



Delta Green
environmental design

Westmill Service Station Electric Vehicle Charging Equipment Scheme External Lighting Impact Assessment

Revision: S2/P04
28th January 2025

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Contents

1.0	SITE DETAILS.....	4
1.1	LOCATION	4
1.2	DEVELOPMENT TYPE.....	5
1.3	ENVIRONMENTAL TYPE.....	5
2.0	DESIGN STANDARDS AND GUIDELINES	6
2.1	BRITISH STANDARDS.....	6
2.2	CIBSE LIGHTING GUIDELINES.....	6
2.3	ILP GUIDELINES.....	6
2.4	DESIGN CRITERIA	6
3.0	LIGHTING DESIGN.....	8
3.1	SELECTED LUMINAIRES	8
3.2	LIGHTING CALCULATIONS	9
3.3	LIGHTING DRAWINGS.....	11
3.4	LIGHTING CONTROLS	16
4.0	MITIGATION OF LIGHT SPILL	17
4.1	MITIGATION METHODS.....	17
5.0	SUMMARY	18

Table of Figures

Figure 1.1.1 (yellow)	–	Image showing the location of the proposed Electric Vehicle Charging Scheme
Figure 3.1.1	–	Preselected luminaire used within the lighting calculation
Figure 3.2.1	–	Calculation output of the preselected column lighting model
Figure 3.2.2	–	Image showing the calculation surfaces
Figure 3.3.1	–	General layout of the lighting model
Figure 3.3.2	–	General lighting layout at the location of the Electric Vehicle Charging Equipment
Figure 3.3.3	–	Isoline plot (false colour rendering) layout for the preselected external column lighting scheme, with existing fence line
Figure 3.3.4	–	Image showing the horizontal illuminance levels on the neighbouring gardens (calculation surface 1)
Figure 3.3.5	–	Isoline legend for the calculation surface
Figure 3.3.6	–	Image showing the vertical illuminance levels on the facade of the nearest neighbouring proposed dwelling (calculation surface 9)
Figure 3.3.7	–	Isoline legend for the calculation surface
Figure 3.3.8	–	Image showing the vertical illuminance levels on the facade of the nearest neighbouring proposed dwelling (calculation surface 6)
Figure 3.3.9	–	Isoline legend for the calculation surface
Figure 3.3.10	–	Image showing the vertical illuminance levels on the facade of the nearest neighbouring proposed dwelling (calculation surface 3)
Figure 3.3.11	–	Isoline legend for the calculation surface
Figure 4.1.1	–	Image showing a luminaire baffle plate
Table 2.4.1	–	Extract from ILP Guidance Notes for the Reduction of Obtrusive Light
Table 2.4.2	–	Extract from ILP Guidance Notes for the Reduction of Obtrusive Light

Table of Revisions

Rev	Originator	Approved	Date
P01	DF	JP	10.10.2024
P02	DF	JP	30.10.2024
P03	DF	JP	24.01.2025
P03	DF	JP	28.01.2025

1.0 SITE DETAILS

1.1 LOCATION

Westmill Service Station is an existing petrol station located in Hitchin. The proposal is for the installation of Electric Vehicle Charging Equipment located to the eastern side of the service station. This is to include new dedicated bays, a charging unit, localised column lighting, and all associated landscaping and infrastructure works.

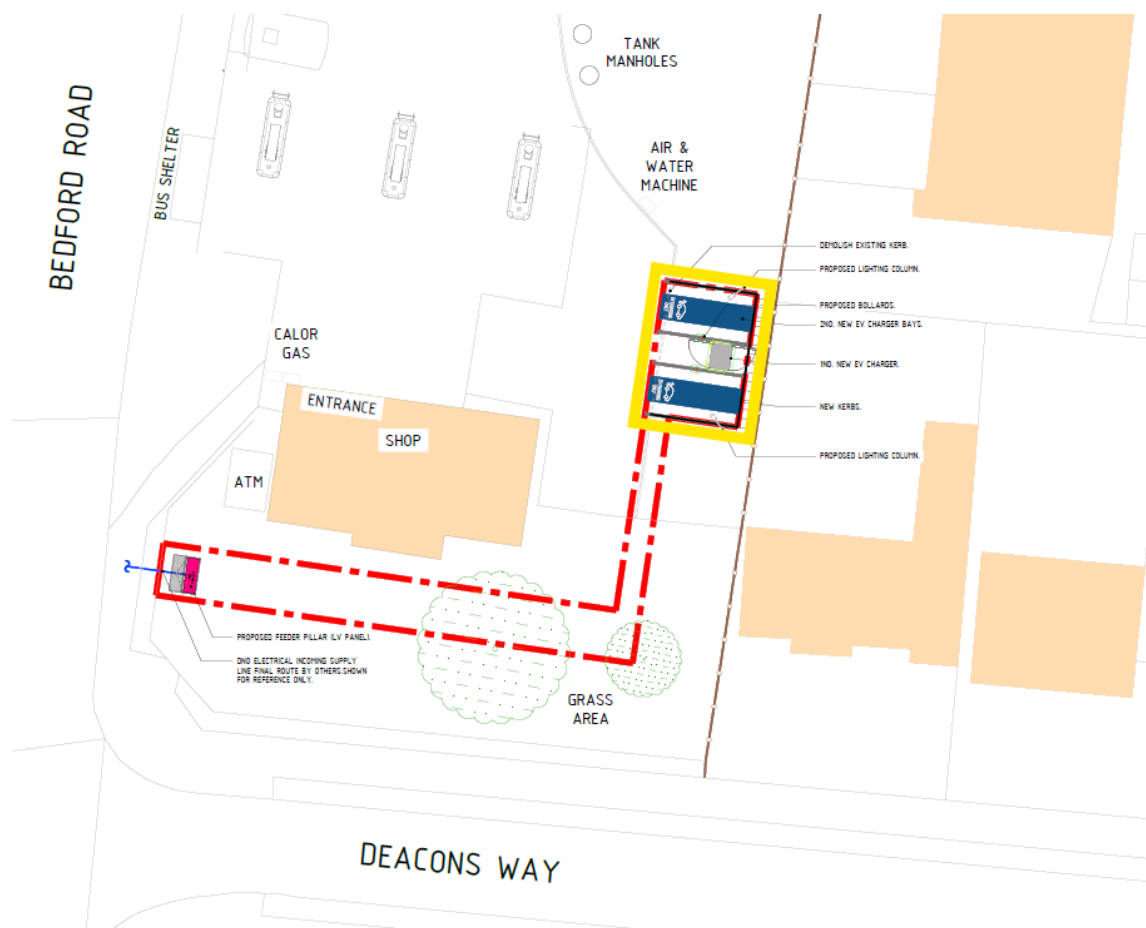


Figure 1.1.1 – Image showing the location of the proposed Electric Vehicle Charging Scheme (yellow)

The service station is in a generally suburban area with adjacent properties, domestic or commercial. Of these, the properties most likely to be affected by the proposed works are positioned along Deacons Way and King Georges Close, which back on to the proposed Electric Vehicle Charging Equipment Scheme. As such, the external lighting scheme for the site has been designed in accordance with national standards and regulations. Section 3.0 of this report reviews the affect that the preselected column lighting has on these properties, and discusses the affect of obtrusive light.

This report reviews the impact on the existing neighbouring dwellings, of introducing new column lighting to the Service Station as part of the proposed Electric Vehicle Charging Equipment Scheme. The report details how the proposed external lighting scheme has a limited impact on the existing neighbouring dwellings, and that mitigation methods to reduce light spill may need to be considered as far as practically possible.

1.2 DEVELOPMENT TYPE

Westmill Service Station is an existing petrol station located on Bedford Road in Hitchin. The site is in a medium district brightness area. There are a few neighbouring properties, however the area has minimal external lighting other than street lighting.

1.3 ENVIRONMENTAL TYPE

Due to the location of the service station, it has been classed as an Environmental Zone E3 as defined within the Institution of Lighting Professionals (ILP) guidance notes for the Reduction of Obtrusive Light. The guidance document defines an Environmental Zone E3 as "medium district brightness", such as small town centres or suburban locations.

The service station and proposed Electric Vehicle Charging Equipment is in close proximity to existing neighbouring dwellings. Therefore, light spill to the existing neighbouring dwellings is the critical element of this scheme.

2.0 DESIGN STANDARDS AND GUIDELINES

2.1 BRITISH STANDARDS

BS EN 12464 – Light and Lighting

This standard details the requirements of external lighting and refers to the reduction of obtrusive light. It forms the basis of the CIBSE lighting guides and the ILP lighting guides. The standard defines the different environmental zones and details the lighting requirements for each.

2.2 CIBSE LIGHTING GUIDELINES

CIBSE Lighting Guide 6 – The Outdoor Environment

LG6 is a CIBSE lighting guide which relates generally to external lighting. The guide details the recommended lux levels and uniformity for various scenarios and areas (for example, car parks, pathways, etc.)

CIBSE SLL Code for Lighting

The SLL Code for Lighting is a covering guidance document which summaries the specific lighting guides and provides broader detail of the requirements for external lighting.

2.3 ILP GUIDELINES

ILP Guidance Notes for the Reduction of Obtrusive Light

The ILP guidance for the reduction of obtrusive light is one of the most common documents referred to when reviewing the impact of external lighting to the surrounding environment. The document details strict parameters for which external lighting must comply. The parameters are determined by the location of the development.

2.4 DESIGN CRITERIA

The Service station is located within a suburban location, which falls into the environmental zone E3. Environmental Zone E3 is defined in the ILP Guidance notes for the reduction of obtrusive light as a “medium district brightness” area, such as small town centres or suburban locations. Definitions for all Environmental Zones can be found within Table 2.4.1 below, taken from the ILP guidance documentation.

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Table 2.4.1 – Extract from ILP Guidance Notes for the Reduction of Obtrusive Light

The proposed preselected lighting scheme has been calculated in accordance with the standards detailed in section 2.0.

The column lighting will each be controlled via an integrated photocell arrangement.

ILP Guidance Note for the Reduction of Obtrusive Light outlines maximum values of vertical illuminance on properties. For an environmental zone of E3, as mentioned in section 1.3, this is 10.0 lux. Definitions for all Environmental Zones can be found within Table 2.4.2 below, taken from the ILP guidance documentation.

Table 3 (CIE 150 table 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 (E _v)	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

Table 2.4.2 – Extract from ILP Guidance Notes for the Reduction of Obtrusive Light

3.0 LIGHTING DESIGN

3.1 SELECTED LUMINAIRES

Luminaires have been preselected as part of the Electric Vehicle Charging Equipment Scheme, to help provide the correct light levels and uniformity across the electric vehicle charging equipment and associated bays, whilst minimising the overall spill of light to the existing neighbouring dwellings. The preselected luminaires generally have directional diffusers and LED light sources, to help control the light distribution and reduce the overall glare from the fitting. The luminaires also have 0% upward light ration to further reduce spill.

The columns modelled within the lighting calculation are 4m, based on the information provided to Delta Green, and positioned to direct light across the electric vehicle charging bays. Mounted with an angle of 15°.



Figure 3.1.1 – preselected luminaire used within the lighting calculation – Philips ClearWay Gen2 DM50, 38.8W, 4730 lm, 4000K LED colour temperature, Colour Rendering Index 70

3.2 LIGHTING CALCULATIONS

The proposed external lighting scheme has been calculated using software called DIALux, developed by DIAL GmbH. The software allows the user to build a 'model space' which represents the site, and then add light fittings from a selection of various manufacturers by means of an eulumdat file. The eulumdat file contains photometric data which is specific to each fitting and includes information regarding the light output levels, colour temperature, and distribution curves.

Once the model has been set up, and luminaires have been added, the user can analyse the effect that these different luminaires have with regards the level and uniformity of light on a given surface.

Figure 3.2.1 is a screen shot of the output of the lighting model.

Calculation surfaces

Properties	E	E _{min}	E _{max}	U ₀ (gr)	g ₂
Calculation surface 6 Perpendicular illuminance Height: 3.667 m	0.49 lx	0.031 lx	4.81 lx	0.063	0.006
Calculation surface 7 Perpendicular illuminance Height: 3.669 m	0.028 lx	0.005 lx	0.090 lx	0.18	0.056
Calculation surface 8 Perpendicular illuminance Height: 0.000 m	42.5 lx	24.8 lx	62.8 lx	0.58	0.39
Calculation surface 8 Horizontal illuminance Height: 0.000 m	42.5 lx	24.8 lx	62.8 lx	0.58	0.39
Calculation surface 1 Perpendicular illuminance Height: 0.000 m	0.37 lx	0.000 lx	7.93 lx	0.00	0.00
Calculation surface 1 Horizontal illuminance Height: 0.000 m	0.37 lx	0.000 lx	7.93 lx	0.00	0.00
Calculation surface 4 Perpendicular illuminance Height: 3.667 m	0.30 lx	0.006 lx	1.06 lx	0.020	0.006
Calculation surface 5 Perpendicular illuminance Height: 3.656 m	0.14 lx	0.033 lx	0.35 lx	0.24	0.094
Calculation surface 2 Perpendicular illuminance Height: 3.521 m	0.046 lx	0.004 lx	0.18 lx	0.087	0.022
Calculation surface 9 Perpendicular illuminance Height: 3.506 m	0.11 lx	0.011 lx	0.36 lx	0.100	0.031
Calculation surface 3 Perpendicular illuminance Height: 3.504 m	0.042 lx	0.005 lx	0.22 lx	0.12	0.023

Figure 3.2.1 – Calculation output of the preselected column lighting model

*The surfaces 1 and 8 are the neighbouring gardens and the Electric Vehicle Charging Equipment location respectively. Surfaces 2, 3, 6, and 9, all have windows. Surfaces 4, 5, and 7, do not have windows.

The results shown within column 4 (E_{max}) indicate that the existing fence line is critical in mitigating some light spill into the neighbouring gardens and onto the neighbouring dwellings, but further mitigation measures need to be considered in order to provide a scheme that is compliant with ILP guidance on the reduction of obtrusive light.

These calculation outputs can be cross-referenced with the calculation surfaces detailed in figure 3.2.2.

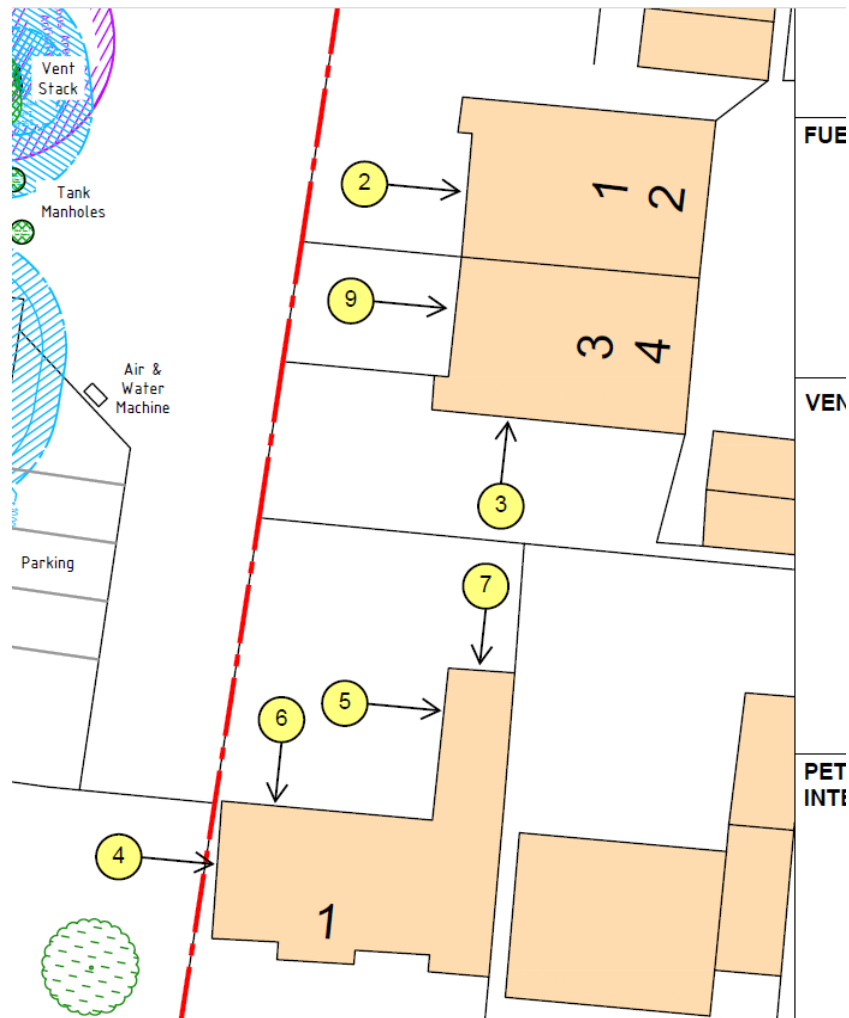


Figure 3.2.2 – Image showing the calculation surfaces

*The proposed preselected external column lighting model has been constructed for the purpose of expressing lux levels only and does not accurately reflect the visual appearance of the Service Station or the neighbouring gardens.

3.3 LIGHTING DRAWINGS

Images have been included in this section which accompanied the calculation, which shows light distribution across the electric vehicle charging equipment and bays, the neighbouring gardens and dwellings, the existing fence line, and the proposed preselected external lighting layout of luminaires at the Service Station.

Figure 3.3.1 details the general layout of the lighting model.

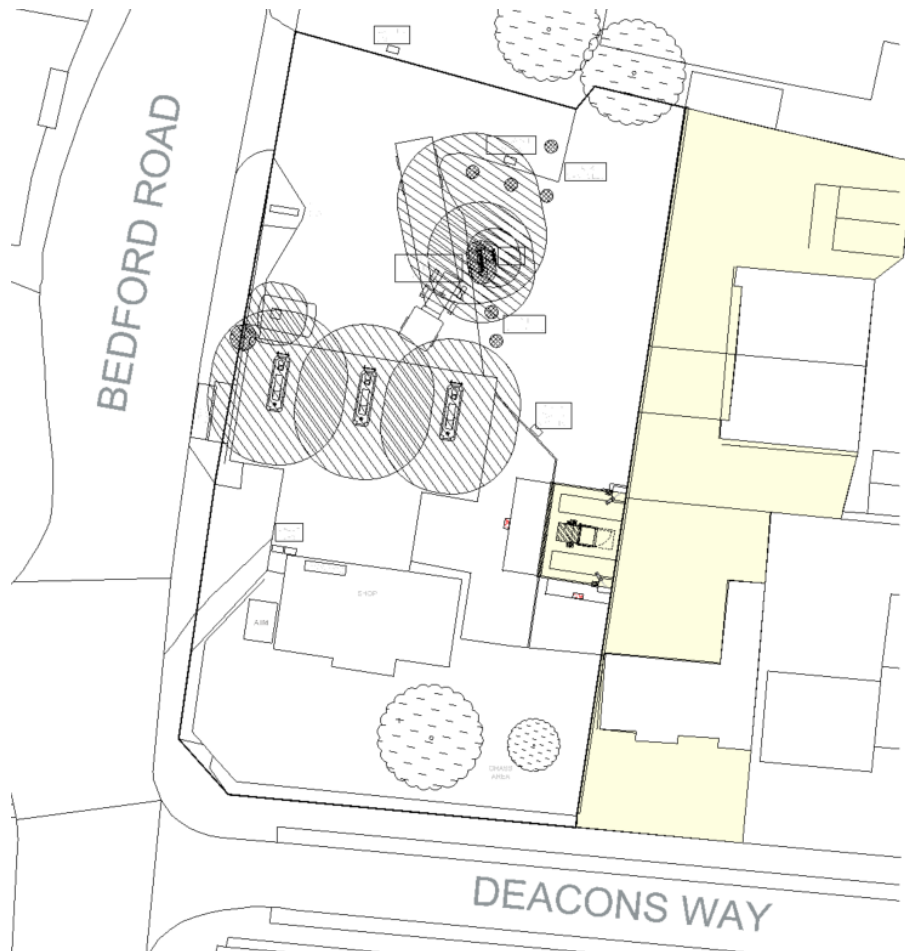


Figure 3.3.1 – General layout of the lighting model

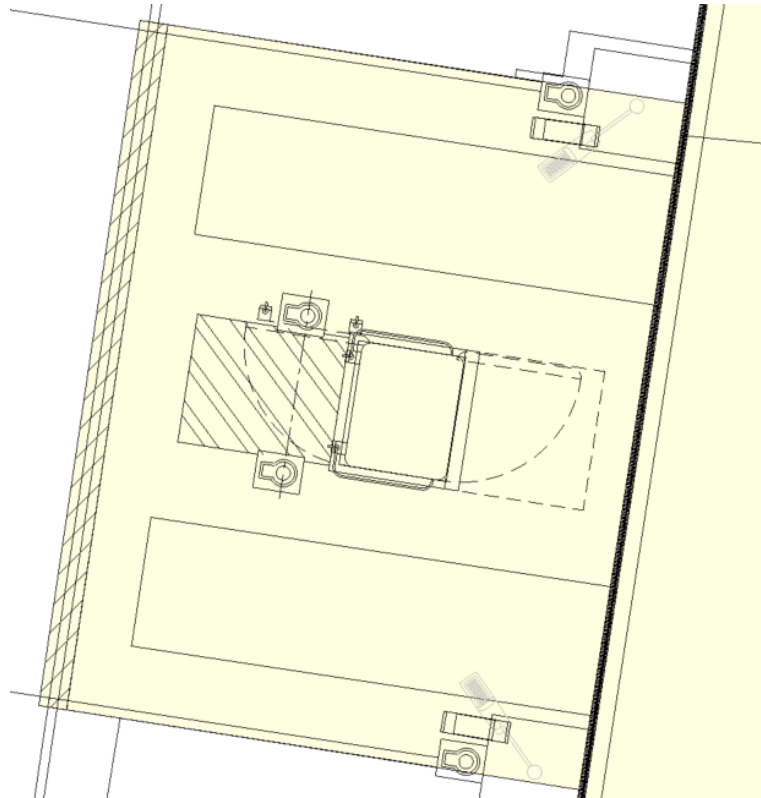


Figure 3.3.2 – General lighting layout at the location of the Electric Vehicle Charging Equipment

Figure 3.3.2 details the luminaire positions. The type of luminaire can be cross-referenced with the luminaire selection detailed in section 3.1.

The isoline plot (false colour rendering) layout shows the extent of light spill to the neighbouring gardens, detailed in figures 3.3.3 and 3.3.4, and the vertical illuminance lux level achieved on the facades of the nearest neighbouring dwellings, detailed in figures 3.3.6, 3.3.8, and 3.3.10.

*Surfaces 3, 6, and 9 are the nearest facades with windows. These can be cross-referenced with the calculation surfaces detailed in figure 3.2.2.

Each isoline is assigned a lux level, detailed in figures 3.3.5, 3.3.7 3.3.9 3.3.11 and is expressed as the extent at which this level of light reaches onto the surrounding areas.

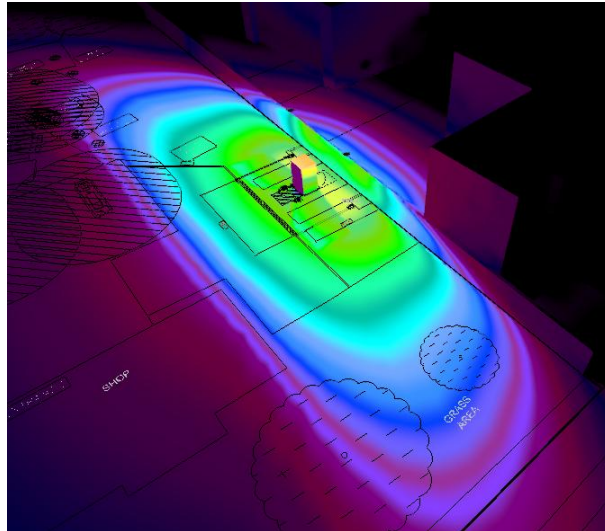


Figure 3.3.3 – Isoline plot (false colour rendering) layout for the preselected external column lighting scheme, with existing fence line

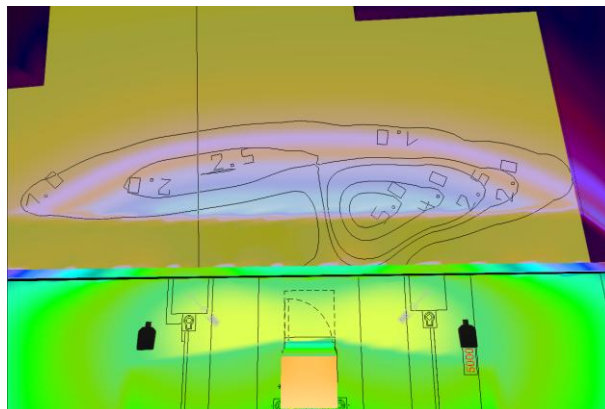


Figure 3.3.4 – Image showing the horizontal illuminance levels on the neighbouring gardens (calculation surface 1)



Figure 3.3.5 – Isoline legend for the calculation surface used in Figure 3.3.4

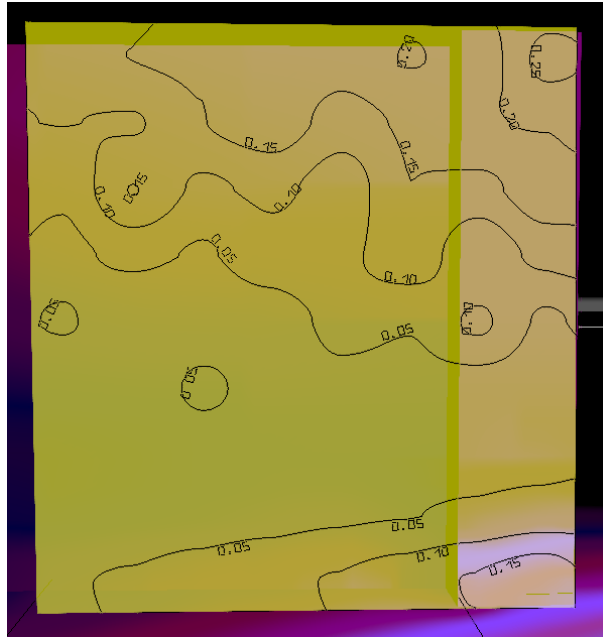


Figure 3.3.6 – Image showing the vertical illuminance levels on the facade of the nearest neighbouring proposed dwelling (calculation surface 9)



Figure 3.3.7 – Isoline legend for the calculation surface used in Figure 3.3.6

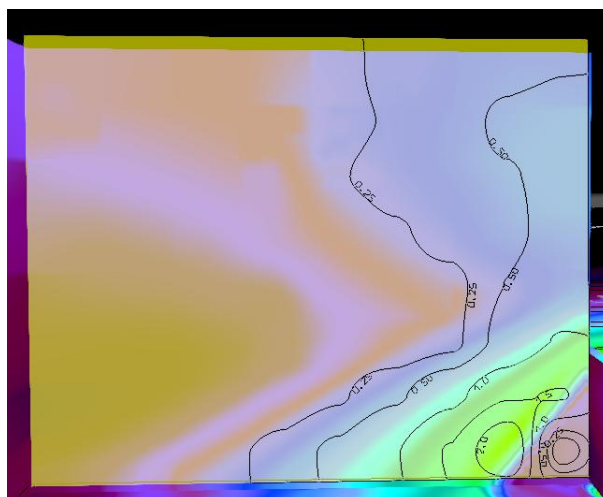


Figure 3.3.8 – Image showing the vertical illuminance levels on the facade of the nearest neighbouring proposed dwelling (calculation surface 6)



Figure 3.3.9 – Isoline legend for the calculation surface used in Figure 3.3.8

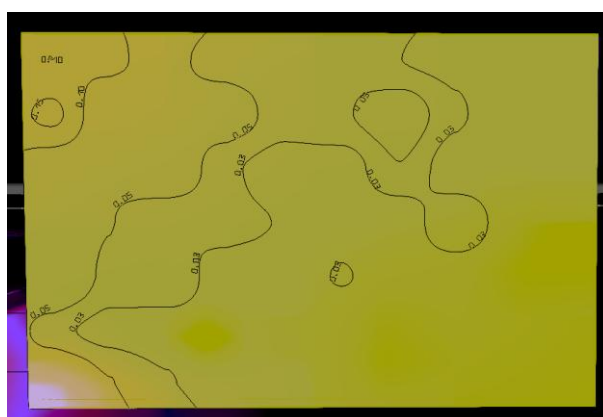


Figure 3.3.10 – Image showing the vertical illuminance levels on the facade of the nearest neighbouring proposed dwelling (calculation surface 3)



Figure 3.3.11 – Isoline legend for the calculation surface used in Figure 3.3.10

3.4 LIGHTING CONTROLS

Lighting controls can be used to help further reduce the impact of lighting on the surrounding environment.

Lighting controls can ensure that lighting is used correctly for the intended purpose and is not used unnecessarily or excessively.

The preselected column lighting will each be controlled via an integrated photocell arrangement.

The system shall also be provided with manual override such that lighting can be turned on or off as required outside of normal operation.

Photocells are also known as 'dawn to dusk' sensors. Briefly described as the following; At dusk, as the natural light level decreases, the sensors prompt the lights to activate, ensuring areas remain illuminated throughout the night. At dawn, as the natural light levels increase, the sensors automatically switch the lights off. Thus, conserving energy and reducing unnecessary light exposure during daylight.

4.0 MITIGATION OF LIGHT SPILL

4.1 MITIGATION METHODS

A number of mitigation methods could be considered for the proposed preselected luminaires, to help reduce the overall spill of light into the existing neighbouring gardens and onto the neighbouring dwellings. The preselected column lighting has been co-ordinated with the existing neighbouring dwellings, to ensure light spill is considered in its entirety.

For the purpose of the lighting calculation, the existing fence line has been indicatively included between the Electric Vehicle Charging Equipment scheme and the neighbouring existing dwellings. This has been modelled as a standard 2.1m tall fence. This existing fence line has a significant impact on reducing the level of light spill from the preselected column lighting, but other mitigation methods need to be considered, to further reduce the spill of light.

Install luminaire baffles

Installing baffle plates onto the luminaires will help reduce the level of light that is emitted backwards from the luminaire. The baffles will be similar to what is shown in Figure 4.1.1.

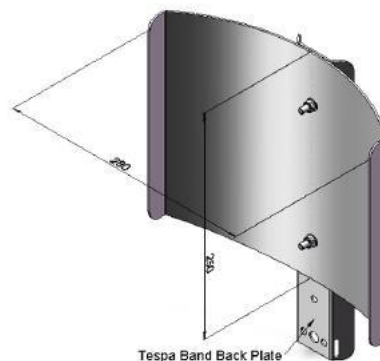


Figure 4.1.1 – Image of a typical luminaire baffle

The actual shape and dimensions of the baffle will be agreed with the lighting manufacturer to provide the most appropriate shielding without hindering the performance of the luminaires.

Set an appropriate angle and orientation for the luminaires

The angle and orientation of a luminaire can significantly affect the light levels and distribution on the surrounding area.

The scheme has been designed using an angle of 15°, with no rotational orientation.

5.0 SUMMARY

In summary, the preselected column lighting will affect the surrounding area. The domestic properties that are immediately adjacent to the proposed Electric Vehicle Charging scheme will have a level of light spill into rear gardens and onto their facades.

The scheme has been designed in the way deemed most appropriate to help reduce the level of spill to the surrounding environment whilst incorporating preselected parameters with regards to luminaire selection and column height.

The lighting was modelled, detailed in figure 3.3.3, to show the extent at which the level of light reaches onto the existing neighbouring gardens and dwellings. The results show that the existing fence line is critical in mitigating some light spill into the neighbouring gardens and onto the neighbouring dwellings, but further mitigation measures need to be considered as far as practically possible.

Luminaires have been preselected to ensure that suitable light levels are achieved across the electric vehicle charging equipment.

Mitigation methods have been proposed to help improve the scheme and reduce the level of spill to the existing neighbouring gardens and dwellings.

The angle and orientation of the luminaires, is critical in providing a scheme that is compliant with ILP guidance on the reduction of obtrusive light. With additional consideration required for the introduction of luminaire baffles.

This report supports a retrospective planning application, and therefore the lights and mitigation measures suggested in this report have been installed. Baffles have been installed as close to the light source as reasonably practicable. As set out in this report, the lighting as installed is compliant with ILP guidance on the reduction of obtrusive light and does not result in an unacceptable level of lighting spill to existing neighbouring gardens and onto the neighbouring dwellings.