptation luminance of .05cd/m^2	0.84 cd/m^2

TI = The measure of disability glare (the reduction in visibility caused by intense light sources in the field of view) expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare

Lv = The luminance that would need to be superimposed on a scene in object space to reduce the scene's contrast by an amount equal to the added retinal illuminance from scattered light on the scene's retinal image. It is most commonly used to describe the contrast-reducing effect of a glare source in the field of view.

(1) Road classifications as given in CIE 115:2010
(2) The veiling luminance values specified in this table are based upon on a permissible TI value of 15%

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2020

Appendix D Lighting Assessment Photo sheets

Appendix E LDO Boundary