A47/A11 Thickthorn Junction

Scheme Number: TR010037

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APFP Regulation 5(2)(a)

Planning Act 2008

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

March 2021

Infrastructure Planning

Planning Act 2008

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

The A47/A11 Thickthorn Junction Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT APPENDICES
Appendix 7.7 – Lighting Assessment

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LIGHTING IMPACT ASSESSMENT

PROJECT: A47/A11 THICKTHORN JUNCTION

PREPARED FOR: SWECO UK LTD

MARCH 2021

PROJECT NUMBER: 1777		DOCUMENT REF: 1777-DFL-ELG-XX-RP-EO-13001-S3-P01			
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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 a new connector road to be constructed from the A11 northbound connecting with the eastbound A47, including two underpasses under the A11 and A47. A dedicated left turn facility is also to be added to the A47 westbound off slip onto the A11 southbound at the existing Thickthorn roundabout (the 'Site'). A new link road will also be constructed from Cantley Lane South to the B1172 Norwich Road to the north, however this link road is not proposed to be lit.

1.1.4 Lighting is to be provided across the Site, with the effects of a total of 82 lighting units to be assessed.

1.1.5 This lighting assessment has been prepared in accordance with the drawings **HE551492-GTY-HLG-000-DR-EO-30001-S3-P02** & **HE551492-GTY-HLG-000-DR-EO-30002-S3-P02**.

1.1.6 The proposed drawings for the development, and associated Isolux Contours, are presented in **Annex 1**.

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, 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 Site is located at the A47/A11 Thickthorn Junction, to the south west of Norwich.

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:

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;

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 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 Development (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 Development 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

Joint Core Strategy for Broadland, Norwich and South Norfolk (Adopted March 2011, Amendments adopted Jan 2014)

2.2.1 The Core Strategy sets out the long-term vision and objectives for the whole of the area covered by Broadland District, Norwich City, and South Norfolk, including strategic policies for steering and shaping development.

2.2.2 The relevant policies of the Joint Core Strategy are considered to be;

Policy DM 3.13 Amenity, noise and quality of life

(1) Development should ensure a reasonable standard of amenity reflecting the character of the local area. In all cases particular regard will be paid to avoiding:

a. Overlooking and loss of private residential amenity space

b. Loss of day light, overshadowing and overhearing impact

c. Introduction of incompatible neighbouring uses in terms of noise, odour, vibration, air, dusts, insects, artificial light pollution and other such nuisances.

Planning permission will be refused where Proposed Development would lead to an excessive or unreasonable impact on existing neighbouring occupants and the amenity of the area or a poor level of amenity for new occupiers.

(3) Development will not be permitted where the Proposed Development would generate noise or artificial light which would be significantly detrimental to the amenity of nearby residents or the occupants of other noise sensitive uses. Proportionate mitigating measures including limiting conditions will be used to reduce the potential noise or artificial light impact to an appropriate level whenever practical to do so.

South Norfolk Local Plan Development Management Policies Document (Adopted Oct 2015)

2.2.3 Clauses 3.89 and 3.90 within the South Norfolk Local Plan Development Management Policies Document outline further detail on the implementation of lighting within the area:

Lighting

3.89 **Amenity** and environmental quality can be impacted in other ways including by poorly designed and managed lighting. This is a particular issue in rural parts where the relatively 'dark skies' contribute greatly to character and amenity References to useful guidance and advice are given in the Notes below.

3.90 The importance of tranquillity to wildlife should also be recognised. Increased noise and lighting in particular can have an adverse impact on certain bat and bird species.

3 Guidance

3.1 Institution of Lighting Professional's Guidance Notes for the Reduction of Obtrusive Light, 2020

3.1.1 Guidance notes produced by the Institution of Lighting Professional (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 cause 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 2** illustrates the different types of obtrusive light.

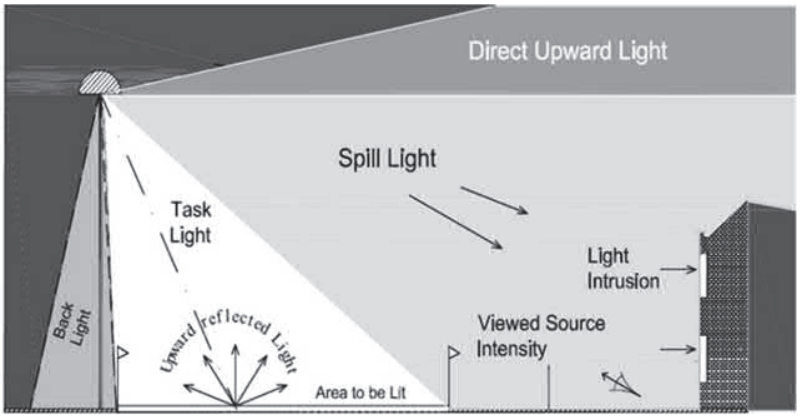


Figure 2 Obtrusive light diagram (*GN01:2020, Figure 1)*

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 Professional's (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).

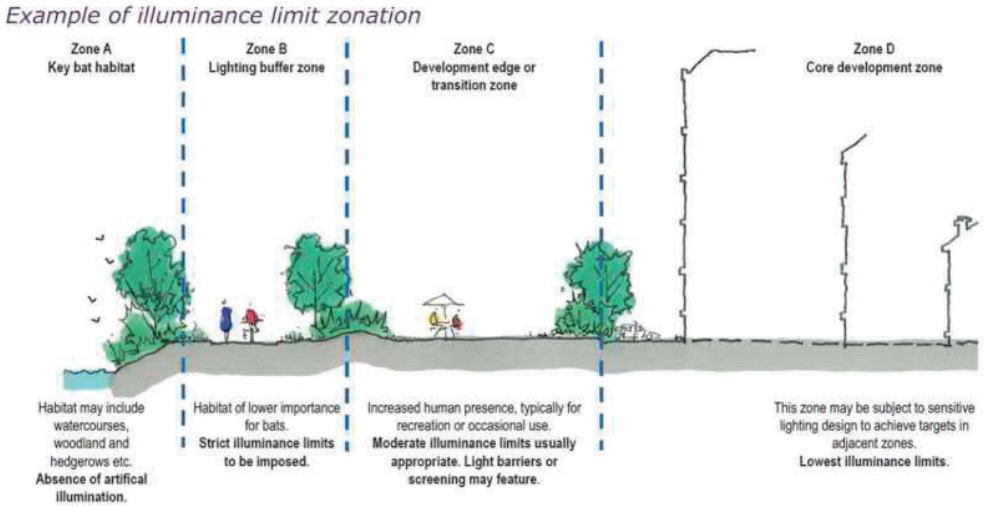


Figure 3 GN08/18 Guidelines for illumination buffer zones

3.4 LA 104 "Environmental assessment and monitoring" Highways England (HE), 2020

3.4.1 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.

3.4.2 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.

3.5 British Standards

3.5.1 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.

4 Assessment methodology and significance criteria

4.1 Methodology

4.1.1 The assessment has been carried out in accordance with published ILP guidance documents that 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 assessment locations for the site survey, where baseline conditions were to be measured.

4.1.6 The assessment has focussed on the outdoor lighting of the Proposed Scheme. All lighting is provided for safety and security.

4.2 Study area

4.2.1 The desktop study comprised of a review of satellite imagery and Landscape visual impact assessment information to assess the potential receptors that could be affected by a change in artificial lighting, in accordance with the criteria outlined in **Tables 4 - 7**. This includes nearby existing residential amenity, roadways, and any identified ecological receptors.

4.2.2 The study area is explained in **Annex 2**.

4.3 Surveys

4.3.1 A baseline survey of the Site was undertaken in 2018 by a third party to identify the existing lighting levels at landscape receptor locations. The methodology and results of this assessment are laid out in **Annex 2** (Baseline Survey results). The results of this baseline survey are considered relevant and valid for informing this assessment, having been carried out in accordance with the relevant guidance and with an industry standard calibrated illuminance meter.

4.3.2 Two types of receptor were surveyed, key lighting related survey viewpoint locations, and key biodiversity survey receptor locations.

4.3.3 The results of the baseline survey are outlined in **Section 6**.

4.3.4 Full baseline survey results are available in **Annex 2**.

4.4 Potential effects from artificial light

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

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

4.4.2 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

4.4.3 **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)

4.4.4 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.

4.4.5 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

4.4.6 The proposals include 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

4.4.7 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.

4.4.8 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.

4.5 Classification of environmental zone

4.5.1 The ILP Guidance Notes Guide quantify the levels of Obtrusive light regarded as acceptable for varying environmental zones E0 to E4.

4.5.2 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

Zone	Surrounding	Lighting Environment	Examples
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:
1. 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.
2. Rural zones under protected designations should use a higher standard of policy.
3. Zone E0 must always be surrounded by an E1 Zone.
4. 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.
5. 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.

4.6 Obtrusive light limitations

4.6.1 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.

4.6.2 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 Limits for the luminous intensity of bright luminaires.

Table 4 (CIE 150 table 3 (amended)): Limits for the luminous intensity of bright luminaires[4].							
Light technical parameter	**Application conditions**	**Luminaire group (projected area A_p in m²)**					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p>0.5$
Maximum luminous intensity emitted by luminaire (*I* in cd)	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 (m²)		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_v (lux)		Building Luminance Average, Pre-curfew
		Pre- Curfew	Post-Curfew	Average L (cd/m²)
E0	0	0	0	< 0.1
E1	0	2	< 0.1 (1*)	< 0.1
E2	**2.5**	**5**	**1**	**5**
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.

4.7 Significance Criteria

4.7.1 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.

4.7.2 The sensitivity of the receptor has been classified as High, Medium, or Low according to the descriptions provided in **Table 4.**

4.7.3 The magnitude of impact is determined as being High, Medium, Low or Negligible and descriptions for each are provided in **Table 5.**

4.7.4 The scale of effect is derived through a matrix (**Table 6**), matching the sensitivity of the receptor, with the magnitude of the impact.

4.7.5 The descriptions that have been adopted for each effect are summarised in **Table 7**, with effects identified as either beneficial or adverse.

4.7.6 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
Very High	Very high importance and rarity, international scale and very limited potential for substitution. In the context of lighting receptors are typically split into Human (Amenity), Human (Safety), and Ecological; with the following criteria relevant to **Very High** receptor value: 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) Human (Safety) - receptors where a change in the lighting has the potential to either dramatically improve or reduce safety (for pedestrians, drivers or workers). 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.
High	High importance and rarity, national scale, and limited potential for substitution. In the context of lighting, the following criteria are relevant to a **High** receptor value: 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) 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.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution. In the context of lighting, the following criteria are relevant to a **Medium** receptor value:

Value (sensitivity) of receptor	Typical Description
	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.
Low	Low or medium importance and rarity, local scale. In the context of lighting, the following criteria are relevant to a **Low** 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.
Negligible	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**
Environmental value (sensitivity)	**Very high**	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Table 7: Likely effects description - Amended from LA 104 Table 3.7

Significance category	Typical description
Very large	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.
Large	Effects at this level are likely to be material in the decision-making process. 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.
Moderate	Effects at this level can be considered to be material decision-making factors.

Significance category	Typical description
	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.
Slight	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.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

4.7.7 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 affects 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 At the time of writing, the location of construction compounds and haul routes have not been identified and therefore potential receptors associated with these areas do not form part of this assessment.

5.1.4 Baseline surveys were carried out during spring 2018 where deciduous vegetation is well developed. It is anticipated where vegetation has been recorded as deciduous this will reduce during the autumn and winter months.

5.1.5 Baseline photography has been taken at 1.7m above ground level.

6 Baseline conditions

6.1 Site description and context

6.1.1 The Proposed Scheme consists of a new connector road to be constructed from the A11 northbound connecting with the eastbound A47, including two underpasses under the A11 and A47. A dedicated left turn facility is also to be added to the A47 westbound off slip onto the A11 southbound at the existing Thickthorn roundabout (the 'Site'). A new link road will also be constructed from Cantley Lane South to the B1172 Norwich Road to the north, however this link road is not proposed to be lit.

6.1.2 The roundabout and approach slip roads currently have street lighting, which is to be upgraded, and additional lighting is to be added to additional roads added as part of the Proposed Scheme.

6.1.3 As the Site is located in a broadly rural area, light spill modelling has been undertaken to determine the potential levels of spill light from the Proposed Scheme onto nearby potentially sensitive receptors.

6.1.4 The DCO drawing of the site is shown in **Annex 3.**

6.1.5 The nearest residential properties to the development site are:

- 102 to 124 Cantley Lane South (approximately 50m south west of the A47, 350 metres south east of the existing Thickthorn Junction)
- Thickthorn Cottages (approximately 230m north west of the existing Thickthorn Junction)

6.1.6 Approximately 400m from the eastern edge of the DCO boundary is Cringleford, a settlement on the outskirts of Norwich. Approximately 2 kilometres to the west are the closest residential properties associated with the village of Hethersett.

6.1.7 The Site is bordered to the immediate west by a service station, with 2 associated restaurants, a petrol state, hotel, and the Thickthorn Park and Ride.

6.1.8 The Site is bordered to the north, east, and south by agricultural land. Approximately 300m to the west, the Thickthorn Park and Ride is bordered by agricultural land, forming a gap of agricultural land between the Site and all nearby residential properties.

6.1.9 Approximately 500m to the south west of the Site is the scheduled monument 'Two Tumuli in Big Wood'.

6.1.10 The Site is bisected from the north west to the south east by the A47 Motorway, which is unlit, with limited spill light to the carriageway from column mounted lighting at the existing Thickthorn Junction.

6.1.11 The 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, Registered Parks and Gardens, or Local Green Space designations.

6.2 Existing lighting

6.2.1 As discussed in **Section 4** this section has been informed by a nighttime lighting survey.

6.2.2 The Site has some existing lighting throughout and in the immediate vicinity;

- Lighting to the roundabout at the existing Thickthorn Junction
- Limited lighting to the A11 to the south west is provided for approximately 75m
- Road lighting is provided to the A11 to the east into Norwich
- Road lighting is provided to the B1172 Norwich Road to the north west
- Car parks to the west associated with the Thickthorn service station and Thickthorn Park and ride are lit throughout.

6.2.3 Road lighting and amenity lighting is present throughout Cringleford to the east.

6.2.4 Extensive car park lighting and floodlighting is provided to the Norfolk and Norwich University Hospital, approximately 1.25km north of the Site.

6.2.5 The city of Norwich is located to the north east of the Site, with road lighting and floodlighting present throughout, which will contribute to local sky glow.

6.3 Baseline survey information

6.3.1 A baseline survey of the Site was undertaken on the 16 and 17 of May 2020 at receptor points identified through an initial desktop study of the area. The location of each receptor was agreed with South Norfolk Council as detailed in **Annex 2**.

6.3.2 Weather conditions were dry and overcast, and the moon was not visible on either night, with the highest natural ambient night-time lighting level recorded at 0.02 lux on the 16 May 2020.

6.3.3 Two types of receptor were surveyed, key lighting related survey viewpoint, and key biodiversity survey receptor locations.

6.3.4 Key lighting related survey viewpoint locations have been identified in **Annex 1** and **Annex 2**.

6.3.5 *Key biodiversity survey receptor* locations and the equipment used to undertake the baseline survey have been identified in **Annex 2**.

6.3.6 The baseline conditions of the majority of the key lighting related viewpoint locations are described as dark, with the exception of Viewpoint 11, which measured ambient light levels of up to 13.19 Lux from residential floodlighting present on the back of properties on Meadow Farm Drive.

6.3.7 The baseline conditions of the majority of the ecological survey locations are described as dark, as indicated by the light measurements recorded.

6.3.8 Notable levels of obtrusive light were recorded at Viewpoint number 21, due to light spill from lighting associated with the highway maintenance compound located at the end of Cantley Lane.

6.3.9 Full baseline survey results are available in **Annex 2**.

7 Lighting requirements

7.1 Artificial lighting requirements

7.1.1 The Proposed Scheme requires British Standard compliant lighting for the safety and amenity of motorists on the approach to and using the A47/A11 Thickthorn Junction, and the safety and amenity of motorists on the approach to and using the new connector road to be constructed from the A11 northbound connecting with the eastbound A47, including the two underpasses under the A11 and A47.

7.1.2 To ensure consistency in the lighting design approach and compliance with 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 detailed in **HE551492-GTY-HLG-000-DR-EO-30001-S3-P02** and **HE551492-GTY-HLG-000-DR-EO-30002-S3-P02,** presented in **Annex 1**.

7.1.3 The proposed scheme laid out in **HE551492-GTY-HLG-000-DR-EO-30001-S3-P02** and **HE551492-GTY-HLG-000-DR-EO-30002-S3-P02** is for the lighting of joining and exit areas from the main carriageway, entry and exit slip roads, and the main Thickthorn Interchange gyratory. Joining and exit areas, and slip roads, are to be lit to lighting class M2 (As defined within **BS5489-1:2020**_, with the potential to be designed as conflict areas at Detailed Design Stage 5. The main Thickthorn Interchange gyratory is to be lit to lighting class C2 (**BS5489-1:2020**).

7.1.4 Where lighting is currently provided to the Thickthorn Interchange Gyratory, the existing 12m steel columns are to be retained. New 10m passive columns with 1m outreach brackets have been proposed for the remainder of the scheme.

7.1.5 Optics chosen for the proposed scheme achieve a luminous intensity of G4 with a Imax of 467.9. Lanterns chosen emit Warm White light, at 3000K colour temperature.

7.1.6 Lighting is to be provided to two short tunnels (Identified as S02 and S04) on the proposed link road to be constructed from the A11 Northbound towards Norwich, connecting with the eastbound A47 towards Lowestoft. Following consultation with Highways England it has been identified that their preference is for the two short tunnels to be lit one lighting class higher than the road lighting on the link road.

8 Potential effects

8.1 Potential effects from operational artificial lighting (without mitigation)

8.1.1 As a result of the exterior lighting 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 **HE551492-GTY-HLG-000-DR-EO-30001-S3-P02** & **HE551492-GTY-HLG-000-DR-EO-30002-S3-P02**.

8.1.2 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.

8.1.3 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.
- Intrusive light affecting ecology: caused by excessive height and tilt.

8.1.4 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

9.1.1 Many of the potential effects of artificial lighting can be effectively mitigated by 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 implemented in **HE551492-GTY-HLG-000-DR-EO-30001-S3-P02** & **HE551492-GTY-HLG-000-DR-EO-30002-S3-P02**, included in **Annex 1**; which will be required for artificial lighting required within the Proposed Scheme during the completed development stage.

9.1.3 The exterior lighting of the Proposed Scheme will:

- Be installed according to the design 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 Operational phase

10.1.1 The effects associated with the Proposed Scheme would be minimised by the application of the mitigation measures outlined in Section 9, in combination with the application of the lighting design set out in **Annex 1**.

10.1.2 Whilst the lighting levels present within the DCO boundary of the Site will 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.

10.1.3 The DCO Boundary is shown in **Annex 3**.

10.1.4 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 are neither excessive nor are they uncommon for the particular environmental zone in which the Site is situated (**E2**), as shown in Table 1. 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.

10.1.5 Views of the Proposed Scheme from residential properties to the south will be largely obscured by the proposed earthworks, with the proposed lighting columns being set among significant banking. Proposed planting will further limit the already low lighting levels onto potentially sensitive receptors.

10.1.6 The majority of the proposed lighting associated with the Site will be set within significant banking, with topological barriers limiting potential spill light. Whilst the Isolux contours presented in **Annex 1** present a negligible risk of light spill onto adjacent receptors, the levels presented assume an absolute adverse scenario of a flat landscape; whereas the banking present throughout will further reduce the potential for spill light.

10.1.7 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.

10.1.8 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 1,** which demonstrates that the light levels at ground height onto the identified receptor positions will be minimised to less than 0.2 lux.

10.1.9 Due to the A47 motorway bisecting the site at a higher elevation compared to the lighting (of approximately 6m), along with existing vegetation on the A47/A11 Thickthorn Junction between the A47 and the proposed lighting, it is unlikely that lighting associated with the Proposed Scheme would give rise to significant effects on road users or pedestrians.

10.1.10 Residual effects associated with the artificial external lighting for the Proposed Scheme are outlined in **Table 8.**

Table 8 Likely Effects Description

Environmental effect	Receptor type*	Sensitivity of receptor	Impact magnitude	Nature of impact (permanent / temporary)	Residual effects
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 1	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 2	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 3	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 4	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 5	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 6	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 7	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 8	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 9	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 10	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 11	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 12	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 13	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 14	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Human Amenity – Viewpoint 15	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Ecological – Viewpoints 1, 2, 3, 41 and 42	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Ecological – Viewpoints 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18 and 19	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Ecological – Viewpoints 11 and 12	Medium	Negligible	Permanent	**Neutral**

Environmental effect	Receptor type*	Sensitivity of receptor	Impact magnitude	Nature of impact (permanent / temporary)	Residual effects
Light Spill, Direct Source Luminance	Ecological – Viewpoints 20, 21, 22, 23, 24 and 25	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Ecological – Viewpoints 26, 27, 28, 29, 30 and 31	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Ecological – Viewpoints 32, 33, 34, 35 and 46	Medium	Negligible	Permanent	**Neutral**
Light Spill, Direct Source Luminance	Ecological – Viewpoints 37, 38, 39 and 40	Medium	Negligible	Permanent	**Neutral**

Viewpoints have been laid out within **Annex 2 – Baseline Survey Results.*

10.1.11 Following the implementation of mitigation measures as outlined in Section 8, and the implementation of the lighting layout proposed in **Annex 1** the residual effects upon the identified viewpoints are assessed to be **Neutral** because the increase in levels are beneath levels of perception (at less than 0.2 lux increase). Furthermore, the lighting would be implemented in line with relevant British Standards and guidance.

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.

Thickthorn Services and Thickthorn Park and Ride – Norwich Road, Hethersett, Norwich NR9 3AU

11.2.2 The Thickthorn Services and Thickthorn Park and Ride is situated immediately adjacent to the Site to the west, and is a completed development. There is substantial lighting associated with the development that is noticeable from the Site and receptor viewpoints 6 and 14.

11.2.3 The measurements taken during the baseline survey undertaken on the 16 and 17 May 2020 indicated that lighting associated with the Thickthorn Services and Thickthorn Park and ride was not significant enough to cause light spill towards the identified receptor positions. The measurements indicate that there is effectively zero light spill towards receptor viewpoints from the Thickthorn services.

A11 Newmarket Road – A11 Cringleford, Norwich, NR4 6UD

11.2.4 Newmarket Road extends directly from the east of the Site towards the built up area of Cringleford. Lighting associated with the A11 is noticeable from the Site and from the A47 motorway running over the Site.

11.2.5 During the baseline survey undertaken on the 16 and 17 May 2020, the A11 was operational and considered within the baseline survey data. Whilst lighting associated with the A11 was

measured at viewpoint 15, the light measurements taken in the baseline survey indicate very limited levels of light onto the viewpoint.

11.2.6 Views of the Site are significantly limited from this adjacent development; and there is effectively zero light spill towards the A11 Newmarket Road from the Site. As such, the cumulative effects associated with the two sites are likely to be negligible.

11.2.7 Light spill onto receptor positions with views of both the Site and the A11 Newmarket Road is limited, with no anticipated light spill from the Proposed Scheme.

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 design presented in **HE551492-GTY-HLG-000-DR-EO-30001-S3-P02** & **HE551492-GTY-HLG-000-DR-EO-30002-S3-P02** ensures that high quality 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 residual effects light spill, glare and sky glow have been assessed as Neutral 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 and tunnel 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 baseline site survey 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 8** would ensure that artificial lighting is not obtrusive**.**

12.5 Residual effects

12.5.1 Due to the mitigation measures outlined in **Section 8**, 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 Application 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 8** are not expected to exceed limitations on light pollution set out within the Joint Core Strategy for Broadland, Norwich and South Norfolk, as reasonable steps have been taken to minimise light pollution wherever possible.

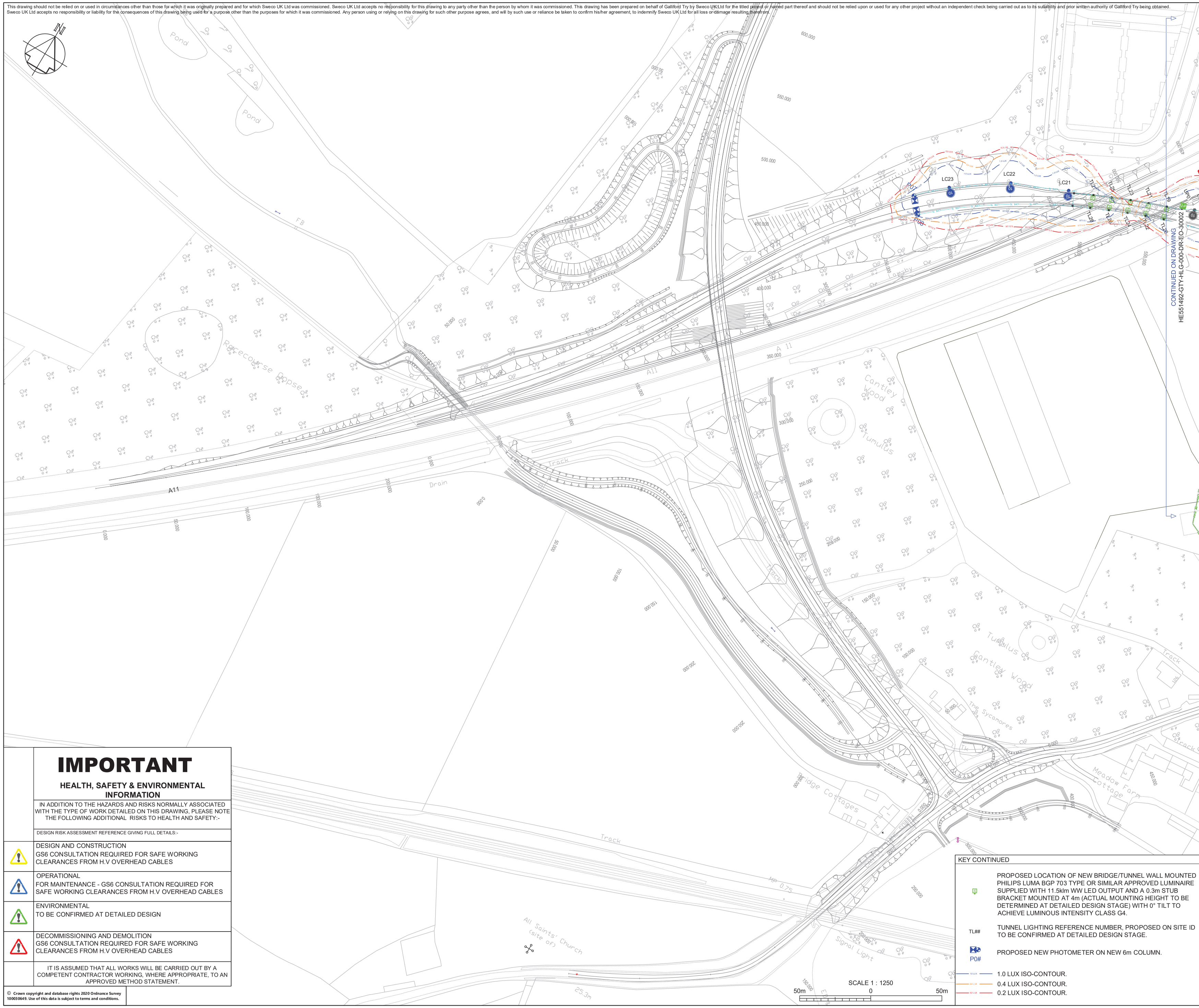
12.5.5 Further to this, lighting levels following the application of the mitigation measures outlined in **Section 8** and the implementation of the lighting layout presented in **Annex 1** are expected to comply with necessary guidance presented in ILP GN01:2020, PLG04, and GN08-18; meeting the tests 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



NOTES

1. THIS DRAWING SHALL ONLY BE USED FOR THE DESIGN ELEMENT STATED IN THE DRAWING TITLE.
2. ALL DIMENSION IN METRES (m) UNLESS OTHERWISE STATED.
3. DO NOT SCALE FROM THIS DRAWING.
4. THIS PRELIMINARY DESIGN IS BASED ON THE RECOMMENDATIONS PROVIDED WITHIN THE DMRB TD 501, CD 352 AND THE BSI. BS 5489-2.
5. ALL PROPOSED LIGHTING COLUMN, DUCT ROUTES, CHAMBERS AND FEEDER PILLARS ARE INDICATIVE ONLY AND SUBJECT TO CONFIRMATION AT THE DETAILED DESIGN STAGE.
6. ALL UNDERGROUND UTILITIES AND ANY PLANNED DIVERSIONS SHOULD BE CONFIRMED AT DETAILED DESIGN STAGE.
7. ALL EQUIPMENT PROPOSED TO BE RETAINED AND REUSED, WILL NEED THE LOCATIONS CHECKED AND THE SUITABILITY FOR REUSE AT DETAILED DESIGN STAGE. IF DEEMED NOT TO BE IN A SUITABLE CONDITION NEW EQUIPMENT WILL BE REQUIRED.
8. PROPOSED ILLUMINATED SIGNS LOCATIONS AND POWER SUPPLY TO BE CONFIRMED AT DETAILED DESIGN STAGE.
9. ISO-LUX CONTOURS DO NOT CONSIDER LIGHT BLOCKING EFFECTS SUCH AS MAN MADE OBJECTS AND LAND TOPOGRAPHY. THEREFORE, THE ABSOLUTE ADVERSE SCENARIO IS REPRESENTED. INITIAL LIGHT OUTPUT LEVELS ARE SHOWN.

KEY TO SYMBOLS

Symbol	Description
10	PROPOSED LOCATION OF NEW 10m MOUNTING HEIGHT PASSIVE SAFE LIGHTING COLUMN WITH A 1m OUTREACH BRACKET FOR A PHILIPS LUMA BGP 704 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 16klm WW LED OUTPUT MOUNTED AT 0° TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
	INDICATIVE LOCATION OF UNDERPASS LIGHTING, TO BE DESIGNED IN ACCORDANCE WITH BS 5489-PART 2: 2016 AND ASSESSED FURTHER AT DETAILED DESIGN STAGE.
	PROPOSED LOCATION OF NEW STREET LIGHTING SUPPLY CABLE AND DUCT. CABLE NETWORK TYPE, SIZE AND NUMBER OF DUCTS TO BE ASSESSED AT DETAILED DESIGN STAGE. DUCTING TYPICAL COVER OF 450mm IN FOOTWAYS AND 750mm IN CARRIAGEWAY.
⊠	PROPOSED LOCATION OF NEW STREET LIGHTING CHAMBER. SIZE, TYPE AND COVER RATING TO BE ASSESSED AT DETAILED DESIGN STAGE.
LC##	LIGHTING COLUMN REFERENCE NUMBER, PROPOSED ON SITE ID TO BE CONFIRMED AT DETAILED DESIGN STAGE.

KEY CONTINUED

Symbol	Description
	PROPOSED LOCATION OF NEW BRIDGE/TUNNEL WALL MOUNTED PHILIPS LUMA BGP 703 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 11.5klm WW LED OUTPUT AND A 0.3m STUB BRACKET MOUNTED AT 4m (ACTUAL MOUNTING HEIGHT TO BE DETERMINED AT DETAILED DESIGN STAGE) WITH 0° TILT TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
TL##	TUNNEL LIGHTING REFERENCE NUMBER, PROPOSED ON SITE ID TO BE CONFIRMED AT DETAILED DESIGN STAGE.
P0#	PROPOSED NEW PHOTOMETER ON NEW 6m COLUMN.
	1.0 LUX ISO-CONTOUR.
	0.4 LUX ISO-CONTOUR.
	0.2 LUX ISO-CONTOUR.

SCALE 1 : 1250

50m 0 50m

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	01/07/20	For Review and Comment	PS	KD	AL
P02.02	---		---	---	---

DESIGNER

SWECO

CONTRACTOR

Galliford Try

CLIENT

highways england

PROJECT TITLE

A47/A11 THICKTHORN JUNCTION

PROJECT STAGE

PCF STAGE 3

DRAWING TITLE

ROAD LIGHTING
SHEET 1 OF 2

SUITABILITY

WORK IN PROGRESS

SHEET SIZE	SCALE	STATUS	REVISION
N/A	1:1250	S0	P02.02

DRAWING NUMBER

HE551492-GTY-HLG-000-DR-EO-30001

IMPORTANT

HEALTH, SAFETY & ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS AND RISKS NORMALLY ASSOCIATED WITH THE TYPE OF WORK DETAILED ON THIS DRAWING, PLEASE NOTE THE FOLLOWING ADDITIONAL RISKS TO HEALTH AND SAFETY:-

DESIGN RISK ASSESSMENT REFERENCE GIVING FULL DETAILS:-

- DESIGN AND CONSTRUCTION
  GS6 CONSULTATION REQUIRED FOR SAFE WORKING CLEARANCES FROM H.V OVERHEAD CABLES
- OPERATIONAL
  FOR MAINTENANCE - GS6 CONSULTATION REQUIRED FOR SAFE WORKING CLEARANCES FROM H.V OVERHEAD CABLES
- ENVIRONMENTAL
  TO BE CONFIRMED AT DETAILED DESIGN
- DECOMMISSIONING AND DEMOLITION
  GS6 CONSULTATION REQUIRED FOR SAFE WORKING CLEARANCES FROM H.V OVERHEAD CABLES

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

IMPORTANT

HEALTH, SAFETY & ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS AND RISKS NORMALLY ASSOCIATED WITH THE TYPE OF WORK DETAILED ON THIS DRAWING, PLEASE NOTE THE FOLLOWING ADDITIONAL RISKS TO HEALTH AND SAFETY:-

DESIGN RISK ASSESSMENT REFERENCE GIVING FULL DETAILS:-

	DESIGN AND CONSTRUCTION GS6 CONSULTATION REQUIRED FOR SAFE WORKING CLEARANCES FROM H.V OVERHEAD CABLES
	OPERATIONAL FOR MAINTENANCE - GS6 CONSULTATION REQUIRED FOR SAFE WORKING CLEARANCES FROM H.V OVERHEAD CABLES
	ENVIRONMENTAL TO BE CONFIRMED AT DETAILED DESIGN STAGE
	DECOMMISSIONING AND DEMOLITION GS6 CONSULTATION REQUIRED FOR SAFE WORKING CLEARANCES FROM H.V OVERHEAD CABLES
	IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

NOTES

1. THIS DRAWING SHALL ONLY BE USED FOR THE DESIGN ELEMENT STATED IN THE DRAWING TITLE.
2. ALL DIMENSION IN METRES (m) UNLESS OTHERWISE STATED.
3. DO NOT SCALE FROM THIS DRAWING.
4. THIS PRELIMINARY DESIGN IS BASED ON THE RECOMMENDATIONS PROVIDED WITHIN THE DMRB TO S01, CD 352 AND THE BSI. BS 5489-2.
5. ALL PROPOSED LIGHTING COLUMN, DUCT ROUTES, CHAMBERS AND FEEDER PILLARS ARE INDICATIVE ONLY AND SUBJECT TO CONFIRMATION AT THE DETAILED DESIGN STAGE.
6. ALL UNDERGROUND UTILITIES AND ANY PLANNED DIVERSIONS SHOULD BE CONFIRMED AT DETAILED DESIGN STAGE.
7. ALL EQUIPMENT PROPOSED TO BE RETAINED AND REUSED, WILL NEED THE LOCATIONS CHECKED AND THE SUITABILITY FOR REUSE AT DETAILED DESIGN STAGE. IF DEEMED NOT TO BE IN A SUITABLE CONDITION NEW EQUIPMENT WILL BE REQUIRED.
8. PROPOSED ILLUMINATED SIGNS LOCATIONS AND POWER SUPPLY TO BE CONFIRMED AT DETAILED DESIGN STAGE.
9. ISO-LUX CONTOURS DO NOT CONSIDER LIGHT BLOCKING EFFECTS SUCH AS MAN MADE OBJECTS AND LAND TOPOGRAPHY. THEREFORE, THE ABSOLUTE ADVERSE SCENARIO IS REPRESENTED. INITIAL LIGHT OUTPUT LEVELS ARE SHOWN.

KEY TO SYMBOLS

- PROPOSED LOCATION OF NEW 10m MOUNTING HEIGHT PASSIVE SAFE LIGHTING COLUMN WITH A 1m OUTREACH BRACKET FOR A PHILIPS LUMA BGP 704 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 16klm WW LED OUTPUT MOUNTED AT 0° TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
- INDICATIVE LOCATION OF UNDERPASS LIGHTING, TO BE DESIGNED IN ACCORDANCE WITH BS 5489-PART 2: 2016 AND ASSESSED FURTHER AT DETAILED DESIGN STAGE.
- PROPOSED LOCATION OF NEW STREET LIGHTING SUPPLY CABLE AND DUCT. CABLE NETWORK TYPE, SIZE AND NUMBER OF DUCTS TO BE ASSESSED AT DETAILED DESIGN STAGE. DUCTING TYPICAL COVER OF 450mm IN FOOTWAYS AND 750mm IN CARRIAGEWAY.
- PROPOSED LOCATION OF NEW STREET LIGHTING CHAMBER. SIZE, TYPE AND COVER RATING TO BE ASSESSED AT DETAILED DESIGN STAGE.
- LC## LIGHTING COLUMN REFERENCE NUMBER, PROPOSED ON SITE ID TO BE CONFIRMED AT DETAILED DESIGN STAGE.

KEY CONTINUED

- EXISTING 12m LIGHTING COLUMN TO REMAIN IN SITU. EXISTING LANTERN TO BE REPLACED WITH POST TOP MOUNTED PHILIPS LUMA BGP705 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 39klm WW LED OUTPUT MOUNTED AT 0° TO ACHIEVE LUMINOUS INTENSITY CLASS G4. (PR/##)
- PROPOSED LOCATION OF NEW 12m MOUNTING HEIGHT PASSIVE SAFE LIGHTING COLUMN WITH POST TOP MOUNTED PHILIPS LUMA BGP705 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 39klm WW LED OUTPUT MOUNTED AT 0° TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
- PROPOSED LOCATION OF NEW 10m MOUNTING HEIGHT PASSIVE SAFE LIGHTING COLUMN WITH A 1m OUTREACH BRACKET FOR A PHILIPS LUMA BGP 704 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 13klm WW LED OUTPUT MOUNTED AT 0° TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
- PROPOSED LOCATION OF NEW 10m MOUNTING HEIGHT PASSIVE SAFE LIGHTING COLUMN WITH A 1m OUTREACH BRACKET AND SIDE ENTRY PHILIPS LUMA BGP 704 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 13klm WW LED OUTPUT WITH INTERNAL SHIELD, MOUNTED AT 0° TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
- PROPOSED LOCATION OF NEW 10m MOUNTING HEIGHT PASSIVE SAFE LIGHTING COLUMN WITH A 1m OUTREACH BRACKET FOR A PHILIPS LUMA BGP 704 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 16klm WW LED OUTPUT MOUNTED AT 0° TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
- ASSUMED LOCATION OF EXISTING FEEDER PILLAR TO REMAIN IN SITU. (EX FP##)
- PROPOSED LOCATION OF NEW STREET LIGHTING GALVANISED STEEL FEEDER PILLAR WITH DNO SUPPLY AND A SUITABLE SIZED DISTRIBUTION BOARD FOR ALL OUTGOING CIRCUITS. (FP##)
- INDICATIVE LOCATION OF NEW STREET LIGHTING GALVANISED STEEL FEEDER PILLAR WITH PRIVATE SUPPLY AND A SUITABLE SIZED DISTRIBUTION BOARD FOR ALL OUTGOING CIRCUITS. (UP01)
- PROPOSED LOCATION OF NEW BRIDGE/TUNNEL WALL MOUNTED PHILIPS LUMA BGP 703 TYPE OR SIMILAR APPROVED LUMINAIRE SUPPLIED WITH 11.5klm WW LED OUTPUT AND A 0.3m STUB BRACKET MOUNTED AT 4m (ACTUAL MOUNTING HEIGHT TO BE DETERMINED AT DETAILED DESIGN STAGE) WITH 0° TILT TO ACHIEVE LUMINOUS INTENSITY CLASS G4.
- LC## LIGHTING COLUMN REFERENCE NUMBER, PROPOSED ON SITE ID TO BE CONFIRMED AT DETAILED DESIGN STAGE.
- TL## TUNNEL LIGHTING REFERENCE NUMBER, PROPOSED ON SITE ID TO BE CONFIRMED AT DETAILED DESIGN STAGE.

KEY CONTINUED

- EXISTING COLUMN TO BE TAKEN UP OR DOWN AND REMOVED TO OFF SITE TIP. (RM##)
- EXISTING WALL BRACKET AND LUMINAIRE TO BE TAKEN UP OR DOWN AND REMOVED TO OFF SITE TIP.
- PROPOSED NEW PHOTOMETER ON NEW 6m COLUMN. (P0#)
- 1.0 LUX ISO-CONTOUR.
- 0.4 LUX ISO-CONTOUR.
- 0.2 LUX ISO-CONTOUR.

SCALE 1 : 1250

50m 0 50m

CONTINUED ON DRAWING HE551492-GTY-HLG-000-DR-EO-30001

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	01/07/20	For Review and Comment	PS	KD	AL
P02	10/07/20	For Review and Comments	PS	KD	AL

DESIGNER: SWECO

CONTRACTOR: GallifordTry

CLIENT: highways england

PROJECT TITLE: A47/A11 THICKTHORN JUNCTION

PROJECT STAGE: PCF STAGE 3

DRAWING TITLE: ROAD LIGHTING SHEET 2 OF 2

SUITABILITY: SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
N/A	1:1250	S3	P02

DRAWING NUMBER: HE551492-GTY-HLG-000-DR-EO-30002

Annex 2- Baseline Survey Results

A47 THICKTHORN JUNCTION

BASELINE LIGHTING SURVEY

PCF STAGE 3

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24/03/20

Notice

Highways England Programme Leader:	[redacted]
Highways England Project Manager:	[redacted]
Galliford Try Sweco Delivery Integration Partner, Project Manager:	[redacted]
PCF STAGE 3 Supplier:	GALLIFORD TRY

Document control

Client	HIGHWAYS ENGLAND
Project	A47/A11 THICKTHORN JUNCTION
Document title	LIGHTING ASSESSMENT
Document reference	HE551492-MMSJV-EAC-000-RP-YL-00001

Revision history

Revision	Purpose description	Originator	Checked	Approved	Authorised	Date
P01.1	First Issue	[redacted]	[redacted]	[redacted]	[redacted]	24/09/18

Prepared for:

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Table of contents

Figures

Tables

1. Lighting assessment – baseline survey results

1.1. Introduction

1.1.1. This report presents the findings of the baseline lighting survey.

1.2. Competent expert evidence

1.2.1. The competent expert holds a Higher National Diploma in Electrical Engineering and is an affiliate of the Institution of Lighting Professionals (ILP). The competent expert has over 9 years' experience in the field of lighting design and in the production of lighting assessments.

1.3. Baseline assessment methodology

1.3.1. The guidance provided in the ILP Professional Lighting Guide 04, Guidance on undertaking Environmental Lighting Impact Assessments (2013) has been used to undertake the lighting baseline survey.

1.3.2. Receptors in the vicinity of the Proposed Scheme were identified through an initial desk study of the area.

1.3.3. The location of each receptor was agreed with South Norfolk Council's, Environmental Management Officer Alison Old on 8 May 2018. Receptor sites where chosen to allow the identification of baseline conditions, and an assessment of potential impacts on people and the environment in which they live, and on the location of potential ecological receptors.

1.3.4. An assessment of each receptor location was undertaken during the day and night and evaluated in terms of their direct and intermittent views towards the Proposed Scheme, and whether existing screening is likely to prevent light spill, views of luminaire intensity or sky glow. Day-time and night-time photographs were taken from each location at a height of 1.7m which is representative of adult eye height.

1.3.5. At each receptor location, 4 readings of vertical illuminance were taken with the sensor of the light meter pointed north, south, east and west at a height of 1.5m. One reading of horizontal illuminance was taken at ground level. This provides information on the levels of ambient light in each area.

Summary of receptor locations

1.3.6. A summary of the viewpoint locations and a description of each receptor are shown in table 1.1 and table 1.2.

Table 1.1: Summary of key lighting related survey viewpoint locations

Survey viewpoint location number	Drawing reference number	Description of location	Receptor(s)
1	HE551492-MMSJV-HLG-000-DR-EO-00008	Public right of way footpath next to railway track	Assessment to be documented in Chapter 8 – Landscape
2	HE551492-MMSJV-HLG-000-DR-EO-00008	Cantley Lane South	Assessment to be documented in Chapter 8 – Landscape
3	HE551492-MMSJV-HLG-000-DR-EO-00008	Tumulus, Cantley Woods	Assessment to be documented in Chapter 7 – Cultural Heritage
4	HE551492-MMSJV-HLG-000-DR-EO-00008	Tumulus, Cantley Woods	Assessment to be documented in Chapter 7 – Cultural Heritage
5	HE551492-MMSJV-HLG-000-DR-EO-00008	Thickthorn Hall	Assessment to be documented in Chapter 8 – Landscape
6	HE551492-MMSJV-HLG-000-DR-EO-00008	Agricultural field (Thickthorn Park)	Assessment to be documented in Chapter 7 – Cultural Heritage
7	HE551492-MMSJV-HLG-000-DR-EO-00008	Residential property 104 Cantley Lane South	Residents of property
8	HE551492-MMSJV-HLG-000-DR-EO-00008	Residential property 102 Cantley Lane South	Residents of property
9	HE551492-MMSJV-HLG-000-DR-EO-00008	Public right of way footpath between Cantley Lane and A11	Assessment to be documented in Chapter 8 – Landscape
10	HE551492-MMSJV-HLG-000-DR-EO-00008	Rear of residential properties on Brettingham Avenue and Taylor Avenue	Residents of properties
11	HE551492-MMSJV-HLG-000-DR-EO-00008	Front of properties on Fern Drive	Assessment to be documented in Chapter 8 – Landscape
12	HE551492-MMSJV-HLG-000-DR-EO-00008	Rear of properties on Meadow Farm Drive	Residents of properties
13	HE551492-MMSJV-HLG-000-DR-EO-00008	Moat of the former Thickthorn Hall	Assessment to be documented in Chapter 7 – Cultural Heritage
14	Drawing not available (Grid reference 618140, 305593)	Thickthorn Cottages	Residents of properties
15	Drawing not available (Grid reference 618631, 305437)	Proposed Cringleford residential extension development	Future residents of proposed properties

Source: Mott MacDonald Sweco Joint Venture (2018)

1.3.7. Areas where changes to lighting levels that may affect light sensitive flora and fauna have been identified as part of the biodiversity assessment in Chapter 9 and summarised in table 1.2.

Table 1.2: Summary of key biodiversity survey receptor locations

Survey viewpoint location number	Drawing reference number	Description of location	Receptor(s)
1, 2, 3, 41 and 42	HE551492-MMSJV-HLG-000-DR-EO-00008	Thickthorn Park	Assessment to be documented in Chapter 9 – Biodiversity
4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18 and 19	HE551492-MMSJV-HLG-000-DR-EO-00008	Field north of Cantley Lane South and west of the A47	Assessment to be documented in Chapter 9 – Biodiversity
11 and 12	HE551492-MMSJV-HLG-000-DR-EO-00008	Thickthorn Services	Assessment to be documented in Chapter 9 – Biodiversity
20, 21, 22, 23, 24 and 25	HE551492-MMSJV-HLG-000-DR-EO-00008	Cantley Lane	Assessment to be documented in Chapter 9 – Biodiversity
26, 27, 28, 29, 30 and 31	HE551492-MMSJV-HLG-000-DR-EO-00008	Field south of Cantley Lane and east of the A47	Assessment to be documented in Chapter 9 – Biodiversity
32, 33, 34, 35 and 36	HE551492-MMSJV-HLG-000-DR-EO-00008	Field south of Cantley Lane South and west of the A47	Assessment to be documented in Chapter 9 – Biodiversity
37, 38, 39 and 40	HE551492-MMSJV-HLG-000-DR-EO-00008	Field north of Cantley Lane and east of the A47	Assessment to be documented in Chapter 9 – Biodiversity

Source: Mott MacDonald Sweco Joint Venture (2018)

1.4. Assumptions and limitations

1.4.1. The assessment of the overall effects on bats and other species, landscape and cultural heritage do not form part of the lighting assessment.

1.4.2. At the time of writing, the location of construction compounds and haul routes have not been identified and therefore potential receptors associated with these areas do not form part of this baseline lighting survey.

1.4.3. Baseline surveys were carried out during spring where deciduous vegetation is well developed. It is anticipated where vegetation has been recorded as deciduous this will reduce during the autumn and winter months.

1.4.4. Where assessment of baseline conditions could not be established due to land access consent not being granted, alternative receptor locations have been used where appropriate, these areas are detailed further in section 1.5.

1.4.5. Baseline photography has been taken at 1.7m above ground level, outside and not within the residential properties identified as receptor locations.

1.5. Baseline conditions

1.5.1. The baseline conditions presented in this section are those surveyed and documented during the day and night-time surveys. For a comprehensive overview, it is recommended that this section of the report should be read with reference to the following:

- Appendix A - Viewpoint location plans
- Appendix B – Baseline survey photograph sheets

Baseline survey conditions

1.5.2. The baseline survey was undertaken between 16 and 18 May 2018 with times and weather conditions detailed in table 1.3.

Table 1.3: Survey periods and weather conditions

Survey Period	Weather conditions	Visibility of night sky	Natural ambient night-time lighting levels[(a)]
16 May - 15:40 to 19:55 (day-time)	13°C Dry, overcast but bright with white and grey clouds	n/a	n/a
16 May 22:35 to 17 May 01:05 (night-time)	**Dry and overcast with a thin layer of cloud.**	**The moon was not visible, but some stars were visible through breaks in the cloud. Sky appeared bright towards the north.**	0.02 Lux
17 May – 15:45 to 16:43 (day-time)	13°C **sunny with intermittent white fluffy clouds**	n/a	n/a
17 May 22:15 to 18 May 02:30 (night-time)	Dry and overcast	Initially the moon and stars were not visible however throughout the night clouds dispersed and some stars became visible	No reading obtained

Source: Mott MacDonald Sweco Joint Venture (2018)
Notes: (a) Natural ambient night-time lighting levels from stars and the moon were measured away from sources of artificial light.

1.5.3. The survey was undertaken during the first intermediate lunar phase (Waxing Crescent Moon) while mostly overcast with intermittent views of stars, the moon itself was not visible during survey period.

Equipment used

1.5.4. A Konica Minolta T-10A illuminance meter (Serial Number 20015630) was used for all on-site light readings in lux (lumen/m²). The hand-held meter is maintained and calibrated in accordance with the manufacturers' instructions (the certificate of calibration can be found in appendix C).

1.5.5. The camera utilised for the on-site photography was a Nikon D3200 digital single-lens reflex.

Baseline survey description and results

Principle light sources

1.5.6. Principle light sources surrounding the site are:

1.5.7. Highway lighting at the A47/A11 Thickthorn roundabout consisting of 12m high lighting columns with high pressure sodium flat glass luminaires. Luminaires are installed with tilts between 0° and 5°.

1.5.8. Highway lighting along the A11 Newmarket Road including the junction with Roundhouse Way consisting of lighting columns at a height of 12m with high pressure sodium luminaires.

1.5.9. Highway lighting along the B1172 Norwich Road roundabout and A47/A11 Thickthorn roundabout link road consisting of lighting columns approximately 6m in height with high pressure sodium flat glass luminaires. Luminaires are installed with tilts of 0°.

1.5.10. Lighting within a highway maintenance compound located at the end of Cantley Lane next to the A47 eastbound carriageway. This lighting consisted of a temporary floodlighting tower, approximately 4m in height with 4 LED floodlights orientated north-east towards Cantley Lane. The lighting from this installation caused significant levels of obtrusive light including spill light onto the vegetation lining Cantley Lane, potentially used by ecological receptors (viewpoints 21, 23 and 25), and sky glow.

1.5.11. Lighting of the Thickthorn Park and Ride consisting of lighting columns approximately 4m to 6m in height with high pressure sodium flat glass luminaires. Luminaires are installed with tilts of 0°.

1.5.12. Lighting within the village of Cringleford which is split in two by the A11. The lighting within the southern section below the A11 consists of lighting columns 4m to 6m in height with predominantly low-pressure sodium luminaires. The northern section is lit with modern ‘white light’ luminaires on a mixture of column heights ranging from 6m to 10m.

1.5.13. Public right of way footpath, running alongside the Cringleford Doctors Surgery on Cantley Lane, is lit using lighting columns approximately 6m high with high pressure sodium luminaires.

Viewpoint location 1 – Public right of way footpath next to railway track

1.5.14. Viewpoint location 1 is located on a public right of way footpath next to the Breckland line railway and corresponds with a representative viewpoint assessed within the Landscape and Visual Impact Assessment (LVIA).

1.5.15. To the north of the viewpoint location is an open agricultural field bounded by a thin line of deciduous vegetation. Beyond the boundary of the field, the terrain declines towards a small river after which the terrain rises. As the gradient increases a single storey dwelling is visible above the vegetation which bounds the field. Behind this dwelling the terrain continues to incline, and Cantley Wood is visible consisting of deciduous trees,

approximately 15m to 20m in height, blocking onward views. To the north-west, vehicles travelling on the A11 are visible through breaks in the vegetation.

1.5.16. The railway is located behind the viewpoint location and can be seen running approximately north-east to south-west. There is deciduous vegetation which varies in heights and thickness between the viewpoint location and the railway. Towards the east a deciduous row of trees is visible which lines Cantley Lane South.

1.5.17. During the day-time survey lighting equipment was not visible from the viewpoint location.

1.5.18. Artificial light sources visible during the night-time survey were intermittent and the night-time scene appeared generally dark as indicated by the light measurement readings in table 1.4.

1.5.19. Small white lights were visible towards the north-east assumed to be security lights associated with some of the isolated dwellings in the area and headlights of vehicles travelling along the A11 were visible towards the north-west.

1.5.20. Spill light onto nearby vegetation was visible towards the north-east and was orange in appearance and likely to be emanating from street lighting on Cantley Lane South.

1.5.21. Orange sky glow was visible mainly towards the east and north, visible on the heavy clouds and assumed to be from the suburban areas on the southern outskirts of Norwich towards the east and the existing lighting associated with A47/A11 Thickthorn roundabout towards the north-east. To a lesser extent white sky glow was visible towards the west and assumed to be from the village of Hethersett.

1.5.22. Overall, the area appeared dark with only intermittent views of light sources. Direct views towards the existing A47/A11 Thickthorn roundabout are blocked by the dense deciduous wooded area of Cantley Wood. Sky glow was prominent towards the north and east assumed to be from the outskirts of Norwich and the existing street lighting associated with A47/A11 Thickthorn roundabout. Headlights of vehicles travelling along the A11 were visible towards the north-west.

Table 1.4: Survey viewpoint 1 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
1	0	north	0
		east	0
		south	0
		west	0

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 2 – Cantley Lane South

1.5.23. Viewpoint location 2 is located on Cantley Lane South which is a road linking the A11 to the village of Ketteringham and represents a viewpoint to be used in the LVIA.

1.5.24. Towards the north and north-east, deciduous vegetation lining Cantley Lane South is visible and behind this the single storey dwelling and the deciduous wooded area of Cantley Wood is visible as described for viewpoint 1. Views towards the A47/A11 Thickthorn roundabout located to the north are screened by Cantley Wood

1.5.25. Views towards the east are of an open field bounded by thick deciduous vegetation screening onward views.

1.5.26. There is deciduous vegetation lining both sides of Cantley Lane South visible towards the south and west. The 1st floor window of a house is visible through a small break in the vegetation when looking south to south-west and an agricultural field and the vegetation bounding the field is visible through another small break in vegetation to the west.

1.5.27. During the day-time survey lighting equipment was not visible.

1.5.28. Direct views of artificial light sources were not visible during the night-time survey and the night-time scene appeared generally dark as indicated by the recorded light measurements in table 1.5.

1.5.29. Orange sky glow is visible towards the east and above the Cantley Wood tree line to the north. White sky glow was visible towards the west. Night-time views towards the south were blocked by vegetation.

1.5.30. In summary, the viewpoint appeared dark with no direct views of lighting. Direct views towards the existing A47/A11 Thickthorn roundabout are blocked by the dense deciduous wooded area of Cantley Wood. Sky glow was prominent towards the north and east and less so towards the west.

Table 1.5: Survey viewpoint 2 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
2	0	north	0
		east	0
		south	0
		west	0

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 3 and 4 – Cantley Wood Tumuli

1.5.31. Viewpoint locations 3 and 4 are two raised Tumuli located in Cantley Wood and were surveyed to assess the existing lighting conditions in relation to the Cultural Heritage assessment.

1.5.32. At viewpoint 3, deciduous trees are growing on and surrounding the Tumulus and there are views through the vegetation of an open field towards the north. Views looking south, east and west are screened by thicker deciduous vegetation although the ground and 1st floor windows of a house are just visible through the vegetation looking east.

1.5.33. At viewpoint 4, the ground is initially open with only knee-high vegetation growing on the Tumulus with taller, thicker deciduous vegetation approximately 10m in height, screening onward views towards the north, east and west with only a small opening in the vegetation towards the south.

1.5.34. During the night-time survey at viewpoint 3, artificial light spilling onto nearby vegetation on Cantley Lane along with localised sky glow is visible to the north-east. The lighting is assumed to be from the floodlighting within the highway maintenance compound at the end of Cantley Lane. Also visible is light spilling onto nearby vegetation to the south-east assumed to be from the lighting installation within the Meadow Farm compound.

1.5.35. At viewpoint 3 and 4, sky glow is visible through the deciduous trees towards the north and east and intensifies towards the east. At both viewpoints the sky glow was orange and it is assumed to be emanating from the A47/A11 Thickthorn roundabout to the north and the outskirts of Norwich to the east. To a lesser extent white sky glow is visible towards the west. At viewpoint 3, intense sky glow assumed to be caused by the floodlighting installation at the end of Cantley Lane can be seen to the north-east.

1.5.36. Overall, the area appeared dark as indicated by the recorded light measurements in table 1.6 with only intermittent views of lighting from viewpoint 3. Both viewpoints are screened from onward views by deciduous vegetation. At both viewpoints, sky glow is mainly visible to the north and east assumed to be associated with the lighting installation on the A47/A11 Thickthorn roundabout and the urbanised area of Norwich. At viewpoint 3, sky glow from the highway maintenance compound at the end of Cantley Lane can be seen towards the north-east

Table 1.6: Survey viewpoints 3 and 4 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
3 and 4	0	north	0
		east	0
		south	0
		west	0

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 5 – Thickthorn Hall

1.5.37. Viewpoint location 5 is located in the grounds of Thickthorn Hall and corresponds with a representative viewpoint assessed within the LVIA.

1.5.38. Access to the hall was not obtained at the time of the survey and therefore the baseline conditions could not be recorded.

Viewpoint location 6 – Thickthorn Park

1.5.39. Viewpoint location 6 is located within Thickthorn Park and was surveyed to assess the existing lighting conditions in relation to the Cultural Heritage assessment. The park is used as an agricultural field and is located next to the Thickthorn Park and Ride site to the east and A11 to the south.

1.5.40. The viewpoint is bounded by thick deciduous vegetation at approximate heights between 8m and 12m on most sides screening views towards the north, east and west. At the south-western extremity of the field there is a break in the vegetation and vehicles travelling on the A11 are visible.

1.5.41. During the day-time survey lighting equipment was not visible from the viewpoint location.

1.5.42. During the night-time survey the high-pressure sodium street lighting on the B1172 roundabout and B1172 link to the A47/A11 Thickthorn roundabout is barely visible through the vegetation in the distance towards the north-east and east of the viewpoint.

1.5.43. Through the break in vegetation to the south, vehicle headlights are visible from the A11 and through the vegetation to the north-west vehicle headlights from the B1172 Norwich Road are visible.

1.5.44. Sky glow was intense looking north in the direction of the Norfolk and Norwich University Hospital lessening towards the east. Sky glow was also visible towards the south.

1.5.45. Overall, the night-time scene appeared generally dark due to the thick deciduous vegetation bounding the field screening onward views as indicated by the light measurement readings included in table 1.7. Sky glow appeared intense above the vegetation towards the north.

Table 1.7: Survey viewpoint 6 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
6	0	north	0
		east	0
		south	0
		west	0

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 7 – 104 Cantley Lane South

1.5.46. Viewpoint location 7 is located within the rear garden of a two-storey residential property on Cantley Lane South near to the westbound carriageway of the A47 and was surveyed to understand the existing conditions at the property.

1.5.47. A 2m high wooden fence encloses the garden screening views from the ground floor windows to the north, east and west. Towards the east evergreen planting approximately 8m high located in the garden of 102 Cantley Lane South can be seen, potentially screening onward views of the A47.

1.5.48. Cantley Lane South runs along the north-east extremity of a field to the rear of the property and a thick deciduous tree line located between Cantley Lane South and the westbound carriageway of the A47 is visible screening views of the A47.

1.5.49. During the day-time survey lighting equipment was not visible from the viewpoint location apart from a LED floodlight mounted at an approximate height of 2m attached to a small building within the garden.

1.5.50. During the night-time survey access to the garden was restricted and the night-time assessment was undertaken in the field to the north of the property.

1.5.51. From the field street lighting located on the A11 is visible through gaps in the vegetation bounding the field towards the north-west. To the east of the field there is deciduous vegetation separating Cantley Lane South from the A47 westbound carriageway and through this vegetation localised sky glow emanating from the floodlighting within the Cantley Lane highway maintenance compound is visible. Towards the south the internal residential lighting from the 1st floor windows of the property are visible above the wooden fence bounding the property.

1.5.52. Orange sky glow is visible to the north in the direction of the A47/A11 Thickthorn roundabout intensifying towards the east in the direction of Norwich. White sky glow was visible towards the west.

1.5.53. In summary, the viewpoint location appeared dark as indicated by the recorded light measurements in table 1.8 with intermittent views of the A11 street lighting towards the north-west and the intense sky glow caused by the floodlighting within the highway maintenance compound to the east. Sky glow is visible to the north, east and west.

Table 1.8: Survey Viewpoints 7 – Light Measurement Results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
7	0	north	0.02
		east	0.02
		south	0
		west	0

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 8 – 102 Cantley Lane South

1.5.54. Viewpoint location 8 is located within the rear garden of a two-storey residential property on Cantley Lane South near to the westbound carriageway of the A47. The property adjoins the property described in viewpoint 7 and was surveyed to understand the existing lighting conditions.

1.5.55. Within the rear garden of the property there is a row of evergreen trees approximately 8m in height and a large wooden shed screening views to the north. A wooden fence approximately 2m in height and a small brick-built building separate the property from the neighbouring viewpoint and screen ground floor views towards the west.

1.5.56. At the eastern boundary of the property there is deciduous vegetation of various heights and density partially screening views to the north-east and east. Through gaps in the vegetation the deciduous trees lining Cantley Lane South and separating the lane from the A47 westbound carriageway are visible providing intermittent views of vehicles travelling on the A47.

1.5.57. Spill light was observed in the garden, the source of this light is from the windows of the property. There were no other sources of artificial light visible from the viewpoint location in the rear garden.

1.5.58. Sky glow was visible above the evergreen trees towards the north in the direction of the A47/A11 Thickthorn roundabout and intensified towards the east in the direction of Norwich.

1.5.59. Overall, there are no immediate views of light sources from the viewpoint location and the immediate area appeared dark as indicated by the light measurement results in table 1.9. Sky glow is visible towards the north and east.

Table 1.9: Survey viewpoints 8 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
8	0.02	north	0
		east	0
		south	0.02
		west	0.01

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 9 – Public right of way footpath between Cantley Lane and A11

1.5.60. Viewpoint location 9 is located on a public right of way footpath running along the boundary of 2 agricultural fields located between Cantley Lane and the A11 Newmarket Road and represents a viewpoint to be used in the LVIA.

1.5.61. A line of deciduous hedgerow, approximately 4m in height, separates the 2 fields. At the viewpoint location there is a break in the hedgerow providing uninterrupted views from the viewpoint location initially of 1 of the open agricultural fields which slopes down

towards the A11 Newmarket Road towards the north. The street lighting on the A11 and travelling vehicles are clearly visible and the residential properties of Cringleford can be seen on the other side of A11. The Cringleford Doctors Surgery on Cantley lane is visible to the east, the building sits in a dip at the bottom of the field with only the roof and very tops of the windows of the single storey building visible. Beyond the building a cluster of dense deciduous vegetation screens onward views. To the north-east there is a cycle path linking Cantley Lane to the A11 and from the viewpoint location street lighting on the cycle path is visible, approximately 6m in height and orientated towards the viewpoint location.

1.5.62. Views towards the east are screened by the deciduous hedgerow separating the fields, onward views will be similar to those towards the south where the open agricultural field is visible which is bounded by thick deciduous trees approximately 10m to 15m in height lining Cantley Lane.

1.5.63. Views towards the west are again of the open agricultural field which is bounded by deciduous trees and bushes approximately 10m in height. There are some breaks in the vegetation and vehicles travelling on the A47 are visible.

1.5.64. During the night-time survey, lighting on the A11 to the north and north-west is clearly visible spilling light onto nearby residential properties and vegetation. The street lighting along the cycle path was in operation during the survey and visible to the north-east.

1.5.65. Views towards the east and south generally appeared dark however views to the west are interrupted by high levels of spill light emanating from the highway maintenance compound on Cantley Lane which was spilling light on the trees lining Cantley Lane and contributing directly to sky glow due to the orientation of the luminaires.

1.5.66. In summary the immediate vicinity of the viewpoint appeared dark as indicated by the light measurement results in table 1.10. There are distant views of street lighting on the A11 to the north and north-west and evidence of spill light emanating from a highway compound at the end of Cantley Lane to the south-west.

Table 1.10: Survey viewpoint 9 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
9	0.02	north	0.05
		east	0.02
		south	0
		west	0.02

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 10 – Rear of residential properties on Brettingham Avenue and Taylor Avenue

1.5.67. Viewpoint location 10 is located on a small track accessed by foot and will be used to assess the distant views from the rear of residential properties on Brettingham Avenue and Taylor Avenue in Cringleford.

1.5.68. A mixture of deciduous and evergreen trees and bushes are present to the north of the viewpoint screening most of the ground and first floor windows to the rear of the properties although some small breaks in the vegetation were present providing intermittent views of residential windows.

1.5.69. Views to the west are initially of an open agricultural field which is bounded by the thick deciduous trees lining Cantley Lane. To the south the same open field is visible which slopes down towards the A47. The bottom on the field is bounded by thick deciduous vegetation which screens the A47. Vehicles travelling on the A47 are barely visible through the vegetation.

1.5.70. During the day-time survey lighting equipment was not visible from the viewpoint location.

1.5.71. Although the rear of the residential properties appeared dark there are street lighting columns 4m to 6m in height with low pressure sodium luminaires lighting Taylor Avenue and Brettingham Avenue to the front of the properties.

1.5.72. During the night-time survey light emanating from the internal windows of the properties to the north of the viewpoint location are visible through the mixture of deciduous and evergreen vegetation.

1.5.73. Obtrusive light emanating from the highway maintenance compound is visible towards the west. This obtrusive light consisted of light spilling onto the trees lining Cantley Lane, potentially used by ecological receptors (viewpoints 21, 23 and 25) and directly up into the night-time sky contributing to sky glow.

1.5.74. To the north-west one street lighting column with a high-pressure sodium light source is visible through a small break in the vegetation and is located next to the A11.The headlights of vehicles travelling on the A47 are visible through the vegetation at the bottom of the field towards the south-west.

1.5.75. Distant views of orange sky glow are visible to the north.

1.5.76. Overall, the immediate vicinity of the viewpoint appeared dark as indicated by the light measurement results in table 1.11. There are intermittent views of street lighting on the A11 and vehicle headlights on the A47. Obtrusive light is visible to the west emanating from the highway compound at the end of Cantley Lane, spilling light onto nearby vegetation potentially used by ecological receptors (viewpoints 21, 23 and 25), and directly into the night sky.

Table 1.11: Survey viewpoint 10 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
10	0	north	0.02
		east	0
		south	0

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
		west	0.02

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 11 – Front of properties on Fern Drive

1.5.77. Viewpoint location 11 is located in the village of Cringleford in front of the 3-storey residential properties on Fern Drive. The viewpoint corresponds with a representative viewpoint assessed within the LVIA.

1.5.78. At the viewpoint location there are residential properties to the north and east screening onward views.

1.5.79. Street lighting is present on Fern Drive and consists of lighting columns approximately 6m in height with a mixture of white light metal halide and yellow high-pressure sodium light sources, the majority of which are oriented towards the properties and mounted at a 0-degree tilt.

1.5.80. Views towards the south and north-west are generally unrestricted with the street lighting on the A11 Newmarket Road and Round House Way clearly visible during the day-time survey.

1.5.81. The A47/A11 Thickthorn roundabout is located to the south-west however views towards the roundabout are screened by deciduous vegetation approximately 10m in height and a single two-storey building.

1.5.82. During the night-time survey, the lighting on the A11 and Round House Way are prominent in the night-time scene. The lighting consists of 10m to 12m lighting columns with high pressure sodium luminaires on the A11 and white light LED luminaires on Round House Way.

1.5.83. The street lighting on Fern Drive was operational during the night-time survey and light spill onto adjacent houses and vegetation is visible.

1.5.84. During the night-time survey interior lights from within the properties behind the viewpoint location to the north and east were visible, and some properties had small building mounted external lighting adjacent to property entrances.

1.5.85. Overall, the viewpoint location and the surrounding areas are extensively lit during the hours of darkness as indicated by the light measurement results shown in table 1.12. Due to the extent of street lighting operating in the area, it was difficult to distinguish the presence of sky glow.

Table 1.12: Survey viewpoint 11 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
11	7.55	north	7.56
		east	1.08
		south	0.32
		west	13.19

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 12 – Rear of properties on Meadow Farm Drive

1.5.86. Viewpoint location 12 is in the horse paddock at the rear of residential properties on Meadow Farm Drive and will be used to represent the distant views of the residents.

1.5.87. To the east and south-east of the viewpoint location there are a mixture of 1 and 2 storey residential buildings present with the rear gardens of these properties backing onto the horse paddock. A mixture of wooden fences and hedgerow, approximately 2m in height bound the gardens to the rear. To the north there is a line of thick deciduous hedgerow, approximately 6m in height screening onward views.

1.5.88. The A47 is located to the south and west of the viewpoint and is heavily screened from the viewpoint by thick deciduous trees and hedges.

1.5.89. During the night-time survey access to the horse paddock was restrictive and the night-time assessment was undertaken approximately 20m north of the day-time survey location at the entrance to the field.

1.5.90. Direct views of light sources were not visible during the night-time survey. Some minor light spill emanating from the residential property windows is visible to the east and vehicle headlights are visible to the south through the deciduous vegetation.

1.5.91. Sky glow can be seen to the north and west visible through the vegetation surrounding the viewpoint. Sky glow is also visible to the east above the residential properties.

1.5.92. Overall, the viewpoint appeared dark as indicated by the light measurement results in table 1.13. The A47 is located to the south and west and extensively screened by dense deciduous vegetation. There are only minor instances of lighting visible during the night-time survey and sky glow visible to the north, east and west.

Table 1.13: Survey viewpoint 12 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
12	0	north	0
		east	0
		south	0
		west	0

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 13 – Front of properties on Fern Drive

1.5.93. Viewpoint location 13 is located within the grounds of the former Thickthorn Hall and is approximately 900m to the west of the A47/A11 Thickthorn roundabout. The viewpoint was surveyed to assess the existing lighting conditions in relation to the Cultural Heritage assessment.

1.5.94. The viewpoint is located within a small ditch and covered in knee-high vegetation. The ground rises to the east and south and onward views are initially screened by small clusters of deciduous trees and bushes. The density of trees lessens to the south and there are intermittent views of agricultural fields.

1.5.95. To the north and west a brick wall, approximately 1.5m high is visible and bounding a small paddock. Visible above the wall to the north is a single storey building beyond which a line of deciduous trees can be seen approximately 10m high screening onward views. Onward views to the west are also screened by deciduous trees and bushes.

1.5.96. During the night-time survey there are no visible sources of lighting. Sky glow is visible through the vegetation to the east and west.

1.5.97. Overall the viewpoint location appeared dark as indicated by the light measurement results in Table 1.14 with only intermittent views of sky glow to the east and west through the deciduous vegetation surrounding the viewpoint.

Table 1.14: Survey viewpoint 13 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
13	0	north	0
		east	0
		south	0
		west	0

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 14 – Thickthorn Cottages

1.5.98. Viewpoint location 14 is located to the south of Thickthorn cottages in the north-west corner of the B1172 Norwich Road roundabout and was surveyed to understand the baseline views from the residential properties.

1.5.99. To the east and south-east of the viewpoint location the B1172 Norwich Road roundabout is visible and surrounded by lighting columns approximately 6m in height with flat glass luminaires installed with tilts of 0°. The lighting installation continues south along with B1172 towards the A47/A11 Thickthorn roundabout. Beyond the B1172 roundabout a fast food restaurant and petrol station can be seen. The B1172 Norwich Road continues west towards Hethersett and this section of road, visible to the south and west of the viewpoint, is not lit with streetlighting.

1.5.100. To the south dense deciduous vegetation approximately 6m high can be seen on the other side of the B1172 and a two-storey residential property is visible to the south-west.

1.5.101. Views towards the north are mainly screened by the two-storey residential properties at Thickthorn cottages.

1.5.102. During the night-time survey the area to the east and south-east of the viewpoint location is extensively lit with clear views of the B1172 roundabout street lighting, lighting within the car park of the fast food restaurant along with the lit signage of the restaurant and petrol station. It was noticeable that light from the B1172 roundabout street lighting installation is spilling onto the Thickthorn Cottages.

1.5.103. Night-time views to the north-east, south and west are dark with only a single illuminated traffic sign spilling a small amount of light onto the road to the south of the viewpoint.

1.5.104. Sky glow is visible to the north but not so noticeable to the south and east due to the proximity of the B1172 street lighting installation.

1.5.105. In summary, the viewpoint experiences views of the street lighting on the B1172 to the east and south-east and onward views of lighting emanating from the fast food restaurant and petrol station. Light spilling onto the properties is visible as indicated by the light measurement results in table 1.15.

Table 1.15: Survey viewpoint 14 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
14	0.27	north	0.29
		east	0.84
		south	0.24
		west	0.02

Source: Mott MacDonald Sweco Joint Venture (2018)

Viewpoint location 15 – Proposed Cringleford residential extension development

1.5.106. 1.5.106. Viewpoint location 15 is located in the agricultural field in the south-east corner of the A47/A11 Thickthorn roundabout and was surveyed to understand the baseline views from the future residents of a proposed residential development.

1.5.107. The A11 is located to the north of the viewpoint within a small cutting with the field sitting slightly higher than the road. Lighting columns, approximately 12m in height that are positioned in the central reservation of the A11 can be seen. Behind the A11 a row of dense deciduous vegetation can be seen screening onward views. To the east the field is bounded by a line of deciduous trees and bushes and street lighting on the A11 roundabout can be seen above the vegetation to the north-east.

1.5.108. The field is bounded by deciduous vegetation to the south and west, towards the west the vegetation is approximately 10m to 12m high and street lighting on the A47/A11 Thickthorn roundabout can be seen where the vegetation briefly reduces in height.

1.5.109. During the night-time survey street lighting on the A11 to the north can be clearly seen and appeared to be spilling light onto nearby vegetation and into the field as indicated by the light measurement results in table 1.16. Towards the west the street lighting visible during the day-time survey on the A47/A11 Thickthorn roundabout is in operation. The luminaires in operation on the A47/A11 Thickthorn roundabout appeared to control the emitted light restricting direct upward light. Towards the east views appeared dark.

1.5.110. Distant sky glow was visible to the west in the direction of Hethersett and to the south localised sky glow is visible in the direction of the highway maintenance compound on Cantley Lane.

1.5.111. In summary, there is limited screening to the northern boundary of the field and the viewpoint experiences a small amount of spill light from the street lighting on the A11. There is deciduous screening on the western boundary screening views of most of the lighting on the A47/A11 Thickthorn roundabout however some lighting is visible where the vegetation reduces in height.

Table 1.16: Survey viewpoint 15 – light measurement results

Viewpoint number	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)
15	0	north	0.17
		east	0.08
		south	0.01
		west	0.04

Source: Mott MacDonald Sweco Joint Venture (2018)

Baseline ecological survey descriptions and results

1.5.112. Recorded light measurement reading for the identified ecological receptors are provided in table 1.17.

1.5.113. Not every ecological receptor has been surveyed, instead where receptors are likely to have similar measured lighting levels, other viewpoint locations have been used to represent these locations.

1.5.114. The baseline conditions of the majority of ecological survey locations appeared dark as indicated by the recorded light measurements.

1.5.115. Obtrusive light was recorded at viewpoint 21, located at the end of Cantley Lane emanating from the floodlighting within the highway maintenance compound. Lighting was spilling onto the vegetation potentially used by ecological receptors lining Cantley Lane potentially used by ecological receptors (viewpoints 21, 23 and 25).

Table 1.17: Ecological survey viewpoints – light measurement results

Viewpoint number	Description of area	Measure at ground level (lux)	Direction of sensor	Measured at 1.5m above ground level (lux)	Comments
1 (viewpoints 2 and 3 not surveyed)	Agricultural field north of A11 Hethersett Bypass (Thickthorn Park)	0	north	0.03	Area appeared dark
			east	0	
			south	0	
			west	0	
12 (viewpoint 11 not surveyed)	Thickthorn Services (west of A47/A11 Thickthorn roundabout)	0.79	north	1.3	Light spill from A47/A11 Thickthorn street lighting
			east	2.5	
			south	1.11	
			west	0.28	
16 (viewpoints 4 to 10, 13, 14, 15 and 17 to 19 not surveyed)	Cantley Lane South including the field north of Cantley Lane South and west of the A47	0.03	north	0.03	Area appeared dark
			east	0.03	
			south	0	
			west	0.01	
20 (viewpoints 22, 24 and 37 to 40 not surveyed)	Field to the north of Cantley Lane	0.01	north	0.03	Area appeared dark
			east	0.07	
			south	0.01	
			west	0	
21 (viewpoints 23 and 25 not surveyed)	Cantley Lane	22.7	north	1.42	Light spill from highway compound lighting located at the end of Cantley Lane
			east	1.18	
			south	50.1	
			west	96.3	
26, 27, 28 and 29 (viewpoints 30 and 31 not surveyed)	Field to the south of Cantley Lane and east of the A47	0	north	0 – 0.01	Area appeared dark
			east	0	
			south	0	
			west	0	
32, 33, 35 and 36 (viewpoint 34 not surveyed)	Field to the south of Cantley Lane South and west of the A47	0	north	0	Area appeared dark
			east	0	
			south	0	
			west	0	
41 and 42	Thickthorn Park	0	north	0	Area appeared dark
			east	0	
			south	0	
			west	0	

Source: Mott MacDonald Sweco Joint Venture (2018)

1.6. References

1.6.1. Institution of Lighting Professionals Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (2013)

1.7. Glossary

Acronym	Description
ILP	Institution of Lighting Professionals
LED	Light Emitting Diode
LVIA	Landscape and Visual Impact Assessment
m	metre

Term	Definition
Artificial Light Source	Manmade lighting such as floodlights, illuminated bollards and street lighting.
Candela	International System of Units (SI) for Luminous Intensity, a common candle emits light with a luminous intensity of approximately 1 candela.
Illuminance	Measurement of Luminous Flux at a point on a surface.
Light Intrusion	Light that falls beyond the boundary of the area being lit.
Light Spill	See Light Intrusion.
Luminaire	Complete light fitting housing the lamp, control gear and optical distribution control.
Luminaire Intensity	Measured in Candelas, this is a measure of the amount of light that a source radiates in a given direction. This can be considered as the power of light in 1 specific angle (or given direction) often to an observer.
Luminance	Luminance is an indicator of how bright a surface will appear.
Lux	SI unit for Illuminance, 1 lumen per square metre.
Obtrusive Light	Light that falls, or can be viewed beyond the boundary of the area being lit which causes annoyance, discomfort or distraction.
Proposed Scheme, the	The concept or design proposed i.e. the road layout and associated earthworks, drainage, structures, lighting, etc
Sky Glow	The illumination of the sky at night by artificial light sources including light emitted directly upward from the light source and also reflected from the ground or a surface.
Site, the	The Proposed Scheme boundary i.e. the existing geographic space the design is proposed to be located within.

Appendix A – Viewpoint location plans

Viewport 1

Viewport 2

LIMIT OF LIGHTING WORKS

1:2500 0 125m 250m

Notes

1. Do not scale from this drawing.
2. Survey viewpoints may be added/subtracted subject to on site conditions and observations.
2. All dimensions are in metres unless otherwise shown. All levels are in metres above Ordnance Datum (AOD). All dimensions & levels should be checked on site.
3. Any drawing errors or discrepancies should be brought to the attention of Mott MacDonald Sweco JV.

Key to symbols

1 Proposed lighting survey viewpoint

1 Proposed ecology related lighting survey viewpoint

Rev	Date	Amendment Details	Drawn	Chk'd	App'd
P01.2	18/04/18	FOR REVIEW & COMMENT	CM	DH	JM

Mott MacDonald Sweco

Client: highways england

Drawing Status	Suitability
FOR REVIEW & COMMENT	S3

Project Title: A47 THICKTHORN JUNCTION WITH A11

Drawing Title: LIGHTING SURVEY VIEWPOINT LOCATION PLAN

Scale	Designed	Drawn	Checked	Approved
1:2500	OConnell, Christopher	Main, Cameron	Hawkins, Dean	McKay, Jamie
Original Size	**Date**	**Date**	**Date**	**Date**
A1	13/03/18	12/04/18	12/04/18	12/04/18

Drawing Number					Project/Ref. No.
HE PIN	Originator	Volume			HE551492
HE551492	- MMSJV	- HLG	-		
000	- DR	- EO	-	00008	Revision
Location	Type	Role		Number	P01.2

pw:\\CSPWint.gront.mj.net:PW_UK Production\Documents\Projects\Transportation\HETTNJCT- A47 THICKTHORN JUNCTION WITH A11\Highways\Road Lighting\Drgs & Models - 2D drawing\HETTNJCT-MMSJV-HLG-000-DR-EO-00004

Appendix B – Baseline survey photograph sheets

Lighting related baseline survey photographs

Survey viewpoint 1

Figure 1.1: Survey viewpoint 1 – day-time looking north

Figure 1.2: Survey viewpoint 1 – night-time looking north

Figure 1.3: Survey viewpoint 1 – day-time looking east

Figure 1.4: Survey viewpoint 1 – night-time looking east

Figure 1.5: Survey viewpoint 1 – day-time looking south

Figure 1.6: Survey viewpoint 1 – night-time looking south

Figure 1.7: Survey viewpoint 1 – day-time looking west

Figure 1.8: Survey viewpoint 1 – night-time looking west

Survey viewpoint 2

Figure 1.9: Survey viewpoint 2 – day-time looking north

Figure 1.10: Survey viewpoint 2 – night-time looking north

Figure 1.11: Survey viewpoint 2 – day-time looking east

Figure 1.12: Survey viewpoint 2 – night-time looking east

Figure 1.13: Survey viewpoint 2 – day-time looking south

Figure 1.14: Survey viewpoint 2 – night-time looking south

Photograph unavailable.

Figure 1.15: Survey viewpoint 2 – day-time looking west

Figure 1.16: Survey viewpoint 2 – night-time looking west

Survey viewpoint 3

Figure 1.17: Survey viewpoint 3 – day-time looking north

Figure 1.18: Survey viewpoint 3 – night-time looking north

Figure 1.19: Survey viewpoint 3 – day-time looking east

Figure 1.20: Survey viewpoint 3 – night-time looking east

Photograph unavailable.

Figure 1.21: Survey viewpoint 3 – day-time looking south

Figure 1.22: Survey viewpoint 3 – night-time looking south

Figure 1.23: Survey viewpoint 3 – day-time looking west

Figure 1.24: Survey viewpoint 3 – night-time looking west

Photograph unavailable.

Survey viewpoint 4

Figure 1.25: Survey viewpoint 4 – day-time looking north

Figure 1.26: Survey viewpoint 4 – night-time looking north

Figure 1.27: Survey viewpoint 4 – day-time looking east

Figure 1.28: Survey viewpoint 4 – night-time looking east

Figure 1.29: Survey viewpoint 4 – day-time looking south

Figure 1.30: Survey viewpoint 4 – night-time looking south

Photograph unavailable.

Figure 1.31: Survey viewpoint 4 – day-time looking west

Figure 1.32: Survey viewpoint 4 – night-time looking west

Survey viewpoint 5

1.7.1. Access to viewpoint location 5 could not be obtained at the time of the survey and therefore the recording of baseline conditions could not be undertaken.

Survey viewpoint 6

Figure 1.33: Survey viewpoint 6 – day-time looking north

Figure 1.34: Survey viewpoint 6 – night-time looking north

Figure 1.35: Survey viewpoint 6 – day-time looking east

Figure 1.36: Survey viewpoint 6 – night-time looking east

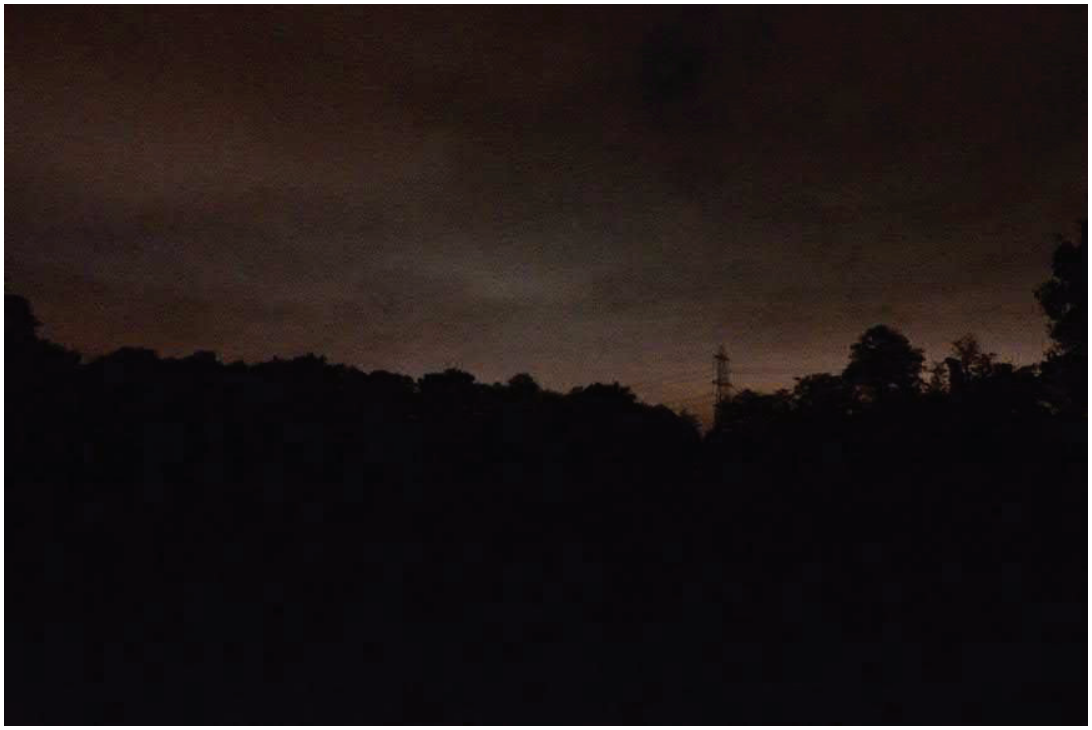


Figure 1.37: Survey viewpoint 6 – day-time looking south

Figure 1.38: Survey viewpoint 6 – night-time looking south

Figure 1.39: Survey viewpoint 6 – day-time looking west

Figure 1.40: Survey viewpoint 6 – night-time looking west

Survey viewpoint 7

Figure 1.41: Survey viewpoint 7 – day-time looking north

Figure 1.42: Survey viewpoint 7 – night-time looking north (alternative viewpoint location)

Figure 1.43: Survey viewpoint 7 – day-time looking east

Figure 1.44: Survey viewpoint 7 – night-time looking east (alternative viewpoint location)

Figure 1.45: Survey viewpoint 7 – day-time looking south

Figure 1.46: Survey viewpoint 7 – night-time looking south (alternative viewpoint location)

Figure 1.47: Survey viewpoint 7 – day-time looking west

Figure 1.48: Survey viewpoint 7 – night-time looking west (alternative viewpoint location)

Survey viewpoint 8

Figure 1.49: Survey viewpoint 8 – day-time looking north

Figure 1.50: Survey viewpoint 8 – night-time looking north

Figure 1.51: Survey viewpoint 8 – day-time looking east

Figure 1.52: Survey viewpoint 8 – night-time looking east

Figure 1.53: Survey viewpoint 8 – day-time looking south

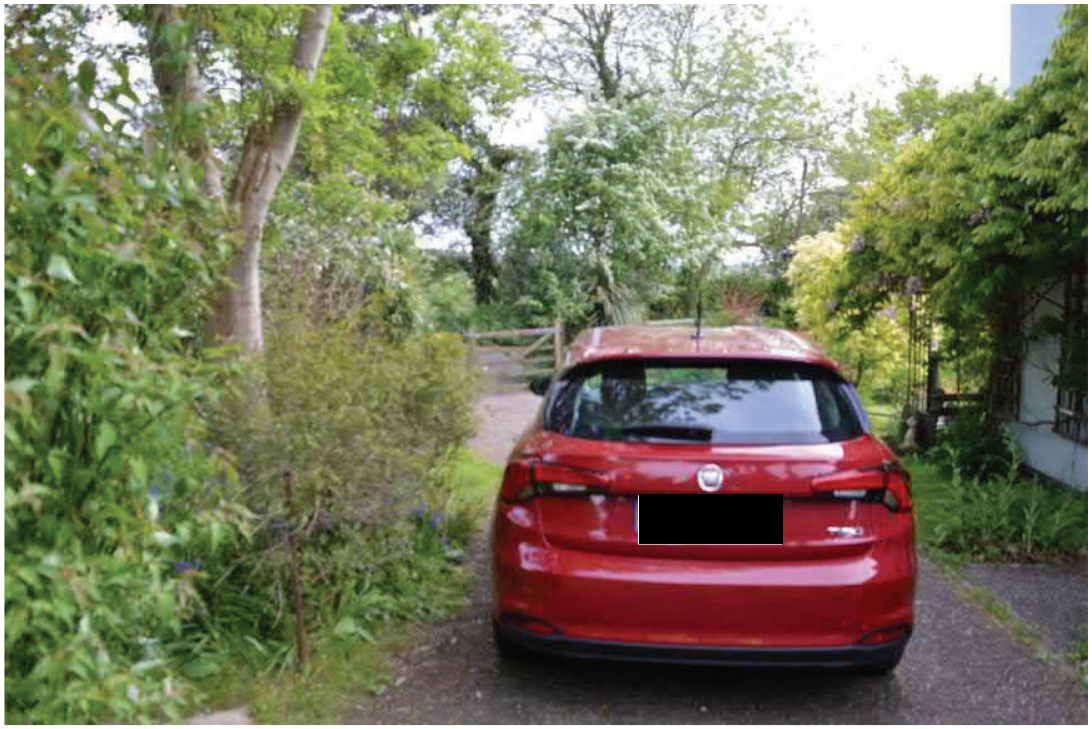
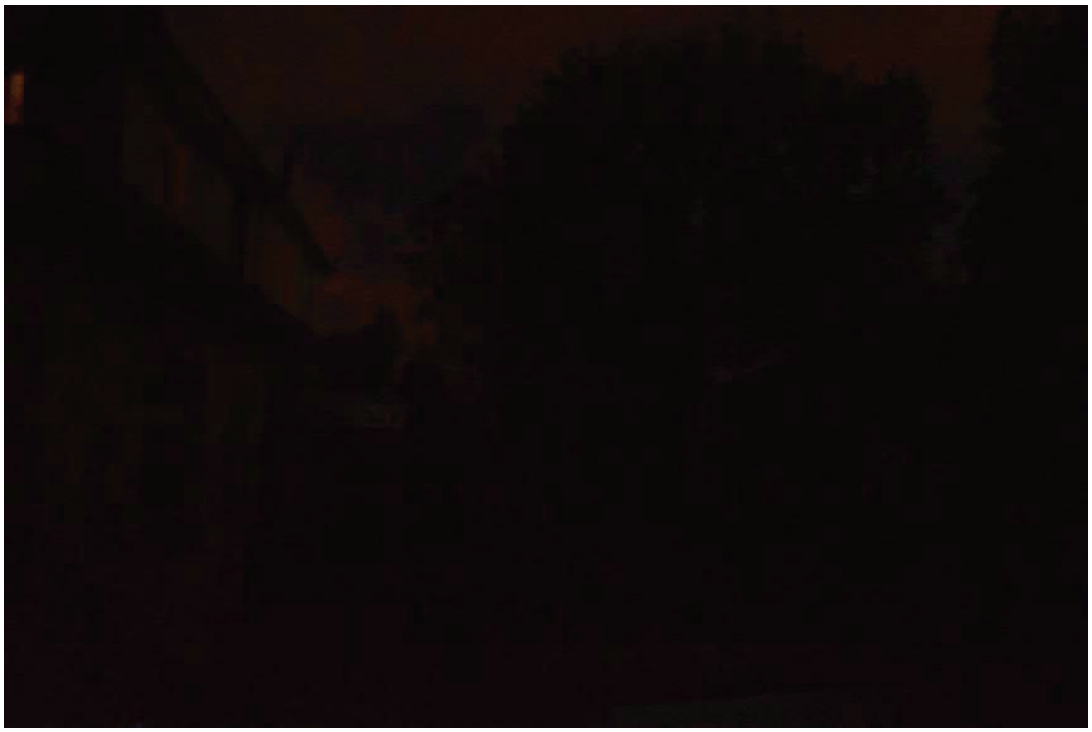


Figure 1.54: Survey viewpoint 8 – night-time looking south

Figure 1.55: Survey viewpoint 8 – day-time looking west

Figure 1.56: Survey viewpoint 8 – night-time looking west



Survey viewpoint 9

Figure 1.57: Survey viewpoint 9 – day-time looking north

Figure 1.58: Survey viewpoint 9 – night-time looking north

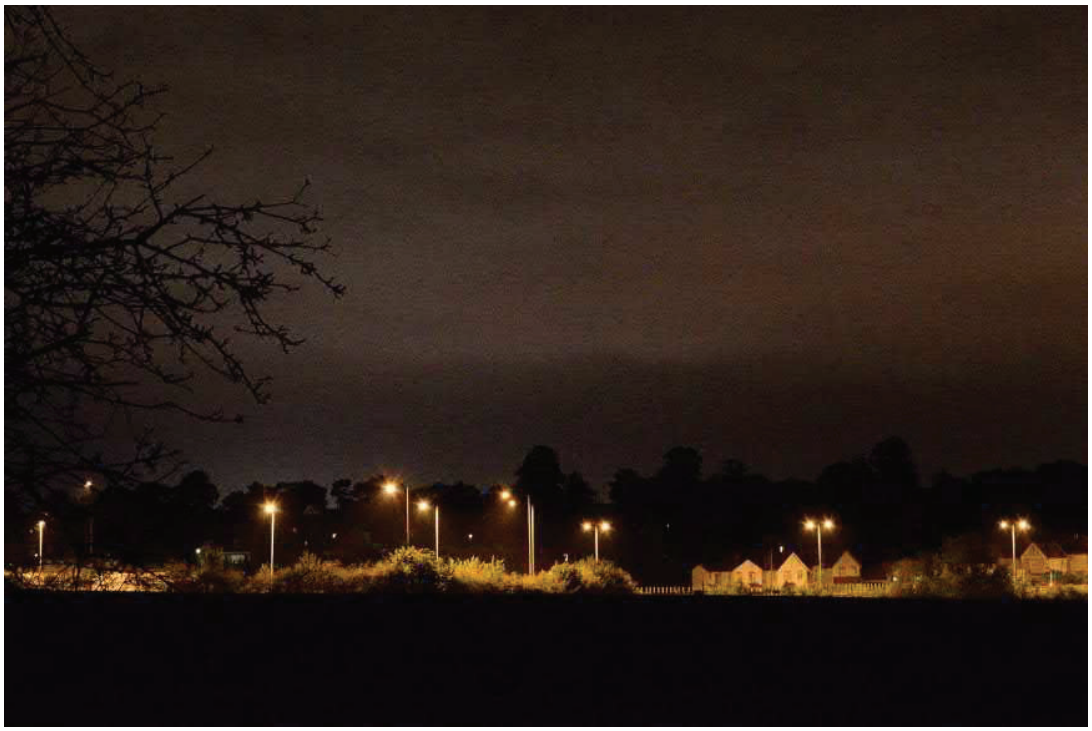


Figure 1.59: Survey viewpoint 9 – day-time looking east

Figure 1.60: Survey viewpoint 9 – night-time looking east

Figure 1.61: Survey viewpoint 9 – day-time looking south

Figure 1.62: Survey viewpoint 9 – night-time looking south

Figure 1.63: Survey viewpoint 9 – day-time looking west

Figure 1.64: Survey viewpoint 9 – night-time looking west

Survey viewpoint 10

Figure 1.65: Survey viewpoint 10 – day-time looking north

Figure 1.66: Survey viewpoint 10 – night-time looking north

Figure 1.67: Survey viewpoint 10 – day-time looking east

Figure 1.68: Survey viewpoint 10 – night-time looking east

Figure 1.69: Survey viewpoint 10 – day-time looking south

Figure 1.70: Survey viewpoint 10 – night-time looking south

Figure 1.71: Survey viewpoint 10 – day-time looking west

Figure 1.72: Survey viewpoint 10 – night-time looking west

Survey viewpoint 11

Figure 1.73: Survey viewpoint 11 – day-time looking north

Figure 1.74: Survey viewpoint 11 – night-time looking north

Figure 1.75: Survey viewpoint 11 – day-time looking east

Figure 1.76: Survey viewpoint 11 – night-time looking east

Figure 1.77: Survey viewpoint 11 – day-time looking south

Figure 1.78: Survey viewpoint 11 – night-time looking south

Figure 1.79: Survey viewpoint 11 – day-time looking west

Figure 1.80: Survey viewpoint 11 – night-time looking west

Survey viewpoint 12

Figure 1.81: Survey viewpoint 12 – day-time looking north

Figure 1.82: Survey viewpoint 12 – night-time looking north

Photograph unavailable.

Figure 1.83: Survey viewpoint 12 – day-time looking east

Figure 1.84: Survey viewpoint 12 – night-time looking east (alternative viewpoint location)

Figure 1.85: Survey viewpoint 12 – day-time looking south

Figure 1.86: Survey viewpoint 12 – night-time looking south (alternative viewpoint location)

Figure 1.87: Survey viewpoint 12 – day-time looking west

Figure 1.88: Survey viewpoint 12 – night-time looking west

Photograph unavailable.

Survey viewpoint 13

Figure 1.89: Survey viewpoint 13 – day-time looking north

Figure 1.90: Survey viewpoint 13 – night-time looking north

Photograph unavailable.

Figure 1.91: Survey viewpoint 13 – day-time looking east

Figure 1.92: Survey viewpoint 13 – night-time looking east

Photograph unavailable.

Figure 1.93: Survey viewpoint 13 – day-time looking south

Figure 1.94: Survey viewpoint 13 – night-time looking south

Photograph unavailable.

Figure 1.95: Survey viewpoint 13 – day-time looking west

Figure 1.96: Survey viewpoint 13 – night-time looking west

Photograph unavailable.

Survey viewpoint 14

Figure 1.97: Survey viewpoint 14 – day-time looking north

Figure 1.98: Survey viewpoint 14 – night-time looking north

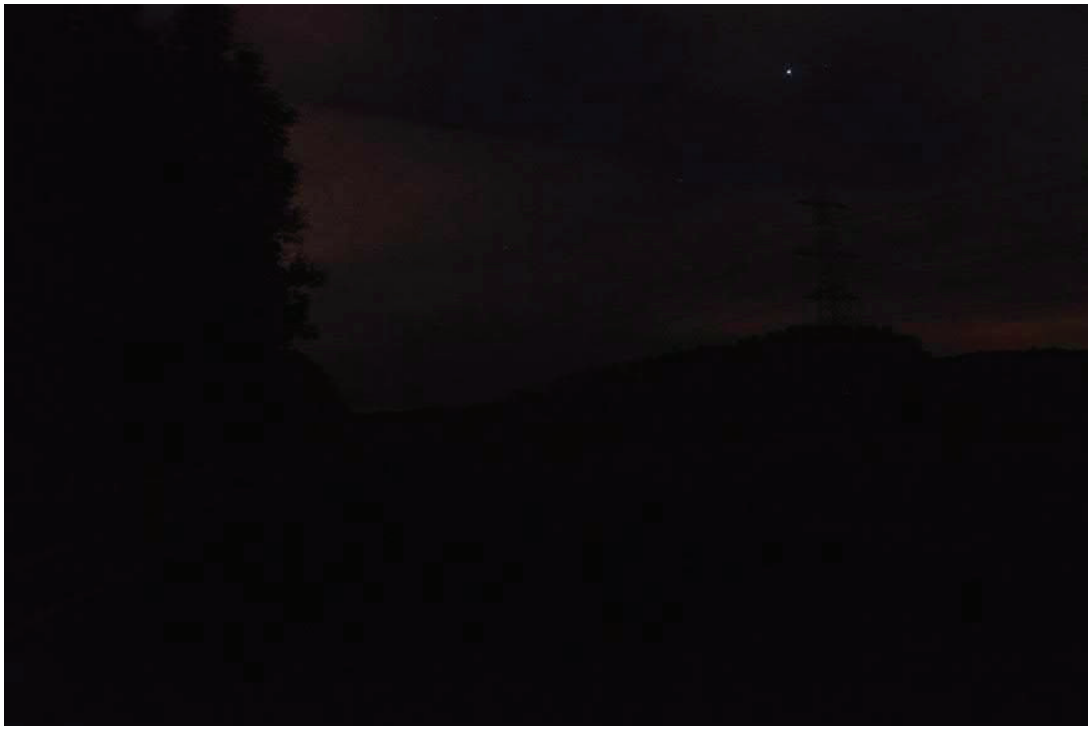


Figure 1.99: Survey viewpoint 14 – day-time looking east

Figure 1.100: Survey viewpoint 14 – night-time looking east

Figure 1.101: Survey viewpoint 14 – day-time looking south

Figure 1.102: Survey viewpoint 14 – night-time looking south

Figure 1.103: Survey viewpoint 14 – day-time looking west

Figure 1.104: Survey viewpoint 14 – night-time looking west

Survey viewpoint 15

Figure 1.105: Survey viewpoint 15 – day-time looking north

Figure 1.106: Survey viewpoint 15 – night-time looking north

Figure 1.107: Survey viewpoint 15 – day-time looking east

Figure 1.108: Survey viewpoint 15 – night-time looking east

Figure 1.109: Survey viewpoint 15 – day-time looking south

Figure 1.110: Survey viewpoint 15 – night-time looking south

Figure 1.111: Survey viewpoint 15 – day-time looking west

Figure 1.112: Survey viewpoint 15 – night-time looking west

Appendix C – Light meter certificate of calibration

Certificate of Calibration

Issued by: BSRIA Instrument Solutions - A division of BSRIA Limited

Date of issue: 26 April 2018

Certificate number STD_105867

BSRIA

Old Bracknell Lane West, Bracknell,
Berkshire RG12 7AH
T: +[redacted]
E: instruments@bsria.co.uk
W: www.bsria.co.uk/instruments

[redacted]

Approved signatory

Customer: Instrument Solutions
Old Bracknell Lane West
Bracknell Berkshire RG12 7AH

Date received: 26 April 2018

Instrument:

BSRIA I.D.:	202892
Description:	Light meter
Manufacturer:	Konica Minolta
Model:	T-10A
Serial number:	20015630
Procedure version:	B6F11V1

Laboratory conditions:

Temperature: 20 °C ± 4 °C Relative humidity: < 75 %rh
Mains voltage: 240 V ± 10 V Mains frequency: 50 Hz ± 1 Hz

Comments:

Instrument calibration conducted as found - no adjustments undertaken.

Instrument was zeroed prior to the start of the calibration.

Calibration information:

The instrument was calibrated by comparison against laboratory reference equipment whose values are traceable to recognised National Standards. This is an electronic document that has been signed digitally.

The uncertainties quoted refer to the calibration only and are not intended to indicate any long term instrument specification/performance.

Calibrated by: [redacted] [redacted] **Date of calibration:** 26 April 2018

This certificate provides traceability of measurement to recognised National Standards, and to the units of measurement realised at the National Physical Laboratory or other recognised National Standards laboratories.

Certificate of Calibration

As Found Results

Certificate number
STD_105867

Reference equipment used in the calibration:

Instrument description	Serial number	Certificate number	Last cal. date	Cal. period
Light Bench (ZZMLB02)	18425/2 & 18426/1	N/A	17/01/2018	52 Weeks
Light Bench (ZZMLB03)	18425/1 & 18427/1	N/A	17/01/2018	52 Weeks
Distance Measuring System (ZZMLB04)	4816	N/A	04/01/2018	52 Weeks

Calibration uncertainties:

Illuminance : 0 to 2000 lux ±5 % of applied value
Total uncertainty equals the above plus the devices resolution.

Instrument contents:

Main unit	Yes
Detector head	Yes
Zero cap	Yes
Meter adapter head	Yes
Cat 5 cable	Yes
Receptor head	Yes
x2 batteries fitted	Yes
x2 batteries spare	Yes
Manual	Yes
Certificate	Yes
Soft case	Yes
Hard carry case	Yes

Inspection results:

Visual inspection	Pass
Integrity seals	Pass
Memory cleared	Pass
Mode set to lx	Pass

Certificate of Calibration

As Found Results

Certificate number STD_105867

Calibration procedure:

The instrument was calibrated against laboratory standards which are themselves traceable back to National Standards. The illuminance measurements were conducted in accordance with the methodology contained in BS667 using a tungsten filament lamp with a colour temperature of 2856k. Illuminance levels were calculated using an inverse square law with respect to distance away from a tungsten filament lamp source.

Calibration results:

Illuminance - lux range

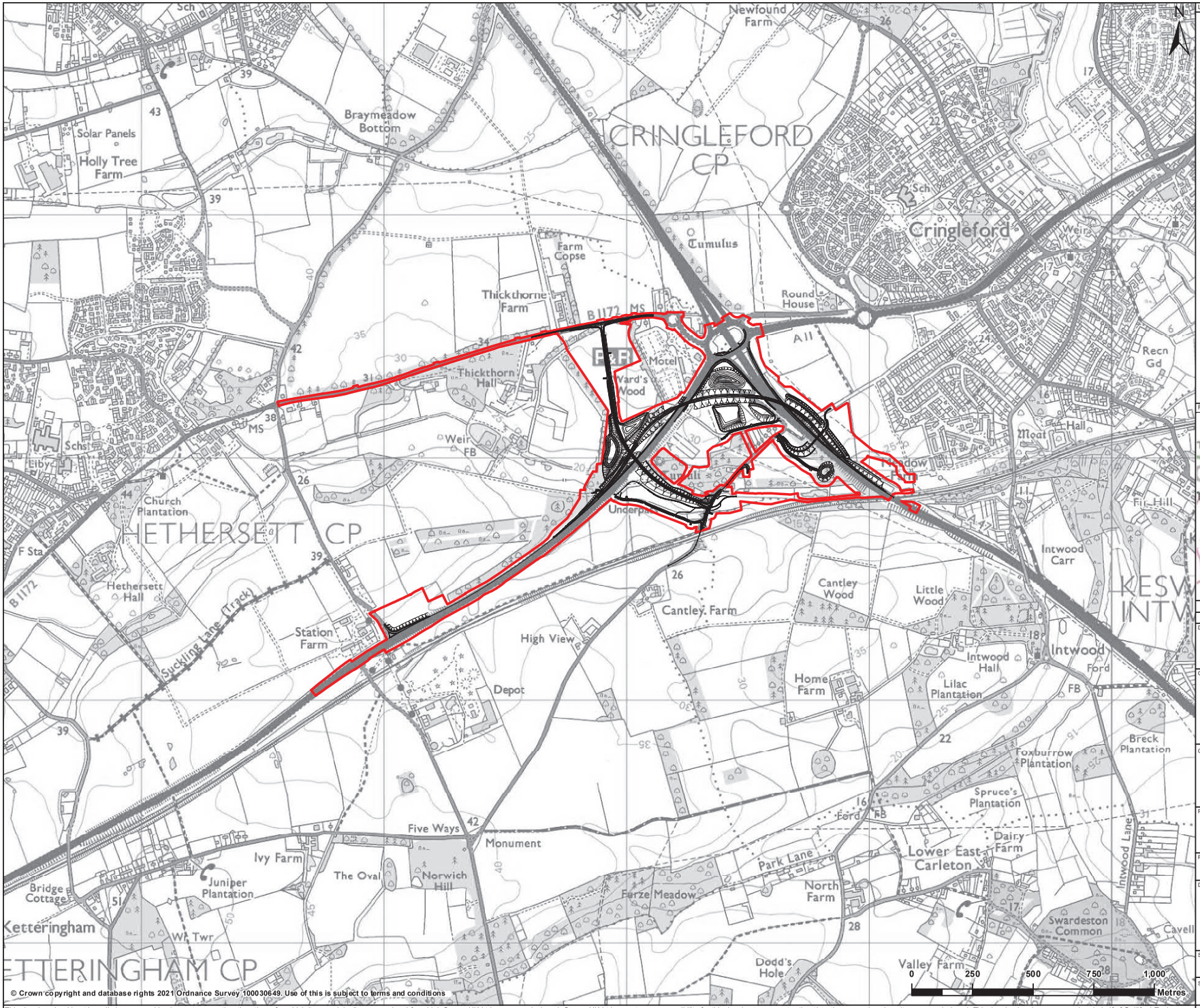
Unit under test display zeroed before test Pass

Specification	Applied	Indicated	Correction	% of Spec.	Comment
±2.50 lux	50.00 lux	50.3 lux	-0.30 lux	12.00%	
±5.0 lux	100.0 lux	100.2 lux	-0.2 lux	4.00%	
±10.0 lux	200.0 lux	199.5 lux	0.5 lux	5.00%	
±25.0 lux	500.0 lux	497.0 lux	3.0 lux	12.00%	
±50.0 lux	1000.0 lux	984.0 lux	16.0 lux	32.00%	
±100.0 lux	2000.0 lux	1933.0 lux	67.0 lux	67.00%	

Any test points marked with a * do not comply with instrument specification.

End.

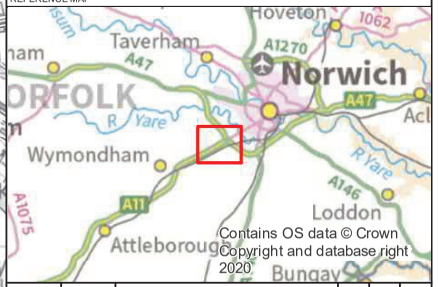
Annex 3- DCO Boundary



LEGEND

- DCO boundary
- Proposed scheme design

REFERENCE MAP



REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	20/01/2021	First edition	AC	FG	FG

DESIGNER: SWECO

CONTRACTOR: GallifordTry

CLIENT: highways england

PROJECT TITLE: A47/A11 THICKTHORN JUNCTION

PROJECT STAGE: PCF STAGE 3

DRAWING TITLE: FIGURE 1.1 - SITE LOCATION
TR010037/APP/6.2

SUITABILITY: FOR INFORMATION

SHEET SIZE	SCALE	STATUS
A3	1:15,000	S2

DRAWING NUMBER: HE551492-GTY-EGN-000-DR-LX-30001