

Moorhill Road, West End, Southampton, SO30 3AZ



Lighting Assessment

14th October 2022
784-B029375

PRESENTED TO

Highwood Group

PRESENTED BY

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EXECUTIVE SUMMARY

Tetra Tech Limited were commissioned by Highwood Group to prepare a Lighting Assessment to support the planning application for the construction of a proposed 70-bed care home on Moorhill Road in West End, Southampton, SO30 3AZ.

Lighting plans have been designed by Tetra Tech and used to produce a model of the proposed development within DIALux software in accordance with the appropriate criteria.

The assessment has concluded that the risk of the proposed scheme resulting in exceedances of either the ILP pre-curfew or post-curfew obtrusive light limitations at local residential receptors will be low.

Following the installation of appropriate lighting as detailed in this report, the risk of the proposed development resulting in exceedances of 1 lux along potential bat foraging/commuting routes and dark corridors is low at all ecological receptor locations.

The assessment demonstrates that there is a low risk of significant adverse impacts on local sensitive residential and ecological receptors, and that the proposed development does not conflict with any national or local planning policies regarding lighting.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
CIBSE	Chartered Institute of Building Services Engineers
CIE	Commission on Illumination
ILP	Institution of Lighting Professionals
LDF	Local Development Framework
LP	Local Plan
CS	Core Strategy
DPD	Adopted Development Plan Documents
SPD	Adopted Supplementary Planning Documents
SG	Endorsed Supplementary Guidance Documents
NGR	National Grid Reference
PPS	Planning Policy Statement
NPPF	National Planning Policy Framework
Lx	Lux
ULR	Upward Lighting Ratio

1.0 INTRODUCTION

Tetra Tech Limited were commissioned by Highwood Group to prepare a Lighting Assessment to support the planning application for the construction of a proposed 70-bed care home on Moorhill Road in West End, Southampton, SO30 3AZ.

1.1 SITE LOCATION AND CONTEXT

The development site currently consists of open land, the approximate national grid reference of which is 447109:113546. Highwood Group is seeking planning permission for a care home at land at Moorhill Road, Southampton.

The proposed development is bounded by:

- Private open land to the north. There is no existing lighting at this location.
- Telegraph Woods to the east – a large public wooded area. There is no existing lighting at this location.
- Private open land to the south. There is no existing lighting at this location.
- Moorhill Road to the west alongside some residential properties. There is some existing street lighting and light from residential properties present at this location.

Reference should be made to **Figure 1-1** for a visual representation of the application site and surrounding area.

1.2 LIGHTING DESIGN AND ASSESSMENT - OVERVIEW

The proposed development will require the installation of a number of luminaires that have the potential to increase existing light levels at sensitive locations within the vicinity of the site. The following stages have therefore been undertaken in order to produce a suitable lighting layout and assess potential impacts:

- Baseline survey;
- Quantitative assessment of potential lighting impacts at existing light sensitive receptors bordering the proposed development site, based on the proposed external lighting design;
- Formulation of appropriate mitigation measures, where necessary, in order to minimise the potentially detrimental impacts of the proposed lighting scheme.

Figure 1-1 – Site Boundary



2.0 POLICY, LEGISLATION AND RELEVANT AGENCIES

2.1 DOCUMENTS CONSULTED

The following documents were consulted during the undertaking of this assessment:

- Guidance Notes for the Reduction of Obtrusive Light, The Institution of Lighting Professionals, 2021;
- National Planning Policy Framework, Ministry of Housing, Communities & Local Government, July 2021;
- Planning Practice Guidance on Light Pollution, Ministry of Housing, Communities & Local Government, 1st November 2019;
- The Conservation of Habitats and Species Regulations, as amended, 2017;
- Environmental Protection Act, 1990;
- Statutory Nuisance from Insects and Artificial Light, Guidance on Sections 101 to 103 of the Clean Neighbourhoods and Environment Act 2005, DEFRA 2006;
- Artificial Lighting and Wildlife Interim Guidance: Recommendations to Help Minimise the Impact of Artificial Lighting, Bat Conservation Trust, 2014;
- BS EN 12464-2: Lighting of Work Places - Outdoor Work Places, British Standards Institute, 2007;
- BS EN 13201-4: Road Lighting – Methods of Measuring Lighting Performance, 2003;
- BS 5489-1: Code of Practice for the Design of Outdoor Lighting - Lighting of Roads and Public Amenity Areas, British Standards Institute, 2013;
- PLG 04- Guidance on Undertaking Environmental Lighting Impact Assessments, ILP, 2013;
- Bats and artificial lighting in the UK, Institution of lighting professionals, Bat Conservation Trust, 2018, and;
- City of Southampton Local Plan Review 2015, Adopted March 2015.
- Eastleigh Borough Local Plan 2016-2036, Adopted June 2018.

2.2 LEGISLATIVE FRAMEWORK

Light pollution was introduced within the Clean Neighbourhoods and Environment Act (2005) as a form of statutory nuisance under the Environmental Protection Act (1990), which was amended to include the following definition:

“(fb) artificial light emitted from premises so as to be prejudicial to health or nuisance;”

Although light was described as a statutory nuisance, no prescriptive limits or rules have been set for assessment. Guidance within the National Planning Practice Guidance with regards to Light pollution has been referred to while producing this assessment as well as documents produced by the International Commission on Illumination (CIE), Institution of Lighting Professionals (ILP) and the Chartered Institute of Building Services Engineers (CIBSE).

2.3 DESIGN STANDARDS

2.3.1 National Standards

The appropriate lighting design criteria for the scheme are contained within:

- BS EN 12464-2: Lighting of Work Places – Outdoor Work Places, 2014;
- BS 5489-1: Code of Practice for the Design of Outdoor Lighting – Lighting of Roads and Public Amenity Areas, 2020; and,
- BS EN 13201-2: Road Lighting – Performance Requirements, 2015.

Good lighting design also includes luminaires that have been selected to minimise light intrusion and glare to pedestrians and drivers, as discussed within the ILP document 'Guidance Notes for the Reduction of Obtrusive Light'.

2.3.2 Best Practice Design

As well as meeting the statutory design standards outlined in section 2.3.1, the external lighting design has sought to meet a number of criteria to ensure that the environmental effects of artificial lighting are managed to a high standard. These criteria are:

- All external lighting schemes must not have an upward lighting ratio (ULR) of more than 2.5%;
- All new column mounted luminaires shall be fitted with flat glass where appropriate to aid 2.5% upward light discharge;
- Where appropriate, luminaires on the site boundary will be fitted with light baffles to prevent light spill.
- Where possible, lighting will be controlled via Central Management System (CMS) time and light level sensors with controls capable of being adjusted and remotely set to adapt to local needs as required.

2.4 PLANNING POLICY AND GUIDANCE

2.4.1 National Policy

The National Planning Policy Framework (NPPF), February 2019 principally brings together and summarises the suite of Planning Policy Statements (PPS) and Planning Practice Guidance (PPG) which previously guided planning policymaking. The NPPF broadly retains the principles of PPS 23: Planning and Pollution Control and with regard to light pollution, paragraph 180 states that:

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

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

The National Planning Practice Guidance web-based resource was launched by the Department for Communities and Local Government (DCLG) on 6 March 2014 and updated for lighting on 1st November 2019 to support the National Planning Policy Framework and make it more accessible. It states that “for maximum benefit, the best use of artificial light is about getting the right light, in the right place and providing light at the right time”. In light of this guidance, the assessment has considered the following implications of the proposed lighting design:

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.
- Will a new development, or a proposed change to an existing site, be likely to materially alter light levels in the environment around the site and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?
- Will the impact of new lighting conflict with the needs of specialist facilities requiring low levels of surrounding light (such as observatories, airports and general aviation facilities)? Impacts on other activities that rely on low levels of light such as astronomy may also be a consideration but will need to be considered in terms of both their severity and alongside the wider benefits of the development.
- Is the development in or near a protected area of dark sky or an intrinsically dark landscape where new lighting would be conspicuously out of keeping with local nocturnal light levels, making it desirable to minimise or avoid new lighting?
- Would new lighting have any safety impacts, for example in creating a hazard for road users?
- Is a proposal likely to have a significant impact on a protected site or species? This could be a particular concern where forms of artificial light with a potentially high impact on wildlife and ecosystems (e.g. white or ultraviolet light) are being proposed close to protected sites, sensitive wildlife receptors or areas, including where the light is likely to shine on water where bats feed.
- Does the proposed development include smooth, reflective building materials, including large horizontal expanses of glass, particularly near water bodies? (As it may change natural light, creating polarised light pollution that can affect wildlife behaviour).

If the answer to any of the above questions is ‘yes’, consideration should be made for:

- where the light shines;
- when the light shines;
- how much light shines; and
- possible ecological impact.

2.4.2 Local Policy

Following a review of the adopted Eastleigh Borough Local Plan 2016-2036, the following policies were identified as being relevant to potential light impacts associated with the proposed scheme:

“Policy DM8, Pollution

Development will not be permitted if it is likely to cause loss of amenity or impact on public health or other unacceptable environmental impacts through:

- i. air pollution (including odours or particulate emissions);*
- ii. pollution of surface, underground, coastal waters or other watercourses;*
- iii. noise or vibration;*
- iv. light intrusion; or*
- v. land contamination.”*

“Policy DM14, Parking

Proposals to provide new car parks, extend existing car parks or provide workplace park and ride facilities will be permitted if: ...

- ...iv. the design, layout, planting and landscaping and lighting provision addresses visual and landscape impacts, noise, lighting and impacts on residential amenity.”*

3.0 METHODOLOGY

The Lighting Assessment includes the establishment of baseline ambient light conditions and an evaluation of impacts associated with the lighting design. This includes an assessment of change in light obtrusion at existing receptor locations.

Light modelling was undertaken using DIALux software, an independent lighting model which is capable of calculating daylight and artificial lighting scenes in interior and exterior scenarios. The model incorporates ILP, CIE 112 and BS EN 12464-2 calculation methodologies and is commonly used for lighting impact assessment.

3.1 LIGHTING DESIGN

The lighting scheme for the development was designed in accordance with the previously outlined standards and guidance. The design of the lighting has been undertaken in a manner such as to address two potentially conflicting needs; namely, on the one hand, to provide a safe environment for the movement of residents when the natural lighting levels fall and, on the other hand, to meet the light obtrusion limitations stated within the relevant standards and guidance in order to avoid any detriment to local amenity and wildlife.

Modelling for the assessment includes luminaires considered appropriate for the proposed residential areas of the development following the use of lights that are consistent with those used at nearby approved development and discussions with the lighting design team, as shown below.

Lighting modelled on proposed development

- DW Windsor Kirium Pro Mini 4LED A3 CLO 500mA UMSUG 42 0007 0000 100 5m Columns
- DW Windsor Pharola DS 2m Columns

3.2 QUANTITATIVE LIGHTING ASSESSMENT

3.2.1 Obtrusive Light

Baseline light conditions were determined during a site survey of the existing site and the surrounding area. A lighting model was subsequently developed to represent the proposed external lighting scheme and to enable the obtrusive light from the proposed development to be calculated at local receptors.

The ILP has developed an Environmental Zone classification system for the categorisation of sensitive receptor locations based on typical levels of baseline obtrusive light. This is summarised in **Table 3-1**.

Table 3-1 – Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 t 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

For each Environmental Zone, recommended obtrusive light limits for exterior lighting installations have also been determined. These are summarised in **Table 3-2** to **Table 3-4**.

Table 3-2 shows the maximum allowable illuminance in the vertical plane for each Environmental Zone for pre-curfew scenarios (after 07:00 hours) and post-curfew scenarios (after 23:00).

Table 3-3 shows the maximum allowable luminous intensity emitted by the luminaires relative to the position of each luminous intensity receptor location depending on what the Environmental Zone is.

Table 3-4 shows the maximum allowable Upward Light Ratio (ULR) for each Environmental Zone. If the modelled maximum values of vertical illuminance, the modelled maximum luminous intensity and the ULR are below the criteria in the tables below, they pass the assessment.

Table 3-2 – Maximum Values of Vertical Illuminance on Properties

Light technical parameter	Application conditions	Environmental Zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (Ev)	Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
	Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

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

Table 3-3 – Limits for the Luminous Intensity of Bright Luminaires

Light technical parameter	Application conditions		Luminaire group (projected area A_p in m ²)					
			$0 < A_p \leq 0.002$	$0.002 < A_p \leq 0.01$	$0.01 < A_p \leq 0.03$	$0.03 < A_p \leq 0.13$	$0.13 < A_p \leq 0.50$	$A_p > 0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	E0	Pre-curfew	0	0	0	0	0	0
		Post-curfew	0	0	0	0	0	0
	E1	Pre-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	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 AP representative area (m2)			0.0008	0.004	0.016	0.063	0.251	>0.5

NOTE:

1. D is the distance between the observer and the glare source in meters;
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 3-4 – Maximum Values of Upward Light Ratio (ULR) of Luminaires

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

The assessment determined the lighting levels and Environmental Zone classification in the vicinity of the

proposed development. Modelling of the lighting scheme was undertaken and predicted obtrusive light values compared with the relevant guidelines, as detailed within **Table 3-2** to **Table 3-4**.

Any roads in the proposed development will be lit in accordance with the relevant legislation. **Table 3-5** shows the relevant guidance when lighting roads and pedestrianised areas.

Table 3-5 – P Lighting Class

Class	Horizontal Illuminance		E ₀ GR _L	
	$\bar{E}_a$ [minimum maintained] lx	E_{min} [maintained] lx	E_{vmin} [maintained] lx	E_{scmin} [maintained] lx
P1	15,0	3,00	5,0	5,0
P2	10,0	2,00	3,0	2,0
P3	7,50	1,50	2,5	1,5
P4	5,00	1,00	1,5	1,0
P5	3,00	0,60	1,0	0,6
P6	2,00	0,40	0,6	0,2
P7	Performance not determined	Performance not determined		

a - To provide for uniformity, the actual values of the maintained average illuminance shall not exceed 1,5 times the minimum E value indicated for the class

Any car parks in the proposed development will be lit in accordance with the relevant legislation. **Table 3-6** shows the relevant guidance when lighting outdoor car parks.

Table 3-6 – Maintained light levels for outdoor car parks

Type of Area and Usage	E Average (lx)	Uniformity (lx)	Examples
Light Traffic	5.0	0.25	Parking areas of shops, terraced houses and cycle parks
Medium Traffic	10.0	0.25	Parking areas of department stores, offices and multipurpose building complexes
Heavy Traffic	20.0	0.25	Parking areas of major shopping centres, major sports and building complexes

For the purposes of this assessment, the car park associated with the proposed development will be lit to an average lux value of 5.0.

The potential environmental effects of the proposed development are identified, in so far as current knowledge of the site and development allows. The significance of potential environmental effects is assessed according to their scale (magnitude) and the sensitivity of the receptors.

For the purposes of this assessment, the effects of the development are considered to be 'significant' if:

- The development is predicted to exceed the maximum sky glow ULR at any surrounding receptor; and,
- The development is predicted to cause either an exceedance of the ILP obtrusive light trespass limitation at a receptor or if the development is predicted to cause an increase of more than 10% at an existing receptor where the ILP obtrusive light trespass limitation is already being exceeded.

4.0 BASELINE

This section provides a review of the existing lighting levels at the site in order to provide a benchmark against which to assess potential impacts associated with the development.

4.1 BASELINE SURVEY

4.1.1 Survey Conditions

A baseline lighting survey was undertaken on the Saturday 19th March 2022. The survey was undertaken after 23:30 to establish the existing post curfew lighting conditions.

4.1.2 Existing Light Sources

Existing light sources surrounding the site are some external lights from residential properties and street lighting along the roads immediately surrounding the site.

4.1.3 Survey Locations

Light monitoring was undertaken at a number of survey locations to determine variations in baseline light levels within the vicinity of the site. Where possible, monitoring at the boundary of the receptor locations was undertaken to provide the best possible representation of existing light obtrusion. Where this was not possible, monitoring was undertaken at the most appropriate representative location. Reference should be made to **Figure 4-1** for an illustrative site map of the monitoring locations.

The purpose of the survey is fourfold:

- The survey enables quantified light levels at (or as near as possible to) local sensitive receptor locations to be measured;
- The site survey also provides an understanding of any significant landforms and vegetation that can potentially provide a pathway screen between light sources and receptors;
- The survey enables the ILP environmental zone to be determined based on sound, quantified evidence; and,
- The survey enables existing significant sources of artificial light and natural screens to be accounted for outside of the quantified model predictions.

Figure 4-1 – Light Monitoring Locations

The survey therefore provides a robust understanding of the current artificial lighting illuminance levels currently experienced around the development site. The locations of all the light monitoring locations are summarised in **Table 4-1** below, and the results from the survey are contained in **Table 4-2**.

A series of measurements were taken at key points; a horizontal ground level measurement and four vertical measurements at 1.5m facing north, east, south and west in general accordance with the recommended monitoring method in the statutory guidance issued by the ILP. Illuminance levels can vary quite significantly over relatively small distances and even with slight changes in the plane of the lens. Therefore, the range of measurements taken over a monitoring length was recorded, to determine the minimum and maximum illuminance at receptor façades.

Table 4-1 – Base Light Monitoring Locations

Reference	Monitoring Location	Key Local Sources of Light
L1	Moorhill Road adjacent to High Firs House.	Street Light and internal residential lighting
L2	Moorhill Road adjacent to Ashdene.	Street Light and internal residential lighting
L3	Moorhill Road adjacent to Aripo.	Street Light and internal residential lighting
L4	Moorhill Road adjacent to Nyewood.	Street Light and internal residential lighting
L5	Moorhill Road opposite side to No.13 Pine Drive East.	Street Light and internal residential lighting
L6	Along the North-western boundary of the site entrance.	Street Lighting
L7	Along the Northern boundary mid-point	Faint and distant street lighting

Reference	Monitoring Location	Key Local Sources of Light
L8	At the North-eastern corner of site boundary.	Pitch dark, no visible sources of light
L9	Along the Eastern boundary mid-point.	Pitch dark, no visible sources of light
L10	At the South-eastern corner of site boundary.	Pitch dark, no visible sources of light
L11	Along the Southern boundary line approximately near the mid-point.	Pitch dark, no visible sources of light as plenty of tree cover
L12	Central to Eastern half of site.	Pitch dark, no visible sources of light
L13	At the South-western corner of site boundary.	Faint and distant street lighting, plenty of tree cover
L14	Central to Western half of site.	Faint and distant street lighting

4.1.4 Survey Results

The results of the monitoring are displayed in **Table 4-2**.

Table 4-2 – Survey Results

Reference	Recorded Illuminance (Lux)					Sky Quality (visual magnitudes per square arcsecond)
	Facing Up	Facing North	Facing East	Facing South	Facing West	
L1	2.83	0.35	1.23	2.31	0.34	15.61
L2	3.21	0.08	2.01	2.59	0.08	16.34
L3	3.15	0.75	1.20	2.06	0.74	15.94
L4	1.91	2.41	0.25	0.09	0.29	16.60
L5	0.43	0.39	0.12	0.84	0.31	17.78
L6	0.10	0.30	0.26	0.25	0.22	17.71
L7	0.01	0.00	0.00	0.00	0.00	18.91
L8	0.01	0.00	0.00	0.00	0.00	18.52
L9	0.01	0.00	0.00	0.00	0.00	18.93
L10	0.01	0.00	0.00	0.00	0.00	19.27
L11	0.01	0.00	0.00	0.00	0.00	20.63
L12	0.01	0.00	0.00	0.00	0.00	18.76
L13	0.04	0.01	0.00	0.04	0.02	20.27
L14	0.02	0.00	0.00	0.00	0.00	18.70

Following the environmental lighting survey, it was concluded that the proposed development site and the surrounding area should be classified as 'Environmental Zone E2 – Low District Brightness', in accordance with the ILP guidance limits outlined within **Table 3-2** for Sky Quality. This is considered representative of relatively dark outer suburban locations. Therefore, the permitted light trespass limit at an offsite receptor in the pre-curfew period (typically considered to be 07:00-23:00) is 5 lux and in the post curfew period (typically considered to be 23:00-07:00) is 1 lux.

4.2 RECEPTORS

The term 'receptors' includes any persons, locations or systems that may be susceptible to changes in environmental factors as a consequence of the development.

4.2.1 Residential Receptors

During the site survey, key residential properties were identified which have the potential to be affected by obtrusive light from the proposed development, as shown in **Table 4-3**. Reference should be made to **Figure 4-2** for an illustration of the residential receptors used for the purposes of this assessment. All the identified residential receptors are considered to be within ILP Environmental Zone E2. Each receptor was input into the model at a height of 4.0m (bungalows and single-storey building at height of 1.5m) at a distance of 10 cm from the building façade to represent illuminance at first-floor window level, representing a typical bedroom, which is deemed to be the most sensitive receptor room.

Table 4-3 – Residential Receptors Moorhill Site

ID	Description	ILP Environmental Zone
R1	Kyrenia, Moorhill Road	E2
R2	Ashdene, Moorhill Road	E2
R3	Hillcrest, Moorhill Road	E2
R4	Aripo, Moorhill Road	E2
R5	Little Oak Cottage, Moorhill Road	E2
R6	Nyewood, Moorhill Road	E2

Figure 4-2 – Modelled Residential Receptors

4.2.2 Ecological Receptors

Lighting associated with the operational phase of the proposed development has the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The Conservation of Habitats and Species Regulations (2017) and subsequent amendments require competent authorities to review planning applications and consents that have the potential to impact on National Site Network (NSN) designated sites (e.g. Special Areas of Conservation). For the purposes of this assessment, it was determined that a number of bat species could utilise the hedgerows and trees surrounding the site for commuting/foraging purposes. In order to represent a worst-case scenario, the assessment has assumed that potential bat species on site will be highly sensitive to artificial light.

For the purposes of the assessment, ecological receptor locations have been included at 14 points along the length of hedgerows and trees around and within the boundary of the site, at heights of 2m. Ecological receptors include locations where historical treelines and hedgerows are to be kept. **Table 4-4** below, provides a reference for these locations whilst a full spatial illustration of modelled ecological receptors is included in **Figure 4-3**.

Table 4-4 – Ecological Receptors

ID	Description
E1 – E3	East of site bordering Telegraph Woods
E4 – E7	Hedgerow along North border of site
E8 – E10	Existing treeline bordering Moorhill Road
E11 – E12	Existing treeline along South border of site
E13 – E14	Existing foliage in Southwest corner of site

Figure 4-3 – Modelled Ecological Receptors

5.0 LIGHTING ASSESSMENT

Potential impacts associated with the proposed lighting design at locations in the vicinity of the site were assessed as described in the following sections.

5.1 OBTRUSIVE LIGHT MODELLING

The detailed lighting design is displayed in **Figure 5-1** and **Figure 5-2**. A detailed lighting plan has been designed by Tetra Tech Ltd and included within a DIALux model of the proposed development in accordance with appropriate criteria. Reference should be made to **Figure 5-3** and **Error! Reference source not found.** for a 3D representation of the proposed model. Buildings surrounding the development site were also included in the model at heights of 8m (2-storey building) and 4m (1-storey building).

The assessment has considered the types of lighting used for the proposed residential areas and has been considered worst-case, as shown below.

Lighting modelled on proposed development

- DW Windsor Kirium Pro Mini 4LED A3 CLO 500mA UMSUG 42 0007 0000 100 5m Columns
- DW Windsor Pharola DS 2m Columns

The model is only able to accurately represent the effects of solid structures such as buildings and walls on light obtrusion. Non-solid barriers such as trees and hedges cannot be accurately modelled and therefore the effects of these are dealt with qualitatively outside the model calculations.

The assessment considers the effect of the proposed development in the pre-curfew and post-curfew periods. The assessment consists of a comparison between assumed baseline illuminance levels at each of the receptor locations against the predicted light obtrusion from the proposed development determined in lighting model. The assumed baseline illuminance levels are ILP Environmental Zone E2.

Where it was not practicable to measure existing illuminance at the receptor location, monitoring results from the nearest equivalent representative monitoring location are used.

The ULR of the proposed development has been calculated and referenced to the maximum permitted limitations for the relevant Environmental Zones of the receptor locations, as detailed in **Table 3-2** to **Table 3-4**.

Figure 5-1 – Detailed External Lighting Layout



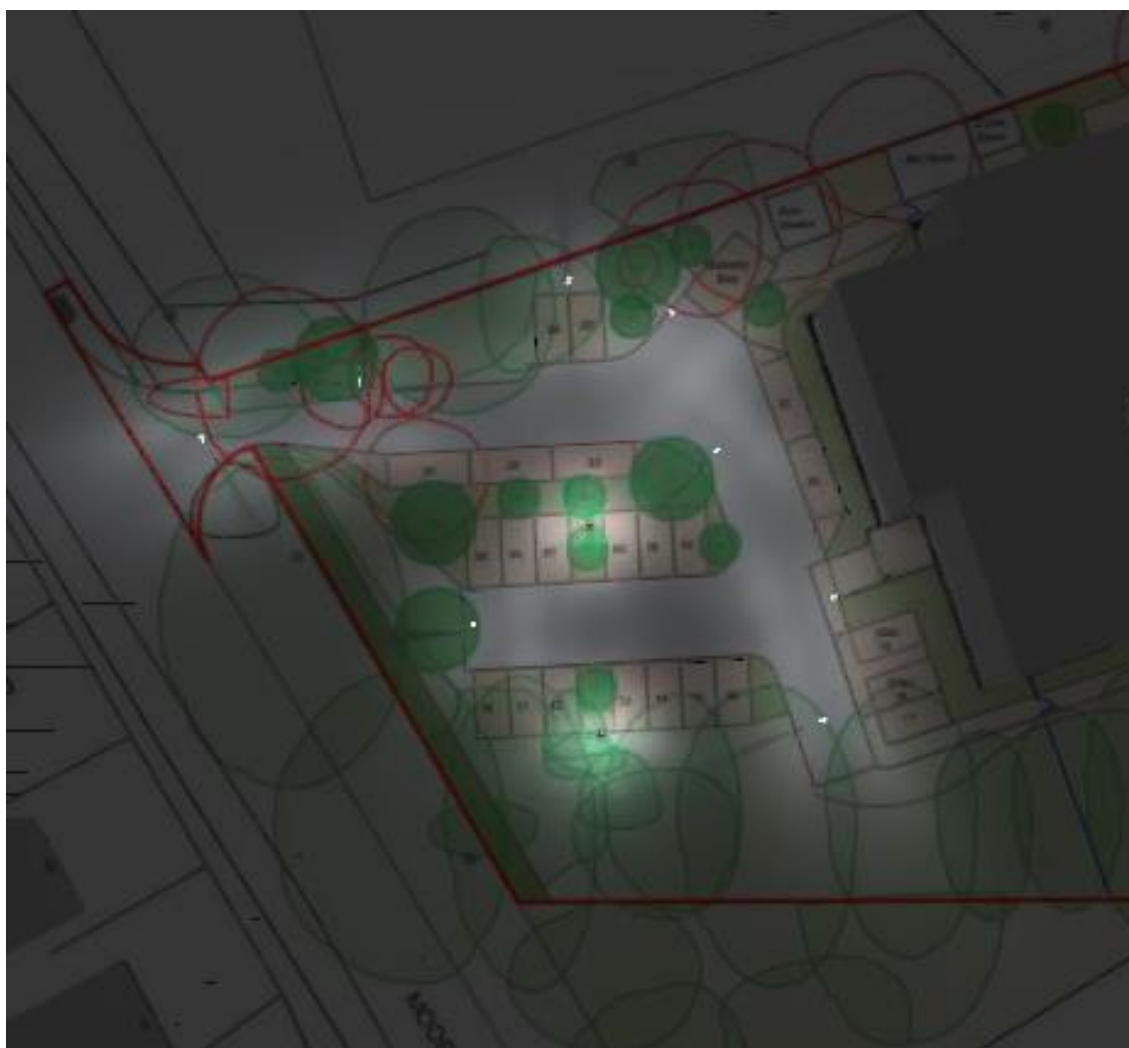
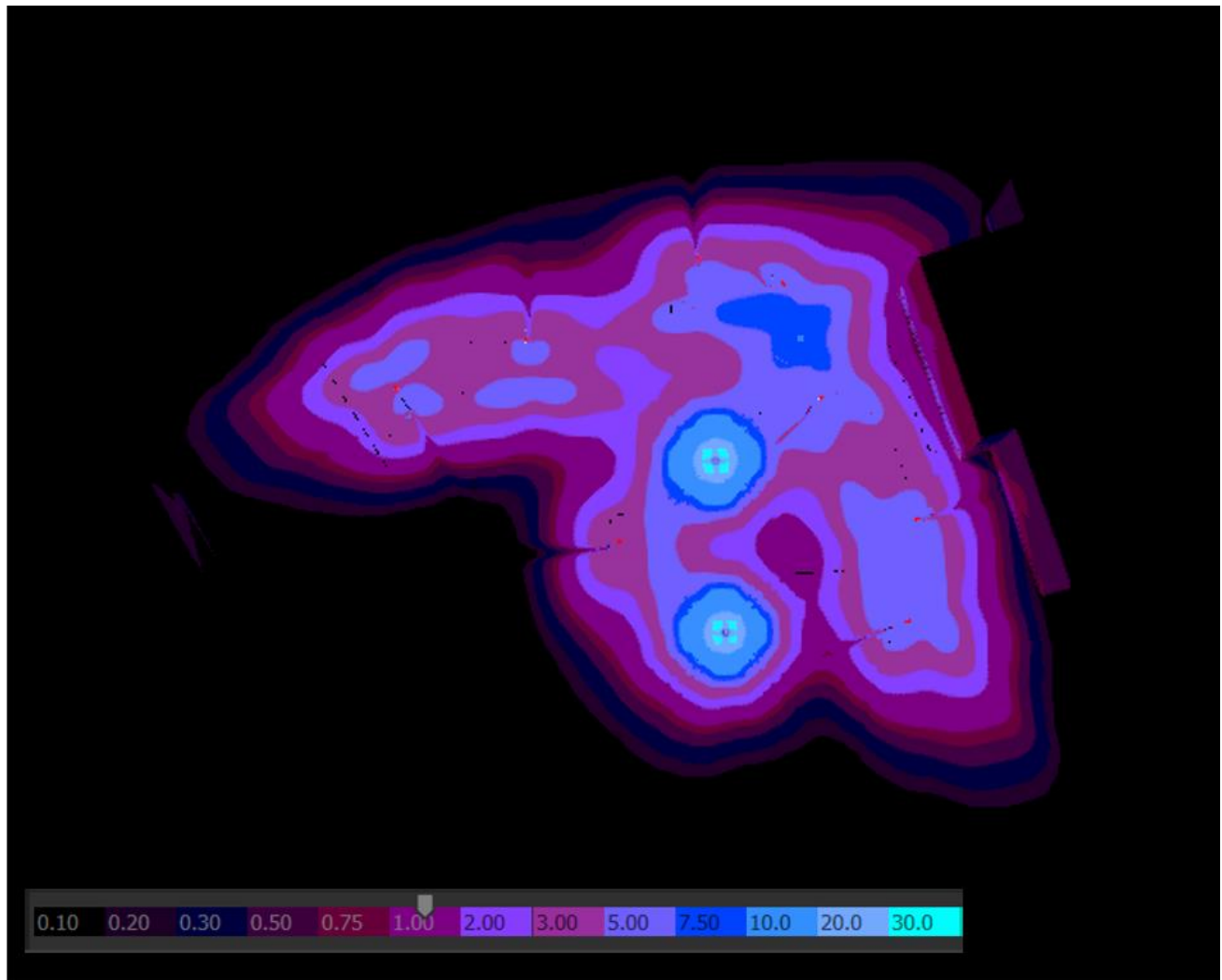
Figure 5-2 – Visual Representation of Proposed External Lighting Model

Figure 5-3 – Visual Representation of Lux Contours

The model is only able to accurately represent the effects of solid structures such as buildings and walls on light obstruction. Non-solid barriers such as trees and hedges cannot be accurately modelled and therefore the effects of these are dealt with qualitatively outside the model calculations.

The ULR of the proposed development has been calculated and referenced to the maximum permitted limitations for the relevant Environmental Zones of the receptor locations, as detailed in **Table 3-2** to **Table 3-4**.

5.1.1 Model Results

5.1.1.1 Residential Receptors

Table 5-1 below compares the modelled lighting arrangements to the ILP pre-curfew and post-curfew criteria limits for ILP Environmental Zone E2, in accordance with the classifications detailed in **Table 3-2** to **Table 3-4**.

Table 5-1 – Residential Receptor Assessment Results

ID	ILP Pre-curfew Criteria (Lx)	ILP Post-curfew Criteria (Lx)	Predicted Model Illuminance (lx)
R1	5.00	1.00	0.03
R2	5.00	1.00	0.04
R3	5.00	1.00	0.13
R4	5.00	1.00	0.10
R5	5.00	1.00	0.07
R6	5.00	1.00	0.05

As the proposed development site includes the installation of a public road, post-curfew lighting levels may be up to 1 lux as stated in **Table 3-2**. The assessment shows that the ILP pre-curfew and post-curfew Zone E2 criteria will not be exceeded any residential receptor locations as a result of lighting from the proposed development at, with a maximum predicted model illuminance of 0.13 lux at R3. Therefore, the proposed development is not predicted to result in any significant adverse impacts with respect to local sensitive residential receptors.

5.1.1.2 Ecological Receptors

It is believed that most bat emergence requires light levels below 1 lux for late emerging species, up to 14 lux for those that emerge earlier (Noctule and Pipistrelle). These lighting levels of 1 lux are required to ensure that bat commuting, and foraging routes are not impacted and that dark corridors beyond the limits of the site are retained. While some bat species, such as Pipistrelle are more tolerant with light levels above this criterion, it reflects worst-case assumptions concerning the sensitivity of those species present to background illuminance levels. As such, the assessment criteria represent a worst-case scenario in terms of impacts on emergence, commuting and foraging (Bat Conservation Trust, 2018).

When determining the likely impacts of lighting associated with the proposed development on sensitive ecological receptors, the assessment has considered the effect of lighting without mitigation. Impacts are

considered potentially significant where predicted illuminance exceeds 1 lux at ecological receptors. If this is the case, further consideration should be given to mitigation measures. **Table 5-2** shows the modelled lighting arrangements for the ecological receptors surrounding the site vicinity and within the site.

Table 5-2 – Ecological Receptor Assessment Results

ID	Predicted Model Illuminance (lx)
E1	0.00
E2	0.00
E3	0.00
E4	0.00
E5	0.01
E6	0.50
E7	0.59
E8	0.55
E9	0.69
E10	0.08
E11	0.09
E12	0.00
E13	0.00
E14	0.00

As illustrated by **Table 5-2**, light trespass associated with the proposed development does not exceed 1 lux at any of the 14 modelled ecological receptor locations adjacent to the site boundary and within the proposed site, with the maximum predicted model illuminance of 0.69 lux at E9. As such, lighting from the proposed development is not predicted to result in any significant adverse impacts with respect to local sensitive ecological receptors.

6.0 CONCLUSIONS

Tetra Tech Limited were commissioned by Highwood Group to prepare a Lighting Assessment to support the planning application for the construction of a 70-bed care home on Moorhill Road in West End, Southampton, SO30 3AZ.

Lighting plans have been designed by Tetra Tech and used to produce a model of the proposed development within DIALux software in accordance with the appropriate criteria.

The assessment has concluded that the risk of the proposed scheme resulting in exceedances of either the ILP pre-curfew or post-curfew obtrusive light limitations at local residential receptors will be low.

Following the installation of appropriate lighting as detailed in this report, the risk of the proposed development resulting in exceedances of 1 lux along potential bat foraging/commuting routes and dark corridors is low at all ecological receptor locations.

The assessment demonstrates that there is a low risk of significant adverse impacts on local sensitive residential and ecological receptors, and that the proposed development does not conflict with any national or local planning policies regarding lighting.

APPENDIX A – REPORT CONDITIONS

This Report has been prepared using reasonable skill and care for the sole benefit of Highwood Group (“the Client”) for the proposed uses stated in the report by – Tetra Tech Limited. Tetra Tech Limited exclude all liability for any other uses and to any other party. The report must not be relied on or reproduced in whole or in part by any other party without the copyright holder’s permission.

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The report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections'. Environmental conditions can vary, and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times. No investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather-related conditions. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions. The “shelf life” of the Report will be determined by a number of factors including; its original purpose, the Client's instructions, passage of time, advances in technology and techniques, changes in legislation etc. and therefore may require future re-assessment.

The whole of the report must be read as other sections of the report may contain information which puts into context the findings in any executive summary.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. Tetra Tech Limited accept no liability for issues with performance arising from such factors.