

# A47 Wansford to Sutton Dualling

**Scheme Number: TR010039**

**Volume 6**

## **6.3 Environmental Statement Appendices**

### **Appendix 7.7 – Lighting Assessment**

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed  
Forms and Procedure) Regulations 2009

July 2021

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning  
(Applications: Prescribed Forms and  
Procedure) Regulations 2009**

A47 Wansford to Sutton  
Development Consent Order 202[x]

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**ENVIRONMENTAL STATEMENT APPENDICES**  
**Appendix 7.7 - Lighting Assessment**

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## LIGHTING IMPACT ASSESSMENT

PROJECT: A47 WANSFORD TO SUTTON DUALLING

PREPARED FOR: SWECO

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Glossary of Terms

**Candela:** The intensity of a light source in a specific direction. The unit of luminous intensity.

**Glare:** The uncomfortable brightness of a light source when viewed against a darker background.

**Illuminance:** The quantity of light, or luminous flux, falling on a unit area of a surface. It is designated by the symbol E. The unit is lux (lx). One lux equals one lumen per square metre (lm/m2).

**Luminance:** Luminous intensity emitted per unit area of a surface in a specific direction. The unit is the candela per square metre (cd/m2).

**Lux:** The unit of **Illuminance**.

**Light Intrusion:** The spill of light beyond the boundary of the property or area being lit

**Light Spill:** The unwanted spillage of light onto adjacent areas, which may affect sensitive receptors; particularly residential properties and ecological sits.

**Light Trespass:** Light that impacts on a surface outside of the area designed to be lit by a lighting installation.

**Sky Glow:** The brightening of the night sky caused by artificial lighting.

# 1 Introduction

## 1.1 General

- 1.1.1 This report has been prepared on behalf of Sweco UK Ltd., by Designs for Lighting Ltd, a specialist exterior lighting consultancy with knowledge and experience in lighting impact assessments and mitigation. Designs for Lighting Ltd 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.
- 1.1.2 The purpose of this report is to provide an analysis of the potential post construction light spill levels associated with the Proposed Scheme, to allow an assessment of the potential effects on sensitive receptors.
- 1.1.3 The Proposed Scheme consists of the dualling of the A11 Eastbound & Westbound between Wansford and Sutton; including two junctions at Wansford and Sutton ('The Sites'). An overbridge is also to be added at the entrance to the Sacrewell Farm & activity centre, approximately 350m east of the Wansford Junction. On & Off slips are to be added to the Westbound carriageway to better enable access to the road associated with the proposed bridge.
- 1.1.4 Lighting is to be provided to both key junctions, with the effects of a total of 48 lighting units to be assessed.
- 1.1.5 This lighting assessment has been prepared in accordance with the proposed scheme drawings included as **Annex 1**, outlining the proposed lighting layout.
- 1.1.6 To support the lighting assessment, additional light spill modelling has been undertaken, the Isolux contour diagrams demonstrating the results of this modelling are presented in **Annex 3**.
- 1.1.7 The principal objective of the assessment is to identify the impact of obtrusive light associated with the Proposed Scheme on various sensitive receptors, including ecology receptors and human visual receptors, and assess the significance of any residual effects from artificial lighting associated with the operational phase of the Proposed Scheme.
- 1.1.8 The lighting impact assessment considers the maximum adverse scenario in relation to the artificial lighting associated with the Proposed Scheme to adequately assess the significance of the likely effects on the identified sensitive receptors.
- 1.1.9 The Sites are located at the A47 Wansford Junction, to the West of Wansford.

# 2 Legislative and policy framework

## 2.1 National Policy and Legislation

### Environmental Protection Act 1990 / Clean Neighbourhoods and Environment Act 2005

- 2.1.1 Since 2005, artificial light has been incorporated as a potential statutory nuisance. An amendment to section 79 of the Environmental Protection Act 1990, contained within the Clean Neighbourhoods and Environment Act 2005 states:

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

### National Planning Policy Framework 2019

- 2.1.2 The National Planning Policy Framework (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. With regard to light pollution, the NPPF was updated in November 2019 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:*

*c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”*

### **Planning Practice Guidance**

- 2.1.3 Guidance for assessing the effects of proposed artificial lighting is outlined in the planning practice guidance (PPG). The guidance states:

*“Does a new development proposal, or a major change to an existing one, materially alter light levels outside the development and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?*

*Does an existing lighting installation make the proposed location for a development unsuitable? For example, this might be because:*

- *the artificial light has a significant effect on the locality;*
- *users of the Proposed Scheme (e.g. a hospital) may be particularly sensitive to light intrusion from the existing light source.*

*Does a proposal have a significant impact on a protected site or species e.g. located on, or adjacent to, a designated European site or where there are designated European protected species that may be affected?*

*Is the development in or near a protected area of dark sky or an intrinsically dark landscape where it may be desirable to minimise new light sources?*

*Are forms of artificial light with a potentially high impact on wildlife (e.g. white or ultraviolet light) being proposed close to sensitive wildlife receptors or areas, including where the light shines on water?*

*Does the Proposed Scheme include smooth, reflective building materials, including large horizontal expanses of glass, particularly near water bodies (because it may change natural light, creating polarised light pollution that can affect wildlife behaviour)?”*

## **2.2 Local Policy**

- 2.2.1 The Sites sit within the boundary of Peterborough City, and are governed by the planning policy of Peterborough City Council; however, both Sites sit in close proximity to Huntingdonshire, with the Wansford junction sitting in close proximity to East Northamptonshire. As such, planning policies for Huntingdonshire and North Northamptonshire are listed here for consideration.

### **Peterborough Local Plan (Adopted July 2019)**

- 2.2.2 The Peterborough City Council Local Plan contains the most appropriate planning policies for the growth and regeneration of Peterborough and the surrounding villages up to 2036.
- 2.2.3 Whilst the Site sits outside of the jurisdiction of Peterborough City Council, the proximity of the Peterborough City Council jurisdiction means it is best practice to consider the policies within the Peterborough Local Plan when performing this assessment.
- 2.2.4 The most relevant policy within the local plan is considered to be;

### **Policy LP17: Amenity Provision**

*“New development should not result in an unacceptable impact on the amenity of existing occupiers of any nearby properties. These impacts may include:*

- a. loss of privacy for the occupiers of any nearby property; or*
- b. loss of public green space and/or amenity space; or*
- c. noise and/or vibration levels resulting in disturbance for the occupiers or users of any nearby property or land; or*

- d. loss of light to and/or overshadowing of any nearby property; or*
- e. overbearing impact on any nearby property; or*
- f. adverse impact on air quality from odour, fumes, dust, smoke or other sources; or*
- g. light pollution from artificial light or glare.”*

#### **Huntingdonshire District Council Local Plan (Adopted May 2019)**

- 2.2.5 The Local Plan & Core Strategy set out the long-term vision and objectives for the area covered by Huntingdonshire Council for the plan period up to 2036, including strategic policies for steering and shaping development.
- 2.2.6 The most relevant policies of the Local Plan & Core Strategy are considered to be;

#### **Policy LP10: The Countryside**

*“...All development in the countryside must: ... c. not give rise to noise, odour, obtrusive light or other impacts that would adversely affect the use and enjoyment of the countryside by others.”*

#### **Policy CS 1: Sustainable Development**

*“All plans, policies and programmes of the Council and its partners, with a spatial element, and all development proposals in Huntingdonshire will contribute to the pursuit of sustainable development.*

*Reflecting environmental, social and economic issues the following criteria will be used to assess how a development proposal will be expected to achieve the pursuit of sustainable development, including how the proposal would contribute to minimising the impact on and adaptability to climate change. All aspects of the proposal will be considered including the design, implementation and function of development. The criteria are: ...*

*Minimising and reducing greenhouse gas emissions, oxides of nitrogen, fine particles and other forms of pollution...”*

#### **North Northamptonshire Joint Core Strategy 2011 – 2031 (Adopted July 2016)**

- 2.2.7 The North Northamptonshire Joint Core Strategy sets out Core Policies, Spatial Policies, Development Principles for Strategic Sites, and Monitoring Frameworks for North Northamptonshire up to 2031.
- 2.2.8 Whilst the Site sits outside of the jurisdiction of North Northamptonshire, the proximity of the North Northamptonshire jurisdiction means it is best practice to consider the policies within the North Northamptonshire Joint Core Strategy when performing this assessment.
- 2.2.9 The most relevant policies within the local plan is considered to be;

#### **Policy 4: Biodiversity and geodiversity**

*“A net gain in biodiversity will be sought and features of geological interest will be protected and enhanced through:*

- a) Protecting existing biodiversity and geodiversity assets by:*
- iii. Protecting the natural environment from adverse effects from noise, air and light pollution;”*

#### **Policy 8: North Northamptonshire Place Shaping Principles**

*“Development should:*

- e) Ensure quality of life and safer and healthier communities by:*
- i. Protecting amenity by not resulting in an unacceptable impact on the amenities of future occupiers, neighbouring properties or the wider area, by reason of noise, vibration, smell, light or other pollution, lost of light or overlooking;”*



### 3 Guidance

#### 3.1 Institution of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light, 2020

- 3.1.1 Guidance notes produced by the Institution of Lighting Professionals (ILP) are among the most commonly referenced guidance notes for good practice within the lighting design industry.
- 3.1.2 Obtrusive light (or sometimes referred to as light pollution) refers to any light emitted in a direction in which it is not required or wanted and as such is detrimental to other users.
- 3.1.3 Consideration is given to light intrusion, direct upward light (sky glow) and glare within the context of varying environmental zones.
- 3.1.4 Light intrusion refers to the spilling of light beyond the boundary of the area to be lit. This includes the intrusion of light into bedroom windows.
- 3.1.5 Sky glow refers to the brightening of the sky above towns caused by direct or reflected upward light.
- 3.1.6 Glare refers to the uncomfortable brightness of a light source when viewed against a dark background. **Figure 1** illustrates the different types of obtrusive light.

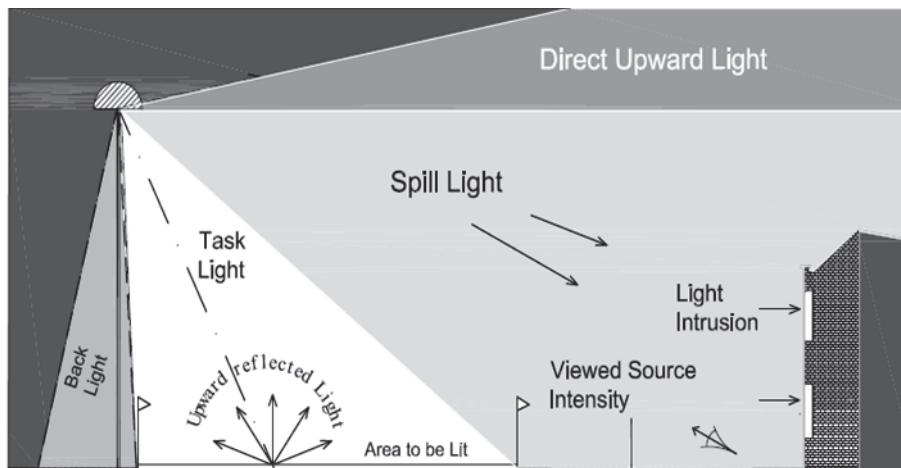


Figure 1 Obtrusive light diagram (GN01:2020, Figure 1)

#### 3.2 Professional Lighting Guide PLG 04 “Guidance on Undertaking Environmental Lighting Impact Assessments” Institution of Lighting Professionals (ILP), 2013

- 3.2.1 PLG 04 is used to ensure that the lighting impact assessment is correctly carried out:  
*“...this document is designed to provide an explanation of, and guidance on, the process for producing a Lighting Assessment...to remove or minimise environmental problems”.*

#### 3.3 Institution of Lighting Professionals (ILP) GN08 – 18 – Bats and Artificial Lighting in the UK

- 3.3.1 Bats and Artificial Lighting in the UK (GN08/18, 2018) The Institution of Lighting Professionals (ILP) and Bat Conservation Trust (BCT) prepared this document. It provides guidance for artificial exterior lighting in close proximity to light sensitive ecology. The following is stated within the document:

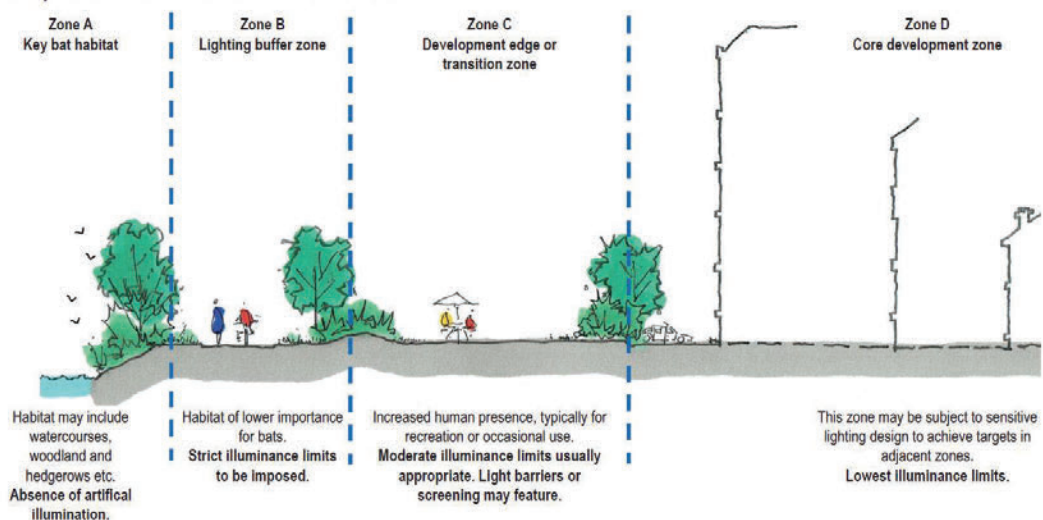
*“Lighting in the vicinity of a bat roost causing disturbance and potential abandonment of the roost could constitute an offence both to a population and to individuals (Garland and Markham, 2007).”*

*It is therefore important that the use of an area by bats is thoroughly assessed before artificial lighting is changed or added in the vicinity of a roost or where bats may commute or forage.”*

*“It is acknowledged that, especially for vertical calculation planes, very low levels of light (<0.5 lux) may occur even at considerable distances from the source if there is little intervening attenuation. It is therefore very difficult to demonstrate ‘complete darkness’ or a ‘complete absence of illumination’ on vertical planes where some form of lighting is proposed on site despite efforts to reduce them as far as possible and where horizontal plane illuminance levels are zero. Consequently, where ‘complete darkness’ on a feature or buffer is required, it may be appropriate to consider this to be where illuminance is below 0.2 lux on the horizontal plane and below 0.4 lux on the vertical plane. These figures are still lower than what may be expected on a moonlit night and are in line with research findings for the illuminance found at hedgerows used by lesser horseshoe bats, a species well known for its light averse behaviour (Stone, 2012).”*

*“Dark buffers, illuminance limits and zonation dark buffer zones can be used as a good way to separate habitats or features from lighting by forming a dark perimeter around them. Buffer zones rely on ensuring light levels (levels of illuminance measured in lux) within a certain distance of a feature do not exceed certain defined limits. The buffer zone can be further subdivided in- to zones of increasing illuminance limits radiating away from the feature” (see Figure 1).*

*Example of illuminance limit zonation*



**Figure 2 GN08/18 Guidelines for illumination buffer zones**

### 3.4 British Standards

3.4.1 The most applicable British Standards for lighting that relate to the Proposed Scheme are:

- **BS 5489-1: 2020 – Lighting of Roads and Public Amenity Areas (Code of practice).** – This British Standard is applicable to the roads that help to facilitate movement of vehicular traffic about the Proposed Scheme.
- **BS EN 13201 Part 2: 2015 - Road lighting. Performance requirements** is applicable to the selection of lighting classes across the roads throughout the Proposed Scheme.

### 3.5 Design Manual for Roads and Bridges (DMRB) LA 104 Revision 1 - August 2020 “Environmental assessment and monitoring” Highways England (HE)

3.5.1 LA 104 details requirements and procedures to be followed when assessing, reporting and monitoring the environmental effects of projects in line with the requirements of the EIA Directive 2014/52/EU.

- 3.5.2 LA 104 section 3 sets out criteria for determining the sensitivity of receptors, magnitude of impacts, significance categories of effects, and a matrix for determining the significance of impact upon the environment. These tables have been amended within **Section 4** of this document for the purposes of the lighting assessment.

### **3.6 Highways England Design Manual for Roads and Bridges**

- 3.6.1 Lighting for the Proposed Scheme has been designed in accordance with the Highways England Design Manual for Roads and Bridges (DMRB).
- 3.6.2 Lighting levels have been selected in accordance with **TD 501** (formerly TD 34/07); which makes specific reference to BS 5489-1.
- 3.6.3 TD 501 contains the requirements for the design of new and replacement road lighting on motorways and all-purpose trunk roads; and specifically addresses the high level approach for lighting requirements as well as the competencies of those involved.

## 4 Assessment methodology and significance criteria

### 4.1 Methodology

- 4.1.1 The assessment has been carried out in accordance with the published guidance documents from the ILP They quantify the levels of direct upward light, light intrusion, viewed source intensity and glare regarded as acceptable for varying environmental zones.
- 4.1.2 The methodology employed for this assessment is appropriate to the location of the 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 a site survey in which the baseline conditions were measured and assessed and the relevant environmental zone in which the Site is located was ascertained
  - evaluation of the likely effects of the proposed lighting using appropriate assessment criteria (outlined in Tables 4 - 7)
  - indicative layout and associated light spill modelling
- 4.1.3 The methodology takes guidance from the Institution of Lighting Professionals PLG 04 document "Guidance on Undertaking Environmental Lighting Impact Assessments". This sets out good practice for conducting the assessment.
- 4.1.4 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.
- 4.1.5 Research undertaken during the desktop study identified the potentially sensitive receptors, against which levels were modelled to determine possible levels of spill light.
- 4.1.6 The assessment has focussed on the outdoor lighting approach of the Proposed Scheme. All lighting is provided for safety and security. No up lighting of the proposed buildings is proposed.

### 4.2 Study area

- 4.2.1 The desktop study includes a review of the potential receptors that could be affected by a change in artificial lighting in line with the criteria outlined in **Tables 4 - 7**. This includes nearby existing residential amenity, roadways, and any identified ecological receptors, within the vicinity of the Proposed Scheme.
- 4.2.2 Potentially sensitive receptors are identified in **Section 6**, and receptor positions are shown in **Annex 2**.

### 4.3 Potential effects from artificial light

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

#### **Effects from light intrusion from exterior lighting on residents (through windows)**

- 4.3.2 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 maxima values quoted are relative to the amount of light measured as a baseline without the presence of the obtrusive light source.

#### **Effects from viewed source intensity on residents and sightseers**

- 4.3.3 **Table 4** within ILP GN01/20 (**Table 2** in this document) 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.

#### **Effects from upward light (or sky glow)**

- 4.3.4 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 “Guidance Notes for the Reduction of Obtrusive Light” 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.
- 4.3.5 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.

#### **Effects from disability glare on transport users**

- 4.3.6 The proposed approach includes requirements for lighting to be installed such that glare is minimised in accordance with the ILP guidance notes.

#### **Effects from light on bat roosts and insects**

- 4.3.7 Light falling on a roost access point will at least delay some species of bats from emerging and this shortens 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 is missed.
- 4.3.8 Insects and foraging 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.

### **4.4 Classification of environmental zone**

- 4.4.1 The ILP Guidance Notes Guide quantify the levels of Obtrusive light regarded as acceptable for varying environmental zones E0 to E4.
- 4.4.2 The Site is located within an area of low to medium level of district brightness, given the generally rural local environment. Therefore, the Environmental Zone is categorised as **E2** (Environmental Zone) in accordance with the ILP Guidance Notes.

**Table 1 Environmental Zones**

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

**Notes:**

- Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.
- Rural zones under protected designations should use a higher standard of policy.
- Zone E0 must always be surrounded by an E1 Zone.
- Zoning should be agreed with the local planning authority and due to local requirements a more stringent zone classification may be applied to protect special/specific areas.
- SQM (Sky Quality Measurements) referenced by the International Dark-Sky Association (IDA), the criteria for E0 being revised in mid-2019 but not retrospective.



6. Astronomical observable dark skies will offer clearer views of the Milky Way and of other objects such as the Andromeda galaxy and the Orion Nebula.

7. Although values of SQM 20 to 20.5 may not offer clear views of astronomical dark sky objects such as the Milky Way, these skies will have their own relative intrinsic value in the UK.

#### 4.5 Obtrusive light limitations

4.5.1 In the absence of suitable statutory guidance, the ILP “Guidance Notes for the Reduction of Obtrusive Light” GN01:2020 is typically used, in order to provide suitable assessment criteria against which to assess the likely effects of artificial lighting.

4.5.2 The relevant criteria of upward light, light intrusion and direct source intensity are discussed below and **Table 2** provides the criterion for source intensity or glare, whilst **Table 3** sets limits for the criteria of upward light and light intrusion.

Table 2 Source Intensity

<b>Table 4 (CIE 150 table 3 (amended)): Limits for the luminous intensity of bright luminaires<sup>4</sup>.</b>							
<b>Light technical parameter</b>	<b>Application conditions</b>	<b>Luminaire group (projected area <math>A_p</math> in m<sup>2</sup>)</b>					
		$0 < A_p \leq 0.002$	$0.002 < A_p \leq 0.01$	$0.01 < A_p \leq 0.03$	$0.03 < A_p \leq 0.13$	$0.13 < A_p \leq 0.50$	$A_p > 0.5$
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 $d$	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 $d$	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 $A_p$		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 $A_p$ representative area (m <sup>2</sup> )		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.  $A_p$  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  $A_p > 0.5$

Table 3 Obtrusive light criteria relating to each Environmental Zones

Environmental Zones	Sky Glow ULR (Max %)	Light Intrusion (into Windows) E <sub>v</sub> (lux)		Building Luminance Average, Pre-curfew
		Pre- Curfew	Post-Curfew	Average L (cd/m <sup>2</sup> )
E0	0	0	0	< 0.1
E1	0	2	< 0.1 (1*)	< 0.1
<b>E2</b>	<b>2.5</b>	<b>5</b>	<b>1</b>	<b>5</b>
E3	5	10	2	10
E4	15	25	5	25

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

#### 4.6 Significance Criteria

- 4.6.1 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.
- 4.6.2 The sensitivity of the receptor has been classified as High, Medium, or Low according to the descriptions provided in **Table 4**.
- 4.6.3 The magnitude of impact is determined as being High, Medium, Low or Negligible and descriptions for each are provided in **Table 5**.
- 4.6.4 The scale of effect is derived through a matrix (**Table 6**), matching the sensitivity of the receptor, with the magnitude of the impact.
- 4.6.5 The descriptions that have been adopted for each effect are summarised in **Table 7**, with effects identified as either beneficial or adverse.
- 4.6.6 Sensitivity criteria, magnitude of impact criteria, scale of effect criteria, and subsequent descriptions, are set out within **LA 104 Environmental assessment and monitoring**, however the tables within this document have been amended to suit a lighting specific discipline.

Table 4 Criteria for Receptor Sensitivity – amended from LA 104 Table 3.2N

Value (sensitivity) of receptor	Typical Description
<b>Very High</b>	<p>Very high importance and rarity, international scale and very limited potential for substitution.</p> <p>In the context of lighting receptors are typically split into Human (Amenity), Human (Safety), and Ecological; with the following criteria relevant to <b>Very High</b> receptor value:</p> <p>Human (Amenity) – receptors which are sensitive to a change in lighting such that the quality of life would be greatly 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 dramatically affects the habitats, breeding or feeding of fauna (e.g. protected habitats or other special areas) or growth patterns of fauna / crops.</p>
<b>High</b>	<p>High importance and rarity, national scale, and limited potential for substitution.</p> <p>In the context of lighting, the following criteria are relevant to a <b>High</b> receptor value:</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>

Value (sensitivity) of receptor	Typical Description
	Human (Safety) - receptors where a change in the lighting has the potential to either significantly improve or reduce safety (for pedestrians, drivers or workers). 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.
<b>Medium</b>	Medium or high importance and rarity, regional scale, limited potential for substitution.  In the context of lighting, the following criteria are relevant to a <b>Medium</b> receptor value: Human (Amenity) – receptors which are sensitive to a change in lighting however not such that the quality of life would be affected. Human (Safety) - receptors where a change in the lighting has the potential to either improve or reduce safety (for pedestrians, drivers or workers). Ecological – where a change in the lighting affects the movement or feeding patterns of fauna but the receptor can adapt.
<b>Low</b>	Low or medium importance and rarity, local scale.  In the context of lighting, the following criteria are relevant to a <b>Low</b> receptor value: Human (Amenity) – receptors which would not noticeably be aware of a change in lighting. (i.e. in areas of medium to high luminance) Human (Safety) - receptors where a change in the lighting has limited potential to affect safety (for pedestrians, drivers or workers). Ecological – area with limited wildlife.
<b>Negligible</b>	Very low importance and rarity, local scale.

Table 5 Criteria for Magnitude of Impact – Amended from LA 104 Table 3.4N

Magnitude of Impact (change)		Typical description
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.  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 major magnitude of change.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.  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.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.



Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.  In the context of lighting, this will constitute a change which, when compared to background levels, is only just noticeable.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 6 Scale of Effect Matrix – Amended from LA 104 Table 3.8.1

	Magnitude of impact (degree of change)					
		No Change	Negligible	Minor	Moderate	Major
<b>Environmental value (sensitivity)</b>	<b>Very high</b>	Neutral	Slight	Moderate or large	Large or very large	Very large
	<b>High</b>	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	<b>Medium</b>	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	<b>Low</b>	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	<b>Negligible</b>	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Table 7 Likely Effects Description

Significance category	Typical description
<b>Very large</b>	Effects at this level are material in the decision-making process.  In the context of lighting this will represent a major change in the levels of obtrusive light at sensitive receptor positions, and dramatically affect ecological habitats. If the effects are considered adverse, this will represent a major increase in obtrusive light at sensitive receptors and / or to users of the site such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna, and requires extensive remedial works.
<b>Large</b>	Effects at this level are likely to be material in the decision-making process.

Significance category	Typical description
	In the context of lighting this may represent a major change in the levels of obtrusive light at sensitive receptor positions, and may significantly affect ecological habitats. If the effects are considered adverse, this may represent a significant increase in obtrusive light at sensitive receptors and / or to users of the site such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna, and may require extensive remedial works.
<b>Moderate</b>	Effects at this level can be considered to be material decision-making factors.  In the context of lighting this will constitute a moderate reduction or increase in obtrusive light at sensitive receptors and/or to users of the site. If the effects are considered adverse, this may cause effects such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna, and requires monitoring and local remedial work.
<b>Slight</b>	Effects at this level are not material in the decision-making process.  In the context of lighting this represents a minor increase or reduction in obtrusive light at sensitive receptors and/or to users of the site. Effects are considered reversible or temporary.
<b>Neutral</b>	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

- 4.6.7 The significance of any effect is determined through the application of **Table 7**. Significant effects are considered where the likely effect is of moderate or greater.

## 5 Limitations

### 5.1 Brief

- 5.1.1 The assessment of the overall effects on landscape and cultural heritage do not form part of the lighting assessment.
- 5.1.2 A limited assessment of the effects on bats and other species forms part of the lighting assessment, however final considerations of the total effects will be undertaken by a qualified ecologist.
- 5.1.3 Whilst the locations of construction compounds and haul routes have been identified, these will require temporary lighting only. At this stage, the extents of the temporary lighting are unknown and cannot be fully assessed within the lighting assessment.

## 6 Baseline conditions

### 6.1 Site description and context

- 6.1.1 The Proposed Scheme consists of the dualling of the A11 Eastbound & Westbound between Wansford and Sutton; including two junctions at Wansford and Sutton ('The Sites'). An overbridge is also to be added at the entrance to the Sacrewell Farm & activity centre, approximately 350m east of the Wansford Junction. On & Off slips are to be added to the Westbound carriageway to better enable access to the road associated with the proposed bridge.

- 6.1.2 The existing A47 / A1 Wansford Junction is lit, with lighting on the approach roads from all directions. Road lighting extends approximately 550m to the west of the boundary of the Proposed Scheme, and 260m to the east of the roundabout. The roundabout and approach slip road street lighting is to be upgraded.
- 6.1.3 The existing A47 Sutton Junction is lit, with lighting on the approach roads from all directions. The roundabout and approach slip road street lighting is to be upgraded.
- 6.1.4 As the Sites are located in broadly rural areas, modelling has been undertaken to determine the potential levels of spill light from the Proposed Scheme onto nearby potentially sensitive receptors.
- 6.1.5 The DCO drawings of the sites are shown in **Annex 4**.

## 6.2 Wansford Junction

- 6.2.1 The Wansford Junction is approximately 140m north east from the closest point of Wansford, and approximately 320m north of the River Nene. The site sits along the A47, approximately 7.7km west of Peterborough City.
- 6.2.2 The junction is bordered to the north and east by agricultural land, and by agricultural land to the immediate south. The River Nene borders the agricultural land to the south, approximately 320m from the eastern Wansford junction roundabout. The site is bordered to the west by the A1; and the village of Wansford beyond.
- 6.2.3 The Site is bisected from the north to the south by the A1 Great North Road.

## 6.3 Sutton Junction

- 6.3.1 The Sutton Junction is approximately 370m north east of the closest point of Sutton, and approximately 1.60 km west of Ailsworth. The site sits along the A47, approximately 5.25km west of Peterborough City.
- 6.3.2 A residential property, with a sand school and associated barns, sits approximately 280m north east of the Site.
- 6.3.3 The Site is bordered immediately on all sides by agricultural land, with the exception of notable woods to the immediate south east. High voltage electric cables cross the Site from north to south, to the east of the existing roundabout.
- 6.3.4 The sites are 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.

## 6.4 Existing lighting

- 6.4.1 As discussed in **Section 4** this section has been informed by a desk top survey.
- 6.4.2 The Wansford roundabout Site has some existing lighting throughout and in the immediate vicinity;
  - Lighting to the existing Wansford junction dog-bone roundabouts;
  - Lighting to the A47 overbridge of the A1;
  - Limited lighting to the A47 to the west of the Site;
  - Lighting to the A1 on/off sliproads; and
  - Limited lighting associated with Wansford, including lighting provided to the A6118 Old North Road.
- 6.4.3 Road lighting and amenity lighting is present throughout Wittering to the north.
- 6.4.4 The Sutton roundabout Site is illuminated, with lighting provided to approach roads in all directions;
  - Lighting to the existing Sutton roundabout;
  - Lighting to the A47 running west approximately 40m;

- Lighting to the A47 running east approximately 80m;
- Lighting to the road towards Upton, running approximately 55m north; and
- Lighting to the road towards Ailsworth, running approximately 100m south, with a single column provided to Nene Way to the south.

6.4.5 The city of Peterborough is located to the east of the Sites, with road lighting and floodlighting present throughout, which will contribute to local sky glow.

## 6.5 Sensitive receptors

- 6.5.1 The Site was assessed to determine potentially sensitive receptors to the effects of obtrusive light, with consideration of ecological sensitivity, residential amenity, and human safety.
- 6.5.2 Receptors in the vicinity of the Wansford junction are a mixture of ecological receptors, considerations of human amenity, and considerations of human safety. The River Nene sits 325m south of the roundabout to be lit, and is the primary ecological concern for the site. The existing planting to the immediate north of the junction also has the potential to be ecologically sensitive. Residential amenity is considered for properties 300m to the north west of the Wansford junction, and human safety is considered for motorists on the A1, running below the existing dog bone roundabouts.
- 6.5.3 Receptors in the vicinity of the Sutton junction are primarily ecological, with a veteran woodland to the south east of the roundabout which has been given a County Wildlife Site (CWS) designation that has been considered when evaluating the proposed lighting. The land to the north of the site is considered broadly rural, and would be protected to reduce the potential effects of lighting on ecology and landscaping to the north.
- 6.5.4 A map of potentially sensitive receptors is included in **Annex 2**.
- 6.5.5 Potentially sensitive receptors are outlined in **Table 8**:

**Table 8 Potentially Sensitive Receptor Type**

Receptor Designation	Receptor Type	Closest Junction	Description
<b>1A</b>	Ecological	Wansford Junction	River Nene (325m S of Junction)
<b>1B</b>	Human Amenity		Old North Road residential properties (300m NW of Junction)
<b>1C</b>	Ecological		Planting (Immediate N of Junction)
<b>1D</b>	Human Safety		A1 Great North Road (100m W of Junction)
<b>2A</b>	Ecological	Sutton Junction	Planting (165m SE of Junction)
<b>2B</b>	Human Amenity (Landscaping)		Rural Boundary (Immediate N of Junction)
<b>2B</b>	Ecological		Rural Boundary (Immediate N of Junction)

## 7 Lighting requirements

### 7.1 Artificial lighting requirements (Construction Phase)

- 7.1.1 The Proposed Scheme requires British Standard compliant lighting for the safety of employees and visitors to the proposed construction compounds.
- 7.1.2 The proposed compounds are close to the Proposed Scheme, with three compounds to the south and east of the Wansford junction, and one compound to the north east of the Sutton junction.
- 7.1.3 The sites are to be lit in accordance with the requirements set out in **BS EN 12464-2:2014 Table 5.1**, with Traffic areas for slowly moving vehicles (max 10 km/h) lit to levels outlined by

Ref. no. 5.1.2, and pedestrian passages, vehicle turning, loading and unloading points lit to levels outlined by Ref. no. 5.1.4.

- 7.1.4 The lighting for these sites is to be provided by temporary columns mounted at heights no greater than 10m. All luminaires are to be post top mounted to the lighting columns.
- 7.1.5 Lighting is to be controlled such that sites are not lit outside of the hours of use. This can be achieved via the use of photocell control, with a manual override switch to enable lighting to be switched off.
- 7.1.6 Lighting is to be implemented on a temporary basis, with lighting being removed once the proposed construction compounds are no longer in use.

## 7.2 Artificial lighting requirements (Operational Phase)

- 7.2.1 The Proposed Scheme requires British Standard compliant lighting for the safety and amenity of motorists on the approach to and using the proposed junctions, slip roads, and associated roundabouts.
- 7.2.2 To ensure consistency in the lighting design approach and compliance with Highways England & British Standards for lighting levels associated with the Proposed Scheme, in conjunction with lighting industry guidance for minimising obtrusive light and effects on ecology, external artificial lighting will be implemented in accordance with the layout prepared for the Proposed Scheme, as presented in **Annex 1**.
- 7.2.3 The proposed scheme laid out in **Annex 1** is for the lighting of the roundabout gyratory, entry slips and exit slips at both Sites. The Sites are to be lit to lighting class M3 (**BS5489-1:2020**); with lighting class C2 (**BS5489-1:2020**) to be applied to conflict areas.
- 7.2.4 The proposed lighting columns for both Sites shall have a mounting height of 10m and are assumed to be aluminium high energy passive soft lighting columns. All luminaires shall be post top mounted to the lighting columns.
- 7.2.5 Optics chosen for the Proposed Scheme achieve a luminous intensity of G4, and are to be mounted at 0° tilt. Lanterns chosen emit Warm White light, at 3000K colour temperature.
- 7.2.6 CMS requirements have been confirmed by Highways England to be a Lucy Zodion system, including a 10-year warranty. Further consultation will be undertaken to determine exact details of the CMS equipment solution requirements and shall be confirmed at Stage 5 detailed design stage.

## 8 Potential effects

### 8.1 Potential effects from construction phase artificial lighting (without mitigation)

- 8.1.1 As a result of the exterior lighting during the construction phase detailed in Section 7 (without mitigation), there is a potential for obtrusive light due to poorly designed or installed lighting equipment if it is poorly implemented within the proposed construction compounds.
- 8.1.2 Glare from inappropriately oriented flood lighting associated with the construction phase has limited potential to affect nearby potentially sensitive receptors. Measures within the lighting approach will seek to minimise the significance of the effect of lighting on residents and ecology.
- 8.1.3 Increases in lighting levels as a result of the lighting required to support the construction phase of the project have the potential to impact residential and ecological receptors through obtrusive light. Where lighting is to be applied to the proposed construction compounds, all efforts will be made to minimise obtrusive light potential through compliance with the key standards and guidance, such as **BS EN 12464-2: 2014**.
- 8.1.4 Luminaires are to be focussed into the site to limit the possibility of obtrusive light occurring, and use focused task lighting as required by the construction task being undertaken. Lighting within the construction phase will be required for the purposes of health and safety of the construction workforce, but all measures will be implemented through the lighting approach to minimise its potential significance.

- 8.1.5 If well implemented, it is unlikely that lighting associated with this phase of the project would give rise to significant adverse effects. This is because the lighting approach will ensure that such lighting is switched off when not required, and where lighting is required, it is suitably sited and oriented to reduce the potential for obtrusive light towards sensitive receptors.

## 8.2 Potential effects from operational artificial lighting (without mitigation)

- 8.2.1 As a result of the exterior lighting during the operational phase detailed in Section 7 (without mitigation), there is a potential for obtrusive light due to poorly designed or installed lighting equipment if it is not implemented in accordance with the design set out in **Annex 1**.
- 8.2.2 Poorly designed lighting in a highways setting generally consists of the installation of poor quality luminaires, the use of intrusive tilt angles, inappropriate lighting distribution, or the over lighting of highways in areas of high environmental sensitivity.
- 8.2.3 Poorly designed lighting can contribute the following obtrusive light components:
- Light spill into windows: this is typical of wall mounted luminaires with high tilt angles;
  - Upward light causing sky glow: this is typical of up-lighting;
  - Glare: due to high light source intensity from floodlights; and
  - Intrusive light affecting ecology: caused by excessive height and tilt.
- 8.2.4 The potential effects from operational lighting without mitigation are likely to be permanent **Moderate Adverse**, based on the above components of obtrusive light, all of which could occur unless mitigation measures outlined in **Section 8** are implemented.

## 9 Scope of Mitigation

### 9.1 Mitigation by design (Construction Phase)

- 9.1.1 Many of the potential effects associated with construction lighting can be effectively mitigated by a suitable lighting approach, good lighting design and choice of suitable lighting equipment and the lighting design being carried out by a suitably qualified and competent lighting professional.
- 9.1.2 The following paragraphs detail good lighting practices to be implemented during the construction phase of the project; which will be required for artificial lighting required within the proposed construction compounds.
- 9.1.3 The exterior lighting of the proposed construction compounds will:
- Use high quality luminaires throughout the design to ensure that light is focussed downwards onto the ground or other surfaces in the horizontal plane, minimising the potential for direct upward light, glare, light spill and light Intrusion. Luminaires of this type would be 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.
  - Ensure that luminaires are positioned such that light is within the proposed construction compounds; and is only applied where needed for the safety of users.
  - Use luminaires with good optical control and an option for installing shields. This would be 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 the calculated lighting levels are as accurate as possible.
  - Emit a warm white colour temperature light (3000K) to reduce the potential for adverse effects on potential ecological receptors.



- Ensure that the peak beam angle of all lights directed towards any potential observer is not to be more than 70 degrees when the luminaire is installed with a tilt angle of 0 degrees.
- Ensure that where luminaires are identified to produce light spill onto sensitive ecological receptors in excess of 0.2 lux, fixtures are fitted with rear shields to limit spill light.
- In areas where operational safety and security allows, luminaires will be turned off when the illuminated areas are not in use.

## 9.1.4

**9.2 Mitigation by design (Operational Phase)**

9.2.1 Many of the potential effects of artificial lighting can be effectively mitigated by a suitable approach to lighting, good design and choice of suitable lighting equipment and the lighting design being carried out by a suitably qualified and competent lighting professional.

9.2.2 The following paragraphs detail good lighting practices implemented in the design; which will be required for artificial lighting required within the Proposed Scheme during the completed development stage.

9.2.3 The exterior lighting of the Proposed Scheme will:

- Be installed according to the designs presented in **Annex 1**.
- Use high quality luminaires throughout the design to ensure that light is focussed downwards onto the ground or other surfaces in the horizontal plane, minimising the potential for direct upward light, glare, light spill and light intrusion. Luminaires of this type would be 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.
- Ensure that luminaires are positioned such that light is along the road; and is only applied where needed for the safety of road users.
- Use luminaires with good optical control and an option for installing shields. This would be 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 the calculated lighting levels are as accurate as possible.
- Emit a warm white colour temperature light (3000K) to reduce the potential for adverse effects on potential ecological receptors.
- Ensure that the peak beam angle of all lights directed towards any potential observer is not to be more than 70 degrees when the luminaire is installed with a tilt angle of 0 degrees.
- Ensure that where luminaires are identified to produce light spill onto sensitive ecological receptors in excess of 0.2 lux, fixtures are fitted with rear shields to limit spill light.

**10 Residual effects assessment****10.1 Construction phase**

10.1.1 Where there is some construction compound lighting during the hours of darkness, which is required for safety, the lighting approach would focus on reducing the potential for construction compound lighting to be obtrusive in nature, by ensuring that construction lighting is focussed on the task, in accordance with **BS EN 12464-2:2014**. There is the potential for some short-term reversible residual effects from construction lighting, that has the potential to be of low magnitude, which would result in an effect of minor significance for human (residential) receptors and ecological receptors.

## 10.2 Operational phase

- 10.2.1 The effects associated with the Proposed Scheme would be minimised by the application of the mitigation measures outlined above, in combination with the application of the lighting design set out in **Annex 1**.
- 10.2.2 Whilst the lighting levels present within the boundaries of the Site may increase, it is unlikely that potential human receptors with views of the 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 proposed lighting design will also minimise light spill, ensuring that lighting is focussed only towards areas where it is required.
- 10.2.3 Although lighting is required for the Proposed Scheme and is likely to be noticeable from the residential receptors identified, it is unlikely to be obtrusive through limiting the luminaire tilt angles and height. The visibility of lighting alone is not considered an obtrusive light component, and the effect on landscaping is to be considered in the environmental impact assessment (EIA). The levels of lighting proposed within the lighting strategies are neither excessive nor are they uncommon for the particular environmental zone in which the Site is situated (**E2**). The residential receptors identified have been considered as having medium or low sensitivity to changes in lighting depending on their perspective of the Proposed Scheme and whether their view is obstructed or unobstructed.
- 10.2.4 Views of both Sites will be partially obscured by existing banking, however only limited additional banking is proposed as part of the Proposed Scheme. Planting surrounding both Sites will further limit the already low lighting levels onto potentially sensitive receptors.
- 10.2.5 Topological barriers (existing and proposed) will further limit potential spill light. Whilst the Isolux contours presented in **Annex 3** present a negligible risk of light spill onto adjacent receptors, the levels presented assume an absolute adverse scenario of a flat landscape; whereas the topological barriers present throughout will further reduce the potential for spill light.
- 10.2.6 The magnitude of change with regard to artificial lighting associated with the Proposed Scheme falling onto the identified receptor positions is considered 'negligible' in line with **Table 5**. This is because the proposed lighting is highly unlikely to breach the relevant **E2** environmental zone limits outlined in **Table 3**, or breach standards and guidance.
- 10.2.7 The artificial exterior lighting within proximity to potential ecological receptors is unlikely to give rise to significant effects, given the lighting design developed for the Proposed Scheme, which have been informed by appropriate guidance on sensitive ecological receptors (GN08/18). Luminaire mounting height, tilt, and the implementation of effective lighting control will reduce the potential for obtrusive light. An indicative lighting layout is provided in **Annex 3**, which demonstrates that the light levels at ground height onto the identified receptor positions will be minimised to less than 0.20 lux, as set out in GN08/18.
- 10.2.8 Due to the A1 bisecting the Wansford roundabout site at a lower elevation compared to the lighting, there is a risk that lighting associated with the Proposed Scheme would give rise to effects on road users or pedestrians. However, the proposed lighting to the Site is unlikely to be more obtrusive than lighting that is already in place; and effects of proposed lighting will be further limited by vegetation between the Wansford roundabout and the A1.
- 10.2.9 Effects associated with the artificial external lighting for the construction phase of the Proposed Scheme are outlined in **Table 9**.

**Table 9 Likely Effects Description**

Environmental effect	Receptor type	Sensitivity of receptor	Impact magnitude	Nature of impact (permanent / temporary)	Residual effects
Light Spill, Direct Source Luminance	Ecological - Receptor 1A	High	Low	Temporary	<b>Slight to Moderate</b>
Light Spill, Direct Source Luminance	Human Amenity - Receptor 1B	Medium	Negligible	Temporary	<b>Neutral</b>



Light Spill, Direct Source Luminance	Ecological - Receptor 1C	Low	Negligible	Temporary	<b>Neutral</b>
Light Spill, Direct Source Luminance	Human Safety - Receptor 1D	Medium	Negligible	Temporary	<b>Neutral</b>
Light Spill, Direct Source Luminance	Ecological - Receptor 2A	Low	Negligible	Temporary	<b>Neutral</b>
Direct Source Luminance	Human Amenity - Receptor 2B	Medium	Low	Temporary	<b>Slight</b>
Light Spill, Direct Source Luminance	Ecological - Receptor 2B	Medium	Negligible	Temporary	<b>Neutral</b>

10.2.10 Residual effects associated with the artificial external lighting for the Proposed Scheme are outlined in **Table 10**.

**Table 10 Likely Effects Description**

Environmental effect	Receptor type	Sensitivity of receptor	Impact magnitude	Nature of impact (permanent / temporary)	Residual effects
Light Spill, Direct Source Luminance	Ecological - Receptor 1A	High	Negligible	Permanent	<b>Neutral</b>
Light Spill, Direct Source Luminance	Human Amenity - Receptor 1B	Medium	Negligible	Permanent	<b>Neutral</b>
Light Spill, Direct Source Luminance	Ecological - Receptor 1C	Low	Negligible	Permanent	<b>Neutral</b>
Light Spill, Direct Source Luminance	Human Safety - Receptor 1D	Medium	Negligible	Permanent	<b>Neutral</b>
Light Spill, Direct Source Luminance	Ecological - Receptor 2A	Low	Negligible	Permanent	<b>Neutral</b>
Direct Source Luminance	Human Amenity - Receptor 2B	Medium	Negligible	Permanent	<b>Neutral</b>
Light Spill, Direct Source Luminance	Ecological - Receptor 2B	Medium	Negligible	Permanent	<b>Neutral</b>

10.2.11 Following the implementation of mitigation measures as outlined in **Section 9**, and the implementation of the lighting layout proposed in **Annex 1** the residual effects are assessed to be **Neutral** because the general level of light upon the Sites would remain broadly similar, and is not likely to be obtrusive in nature. Furthermore, the lighting would be implemented in line with relevant British Standards and guidance through the implementation of the Detailed and Outline lighting strategies.

## 11 Cumulative Effects Assessment

### 11.1 Single project effects

11.1.1 Due to the limited lighting requirements for the operation of the Proposed Scheme, including a design intended to limit the use of light only to areas where illumination is required for the safety of road users, there are unlikely to be single project effects of significance related to lighting.

### 11.2 Different project effects

- 11.2.1 The following completed developments have been considered in relation to the Proposed Scheme, in order to determine the potential for likely significant cumulative effects of lighting resulting from the Proposed Scheme:

**BP Petrol Station and Spar – A47 Nene, Peterborough, PE8 6LB**

- 11.2.2 The BP Petrol Station and Spar is situated approximately 580m to the east of the Wansford Site and approximately 1.90km to the east of the Sutton Site, and is a completed development. There is poorly controlled floodlighting associated with the development that spills onto the A47, using up to 6m columns.
- 11.2.3 Lighting to filling stations is typically provided in accordance with **BS EN 12464-2:2014**, with levels of between 20 lux and 50 lux. Vehicle parking areas will be darker, typically at approximately 5 lux, and some areas can be lit up to 150 lux where air pressure, water checking points, and meter reading areas are needed.
- 11.2.4 The distance between the Sites and this development indicate that lighting between the site would not be significant enough to cause light spill towards identified receptor positions. The modelling undertaken in **Annex 3** indicates that light levels towards the petrol station are below the levels required to constitute unacceptable levels of spill light, even when additional lighting from the petrol station is considered.

**A1/A47 GSJ West Roundabout – A47 Wansford, Peterborough, PE8 6LE**

- 11.2.5 The A1/A47 GSJ West Roundabout sits directly west of the Site, across the A1 overbridge. Lighting associated with the roundabout is noticeable from the Wansford Site.
- 11.2.6 Lighting from the A1/A47 GSJ West Roundabout will directly contribute to lighting levels on the Site, and will fall on wooded areas to the immediate west of the Site.
- 11.2.7 Lighting to the A1/A47 GSJ West roundabout and A1 overbridge will typically be provided in accordance with **BS 5489-1:2020**, Lighting Classes for Traffic Routes. Lighting levels will be provided to a C2 lighting class for conflict areas, and to an M3 class for dual carriageways, which equate to lighting levels of at least 15 lux. Existing lighting is provided by traditional (HPS) light sources mounted on 8m lighting columns.
- 11.2.8 This combined lighting levels are, however, unlikely to contribute to an increase in obtrusive light onto the Site or nearby receptors, as both the existing Site and this adjacent development are currently lit. Lighting levels are unlikely to increase within the Site, and levels are likely to reduce on receptor points that are affected by both developments, due to improved optical control within the Site.

**Sand School & Barns – A47 Nene, Peterborough, PE8 6LB**

- 11.2.9 A sand school with associated barns and a residential property is located approximately 280m north east of the Sutton roundabout, and is a completed development. There is poorly controlled floodlighting associated with the development that spills onto the connecting road between the Sutton roundabout and the village of Upton.
- 11.2.10 There is the potential for spill light from the floodlighting to affect any receptor positions between the completed development and the Sutton roundabout Site.
- 11.2.11 Lighting for sand schools is typically provided in accordance with **BS EN 12193:2018**, Table A.13; to levels of 100 lux. However, a visual assessment of the site indicates that lighting is unlikely to have been provided to British standards, so the levels within this standard should be taken indicatively.
- 11.2.12 The topology of farmland adjacent to the Site as well as site buildings associated with the sand school, indicate that unacceptable levels of cumulative effects are unlikely. Levels associated with modelling undertaken in **Annex 3** indicate that light spill in the direction of this development is minimal, and unlikely to increase levels on nearby receptors beyond limits identified in **Section 4**.

### 11.3 Operational phase cumulative effects

- 11.3.1 Information relating to baseline lighting levels measured for the adjacent projects in **Section 11.2** indicates that the lighting associated with these developments presents the potential for spill light and glare based on the chosen light sources.
- 11.3.2 Measures have been implemented within the lighting design provided in **Annex 1** throughout the Proposed Scheme, to ensure that lighting provided is the minimal necessary to ensure site operational safety and security. The designs presented in **Annex 1** ensure that professional grade luminaires will be used throughout the site to ensure upward light is reduced to align with the relevant Environmental Zone Criteria.
- 11.3.3 Due to the good design practice that will be applied throughout the Proposed Scheme, the potential for light spill, glare and sky glow have been assessed as Negligible in significance. Therefore, significant cumulative effects from lighting in combination with the identified cumulative schemes is unlikely.

## 12 Conclusions

### 12.1 Introduction

- 12.1.1 This report considers the effects resulting from artificial lighting associated with the Proposed Scheme and its surroundings. It assesses the potential effects from obtrusive light associated with the proposed road lighting design. The principal objective is to assess the significance of likely residual effects.

### 12.2 Baseline conditions

- 12.2.1 The Site is within a rural environment which is assessed to be an **E2** environmental zone due to the natural landscape buffering the Proposed Scheme.
- 12.2.2 A desktop study was undertaken to assess the baseline conditions on nearby potentially sensitive receptor positions, which were assessed to be of low ambient luminance.

### 12.3 Potential significant effects

- 12.3.1 The requirement for artificial lighting to support the Proposed Scheme means that there could be some potential effects caused by some parts of the required lighting including; light spill, direct source luminance or glare (onto receptor views) and sky glow or upward light. Without mitigation, the potential effects are likely to be **Moderate Adverse**, as poor-quality light sources could be installed, and lighting levels are non-compliant with British Standards or guidance documents. To avoid this, mitigation measures are implemented.

### 12.4 Mitigation and enhancement

- 12.4.1 The mitigation measures deployed through the lighting layout presented in **Annex 1** along with the mitigation measures outlined in **Section 9** would ensure that artificial lighting is not obtrusive.

### 12.5 Residual effects

- 12.5.1 Due to the lighting approach and the mitigation measures outlined in **Section 9**, the residual effects of the operational phase are assessed to be **Neutral**. This is due to the low potential for obtrusive light to affect human and ecological receptors, through the through implementation of the lighting layout.
- 12.5.2 Potential human sensitive receptors located outside the boundaries of the Site are unlikely to be subjected to obtrusive light from the Proposed Scheme, due to the design of the proposed lighting for the Site.
- 12.5.3 In combination, the design implementation seeks to ensure that light is only focussed where it is needed, and the layout of the site will provide shielding to sensitive receptors from the effects of obtrusive light. This will help reduce the potential for the levels of glare and light spill to be greater than those permitted within **Table 3**.
- 12.5.4 Lighting levels following the application of the mitigation measures outlined in **Section 9** are not expected to exceed limitations on light pollution set out within the relevant local policies set

out in **Section 2**, as reasonable steps have been taken to minimise light pollution wherever possible.

- 12.5.5 Further to this, lighting levels following the application of the mitigation measures outlined in **Section 9** and the implementation of the lighting layout presented in **Annex 1** are expected to comply with necessary guidance presented in ILP GN01:2020, PLG04, and GN08-18; meeting the tests identified for this installation.
- 12.5.6 In conclusion, lighting levels associated with the Proposed Scheme will be sympathetic to the surroundings and consist of the lowest possible lighting levels whilst meeting relevant British Standards. As such, there are unlikely to be significant effects from artificial lighting installed as part of the Proposed Scheme.

## **12.6 Cumulative effects**

- 12.6.1 Significant cumulative effects from the operational lighting associated with the identified cumulative developments are unlikely, due to the principles within the lighting design, that seek to reduce the potential for obtrusive light through glare, light spill and upward light caused by the Proposed Scheme.

## **[Annex 1- Proposed Scheme Drawings]**

File references:

HE551494-GTY-HLG-000-DR-EO-30021

HE551494-GTY-HLG-000-DR-EO-30022

HE551494-GTY-HLG-000-DR-EO-30023

HE551494-GTY-HLG-000-DR-EO-30024

HE551494-GTY-HLG-000-DR-EO-30025

HE551494-GTY-HLG-000-DR-EO-30026

HE551494-GTY-HLG-000-DR-EO-30027

HE551494-GTY-HLG-000-DR-EO-30030

HE551494-GTY-EGN-000-DR-GI-30006 (ENVIRONMENTAL STATEMENT FIGURE 2.3  
TEMPORARY WORK AREAS REQUIRED DURING CONSTRUCTION TR010039/APP/6.2)

## **[Annex 2- Receptor Positions]**

File references:

1779-DFL-HLG-XX-VS-EO-13001-S2-P01

### **[Annex 3- Light Spill Diagrams]**

File references:

1779-DFL-HLG-XX-VS-EO-13002-S2-P01

1779-DFL-HLG-XX-VS-EO-13003-S2-P01

## **[Annex 4- Proposed Scheme Boundary]**