consulting engineers

REPORT

Project:	Land at Rectory Farm (North), Yatton
Subject:	Lighting Scheme and Assessment
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1 INTRODUCTION

Land at Rectory (North), Yatton is to be a residential development located to the west of Mendip Road in Yatton, North Somerset.

The site is situated on an area which has been identified as of importance for foraging and roosting bats, in particular the northern boundary, as well as two of the bridges spanning the drainage rhynes. It is therefore subject to a lighting assessment to analyse the potential impact from light spill onto bat habitat.

The purpose of this report is to:

- Confirm the policies and ecological parameters required for this project.
- Describe the methods used for simulation, analysis and calculation of the potential light spilled from the residential units and public realm lighting adjacent to bat habitat.
- Assess the impact this potential light pollution may have on the associated areas.
- Propose any necessary adjustments required to the lighting and building structure to reduce any light pollution to the required standard according to the guidance.
- Outline the public realm lighting to the development and confirm the design strategy.

1.1 BASELINE STUDY

There are no existing external luminaires within the project site boundary. As a result of this it has been proposed that a baseline study in this instance would be irrelevant. The baseline for the site and neighbouring areas has therefore been assumed as 0 lux, and therefore the design of the new development will be based on a worst-case analysis.

1.2 CONSTRUCTION OPERATIONS

During construction the temporary construction lighting will need to be carefully considered to ensure minimal impact on the wider environment. The following recommendations will be observed:

- All luminaires will be mounted within the site and aimed such that the main distribution is toward the works and limiting and/or preventing light spill outside of the site boundary.
- The artificial lighting will be controlled such that it is only on when absolutely necessary.
- The site will not be over lit.

Figure 1.1 – Plan view of proposed site layout, with Rectory Farm to the south.

2 LOCAL POLICY, GUIDANCE & STANDARDS

2.1 ECOLOGY LIGHT LEVEL REQUIREMENTS

The following design guides and standards are used when designing light installations in areas of ecological importance:

- ILP GN08:2018 Bats and Artificial Lighting in the UK
- ILP GN01:2011 Reduction of Obtrusive light
- Bats and Lighting in the UK, Bat Conservation Trust 2008

2.2 ROAD & PUBLIC REALM LIGHTING REQUIREMENTS

The following standards are used when designing light installations on roads and public realm areas.

- BS 5489-1: Design of Road Lighting.
- BS EN 13201-2: Road Lighting. Performance requirements.
- BS EN 12464-2: Light and Lighting – Lighting of outdoor work places. Outdoor work places.

3 LIGHTING CALCULATION PARAMETERS

3.1 CALCULATION SOFTWARE

The software used for this lighting analysis was Dialux Evo 11.0. Dialux is capable of planning, visualising, and performing lighting calculations for indoor and outdoor installations including roads. It is regarded as an industry standard and is one the most widely used light modelling packages.

3.2 ECOLOGY LIGHTING REQUIREMENTS

ILP GN08 recommends analysis showing predicted illumination levels both horizontally at ground level and vertically along critical bat habitat areas.

The light spill at ground level has been calculated across the whole site to ensure that limited light spill is impacting on the bat corridors. 0.5lx is the recommended maximum lux level on bat habitats. This is noted by the red zone on Figure 3.1.

Some of the sections of the road pass over bat corridors. After consultation with the ecologist, it has been assumed that if lux levels are controlled at the bottom of the rhynes then the development will not impact the foraging routes of bats using the area. Therefore, vertical planes have been modelled at the key crossing points. This is set at 3m below the profile grade line and rises to 1.5m below the profile grade line. This is noted by the blue arrows and lines in Figure 3.1.

Figure 3.1 – Plan view of proposed site layout, with Rectory Farm to the south

3.3 MITIGATION STRATEGIES

The following mitigation strategies have been implimented:

- Back shields are to be applied to all street lights which face onto the site boundaries.
- Columns have been carefully positioned and selected to ensure that the roadways are lit but not the surrounding area.
- All external lighting around the site is to be 3000K or warmer.

3.4 MODELLING ASSUMPTIONS

- Houses have been modelled as 5.7m tall blocks.
- Not all houses have been modelled at this stage and further modelling will be required to show the impact of internal lighting, if required.
- Internal lighting spill from housing and apartments, has not been included at this stage.
- Two buildings adjacent to the drainage ditch have been modelled as 2.85m tall, due to their significant contribution to blocking light spill to a bat commuter zone.
- The ground surface surrounding the drainage ditches has not been modelled, producing a conservative estimate of lux spill into the ditches.

3.5 EXTERNAL LIGHTING

3.5.1 Road Lighting

It is assumed that the roads will be adopted and the following strategy will need to be approved. A typical residential dimming regime is shown below.

All Night Operation	*[Sunset + 15 mins] to 00:00 AM*	*75%*
	00:00 AM to 05:00 AM	*50%*
	05:00 AM to [Sunrise - 15mins)	*75%*

Figure 3.2 – Extract from a typical council street lighting policy

For the road lighting calculations any spill from dwellings has been omitted, and the maintenance factor has been set to 0.8 to ensure that light levels will remain compliant. When the light spill is calculated, the maintenance factor is then set to 1, to show the impact the new columns will have from day one of installation.

The required lux levels are depicted in the table below.

Area	Lighting Standard	Lighting Class	Target E_{av}	Target E_{min}
Road	BS EN 13201-2	P4	5.0lx	1.0lx
Cycle Path	BS EN 13201-2	P4	5.0lx	1.0lx

3.5.2 Car Park Lighting

Car parks will be controlled by photocell and set to align with a standard residential dimming regime.

Area	Lighting Standard	Target E_{av}	Uniformity E_{av}/E_{min}
Car Park	BS EN 12464-2	10lx	0.4

All lamps are proposed to be TRT AMS4 fittings and will be:

- 3000K
- Columns to be 6m
- Combination of forward and road optics to illuminate the areas as required
- 0º tilt
- Back shields on luminaires

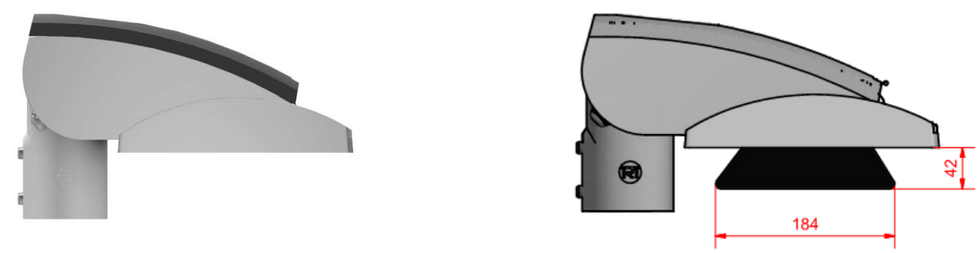


Figure 3.3 – TRT Aspect Mini (Right with back shield)

4 RESULTS

Displayed below are five sets of results. The five models depict strategies including:

1. Higher output luminaires with a larger spacing
2. Lower output luminaires at closer spacing
3. 1.1m walls along the paths at the two key rhyne crossing points, using the higher output luminaire scheme
4. As Strategy 1, but with the slab at rhyne crossing points widened by 1m on each side
5. As Strategy 2, but with the slab at rhyne crossing points widened by 1m on each side

4.1 VERTICAL PLANE RESULTS

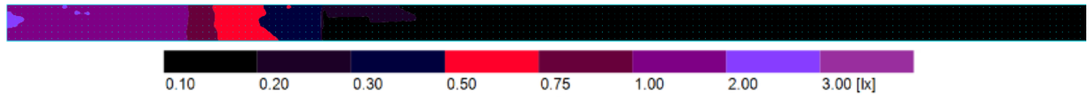
A vertical calculation surface is recommended in ILP GN08 in addition to horizontal results. This is to ensure that there are no sources of glare on a typical bat flight path.

The vertical plane was calculated as detailed in section 3.2. The planes modelled will be referred to as in Figure 4.1 below. For the vertical plane, the results with the worst lux spill have been displayed.

Figure 4.1 – Vertical Planes References

4.1.1 Strategy 1 – Higher output luminaires with larger spacing

Failing Planes: A (0.94lx), B (0.96lx), C (1.64lx), D (2.05lx), E (1.67lx), F (1.41lx), G (1.23lx), H (1.4lx)

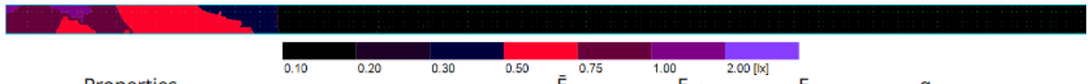


Properties	$\bar{E}$	E_{min}	E_{max}	g_1
Vertical Plane D Perpendicular illuminance Height: -2.250 m	0.42 lx	0.036 lx	2.05 lx	0.086

Figure 4.2 – Results on vertical plane D

4.1.2 Strategy 2 – Lower output luminaires at smaller spacing

Failings Planes: B (0.51lx), C (0.70lx), D (1.16lx), E (0.58lx), G (0.87lx)

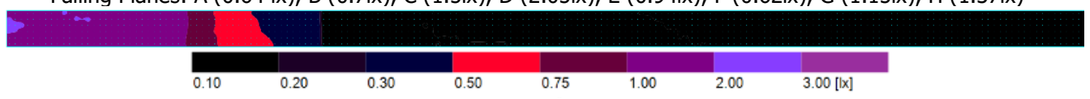


Properties	$\bar{E}$	E_{min}	E_{max}	g_1
Vertical Plane D Perpendicular illuminance Height: -2.250 m	0.21 lx	0.020 lx	1.16 lx	0.095

Figure 4.3 – Results on vertical plane D

4.1.3 Strategy 3 – 1.1m walls along 2no key rhyne

Failing Planes: A (0.64 lx), B (0.7lx), C (1.5lx), D (2.05lx), E (0.94lx), F (0.62lx), G (1.15lx), H (1.37lx)

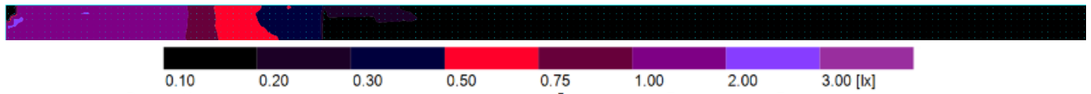


Properties	$\bar{E}$	E_{min}	E_{max}	g_1
Vertical Plane D Perpendicular illuminance Height: -2.250 m	0.41 lx	0.036 lx	2.05 lx	0.088

Figure 4.4 – Results on vertical plane D

4.1.4 Strategy 4 – As Strategy 1 with crossing points at 2no key rhynes widened by 1m on each side

Failing Planes: A (0.66 lx), B (0.83 lx), C (1.38 lx), D (2.04 lx), E (1.33 lx), F (1.04 lx), G (1.15 lx), H (1.35 lx)

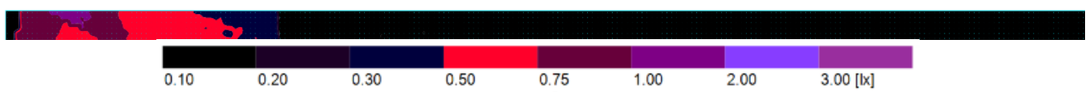


Properties	Ē	E_{min}	E_{max}	g_1
Vertical Plane D Perpendicular illuminance Height: -2.250 m	0.41 lx	0.036 lx	2.04 lx	0.088

Figure 4.5 – Results on vertical plane D

4.1.5 Strategy 5 – As Strategy 2 with crossing points at 2no key rhynes widened by 1m on each side

Failing Planes: B (0.51 lx), C (0.66 lx), D (1.16 lx), E (0.51 lx), G (0.65 lx)



Properties	Ē	E_{min}	E_{max}	g_1
Vertical Plane D Perpendicular illuminance Height: -2.250 m	0.20 lx	0.009 lx	1.16 lx	0.045

Figure 4.6 – Results on vertical plane D

4.2 LIGHT SPILL RESULTS

An indicative lux contour plan for each lighting strategy is displayed below. Effort has been made to reduce the lux levels around areas of ecological significance, as well as to minimise spill beyond the site boundary. As the light spill between Strategies 4, 5 and the other strategies is negligible, results have not been shown.

4.2.1 Strategy 1 – Higher output luminaires with larger spacing

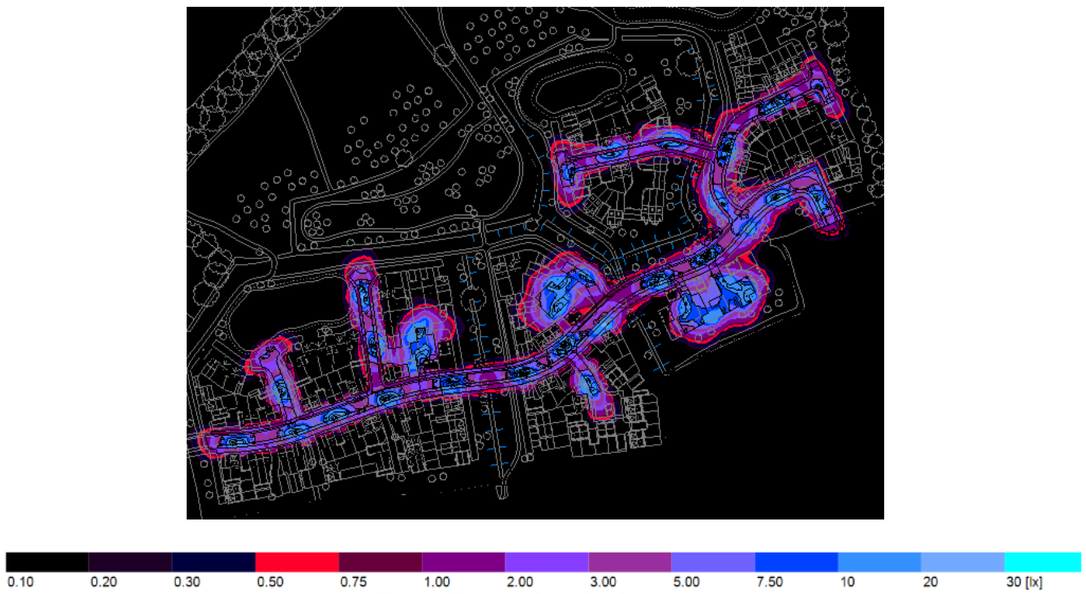


Figure 4.7 – Light Spill with Strategy 1

4.2.2 Strategy 2 – Lower output luminaires at smaller spacing

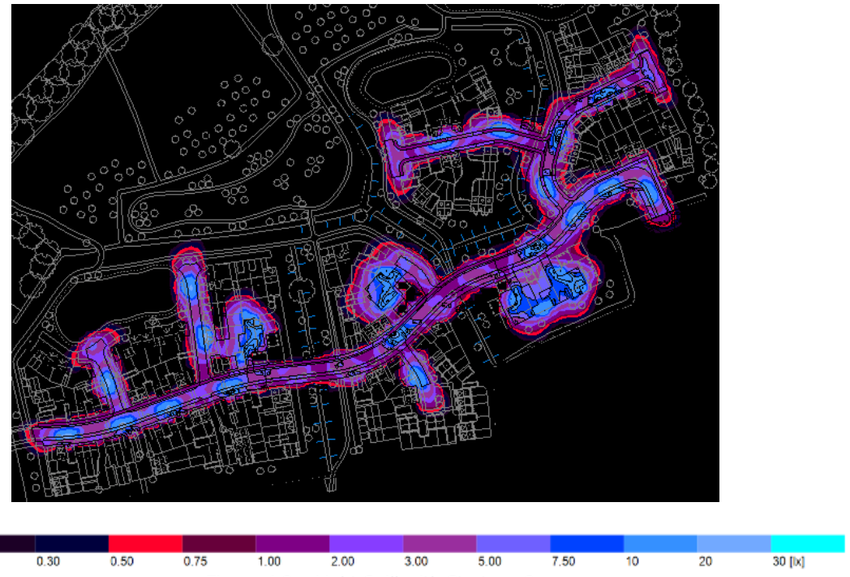


Figure 4.8 – Light Spill with Strategy 2

4.2.3 Strategy 3 – 1.1m walls along 2no key rhyne

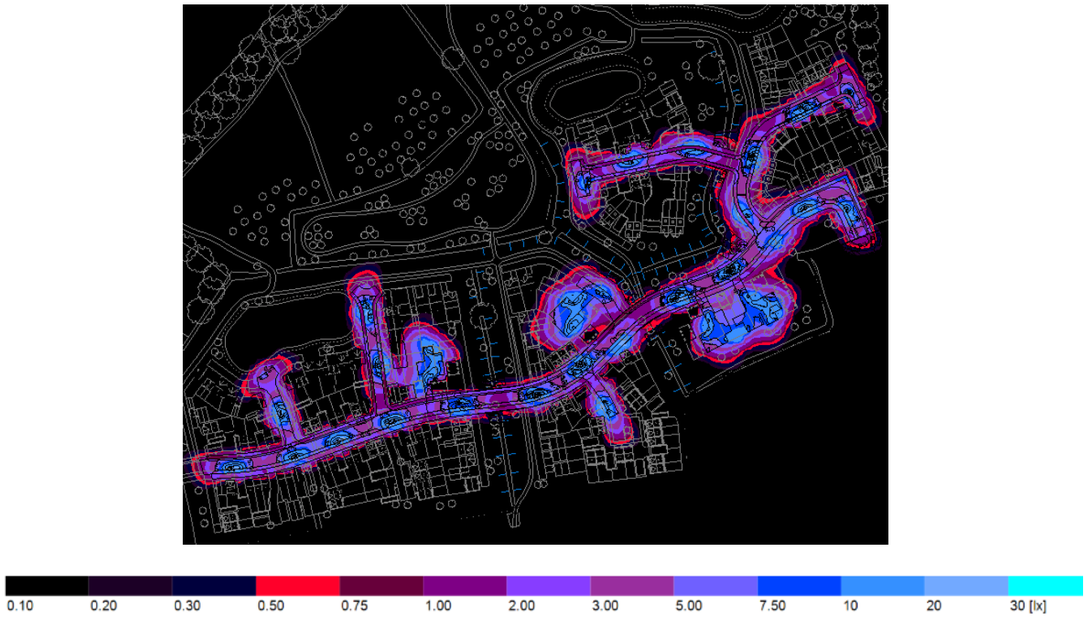
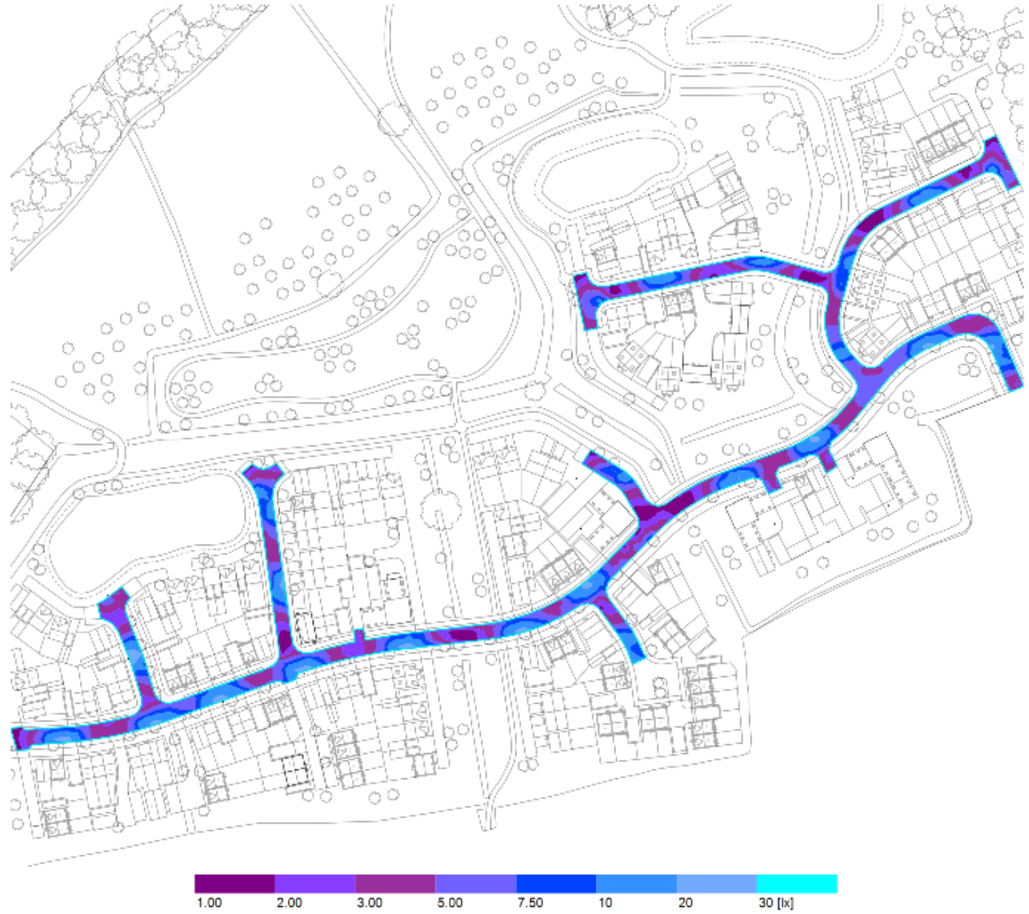


Figure 4.9 – Light Spill with Strategy 3

4.3 ROAD LIGHTING RESULTS

As variance in light spill between Strategies 4, 5 and the other strategies is negligible, results have not been shown.

4.3.1 Strategy 1 – Higher output luminaires with larger spacing



Properties	$\bar{E}$	E_{min}	E_{max}	g_1
Adopted Road Perpendicular illuminance Height: 0.000 m	6.88 lx	1.08 lx	29.6 lx	0.16

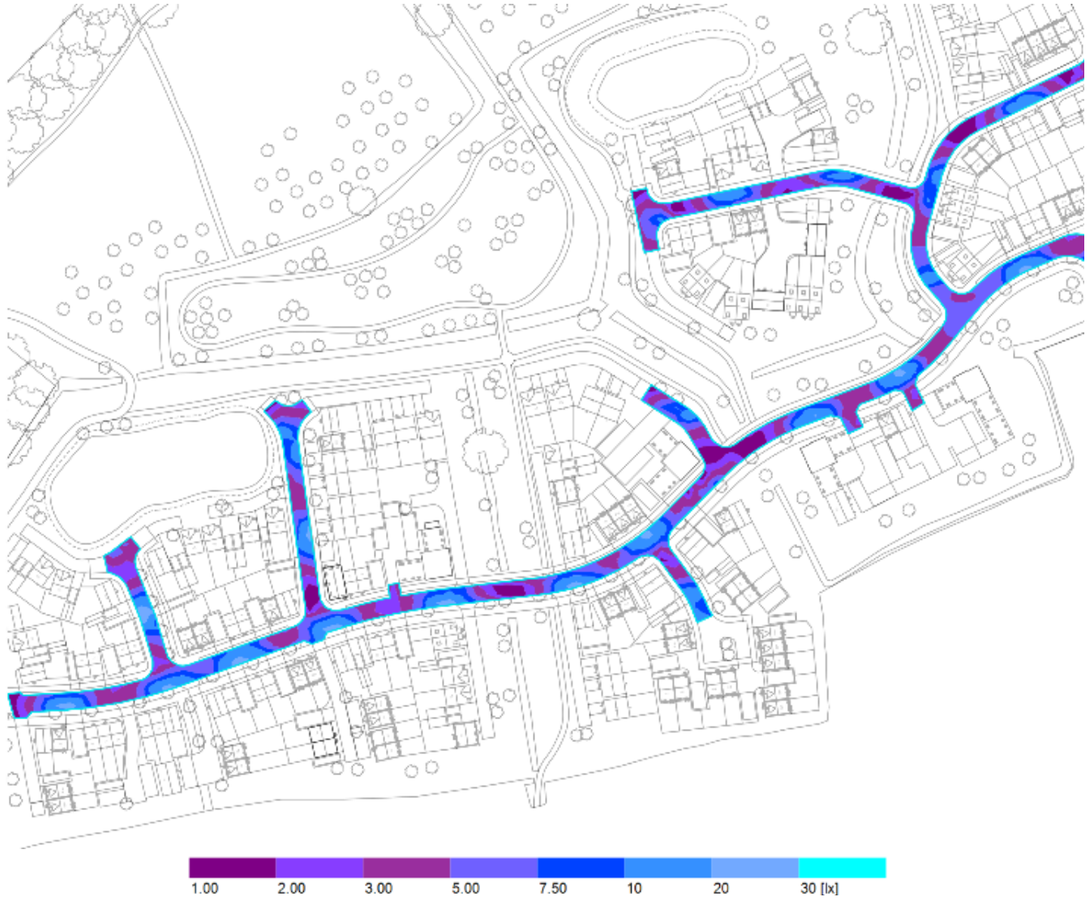
Figure 4.10 – Road Lighting with Strategy 1

4.3.2 Strategy 2 - Lower output luminaires at closer spacing

Properties	$\bar{E}$	E_{min}	E_{max}	g_1	g_2
Adopted Road Perpendicular illuminance Height: 0.000 m	6.21 lx	1.00 lx	29.6 lx	0.16	0.034

Figure 4.11 – Road Lighting with Strategy 2

4.3.3 Strategy 3 – 1.1m walls along 2no key rhyne

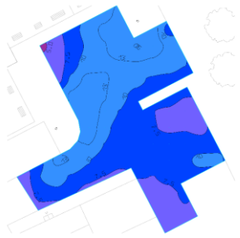


Properties	$\bar{E}$	E_{min}	E_{max}	g_1
Adopted Road Perpendicular illuminance Height: 0.000 m	6.87 lx	1.08 lx	29.6 lx	0.16

Figure 4.12 – Road Lighting with Strategy 3

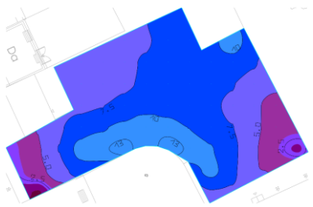
4.4 CAR PARK LIGHTING

The indicative lighting layout for the car parks has been modelled using the same strategy as the street lighting proposal. E3 understands that the parking layouts are subject to change. As a result of this, the lux levels and lighting design within in the car parks and surrounding areas are likely to change. Once the car park layout has been confirmed studies will be undertaken to review alternative lighting strategies using downward facing bollards to help further reduce the lighting impact.



Properties	Ē	E_{min}	E_{max}	g_1
Community Hub Car Park 1 Perpendicular illuminance Height: 0.000 m	9.67 lx	4.43 lx	15.0 lx	0.46

Figure 4.13 – Lux levels on the Community Hub Car Park 1



Properties	Ē	E_{min}	E_{max}	g_1
Community Hub Car Park 2 Perpendicular illuminance Height: 0.000 m	7.69 lx	0.89 lx	14.4 lx	0.12

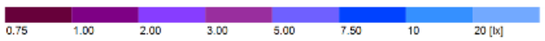
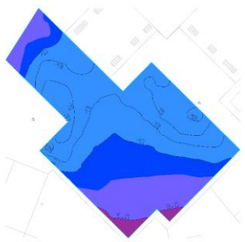
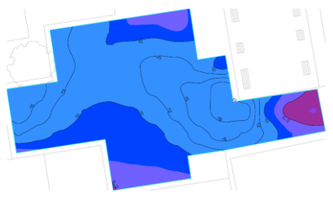


Figure 4.14 – Lux levels on the Community Hub Car Park 2



Properties	Ē	E_{min}	E_{max}	g_1
Central Car Park Perpendicular illuminance Height: 0.000 m	10.8 lx	4.18 lx	18.1 lx	0.39

Figure 4.15 – Lux levels on the Central Car Park



Properties	Ē	E_{min}	E_{max}	g_1
South Car Park Perpendicular illuminance Height: 0.000 m	11.2 lx	2.94 lx	19.4 lx	0.26

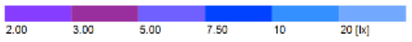


Figure 4.16 – Lux levels on the South Car Park

5 CONCLUSION

This report provides information on the proposed lighting strategy for the Land at Rectory Farm (North), Yatton housing development. A key element of this is the impact that the new lighting might have on surrounding bat habitat from light pollution, due to the introduction of new light sources.

The lighting has been modelled without relying on mitigation from blinds, curtains or vegetation to produce a worst-case result. Measurements have been taken at ground level and in the vertical plane.

The roadways will not be over lit, and lighting has been reduced in key areas where required to reduce light pollution.

By implementing mitigation strategies including back shields, and selected luminaires, the potential impact to bats from light pollution can be significantly reduced, as outlined in this report.

With the current proposals, the results show that no light spill will impact the adjacent stream and the woodland boundaries surrounding the site will remain dark.

The result shows that light spill has been contained to within the site boundary, and that lux levels on ecologically significant zones has been minimised.

Using the illustrative masterplan as the basis for this lighting strategy, lighting levels at certain points around the rhynes are not below the target of 0.5lux. However, at reserved matters stage, a lighting strategy which positively responds to lighting on the rhynes can be achieved by further developing the mitigation measures detailed within this report. The requirement to prepare a detailed lighting strategy can be reasonably conditioned as part of an Outline planning permission.