



Preliminary Environmental Information (Work in Progress) Report (PEIR)

Draft Environmental Statement

**Chapter 8:** Lighting

On behalf of  
Oxfordshire Railfreight Limited

Prepared by DFL-UK Ltd  
Revision C  
May 2022



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## 8.1 INTRODUCTION

- 8.1.1 This draft chapter assesses the impact of lighting associated with the Proposed Development.
- 8.1.2 The Proposed Development is a Nationally Significant Infrastructure Project (NSIP) and a description of the Proposed Development and the terminology given is given in Chapter 2 of this Environmental Statement (ES).
- 8.1.3 This draft chapter sets out the scope of the assessment and the methodology used, the policy context for the Proposed Development, the baseline conditions within and in the vicinity of the Order Limits, and assesses the likely effects before and after the implementation of mitigation measures; and the resulting residual effects.

### Competency

- 8.1.4 This chapter is prepared by DFL-UK Ltd, a specialist lighting consultancy with extensive knowledge and experience in lighting impact assessments and mitigation. DFL-UK is currently represented within the Institution of Lighting Professionals (ILP) technical committee and British Standard committees for lighting, providing technical input into industry technical guidance documents.
- 8.1.5 DFL-UK Ltd are accredited to ISO9001 and are Corporate Premier Members of the Institution of Lighting Professionals and Members of the Highway Electrical Association. All lighting designs and lighting impact assessments produced by DFL-UK are authorised by an Incorporated or Chartered Engineer.
- 8.1.6 Lighting assessment and strategy input into the project has been led by Ryan Carroll, Principal Lighting Consultant for the Environmental Impact & Planning Team. Ryan holds a BSc with Honours in lighting design & technology and Incorporated Engineer (IEng) status on the Engineering Council Register. Ryan is a member of the Institution of Lighting Professionals (MILP) with over 6 years' experience in the preparation of lighting designs and impact assessments for environmentally sensitive projects. Ryan is a Young Lighting Professional's representative on the Institution of Lighting Professional's technical committee, assisting with the writing of key industry guidance and delivering national curriculum recognised CPD papers.

## 8.2 ASSESSMENT SCOPE AND METHODOLOGY

### Brief

- 8.2.1 The assessment has been carried out in accordance with the published guidance documents from the Institution of Lighting Professionals (ILP); namely ILP Professional Lighting Guide 04 – Guidance on Undertaking Environmental Lighting Impact Assessments (PLG04:2013) and ILP Guidance Note GN01/21 – The

Reduction of Obtrusive Light (GN01:2021). These documents quantify the levels of direct upward light, light intrusion, viewed source intensity and glare regarded as acceptable for varying environment zones.

- 8.2.2 The methodology employed for this assessment is appropriate to the location of the Application Site. It comprises a desk-top study of the legislative, policy and guidance context; consultation with the design team; a desk-top survey followed by an on-site survey in which the baseline conditions were measured and assessed and the relevant environmental zone in which the Application Site is located was ascertained; evaluation of the likely effects of the proposed lighting using appropriate assessment criteria; layout and associated light spill modelling.
- 8.2.3 The desktop study involved research into relevant local and national legislation, policy and guidance relating to obtrusive light. It also involved consultation with relevant parties and studying of ordnance survey maps, plans and aerial photography views to identify likely receptor locations.
- 8.2.4 Research undertaken during the desktop study identified the assessment locations for the baseline survey, where baseline conditions were measured within the Order Limits.
- 8.2.5 The assessment focusses on the external lighting strategy of the Proposed Development, as this has the greatest potential to give rise to obtrusive light, leading to adverse effects on sensitive receptors.

#### **Methods of Baseline Data Collection**

- 8.2.6 To determine an appropriate study area, a desktop-based assessment of the Application Site and its surrounds using satellite imagery was undertaken. During the desktop assessment, potentially sensitive receptors in the vicinity of the Application Site were identified.
- 8.2.7 Liaison with consultant team members was undertaken to align the identified potentially sensitive receptors with those being considered by the Landscape and Visual Impact Assessment (LVIA) and ecologists associated with the development.
- 8.2.8 The study area was determined by assessing the potential receptors that could be affected by a change in artificial lighting in line with the criteria outlined in GN01:2021. This includes nearby residential receptors, roadways, and any identified ecological receptors.
- 8.2.9 The study area is detailed in Appendix 8.1.
- 8.2.10 Following the determination of potentially sensitive receptors, an on-site baseline survey was undertaken using a calibrated light meter to measure horizontal and vertical illuminance at key receptor locations within and adjacent to the Order Limits.

The survey was undertaken following the onset of Astronomical Twilight by two lighting engineers qualified and experienced in the undertaking of such surveys.

- 8.2.11 Furthermore, during the baseline survey, photography of existing sources of lighting within the Application Site and its surrounds was taken aid the assessment of the existing lit character of the area. Details of the baseline survey are included within this chapter and Baseline Lighting Levels are presented in Appendix 8.2.

**Identification of Sensitive Receptors**

- 8.2.12 Sensitive receptors were identified during desk-top studies and on-site surveys, and through discussion with other relevant consultant specialists, and categorised according to their sensitivity. Potentially Sensitive Receptors were identified within the study area identified in Appendix 8.1.
- 8.2.13 Sensitive receptors include human, flora and fauna receptors. Sensitivity is categorised in accordance with Table 8.4 according to the potential impact, be it amenity, safety, or potential ecological impacts. Receptors are categorised in accordance with their sensitivity, and are identified to be of ‘High’, ‘Medium’, ‘Low’, or ‘Negligible’ sensitivity.

**Methodology of Assessment of Impact**

- 8.2.14 The effects of operational and construction phase lighting assessed in accordance with the criteria outlined in tables 8.2 and 8.3, typically, effects from construction lighting is considered ‘Temporary’ and the effects from operational lighting are considered ‘Permanent’.
- 8.2.15 In the absence of statutory guidance, the ILP “Guidance Notes for the Reduction of Obtrusive Light” GN01:2021 are used to inform the assessment of the Environmental Zone against which to assess the likely effects of artificial lighting.
- 8.2.16 Obtrusive light limits for varying Environmental Zones are quantified in ILP Guidance Note GN01:2021; and are separated by Environmental Zones E0 to E4.
- 8.2.17 The Application Site is assessed against the Environmental Zone criteria in accordance with the guidance, shown below in Table 8.1:

**Table 8.1 Environmental Zone Descriptions**

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5 +)	Astronomical observable dark skies, UNESCO starlight reserves, IDA Dark Sky Parks

Zone	Surrounding	Lighting Environment	Examples
E1	Natural	Intrinsically dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness (SQM ~ 15 to 20)	Sparsely inhabited rural areas, Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, Small town centres or suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night time activity

8.2.18 The relevant criteria of upward light, light intrusion and direct source intensity are discussed below and Table 8.2 provides the criterion for source intensity or glare, whilst Table 8.3 sets limits for the criteria of upward light and light intrusion.

**Table 8.2 Obtrusive light criteria relating to each Environmental Zone**

Light technical parameter	Application conditions	Luminaire group (projected area $A_p$ in $m^2$ )					
		$0 < A_p \leq 0.002$	$0.002 < A_p \leq 0.01$	$0.01 < A_p \leq 0.03$	$0.03 < A_p \leq 0.13$	$0.13 < A_p \leq 0.50$	$A_p > 0.5$
Maximum luminous intensity emitted by luminaire ( $I$ in cd)	E0						
	Pre-curfew	0	0	0	0	0	0
	Post-curfew	0	0	0	0	0	0
	E1						
	Pre-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	2500
	Post-curfew	0	0	0	0	0	0
	E2						
	Pre-curfew	0.57 d	1.3 d	2.5 d	5.0 d	10 d	7500
	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	2.8 d	7.5 d	15 d	10000
	Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	1000
	E4						
	Pre-curfew	1.4 d	3.1 d	6.3 d	13 d	26 d	25000
Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	2500	

**Table 8.3 Obtrusive light criteria relating to each Environmental Zone**

Environmental Zones	Sky Glow ULR (Max %)	Light intrusion (into windows) $E_v$ (lux)		Building Luminaire Average, Pre-curfew
		Pre-curfew	Post-curfew	Average L ( $cd/m^2$ )
E0	0	0	0	< 0.1
E1	0	2	< 0.1	< 0.1

Environmental Zones	Sky Glow ULR (Max %)	Light intrusion (into windows) E <sub>v</sub> (lux)		Building Luminaire Average, Pre-curfew
		Pre-curfew	Post-curfew	Average L (cd/m <sup>2</sup> )
E2	2.5	5	1	5
E3	5	10	2	10
E4	15	25	5	25

### Characterisation of Effect

8.2.19 Effects from lighting are categorised in the following terms:

- Adverse or Beneficial – Lighting has the potential to improve the amenity or safety of a space (representing a beneficial positive effect) or to adversely affect amenity, safety, or ecology (representing a negative effect).
- Extent – Lighting has potential to create effects at a local or area level, however (due to the nature of light drop-off) light typically does not produce effects at a regional or national level. Cumulatively, widespread skyglow can occur across a region if a number of sites are continuously poorly lit.
- Magnitude – Changes in the magnitude of lighting has the potential to be negligible, low, medium, or high; where negligible represents little change from the baseline level, and where high represents a large change compared to the natural variants in background levels.
- Duration - Operational lighting is typically installed permanently, so effects last for an extended duration. Construction lighting will typically have a limited duration, only providing illumination for part of the night, and being removed following the completion of a development.
- Timing – In the context of lighting, timing refers to the duration of lighting throughout a night. Modern lighting installations can be switched or dimmed such that the timing of effects is limited during the middle of the night.
- Frequency – Lighting is generally provided every night, so the frequency of lighting is not typically variable. Installations where frequency can vary will typically constitute workspaces with variable use (e.g. remote facilities accessed infrequently) or dwellings/sites with bespoke switching regimes and limited used (e.g. a large residential property with lighting switched by PIR sensors).
- Reversibility – Lighting and the effects of lighting are typically fully reversible, as remedial action to improve poor lighting can be taken (such as the dimming or shielding of luminaires, or full luminaire removal).
- Likelihood – The effects associated with lighting are typically quantified in terms of an amount of light falling onto a potentially sensitive receptors, which typically has a certainty of occurring. As a result, mitigation measures implemented to reduce the effects of lighting assume that the identified lighting levels will occur and identify action that can be taken to ensure that the levels achieved are within the limits identified in relevant standards and guidance.



## Significance Criteria

- 8.2.20 The significance of an effect from artificial lighting has been based upon the sensitivity of the receptor and the magnitude of change at that receptor due to the revised conditions.
- 8.2.21 The sensitivity of the receptor has been classified as High, Medium, or Low according to the descriptions provided in Table 8.4.
- 8.2.22 The magnitude of impact is determined as being High, Medium, Low or Negligible and descriptions for each are provided in Table 8.5.
- 8.2.23 The scale of effect is derived through a matrix (Table 8.6), matching the sensitivity of the receptor with the magnitude of the impact.
- 8.2.24 The descriptions that have been adopted for each effect are summarised in Table 8.7, with effects identified as either beneficial or adverse.

**Table 8.4: Criteria for Receptor Sensitivity**

Sensitivity	Description of Criteria
High	<p>The environment is fragile, and an impact is likely to leave it in an altered state from which recovery would be difficult or impossible.</p> <p>Human (amenity) – receptors which are sensitive to a change in lighting such that the quality of life would be affected (i.e. lighting is designated a statutory nuisance).</p> <p>Human (safety) – receptors where a change in the lighting has the potential to either dramatically improve or reduce safety (for pedestrians, drivers or workers).</p> <p>Ecological – where a change in the lighting affects the habitats, breeding or feeding of fauna (e.g. protected habitats or other special areas) or growth patterns of fauna / crops.</p>
Medium	<p>The environment has a degree of adaptability and resilience and is likely to accommodate the changes caused by an impact, although there may still be some residual modification as a result.</p> <p>Human (amenity) – receptors which are sensitive to a change in lighting however not such that the quality of life would be affected.</p> <p>Human (safety) – receptors where a change in the lighting has the potential to either improve or reduce safety (for pedestrians, drivers or workers).</p> <p>Ecological – where a change in the lighting affects the movement or feeding patterns of fauna but the receptor can adapt.</p>

Sensitivity	Description of Criteria
Low	<p>The environment is adaptable and is resilient to change. Nearly all impacts can be absorbed within it without modifying the baseline conditions.</p> <p>Human (amenity) – receptors which would not noticeably be aware of a change in lighting (i.e. in areas of medium to high luminance).</p> <p>Human (safety) – receptors where a change in the lighting has limited potential to affect safety (for pedestrians, drivers or workers).</p> <p>Ecological – area with limited wildlife.</p>
Negligible	Receptor has little or no night-time activity.

**Table 8.5: Criteria for Magnitude of Change**

Magnitude of Impact	Description of Criteria
High	A large change compared to the natural variants in background levels. A clear breach of limits and standards may occur. For example, levels of obtrusive light in the form of sky glow, light intrusion or glare towards a receptor which exceeds the limits set within the ILP guidance for a higher environmental zone might classify as a high magnitude of change.
Medium	Change which is noticeable and may be a breach of limits and standards. In terms of the limits set in the ILP guidance this might equate to exceeding the limit but within the limits set for the next Environmental Zone.
Low	Change which, when compared to background levels, is only just noticeable.
Negligible	Change is not noticeable.

**Table 8.6: Scale of Effect Matrix**

Magnitude of Impact	Sensitivity of Receptor			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor to Moderate	Negligible
Low	Moderate	Minor to Moderate	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

**Table 8.7: Likely Effects Description**

Likely Effect	Description
Major beneficial	Substantial reduction in obtrusive light at sensitive receptors and/or users of the site such that large scale improvements to visual amenity, human safety or health is delivered. Significantly improves ecological habitats.
Moderate beneficial	Moderate reduction in obtrusive light at sensitive receptors and/or users of the site such that noticeable improvements to visual amenity, human safety or health are delivered. Improves ecological habitats.
Minor beneficial	Minor reduction in obtrusive light at sensitive receptors and/or users of the site such that perceptible improvements to visual amenity, human safety or health is delivered; perceptible improvement to ecological habitats.
Neutral / Not significant	No appreciable effect on sensitive receptors. Effects are reversible.

Likely Effect	Description
Minor Adverse	Minor increase in obtrusive light at sensitive receptors and / or users of the site such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna. Effects are reversible or temporary.
Moderate Adverse	Moderate increase in obtrusive light at sensitive receptors and / or users of the site such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna. Requires monitoring and local remedial work. For example, lighting which is visible and causes nuisance to a sensitive receptor outside the site.
Major Adverse	Major increase in obtrusive light at sensitive receptors and / or users of the site such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna. Requires extensive remedial works. For example, a floodlighting installation which directs light into the eyes of oncoming motorists causing disability glare and potential reduction in visual performance leading to an increased risk of collision.

### Limitations and Assumptions

- 8.2.25 It is assumed that at the detailed design stage, that the proposed lighting will be designed by qualified and competent lighting professionals, in compliance with relevant lighting design standards identified in section 8.3 and the mitigation measures that have been developed for the Proposed Development, outlined in section 8.5.
- 8.2.26 This assessment is limited by the potential that plot types, layouts, number or positions could be changed following the issue of this report. It is assumed that at the detailed design stage, should changes have been made, the proposed lighting for the new layout will be implemented in accordance with the lighting strategy outlined as an appendix 8.6 to this chapter and in compliance with the relevant lighting design standards identified in section 8.3.
- 8.2.27 The methodology applied within this ES Chapter and the associated lighting strategy is in accordance with relevant British Standards and ILP Guidance, which is typically informs Local Policies and is referenced by Local Planning Authorities throughout the UK.

## 8.3 POLICY CONTEXT

### National Policy Statement for National Networks, Department for Transport, December 2014 (NN NPS)<sup>1</sup>

- 8.3.1 The “*Dust, odour, artificial light, smoke, steam*” section (starting at 5.81) and the “*Landscape and visual impacts*” section (starting at 5.143) of the NPS state that the applicant should assess the potential for artificial light and light pollution to have a detrimental impact on amenity, as part of the ES.
- 8.3.2 Lighting should also form part of the landscape and visual assessment reported within the ES. It is a requirement for the landscape and visual assessment to include the visibility and conspicuousness of the project and potential impact on views and visual amenity. This should include and likely light pollution effects including on local amenity, rural tranquillity and nature conservation. Potential effects on local amenity are covered through this chapter, with rural tranquillity falling under Chapter 7 – Landscape & Visual and nature conservation falling under Chapter 6 – Ecology.

### The Cherwell Local Plan 2011 – 2031, Cherwell District Council, Adopted July 2015<sup>2</sup>

- 8.3.3 Whilst the NN NPS is the key source of national policy and guidance for this SRFI application, the Local Planning Authority (LPA) of Cherwell District Council is a consultee to the development proposals. As such, policies relating to lighting outlined within Cherwell District Council planning guidance should be considered.
- 8.3.4 The most relevant elements to lighting within the Cherwell District Council Local Plan are policy ESD 15 (The Character of the Built and Historic Environment) and Strategic Objective SO 15.
- 8.3.5 Policy ESD 15 (The Character of the Built and Historic Environment) states the following of relevance to lighting:
- “New development proposals should: ...  
... Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation...”*
- 8.3.6 Strategic Objective SO 15 states the following of relevance to lighting (emphasis added):

*“To protect and enhance the historic and natural environment and Cherwell’s core*

<sup>1</sup> National Policy Statement for National Networks (2014). Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/387223/npsnn-web.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf)

<sup>2</sup> Cherwell District Council. The Cherwell Local Plan 2011 – 2031 (2015). Available at: <https://www.cherwell.gov.uk/info/83/local-plans/376/adopted-cherwell-local-plan-2011-2031-part-1>

*assets, including protecting and enhancing cultural heritage assets and archaeology, maximising opportunities for improving biodiversity and minimising **pollution** in urban rural areas.”*

### **Environmental Protection Act 1990 / Clean Neighbourhoods and Environment Act 2005<sup>34</sup>**

- 8.3.7 Since 2006, artificial light is incorporated as a potential statutory nuisance in the Environmental Protection Act 1990 (as amended by section 102 of the Clean Neighbourhoods and Environment Act 2005). Section 79(1) of the Environmental Protection Act 1990 (as amended) states:

*“(fb) Artificial light emitted from premises so as to be prejudicial to health and nuisance constitutes a ‘Statutory Nuisance’ ... and it shall be the duty of every local authority to cause its area to be inspected from time to time to detect any statutory nuisances which ought to be dealt with under section 80 below or sections 80 and 80A below and, where a complaint of a statutory nuisance is made to it by a person living within its area, to take such steps as are reasonably practicable to investigate the complaint.”*

### **National Planning Policy Framework: 2021<sup>5</sup>**

- 8.3.8 Whilst the primary source of national policy and guidance for this application is the NPS, it is prudent to consider guidance offered in the National Planning Policy Framework (NPPF) in relation to the Proposed Development.
- 8.3.9 The NPPF sets out the government’s planning policies for England and how they are expected to be applied and provides a framework for local plans. Regarding light pollution (section 180), the NPPF was updated in July 2021 and states that the following elements are to be considered:

*“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:*

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*

<sup>3</sup> Environmental Protection Act 1990 (1990). Available at:  
<https://www.legislation.gov.uk/ukpga/1990/43/contents>

<sup>4</sup> Clean Neighbourhoods and Environment Act 2005 (2005). Available at:  
<https://www.legislation.gov.uk/ukpga/2005/16/contents>

<sup>5</sup> National Planning Policy Framework 2021 (2021). Available at:  
<https://www.gov.uk/government/publications/national-planning-policy-framework--2>

- b) *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) *limit the impact of light pollution and artificial light on local amenity intrinsically dark landscapes and nature conservation.”*

**British Standard: BS 5489 -1 :2020 – Lighting of Roads and Public Amenity Areas- Code of practice, British Standards Institute<sup>6</sup>**

8.3.10 The above-mentioned British Standard is applicable to the artificial lighting of the roadways within the Order Limits to ensure that lighting is implemented in accordance with best practice, whilst achieving the minimum recommended performance requirements. The British Standard also helps to ensure that lighting is appropriately designed and fit for the task for which artificial lighting is required.

**British Standard: BS EN 12464 – 2:2014 – Lighting of work places (Part 2: Outdoor work places)<sup>7</sup>**

8.3.11 The above-mentioned British Standard is applicable to the artificial lighting of the yards, loading bays, and freight areas of the SRFI to ensure that lighting is implemented in accordance with best practice, whilst achieving the minimum recommended performance requirements. The British Standard also helps to ensure that lighting is appropriately designed and fit for the task for which artificial lighting is required.

**ILP: Guidance for Undertaking Environmental Lighting Impact Assessments (PLG04: 2013)<sup>8</sup>**

8.3.12 This industry standard guidance outlines good practice for undertaking assessments of the potential impact of artificial environmental lighting. The guidance outlines the procedures and considerations relevant to assessing potential environmental lighting impacts. PLG04:2013 is applicable to the SRFI as an assessment of the lighting is required to be undertaken in accordance with good practice.

**ILP: Guidance Notes for the Reduction of Obtrusive Light (GN01:2021)<sup>9</sup>**

8.3.13 This guidance note aims to reduce the potential for obtrusive light to occur, caused by poorly designed and installed exterior artificial lighting. The lighting strategy for the

<sup>6</sup> BSI (2020) BS EN 5489-1: 2020: Lighting of Roads and Public Amenity Areas (Code of Practice). Available at: <https://www.bsigroup.com>

<sup>7</sup> BSI (2014) BS EN 12464-2: 2014: Light and lighting – Lighting of work places, Part 2: Outdoor work places. Available at: <https://bsigroup.com>

<sup>8</sup> Institution of Lighting Professionals (ILP) (2013) ILP Professional Lighting Guide PLG04, Guidance on Undertaking Environmental Lighting Impact Assessments. Available at: <https://theilp.org.uk>

<sup>9</sup> Institution of Lighting Professionals (ILP) (2021) ILP Guidance Note 01/21 – Guidance notes for the reduction of obtrusive light. Available at: <https://theilp.org.uk>

SRFI is informed by the most relevant sections of GN01:2021 to reduce the potential for obtrusive light from a wide range of exterior lighting applications.

### **Bat Conservation Trust and ILP: Bats and Artificial Lighting in the UK (GN08:2018)<sup>10</sup>**

- 8.3.14 This guidance in relation to the potential for artificial lighting to affect bats outlines key mitigation measures regarding the lighting performance. This guidance is considered and applied where the ecology assessment for a project highlights the potential for artificial light at night to impact bats.

## **8.4 BASELINE CONDITIONS**

### **Application Site Location and Context**

- 8.4.1 The Application Site is located to the east of the former Upper Heyford Airfield, is split into the “Main Site”, and separate Highways Works areas. The full Proposed Development description can be found in **Chapter 2** of this ES.
- 8.4.2 The Main Site directly abuts the former Upper Heyford Airfield (which is now a mixed use facility with industrial estates, warehousing etc); and is therefore located in close proximity to the “Heyford Park” development adjacent to the Airfield.
- 8.4.3 The Main Site is located approximately 500 metres south west of Ardley village, separated by the existing Chiltern Railway Line, and is bounded to the north by the Chiltern Railway Line and by the B430 to the east. The Main Site is located approximately 450 metres west of the Viridor Ardley ERF, which is not expected to be sensitive to changes in lighting.
- 8.4.4 The environment surrounding the Main Site to the east, south, and immediate north is broadly agricultural, with farmland separating the Main Site from nearby potentially sensitive receptors.
- 8.4.5 More broadly, the Main Site is located approximately 1.5 km north of the village of Middleton Stoney, 1.75 km north east of the village of Caulcott, and is situated approximately 3.75 km north west of the built form of Bicester, the nearest town.
- 8.4.6 At its closest point, the Main Site sits approximately 900 metres west of the M40 motorway, with the closest motorway junction at Junction 10 sitting approximately 1.1 km north east of the Main Site.

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<sup>10</sup> Institution of Lighting Professionals (ILP) (2018) ILP Guidance Note 08/18 – Bats and Artificial Lighting in the UK. Available at: <https://theilp.org.uk>

- 8.4.7 The Main Site is not covered by any statutory or non-statutory landscape designations at either a National or Local level, such as National Parks, AONB's, Special Landscape Areas, or Local Green Space designations.
- 8.4.8 The Application Site covers a wider area, and includes sections of adoptable highway that cross the Ardley Cutting and Quarry SSSI to the immediate north of the Main Site. Whilst not within the Main Site, the Ardley Cutting and Quarry SSSI and the Ardley Trackways SSSI sit adjacent to the Main Site to the north and west respectively.
- 8.4.9 The Main Site is predominantly described as 'Intrinsically Dark' in accordance with the criteria set out in Table 8.1, with limited examples of localised lighting throughout, and is set in an inhabited rural area. Low to moderate sky glow was observed during the baseline lighting survey of the Order Limits, notably in the direction of Heyford Park and the Viridor Ardley Energy Recovery Facility. Within the Order Limits, areas exist that can be described as having 'Low' to 'Medium' district brightness, for example in proximity to Fewcott and Junction 10 of the M40. Where a development exists in proximity to the boundary of two environmental zones, ILP Guidance Notes for the Reduction of Obtrusive Light (GN01:2021) state that the more stringent criteria are to be used. Therefore, the Application Site and surroundings are categorised as being an E2 Environmental Zone in accordance with the ILP Guidance Notes for the Reduction of Obtrusive Light (GN01:2021).

### **Baseline Survey**

- 8.4.10 This section has been informed by a night-time lighting survey of the Order Limits, which was undertaken in accordance with ILP PLG04.
- 8.4.11 The baseline survey was carried out during the evening of the 12<sup>th</sup> of January 2022 by two lighting professionals experienced and qualified to undertake such surveys.
- 8.4.12 The survey was undertaken following the onset of astronomical dusk (17:38 hours). Weather conditions were partly cloudy, and the moon was visible. Moonlight was observed during the survey, and the moon was 75% visible (Waxing Gibbous) according to <https://moonphases.co.uk>.
- 8.4.13 Illuminance measurements were taken in both the horizontal and vertical plane as appropriate, in the areas of the Application Site where significant measurable lighting was observed.
- 8.4.14 Areas throughout the Order Limits were visited, with photography taken where examples of lighting were observed.
- 8.4.15 Measurements were taken using a Hagner T-10 illuminance meter (serial number: 55611050) which had a valid calibration certificate (certificate No: LB211703) and is



widely regarded as the standard instrument for providing a consistent level of accuracy at the low illuminance levels associated with site measurements in locations with typically low ambient luminance.

- 8.4.16 For the majority of the Main Site, existing lighting was exceptionally limited. Lighting in proximity to the western boundary (in proximity to the former Upper Heyford Airfield) was exceptionally low, with spill light from existing road lighting spilling into the Application Site in the vicinity of the Camp Road / Chilgrove Drive junction. Photography of this lighting was gathered as part of the baseline illuminance survey, and is presented in images 1 – 5 of Appendix 8.4. The rest of the western boundary can be considered 'Dark'.
- 8.4.17 Limited lighting was observed to the west of the Main Site, in proximity to the existing farm buildings on the B430 (J W Pickford & Son) and the Ardley Fields Household Waste & Recycling Centre.
- 8.4.18 The Severn Trent Green Power Ardley Composting Facility was surveyed from the adjacent public highway, but was found to have almost no lighting switched on into the evening. This sits almost immediately south of the Main Site.
- 8.4.19 Further afield (approx.500m south of the Main Site boundary), farm buildings were surveyed, but also found to have no significant light sources beyond indicator lighting on burglar alarms (and other sources of such magnitude). Houses further south on the B430 Ardley Road north of Middleton Stoney were surveyed, but also found to have little to no exterior lighting.
- 8.4.20 Farm buildings in proximity to the proposed highways works bisecting Middleton Road were surveyed (At the Nolan Fuel Oils refilling site), however, only exceptionally limited security lighting was observed.
- 8.4.21 Viridor's Ardley Energy Recovery Facility (ERF) is located approximately 300m east of the Main Site. This facility was visibly the brightest point in the vicinity of the Application Site, as the access road is illuminated and there are noticeable levels of building luminance. Whilst the levels of lighting observed at the ERF are unlikely to contribute to lighting levels within the Application Site, they do contribute to low levels of local sky glow.
- 8.4.22 The baseline lighting levels established during the baseline survey are shown in Appendix 8.2. The positions of photographs taken during the baseline survey are shown in Appendix 8.3, with photography gathered during the baseline survey shown in Appendix 8.4.

## Potentially Sensitive Receptors

- 8.4.23 Following the desktop assessment and survey of the Application Site and surrounding study area, it has been determined that there are potentially sensitive receptors in the vicinity of the Application Site that will need to be considered.
- 8.4.24 The potentially sensitive receptors and their corresponding sensitivity are identified in Table 8.8 and shown in Appendix 8.5:

**Table 8.8 Potentially Sensitive Receptor Sensitivity**

Receptor Type	Receptor Location (See Appendix 8.5)	Description	Sensitivity
Human – Residential	Location 1	Mixed Use – B430 “J W Pickford & Son”	Low
Human – Residential	Location 2	Mixed Use – B430 Farmhouse (South)	Medium
Human – Residential	Location 3	Mixed Use – B430 Farmhouse (South East)	Medium
Human – Residential	Location 4	Residential Properties – B430 South	Medium
Human – Residential	Location 5	Residential Properties – Middleton Stony	Medium
Human – Residential	Location 6	Mixed Use – Middleton Road Nolan Fuel Oils	Medium
Human – Residential	Location 7	Residential Properties – Heyford Park	Medium
Human – Residential	Location 8	Residential Properties – Ardley	Medium
Human – Amenity	Location 9	Users of Upper Heyford Airfield	Low
Human – Safety	Location 10	Road Users – B430	Medium
Human – Safety	Location 11	Road Users – M40	High
Human – Safety	Location 12	Road Users – Camp Road	Medium
Human – Safety	Location 13	Train Drivers – Railway to north of Application Site	High
Environmental	Location 14	Main Site Boundary – Ecology	Medium
Environmental	Location 15	Railway Line – Ecology	Medium

## Future Baseline

- 8.4.25 The Application Site is located within close proximity to Heyford Park, which is currently undergoing significant residential development (this development is spread across a significant number of planning applications, with the most relevant being Cherwell District Council Planning Ref: 18/00825/HYBRID). As this residential development progresses, and more development occupied, light pollution associated with Heyford Park is likely to increase.

8.4.26 Due to the scale of the Application Site, this is only likely to potentially affect lighting levels at the western boundary; however, it may also lead to an increase in sky glow that will be visible from the Application Site. This increase in sky glow will result from indirect reflected light from Heyford Park, rather than from direct light spill from lighting equipment.

## 8.5 ASSESSMENT OF LIKELY EFFECTS

### Potential Effects from Artificial Light

8.5.1 The following potential effects can arise from inappropriately designed artificial lighting:

- Effects from light intrusion from exterior lighting on residents (through windows)
- Effects from viewed source intensity on residents and sightseers
- Effects from upward light (or sky glow)
- Effects from disability glare on transport users
- Effects from light on bats, roosts and insects

8.5.2 Light intrusion (or light spill) is the term for the spilling of light beyond the boundary of the area being lit. The ILP Guidance Notes places a limit on the amount of vertical illuminance which falls upon the centre of a dwelling window. The suggested maximum values quoted are relative to the amount of light measured as a baseline without the presence of the obtrusive light source.

8.5.3 Table 8.2 within this document (Table 4 within ILP GN01:2021) advises limits on luminaire intensity or viewed source intensity from flood lighting luminaires towards an observer. The greatest effects are usually encountered from poorly aimed floodlights or security lighting, or from lighting which is located too close to properties.

8.5.4 Light emitted above the horizontal either directly from luminaires or indirectly as reflected light from surfaces such as the landscape or buildings, has the potential to cause sky glow. The ILP GN01:2021 places limits on the percentage of direct upward light emitted from the luminaires in their installed attitude, which is dependent upon the environmental zone in which the site lies.

8.5.5 Indirect upward light is subject to surface reflectance properties. It is not easily quantifiable but is unlikely to be as significant as direct upward light from luminaires.

8.5.6 Light falling on a roost access point will at least delay some species of bats from emerging, thus shortening the amount of time available to them for foraging. As the main peak of nocturnal insect abundance occurs at and soon after dusk, a delay in emergence means this vital time for feeding may be missed.

- 8.5.7 In addition to causing disturbance to bats at the roost, artificial lighting can also affect the feeding behaviour of bats. There are two aspects to this – one is the attraction that light from certain types of lamps has to a range of insects; the other is the presence of lit conditions.
- 8.5.8 The proposed (draft) lighting strategy presented as Appendix 8.6 to this chapter includes requirements for lighting to be installed such that glare is minimised in accordance with the ILP guidance notes.

### **Likely effects associated with the Proposed Development**

- 8.5.9 The assessment of likely effects considers the potential effects from caused by obtrusive light associated with the construction and operational phase of the Proposed Development.
- 8.5.10 Likely significant effects are assessed in accordance with the criteria and matrices presented in Tables 8.4 to 8.7.
- 8.5.11 To ensure the potential for obtrusive light from the Proposed Development is suitably minimised, mitigation measures will be embedded into the lighting strategy, thus ensuring the reliance on secondary mitigation measures is avoided.
- 8.5.12 The draft lighting strategy which has informed this assessment is presented as Appendix 8.6 to this chapter.
- 8.5.13 All likely effects are considered following the implementation of the embedded mitigation measures.

### **Embedded Mitigation**

- 8.5.14 The potential impacts associated with the Proposed Development are mitigated through the implementation of a lighting strategy, in accordance with the measures outlined in this section. By designing lighting to be minimally obtrusive at the design stage, the impacts of lighting will be mitigated without the requirement for the implementation of additional mitigation measures.

#### Embedded Mitigation (Construction Phase)

- 8.5.15 The implementation of construction lighting (without mitigation) during the development process can create the potential for obtrusive light to occur, due to poorly designed or installed lighting equipment. Generally, construction lighting is provided by poorly controlled flood lighting luminaires, not designed to carefully control components of obtrusive light.
- 8.5.16 As such, embedded mitigation measures shall be implemented in construction lighting to ensure that unacceptable levels of obtrusive light are not generated.
- 8.5.17 The potential effects of construction lighting will be mitigated through the implementation of the embedded measures below:

- Construction lighting will be provided in compliance with the guidance within BS EN 12464-2:2014; which defines appropriate lighting levels for outdoor work tasks. The levels required will vary depending upon the task being undertaken and will be assessed on a task-by-task basis. Construction lighting will not significantly exceed the relevant lighting standard for the task being undertaken in order to limit the visibility of construction lighting within the landscape.
- Construction lighting will be maintained at a low level and focussed into the site, onto the task being undertaken.
- Construction tasks will predominantly be undertaken during the hours of daylight, and as such, there is limited requirement for construction lighting throughout the construction phase of the Proposed Development.
- Luminaires used for construction lighting will be fitted with baffles or shields where necessary to ensure that lighting is not directed towards potentially sensitive receptors.
- To limit the visibility of construction lighting within the landscape, it will be switched off when not in use.

8.5.18 These measures will be secured through the implementation of the Construction Environmental Management Plan (CEMP).

#### Embedded Mitigation (Operational Phase)

8.5.19 The implementation of operational lighting (without mitigation) can create the potential for obtrusive light to occur, due to poorly designed or installed lighting equipment if it is not installed in accordance with best practice and guidance.

8.5.20 As such, proposed embedded mitigation measures are outlined below to ensure that unacceptable levels of obtrusive light are not generated. These measures are taken into account in the assessment of likely effects.

8.5.21 The potential effects of operational lighting will be mitigated through the implementation of a fully comprehensive lighting strategy, that shall include the embedded measures below:

- Lighting for the Proposed Development will be subject to a detailed lighting design by a competent lighting professional at the detailed submission stage. Lighting throughout the Proposed Development will be designed in accordance with the relevant lighting standards for highways and outdoor workplaces identified in BS 5489-1:2020 and BS EN 12464-2:2014 respectively.
- At the detailed design stage, luminaires shall be designed such that light spill onto sensitive ecology receptors adjacent to the Main Site does not exceed the levels outlined in GN08:2018 (0.40 lux vertical illuminance, 0.20 lux horizontal illuminance).
- Luminaires throughout the development will be of high quality, ensuring that light is focussed downwards onto the ground or other surface in the horizontal plane, minimising the potential for direct upward light, glare, light spill and light intrusion.

Luminaires of this type are designed to ensure that they are optically efficient, thus reducing the amount of light spilled onto the vertical plane, thereby reducing the potential for obtrusive light. It is proposed that column mounted luminaires are only intended for the lighting of the Main Site accesses, Main Site internal roads, Main Site car parks, Main Site yard areas and the Rail Freight Terminal.

- Where luminaires are proposed to be installed close to the Application Site boundaries, they will be oriented away from the boundary to focus light into the Proposed Development, especially on the west side of the Application Site, to minimise the potential for obtrusive light to occur outside the Application Site boundary.
- Luminaires proposed will have good optical control and the option for installing shields. This is an effective method of shielding the source intensity and reducing both horizontal and vertical spill light. If during the design of the lighting installation it is decided that luminaires are to be installed with shields, then photometry with the effects of shields would be considered to ensure that calculated lighting levels are accurate at the detailed design stage.
- Luminaires are to emit a warm white colour temperature (3000K or less unless otherwise specified by an adopting authority) to reduce the potential for adverse effects onto potentially sensitive ecological receptors.
- Luminaires installed directed towards any potential observer are not to have a peak beam angle greater than 70 degrees when the luminaire is installed with a tilt angle of 0 degrees. This applies mainly to column mounted roadway and car park luminaires.
- All luminaires throughout the Application Site are to be mounted at a tilt angle of 0- degrees to minimise upward light, glare, and stray light.
- All luminaires throughout the Application Site are to be mounted at a maximum mounting height of 10 metres above ground level.

8.5.22 Embedded mitigation measures are outlined in the lighting strategy presented as Appendix 8.6 to this chapter.

### **Likely Effects (Construction Phase)**

8.5.23 The effects of light from construction lighting associated with the Proposed Development will be minimised by the application of the mitigation measures outlined in the Embedded Mitigation section.

8.5.24 It is not expected that lighting for construction would be required for significant periods throughout the night, as the majority of the construction work would take place during the day, after which time task lighting associated with construction would be switched off.

8.5.25 Some construction compounds are likely to require security lighting during the hours of darkness, however, effective implementation of the mitigation measures relevant to construction lighting will reduce the potential for obtrusive light from compound security lighting.

8.5.26 Following the effective implementation of the embedded mitigation measures, effects associated with construction phase lighting would be negligible in magnitude, temporary in duration, and the effects reversible. Therefore, the significance of effects from construction phase lighting would be negligible.

8.5.27 The residual effects associated with construction lighting are outlined in Table 8.9.

#### **Likely Effects (Operational Phase)**

8.5.28 The effects of light from operational lighting associated with the Proposed Development will be minimised by the application of mitigation measures outlined in the Embedded Mitigation section.

8.5.29 Whilst the lighting levels present within the boundary of the Application Site will increase, it is unlikely that potential human receptors with views of the Application Site would be subjected to an increase in obtrusive light; due to the mitigation measures, site layout and compliance with lighting standards. Implementation of the embedded mitigation measures will also minimise light spill, ensuring that lighting is focussed only towards areas where it is required.

8.5.30 Although lighting is required for the Proposed Development and may be noticeable from the residential receptors identified, it is unlikely to be obtrusive through limiting the luminaire tilt angles and mounting heights of the proposed luminaires. As outlined in GN01:2021, the visibility of lighting alone is not considered an obtrusive light component.

8.5.31 The levels of lighting outlined within the relevant sections of BS 5489-1:2020 and BS EN 12464-2:2014 for the applications proposed within the Proposed Development are determined as the lowest possible lighting levels to guarantee the safety of users of the site. The residential receptors identified have been considered as having Medium sensitivity to changes in lighting.

8.5.32 Views of the Proposed Development within the Main Site boundary in most directions will be partially screened by proposed strategic mounding, which is proposed to cover significant lengths of the Main Site boundary. Whilst not required to achieve the likely effects stated, planting and further topographical barriers will further reduce direct views of the Application Site.

8.5.33 Views of the Proposed Development from the north will be partially screened by established planting, and topographical features associated with the railway line to the north. Furthermore, receptors to the north of the Application Site will benefit from additional separation from the Main Site boundary.

8.5.34 Due to the extents of the Proposed Development, ecological receptors are considered to be beyond the Application Site boundaries, and the railway line to the north. As such, lighting proposals will seek to limit light spill onto the boundaries and onto the existing rail line, making the artificial exterior lighting associated with the Proposed Development unlikely to give rise to significant adverse effects upon

potentially sensitive ecological receptors. Through the implementation of the embedded mitigation measures outlined above, lighting levels at site boundaries will be kept to a minimum – with these being the areas which typically hold the greatest ecological sensitivity. The use of minimal lighting levels, switching off of luminaires, minimal mounting heights, elimination of tilt, and the implementation of effective lighting controls will reduce the potential for lighting to impact site boundaries.

- 8.5.35 Due to the limitation of lighting levels at the Application Site boundary, it is unlikely that lighting associated with the Proposed Development would give rise to significant negative effects on road users. The Proposed Development features road lighting to some areas that is designed to increase the safety of conflict areas that will be designed and implemented as part of detailed highways design processes. The embedded mitigation measures have been developed to ensure that obtrusive light in the form of glare is minimised in line with obtrusive light guidance and criteria outlined within relevant British Standards, further reducing this impact.

## **8.6 MITIGATION AND RESIDUAL EFFECTS**

- 8.6.1 There are no further additional mitigation measures that are to be applied with regards to lighting, due to the embedded nature of the mitigation measures outlined above.
- 8.6.2 As such, the residual effects associated with the Proposed Development can be assessed based upon the implementation of the embedded mitigation measures in section 8.5, and the associated lighting strategy provided as an appendix to this chapter.

### **Residual Effects**

- 8.6.3 Due to the scale of the Proposed Development and the adjacent Heyford Park redevelopment, the baseline lighting levels within the Application Site will change once lighting associated with the Proposed Development is implemented. This does not affect the impacts upon existing potentially sensitive receptors in the vicinity of the Application Site; however, the baseline lighting levels will be more consistent with an E3 Environmental Zone once the Proposed Development is in the operational phase.
- 8.6.4 The magnitude of change to Receptor Location 1 (Mixed Use - B430 “J W Pickford & Son”) is considered ‘Low’, as the change will be noticeable, but will not significantly impact the amenity of users of the premises. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.5 The magnitude of change to Receptor Location 2 (Mixed Use - B430 Farmhouse (South)) is considered ‘Negligible’, as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach



- the relevant E2 environmental zone limits outlined in Table 3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.6 The magnitude of change to Receptor Location 3 (Mixed Use - B430 Farmhouse (South East)) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.7 The magnitude of change to Receptor Location 4 (Residential Properties - B430 South) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.8 The magnitude of change to Receptor Location 5 (Residential Properties – Middleton Stoney) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.9 The magnitude of change to Receptor Location 6 (Mixed Use – Middleton Road Nolan Fuel Oils) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.10 The magnitude of change to Receptor Location 7 (Residential Properties – Heyford Park) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.11 The magnitude of change to Receptor Location 8 (Residential Properties - Ardley) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.12 The magnitude of change to Receptor Location 9 (Users of Upper Heyford Airfield) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.13 The magnitude of change to Receptor Location 10 (Road Users – B430) is considered 'Negligible', as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the

- relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.14 The magnitude of change to Receptor Location 11 (Road Users – M40) is considered ‘Negligible’, as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.15 The magnitude of change to Receptor Location 12 (Road Users – Camp Road) is considered ‘Negligible’, as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance.
- 8.6.16 The magnitude of change to Receptor Location 13 (Train Drivers – Railway to north of Application Site) is considered ‘Negligible’, as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 8.3 (5.00 lux pre-curfew, 1.00 lux post-curfew), or breach standards and guidance, and is unlikely to affect visibility for train drivers.
- 8.6.17 The magnitude of change to Receptor Location 14 (Main Site Boundary - Ecology) is considered ‘Negligible’, as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant limits outlined in ILP GN08:2018 (0.40 lux vertical illuminance, 0.2 lux horizontal illuminance), or breach standards and guidance.
- 8.6.18 The magnitude of change to Receptor Location 15 (Railway Line - Ecology) is considered ‘Negligible’, as the change will not be noticeable in accordance with the criteria set out in Table 8.5. The proposed lighting is highly unlikely to breach the relevant limits outlined in ILP GN08:2018 (0.40 lux vertical illuminance, 0.2 lux horizontal illuminance), or breach standards and guidance.
- 8.6.19 The magnitude of change against each receptor location has been used to inform the residual effects associated with the operational lighting, in accordance with the matrix presented in Table 8.6.
- 8.6.20 The significance of effect to Receptor Location 1 (Mixed Use – B430 “J W Pickford & Son”) is considered ‘Negligible’, as the receptor is of ‘Low’ sensitivity, and would be subject to a ‘Low’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.21 The significance of effect to Receptor Location 2 (Mixed Use – B430 Farmhouse (South)) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.

- 8.6.22 The significance of effect to Receptor Location 3 (Mixed Use – B430 Farmhouse (South East)) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.23 The significance of effect to Receptor Location 4 (Residential Properties – B430 South) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.24 The significance of effect to Receptor Location 5 (Residential Properties – Middleton Stoney) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.25 The significance of effect to Receptor Location 6 (Mixed Use – Middleton Road Nolan Fuel Oils) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.26 The significance of effect to Receptor Location 7 (Residential Properties – Heyford Park) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.27 The significance of effect to Receptor Location 8 (Residential Properties - Ardley) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.28 The significance of effect to Receptor Location 9 (Users of Upper Heyford Airfield) is considered ‘Negligible’, as the receptor is of ‘Low’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.29 The significance of effect to Receptor Location 10 (Road Users – B430) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.30 The significance of effect to Receptor Location 11 (Road Users – M40) is considered ‘Negligible’, as the receptor is of ‘High’ sensitivity, and would be subject to a ‘Negligible’ change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.31 The significance of effect to Receptor Location 12 (Road Users – Camp Road) is considered ‘Negligible’, as the receptor is of ‘Medium’ sensitivity, and would be

subject to a 'Negligible' change. As a result, the residual effect would be a permanent negligible effect at a local level.

- 8.6.32 The significance of effect to Receptor Location 13 (Train Drivers – Railway to north of Application Site) is considered 'High', as the receptor is of 'Medium' sensitivity, and would be subject to a 'Negligible' change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.33 The significance of effect to Receptor Location 14 (Main Site Boundary - Ecology) is considered 'Negligible', as the receptor is of 'Medium' sensitivity, and would be subject to a 'Negligible' change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.34 The significance of effect to Receptor Location 15 (Railway Line - Ecology) is considered 'Negligible', as the receptor is of 'Medium' sensitivity, and would be subject to a 'Negligible' change. As a result, the residual effect would be a permanent negligible effect at a local level.
- 8.6.35 The residual effects associated with construction lighting are summarised in Table 8.9.

**Table 8.9 Likely Significant Effects**

Receptor Location	Sensitivity of Receptor	Impact Magnitude	Nature of impact (Permanent / Temporary)	Residual Effects
<b>Construction</b>				
1	Low	Negligible	Temporary	Negligible
2	Medium	Negligible	Temporary	Negligible
3	Medium	Negligible	Temporary	Negligible
4	Medium	Negligible	Temporary	Negligible
5	Medium	Negligible	Temporary	Negligible
6	Medium	Negligible	Temporary	Negligible
7	Medium	Negligible	Temporary	Negligible
8	Medium	Negligible	Temporary	Negligible
9	High	Negligible	Temporary	Negligible
10	Medium	Negligible	Temporary	Negligible
11	High	Negligible	Temporary	Negligible
12	Medium	Negligible	Temporary	Negligible
13	High	Negligible	Temporary	Negligible
14	Medium	Negligible	Temporary	Negligible
15	Medium	Negligible	Temporary	Negligible
<b>Completed Development</b>				
1	Low	Low	Permanent	Negligible
2	Medium	Negligible	Permanent	Negligible
3	Medium	Negligible	Permanent	Negligible
4	Medium	Negligible	Permanent	Negligible

Receptor Location	Sensitivity of Receptor	Impact Magnitude	Nature of impact (Permanent / Temporary)	Residual Effects
5	Medium	Negligible	Permanent	Negligible
6	Medium	Negligible	Permanent	Negligible
7	Medium	Negligible	Permanent	Negligible
8	Medium	Negligible	Permanent	Negligible
9	High	Negligible	Permanent	Negligible
10	Medium	Negligible	Permanent	Negligible
11	High	Negligible	Permanent	Negligible
12	Medium	Negligible	Permanent	Negligible
13	High	Negligible	Permanent	Negligible
14	Medium	Negligible	Permanent	Negligible
15	Medium	Negligible	Permanent	Negligible

- 8.6.36 It is assessed that effects associated with lighting for the Proposed Development will be **negligible** in significance; as the magnitude of impact is **negligible** where receptor sensitivity is **medium** or **high**, and the magnitude of impact is **low** where receptor sensitivity is **low**. All impacts will be at a local level.
- 8.6.37 Impacts associated with the Construction Phase of the Proposed Development will have effects in the short term only and will be temporary and reversible.
- 8.6.38 Impacts associated with the Operational Phase of the Proposed Development will have effects in the short, medium, and long term. The effects will not change significantly over the lifetime of the installation, however, impacts may reduce slightly as planting becomes established. Impacts associated with the Operational Phase of the Proposed Development will be reversible; with the capacity to take remedial action.
- 8.6.39 In summary, effects associated with lighting for the Proposed Development will be **negligible** in the long term at a local level.

### Climate Change

- 8.6.40 The lighting discipline has limited interactions with climate change, however, measures taken within the embedded mitigation measures will reduce the potential impact of the Proposed Development upon the climate.
- 8.6.41 Through the selection of high-quality luminaires, with appropriate optics and outputs designed to meet relevant British standards; the proposed lighting will use significantly less energy than an equivalent installation that was poorly design or implemented.
- 8.6.42 Furthermore, the use of bespoke switching and dimming regimes will further reduce the energy consumption associated with the Proposed Development.

- 8.6.43 Through compliance with relevant industry guidance outlined in ILP GN08:2018, the Proposed Development will seek to limit its impact upon nearby potentially sensitive ecological receptors. This ensures that lighting associated with the Proposed Development will not have a significant impact upon nature connectivity or recovery networks.

### **Human Health**

- 8.6.44 Since 2006, artificial light is incorporated as a potential statutory nuisance in the Environmental Protection Act 1990 (as amended by section 102 of the Clean neighbourhoods and Environment Act 2005). The protection of human health is identified in section 78 of the Environmental Protection Act 1990 (as amended), which states that “*Artificial light emitted from premises so as to be prejudicial to health and nuisance constitutes a ‘Statutory Nuisance’*”.
- 8.6.45 To ensure that lighting associated with the Proposed Development does not constitute a statutory nuisance (defined as the point at which it constitutes a nuisance or impacts human health), lighting has been designed in accordance with relevant industry guidance and standards, specifically ILP GN01:2021.
- 8.6.46 Through compliance with the measures outlined in ILP GN01:2021 (which have been included as embedded mitigation) the Proposed Development demonstrates that it is highly unlikely to cause harm to human health through the implementation of lighting.

## **8.7 CUMULATIVE EFFECTS**

- 8.7.1 This section will assesses the likely significant effects of the Proposed Development on your topic/key receptors when considered in the context of other future committed projects within close proximity.
- 8.7.2 The list of other schemes/commitments is to be agreed for the final ES with the Local Planning Authority. However, given the requirement for all new developments to minimise or eliminate obtrusive lighting effects, there are unlikely to be any significant cumulative lighting effects on shared receptors from the Proposed Development and other committed developments.

## **8.8 SUMMARY AND CONCLUSIONS**

- 8.8.1 This chapter considers the effects resulting from artificial lighting associated with the Proposed Development on the Application Site and its surroundings. It assesses the potential effects from obtrusive light associated with the proposed exterior lighting. The principal objective is to assess the significance of likely residual effects.
- 8.8.2 The Application Site is predominantly within a sparsely inhabited rural environment, consistent with the conditions of an E2 Environmental Zone.

- 8.8.3 A baseline survey of the Order Limits was undertaken to assess the baseline conditions which were assessed to be of low ambient luminance.
- 8.8.4 The requirement for artificial lighting to support the Proposed Development means that there could be potential effects caused by elements for the required lighting, including: light spill, direct source luminance or glare (onto receptor views) and sky glow or upward light. Without embedded mitigation measures included through the implementation of a high-quality lighting design, the effects have the potential to be **moderate adverse** in the long term at a local level, as poor quality light sources could be installed, and lighting levels could be non-compliant with British Standards or guidance documents. To avoid this, embedded mitigation measures are implemented.
- 8.8.5 The mitigation measures deployed through the embedded mitigation measures and additional mitigation measures would ensure that artificial lighting is not obtrusive.
- 8.8.6 To ensure the likely effects of lighting within the Proposed Development as stated in this chapter are achieved, lighting will be implemented in accordance with a lighting strategy prepared for the Proposed Development, shown in Appendix 8.6.
- 8.8.7 Measures are outlined within the Embedded Mitigation section that will reduce the visibility of lighting within the landscape and the potential adverse effects.
- 8.8.8 Due to the embedded and additional mitigation measures outlined, and implemented in light spill modelling, the residual effects from the lighting of the construction and operational phases of the Proposed Development are assessed to be **negligible** in the long term at a local level. This is due to the low potential for obtrusive light to affect human and ecological receptors, through the thorough implementation of the mitigation measures identified.
- 8.8.9 Potentially sensitive human receptors located outside the boundaries of the Application Site are unlikely to be subjected to obtrusive light from the Proposed Development, due to the full and continuous implementation of the mitigation measures outlined for the Proposed Development.
- 8.8.10 Lighting will be implemented ensuring that light is only focussed where it is needed, and the layout of the Proposed Development will provide shielding of the luminaires to sensitive receptors. This will help to reduce the potential for the levels of glare and light spill to be greater than those permitted within Table 8.3.
- 8.8.11 In conclusion, lighting levels associated with the Proposed Development will be sympathetic to the surroundings and consist of lighting levels appropriate for the tasks being undertaken. As such, there are unlikely to be significant adverse effects from artificial lighting installed as part of the Proposed Development.