
Appendix 4.4
Lighting Assessment

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Lighting Assessment Report

Herbata Data Centre Campus

Naas, County Kildare

May 1, 2024

Document Number: 10360452-HDR-XX-XX-RP-E-630001

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Issue: P06

Status: Issue for planning



Document Control

Issue	Date	Status	HDR Author	HDR Approval	Notes
P01	31/03/2023	For Information	31/03/23.AC	31/03/23.JM	DRAFT 1 issue
P02	28/04/2023	For Review	28/04/23.AC	28/04/23.JM	DRAFT 2 issue
P03	17/05/2023	For Review	17/05/23.AC	17/05/23.JM	Planning Issue
P04	07/08/2023	For Review	07/08/23.AC	07/08/23.JM	Planning Issue
P05	07/09/2023	For Review	07/08/23.AC	07/09/23.JM	Planning Issue
P06	01/05/2024	For Review	01/05/24.JJ	01/05/24.UG	Planning Issue

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1 Introduction

This lighting assessment document has been prepared by HDR to accompany planning application to Kildare County Council for the Herbata Data Centre Campus project. Its purpose is to set out design criteria for external lighting and to establish the baseline consideration of the area surrounding the proposed development while describing methods (at design and installation stages). This will be applied to limit the impact of light spillage on surrounding area (obtrusive light), limit its impact on bats' colonies close by, including light spillage into the night sky (sky glow) from the new development.

External lighting design scope:

New external lighting will be provided to the following areas:

- Access roads within the site
- Car park
- Site security lighting (including emergency escape lighting)

Lighting design strategy has been developed to complement the new landscape design and be integrated into the existing surroundings.

The site will operate as a 'DARK' site with minimal and controlled lighting at the entrance / parking areas, together with low level lighting around the site only used for emergency.

New road lighting along R409 is provided by others. Due to the long distance between R409 and nearest bat house location (approximate 300m), we have assumed that there is no light pollution impact to bat houses from road lighting along R409.

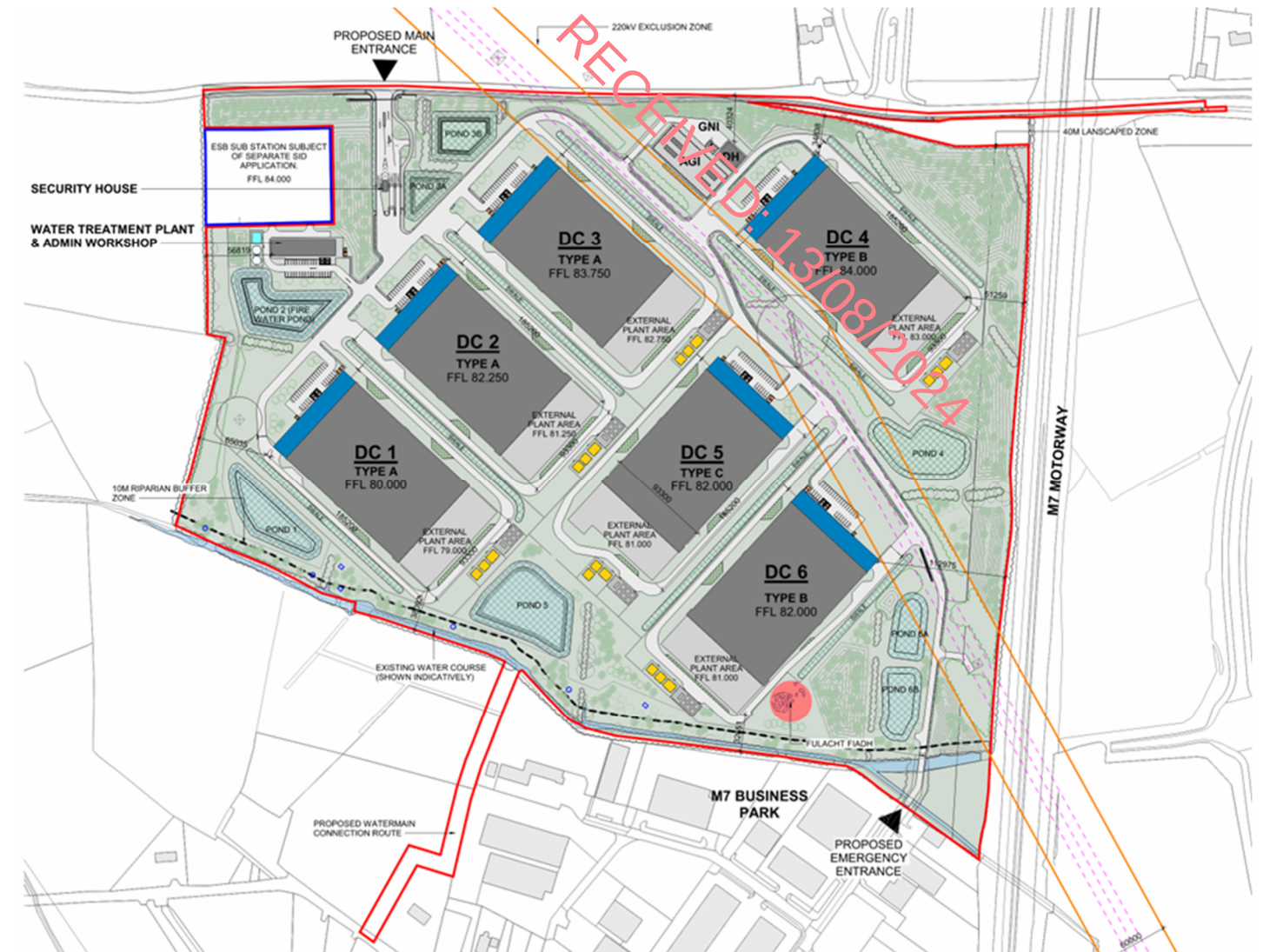


Figure 1-1. Site Location and Boundary Lines

2 Lighting Design Criteria

The following mandatory, legislative, and regulatory requirements including Irish Standards, Codes of Practice and Best Practice professional guidance publications will form the design criteria parameters of the external lighting installation:

2.1 Planning Policy and Legislations - Regional Planning Policy

The Kildare County Development Plan sets out policies/objectives/ standards for public lighting in the following documentation.

Chapter 5: Sustainable Mobility Transport

'Document Aim: To promote and facilitate ease of movement within and through County Kildare, by integrating sustainable land use planning and a high-quality integrated transport system; and to support and prioritise investment in more sustainable modes of travel, the transition to a lower carbon transport system, and the development of a safer, efficient, inclusive, and connected transport system.'

'Provide new or upgraded lighting for all footpath and cycle track schemes subject to the consideration of ecology and impacts on wildlife. Appropriate environmental assessments will be required and may result in unlit sections which may include some parts of the county's Greenways. Where applicable, all species-specific mitigation will be included within the relevant sections of the Appropriate Assessment.' (As per Action TM A19)

Chapter 15: Development Management Standards

'Development management is a statutory process that ensures that development takes place in an orderly and efficient manner. Specific control measures are outlined to ensure that new development is of high quality and relates to the character, scale, layout, and form of the area in question. Development will be managed by means of established and proven principles aided by guiding standards, in particular guidelines issued to the Planning Authority by the Minister regarding its functions, under Section 28 of the Planning and Development Act 2000...'

Street lighting should, at a minimum, comply with the standards set out in the most recent revision of the Kildare County Council document 'Street Lighting Technical Specification' and Section 5.12 of this Plan (as per section 15.7.9)

Kildare Technical Specification for Street Lighting Rev 03, 01 06 2019

Kildare County Council Lighting Policy - Kildare County Council's general principles and requirements for street lighting are set out in the Kildare County Council Lighting Policy: Street Lighting Technical Specification.

2.2 Lighting Guides and Regulations

ILP (The Institution of Lighting Professionals) Guidance Notes for the Reduction of Obtrusive Light GN01:2021

This Guidance Note is updated version of the previous document, and it considers industry comment regarding the assessment and definition of obtrusive lighting. It states – Good lighting practice is the provision of the right light, at the right time, in the right place, controlled by the right system.

CIE (The International Commission on Illumination) 150: 2017 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations

The purpose of this Guide is to help formulate guidelines for assessing the environmental impacts of outdoor lighting and to give recommended limits for relevant lighting parameters to contain the obtrusive effects of outdoor lighting within tolerable levels. The guidance given is primarily applicable to new installations; however, some advice is also provided on remedial measures which may be taken for existing installations. (page VI in the document).

CIE 126: 1997 Guidelines for Minimising Sky Glow

This Technical Report gives general guidance for lighting designers and policy makers on the reduction of the sky glow. The report briefly discusses the theoretical aspects of sky glow, and it gives recommendations about maximum permissible values for lighting installations in relation to the needs of astronomical observations - casual sky viewing included. (Page V in the document).

ILP (The Institution of Lighting Professionals) Guidance Notes 08/18 Bats & Artificial Lighting

The Bat Conservation Trust in partnership with the Institution for Lighting Professionals (ILP) and Clarkson & Woods ecological consultants have published this latest practical guidance on considering the impact upon bats when designing lighting schemes.

Eurobats: Guidelines 8_ Light Pollution

In October 2018 new Eurobats guidance on bats and artificial lighting was published. This was drafted by a panel of experts including BCT and uses the currently available research and knowledge to look at solutions to avoid, mitigate and compensate the negative impacts of artificial light. It is broad international guidance that complements the nationally drafted BCT / ILP guidance (as above).

Code of Practice for Road Lighting-Part 1

Irish Standards Institution, IE 5489-1:2020

Code of Practice for Road Lighting-Part 2 Performance requirements

Irish Standards Institution, IE EN 13201-2: 2015

IE EN 12464-2: 2014 Light and lighting – Lighting of workplaces Part 2:

Outdoor workplaces

This standard specifies requirements for lighting of tasks in most outdoor workplaces and their associated areas in terms of quantity and quality of illumination. In addition, recommendations are given for good lighting practice.

2.3 General Approach and Performance Criteria

Our approach to lighting design of the external spaces will be holistic to embrace the existing and new landscape environment and to create visual connection, interest, and flow between the spaces. Adequate and properly distributed light (limiting obtrusive light/light pollution and minimising the sky glow) of a suitable colour will be provided to ensure safety and security at night while ensuring minimal disruption to ecological aspects of surrounding area (bats habitat).

Lighting design will be based on the following considerations:

Obtrusive light

ILP Guidance Note 01/21 The Reduction of Obtrusive Light document outlines different forms of obtrusive light such as:

- Sky glow: the brightening of the night sky
- Glare: the uncomfortable brightness of a light source when viewed against a darker background
- Light spill: the spilling of light beyond the boundary of the area being lit.
- Light intrusion ('Nuisance'): are all forms of obtrusive light which may cause nuisance to others including the passage of light from the external sources into the building.

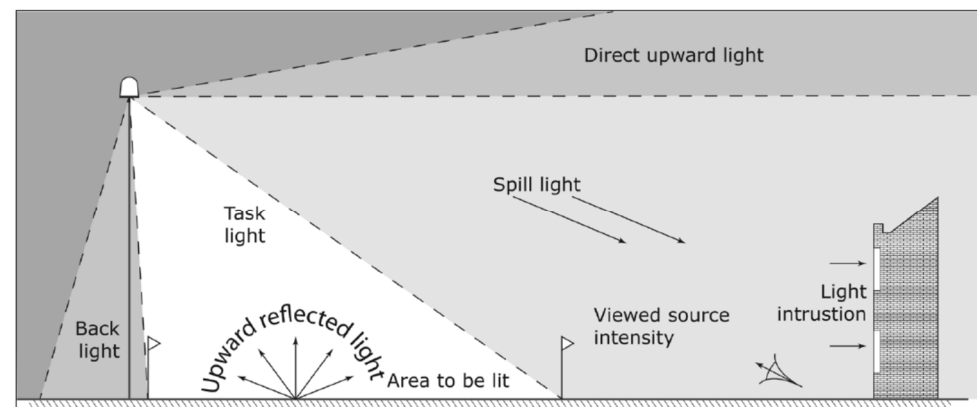


Figure 2-1. ILP Guidance Note 01/21 -Types of Intrusive Light

Obtrusive light (light pollution) is minimised at design stage by appropriate selection of the four lighting elements: a light source, a luminaire (together with its optical control system), method of installation and lighting controls.

Quality of light - Light sources and Luminaires

The external lighting to all areas will be designed using energy efficient LED light sources with good colour rendering properties and colour temperature to compliment the landscape design.

All luminaires will be specified with the correct optics and be mounted at the right height to deliver light to the specific task/area and minimise light pollution while saving energy usage.

All luminaire optics will be selected with downward light distribution and without upward lighting component as per ILP Guidance Note 01/21.

Installation and light direction

All luminaires will be mounted at the correct height and aimed (as required) away from any adjacent areas to prevent light spill into this area or creating a glare problem (to drivers, cyclists, or pedestrians).

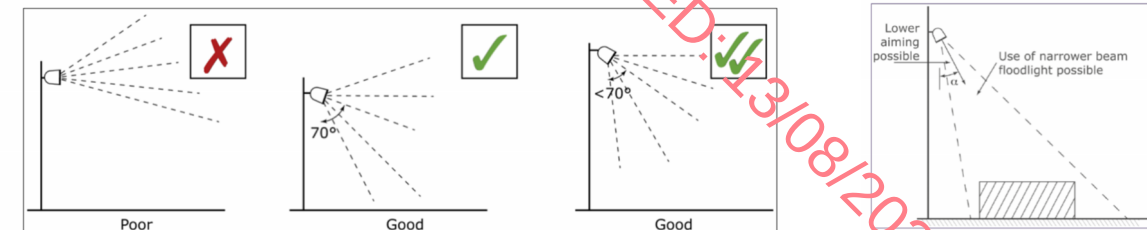


Figure 2-2. ILP Guidance Note 01/21 -Luminaire Aiming Angles

Surfaces and Reflectance

Luminaire selection with good optics and careful positioning of the light fixtures across the site will minimise the light spilling up. However, the light which arrives at the ground can be reflected up into the night sky. Reducing the reflectance of the ground surface will reduce the reflected light but could also give the impression of dark surface. During detail design stage the reflectance of the surface and contrast between, will be considered to provide the balance between the safety and reflected light spill.

Ecology and Bats

The light spilled into the surrounding area can have a negative impact on ecology of the site. The ecological issues have been identified as a key element for consideration due to the bat habitats identified to be near the site.

Based on information from both documents: Eurobats Guideline No.8 and the Institution of Lighting Professionals (ILP) Guidance Note No.8 (including other documents relevant to external lighting) we have outlined our approach to mitigating effect of ALAN (Artificial Light at Night).

Artificial lighting has a wide range of effect on bats, including their feeding, hibernation, and migratory habits.

The levels of illumination, bats are normally exposed to are very low, as low as 0.1 Lux produced from the stars and moonlight, so any levels above provided by artificial lighting will have an impact on bats and will disrupt bat patterns and their way of life.

The light spectrum ranges from short wave Ultraviolet (UV) to long wave infrared light. The effect of blue light (according to the publications) has negative effects on bats and therefore warm light colour is proposed.

Current site proposals have several sources of potential light pollution, some emanating from internal building lighting (Admin building), access road and car park lighting and other external practical/maintenance lighting such as security light.

To mitigate the impact of artificial lighting on bats our lighting design approach will be:

- Use of LED light source with good colour rendering (CRI>80) and no UV emission
- Use of warm colour temperature (2700K) and colour spectrum >550nm which has less impact on bats.
- Use of LED luminaires with a good optical control to provide the lighting where needed without spilling the light to the surrounding area. Luminaire upward light will be 0%.
- Light will be aimed to the surface being illuminated and luminaires will have a glare shield to minimise any potential light spill.
- The intensity of the light will be controlled via dimming, to minimise the ground surface reflections.
- All external lighting will be controlled via lighting control system comprising of photocells/time clock/dimming/sensors etc to provide 'dark periods' at night.



Luminaires to be mounted at short column and have a good optical light distribution.

Environmental Conditions

The following describes the area surrounding the proposed development and the site in relation to existing sources of lighting in the area.

Environmental Zone - ILP Guidance Note 01/21 lists five 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 to 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 this assessment, it is considered that our development is an area of 'Low district brightness' (Zone E2). Therefore, the relevant maximum values from the tables above and below (shown in red) should be applied. Note. This zone selection will need to be confirmed by local authorities.

ILP Guidance Note 01/21 – Limitation of illuminance on surrounding premises (Light intrusion/ nuisance and management of spill light)

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

CIE 150 table 2: Maximum values of vertical illuminance on premises

ILP Guidance Note 01/21 – Limitation of sky glow.

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

CIE 150 table 5: Maximum values of upward light ratio (ULR) of luminaires

Adjacent Zone consideration

Areas to be lit within visual distance of the boundary line will be carefully designed to avoid light spill to the surrounding area (this will be carried out by implementing luminaires with good optics, aiming the light where is required, correct luminaire mounting height and its location within the landscape).

Safety and security

Lighting will be provided to ensure safe movement to all: pedestrians, cyclists, and vehicles within development boundary.

Sustainability

Lighting scheme will be energy efficient and sustainable. All lighting design methods (including use of the latest technology incorporating lighting controls) shall be employed in accordance with all mandatory legislations and regulations.

3 Lighting Design Strategy

3.1 Overall Design Criteria

Careful consideration at the planning and design stages can ensure that the task that requires lighting can be achieved whilst controlling light pollution.

External lighting design will be based on the following drivers to provide the best lighting solution for this project:

- Defining the use of external space
- Aesthetic considerations, including architectural and landscape appropriateness.
- Local infrastructure
- Local planning guidance and lighting master planning requirements
- Requirements of vehicular traffic in and around the area
- Colour and types of the landscape materials.
- Changes in level and identification of obstructions
- Choice of light sources
- Choice of luminaire
- Visual impact of light fixtures by day
- Vulnerability to vandalism/strength of equipment
- Maintenance
- Access requirements (visually impaired and physically disabled people)
- Health and safety of the public and local fauna and flora
- Ecological consideration (bats habitat in the area surrounding the site)
- Environmental considerations
- Interference with adjacent transport routes
- Obtrusive light
- Energy usage
- Lighting controls

It is proposed that lighting systems will be provided to the exterior spaces including, but not limited to pedestrian footpaths, car parks, circulation routes within the site boundaries, entrances and exit areas. The purpose of the lighting is to identify and illuminate pedestrian and vehicular routes within the site and to secure the health and safety of its users throughout the hours of darkness. Sufficient lighting will be provided for a safe environment whilst limiting obtrusive light. This will be achieved by using luminaires that are directional and with optical control to illuminate only the task area concerned so upward light would only ever be from reflection.

Numerical lighting design criteria will be considered as per following documents:

Illumination levels (as references in the tables below) are defined as per IE EN 12464-2: 2014

Table 5.1 — General requirements for areas and for cleaning at outdoor work places

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx	U_o —	R_{GL} —	R_a —	Specific requirements
5.1.1	Walkways exclusively for pedestrians	5	0,25	50	20	
5.1.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	0,40	50	20	
5.1.3	Regular vehicle traffic (max. 40 km/h)	20	0,40	45	20	At shipyards and in docks, R_{GL} may be 50
5.1.4	Pedestrian passages, vehicle turning, loading and unloading points	50	0,40	50	20	
5.1.5	Cleaning and servicing	50	0,25	50	20	All relevant surfaces

Note- The speed selection above will need to be confirmed by local authorities.

Table 5.9 — Parking areas

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx	U_o —	R_{GL} —	R_a —	Specific requirements
5.9.1	Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	0,25	55	20	
5.9.2	Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	0,25	50	20	
5.9.3	Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose building complexes	20	0,25	50	20	

IE EN 5489-1: 2020 Road lighting Part 1

Document (table referenced below) states different Lighting Class depending on the traffic flow:

Table A.5 — Lighting classes for subsidiary roads

Traffic flow	Lighting class		
	E1 to E4 ^{A)}	E1 to E2 ^{A)}	E3 to E4 ^{A)}
	Pedestrian and cyclists only	Speed limit $v \leq 30$ mph	Speed limit $v \leq 30$ mph
Busy ^{B)}	P5	P4	P3
Normal ^{C)}	P5	P5	P4
Quiet ^{D)}	P6	P5	P4

IE EN 13201-2: 2015 Road lighting – Part 2: Performance Requirements
Document (table referenced below) states horizontal illumination for different Lighting Classes

Table 3 — P lighting classes

Class	Horizontal illuminance		Additional requirement if facial recognition is necessary	
	$\bar{E}^a$ [minimum maintained] lx	E_{min} [maintained] lx	$E_{v,min}$ [maintained] lx	$E_{sc,min}$ [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 value of the maintained average illuminance shall not exceed 1,5 times the minimum $\bar{E}$ value indicated for the class.

As previously stated, the development is located within an E2 environmental; zone and as such, the development will be considered as class P5 for the purpose of this assessment.

Class P4 has a requirement of 3 lux (average illumination) and 0.6lux (minimum illuminance) on the horizontal plane.

A detailed lighting design to meet some or all the following objectives:

- to provide safety for pedestrians from moving vehicles around within the site boundary
- to deter anti-social behaviour
- to ensure the safe movement of vehicles
- to match the lighting design and lighting equipment to the architecture and environment
- to illuminate road and directional signs
- to limit light pollution
- to mitigate the impact on bat habitat
- to maintain lighting installations and protect them from vandalism.
- to facilitate CCTV surveillance.

Lighting controls:

It is recognised that suitable lighting control is required to be installed to maintain the site operation as a 'DARK' site and as such it is proposed that series of control measures are applied both for interior and exterior lighting.

Interior lighting

As a part of an energy-controlled measure together with control of spill light from internal spaces, all areas will have Passive Infra-Red (PIR) controlled lighting. The exception to this will be only emergency lighting that come on only in the event of power failure or testing under controlled condition. A provision of override switches will be made to allow security patrols to control the lighting.

External lighting

Control to all external lighting will be by automated switching where lighting is used only when required and switched off or blanked out 2 hours after sunset. This is to be confirmed.

External plant areas and roof areas will have localised minimal lighting which will normally be off with timers to ensure extinction. Sockets for occasional task lighting will be provided in the event of a need to access for emergency use.

Security cameras will not be provided with lighting in the visual range, instead only by infra-red flood lighting.

Road lighting shall be controlled using photocells and time clocks. Photocells will be either integral to the luminaire or positioned to be local to the relevant lighting circuit. Timeclocks will override the photoelectric cells during hours post curfew (suggested as 23:00 hours by The Institute of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light 2021). This is to be discussed and agreed as required.

4 Lighting Calculations and Conclusions

Lighting calculations using DIALux software were carried out to determine two aspects of light spill to the area surrounding the proposed site development:

- Light spill from the internal to external space (Admin building predominantly)
- External lighting to parking area and access roads around the proposed site

Interior lighting calculations were carried out to ground floor and first floor office spaces. Horizontal calculation surfaces are set near the building outline. These are to show the light spill from an office space into the adjacent outdoor environment and to demonstrate its contribution toward the potential light pollution, as the street lighting will be switched off and only operational in emergency situations and evacuations.

4.1 Indoor Lighting (Internal Lighting Spill from Admin Building)

Office Lighting Calculation Assumptions:

Room Reflectance Values considered:

Ceiling (Standard Value) = 70%

Wall (paster) = 78%

Floor (Standard Value) = 20%

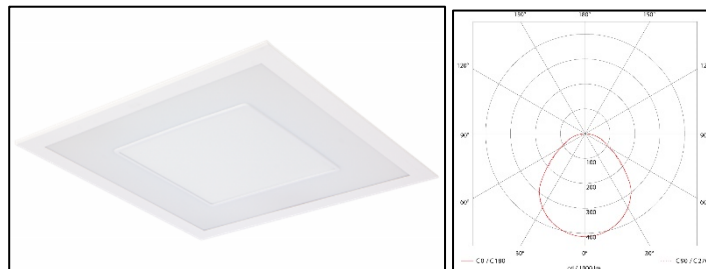
Windows Glass transmittance value 66%

Windows Glass Reflectance value 6%

Luminaire Mounting Height = 3.2m.

Lighting control system will be provided to allow for zone control and dimming.

Luminaire used (Tamlite Advance 600x600) typical arrangement:

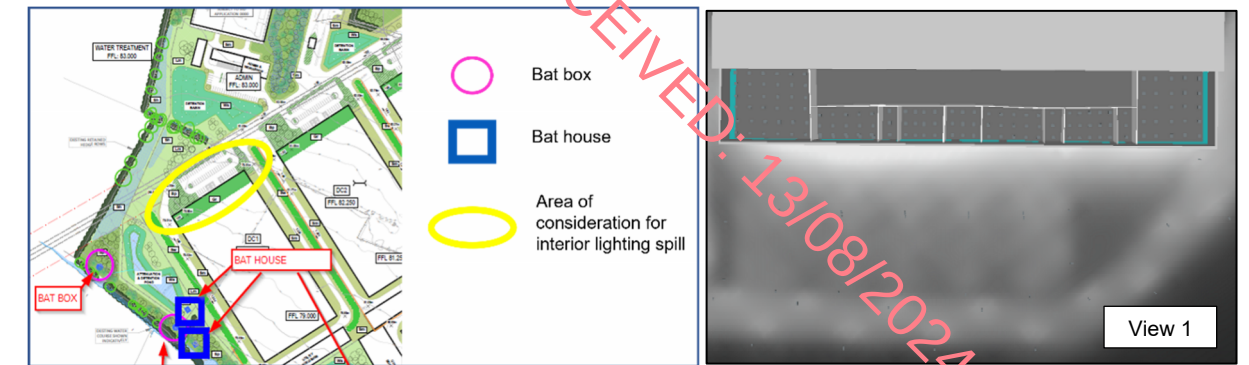


Office Lighting Calculations Design criteria:

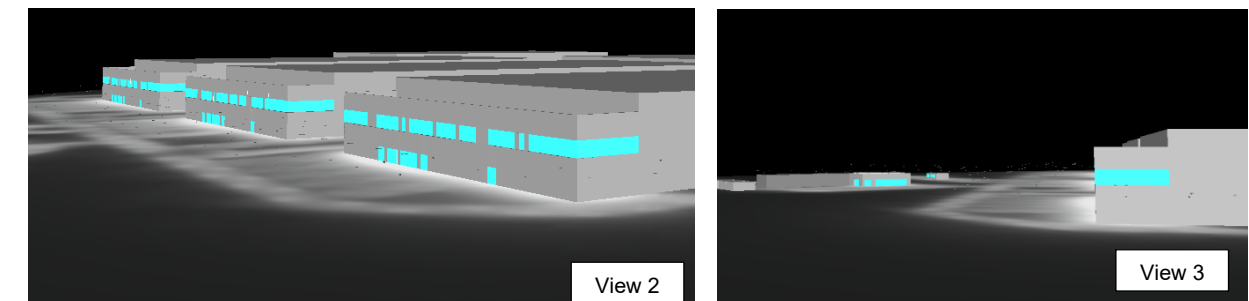
Average illumination level = 400lux

Uniformity = 0.4 – 0.8

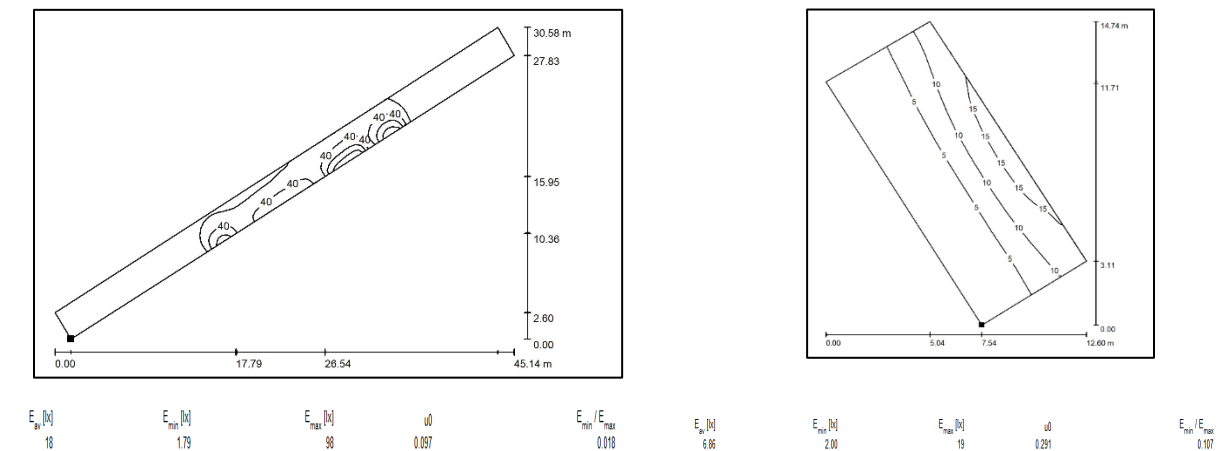
Interior lighting spill (typical arrangement from building closest to the bat habitat)



(Refer to Appendix A for bat box and house location plan)



(Refer to Appendix B for site view selection plan)



Calculated lighting levels – light spilled from the interior lighting to the adjacent outdoor space (to minimise the light pollution blinds will be required)

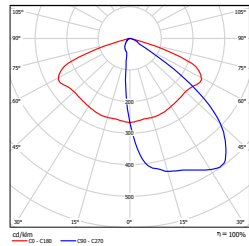
4.2 External Lighting to Overall Site

External Overall Site Lighting Calculation Assumptions:

Ground Reflectance: 30%

Pole mounted luminaires: 6m pole height, with arm bracket 750mm and antiglare and back shield (as per below image typical arrangement)

Luminaire used (Tamlite City RLB with baffle/shield optic) typical arrangement.



External Lighting Calculations Design criteria:

Average illumination level = 10-20lux

Uniformity = 0.4

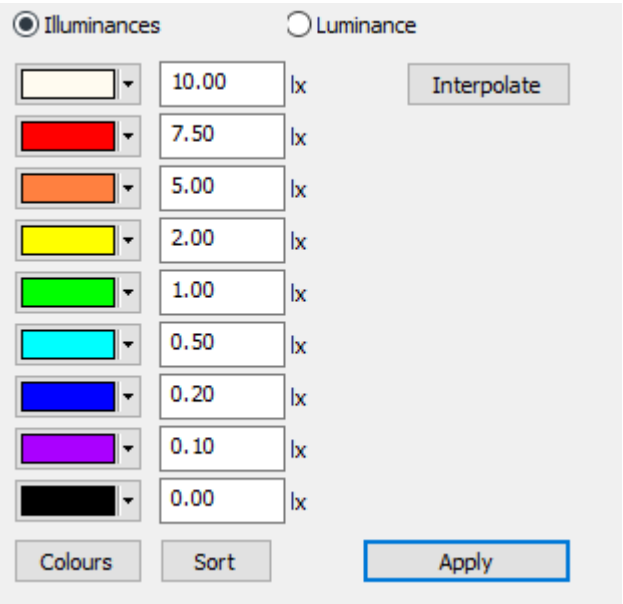
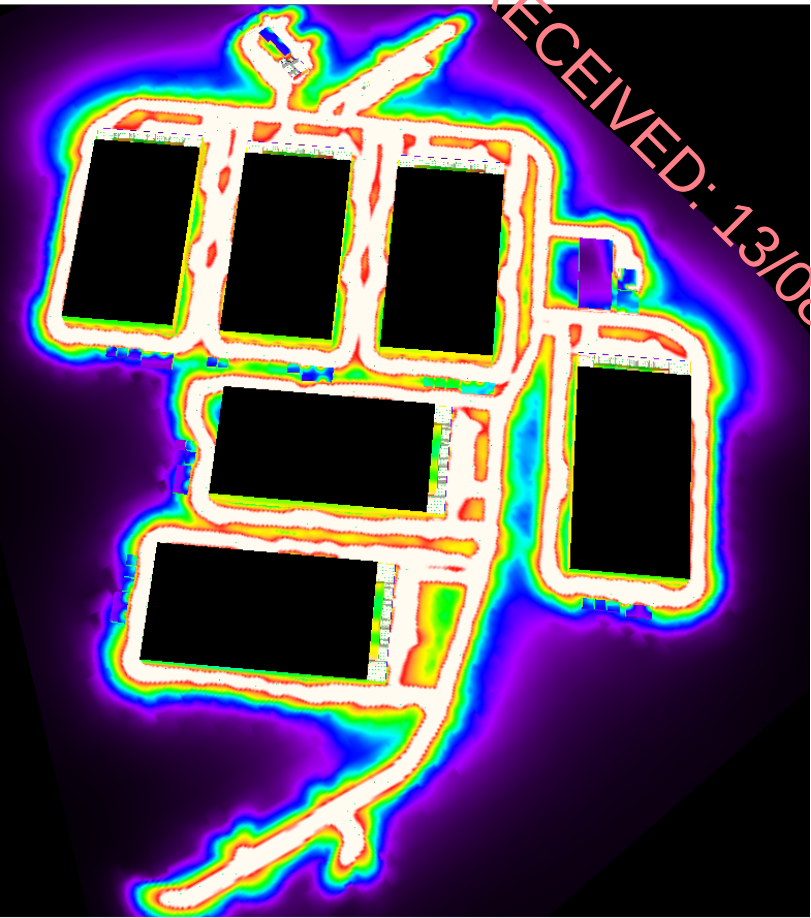
Overall site lighting layout

The external lighting calculations to the overall site were carried out by modelling office building blocks and access roads together with proposed external/street lighting.

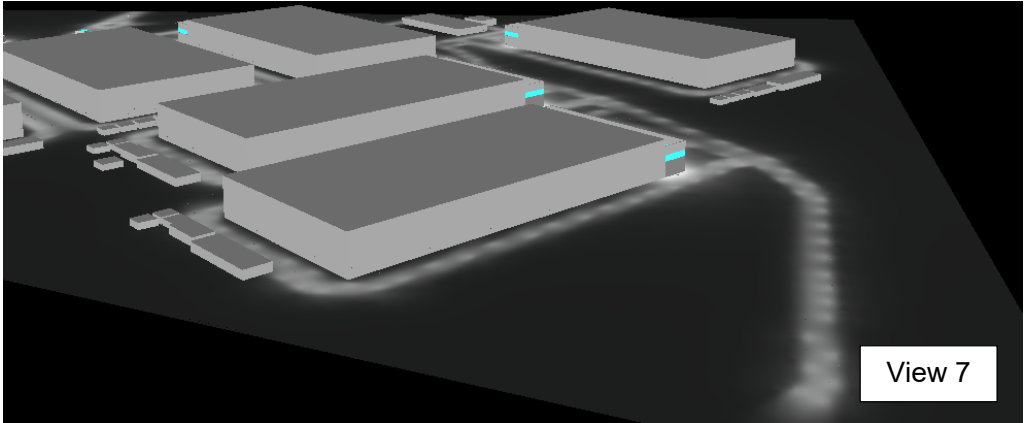
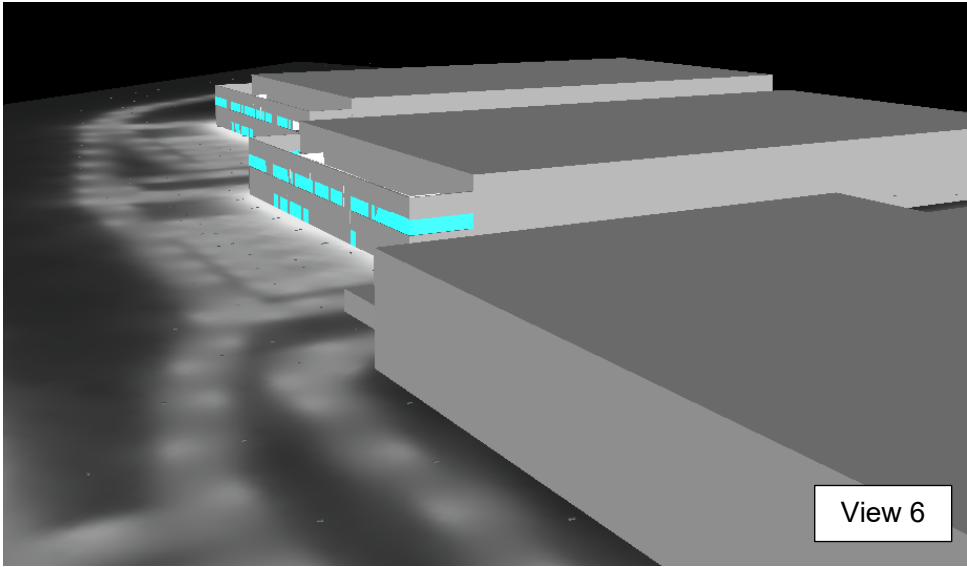
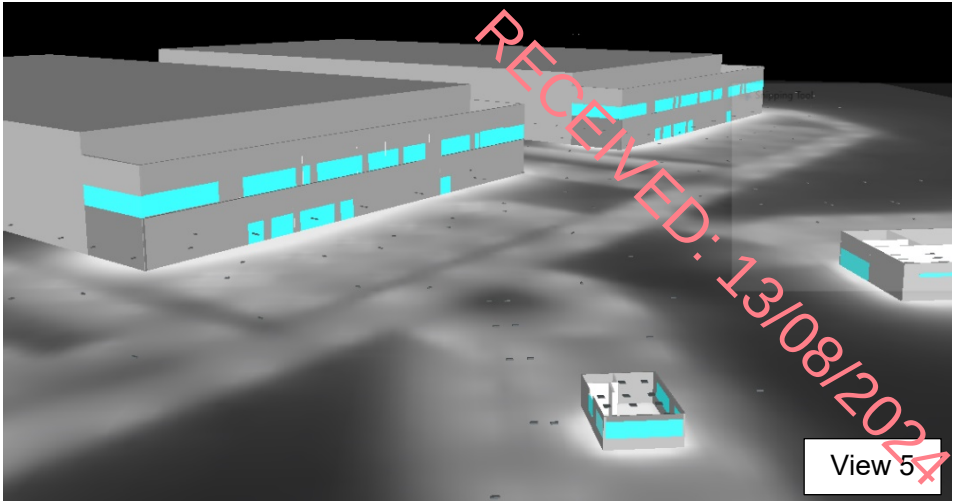
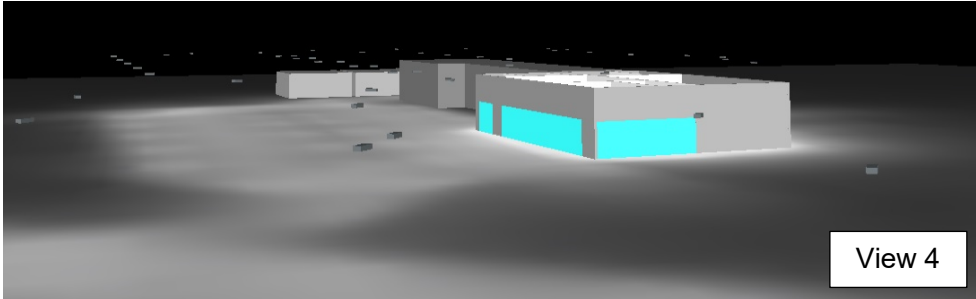
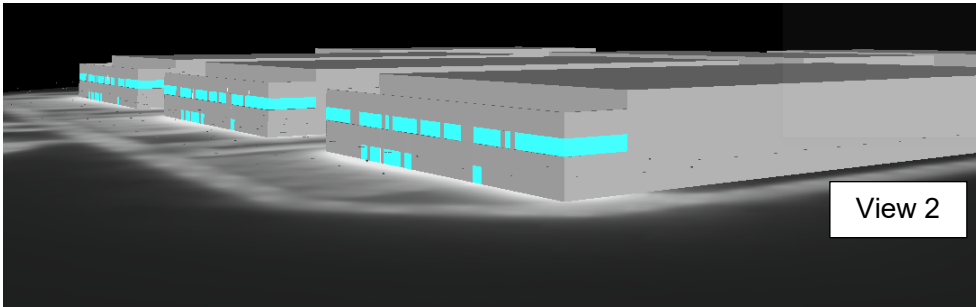
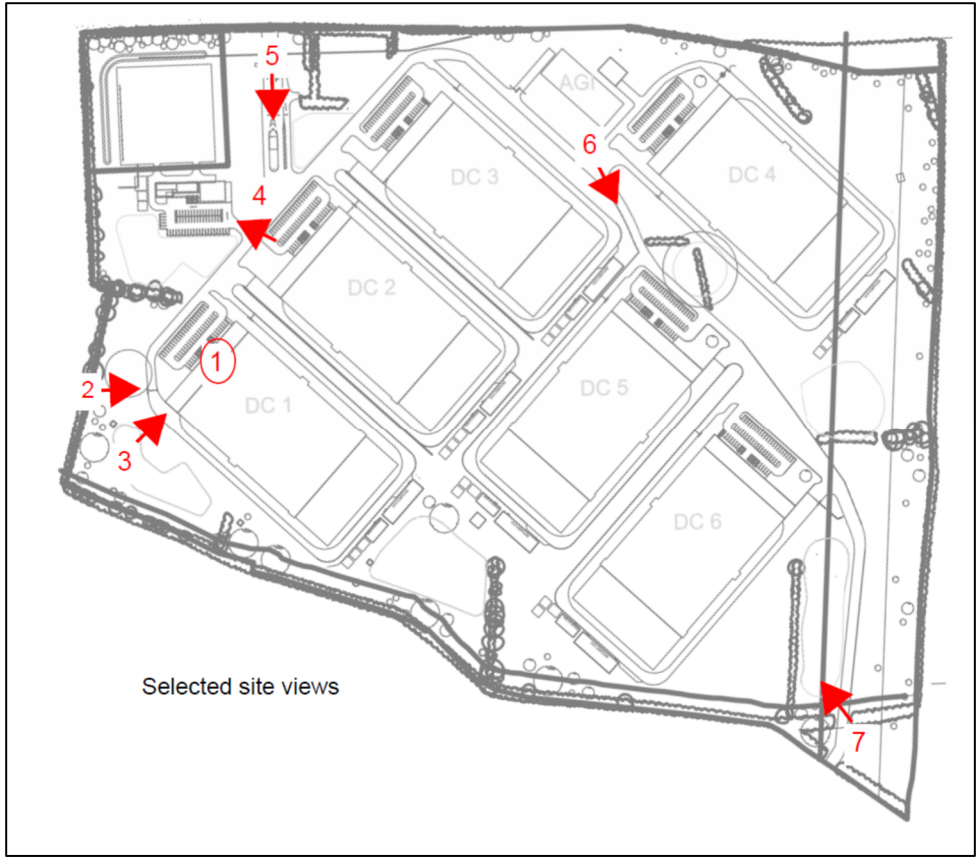
The diagrams below show lighting isolux plots identifying lighting levels and how they taper off away from the areas that are being illuminated (i.e., car parks, access roads, etc.) by using the luminaires with specific light distribution optics and back shields.

The average lighting levels calculated are in the range between 10 – 20 lux across. The uniformity in some areas is below targeted 0.4 (for the road lighting). This is due to the site limitations for location of the pole mounted lights in relation to the landscape elements, road design and locations of pylons. Reference should be made to the overall site calculation summary in Appendix C and lighting layout drawing 10360452-HDR-XX-XX-DR-E-632000 in Appendix D.

Overall site lighting calculations with legend below



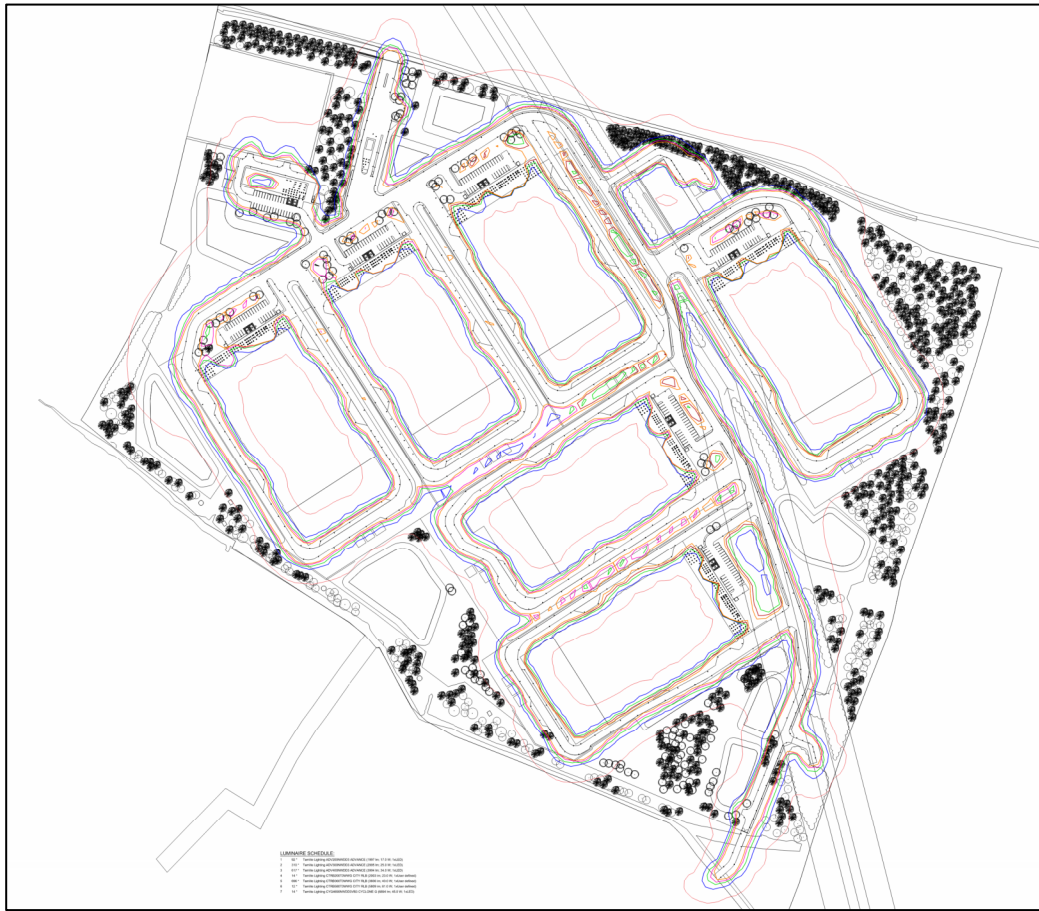
3D site views (DIALux modelling and lighting calculation visuals):



Lighting calculations overview

The average lighting levels calculated are in the range between 10 – 20 lux across with uniformity mostly in the range of 0.4. However, the uniformity in some areas is below targeted 0.4 (for the road lighting). This is due to the site limitations and environmental restrictions (such as preference for lower column lights to help with mitigation of light spill related to bat habitat) where pole mounted lights can be positioned in relation to the landscape elements, site road design and proximity of the Pylon locations.

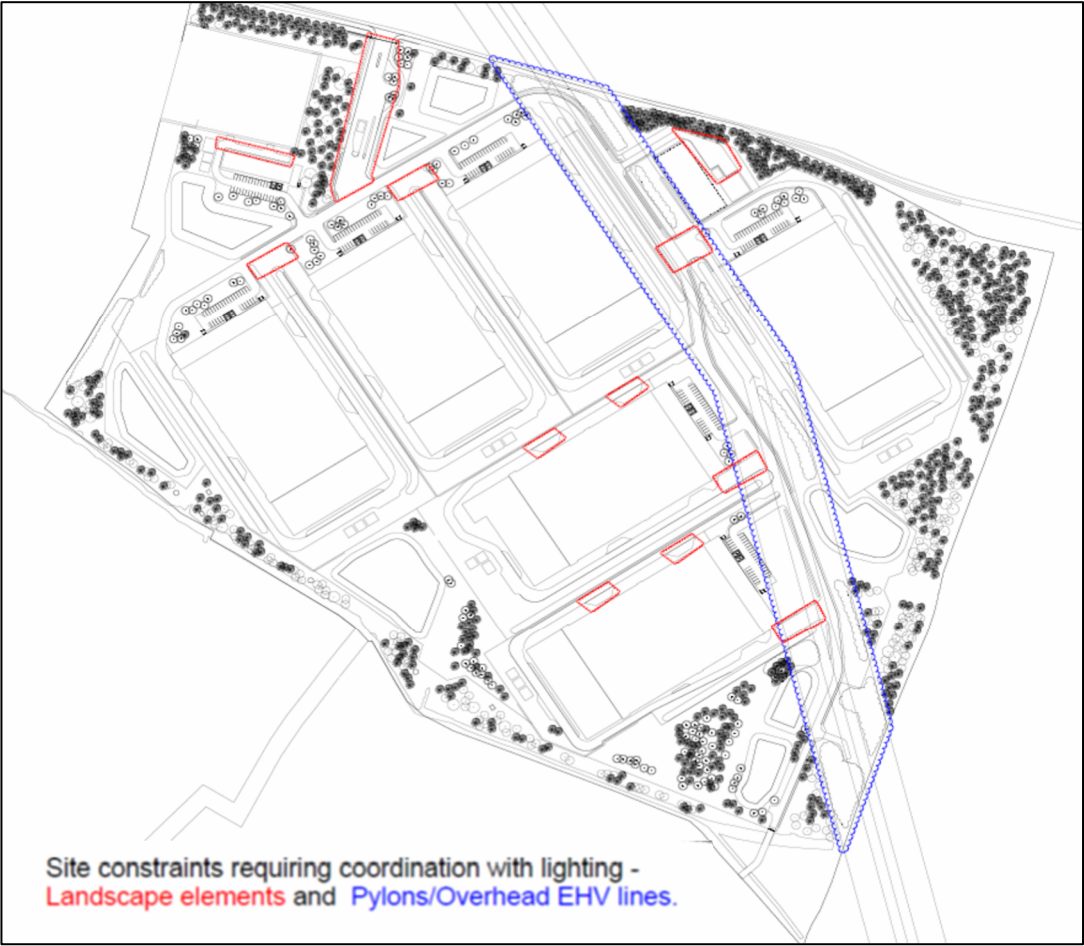
Reference should be made to the overall site calculation summary in Appendix C and lighting layout drawing 10360452-HDR-XX-XX-DR-E-632000 in Appendix D. The lighting calculation summary highlights areas where uniformity is below 0.4.



To improve lighting uniformity across the site (as per areas highlighted below) further coordination between light fixtures location and landscape elements, road design together with Pylon/overhead EHV lines will need to be carried out.

Image below highlights areas where landscape elements and lighting are to be coordinated in red colour, and lighting to be coordinated with Pylons/Overhead EHV lines in blue colour.

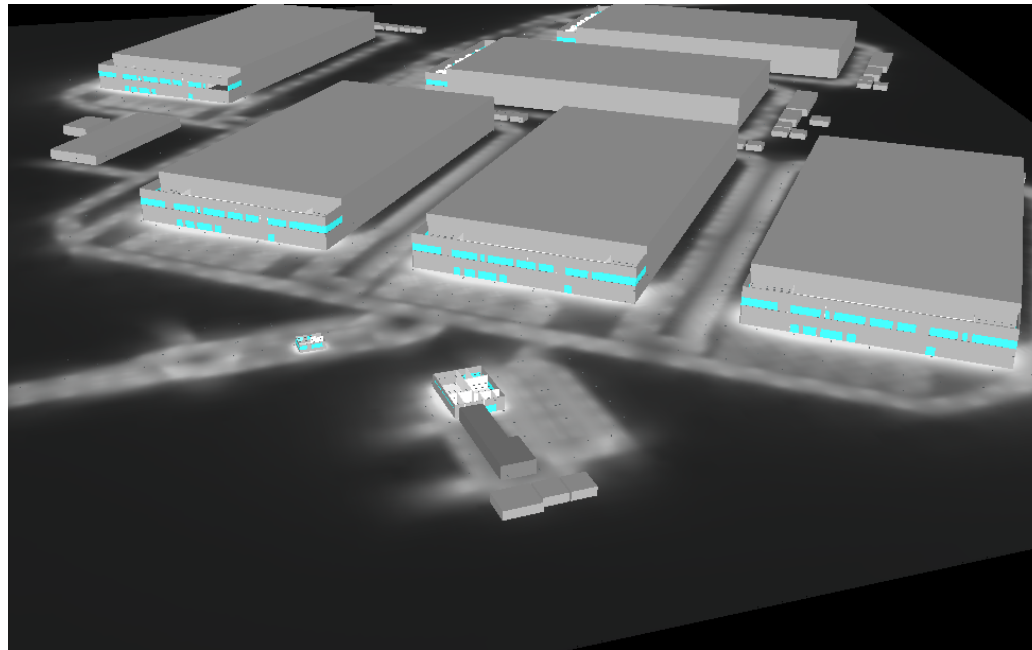
Landscape elements such as pond/water features, road design and areas immediately adjacent to roads will need coordination with lighting to allow for the positioning of lights to ensure safe movement.



4.4 Conclusion/Recommendations

It is proposed that external lighting to Herbata Data Centre Campus development is to provide functional lighting and to ensure safe movement and security inside the site boundary while minimising the light pollution and its impact on the surrounding rural areas containing bat colonies. The lighting level criteria for safe movement is much higher (5-20lux) depending on the activity (pedestrian use/car parking/traffic/security etc.) when compared to the low levels recommended by ILE Note for Environmental Zone E2 (pre-curfew 5lux and post curfew 1lux).

Therefore, it is essential that lighting is controlled from dusk to dawn by ensuring that all external lighting is normally turned off and all internal lighting (from the admin/office block) is prevented to spill externally using solid materials or screens or blinds at night.



The following strategies are recommended (in addition to elements listed in section 2.3 General Approach and Design criteria) to minimise light pollution at night:

- Only provide lighting for circulation areas and avoid any lighting to surrounding areas, such as protected areas on site.
- Control all external lighting by switching, use only when required and switched off or blanked out 2 hours after sunset.
- Control internal lighting using PIR/automatic switching/dimming facility and use of blinds at windows and glass doors to prevent light spill externally.
- Keep lighting levels as low as possible in accordance with European Standards.
- Use of dimmable lighting system across the site will provide flexible lighting solution to provide a good and balanced lit environment (i.e., reducing the intensity of the light where in close proximity to the site boarder with possible light spill where shield is not enough, and light spill is by surface reflection).

In summary, the light pollution is minimised by implanting: luminaires with good optical distribution, use of glare shields, selecting suitable luminaire height, dimmable light source, good lighting control and by switching the light off for a period (post curfew).



Appendix A. Bat House and Bat Box’s Location

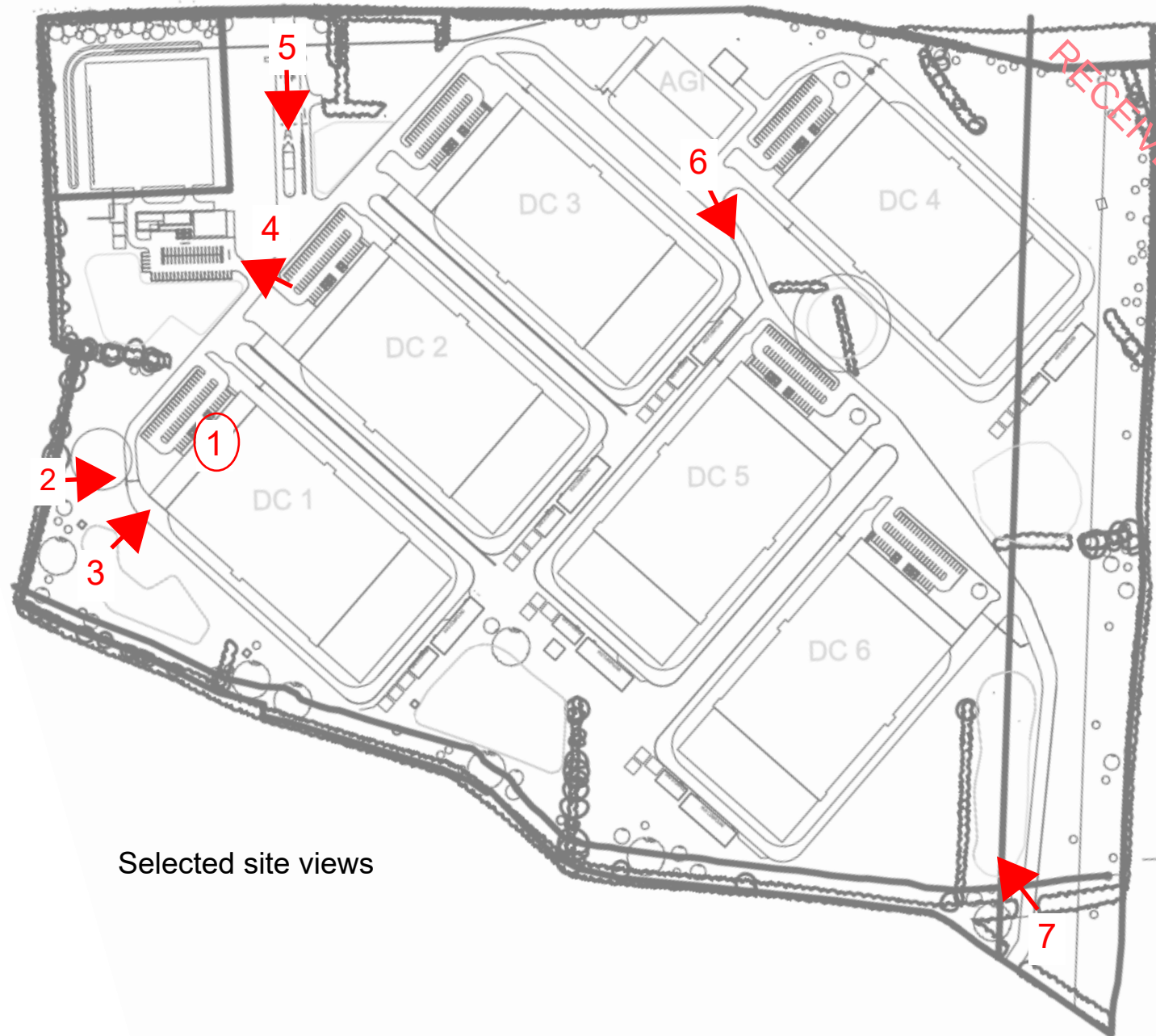
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Appendix B. Site Plan with Selected Views

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Selected site views

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Appendix C. External Lighting Analyses Calculations (Overall Site)

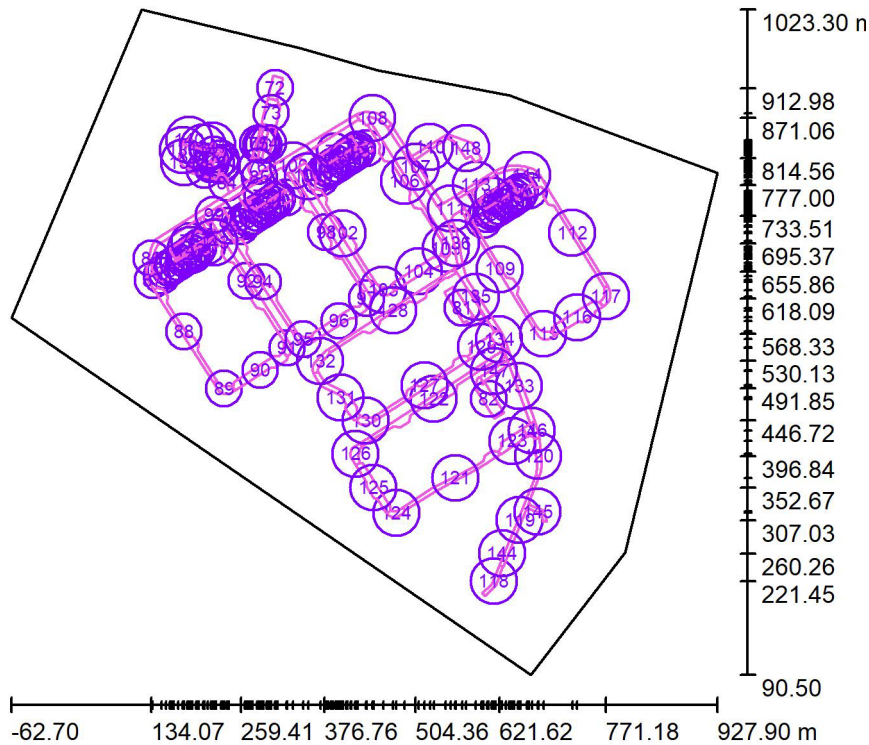
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In order to improve lighting uniformity across the site (as per areas highlighted in calculation results over the following pages) further coordination between light fixtures location and landscape elements, road design together with Pylon/overhead EHV lines will need to be carried out.

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Exterior Scene 1 / Calculation surfaces (results overview)



Scale 1 : 10615

Calculation Surface List

No.	Designation	Type	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
1	Admin Building Lobby	perpendicular	9 x 5	237	134	292	0.564	0.457
2	Admin Building Kitchenette	perpendicular	9 x 7	292	195	391	0.666	0.497
3	Admin Building Open Plan Office	perpendicular	11 x 9	407	189	545	0.464	0.346
4	Admin Building Conference Room	perpendicular	7 x 9	414	183	652	0.442	0.281
5	Admin Building Managers Office	perpendicular	15 x 7	362	209	473	0.577	0.442
6	Admin Building Workshop	perpendicular	7 x 13	343	222	426	0.647	0.520
7	Admin Building Storage	perpendicular	15 x 7	177	135	214	0.761	0.630
8	Security House Kitchenette	perpendicular	7 x 7	56	33	100	0.584	0.325
9	Security House Office	perpendicular	9 x 7	361	98	491	0.272	0.200

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Exterior Scene 1 / Calculation surfaces (results overview)

Calculation Surface List

No.	Designation	Type	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
10	Security House Panel Zone	perpendicular	7 x 7	282	190	341	0.672	0.556
11	Security House Lobby	perpendicular	7 x 9	257	121	376	0.472	0.322
12	DC01 GND Asset Management	perpendicular	7 x 9	210	130	292	0.618	0.444
13	DC01 GND Meeting Room	perpendicular	9 x 7	344	177	453	0.516	0.391
14	DC01 GND Lobby	perpendicular	11 x 7	163	90	226	0.553	0.399
15	DC01 GND Security	perpendicular	9 x 9	384	192	538	0.501	0.357
16	DC01 GND Manager Office	perpendicular	9 x 7	356	289	427	0.812	0.677
17	DC01 L1.01 Office	perpendicular	11 x 11	378	188	491	0.497	0.383
18	DC01 L1 Printer & Phone Booth	perpendicular	5 x 9	243	146	322	0.601	0.454
19	DC01 L1 Canteen	perpendicular	11 x 7	261	158	329	0.603	0.478
20	DC01 L1 Stairs 2	perpendicular	5 x 9	188	114	253	0.608	0.453
21	DC01 L1 Gym	perpendicular	11 x 7	326	185	419	0.568	0.442
22	DC01 L1 Meeting Room 1	perpendicular	9 x 9	470	202	660	0.429	0.306
23	DC01 L1 Meeting Room 2	perpendicular	11 x 9	541	209	774	0.387	0.270
24	DC01 L1 Welfare Room	perpendicular	9 x 5	240	129	320	0.536	0.402
25	DC01 L1 Facilities	perpendicular	7 x 11	480	193	731	0.402	0.264
26	DC01 L1 Office 2	perpendicular	13 x 11	454	253	559	0.558	0.453
27	DC02 GND Asset Management	perpendicular	7 x 9	216	135	284	0.627	0.477
28	DC02 GND Meeting Room	perpendicular	9 x 7	357	190	464	0.532	0.410
29	DC02 GND Lobby	perpendicular	11 x 7	167	95	227	0.566	0.417
30	DC02 GND Security	perpendicular	9 x 9	396	197	546	0.497	0.361
31	DC02 GND Manager Office	perpendicular	9 x 7	379	308	444	0.814	0.694
32	DC02 L1.01 Office	perpendicular	11 x 11	381	188	493	0.492	0.380
33	DC02 L1 Printer & Phone Booth	perpendicular	5 x 9	255	154	337	0.602	0.457
34	DC01 L1 Canteen	perpendicular	11 x 7	267	163	331	0.609	0.491
35	DC02 L1 Stairs 2	perpendicular	5 x 9	200	129	267	0.644	0.481
36	DC02 L1 Gym	perpendicular	11 x 7	339	174	426	0.514	0.410
37	DC02 L1 Meeting Room 1	perpendicular	9 x 9	474	213	668	0.451	0.319
38	DC02 L1 Meeting Room 2	perpendicular	11 x 9	549	214	775	0.390	0.276
39	DC02 L1 Welfare Room	perpendicular	9 x 5	245	134	324	0.546	0.412



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Exterior Scene 1 / Calculation surfaces (results overview)

Calculation Surface List

No.	Designation	Type	Grid	E _{av} [lx]	E _{min} [lx]	E _{max} [lx]	u0	E _{min} / E _{max}
40	DC02 L1 Facilities	perpendicular	7 x 11	484	195	733	0.404	0.267
41	DC02 L1 Office 2	perpendicular	13 x 11	457	255	566	0.558	0.451
42	DC03 GND Asset Management	perpendicular	7 x 9	212	130	295	0.615	0.443
43	DC03 GND Meeting Room	perpendicular	9 x 7	357	189	463	0.531	0.409
44	DC03 GND Lobby	perpendicular	11 x 7	169	95	230	0.565	0.415
45	DC03 GND Security	perpendicular	9 x 9	396	197	548	0.497	0.360
46	DC03 GND Manager Office	perpendicular	9 x 7	384	314	450	0.816	0.697
47	DC03 L1.01 Office	perpendicular	11 x 11	382	187	495	0.491	0.379
48	DC03 L1 Printer & Phone Booth	perpendicular	5 x 9	256	155	338	0.605	0.459
49	DC03 L1 Canteen	perpendicular	11 x 7	267	162	333	0.607	0.487
50	DC03 L1 Stairs 2	perpendicular	5 x 9	199	127	266	0.639	0.477
51	DC03 L1 Gym	perpendicular	11 x 7	339	175	426	0.515	0.410
52	DC03 L1 Meeting Room 1	perpendicular	9 x 9	473	213	668	0.450	0.319
53	DC03 L1 Meeting Room 2	perpendicular	11 x 9	549	214	774	0.390	0.276
54	DC03 L1 Welfare Room	perpendicular	9 x 5	245	134	324	0.546	0.412
55	DC03 L1 Facilities	perpendicular	7 x 11	485	197	734	0.406	0.268
56	DC03 L1 Office 2	perpendicular	13 x 11	457	255	566	0.558	0.451
57	DC04 GND Asset Management	perpendicular	7 x 9	212	130	290	0.613	0.449
58	DC04 GND Meeting Room	perpendicular	9 x 7	357	190	464	0.531	0.409
59	DC04 GND Lobby	perpendicular	11 x 7	168	95	229	0.566	0.416
60	DC04 GND Security	perpendicular	9 x 9	391	197	542	0.502	0.363
61	DC04 GND Manager Office	perpendicular	9 x 7	380	309	445	0.813	0.694
62	DC04 L1.01 Office	perpendicular	11 x 11	382	189	496	0.495	0.382
63	DC04 L1 Printer & Phone Booth	perpendicular	5 x 9	256	155	338	0.606	0.460
64	DC04 L1 Canteen	perpendicular	11 x 7	265	161	329	0.607	0.488
65	DC04 L1 Stairs 2	perpendicular	5 x 9	199	127	267	0.640	0.477
66	DC04 L1 Gym	perpendicular	11 x 7	337	174	421	0.516	0.413
67	DC04 L1 Meeting Room 1	perpendicular	9 x 9	474	214	668	0.451	0.319
68	DC04 L1 Meeting Room 2	perpendicular	11 x 9	548	214	774	0.390	0.276
69	DC04 L1 Welfare Room	perpendicular	9 x 5	246	134	327	0.543	0.410



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Exterior Scene 1 / Calculation surfaces (results overview)

Calculation Surface List

No.	Designation	Type	Grid	E _{av} [lx]	E _{min} [lx]	E _{max} [lx]	u0	E _{min} / E _{max}
70	DC04 L1 Facilities	perpendicular	7 x 11	372	185	462	0.497	0.400
71	DC04 L1 Office 2	perpendicular	13 x 11	458	255	566	0.558	0.451
72	Road 1	perpendicular	25 x 11	31	14	49	0.462	0.292
73	Road 2	perpendicular	11 x 15	37	15	65	0.394	0.224
74	Road 3	perpendicular	27 x 9	35	22	64	0.622	0.338
75	Road 4	perpendicular	3 x 17	30	22	41	0.743	0.549
76	Road 5	perpendicular	15 x 11	22	3.84	49	0.172	0.078
77	DC02 Parking	perpendicular	29 x 15	40	14	74	0.362	0.193
78	DC01 Parking	perpendicular	31 x 13	26	13	54	0.515	0.246
79	DC03 Parking	perpendicular	29 x 15	39	17	88	0.438	0.196
80	DC04 Parking	perpendicular	31 x 15	37	17	61	0.447	0.270
81	DC05 Parking	perpendicular	31 x 15	34	10	58	0.297	0.175
82	DC06 Parking	perpendicular	29 x 15	34	14	64	0.425	0.224
83	Admin Building Parking	perpendicular	19 x 11	34	10	61	0.297	0.167
84	Road 13	perpendicular	21 x 11	26	15	40	0.586	0.383
85	Road 14	perpendicular	325 x 11	30	11	55	0.370	0.205
86	Road 15	perpendicular	45 x 11	31	14	49	0.463	0.293
87	Road 16	perpendicular	25 x 11	42	14	60	0.327	0.230
88	Road 17	perpendicular	157 x 7	30	13	45	0.440	0.296
89	Road 18	perpendicular	25 x 11	37	20	47	0.546	0.432
90	Road 19	perpendicular	51 x 7	26	12	37	0.465	0.325
91	Road 20	perpendicular	15 x 9	38	22	51	0.584	0.439
92	Road 21	perpendicular	128 x 8	33	11	56	0.330	0.195
93	Road 22	perpendicular	27 x 9	38	18	64	0.481	0.282
94	Road 23	perpendicular	157 x 7	32	14	46	0.426	0.295
95	Road 24	perpendicular	25 x 11	46	29	56	0.624	0.518
96	Road 25	perpendicular	51 x 7	29	13	45	0.446	0.288
97	Road 26	perpendicular	15 x 7	32	20	44	0.641	0.460
98	Road 27	perpendicular	128 x 8	28	10	42	0.365	0.246
99	Road 28	perpendicular	25 x 9	24	10	46	0.427	0.227



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Exterior Scene 1 / Calculation surfaces (results overview)

Calculation Surface List

No.	Designation	Type	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
100	Road 29	perpendicular	25 x 9	29	9.15	45	0.311	0.203
101	Road 30	perpendicular	27 x 9	43	19	58	0.448	0.331
102	Road 31	perpendicular	128 x 16	33	14	49	0.431	0.291
103	Road 32	perpendicular	23 x 11	34	17	44	0.506	0.389
104	Road 33	perpendicular	51 x 7	30	12	45	0.381	0.255
105	Road 34	perpendicular	23 x 11	39	23	49	0.587	0.465
106	Road 35	perpendicular	128 x 8	28	9.19	55	0.330	0.166
107	Road 36	perpendicular	161 x 9	34	11	50	0.329	0.225
108	Road 37	perpendicular	27 x 9	44	23	64	0.521	0.360
109	Road 38	perpendicular	128 x 8	29	9.81	45	0.334	0.220
110	Road 39	perpendicular	64 x 8	31	16	51	0.532	0.319
111	Road 40	perpendicular	15 x 13	23	6.88	44	0.299	0.155
112	Road 41	perpendicular	128 x 16	25	12	46	0.471	0.254
113	Road 42	perpendicular	64 x 8	35	22	45	0.637	0.495
114	Road 44	perpendicular	31 x 11	38	18	61	0.485	0.301
115	Road 45	perpendicular	25 x 11	36	18	46	0.492	0.379
116	Road 46	perpendicular	51 x 7	23	8.39	40	0.360	0.210
117	Road 47	perpendicular	32 x 16	38	21	47	0.537	0.437
118	Road 48	perpendicular	7 x 13	32	20	38	0.626	0.516
119	Road 49	perpendicular	165 x 11	43	26	67	0.609	0.388
120	Road 50	perpendicular	47 x 11	33	16	45	0.496	0.366
121	Road 51	perpendicular	155 x 7	24	9.90	53	0.417	0.187
122	Road 52	perpendicular	173 x 9	23	7.70	37	0.335	0.206
123	Road 53	perpendicular	45 x 11	26	4.11	52	0.156	0.079
124	Road 54	perpendicular	23 x 11	48	25	61	0.535	0.418
125	Road 55	perpendicular	51 x 7	36	12	59	0.325	0.200
126	Road 56	perpendicular	23 x 13	41	22	51	0.547	0.439
127	Road 57	perpendicular	155 x 7	27	15	38	0.536	0.381
128	Road 58	perpendicular	173 x 9	25	5.23	43	0.206	0.122
129	Road 59	perpendicular	45 x 11	26	7.68	58	0.297	0.133



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Exterior Scene 1 / Calculation surfaces (results overview)

Calculation Surface List

No.	Designation	Type	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
130	Road 60	perpendicular	23 x 11	41	25	51	0.595	0.485
131	Road 61	perpendicular	51 x 7	34	14	57	0.403	0.236
132	Road 62	perpendicular	23 x 13	41	22	58	0.530	0.373
133	Road 63	perpendicular	35 x 11	30	13	47	0.433	0.271
134	Road 64	perpendicular	15 x 7	28	15	40	0.515	0.365
135	Road 65	perpendicular	89 x 11	28	12	43	0.428	0.280
136	Road 66	perpendicular	47 x 7	20	8.48	33	0.426	0.255
137	Road 68	perpendicular	9 x 11	45	27	57	0.611	0.480
138	Road 69	perpendicular	19 x 7	34	23	53	0.666	0.426
139	Road 70	perpendicular	73 x 7	42	11	66	0.267	0.170
140	Road 71	perpendicular	9 x 9	52	41	60	0.786	0.687
141	Road 72	perpendicular	9 x 9	51	34	62	0.664	0.543
142	DC01 Building Light Spill (Front)	perpendicular	128 x 8	22	3.08	98	0.137	0.031
143	DC01 Building Light Spill (Side)	perpendicular	8 x 4	7.22	2.15	20	0.297	0.109
144	Road 73	perpendicular	11 x 7	52	39	64	0.746	0.614
145	Road 74	perpendicular	25 x 9	50	25	67	0.501	0.374
146	Road 75	perpendicular	15 x 11	32	14	51	0.424	0.267
147	Road 76	perpendicular	43 x 9	21	11	39	0.508	0.271
148	Road 77	perpendicular	29 x 11	37	0.05	61	0.001	0.001

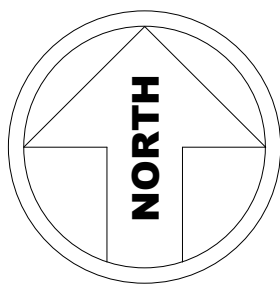
Summary of Results

Type	Quantity	Average [lx]	Min [lx]	Max [lx]	u0	E_{min} / E_{max}
perpendicular	148	58	2.15	775	0.04	0.00



Appendix D. Site Plan External Lighting Analyses

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ESB SUB STATION SUBJECT OF SEPARATE SID APPLICATION



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LUMINAIRE SCHEDULE:

- | | | |
|---|------|---|
| 1 | 92" | Tamile Lighting ADV200NWD03 ADVANCE (1987 lm; 17.0 W; 1xLED) |
| 2 | 310" | Tamile Lighting ADV300NWD03 ADVANCE (2886 lm; 25.0 W; 1xLED) |
| 3 | 617" | Tamile Lighting ADV400NWD03 ADVANCE (3884 lm; 34.0 W; 1xLED) |
| 4 | 14" | Tamile Lighting CTRB30073WWG CITY RLB (2003 lm; 23.0 W; 1xUser defined) |
| 5 | 696" | Tamile Lighting CTRB30073WWG CITY RLB (3606 lm; 40.0 W; 1xUser defined) |
| 6 | 12" | Tamile Lighting CTRB30073WWG CITY RLB (3606 lm; 61.0 W; 1xUser defined) |
| 7 | 14" | Tamile Lighting CYG4689WWD03VMS CYCLOONE G (6884 lm; 45.0 W; 1xLED) |

All dimensions to be checked on site. Figured dimensions take precedence over stated dimensions. Any errors or discrepancies to be reported to client. This drawing may be updated or modified by the recipient.

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 2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL DISCIPLINE DRAWINGS, REPORTS AND SPECIFICATIONS.

ISOLINES:

0.1 LUX
2.0 LUX
5.0 LUX
7.5 LUX
10.0 LUX

REV	DATE	DESCRIPTION
P04	01/05/24	ISSUE FOR PLANNING
P03	07/09/23	ISSUE FOR PLANNING
P02	17/05/23	ISSUE FOR PLANNING
P01	28/04/23	STAGE 2 ISSUE
Rev	Date	Description
STATUS		
PLANNING		
PROJECT		
HERBATA NAAS		
PROJECT ADDRESS		
NAAS, CO. KILDARE		
DWG TITLE		
ELECTRICAL SERVICES - EXTERNAL LIGHTING LAYOUT		
DWG NO.		
10360452-HDR-XX-XX-DR-E-632000		
REV	SUBMITALTY	PROJECT NO.
P04	S3	10360452
DATE	01/05/24	DRN GDS LDR AC
SCALE		
1:1000		



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