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Member of the SNC-Lavalin Group

Cambridge South East Transport Phase 2

Environmental Statement

Appendix 11.3 Lighting Impact Assessment

31st July 2023

Appendix 11.3 Lighting impact assessment

Method of assessment

Scope of assessment

11.3.1 The Proposed Development incorporates various elements of artificial lighting. The Environmental Lighting Impact Assessment (ELIA) evaluates the impacts of the proposed lighting installation and:

- Identifies and describes the artificial light currently affecting each site and surrounding identified receptors.
- Provides a description of the proposed lighting standards and associated lighting design information utilised to inform the assessment of obtrusive light (sometimes referred to as light pollution).
- Provides the limitations of obtrusive light for each environmental zone in accordance with the guidance provided in ILP GN01:2021 (included in Annex B)
- Identifies design interventions and provides guidance on mitigation measures, with a view to reducing potential impacts to a negligible magnitude.
- Identifies predicted impacts of obtrusive light using a combination of qualitative and quantitative assessment techniques.

11.3.2 As well as ILP GN01:2021, the guidance provided in ILP PLG04:2013 has been used to undertake the lighting assessment

Baseline assessment methodology

11.3.3 Receptors in the vicinity of the Proposed Development were identified through an initial desk-based study of the area further informed by site attendance and walkover.

11.3.4 The location of each receptor (prefixed 'LR') was agreed with Gareth Kearney Principal Environmental Health Officer - City Council during a meeting that took place on 17th March 2021. Refer to Lighting Receptor and Environmental Zone Plan included in Annex A of this report for further details. Receptor sites were chosen to allow the identification of baseline lighting conditions, and an assessment of potential impacts on people and the environment in which they live.

11.3.5 An assessment of each receptor location in Table A11.3.1 was undertaken during day and at night. These were evaluated in terms of their direct and intermittent views towards the Proposed Development, and whether existing screening is likely to prevent spill light, views of luminous intensity or sky glow. Day and Night time photographs were taken from each location at a height of 1.7m (representative of adult eye height).

11.3.6 To record the baseline lighting levels at each receptor location, four vertical readings of illuminance were taken with the sensor of the light meter pointed north, east, south, and west at a height of 1.5m. One horizontal reading was taken at ground level. providing information on the levels of ambient light at each receptor location.

11.3.7 A Konica Minolta T-10A illuminance meter (Serial Number 20017001) was used for all on site light readings in Lux (Lumen / m^2). The hand-held meter was maintained and calibrated in accordance with the manufacturer's instructions. The Certificate of Calibration can be found in Annex C.

11.3.8 The camera utilised for the on-site photography was a Nikon D3200 SLR with 35mm fixed focal length lens and a tripod.

11.3.9 The lighting receptors assessed during the desk-top study were reviewed and further receptors advised by the Biodiversity, Landscape, Visual and Heritage environmental specialists. An assessment was carried out to identify which receptors were to be assessed using a combination of quantitative and qualitative techniques and those which would be qualitatively assessed.

11.3.10 A summary of the locations and a description of each receptor assessed both quantitatively and qualitatively is listed in Table A11.3.1. Refer to Figure A11.3.1 for viewpoint locations.

Table A11.3.1 Summary of receptor locations assessed both quantitatively and qualitatively

Receptor Location No.	Eastings	Northings	Description of Location
LR01	545998	255038	Francis Crick Avenue (Signalised Junction)
LR02	546022	254785	Francis Crick Avenue (Middle)
LR03	546077	254587	Francis Crick Avenue (Roundabout)
LR04	546725	253651	White Hill House, Granham's Road, Great Shelford
LR05	546521	253427	50, Granham's Road, Great Shelford
B01	546553	253470	Granham's Road, Great Shelford
B02	546392	253236	Granham's Road, Great Shelford
LR06	547393	253139	173, Hinton Way, Great Shelford
LR07	547287	253014	154, Hinton Way, Great Shelford
LR07a	547008	252988	Rear of 18, Coppice Avenue, Great Shelford
B03	547268	253165	Hinton Way, Great Shelford
LR08	547796	252147	15, Haverhill Road, Stapleford
LR09	547797	252084	88, Haverhill Road, Stapleford
B08	547862	252221	Haverhill Road, Stapleford
B09	547933	252322	Haverhill Road, Stapleford
LR10	549538	250013	Sutton House, Babraham Road, Sawston
LR10a	549709	250077	North of The Hawthorns, Babraham Road, Sawston

Receptor Location No.	Eastings	Northings	Description of Location
B10	549776	250071	Babraham Road/Sawston Road, Sawston
LR10b	549165	250469	North Farm, West Way, Sawston
LA18	550579	249911	Sawston Road, Babraham
LR12	550832	250023	High Street, Babraham
B11	550724	249540	High Street, Babraham
LR13	551365	250109	Home Farm Agricultural Buildings, Babraham
LR14	551574	250206	Field near Honeysuckle Lane, Babraham
LR15	551623	250355	Field behind Oak Lane, Babraham
LR16	551971	249755	Footpath 12/4 next to and west of footbridge over A11
B12	551757	249594	Field adjacent to A11, Little Abington
B13	551869	249791	Footpath 12/4 from Babraham village to A11 footbridge
B15	552100	250169	Field adjacent to A1307/A11 and Four Went Ways roundabout, Little Ablington
B16	551981	250298	Field adjacent to A1307/A11 and Four Went Ways roundabout, Little Ablington
LR17	552137	249762	Newmarket Road, Little Abington

Table A11.3.2 Summary of receptor locations assessed qualitatively

View Point Location No.	Description of Location	Additional Notes
VP1	Residents on Babraham Road, Urwin Gardens and users of permissive bridleway looking south-west.	Qualitative assessment undertaken
VP2	Staff working in buildings on and users of Dame Mary Archer Way and users of the public right of way.	Qualitative assessment undertaken
VP3	Staff working on the Cambridge Biomedical Campus and users of Footpath 39/47 looking south.	Refer to Lighting Receptor reference LR02
VP4	Users of National Cycle Route 11/ DNA Cycle Path (PPA/0155) looking south.	Qualitative assessment undertaken
VP5	Residents on Southwell Drive, Lapwing Avenue, Kingfisher Gardens and visitors to the Cabbage Moor campsite looking east.	Qualitative assessment undertaken
VP6	Visitors to Nine Wells LNR and users of Footpath Great Shelford 198/2 looking west.	Qualitative assessment undertaken – This receptor is representative of Historic Receptor locations for Nine Wells LNR (546067, 254143) and (546071, 254084)
VP7	Users of National Cycle Network Route 11/DNA Cycle Path (PPA/0155) looking north.	Qualitative assessment undertaken
VP8	Residents at White Hill Farm, Nine Wells House, White Hill House and users of the permissive bridleway looking south-west.	Qualitative assessment undertaken
VP9	Residents on A1301 Cambridge Road and adjacent side roads looking east.	Qualitative assessment undertaken
VP10	Residents on Granham's Road and users of Footpath Great Shelford 198/1 looking north-west.	Qualitative assessment undertaken – This receptor is representative of Historic Receptor location for Granham's Farm (546685, 253240)

View Point Location No.	Description of Location	Additional Notes
VP11	Users of Granham's Road and users of Footpath Cambridge 39/8 looking south-west.	Qualitative assessment undertaken
VP12	Residents and users of Hinton Way looking south	Qualitative assessment undertaken
VP13	Residents on Hinton Way looking south-west.	Refer to Lighting Receptor reference LR06
VP14	Residents on Hinton Way and Coppice Avenue looking north-east.	Qualitative assessment undertaken
VP15	Residents on Mingle Lane, Duke's Meadow and Gog Magog Way and visitors to St. Andrew's Church and Stapleford Cemetery looking north-east.	Qualitative assessment undertaken - This receptor is representative of Historic Receptor location for St. Andrew's Church (547117, 252148)
VP16	Residents on Haverhill Road, Chalk Hill and at the eastern end of Gog Magog Way looking north-east.	Refer to Lighting Receptor reference LR08 and LR09
VP17	Residents of Middlefield Cottage, South Hill House, The House on the Hill and other residences on Fox Hill and users of Haverhill Road looking south and south-west.	Qualitative assessment undertaken – This receptor is representative of Historic Receptor locations for Middlefield House 548002, 252872) and (548023, 252690)
VP18	Visitors to Magog Down Users of Footpath Stapleford 212/3 and residents of Gog Magog cottages looking south-west.	Qualitative assessment undertaken – This receptor is representative of Historic Receptor location for Magog Down (548761, 252900)
VP19	Users of Bridleway Stapleford 212/2 and residents on Haverhill Road looking east.	Qualitative assessment undertaken
VP20	Users of Bridleway Stapleford 212/2 looking west.	Qualitative assessment undertaken
VP21	Users of Cambridge Road looking north-east.	Qualitative assessment undertaken

View Point Location No.	Description of Location	Additional Notes
VP22	Users of Restricted Byway Babraham 12/10 and residents of North Farm looking south-west.	Qualitative assessment undertaken
VP23	Users of Bridleway Babraham 12/12 (Rowley Lane) looking south-west.	Qualitative assessment undertaken
VP24	Residents on Sawston Road / Babraham Road, Lynton Way and Stanley Webb Close looking east and south-east	Refer to Lighting Receptor reference LR10 and LR10a
VP25	Users of Footpath 179/1, 179/2,196/12 and 196/14 looking north-east.	Qualitative assessment undertaken
VP26	Users of Sawston Road and cycleway looking west.	Qualitative assessment undertaken
VP27	Users of Footpath Babraham 12/8 and 12/9 and residents in properties north of Sawston Road looking south.	Refer to Receptor reference LA18
VP28	Users of Sawston Road and High Street looking east.	Qualitative assessment undertaken
VP29	Residents at the northern end of High Street, Babraham and Oak Lane and users of the A1307 Cambridge Road looking south-east.	Qualitative assessment undertaken
VP30	Users of Footpath Babraham 12/4 looking south and south-east and footpath 4/3 looking west.	Refer to Receptor reference LR13
VP31	Residents at Home Farm Cottages, Pampisford Hall and users of Footpath 179/4 looking north-east.	Qualitative assessment undertaken
VP32	Residents and road users on High Street, Babraham east of the River Granta looking south-east.	Qualitative assessment undertaken
VP33	Residents and road users on High Street, Babraham west of the River Granta looking south.	Qualitative assessment undertaken

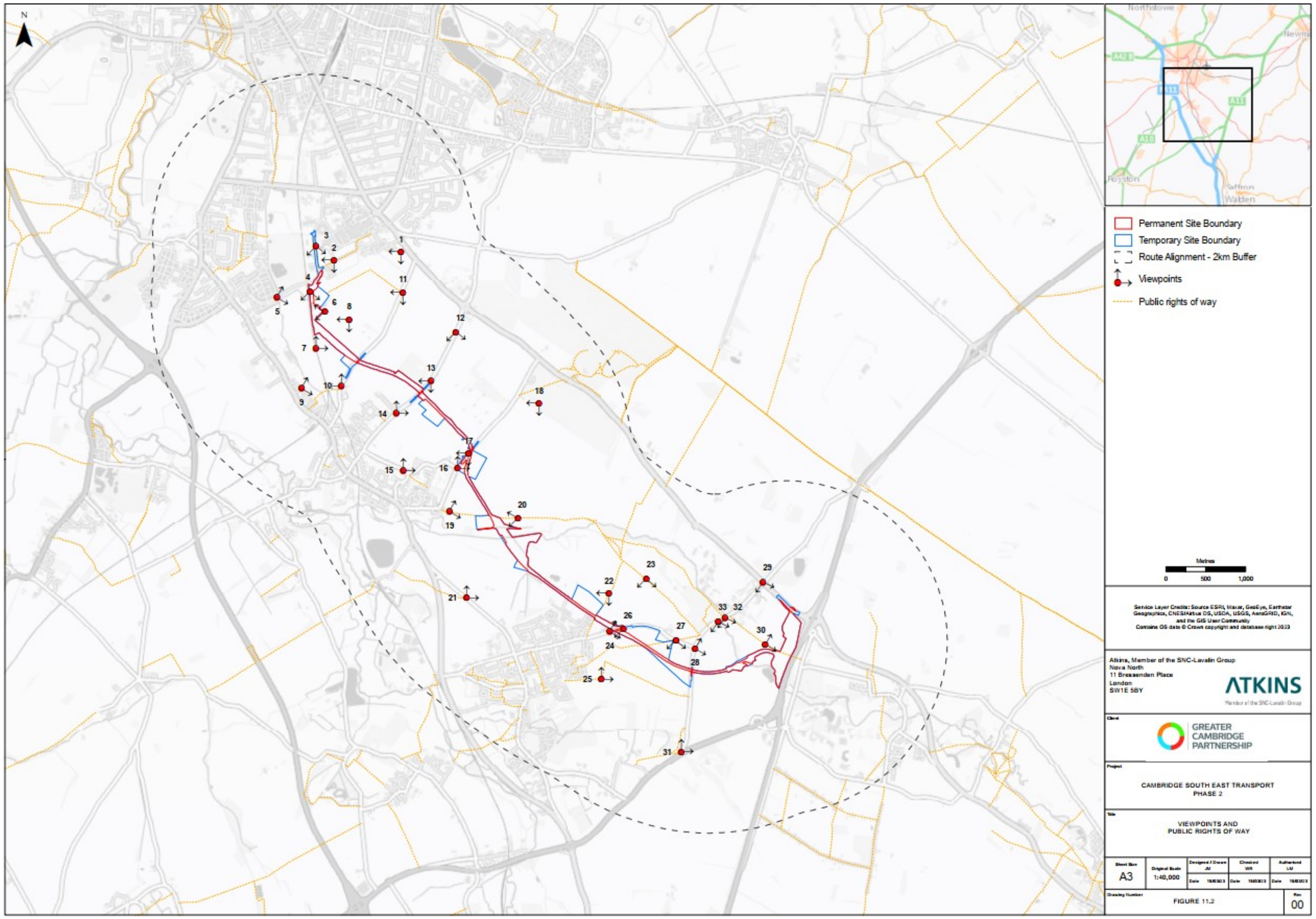

Figure A11.3.1 Viewpoints and public rights of way

11.3.11 Table A11.3.3 lists the locations where biodiversity, landscape visual and Historic Environment receptors and/or viewpoints identified are a duplication or substitution of some of the locations included in Table A11.3.1 and Table A11.3.2. As agreed with the respective specialists, data gathered for the replacement receptors identified below were utilised to inform the assessment of likely significant effects for that location.

Table A11.3.3 Replacement viewpoint and receptor locations

Receptor / viewpoint Location No.	Replacement receptor / viewpoint reference
B04	Refer to Receptor LR06
B05	Refer to Receptors LR06 and LR07
B06	Refer to Receptor LR07
B07	Refer to Receptor LR08
B14	Refer to Receptor LR16
VP3	Refer to Receptor LR02
VP13	Refer to Receptor LR06
VP16	Refer to Receptor LR08 and LR09
VP24	Refer to Receptor LR10 and LR10a
VP27	Refer to Receptor LA18
VP30	Refer to Receptor LR13
H07	Refer to Receptor LR12 and LR13

Identifying the environmental zone

11.3.12 To define the maximum permissible levels of obtrusive light an appraisal has been carried out to classify the Proposed Development in terms of its 'environmental zone', which equates to the district brightness of the surroundings (see Table A11.3.4) for environment zone information).

11.3.13 Where a site is between two possible environmental zones, ILP guidance recommends that, of the two options, the most stringent environmental zone to achieve is assigned for assessment purposes.

11.3.14 In this case there are two different environmental zones E2 and E3 zone. The E3 zone location is in the vicinity of Francis Crick Avenue and Dame Mary Archer Way/Addenbrookes Road Roundabout in Trumpington. All other locations have been deemed to be an E2 environmental zone. The environmental zones detailed have been agreed with Gareth Kearney Principal Environmental Health Officer - Cambridge City Council. Refer to Lighting Receptor and Environmental Zone Plan included in Annex A of this report for further details.

Table A11.3.4 Environmental zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (*SQM 20.5+)	Astronomical Observed 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 or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night time activity

Obtrusive light limitations

11.3.15 A lighting installation located in an area deemed to be more sensitive will equate to greater constraints with regards to obtrusive light. Table A11.3.5, Table A11.3.6, Table A11.3.7, Table A11.3.8 and Table A11.3.9 detail maximum permissible levels of obtrusive light associated with environmental zones E2 and an E3.

Table A11.3.5 Limits of luminaire upward light ratio and vertical illuminance on premises

Environmental Zone	Maximum values of upward light ratio (ULR) / % of luminaires*2	Illuminance in the vertical plane (E_v)*1	
		Pre-Curfew*3	Post Curfew*3
E2	2.5	5 Lux	1 Lux
E3	5	10 Lux	2 Lux

Note:

*1 Table 3 ILP GN01:2021 (Table 2 CIE 150:2017).

*2 Table 6 ILP GN01 2021 (Table 5 CIE 150:2017):

*3 Curfew: The time after which more stringent requirements (for control of obtrusive light) will apply; often a condition of use of lighting by the local planning authority. ILP GN01:2021 advises that application curfew times often commence between 21:00 to 23:00 and may run until 07:00. 23:00 were agreed with Gareth Kearney Principal Environmental Health Officer – Cambridge City Council as part of the consultation process.

Table A11.3.6 Limits for the luminous intensity of bright luminaires

Light technical parameter	Applicable Conditions	Luminaire group (projected area A_p in m^2)					
		0 < A_p <= 0.002	0.002 < A_p <= 0.01	0.01 < A_p <= 0.03	0.03 < A_p <= 0.13	0.13 < A_p <= 0.50	A_p > 0.50
Maximum luminous intensity emitted by luminaire (I in cd)	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
Aid to gauging A_p		2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding A_p representative area (m^2)		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 metres
2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut-off in the designated directions
3. Ap is the apparent surface of the light source seen from the observer position
4. For further information refer to Annex C of CIE 150:2017
5. Upper limits for each zone shall be taken as those with column Ap > 0.5

Table A11.3.7 Maximum values of threshold Increment (TI) and viewing direction in the path of travel

Light technical parameter	Road classification*			
	No road lighting	M6/M5	M4/M3	M2/M1
Veiling Luminance † (L_v)	0.037 cd/m^2	0.23 cd/m^2	0.40 cd/m^2	0.84 cd/m^2
Threshold Increment (TI)	15% based on adaption luminance of 0.1 cd/m^2	15% based on adaption luminance of 1.0 cd/m^2	15% based on adaption luminance of 2.0 cd/m^2	15% based on adaption luminance of 5 cd/m^2
* Road classifications as given in CIE 115:2010 † The veiling luminance values specified in this table are based upon permissible TI value of 15%				

Table A11.3.8 Maximum values of threshold Increment for residential roads

Light technical parameter	Road classification*						
	P7	P6	P5	P4	P3	P2	P1
Threshold Increment (TI)	Not determined	35	30	30	25	24	20

Table A11.3.9 Maximum permitted values of average surface luminance (cd/m^2).

Light technical parameter	Application Conditions	Environmental Zones	
		E2	E3
Sign luminance (L_s)	Taken as the product of the design average illuminance and reflectance divided by π, or for self-luminous signs, its average luminance.	400	800
Note: The values apply to both pre- and post-curfew, except that in zones 0 and 1 the values shall be zero post curfew. The values for signs do not apply to signs for traffic control purposes.			

Dimming profiles

11.3.16 CCC Lighting and Bus Facilities and Operations teams were consulted, and the dimming profiles detailed in Table A11.3.10 were agreed.

Table A11.3.10 Lighting configurations

Area of Lighting	Pre-curfew	Post-curfew
Francis Crick Avenue – Signalised junction	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
Francis Crick Avenue	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
Dame Mary Archer Way/Addenbrookes Road Roundabout	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
Granham's Road	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
Hinton Way	06:00 - 100% Output	22:00 – 06:00 60% Output
Haverhill Road	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
Babraham Road/Sawston Road	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
High Street Babraham	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
A1307 Proposed roundabout and approach roads	06:00 - 20:00 100% Output 20:00 – 24:00 Stage 1 – drop by 1 lighting class.	20:00 – 24:00 Stage 1 – drop by 1 lighting class. 24:00 – 06:00 Stage 2 – drop by 1 lighting class.
Access Road into A11 Travel Hub from A1307 roundabout	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output
A1307 A11 Travel Hub	06:00 - 22:00 100% Output	22:00 – 06:00 60% Output

Impact assessment methodology

11.3.17 The ELIA has considered the potential impacts from the lighting associated with the Proposed Development on each identified receptor or viewpoint. The assessment evaluates whether the limitations detailed in Tables A11.3.5 to A11.3.9 and visualised in Figure A11.2 will be exceeded in terms of the following:

- Sky Glow – The illumination of the sky at night by artificial light sources including light emitted directly upward from the light source and reflected from the ground or surface.
- Light Intrusion – Light that falls beyond the boundary of the area being lit.
- Luminous Intensity – The measure of the amount of light that a source radiates in a given direction.
- Discomfort/Disability Glare – The measure of the amount of glare for highway users.

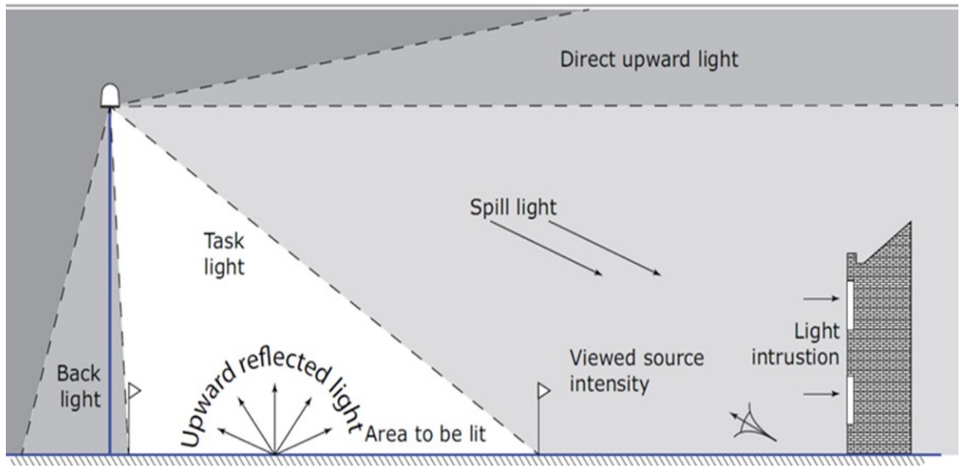

Figure A11.3.2 Types of obtrusive light

11.3.18 A 3-dimensional (3D) lighting model has been used to calculate lighting levels for most of the Proposed Development. This includes the main lit areas, lit by lighting columns for which there is a design and specification. Other sources of lighting, for which there is no current design, include solar studs, illuminated signage, external building lighting, internal building lighting, stop shelters, under canopy lighting and ticket machines. It is not possible to model these light sources, so a qualitative assessment has been undertaken to supplement the modelling.

11.3.19 The combined quantitative and qualitative assessments have considered the baseline lighting conditions at each identified receptor and reviewed these against the potential lighting impacts from the Proposed Development as a whole.

11.3.20 Table A11.3.2 contains details of all the viewpoint locations that have been assessed qualitatively. The qualitative assessment has taken into account the embedded mitigation measure.

11.3.21 Both the quantitative and qualitative assessments carried out have been used to predict the likely levels of obtrusive light and whether the obtrusive light limitations detailed in this section of the ELIA are exceeded. The qualitative assessments carried out are based on professional judgement and experience.

11.3.22 It should be noted that ILP PLG04:2013, advises that building luminance is applicable only to buildings, structures, statues etc which are directly illuminated as a decorative night time feature and not buildings which are illuminated as a result of spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area. It has been confirmed that no buildings are being directly illuminated as a night-time feature as part of the Proposed Development, as such building luminance has been de-scoped from this assessment.

11.3.23 ILP PLG04:2013 provides no methodology for assessing the environmental value (or sensitivity) of receptors or viewpoints in terms of lighting and therefore the magnitude of the effect is evaluated from the limitations (for each zone) provided within this section. The impacts of artificial lighting for the Proposed Development will have varying levels of significance and have been assessed based on the magnitude experienced by each identified receptor. The level of change is presented on a scale of minor, moderate, major or none/negligible. The resulting overall impacts can be described as positive, neutral or negative. Table A11.3.11 outlines the matrix used to assess the magnitude of impact of the Proposed Development

Table A11.3.11 Evaluation table

Nature	Reference	Level	Description	Remedial Needs
Positive	1	Major / substantial beneficial impacts	Significant improvements in night environment and/or reductions in glare, spill light and sky glow etc	No remedial/mitigation measures required
	2	Moderate beneficial impacts	Noticeable improvements in night environment and/or reductions in glare, spill light and sky glow etc	
	3	Minor beneficial impacts	Slight improvements in night environment and/or reductions in glare, spill light and sky glow etc	
Neutral	4	None / negligible	No significant impacts or overall impacts balancing out	
Negative	5	Minor adverse impacts	Slight increase in visibility of site, glare, and sky glow etc	Develop appropriate levels and type of mitigation
	6	Moderate adverse impacts	Noticeable increase in visibility of site, glare and sky glow etc	
	7	Major adverse impacts	Significant problems with increase in visibility of site, glare, and sky glow etc	

11.3.24 Changes in levels of artificial lighting can affect ecological receptors, for example bats and other nocturnal species. The lighting assessment has evaluated baseline levels for the biodiversity receptors within Table A11.1 (Prefix B) and the predicted change to levels of artificial lighting at each identified ecological receptor location. The effects of the predicted change on ecology will be factored into an assessment of the overall effect on biodiversity as detailed in the Biodiversity chapter of the ES.

11.3.25 Changes in levels of artificial lighting can affect landscape receptors, the lighting assessment has evaluated baseline levels for the landscape receptors within Table A11.2 and the predicted change to levels of artificial lighting at each location. The effects of the predicted change on the landscape have been factored into an assessment of the overall effect on the landscape as detailed in the Landscape and Visual Impact chapter of the ES

11.3.26 The assessment of the overall effects on Biodiversity, Population and Human Health, Historic environment and Landscape and Visual form part of the respective assessments detailed in the ES.

Calculation methodology

11.3.27 Numerical modelling and calculations have been carried out using the Lighting Analysis – AGi32 software package versions 19.3 and 19.4.

11.3.28 For this assessment, a Radiosity Stopping Criterion of 99% has been used to ensure that results are accurate.

11.3.29 The AGi32 model consists of the following elements:

- An existing ground surface model taken from the elevations on the GIS map.
- A 3D representation model of each residential dwelling in proximity to the identified receptors and the proposed lighting designs.
- The luminaires included within the proposed lighting design for the specific calculation area being analysed.
- One Illuminance calculation point at each viewpoint location with an elevation height equal to ground level (GL) within the model.
- An illuminance calculation point at each viewpoint location at GL+1.5m for directions north, east, south and west.
- Luminous intensity calculation point at each viewpoint location at GL+1.5m for directions north, east, south, and west.
- Illuminance calculations at window locations of residential dwellings in proximity to the identified receptors and proposed lighting design.

Existing ground surface model methodology

11.3.30 To create the existing ground surface model, elevations shown on the GIS map were used to generate the surface in AutoDesk Civil 3D 2020. The data origin of the Digital Terrain Model (DTM) is 5m LiDAR flown by Bluesky. The data was obtained under licence from Cambridgeshire County Council © Crown Copyright and database rights 2021, Ordnance Survey 100023205, forming part of the Aerial Photography for Great Britain (APGB).

3D Representation model of the residential dwellings

11.3.31 3-dimensional (3D) geometric models of residential properties in close proximity to the identified receptors and proposed lighting design have been developed based on GIS map data, site photographs and information gathered during baseline surveys.

11.3.32 Each building footprint has been taken from the GIS map and extruded to the approximate height of the building. The location of windows which are representative of the baseline survey locations were included within the 3D model using the baseline survey photographs and online mapping data to guide where the windows should be placed. Once completed, the building was appended to the surface model.

Proposed luminaire location methodology

11.3.33 The following luminaires have been included within the Proposed Development obtrusive light calculations:

- Proposed busway lighting
- Proposed CCC adopted highway lighting

11.3.34 Each luminaire type, output, location, tilt and orientation has been added manually to the AGi32 file. This information has been gathered from the lighting designs produced. The luminaire mounting heights have been determined by taking the height of the ground surface model at the approximate location of the lantern and adding the mounting height from the design calculations.

Limitations, assumptions and clarifications

11.3.35 Where lighting designs are developed to a suitable level to enable a quantitative assessment to be undertaken, calculations will be undertaken to understand levels of obtrusive light at each receptor location and calculated in accordance with CIE 150:2017.

11.3.36 The lighting assessment has been performed with the dimming profiles detailed within Table A11.3.12 below:

Table A11.3.12 Lighting configurations

Area of Lighting	Dimming Profiles				
	Darkness*	20:00	22:00	24:00	6:00
Francis Crick Avenue	100%	100%	60%	60%	0%
Granham's Road	100%	100%	60%	60%	0%
Hinton Way	100%	100%	60%	60%	0%
Haverhill Road	100%	100%	60%	60%	0%
Babraham/Sawston Road	100%	100%	60%	60%	0%
High Street	100%	100%	60%	60%	0%
A11 Travel Hub + Access Road	100%	100%	60%	60%	0%
A1307 Roundabout	100%	80%	80%	60%	0%

* Lux levels for 'darkness' to be determined by Central Management System (CMS) or preprogramed photocell at 35 Lux on / 18 Lux off as specified in the CCC Street Lighting Development Specification Revision 3 (2016)

11.3.37 Trees and all other vegetation have been ignored for the purpose of this analysis to provide a 'worst case' assessment, i.e. in winter when vegetation is minimal, or to allow for vegetation to be removed in the future.

11.3.38 Obtrusive light levels were calculated for the receptor locations shown in Annex A and the residential property windows which are close to the proposed lighting designs and are representative of the baseline survey locations.

11.3.39 Obtrusive light limitations are based on the level of light experienced at the windows of each receptor. The locations of the receptor windows have been assumed based on baseline survey, pictures and desktop study, therefore the calculation results represent the level of light experienced at the assumed window locations.

11.3.40 Additional spill light and luminous intensity calculations have been produced on Francis Crick Avenue for the buildings in close proximity to lighting receptors LR01, LR02, and LR03. As these building have been constructed relatively recently and the topographical survey does not extend into construction sites, the locations of some of these buildings have been assumed based on desktop analysis of the GIS Map.

11.3.41 Additional spill light calculations have been produced for the areas where existing lighting infrastructure is present in close proximity to a receptor and the contribution of spill light from the Proposed Development at the receptor window locations is not zero lux, this is only the case at the following locations: -

- LR07 – 154 Hinton Way (existing lighting column reference number L25VHR)
- LR08 – 11, 13 and 15 Haverhill Road (existing lighting column reference number L11VQF)

11.3.42 In this situation the existing lighting column has been included within another spill light calculation. The results of both calculations are provided where the spill light from the Proposed Development are shown without brackets and the combined results of spill light from both the existing lighting and the Proposed Development lighting are shown in brackets.

11.3.43 Due to the location of receptor LR07 (Outside 154 Hinton Way) being within the lit area associated with the highway an additional luminous intensity calculation has been undertaken that is located on the frontage of 154 Hinton Way. This location has been assumed as the location most likely to have maintained views of the bright surfaces of the luminaires.

11.3.44 A maintenance factor is a luminaire and lamp specific de-rating factor applied to lighting calculations to allow for lumen depreciation of a light source over time and a predicted amount of dirt build up on the glazing of the luminaire given its height and the pollution category of the area. Maintenance factors are utilised within the design calculations to prove that an installation will have compliant lighting levels on a worst-case basis. In these situations, worst case would be at the end of the maintenance cycle when the light source has depreciated the most and the glazing of the luminaire is the dirtiest.

11.3.45 For obtrusive light assessments, a maintenance factor of 1 (no de-rating) has been utilised as this accounts for the worst-case scenario for obtrusive light, this shows the impacts of the installation on the first day of its use or immediately after it has been maintained.

11.3.46 Obtrusive lighting calculations carried out take no account of the reflective properties of the various surfaces.

11.3.47 It should be noted that perceived levels of sky glow can be variable depending on several factors such as weather conditions, quantity of dust and gas in the atmosphere, amount of directed upward and indirect reflected light and the viewing direction of the observer.

11.3.48 Due to the lack of accurate inventory details available, the existing lighting information for the following areas has not been included within the lighting model: -

- Francis Crick Avenue signalised junction with the Guided Busway
- Francis Crick Avenue
- Dame Mary Archer Way

11.3.49 Where the illuminance contribution on the lighting receptors from the proposed lighting within the Proposed Development is zero, the existing lighting infrastructure has not been included within the obtrusive light calculations. This applies to the following areas: -

- Hinton Way (North)
- Haverhill Road (North)
- Babraham/Sawston Road
- A1307 Roundabout
- A11 Travel Hub (Outer)

11.3.50 Where lighting receptors are located entirely within the calculated area and will not be impacted by the existing lighting, the existing lighting infrastructure has not been included within the obtrusive light calculations. This applies to the following areas: -

- A11 Travel Hub (Inner)
- Dame Mary Archer Way/Addenbrookes Road Roundabout

11.3.51 If any changes are implemented during design development or as a consequence of value engineering that have potential to increase the levels of obtrusive light, it is recommended that the lighting assessment is re-performed.

11.3.52 The horizontal spill light contours detailed in Annex E have been produced using the industry standard 2D calculation package, Lighting Reality, and therefore do not consider blocking effects from 3D objects such as walls and fences. In conjunction with this the contours generated do not take account of changes in topology levels.

11.3.53 It should be noted that the calculation points used within the 3D model may differ slightly from the actual receptor locations. This is due to potential inaccuracy of measuring the exact location during the baseline survey in comparison to the accuracy of the 3D lighting model locations.

11.3.54 When lighting design calculations are carried out site constraints often limit the most efficient position of light fittings. Often in these situations slight over lighting of areas is a result of a designer's need to compromise ideal positions or spacing between columns. As such, the qualitative assessment of lighting impacts assumes that the achieved levels of lighting for each application would be slightly beyond the minimum required levels of this report.

11.3.55 The HQPT route in the vicinity of receptor reference B11 was realigned however the light measurements, survey notes and pictures are representative of the baseline conditions at the current location of the proposed signalised crossing.

11.3.56 Due to adverse weather conditions including high wind and associated long exposure times required for night time photography, some photographs may suffer from motion blur however are representative of the night time scene.

11.3.57 Due to the lower temperatures experienced during some night-time surveys, condensation can form on the camera lens which due to the effect of refracted light can result in rainbow-like aberrations on some photographs.

11.3.58 Baseline survey lighting measurement results are taken at ground level or at 1.5 m above ground level and are not taken at the windows of the identified receptors.

11.3.59 The following have been excluded from this assessment:

- Illuminated signs (advertisement) - as it is assumed none are included as part of the Proposed Development at this stage, for future development illuminated signs shall meet the limits detailed in Table A11.3.
- Upward flux ratio - as this is only required where there is a defined performance requirement, specialised fauna growth lighting systems (such as those used to promote grass growth in sports stadia), proximity to optical observatories, or locations that lie within an E1 environmental zone which abuts a dark sky protected E0 environmental zone.

Baseline description

Survey conditions

11.3.60 The baseline survey was undertaken over a period of five days and six nights between 28th January 2021 and 4th March 2021. These surveys were performed between 11.30 and 16.45 hrs for the daytime assessment and 17.45 and 23.00 hrs for the night-time assessments. A summary of weather conditions experienced during the surveys is provided in Table A11.3.13.

Table A11.3.13 Weather conditions

Date	Times and Temperature	Lunar Phase	Moon Visible	Stars Visible	Weather conditions
28th January 2021	13:16 – 15.11 11°C – 12°C	NA	NA	NA	Dry, partly cloudy with some sunshine and windy
28th January 2021	12:44 – 15:40 10°C – 11°C	NA	NA	NA	Dull, overcast, cloudy with periods of sunshine through breaks in the cloud, windy
1st February 2021	13:08 – 14:30 4°C	NA	NA	NA	Dull, overcast, grey.
2nd February 2021	17:50 – 20:21 7°C – 11°C	Waning gibbous 75%	No	Yes	Windy, dry (slight rain on last receptor B01), mostly cloudy with wispy cloud
3rd February 2021	19:43 – 21:28 6°C – 7°C	Waning gibbous 64%	No	Yes	Windy, dry with broken cloud
4th February 2021	18:24 – 20:03 7°C	Third Quarter 53%	No	Yes	Mainly Dry although a few spots of rain were felt on first receptor (B09), cold, mostly cloudy with some low cloud
23rd February 2021	11:32 – 15:28 12°C	NA	NA	NA	Sunny with a strong wind
24th February 2021	11:53 – 12:23 17°C	NA	NA	NA	Sunny with a strong wind
25th February 2021	19:35 – 21:50 6°C – 7°C	Waxing gibbous 96%*	Yes	Yes	Dry with moon and some stars visible through broken cloud
26th February 2021	19:18 – 20:04 5°C – 7°C	Waxing gibbous 99%	Yes	Yes	Dry, cold with minimal cloud
4th March 2021	21:36 - 23:00 4°C	Waning gibbous 68%	No	Yes	Dry, cold and patchy cloud
11.1.1 *A baseline illuminance reading was taken on 25th February to record the approximate contribution provided by moonlight. The moon was 96% full and the evening was clear from cloud at the time of the reading. This reading was 0.1Lux. No further baseline readings were taken on 26th February as the weather conditions favoured the results as a worst case on 25th February.					

Baseline survey descriptions and results

11.3.61 The baseline conditions presented within Table A11.3.14 are those surveyed and documented during the day and night-time surveys for all receptors within Table A11.3.1.

Table A11.3.1 Baseline lighting conditions

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR01 – Francis Crick Avenue (Signalised Junction)</td>
<td>Viewing to the north along Francis Crick Avenue there is a large glass fronted building on the eastern side of the highway, which is under construction and surrounded by hoardings, further in the distance is the MRC laboratory on the western side of the highway. The MRC Laboratory building to the north has a carparking area with lighting installed at various locations within. The luminaires are squarish in appearance. In this direction flat glass ‘full cut off’ type luminaires mounted at a 00 tilt via a side entry bracket approximately 1m in length on 10m tapered columns can be seen in a staggered arrangement on Francis Crick Avenue.

Viewing to the east is the Royal Papworth Hospital with several windows overlooking the large, grassed area in front of the hospital. Feature lighting is installed in this area, consisting of way marker illuminated bollards, art installations and illuminated signs lighting this area. Bollard style lighting and spotlights mounted on columns approximately 8m in height are installed either side of the busway. There are approximately six of these columns with three spotlights mounted on each all are in the proximity of the junction with further column mounted spotlights mounted along the busway as in travels through the Addenbrookes site. A number of deciduous trees have been planted in the area surrounding the junction and within the grassed area.

Viewing to the south the view is looking towards the Francis Crick Avenue roundabout with Dame Mary Archer Way and Addenbrookes Road there are a few deciduous trees planted which line both sides of the highway. Flat glass ‘full cut off’ type luminaires mounted at a 00 tilt via a side entry bracket approximately 1m in length on 10m tapered columns can also be seen in this direction. The street lighting is installed on both sides of the highway in a staggered arrangement. Floodlighting is installed within the construction compounds on the western side of the highway.

Viewing to the west the existing guided busway enters the junction with the AstraZeneca Building to the south and the MRC Laboratory building to the north of the guided busway. The guided busway has Luma LED luminaires mounted post top at a 00tilt on columns 6m in height. The junction with Francis Crick Avenue has illuminated traffic signs and traffic lights installed.</td>
<td>The external lighting provides a relatively high level of localised illumination via many light sources, as can been seen from the lighting measurements provided. The spotlighting mounted on columns approximately 8 m in height produce a whitish yellow light which is bright and emits glare at close proximity. The street lighting on Francis Crick Avenue are yellowish white in colour, bright and emit glare. A new lighting design is required as the existing columns will require relocation to provide room for the cycle path and footway and for the new crossings.

Viewing to the north the building under construction on the eastern side of the highway has many white internal fluorescent style lights. To the north of the existing guided busway is the MRC Laboratory building and associated carpark. The lighting within the carpark is hardly visible when viewing from this location.

Viewing to the east the Royal Papworth Hospital and associated buildings have many internal lights, the grassed area has bollard lighting, tree uplighters, illuminated art installations in the form of tents and illuminated signs showing directions. There are bollards installed at low level highlighting the busway as it travels into the main site creating a pattern on the surface of the busway indicating a low level of uniformity.

Viewing to the south on the western side of the highway the Cambridge Biomedical Campus building and the AstraZeneca building have many internal lights that are white in appearance, The AstraZeneca Building has low level external lighting mounted along the frontage and to the fence at the rear of the building. Between the two buildings there is a construction compound with very bright white floodlighting apparent from this location which emit a high level of glare. To the eastern side of the highway white internal building lighting is visible, with a number of low level bollards lights providing light that is white in appearance, some tree up-lights are also visible in this direction illuminating the tree canopies with a light that is white in appearance.

Viewing to the west the existing busway has Luma LED luminaires mounted on 6m high lighting columns at 00tilt, theses lights are a white in appearance. The light levels on the guided busway are visibly lower than the junction with Francis Crick Avenue. A single streetlight can be seen of the same type as described above providing a yellowish white in colour light that is bright and emits glare.

Skyglow is not apparent at this location due to the brightness of the location.</td>
<td>Principal Light sources: Vehicle headlights, internal and external building lights, car-park lighting, column mounted spotlights, art installations, street lighting, illuminated bollards, traffic lights and illuminated traffic signs.

Principal sources of glare: Compound floodlighting, street lighting on Francis Crick Avenue, column mounted spotlights at the junction with the busway and Francis Crick Avenue.

Principal sources of spill light: Numerous lighting sources in the area with several contributing to spill light however principal light sources that provide the most significant contribution towards spill light are street lighting and column mounted spotlighting.

Sources of sky glow: None apparent due to brightness at location
<table>
<tr><td colspan="2">Lighting measurements (26th February 2021 20:04)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>19.2</td></tr>
<tr><td>North (at 1.5m)</td><td>2.59</td></tr>
<tr><td>East (at 1.5m)</td><td>7.87</td></tr>
<tr><td>South (at 1.5m)</td><td>25.97</td></tr>
<tr><td>West (at 1.5m)</td><td>7.21</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR02 – Francis Crick Avenue (Middle)</td>
<td>Viewing northwards along Francis Crick Avenue there is a pedestrian crossing close by with column mounted yellow beacons. Flat glass ‘full cut off’ type luminaires mounted at 0deg tilt via a side entry bracket approximately 1m in length on 10m tapered columns are installed on Francis Crick Avenue. The street lighting is installed on both sides of the highway in a staggered arrangement. Due to construction taking place in this location it appears that a couple of streetlights could be missing due to gaps in the column arrangement; assumed to be due to the addition of access from the highway for the construction compounds located along the route. Deciduous trees line both the eastern and western sides of Francis Crick Avenue.

Viewing eastwards is a compound with LED type floodlighting installed to the exterior of the portacabins within the compound.

Viewing to the south towards Francis Crick Avenue roundabout with Dame Mary Archer Way and Addenbrookes Road, the same type of luminaires are installed as described for the northern view, this type of lighting is also visible on Dame Mary Archer Way. The roundabout lighting is also visible with longer brackets than the lighting on Francis Crick Avenue however at this distance is not identifiable.

Viewing westwards there is a compound with portacabins within which have floodlighting installed to the exterior.</td>
<td>The external lighting provides a relatively high level of localised illumination, as can been seen from the lighting measurements provided. The street lighting is bright, yellowish/white in colour and emits glare from certain columns along the route with one in particular in the west emitting a level of glare that made direct viewing difficult.

Viewing northwards, the construction compound portacabin internal lighting is visible and floodlighting mounted external to portacabins within the compound is very bright and white and emitting glare to a high level.

Viewing eastwards, the multistorey carpark can be seen in the distance with internal lighting visible that is white in appearance. In the foreground there is a large double storey portacabin with very bright white LED floodlights mounted to the exterior on the second storey. Further column mounted floodlights are visible on the perimeter of the construction compound where the portacabin is located, this floodlighting emits glare. The portacabin has a bulkhead style external light fitted to an access door on the second floor which is white in appearance.

To the south-east the Abcam building is bathed in a yellowy-orange light.

Looking south white carpark lighting visible from this location, near the Abcam Building, two non-operational streetlights located on Dame Mary Archer Way and the roundabout also visible directly in front of the carpark lights.

Street lighting at the roundabout and on Addenbrookes Way is visible and yellowy orange in appearance. Francis Crick Avenue street lighting is also visible in this direction and is bright, yellowish white in colour and emits glare. The Anne Mclaren building stairwell lighting and internal lighting is visible and white in appearance with white exterior lighting fitted at intervals. The bright white floodlights within the construction compound area adjacent to the Anne Mclaren building are visible and are emitting glare.

Viewing westwards further compound floodlighting is white and bright in appearance and emitting high levels of glare. The surface of the highway shows a lack of uniformity at this location and it is assumed that this is due to the addition of the access for the construction compounds on the western side. The building at the northern side of the construction compounds has many internal lights which are yellow in colour.

Skyglow is not apparent due to the brightness of the area.</td>
<td>Principal Light sources: Vehicle headlights, internal and external building lights, compound floodlighting, street lighting

Principal sources of glare: Compound floodlighting, street lighting on Francis Crick Avenue

Principal sources of spill light: Numerous lighting sources in the area with several contributing to spill light however principal light sources that provide the most significant contribution towards spill light are street lighting.

Sources of sky glow: None apparent due to brightness at location
<table>
<tr><td colspan="2">Lighting measurements (26th February 2021 19:49)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>8.45</td></tr>
<tr><td>North (at 1.5m)</td><td>4.7</td></tr>
<tr><td>East (at 1.5m)</td><td>2.03</td></tr>
<tr><td>South (at 1.5m)</td><td>6.49</td></tr>
<tr><td>West (at 1.5m)</td><td>9.28</td></tr>
</table>
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</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR03 – Francis Crick Avenue (Roundabout)</td>
<td>
The roundabout connects Addenbrookes Road, Francs Crick Avenue and Dame Mary Archer Way. There are Flat glass ‘full cut off’ type luminaires mounted at a 50 tilt via a side entry bracket approximately 1.5m in length on 8m stepped tubular columns installed in the location of the roundabout. Illuminated bollards are installed at each junction entrance on to the roundabout and illuminated signs within the centre island.
Viewing to the northwest Francis Crick Avenue is visible beyond the roundabout and has flat glass ‘full cut off’ type luminaires mounted at a 00 tilt via a side entry bracket approximately 1m in length on 10m tapered columns installed lining the route as it goes northward. The Anne Mclaren Building is visible on the western side of Francis Crick Avenue also a number of temporary buildings and portacabins are visible directly to the northwest with some post top mounted LED lighting installed on approximately 6m high columns with totem light poles also installed in the area adjacent to the Anne Mclaren Building. Further to the north the Cambridge Biomedical Campus building can be seen in the distance on the western side of Francis Crick Avenue. There are also a number of deciduous trees lining the footpaths either side of Francis Crick Avenue.
Viewing to the northeast is Dame Mary Archer Way in the foreground with flat glass ‘full cut off’ type luminaires mounted at a 00 tilt via a side entry bracket approximately 1m in length installed on 10m tapered columns. Further in the distance the Addenbrooke’s Hospital multistorey car park and associated access road with the same type of lighting as described for Dame Mary Archer Way. The Royal Papworth Hospital frontage can be seen further in the distance with lower mounting height lighting columns approximately 6m in height with post top mounted luminaires. The view further to the east is blocked by deciduous vegetation.
Viewing to the southeast located between the roundabout and Abcam building is a gated entrance to an area with a portacabin and two brick buildings. Access to this area is directly from the roundabout and there is a tarmac area in front of the portacabin where vehicles are seen to be parked. Views further to the south are screened by some local deciduous trees and vegetation. Further in the distance behind the portacabin and two brick buildings lighting associated with a parking area and access road for the parking area can be seen. The lighting in this area is a mix of single and twin head lighting columns with LED luminaires assumed to be mounted at between 6m and 8m in height with a mix of mounting angles between 00 and 50 mounted either post top or side entry with small brackets. Deciduous planting then boarders the car parking area from the field beyond, this fields topography raises from the low point near the car parking towards the distance in the south east.
Viewing towards the southwest is Addenbrookes Road which has street lighting columns installed along the route across the river, these lighting columns are mounted with flat glass ‘full cut off’ type luminaires and are a mix of 8m and 6m mounting heights. The taller columns closer to the roundabout are mounted via a 1.5m bracket at 50 tilt with the more distant 6m columns mounted post top at approximately 00. The roundabout splitter island has two illuminated bollards installed. The topography rises up to the bridge crossing the river from the low point at the receptor location. Some deciduous planning is visible on the western embankment of the Addenbrookes Road.
</td>
<td>
The external lighting provides a relatively high level of localised illumination, as can been seen from the lighting measurements provided, although there were approximately three streetlights on the roundabout and Dame Mary Archer Way that were not operational at the time of surveying. The lighting on the roundabout is yellowish orange in appearance.
Viewing to the northwest, Francis Crick Avenue lighting is visible and produces a light that is whitish yellow in appearance. An illuminated bollard on the roundabout splitter island near the roundabout is visible from this location. The Anne Mclaren Building is visible on the western side of Francis Crick Avenue with up lighting installed lighting the exterior of the property. The internal staircase is illuminated with fluorescent style lighting on each floor, white in appearance. To the north of the Anne Mclaren building several post top mounted LED luminaires installed on approximately 6m high columns are visible producing a light that is white in appearance. Totem light poles are also installed in the area and provide white light with some glare apparent in this direction. A construction compound with very bright white floodlighting installed which are all emitting glare to a high level. Internal lighting white in appearance is emitted from the white portacabins with a more yellowish white light emitted from the grey portacabins. The grey portacabins also have additional external lighting installed that is white in appearance.
Viewing to the northeast, Dame Mary Archer Way street lighting is visible and is a whiteish yellow colour in appearance. Further in the distance the Addenbrooke’s Hospital multistorey car park internal lighting is visible and white in appearance, the access road has the same type of lighting as described for Dame Mar Archer Way. The Royal Papworth Hospital frontage can be seen further in the distance with internal lighting that is mostly white in appearance visible. Lower mounting height lighting columns approximately 6m in height with post top mounted luminaires producing a light that is white in appearance can be seen from the frontage of the multistorey car park carrying on to the frontage of the Royal Papworth Hospital. The view further to the east are partially blocked by deciduous vegetation however some low level bollard lighting that is white in appearance can been seen along the frontage of the Abcam building. The street lighting columns installed on Dame Mary Archer Way are also partially visible with red traffic signals and some white street lighting further in the distance visible. In the southeast the portacabin directly accessed form the roundabout has internal lighting visible that is white in appearance although the area surrounding is quite dark with only minimal spill light apparent on the forecourt directly in front of the portacabin. Lighting columns within the car park and access road are visible to the rear of the Abcam building producing a light that is white in appearance. Decorative totem lighting and lower level bollard type lighting is also visible within the car park producing a light that is white in appearance.
Viewing to the southwest and along Addenbrookes Road, yelloweye orange street lighting is visible as the route runs over the bridge towards the residential area beyond where many internal residential lights and streetlights are visible in the distance, mostly white in appearance. The illuminated bollards on the roundabout splitter island near the roundabout on Addenbrookes Road are visible directly in front of this location.
Skyglow is not apparent due to the brightness of the area.
</td>
<td>
Light sources: Vehicle headlights, internal and external building/portacabin lights, car-park lighting, feature lighting, Totem light poles, street lighting, floodlighting, illuminated bollards, traffic bollards and signs.
Principal sources of glare: Compound floodlighting, street lighting on Francis Crick Avenue
Principal sources of spill light: Numerous lighting sources in the area with several contributing to spill light however principal light sources that provide the most significant contribution towards spill light are Street Lighting.
Sources of sky glow: None apparent due to brightness at location
<table>
<tr><td colspan="2">Lighting measurements (26th February 2021 19:18)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.46</td></tr>
<tr><td>North (at 1.5m)</td><td>1.29</td></tr>
<tr><td>East (at 1.5m)</td><td>0.48</td></tr>
<tr><td>South (at 1.5m)</td><td>0.70</td></tr>
<tr><td>West (at 1.5m)</td><td>2.20</td></tr>
</table>
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</tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR04 – White Hill House, Granham’s Road, Great Shelford</td>
<td>This receptor is located on a hill. The topography slopes downward towards the proposed location of the junction. There are no streetlights at this location although there is a floodlight on the exterior of an outbuilding on the property of White Hill House viewing directly north.

Viewing to the north, there are a multitude of trees on the western side of the highway, a mixture of evergreen and deciduous which provide some level of screening for the receptor, with a perimeter wall running the length of the property.

Viewing to the east there are trees running along the highway in front of the receptor and to the east of the receptor the view consists of a field which slopes upwards.

To the south there are large clusters of trees visible over open fields with a broken hedge line on the eastern side of the highway with a view towards Hinton Way in the distance.

To the southwest, the view looks along Granham’s Road as it snakes downhill towards the level crossing and residential area. A hedgerow runs the length of the highway on the eastern side with the occasional gap. Telegraph poles are visible running along the hedgerow. There are deciduous trees with evergreen vegetation located at intervals within the hedgerow. A large open field is located beyond the hedgerow to the east with a treeline consisting of deciduous trees with evergreen vegetation to the south of the field with a further field beyond the treeline with more trees visible beyond this. There is heavier tree coverage that is a mix of deciduous and evergreen lining the western side of the highway screening more distant views.</td>
<td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Looking north towards White Hill House there is some artificial lighting visible through the trees which are small and white in appearance. Occasional vehicle headlights are visible as they pass along Granham’s Road.

To the east, no artificial lighting is visible.

Looking south there are two rows of yellow-white streetlights, with one row looking brighter than the other, visible in the distance across the field, one row looks to be higher than the other and these are located behind a cluster of trees.

When viewing southwest, lighting is visible from the property at LR05 and is very bright through the trees, the lighting is a mixture of lower level lighting that is yellowy-white in appearance with some yellowish white light sources further in the distance. Due to the distance and broken views through the trees screening this direction the lighting types and locations are not accurately identifiable. Some of the trees located to the east of LR05 are illuminated by lighting to the rear of this property.

When viewing from southwest to west, there is one very bright white light visible in the distance.

Looking from west through to north the sky is illuminated through and above the trees although no actual artificial lighting is visible in these directions due to the thickness of the vegetation in this direction.

Skyglow is very apparent in the northly direction, this is white in nature, apparent above the treeline and lights the sky up considerably due to the low level cloud cover.</td>
<td>Light sources: Vehicle headlights, internal and external building lighting and Streetlights.

Principal sources of glare: One bright white light visible in the distance when viewing from southwest to west

Principal sources of spill light: None at this location

Sources of sky glow: Cambridge in North / Northwest direction

<table>
<tr><td colspan="2">Lighting measurements (2nd February 2021 20:21)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.03</td></tr>
<tr><td>North (at 1.5m)</td><td>0.01</td></tr>
<tr><td>East (at 1.5m)</td><td>0.02</td></tr>
<tr><td>South (at 1.5m)</td><td>0.02</td></tr>
<tr><td>West (at 1.5m)</td><td>0.00</td></tr>
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</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR05 – 50, Granham’s Road, Great Shelford</td>
<td>The location is situated on the eastern side of Granham’s Road. The topography is flat at this location although it rises in the northern direction towards LR04. Looking northwards two deciduous trees are located on the norther side of the highway beyond is an open field with a large cluster of deciduous trees screening views of the proposed construction compound. In the north-northwest Addenbrooke’s site is visible in the distance. The train track runs through the field some way in the distance and trains are visible running both north towards and south away from Cambridge.

To the Northeast, looking along Granham’s Road there are trees sparsely lining the road on either side with a hedge row bordering the field to the eastern side of the highway. A large cluster of trees are visible further in the distance which are mainly deciduous.

To the southeast there is a low hedge and some larger trees bordering the garden of the receptor with the adjacent field.

To the south the view is of the receptor property which is large and has many windows to the front with views across towards Nine Wells LNR. The train track and Addenbrookes site are visible in the distance to the north. The property does not benefit from direct screening either in northwest or to the north although there are mature trees at the back of the property. There are no streetlights installed along Granham’s Road at this location although street lighting is visible further down Granham’s Road to the southwest. The property has wall lights on the exterior at the front mounted either side of the double garage. There are various bollard style lights mounted along the driveway and a wall mounted light is installed either side of the entrance gate.</td>
<td>The location is illuminated by the receptor internal and external lighting although the overall area is relatively dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Granham’s Road.

Looking to the northwest internal building lights are visible in the distance which are most probably from residential properties located along the A1301 and Addenbrookes Road and white and yellow street lighting can be seen running towards the location of the red light of a crane when viewing in this direction.

Viewing to the north no artificial lighting is visible only the hedgerow and traffic sign can be seen in the foreground. The sky is apparent with a white hue highlighting the hedgerow.

Looking northeast a few white lights are visible through the trees located beyond the field and are assumed to be a mix of external and internal residential lighting although at this distance the lighting types and locations are not accurately identifiable.

Looking south directly at 50 Granham’s Road, internal property lighting is visible. Externally, there are low level bollard style lights illuminating the driveway to the side and further bollard lights at the front of the property, the light emitted is yellow tinged. There are three wall lights installed at the northeast side of the property with a further two wall lights mounted on the front face of the property, one either side of the double garage doors. Wall lights are mounted either side of the entrance gate which match those on the garage doors, these lights emit a yellow coloured light. There is a high level of spill light apparent on the trees to the southeast behind the receptor property which indicates that artificial lighting is installed either externally or internally or a combination of both, but the actual extent and type cannot be assessed from this location. There is a large amount of spill light apparent on the vegetation located on the western side of Granham’s Road emanating from No. 50 Granham’s Road.

When viewing south to southwest, street lighting is visible as two parallel lines. The top row of lighting is slightly orange with the lower row seeming to be white in colour compared to the top row. Internal lights from residential properties are also visible.

Looking to the west there is one very bright white light amongst a line of orange streetlights which maybe a floodlight, this is very apparent and emits a level of glare at this location.

Skyglow is very apparent in the northly direction which is white in nature. It is above the treeline and residential properties in the distance and lights the sky up considerably due to the low level cloud cover.</td>
<td>Principal Light sources: Vehicle headlights, 50, Granham’s Road internal and external lighting and one bright white light to the west.

Principal sources of glare: To the west, one bright white light.

Principal sources of spill light: 50, Granham’s Road

Sources of sky glow: Cambridge in North / Northwest direction

<table>
<tr><td colspan="2">Lighting measurements (2nd February 2021 19:37)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.03</td></tr>
<tr><td>North (at 1.5m)</td><td>0.02</td></tr>
<tr><td>East (at 1.5m)</td><td>0.13</td></tr>
<tr><td>South (at 1.5m)</td><td>0.23</td></tr>
<tr><td>West (at 1.5m)</td><td>0.02</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>B01 – Granham’s Road, Great Shelford</td><td>Looking north a large cluster of trees is visible running along the northern edge of the highway with a red brick property in the background.

To the east, there is a hedge row bordering the eastern side of the highway with a large cluster of trees in the distance across the field.

To the south and southwest there are a row trees providing screening for 50, Granham’s Road with a hedgerow on the southern side of the highway as it snakes downhill towards the level crossing and residential area. On the northern side of Granham’s Road there is another hedgerow with an open field beyond. A large cluster of deciduous trees with evergreen vegetation is located to the southwest approximately 165m from this location.

To the west there is a track running along a large cluster of trees. There is no street lighting at this location.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Granham’s Road.

When looking to the north there a few property lights visible in the distance through the trees that are white in colour.

When looking to the northeast there are no artificial lights visible in this direction.

When viewing east, a few small white lights are apparent through the hedgerow in the distance.

Viewing south to southwest, the lighting of the property at LR05 is very apparent and bright through the trees, the lighting is a mixture of heights and predominantly yellowy-white in appearance with a mix of internal and external lighting visible. To the southwest, a few yellowy-white lights are visible in two groups through the large cluster of trees to the southwest of the open field on the northern side of Granham’s Road. There is one very bright white light apparent intermittently in the distance which emits glare and seems to be pointed in this direction.

When viewing from west to north, beyond the large cluster of trees, white and yellow street lighting is visible in the distance and white internal residential lighting which continues towards the north where the red light from a crane on the Addenbrooke’s site is also apparent. Headlights from travelling vehicles are visible. Intermittently trains can be seen to the west due to the internal lighting being visible, the trains travel north to south or visa-versa.

The skyglow is very bright and white in the north west to northly direction which due to the low cloud cover appears to light up the whole sky. In the northeast it is a white glow which highlights the tree line.</td><td>Principal Light sources: Vehicle headlights, internal and external building lighting and Streetlights

Principal sources of glare: Bright white light when viewing southwest

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction.

<table><tr><td colspan="2">Lighting measurements (2nd February 2021 20:07)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.02</td></tr><tr><td>North (at 1.5m)</td><td>0.02</td></tr><tr><td>East (at 1.5m)</td><td>0.01</td></tr><tr><td>South (at 1.5m)</td><td>0.01</td></tr><tr><td>West (at 1.5m)</td><td>0.02</td></tr></table></td></tr>
<tr><td>B02 – Granham’s Road, Great Shelford</td><td>To the north there is a large redbrick property located on a hill with large trees which are a mixture of deciduous and evergreen providing screening for the property although many windows are still visible due to the screening being sparse at that location

To the northeast viewing along Granham’s Road the highway route goes uphill with a hedgerow in the foreground and large deciduous trees located on the northern side of the highway beyond the hedgerow. On the southern side there is a low level hedgerow with a deciduous tree located within. Telegraph poles are visible located intermittently within this hedgerow. A deciduous tree is also visible approximately 100m from this location. To the east, there is screening provided by hedge/trees on the northern side of the highway with a lower level hedgerow on the southern side with tree cover on the top of the hill beyond the open field. To the south a broken hedgerow borders the highway on the eastern side with a large cluster of trees on the eastern side of the highway with a line of trees on the western side running into the distance to the west. To the southwest, looking towards the 50, Granham’s Road the side windows of this property are clearly visible with a large cluster of trees running along a track on the northern side of the highway. There is no street lighting at this location.</td><td>The immediate area surrounding the viewpoint was dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Granham’s Road.

Looking north there are two properties located in the distance which are visible through the tree cover. Lighting which could be both internal and external from both properties and yellowy-white in appearance can be seen through the trees. To the northeast no artificial lighting is visible.

When viewing eastwards, no artificial lighting is apparent in this direction.

When viewing to the south there are yellow streetlights visible across the field in the distance.

Looking to the southwest, 50 Granham’s Road at LR05 is visible due to the bright external yellowy white wall lights and the internal lighting with a high level of spill light apparent on the trees located behind this property.

When viewing west to northwest, white internal residential lighting, street lighting which is both orange and white is visible from this location. Intermittently trains can be seen to the west due to the internal lighting being visible, the trains travel north to south or visa-versa.

Skyglow is apparent looking north to northwest, which is white in nature lights up the sky due to the low level cloud.</td><td>Principal Light sources: Vehicle headlights, internal and external building lighting and Streetlights

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction.

<table><tr><td colspan="2">Lighting measurements (2nd February 2021 19:59)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.03</td></tr><tr><td>North (at 1.5m)</td><td>0.04</td></tr><tr><td>East (at 1.5m)</td><td>0.02</td></tr><tr><td>South (at 1.5m)</td><td>0.02</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>LR06 – 173, Hinton Way, Great Shelford</td><td>This is a residential area with 6m mounting height street lighting columns fitted with post top mounted luminaires with a glass bowl mounted at approximately a 50 tilt installed along the highway. The topography has a gradient running downhill towards the main residential area in the south.

Looking north towards 173 Hinton Way there are large deciduous trees and a hedge located in front of the property. The property has two entrances to a large driveway with no vegetation to provide screening therefore many windows have a view of the highway. Across the highway to the southern side of the receptor a few large deciduous trees and a hedge are located with a further quantity of trees beyond. One 6m mounting height lighting column is located on the southern side of the highway in close proximity to the receptor which has been fitted with a fluorescent tube type luminaire with a glass bowl fitted.

Viewing eastwards directly across the highway is the neighbouring property (186 Hinton Way) which is surrounded by deciduous trees providing the property with a level of screening from the adjacent fields. A further 6m lighting column is located approximately 50m to the north of this property.

To the southwest and west-southwest looking along Hinton Way, large pine trees are visible in the distance at the rear of the LR07. A hedge is planted along the length of the southern side of highway which is a mixture of evergreen and deciduous vegetation and approximately 2m in height. On the northern side the highway deciduous trees line the highway in close proximity to the receptor then further in the distance a hedge that is a mix of deciduous and evergreen and approximately 2m in height can be seen. Lighting columns are visible installed along Hinton Way towards and beyond LR07 on the northern and southern sides of the highway.

To the west there are a large number of deciduous trees screening views beyond.</td><td>This is a street lit area with 6m lighting columns producing a whiteish yellow light with levels typical of a residential class road, as can be seen from the light readings taken. Occasional vehicle headlights are visible as they pass along Hinton Way.

When viewing north towards 173 Hinton Way, internal residential lighting is visible. This receptor has spill light from the 6m mounting height lighting column located on the opposite side of Hinton Way to the south.

When looking to the northeast 186 Hinton Way is directly in view. To the northern side of this property and located further along Hinton Way another streetlight is located which is very bright orangey white in appearance emitting a high level of glare. Spill light is present on the exterior of 186 Hinton Way and the surrounding vegetation from the streetlight column located on the southern side of the highway.

When looking southeast, only one small white light is visible through the hedgerow.

Viewing southwest street lighting is installed along Hinton Way towards the main residential area. These lighting columns emit a whiteish yellow light which spills light on the hedgerow to the rear and in front of each lighting column. No further lighting is visible to the southwest.

When looking to the southwest and west-southwest the same street lighting as the south-westerly direction is visible with a few small white lights visible in the distance through the vegetation. No artificial lighting is apparent to the west due to the deciduous screening.

Skyglow is apparent when looking from the southwest to the northwest, is white in appearance and seems at its brightest in the northwest direction.</td><td>Principal Light sources: Vehicle headlights, street lighting located on Hinton Way, internal residential lighting.

Principal sources of glare: Streetlight to the north of 186 Hinton Way.

Principal sources of spill light: Street lighting on Hinton Way

Sources of sky glow: Cambridge in Northwest direction

<table><tr><td colspan="2">Lighting measurements
(4th February 2021 20:03)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>2.41</td></tr><tr><td>North (at 1.5m)</td><td>1.1</td></tr><tr><td>East (at 1.5m)</td><td>4.82</td></tr><tr><td>South (at 1.5m)</td><td>0.19</td></tr><tr><td>West (at 1.5m)</td><td>0.15</td></tr></table></td></tr>
<tr><td>LR07 – 154, Hinton Way, Great Shelford</td><td>This is a residential area with 6m mounting height street lighting columns fitted with post top mounted luminaires with a glass bowl mounted at approximately a 50 tilt installed along both sides of the highway. The topography has a slight gradient running uphill along the highway towards 173 Hinton Way from the main residential area in the southwestern direction.

Looking northeast along Hinton Way a 2m high hedgerow consisting of a mixture of deciduous and evergreen vegetation borders the fields on the northern and southern sides of the highway. Further in the distance a large cluster of deciduous trees are located on the northern side of the highway and some large pine trees are located on the southern side of the highway near 186 Hinton Way.

Looking eastwards there is a direct view of a large gated entrance with open fields beyond the gate and hedgerow along the southern side of Hinton Way, trees are visible in the distance beyond the open fields.

Looking southeast the receptor is directly in view with the side windows clearly visible through the branches of the large deciduous trees and hedgerow situated along the northern and eastern boundary of the property.

Looking west across Hinton Way a 2m high hedgerow consisting of a mixture of deciduous and evergreen vegetation borders the fields on the northern side of Hinton Way, open fields are visible beyond with trees further in the distance.</td><td>This is a street lit area with 6m lighting columns producing whiteish yellow light with levels typical of a residential class road, as can be seen from the light readings taken. Occasional vehicle headlights are visible as they pass along Hinton Way.

Looking northeast towards 186 Hinton Way one street lighting column is visible in the distance that emits a bright white light, the remaining street lighting is as described above. The streetlight on the northern side of the highway is very bright and emits a high level of glare.

The street lighting installed along Hinton Way spills light on the hedgerow to the rear and in front of each lighting column.

Looking to the east no artificial light is visible other than a small amount of spill light from the surrounding street lighting on the entrance gate to the fields beyond.

Looking southeast towards the receptor, spill light is evident on the hedge on the southern side of Hinton Way.

Looking westwards no artificial lighting is apparent.

Skyglow is only apparent when viewing in the north and east. It is most apparent in the north where it is very bright and white in appearance.</td><td>Principal Light sources: Vehicle headlights, street lighting

Principal sources of glare: Street lighting on Hinton Way in the vicinity of LR06 and street lighting on the northern side of the highway in close proximity to the receptor

Principal sources of spill light: Street lighting located on Hinton Way

Sources of sky glow: Cambridge in North

<table><tr><td colspan="2">Lighting measurements (4th February 2021 19:48)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>2.11</td></tr><tr><td>North (at 1.5m)</td><td>0.76</td></tr><tr><td>East (at 1.5m)</td><td>0.14</td></tr><tr><td>South (at 1.5m)</td><td>0.72</td></tr><tr><td>West (at 1.5m)</td><td>1.88</td></tr></table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>LR07a – Rear of 18, Coppice Avenue, Great Shelford</td><td>Looking to the east and across a flat open field a hedgerow runs the length of the field and is approximately 2m in height beyond which is Hinton Way. Hinton Way has street lighting installed along its route and residential properties are visible on the southern side.

Looking westwards the view is of the receptor which has minimal screening provided by three large, mature deciduous trees and a low level hedgerow. The property has large windows which seem to fill the full height of the property and constitute the majority of the exterior on the eastern and southern sides of the property. A small floodlight is installed on the eastern elevation of the property facing the field to the east, with additional exterior lighting fitted to the southern elevation of the building.</td><td>The immediate area surrounding the viewpoint was dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Hinton Way.

To the northeast a single streetlight provides glare with light that is white in appearance.

Viewing to the east the internal residential lighting and street lighting on Hinton Way is clearly visible and a whiteish yellow colour in appearance. There is spill light apparent on the hedge, within the field boundary and on the frontage of the residential properties located on the southern side of Hinton way.

Viewing to the west, the receptor internal lighting is visible and is yellow-white in appearance, the external lighting was not active at the time of the survey.

Skyglow is apparent above the trees in the northwest and north and is bright and white.</td><td>Principal Light sources: Vehicle headlights, internal residential lighting and street lighting

Principal sources of glare: Streetlight in the vicinity of LR06

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table>
<tr><td colspan="2">Lighting measurements (25th February 2021 21:50)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.17</td></tr>
<tr><td>North (at 1.5m)</td><td>0.02</td></tr>
<tr><td>East (at 1.5m)</td><td>0.09</td></tr>
<tr><td>South (at 1.5m)</td><td>0.07</td></tr>
<tr><td>West (at 1.5m)</td><td>0.02</td></tr>
</table></td></tr>
<tr><td>B03 – Hinton Way, Great Shelford</td><td>Looking northwards the receptor location is close to the hedgerow bordering the field, beyond are large deciduous trees with evergreen foliage providing screening in this direction.

Looking southeast, the view is across a flat open field towards Hinton Way where a hedgerow with evergreen foliage borders the field. Residential properties located on the southern side of Hinton Way are visible in this direction with street lighting lining the highway. There is a mix of deciduous and evergreen trees and vegetation in the vicinity of these residential properties although the majority of top floor windows are clearly visible with limited benefit from the screening in the vicinity.</td><td>The immediate area surrounding the viewpoint was dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Hinton Way.

There are no artificial lights apparent when viewing towards the north through the hedgerow and large group of trees. Viewing southeast the streetlights are clearly visible and yellow-white in appearance along Hinton Way. Spill light is apparent on the top of the hedgerow in this direction and within the field area bordering the highway. Interior residential lighting is also visible in this direction and largely yellow-white in appearance. A helicopter was flying in this direction at the time of the baseline survey with its associated lights clearly visible in the sky.

Skyglow is very apparent above the trees in the north-westerly direction.</td><td>Principal Light sources: Vehicle headlights, internal residential lighting, street lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in Northwest direction

<table>
<tr><td colspan="2">Lighting measurements (25th February 2021 19:36)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.17</td></tr>
<tr><td>North (at 1.5m)</td><td>0.02</td></tr>
<tr><td>East (at 1.5m)</td><td>0.09</td></tr>
<tr><td>South (at 1.5m)</td><td>0.10</td></tr>
<tr><td>West (at 1.5m)</td><td>0.02</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>LR08 – 15, Haverhill Road, Stapleford</td><td>This receptor is directly in front of a semi-detached single storey residential property which is the last in a row of three similar style properties.

The property has a mix of deciduous and evergreen trees and shrubs screening the northern and western aspects. To the north distant views are largely screened by a deciduous hedgerow approximately 2/3 m in height on the northern side of Haverhill Road although a residential property can be seen in the distance through gaps in the hedgerow beyond the open field and hedgerow.

Viewing to the northeast looking along Haverhill Road, no artificial lighting is installed. A hedgerow runs along the northern side of the highway with deciduous trees intermittently planted within the hedgerow. On the southern side of the highway there is a large open field, further in the distance trees are planted intermittently along the field perimeter. In the far distance there are some large residential properties with more trees visible in the distance.

Looking east there is a pedestrian style beacon globe mounted on a lighting column approximately 5m in height located in the middle of a traffic island with keep left traffic bollards mounted on each end. On the eastern side of Haverhill Road there is large open field which is relatively flat with a slight incline in height going into the distance. Located within this field is a large group of trees in the distance.

Looking south the edge of Stapleford village is visible with 6m lighting columns installed along Haverhill Road into the village in a staggered arrangement. The luminaires are mounted post top at a 50 tilt with compact fluorescent type tubes installed with glass bowl type covers. The last lighting column is located outside 13 Haverhill Road, after this point no further street lighting is installed heading northeast away from Stapleford.

To west is a direct view of 11 to 15 Haverhill Road residential properties with further residential properties visible beyond. The light column outside number 13 Haverhill Road is also visible in this direction.</td><td>This is a street lit area with 6m lighting columns producing white light with levels typical of a residential class road, as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Haverhill Road.

Viewing to the northeast there are small clusters of white and orange lights in the distance, assumed to be residential in nature. The beacon located in the middle of the traffic island was not working at the time of the survey. No further street lighting is installed in this direction beyond the last lighting column installed outside number 13 Haverhill Road. As can be seen from the light reading provided for the northern and eastern directions it is noticeably darker than the village to the south and west.

Looking eastwards spill light is apparent in the field and is white in appearance. Some lighting white/yellow coloured is visible in the distance on the horizon however the majority of the field is dark in appearance.

When viewing southwards spill light is apparent in the gardens and on the frontages of the residential properties in the distance on the eastern side of Haverhill Road.

To the west, there are views of lighting visible through the windows of residential properties and one street lighting column providing a light that is white in appearance In the foreground receptor LR08 and neighbouring properties are visible with spill light apparent on the frontages of these properties.

Skyglow is very apparent when looking northwest to north where it is at its brightest and whitest. To the east there are three distinct patches which are white in appearance. To the southeast there is a further patch which is brighter than those in the east.</td><td>Principal Light sources: Vehicle headlights, residential lighting and street lighting

Principal sources of glare: None

Principal sources of spill light: Street lighting along Haverhill Road

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (4th February 2021 19:01)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.68</td></tr><tr><td>North (at 1.5m)</td><td>0.02</td></tr><tr><td>East (at 1.5m)</td><td>0.04</td></tr><tr><td>South (at 1.5m)</td><td>0.92</td></tr><tr><td>West (at 1.5m)</td><td>0.98</td></tr></table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR09 – 88, Haverhill Road, Stapleford</td>
<td>This receptor location is at the side of a two-storey residential property situated on the edge of Stapleford Village. The topography is relatively flat with a slow rise to the east. When looking northwards the immediate view is of Haverhill Road where there is a pedestrian style beacon mounted on a lighting column approximately 5m in height located in the middle of a traffic island with keep left traffic bollards mounted on each end. There is a 6m lighting column located outside 13 Haverhill Road with luminaire mounted post top at a 50 tilt with compact fluorescent type tube installed with glass bowl type covers. Distant views are largely screened by a deciduous hedgerow approximately 2/3 m in height on the northern side of Haverhill Road although a residential property can be seen in the distance through gaps in the hedgerow and beyond the open field further trees can be seen in the distance.

Viewing to the northeast looking across Haverhill Road, no artificial lighting is installed. A hedgerow runs along the northern side of the highway with deciduous trees intermittently planted within the hedgerow. On the southern side of the highway there is a large open field, further in the distance trees are planted intermittently along the field perimeter. Further in the distance to the northeast there is a large residential property with a large number of trees located further northeast behind this property. Some large residential properties with more trees visible in the distance are located further to the northeast / east.

Looking east the view consists of an open field with a large group of trees located in the distance.

Viewing south is the receptor property which has a side window on the first floor which looks out onto the open field with two ground floor windows facing in the same northeast direction. A finial style light is mounted on the exterior of the rear extension of the receptor on the southern aspect.

Looking to the west, Stapleford Pavilion is visible and is situated in a recreational area complete with children’s play area. Bulkhead style fittings are visible mounted on the exterior of the pavilion. Gog Magog Way runs down the side of the recreational area with residential properties located on the northern side. On the corner of Gog Magog Way and Haverhill Road a floodlight is visible mounted to the exterior of the property which is located close to this junction. There are two streetlights visible from this location on the northern side of Gog Magog Way that are approximately 6m in height with luminaires that are mounted post top at a 50 tilt with compact fluorescent type tubes installed with glass bowl type covers.</td>
<td>This is a street lit area with 6m lighting columns producing white light with levels typical of a residential class road, as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Haverhill Road.

To the north directly in front when viewing in this direction, spill light emanating from the street lighting on Haverhill Road that is white in appearance is very apparent on the exterior of the residential properties and in the front garden area of each property located on the northern side of Haverhill Road.

To the northeast there are two bright yellowish lights with a few small white lights visible in the distance beyond the field. There are also some small white lights that are actually roads signs and a traffic bollard reflecting light from passing traffic. Some internal yellowish residential lights are also visible in the distance. Spill Light is very apparent in the field in this location which is white in appearance caused by street lighting in this area. This direction is noticeably darker than the street lit Haverhill Road area and Stapleford Village.

To the east there is only one white very small light visible in the distance.

To the south the receptor property is located, spill light is apparent on both the front and side aspects of the receptor property from the street lighting on Haverhill Road and is white in appearance. Internal lighting is visible intermittently from this receptor.

Viewing west, the recreational area is dark with spill light apparent from local street lighting on the ground around the edge and also on the surrounding vegetation. Within the park there is lighting visible mounted to the exterior of the pavilion with spill light apparent on the ground directly in front of the building.

Skyglow is very apparent when looking northwest to north where it is at its brightest and whitest. To the east there are three distinct patches which are white in appearance. To the southeast there is a further patch which is brighter than those in the east. To the northeast direction skyglow is not visible.</td>
<td>Principal Light sources: Vehicle headlights, residential lighting and street lighting

Principal sources of glare: None

Principal sources of spill light: street lighting

Sources of sky glow: Cambridge in North / Northwest direction

<table>
<tr><th colspan="2">Lighting measurements (4th February 2021 19:13)</th></tr>
<tr><th>Direction of sensor</th><th>Light reading in Lux</th></tr>
<tr><td>Ground</td><td>0.47</td></tr>
<tr><td>North (at 1.5m)</td><td>0.36</td></tr>
<tr><td>East (at 1.5m)</td><td>0.02</td></tr>
<tr><td>South (at 1.5m)</td><td>0.02</td></tr>
<tr><td>West (at 1.5m)</td><td>0.21</td></tr>
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</tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>B08 – Haverhill Road, Stapleford</td><td>This receptor is at the side of Haverhill Road on a pedestrian footpath which runs along the southern side of Haverhill Road boarded by an open field, this location has no street lighting installed. The topography is relatively flat with a slow rise to the east.

When looking north a deciduous hedgerow boarders Haverhill Road with a residential property visible in the distance beyond the open fields that is surround by trees on three sides with further residential properties visible in the distance which are also are surrounded by trees to an extent.

Looking east the view consists of the open field with the large group of trees located in the distance.

Viewing south-southwest the receptor property beyond the open field is located with the side windows visible from this distance. In the west street lighting is visible along the highway going into the village consisting of a pedestrian style beacon mounted on a lighting column approximately 5m in height located in the middle of a traffic. The street lighting columns are 6m in height and have luminaires mounted post top at a 50 tilt with compact fluorescent type tubes installed with glass bowl type covers.

Looking westwards a deciduous hedgerow is located directly in front with 3 deciduous trees located along the length at intervals, views beyond are screen by the hedgerow and trees.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Haverhill Road.

When viewing northwards, one cluster of residential internal light yellowish white in appearance is apparent, no other lighting is visible in this direction.

Viewing eastwards there a small cluster of white lights are apparent in the distance.

Looking to the south-southwest, the streetlights are visible at intervals running down the highway into Stapleford village and the optic distribution is very distinguishable as a pattern on the highway surface. The lighting from the street lighting is white in appearance with a slight yellow tinge. The receptor property (LR09) on the southern side of Haverhill Road is visible with spill light apparent on the side of the property and within the field. The internal residential lights of the receptor property (LR09) are visible and are white in appearance with a slight yellow tinge. The beacon to the west of the view was not operational at the time of the survey.

Looking westwards one white light is visible through the hedgerow.

Skyglow is very apparent when looking northwest to north where it is at its brightest and whitest. To the east there are three distinct patches which are white in appearance. To the southeast there is a further patch which is brighter than those in the east.</td><td>Principal Light sources: Vehicle headlights, Residential lighting and street lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (4th February 2021 18:39)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.01</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.02</td></tr><tr><td>West (at 1.5m)</td><td>0.02</td></tr></table></td></tr>
<tr><td>B09 – Haverhill Road, Stapleford</td><td>This receptor is at the side of Haverhill Road on a pedestrian footpath which runs along the southern side of Haverhill Road boarded by an open field, this location has no street lighting installed.

When looking north a deciduous hedgerow boarders Haverhill Road with a residential property visible in the distance beyond the open fields that is surround by trees on three sides with further residential properties visible in the distance which are also are surrounded by trees to an extent.

Looking east the view consists of the open field with the large group of trees located in the distance.

Viewing southwest the receptor property (LR09) beyond the open field is located with the side windows visible from this distance. Street lighting is visible along the highway going into the village consisting of lighting columns that are 6m high and have luminaires mounted post top at a 50 tilt with compact fluorescent type tubes installed with glass bowl type covers. The junction of Haverhill Road and Gog Magog Way is obscured by a tree located directly in front of the receptor however some the residential properties located on Gog Magog Way are visible with a tree line further in the distance behind these properties.

Looking westwards a few residential properties are visible beyond the hedgerow on the northern side of Haverhill Road across the open field.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Haverhill Road.

When viewing northwards, there is a greater number of small lights compared to B08 and are most probably residential in nature.

When viewing eastwards one cluster of white lights are apparent in the distance and to the southeast there is also a cluster of orange lights in the distance.

To the south the only lighting visible is a further line of orangish lights running along the horizon.

Looking to the southwest there is street lighting installed along Haverhill Road into Stapleford village. There are trees in close proximity to this receptor which provides a level of screening although the receptor LR09 is visible through these trees.

To the southwest, internal residential lighting in the vicinity of Gog Magog Way is apparent with a mixture of white and yellow lights. One white streetlight is also apparent from this location.

To the west, only one small white light is visible through the hedgerow located on the northern side of Haverhill Road.

Skyglow is very apparent when looking northwest to north where it is at its brightest and whitest. To the east there are three distinct patches which are white in appearance. To the southeast there is a further patch which is brighter than those in the east. To the northeast direction skyglow is not visible.</td><td>Principal Light sources: Vehicle headlights, residential lighting and street lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (4th February 2021 18:24)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.02</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.01</td></tr><tr><td>West (at 1.5m)</td><td>0.02</td></tr></table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR10 – Sutton House, Babraham Road, Sawston</td>
<td>This receptor is located on Babraham Road Sawston and until recently could be deemed to be on the edge of Sawston Village. A new development (The Hawthorns) is currently under construction and new street lighting has been installed on this section of the highway, with the first new lighting column located adjacent to the eastern property boundary of Sutton House. Viewing to the north a direct view of The Hawthorns residential development and Sutton House is seen.

Looking eastwards there are two deciduous saplings that partially screening more distant views with new residential properties clearly visible. The driveway/access road has a streetlight installed facing the new properties in this area. Further in the distance new street lighting can be seen and is installed on the northern side of the highway. On the southern side of the highway a broken deciduous hedgerow borders the highway from the open field beyond.

When viewing towards the east-southeast the hedgerow on the southern side of Babraham Road is visible and buildings on Sawston Road can be seen in the distance beyond the open field which are surrounded by trees and vegetation which provide a level of screening for these properties. There are large industrial style buildings within wooded areas further in the distance.

Looking to the south the view over the hedgerow on the southern border of Babraham Road is of the fields which are relatively flat although there is a slight fall away in this direction downhill. Beyond the fields there are large wooded areas as the topology rises in height.

Looking to the west-southwest is the edge of the new development on the northern side of Babraham Road. The street lighting continues in the direction of Sawston village although there is a gap between this street lighting which looks very new and the existing street lighting column located at the edge of the combined footway and cycleway on the south side of the highway.

The new street lighting consists of 6m columns with Urbis Axia or similar style LED luminaires mounted post top at approximately a 50 tilt. There are five columns visible from this location.</td>
<td>The street lighting provides a relatively high level of localised illumination as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Babraham Road.

The street lighting can be seen spilling light onto the frontages of the nearby properties adjacent to the road with the light being white in appearance and emitting glare, on lighting columns approximately 6m in height, extending to the east and west along Babraham Road.

Viewing to the north the nearest new residential property is clearly visible. The driveway/access road is illuminated by a streetlight installed to face the new properties in The Hawthorns residential development area. The residential properties have decorative external lighting mounted each side of the front door. There is a streetlight directly next to this receptor and the new development. Viewing to the east the driveway/access road is illuminated by a streetlight installed to face the new properties in The Hawthorns residential development area. Beyond the two deciduous saplings partially screening more distant views new street lighting can be seen and is installed on the northern side of the highway producing a light that is white in appearance with glare in this direction, although intermittent as direct view broken by saplings partially screening this direction. Internal lighting is visible from neighbouring properties slightly further along Babraham Road.

Viewing east-southeast there are a few orange coloured lights in the distance.

Viewing to the south, no artificial lighting is apparent through the hedgerow located on the southern side of the highway.

To the west-southwest, a few yellow, white, and orange lights can be seen through the hedgerow and vegetation in this direction with street lighting visible along the highway into the village.

Due to the brightness at this receptor it was difficult to assess skyglow except in the north westerly direction this was whitish in appearance.</td>
<td>Principal Light sources: Vehicle headlights, residential lighting and street lighting

Principal sources of glare: Street lighting on Babraham Road

Principal sources of spill light: Street lighting on Babraham Road

Sources of sky glow: Skyglow largely screened due to brightness of local area other than in a northwest direction skyglow appears whitish in colour.

<table>
<tr><td colspan="2">Lighting measurements (3rd February 2021 20:52)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>9.15</td></tr>
<tr><td>North (at 1.5m)</td><td>2.00</td></tr>
<tr><td>East (at 1.5m)</td><td>2.50</td></tr>
<tr><td>South (at 1.5m)</td><td>8.00</td></tr>
<tr><td>West (at 1.5m)</td><td>0.85</td></tr>
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<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR10a – North of The Hawthorns, Babraham Road, Sawston</td>
<td>The receptor location is located on Babraham Road Sawston at the north of a newly constructed two storey residential property. New street lighting has been installed on this section of Babraham Road.

Looking northwards across the field the topology slopes away to the north with a treeline in the distance and another field beyond.

Looking eastwards, an open field is visible beyond which Church Farm is visible with trees within the property boundary. Beyond there are various industrial style buildings in the distance within wooded areas.

Looking southwards across the open field opposite some intermittent hedgerows are visible with the topology sloping downhill into the distance. Large wooded areas are visible further into the distance with a mix of deciduous and evergreen trees.

Looking westwards towards Sawston village, The Hawthorns is on the northern side of Babraham Road. New street lighting commences from this location into the village. The new street lighting consists of 6m columns with Urbis Axia or similar style LED luminaires mounted post top at approximately a 50 tilt. There are five columns visible from this location.</td>
<td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Babraham Road.

Viewing northwards one very small light is visible in the distance along with four brighter white lights, one appearing much brighter than the other three.

Viewing to the northeast there is a line of yellow lights running in a line visible in the distance with the downward beam of light very apparent on some.

Viewing eastwards, in the distance is one small red and four distinctly bright lights, three are orange and one is white. Lights that are yellowy in appearance are also apparent in the location of Church Farm and Babraham Hall. The solar studs on the combined footway and cycleway are also visible along the route to Babraham although some are not working at the time of the survey. An orange hue is also visible on the horizon in the direction of the Four Went Ways roundabout and service area.

Viewing towards the southeast there are approximately six orange lights in the distance which create an orange hue on the horizon.

To the south no artificial lights can be seen and the view is dark.

To the southwest there is a group of approximately five orange lights in the distance and in the foreground a few yellow, white, and orange lights can be seen. Spill light is apparent on the adjacent field.

Viewing to the west, yellow, white and orange lights can be seen within Sawston Village and the white street lighting on Babraham Road.

Viewing to the Northwest there are approximately two or three red lights visible in the distance.

Skyglow is apparent in the northerly direction with the brightest white in the northwest to north. In the northeast is an orangey-yellow hue in the direction of Four Went Ways. There is a slight white hue to the east which decreases when viewing along the horizon towards the south. It appears again as an orangey-yellow hue to the southeast and turns white to the southwest. There is no skyglow visible in the west.</td>
<td>Principal Light sources: Vehicle headlights

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction, Four Went Ways/A11

<table>
<tr><td colspan="2">Lighting measurements (3rd February 2021 21:07)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.00</td></tr>
<tr><td>North (at 1.5m)</td><td>0.00</td></tr>
<tr><td>East (at 1.5m)</td><td>0.00</td></tr>
<tr><td>South (at 1.5m)</td><td>0.00</td></tr>
<tr><td>West (at 1.5m)</td><td>0.00</td></tr>
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<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>B10 – Babraham/Sawston Road, Sawston</td><td>This location is further along Babraham Road where it changes into Sawston Road and is situated on the combined footway and cycleway that follows the highway into Babraham village. Looking northwards across the flat field which slopes away to the north there is a treeline in the distance with another field beyond.

Looking eastwards across open fields in the direction of Churchfield Farm, there are trees visible within this properties boundary and beyond there are various industrial style buildings further in the distance with wooded areas also visible.

Looking southwards across the open field some intermittent hedgerows are visible with the topology sloping downhill into the distance. Large wooded areas are visible further into the distance with a mix of deciduous and evergreen trees. Looking west the new development is located on the northern side of the highway. On the southern side and west along the highway is Sawston village. There is a flat field located between this receptor and the edge of the village on the south side of the highway. There is a sparsely tree lined boundary hedge which provides some screening. There is minimal screening provided by a sparsely planted hedge along the field boundary running to the west of new development although no screening is present to the east of The Hawthorns.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Babraham Road.

Viewing northwards one bright white light in the northwest which emits glare in this direction. In the north a cluster of bright white lights is apparent and to the northeast a line of white lights and four very bright lights appear as orange, white, orange, orange visible in the distance.

Viewing eastwards, yellowy lights are apparent in the location of Church Farm and Babraham Hal. In the distance there is one bright yellow light with a cluster of small white lights visible nearby. In the distance an orange hue is visible on the horizon with a further group of more dull lights visible to the southeast in the distance, white in appearance.

To the south no artificial lights are visible and the view is dark.

To the southwest there is a group of approximately five orange lights in the distance and in the foreground a few yellow, white, and orange lights in the direction of Sawston village can be seen. Spill light is apparent on the adjacent field.

Viewing to the west, yellow, white, and orange lights can be seen within Sawston Village and the white street lighting on Babraham Road the closer of which are producing glare in this direction.

Viewing to the Northwest there are approximately two or three red lights visible in the distance.

Skyglow is apparent in the northerly direction with the brightest white in the northwest to north. In the northeast is an orangey-yellow hue in the direction of Four Went Ways. There is a slight white hue to the east which decreases when viewing along the horizon towards the south. It appears again as an orangey-yellow hue to the southeast and turns white to the southwest. There is no skyglow visible in the west.</td><td>Principal Light sources: Vehicle headlights, residential lighting and street lighting

Principal sources of glare: Street lighting on Babraham Road, light source visible in the northwest direction

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction, Four Went Ways/A11

<table>
<tr><td colspan="2">Lighting measurements (3rd February 2021 21:28)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.00</td></tr>
<tr><td>North (at 1.5m)</td><td>0.00</td></tr>
<tr><td>East (at 1.5m)</td><td>0.00</td></tr>
<tr><td>South (at 1.5m)</td><td>0.00</td></tr>
<tr><td>West (at 1.5m)</td><td>0.02</td></tr>
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</td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR10b – North Farm, West Way, Sawston</td>
<td>This receptor is located to the south of the entrance to North Farm and to the west of Cambridge concrete plant. Located to the northeast in direct view is a metal gates and fence beyond which is a large open field.

Looking northwards is a direct view of the entrance gates to North Farm. Located on each side of the entrance gate is a decorative light mounted on a pillar. A large deciduous tree is to the east side of North Farm’s driveway with a line of deciduous trees and vegetation providing a level of screening along the farm’s boundary.

Looking eastwards the view consists of the flat field and the hedgerow planted along the Concrete Plant’s northern boundary with dense trees in the distance. No artificial lighting is visible in this direction.

To the southeast is Cambridge Concrete Plant with a metal fence installed on the plant’s western boundary. To the east of the concrete plant there are a few industrial style buildings and some buildings in mid-construction. Some of the industrial buildings have floodlights mounted to the exterior. A neighbouring industrial unit is located on the southern side of the concrete plant.

The concrete plant is in direct view with a carpark located on the northern side and the plant on the southern. A floodlight is fixed to the plant machinery at high level.

To the west there are evergreen and deciduous trees beyond which is a large carpark surrounded by industrial units. The carpark has a quantity of lighting columns installed with numerous floodlights installed on the exterior of the industrial units in prominent positions. The lighting columns are approximately 8/10m in height with post top mounted luminaires.</td>
<td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Viewing northwards is the entrance to North Farm. No artificial lighting is visible in this direction although the lights installed on the property entrance gates illuminate when the gates open automatically but this lasts only for the period of operation.

Viewing eastwards through the gates and fencing there two bright orange lights with a mixture of smaller yellow, white, and orange lights seen in the distance.

Viewing southeast there is a bright white floodlight visible which emits glare in this direction mounted on a property beyond the concrete plant. Spill light is visible on the top of the concrete plant originating from a white light source installed on the southern side of the machinery. A further small white light is visible on the neighbouring property to the south of the concrete plant.

Viewing westwards, the lighting columns located within the carpark and the exterior floodlighting emit a high level of glare. Spill light is evident on the surface of West Way in some areas. Internal lighting is visible through rooflights and exterior windows of the industrial units.

Skyglow is apparent in the northwest through to the northeast. It is at its whitest and brightest in the north.</td>
<td>Principal Light sources: Concrete plant floodlights, floodlight behind concrete plant, carpark lighting and floodlighting in location of storage buildings

Principal sources of glare: Storage building floodlighting, storage building carpark lighting, floodlight mounted to the exterior of a property located behind the concrete plant

Principal sources of spill light: None

Sources of sky glow: Cambridge in Northerly direction
<table>
<tr><td colspan="2">Lighting measurements (4th March 2021 21:36)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.02</td></tr>
<tr><td>North (at 1.5m)</td><td>0.02</td></tr>
<tr><td>East (at 1.5m)</td><td>0.02</td></tr>
<tr><td>South (at 1.5m)</td><td>0.04</td></tr>
<tr><td>West (at 1.5m)</td><td>0.09</td></tr>
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<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LA18 -Sawston Road, Babraham</td>
<td>This receptor is located on the combined footway and cycleway on Sawston Road approximately 200m from the T-junction with High Street Babraham.

Viewing to the north the view is of a field located on the northern side of the highway. The field has a treelined boundary running along the northern boundary with a dense tree lined boundary on the north eastern boundary. Beyond the field broken views of additional structures can be seen through the trees that are largely screening more distant views.

Viewing to the east along the highway to the High Street junction, there are fields to the north and south with trees located beyond. An agricultural style building is also visible in this direction.

Viewing to the southeast and south the topography is an open field with even ground although sloping downhill towards a large cluster of trees in the distance, the receptor location slightly higher than the surrounding area.

Viewing to the west-northwest Sawston Road is visible with trees screening Church Farm on the northern side of the highway. Sawston Village and The Hawthorns are visible in the distance beyond open fields and a hedgerow in the foreground.</td>
<td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along Sawston Road.

Viewing to the north a cluster of white lights are visible through the trees on the northern edge of the field. There are a few clusters of white lights visible to the west side with one cluster brighter than the rest and a small orange and a small red light also visible.

Viewing to the north to east on the horizon, a group of yellowish lights and orange lights are visible in the distance.

Viewing to the east solar studs installed on the combined footway and cycleway are visible although a few were not working at the time of surveying.

Viewing to the southeast three yellowish lights visible in the distance along with intermittent views of vehicle headlights. There are no further artificial lights visible in this direction.

Viewing to the west-northwest solar studs installed on the combined footway and cycleway are visible in the foreground, although a few were not working at the time of surveying.

Sawston Village residential lighting is apparent in the distance which stretches along the horizon. On the northern side, a group of very small white lights are visible and on the southern side there are numerous lights which are less intense mainly whitish in colour although more yellowy as the highway enters the village. One yellowy bright light is visible within the village with red lights visible nearby.

There is one very bright light located in the vicinity of the new Hawthorns development which is orange in appearance. The street lighting installed in front of the Hawthorns is very bright and white in appearance.

Skyglow is apparent in the northern direction where it is at its whitest and brightest and apparent to a slightly lesser degree in the south. It decreases in intensity when viewing towards the west and east. Elsewhere a treeline is apparent in the distance due to a slight white glow.</td>
<td>Principal Light sources: Vehicle headlights

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table>
<tr><td colspan="2">Lighting measurements (3rd February 2021 19:43)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.00</td></tr>
<tr><td>North (at 1.5m)</td><td>0.00</td></tr>
<tr><td>East (at 1.5m)</td><td>0.00</td></tr>
<tr><td>South (at 1.5m)</td><td>0.01</td></tr>
<tr><td>West (at 1.5m)</td><td>0.01</td></tr>
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<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>LR12 – High Street, Babraham</td><td>This receptor is located on High Street Babraham approximately 165m from Babraham Primary School and 180m from the T-junction with Sawston Road. The receptor location is elevated in level in comparison to the High Street roadway.

Viewing to the northwards there is a public bridleway located on the western side of the High Street with a gated entrance. A brick wall on the norther side of the High Street indicates the boundary between the highway and sports ground pavilion beyond. Beyond the brick wall there are numerous trees visible which are mainly deciduous in nature. The trees provide a level of screening although some industrial style buildings are visible through the trees in this direction. Looking to the eastern side of the High Street a residential property (The Old Vicarage) is visible through a large group of deciduous trees.

Viewing eastwards, views across the border hedgerow to open field where a large deciduous tree is located in the field’s northern boundary hedge. In the distance there is a tree line at the far end of the field.

Viewing to the south/southwest, the topography is largely flat with a slight incline to the south with an expanse of open fields visible with telegraphs poles running from east to west in the distance. The High Street is bordered to the east with a hedgerow with further deciduous trees seen in the distance.

Viewing to the West is an open field with a line of trees located at the far end of the field visible, many properties in the location of Churchfield Farm are visible through the trees.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along the High Street.

Viewing to the north there are 2-3 lights visible through the trees in the distance which are white in appearance. Viewing to the northeast approximately 100m away the light from the street lighting on the High Street is apparent and white in nature.

Viewing to the east there is a group of yellow lights in the direction of the Four Went Ways roundabout and service area with a further cluster of bright yellow lights in the east-southeast direction.

Viewing to the south/southwest there is no artificial lighting apparent, only the solar studs installed on the combined footway and cycleway are visible in this direction. Not all solar studs were working at the time of surveying.

Viewing to the west there are four dull white lights apparent through the trees with one red light on its own further in the distance.

Skyglow is apparent in every direction except in the northeast and it is at its most intense to the northwest.</td><td>Principal Light sources: Vehicle headlights

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (3rd February 2021 20:24)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.00</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.00</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
<tr><td>B11 – High Street, Babraham</td><td>This location is very exposed.

Viewing to the north towards the junction of the High Street and Sawston Road the High Street is bordered by a mix of deciduous trees and a broken hedgerow on the southern side of the High Street beyond which are open fields with further tree lines visible in the distance. An additional hedgerow bordering the eastern side of the High Street is visible beyond which are open fields with further tree lines visible in the distance.

Viewing to the East across High Street a small hedgerow can be seen with a large field beyond with a treeline visible in the distance. In the distance Bourne Bridge located near the A11 and wind generators in the very far distance beyond the A11 can be seen. A large white structure and farm buildings can also be seen from this location.

Viewing to the South, the High Street can be seen with the hedgerows and trees visible bordering the highway as describe to the north. There is a large wooded area which is a mixture of deciduous and evergreen trees running from east to west along the edge of the field on either side of High Street.

Viewing to the west-northwest beyond the hedgerow is an open field with Sawston Village and the new development (The Hawthorns) visible further in the distance. Further to the west trees can be seen screening more distant views of Sawston Village.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. Occasional vehicle headlights are visible as they pass along the High Street.

Viewing to the north there are no artificial lights visible in this direction.

Viewing to the northeast there are three white lights and further to the east there is a cluster of yellowy-orange lights in the distance in the direction of Four Went Ways roundabout and service area.

To the east in the distance there is a group of faint mainly yellowy with one white light in a small group and a further four faint yellowy lights in the distance. In the east there is an orange hue and one bright white light in this direction.

Viewing to the south there are no artificial lights visible in this direction.

Viewing to the west-northwest Sawston Village lighting is visible which is predominantly white in appearance with one bright red light apparent. As the view moves to the north there are some bright orange and bright white lights visible with one or two red lights apparent further along Babraham Road.

Skyglow is very bright white to the north, slightly white when viewing southeast to south and minimal in the west.</td><td>Principal Light sources: Vehicle headlights, Sawston Village residential lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (3rd February 2021 20:07)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.00</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.00</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
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<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>LR13 – Home Farm Agricultural Buildings, Babraham</td><td>This receptor is in a very exposed location on the edge of a field close to some agricultural buildings and on the route of a public footpath between Little Abington and Babraham.

Viewing to the North the agricultural buildings are located directly in front with the nearest residential buildings (Harvest House and Shepherd's Cottage) which are set back approximately 125m and benefit from the screening that these agricultural buildings provide.

Viewing to the East there is a large flat field with a treeline located at the end which provides a level of screening for this location. The Four Went Ways roundabout and service area are located in this direction.

Viewing to the southeast the direct view is of a flat open field with a public footpath located to the south. In the distance to the southeast of the field a treeline consisting of mainly deciduous trees runs north to south.

Viewing south there is an open field beyond which there are vehicles traveling along the A11/A505 that can be seen in the far distance through various vegetation and trees. A treeline is located at the far end of the small field in the direction of the River Granta.

Viewing to the West and northwest are the nearest residential properties (The old Vicarage, Shepherd's Cottage and Harvest House) which benefit from various trees and vegetation planted in front and within the property boundaries which will provide some beneficial screening. There are some gaps in the screening where the vegetation is sparse.</td><td>This receptor location is relatively dark as indicated by the recorded light measurements however the agricultural building in the north is brightly lit providing spill light onto the receptor location.

Viewing to the north the agricultural buildings have a large bright white floodlight fixed to the exterior at this location which emits glare and spill light onto the receptor location. Residential lighting, both interior and exterior is visible from the neighbouring properties, with an exterior light that is very bright yellow and emits a level of glare.

Viewing to the east-southeast there are a group of yellowy-orange lights located in the direction of the Four Went Ways roundabout and service area creating a slight orange hue in that area. A further two small white lights are visible further along the horizon and after a short distance a single orange light is visible as the viewpoint changes to the southeast direction.

As the view moves to the southeast-south the view is very dark. The treeline to the southeast of the open field is apparent against the sky. To the south there are a bank of yellow tinged lights in the distance and vehicle headlights can be seen travelling along the A11/A505. The group of yellow lights are located in the direction of the A11/A505 junction.

Viewing to the west there is no artificial lighting apparent in this direction.

Skyglow is slightly apparent in the north however largely masked by the brightness of the floodlighting.</td><td>Principal Light sources: Floodlights, residential lighting (both internal and external)

Principal sources of glare: External floodlighting mounted on the agricultural buildings, external residential lighting at Harvest House

Principal sources of spill light: External floodlighting fitted to agricultural buildings

Sources of sky glow: Cambridge in North / Northwest direction

Lighting measurement (25th February 19:35)

Direction of sensor | Light reading in Lux
Ground | 0.12
North (at 1.5m) | 0.36
East (at 1.5m) | 0.08
South (at 1.5m) | 0.04
West (at 1.5m) | 0.11</td></tr>
<tr><td>LR14 – Field near Honeysuckle Lane, Babraham</td><td>This receptor is approximately 150m from Honeysuckle lane on the corner of a field and is exposed.

To the north is a large wooded area which seems to mainly consist of deciduous trees providing screening for the residential properties beyond.

Viewing easterly direction there is a hedge with a large oak tree planted within beyond which is a large field. In the distance there are a number of wind turbines visible.

Viewing southeast there is an open field with a treeline running along the northern and eastern perimeters. The eastern treeline provides a boundary between this field and the neighbouring field. At the end of the field in the southeast there is a larger wooded area.

Viewing to the west, a bank of deciduous and evergreen trees is located which screens more distant views.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Viewing to the north there is very little artificial light visible, only very small pinholes of light visible through the trees that are screening more distant views.

Viewing to the east the street lighting located on the A1307 and within the service area is visible and yellowy orange in appearance with vehicle headlights seen intermittently.

Viewing to the southeast the northern and eastern treelined boundaries are distinguishable from the sky but no artificial lighting is visible in this direction. Viewing to the south orange light sources are visible in the distance beyond the river Granta, the A505/A11 junction is in this direction.

Viewing to the west no artificial light visible.

Skyglow is visible in the north as a white glow.</td><td>Principal Light sources: Vehicle headlights and street lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

Lighting measurements (25th February 2021 19:51)

Direction of sensor | Light reading in Lux
Ground | 0.09
North (at 1.5m) | 0.02
East (at 1.5m) | 0.11
South (at 1.5m) | 0.04
West (at 1.5m) | 0.03</td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>LR15 – Field behind Oak Lane, Babraham</td><td>This receptor is very exposed due to the location being on the edge of a large almost flat field which extends from the edge of a wooded area to the north and west to another wooded area in the east and south near the A1307, A11 and Four Went Ways roundabout.

Viewing to the north there is a large wooded area which is a mixture of both deciduous and evergreen trees which provide some beneficial screening for Oak Close which is located beyond this wooded area.

Viewing to the east and southeast beyond the open fields is the A1307 running from the Four Went Ways roundabout towards Cambridge. Vehicles can be seen running along this highway at regular periods. A boundary hedge and deciduous trees provide a level of screening between the A1307 and the field.

Viewing to the South is the large open field with the boundary hedge which increases in depth eastwards. Further trees can be seen in the distance beyond the fields to the south.

Viewing to the west there is a large wooded area which is a mixture of both deciduous and evergreen trees which provide some beneficial screening for the properties beyond.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Viewing to the north residential lighting from properties located on Oak Lane is visible through the trees.

Viewing to the east and southeast there is the occasional view of headlights from vehicles travelling along the A1307. The street lighting located on the A1307 roundabout and within the service area is also visible and yellowy orange in appearance.

Viewing to the south no artificial lighting is visible in this direction.

Viewing to the west no artificial lighting is visible in this direction.

Skyglow is visible in the north as a white glow.</td><td>Principal Light sources: Vehicle headlights, street lighting and residential lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (25th February 2021 19:58)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.10</td></tr><tr><td>North (at 1.5m)</td><td>0.03</td></tr><tr><td>East (at 1.5m)</td><td>0.07</td></tr><tr><td>South (at 1.5m)</td><td>0.03</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
<tr><td>LR16 – Footpath 12/4 next to and west of footbridge over A11</td><td>Viewing northwards there is a small deciduous hedge with two deciduous trees located within. Beyond is a ploughed field which is treelined to the northeast and northwest boundaries. A wooded area is visible in the distance. The topography rises to the north towards the A1307 and Four Went Ways.

To the east towards the A11, there is a boundary line consisting of trees and mixed vegetation running along the length of the A11 route although vehicles are visible travelling along the A11 through the trees and vegetation. A direction sign located on the A11 is visible above this vegetation. Bourne Bridge is direct in view.

Viewing to the south, the view looks across a ploughed field with trees providing screening to the southeast following the route of the A11. The topography runs downhill southwards towards the River Granta. To the southwest the view is of an open ploughed field with a line of deciduous trees beyond the field with the lake visible through these trees and further trees beyond the lake in the distance.

Viewing to the northwest towards Babraham, the view is of the footpath and the field with a deciduous tree line to the north of the footpath. The topography is even where the footpath is located, although sloping downwards to the south with the gradient slowly rising northwards. To the northwest the view is directly along the footpath to the High Street with an open ploughed field to the south with further trees visible in the distance. The northern side of the footpath a deciduous hedgerow with deciduous trees planted intermittently screening views further to the north.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements. The occasional light is visible from a passing cyclist travelling to and from Babraham Village.

Viewing to the north headlights are visible in the distance from vehicles travelling along the A1307. There are a few yellow- orange lights also visible in the distance in this direction.

Viewing to the northeast a few yellow- orange streetlights are visible in the distance through the trees.

Viewing to the east headlights are visible in the distance from vehicles travelling along the A11.

Viewing to the south headlights are visible in the distance from vehicles travelling in the distance through the trees.

Viewing to the southwest and west intermittent headlights are visible in the distance through the trees from travelling vehicles, no other lighting is visible in these directions. To the northwest no artificial lighting is visible.

Skyglow is visible when viewing from the east through to the northwest as a white glow just above the trees.</td><td>Principal Light sources: Vehicle headlights, cycle lights and street lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in Northwest direction

<table><tr><td colspan="2">Lighting measurements (2nd February 2021 18:24)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.01</td></tr><tr><td>North (at 1.5m)</td><td>0.01</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.00</td></tr><tr><td>West (at 1.5m)</td><td>0.01</td></tr></table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>B12 – Field adjacent to A11, Little Abington</td><td>Viewing to the north there is an open field beyond which Two Acre plantation can be seen with a small hedge running either side. There are approximately six deciduous trees located at intervals within the hedge. Beyond the hedge is a green field with trees located further in the distance. To the northeast the view is of an open field beyond which a portion of Two Acre plantation can be seen. A boundary hedgerow in which some large deciduous trees are located boarders the open filed to the next field with further trees lines located beyond. Large direction signs can be seen in the distance through the tree line.

Viewing to the east, an open field with a line of trees bordering the boundary between the A11 and this field is visible, a direction sign located on A11 is visible above the trees.

Viewing to the south a small wooded area is visible with the River Granta and a lake seen through the trees.

Viewing to the west-northwest, agricultural buildings are visible at the end of a ploughed field, trees are also visible in the distance around the perimeter.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Viewing to the north there is no artificial light visible.

Viewing to the northeast a broken row of orangery yellow streetlights are visible in the distance, the service area and the A1307 roundabout are in this direction.

Viewing to the east through to the southeast vehicle headlights can be seen travelling on the A11.

Viewing to the south no artificial lighting is visible.

Viewing to the northwest one bright white light source is visible.

Skyglow is apparent in the northwest as a white glow and slightly white in the southeast.</td><td>Principal Light sources: Vehicle headlights, street lighting, light source in the direction of Home Farm

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (2nd February 2021 17:50)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.01</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.00</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
<tr><td>B13 – Footpath 12/4 from Babraham village to A11 footbridge</td><td>Viewing to the north there is a small deciduous hedge with two deciduous trees located within, beyond is a ploughed field which is treelined to the northeast and northwest boundaries. Two Acre plantation is visible beyond the hedge and open field. The topography rises to the north towards the A1307 and Four Went Ways.

To the northeast a deciduous hedge and tree largely screen views beyond however a ploughed field is visible beyond the hedge with further trees visible in the distance. To the east viewing towards the A11 Bourne Bridge is visible and in the foreground there is a hedgerow with intermittent deciduous trees bordering the footpath from the field to the north. A boundary line consisting of trees and mixed vegetation along the length of the A11 route is visible further in the distance. Vehicles are visible travelling along the A11 through the trees and vegetation. A direction sign located on the A11 is visible above this vegetation

Viewing to the south, the view looks across a ploughed field with trees providing screening to the southeast following the route of the A11, a direction sign located on the A11 is visible above the boundary between A11 and the field. To the southwest views are across an open field with trees lining the River Granta, a lake is visible through gaps in the treeline with further trees visible beyond the lake.

Viewing to the northwest along the footpath towards Babraham, the view is of the open ploughed field to the south with further trees visible in the distance. The topography is even where the footpath is located, although sloping downwards to the south with the gradient slowly rising northwards. The northern side of the footpath a deciduous hedgerow with deciduous trees planted intermittently screening views further to the north.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Viewing to the north there is no artificial light visible.

Viewing to the northeast a deciduous hedge and tree largely screen views beyond however there are some orangey yellow streetlights and white light with a green tinge visible in the distance through gaps in the screening.

Viewing to the east through to the southeast vehicle headlights can be seen travelling on the A11.

Viewing to the south no artificial lighting is visible.

Viewing to the southwest the occasion set of white headlights are visible.

To the southwest no other artificial lighting is apparent.

To the west no artificial lighting is apparent.

Skyglow is apparent just on the treeline looking southeast to southwest. It is white with an orange tinge in the northwest just above the trees.</td><td>Principal Light sources: Vehicle headlights, street lighting and cycle lights

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (2nd February 2021 18:12)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.00</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.00</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr><td>B15 – Field adjacent to A1307/A11 and Four Went Ways roundabout, Little Abington</td><td>This receptor is on the edge of a field close to Four Went Ways roundabout. Directly to the north are deciduous trees and vegetation which constitute the field boundary separating the A1307 and Four Went Ways roundabout from the field.

Viewing to the east there is a bank of deciduous trees and vegetation which creates a boundary between the roundabout, the A11 and this location.

Viewing to the south the A11 is visible beyond a treeline which runs along the eastern edge of the large open field. A large bank of deciduous trees located within the field is visible in the distance to the south. To the southwest the view is mainly of a flat open field with a slight slope downhill towards Babraham Village. A deciduous hedge and intermittent trees can be seen bordering the field from the field beyond with Two Arce plantation also visible. Further trees are visible in the distance beyond this with some agricultural buildings visible in the distance in the direction of Honeysuckle Lane.

Viewing to the west Oak lane is visible behind a large bank of trees, street lighting located on Oak Lane is also visible from this location. The residential property located on the corner of High Street and the A1307 is clearly visible as no screening is in place to block the view of this building from the receptor location. The entrance to The Close and the residential properties on The Close can be seen to further to the northwest.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Viewing northwards, the yellowy orange street lighting located on the roundabout and A1307 is slightly visible through the vegetation.

Viewing eastwards, the service area lighting and street lighting is visible as bright yellowy orange through the vegetation.

Viewing southwards, no artificial lighting is visible only the occasional passing vehicle headlights. To the southwest no artificial lighting is visible.

Viewing westwards there is a large bank of trees in the vicinity of Oak Lane. The residential lighting from the properties located further to the west can be seen through the trees although the lighting is dull in nature due to the level of screening. To the northeast of these trees and on the other side of High Street there is a small group of lights visible, one white and approximately three orange lights. One white light is very bright compared to the others and emits glare in this direction, in the distance beyond the white bright light a small red light is visible. Headlights from vehicles are visible travelling along High Street and A1307.

Skyglow is apparent when looking from the northwest through to the south although it is at its brightest and whitest in the north-northwest direction and minimal in other directions.</td><td>Principal Light sources: Vehicle headlights, street lighting and residential lighting

Principal sources of glare: Light source located in The Close

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements (4th March 2021 23:00)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.00</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.00</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
<tr><td>B16 – Field adjacent to A1307/A11 and Four Went Ways roundabout, Little Abington</td><td>Viewing to the north there is a deciduous tree line and boundary hedge running along the southern side of the A1307 as it exits the roundabout.

Viewing to the southeast a bank of trees which creates a boundary between the A1307, the roundabout and the A11 are visible.

Viewing to the south in the foreground is a large open field. The field is flat with a slight gradient rising uphill to the south. To the southeast Two Arce plantation can be seen, a deciduous hedgerow with intermittent trees is bordering the field from the next field then in the distance further trees are seen.

Viewing to the west Oak Lane is visible behind a large bank of trees, street lighting located on Oak Lane is also visible from this location. Further to the southwest there are agricultural buildings further in the distance towards Honeysuckle Lane. The residential property located on the corner of High Street and the A1307 is clearly visible as no screening is in place to block the view of this building from the receptor location. The entrance to The Close and the residential properties on The Close can be seen to further to the northwest.</td><td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Viewing northwards there are no artificial lights apparent and the view is dark.

Viewing eastwards there are yellowy-orange streetlights visible through the screening from the direction of the Four Went Ways roundabout.

Viewing southwards there are a few small sized lights in the distance which are assumed to be vehicle headlights due to the intermittency and movement. No other artificial lighting is visible other than a slight white hue of lighting in the distance.

Viewing westwards there is one very bright white light apparent in the distance towards Home Farm.

Viewing from the west to the northwest there is a large bank of trees in the vicinity of Oak Lane. The residential lighting from the properties located further to the west can be seen through the trees although the lighting is dull in nature due to the level of screening. To the northwest of these trees and on the other side of High Street there is a small group of lights visible, one white and approximately three orange lights. One white light is very bright compared to the others and emits glare in this direction, in the distance beyond the white bright light a small red light is visible. Headlights from vehicles are visible travelling along High Street and A1307.

Skyglow is apparent in the north-northwest direction and is bright and white.</td><td>Principal Light sources: Vehicle headlights, street lighting and residential lighting

Principal sources of glare: Light source located in The Close

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table><tr><td colspan="2">Lighting measurements(4th March 2021 22:52)</td></tr><tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr><tr><td>Ground</td><td>0.00</td></tr><tr><td>North (at 1.5m)</td><td>0.00</td></tr><tr><td>East (at 1.5m)</td><td>0.00</td></tr><tr><td>South (at 1.5m)</td><td>0.00</td></tr><tr><td>West (at 1.5m)</td><td>0.00</td></tr></table></td></tr>
</table>

<table>
<tr><th>Receptor number and location</th><th>Description of existing day-time view</th><th>Description of existing night-time view</th><th>Summary of prevalent lighting</th></tr>
<tr>
<td>LR17 – Newmarket Road, Little Abington</td>
<td>The receptor is located on a busy road outside the Cambridge International School. Viewing north-northwest and northwest the view is of the boundary hedgerow and trees which are mainly deciduous, beyond which is an open grassed area and further trees then the A11.

Looking northeast along Newmarket Road leading to the service area deciduous trees and vegetation that line both sides of the highway along the length of the road. In the distance street lighting on the roundabout to the service area is visible.

To the east is a deciduous wooded area behind a fence which is approximately 1m in height. Beyond is an open field and residential properties are visible further in the distance.

Viewing to the south looking along Newmarket Road, deciduous trees and vegetation line both sides of the highway along the length of the road with Cambridge International School buildings visible through the treeline.

Viewing to the southwest and west there are mainly deciduous trees and vegetation visible with an open grass area located behind the trees, beyond which further trees then the A11.</td>
<td>The immediate area surrounding the viewpoint appeared dark as indicated by the recorded light measurements.

Newmarket Road has minimal traffic passing at the time of surveying.

Viewing to the north-northwest and northwest there is the occasional headlights visible through the vegetation from passing traffic and a white hue visible through the trees and vegetation, no other artificial lighting is visible.

Viewing to the northeast street lighting located at the service area roundabout is visible and yellowy orange in colour. The lighting columns are 10-12m approximately in height.

Viewing to the south residential lighting is visible in the distance through the treeline and is white in appearance.

Viewing to the southwest there is a white hue visible through the trees and passing vehicle headlights are seen at intervals.

Viewing to the west there is the occasional headlight from vehicles travelling along the A11 and lights from a passing plane were visible in the sky at the time of the survey.

Skyglow is apparent northwards through the trees. There is a white hue visible south and south-westwards with a white glow above the trees looking from west to northwest.</td>
<td>Principal Light sources: Vehicle headlights, street lighting and residential lighting

Principal sources of glare: None

Principal sources of spill light: None

Sources of sky glow: Cambridge in North / Northwest direction

<table>
<tr><td colspan="2">Lighting measurements (2nd February 2021 18:49)</td></tr>
<tr><td>Direction of sensor</td><td>Light reading in Lux</td></tr>
<tr><td>Ground</td><td>0.00</td></tr>
<tr><td>North (at 1.5m)</td><td>0.00</td></tr>
<tr><td>East (at 1.5m)</td><td>0.00</td></tr>
<tr><td>South (at 1.5m)</td><td>0.00</td></tr>
<tr><td>West (at 1.5m)</td><td>0.00</td></tr>
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Proposed Development – lighting requirements

Construction site, access and compound

11.3.62 During construction, compounds will be provided for use by the appointed contractor. This will include site offices and welfare facilities. The standard permitted hours provided within the CEMP are set out in Table A11.3.15.

Table A11.3.2 Proposed site working hours

Day	Times	Comments
Monday – Friday Day Working	07:30 – 18:00	Route wide works
Saturday Working	07:30 – 16:00	Route wide works
Monday – Sunday Night Works	20:00 – 06:00	Restricted to works that cannot be completed within standard traffic management, such as carriageway surfacing which will be completed under full road closures. Requires prior approval from local highway authority.
Public Holidays	Any time	No works are anticipated during public holidays, any exceptional works will be restricted to works that are required for safety reasons only and with prior approval from GCP and relevant statutory bodies.

11.3.63 It is anticipated that night-time working will be restricted to hours indicated above. During the winter months, typical working hours will overlap with hours of darkness. During these winter months where work is required to take place during the hours of diminishing ambient lighting levels, task lighting for health and safety will be needed.

11.3.64 Floodlighting is typically used to provide construction phase task lighting and will be restricted to a 6m mounting height. This type of lighting is often portable and will range in height depending on the type of tasks being undertaken. Where lighting in the main construction areas is required for health and safety purposes, lighting levels will be designed to between 50 and 100 Lux, in accordance with the Proposed Development Construction Lighting Plan, BS EN 12464-2:2014 and / or BS 5489-1:2020 depending on the tasks being undertaken.

11.3.65 Security lighting is often required to deter crime in both site compounds or other areas where plant and materials are stored overnight. Lighting used for security will be centred around the compounds and offices. Lighting is likely to be provided from lighting columns and building mounted floodlights and will be restricted to an 8m mounting height.

11.3.66 The construction compounds will be lit in accordance with the Proposed Development Construction Lighting Plan, BS EN 12464-2:2014 and / or BS 5489-1:2020 dependant on the tasks being undertaken and will typically be restricted to an 8m mounting height. Where there are vehicle access points and wheel wash stations, lighting to provide between 50 and 150 Lux. Where there are plant or machine inspection points, lighting to provide between 100 and 150 Lux.

Operational phase required lighting levels

11.3.67 Lighting standards used within the Proposed Development are listed in Table A11.3.16 and Table A11.3.17.

Table A11.3.3 Required lighting levels

Lighting Standard/s	Average Illuminance (Lux)	Minimum Illuminance (Lux)	Overall Uniformity (U_o)	Longitudinal Uniformity (U_l)	Average luminance (cd/m^2)
P2	10 - 15	2			
P4	5 – 7.5	1	-	-	-
P5	3 - 4.5	0.6	-	-	-
Wayfinding*	-	0.6	-	-	-
Light Traffic Car Park	5	-	0.25	-	-
Heavy Traffic Car Park	20	-	0.25	-	-
C2	20	-	0.4	-	-
C3	15	-	0.4	-	-
C4	10	-	0.4	-	-
C5	7.5	-	0.4	-	-
M4	-	-	0.4	0.6	0.75

* Wayfinding lighting does not adhere to a specific lighting class, the minimum illuminance requirement from the P5 lighting class has been used but due to low level bollard lighting being utilised in the area, as well as spill light from surrounding areas, the maximum average illuminance for the P5 lighting class is exceeded.

Table A11.3.17 Required lighting levels for zebra crossings

Required Calculation Grid Location	Average Illuminance (Lux)	Uniformity (U_o)
Carpet	3.5 x maintained average horizontal road illuminance	0.6
Centre of Crossing	2 x maintained average horizontal road illuminance	-
Kerb Edges (x2)	2 x maintained average horizontal road illuminance	-
Rear of Waiting Area (x2)	1.5 x maintained average horizontal road illuminance	-

Francis Crick Avenue including junction with guided busway & roundabout with Dame Mary Archer Way

11.3.68 The lighting within Francis Crick Avenue including the junction with the Guided Busway and Roundabout with Dame Mary Archer Way is designed in accordance with BS5489-1:2020 to appropriate lighting levels for their intended use, see Table A11.3.18 for details.

Table A11.3.18 Achieved lighting levels Francis Crick Avenue roundabout & guided busway junction

Lit Area Descriptor	Lighting Standard/s	Average Illuminance (Lux)	Minimum Illuminance (Lux)	Uniformity (U_o)
Francis Crick Avenue Roundabout	C4	12.64	-	0.41
Francis Crick Avenue	C4	14.99	-	-
Francis Crick Avenue Junction	C4	12.59	-	0.45

11.3.69 All luminaires within this area are post-top mounted at 0° tilt on 10m columns. For luminaire schedule summary refer to Table A11.3.19.

Table A11.3.19 Luminaire schedule Francis Crick Avenue roundabout & guided busway junction

Luminaire	Lamp/Optic	Shield	Output (klm)	Luminous Intensity	Colour Temperature	Quantity
Luma Mini BGP703	DW10	BL1	6	G4	4000K	8
Luma Mini BGP703	DW10	BL1	10	G4	4000K	28
Luma Mini BGP702	DM33	-	3	G6	3000K	9

Signalised crossings

11.3.70 There are two signalised crossings, Granham's Road Crossing and High Street Crossing which are designed in accordance with BS5489-1:2020 to appropriate lighting levels for their intended use, see Table A11.3.20 for details.

Table A11.3.20 Achieved lighting levels signalised crossings

Lit Area Descriptor	Lighting Standard/s	Average Illuminance (Lux)	Minimum Illuminance (Lux)	Uniformity (U_o)
Granham's Road Crossing	C5	8.60	-	0.49
Granham's Road Approach	P4	5.56	1.15	-
Granham's Road Active Travel Path	P4	5.35	1.3	-
High Street Crossing	C5	7.53	-	0.53
High Street Approach	P4	5.75	1.57	-
High Street Active Travel Path	P4	5.51	1.11	-

11.3.71 All luminaires within this area are post-top mounted at 0° tilt on 6m columns. For luminaire schedule summary refer to Table A11.3.21

Table A11.3.21 Luminaire schedule signalised crossings

Luminaire	Lamp/ Optic	Shield	Output (klm)	Luminous Intensity	Colour Temperature	Quantity
Luma Micro BGP702	DM32	BL1	3.6	G4	3000K	6

Luminaire	Lamp/ Optic	Shield	Output (klm)	Luminous Intensity	Colour Temperature	Quantity
Luma Micro BGP702	DM33	-	3	G6	3000K	24
Luma Micro BGP702	DW10	BL1	5	G4	3000K	2

Bus stops

11.3.72 There are three bus stops (excluding Francis Crick Avenue which is much smaller and already lit); Great Shelford Stop located on Hinton Way, Stapleford Stop located on Haverhill Road and Sawston Stop located on Babraham/Sawston Road which are designed in accordance with BS5489-1:2020 to appropriate lighting levels for their intended use, see Table A11.3.22 for details.

Table A11.3.22 Achieved lighting levels bus stops

Lit Area Descriptor	Lighting Standard/s	Average Illuminance (Lux)	Minimum Illuminance (Lux)	Uniformity (U_o)
Hinton Way Crossing	C5	7.56	-	0.43
Hinton Way Approach	P4	7.28	1.60	-
Hinton Way Active Travel Path	P4	5.65	1.09	-
Great Shelford Stop	Light Traffic Car Park	5.97	-	0.28
Haverhill Road Crossing	C5	7.72	-	0.44
Haverhill Road Approach	P4	7.07	1.37	-
Haverhill Road Active Travel Path	P4	5.17	1.07	-
Stapleford Stop	Light Traffic Car Park	6.06	-	0.39
Sawston Road Crossing	C5	7.51	-	0.44
Sawston Road Approach	P4	5.78	1.12	-
Sawston Road Active Travel Path	P4	5.61	1.20	-
Sawston Stop	Light Traffic Car Park	7.26	-	0.27

11.3.73 All luminaires within this area are post-top mounted at 0° tilt on 6m columns. For luminaire schedule summary refer to Table A11.3.23

Table A11.3.23 Luminaire schedule bus stops

Luminaire	Lamp/Optic	Shield	Output (klm)	Luminous Intensity	Colour Temperature	Quantity
Luma Micro BGP702	DM32	BL1	2.4	G4	3000K	4
Luma Micro BGP702	DM32	BL2	2.2	G6	3000K	10
Luma Micro BGP702	DM33	BL1	3.0	G6	3000K	18
Luma Micro BGP702	DM33	-	3.0	G6	3000K	26
Luma Micro BGP702	DM33	BL1	2.0	G6	3000K	10
Lanterns SGS451	VX1 IT3	P1	6.80	G6	3000K	2

A11 Travel Hub, Access Road & A1307 Roundabout

11.3.74 The lighting within the A11 Travel Hub, access road & A1307 Roundabout are designed in accordance with BS5489-1:2020 to appropriate lighting levels for their intended use, see Table A11.3.24 and Table A11.3.25 for details.

Table A11.3.24 Achieved lighting levels A11 Travel Hub and A1307 Roundabout

Lit Area Descriptor	Lighting Standard/s	Average Illuminance (Lux)	Minimum Illuminance (Lux)	Uniformity (U_o)
A11 Travel Hub South Car Park	Heavy Traffic Car Park	20.5	-	0.26

Lit Area Descriptor	Lighting Standard/s	Average Illuminance (Lux)	Minimum Illuminance (Lux)	Uniformity (U_o)
A11 Travel Hub North Car Park	Heavy Traffic Car Park	21.96	-	0.28
A11 Travel Hub Internal Road	C2	25.43	-	0.4
A11 Travel Hub Footpath	Wayfinding	-	0.6	-
A11 Travel Hub Access Road	P	5.08	1.66	-
A1307 Roundabout	C3	15.25	-	0.41

Table A11.3.25 Achieved lighting levels (M Class)

Lit Area Descriptor	Lighting Standard/s	Average luminance (cd/m^2)	Overall Uniformity (U_o)	Longitudinal Uniformity (U_l)
A1307 Roundabout Eastern and Western Approach Roads	M4	0.75	0.53	0.69

11.3.75 All luminaires within this area are post-top mounted at 0° tilt on 8m columns except for the A1307 Roundabout luminaires which are mounted on 10m columns. For luminaire schedule summary refer to Table A11.3.26

Table A11.3.26 Luminaire schedule A11 Travel Hub, Access Road & A1307 roundabout

Luminaire	Lamp/ Optic	Shield	Output (klm)	Luminous Intensity	Colour Temperature	Quantity
Luma Micro BGP702	DW10	BL1	4.6	G4	3000K	9
Luma Mini BGP703	DW10	BL2	13	G4	3000K	9
Luma Medium BGP704	DM32	BL2	13	G4	3000K	19
Luma Medium BGP704	DM32	BL1	15	G4	3000K	17
Luma Medium BGP704	DM33	BL2	13	G6	3000K	25
Luma Medium BGP704	DS50	-	21.5	G6	3000K	72
BRT6 Bollard	T3	-	2	None*	2700K	12

* Illuminated bollards used in the Proposed Development do not meet any luminous intensity class but still does not produce any direct upward light (Imax90 = 0).

Zebra crossings

11.3.76 There are four zebra crossings within the Proposed Development, two are located on Francis Crick Avenue, see Table A11.3.27 for details, and two are located within the A11 Travel Hub, see Table A11.3. for details. All zebra crossings have been designed in accordance with ILP TR12-2007, the illuminance requirements of which are detailed in Table A11.16. ILP TR12-2007 also recommends a change in colour temperature as an effective method of drawing motorists' attention to the potential hazard of the crossing ahead; as such luminaires used for the lighting of zebra crossings have been specified with a change in colour temperature to contrast with the surrounding lighting in the vicinity of the proposed zebra crossings.

Table A11.3.27 Achieved lighting levels Francis Crick Avenue zebra crossings

Lit Area Descriptor	Maintained Average Horizontal Road Illuminance (Lux)	Calculation Grid Location	Average Illuminance (Lux)	Uniformity (Uo)
Francis Crick Avenue Northern Crossing 1	14.99	Carpet	83.69	0.80
		Rear of Waiting Area (West)	35.41	0.76
		Kerb Edge (West)	34.41	0.66
		Centre of Crossing	37.06	0.65
		Kerb Edge (East)	31.21	0.70

Lit Area Descriptor	Maintained Average Horizontal Road Illuminance (Lux)	Calculation Grid Location	Average Illuminance (Lux)	Uniformity (Uo)
		Rear of Waiting Area (East)	29.26	0.69
Francis Crick Avenue Northern Crossing 2	14.99	Carpet	79.67	0.88
		Rear of Waiting Area (West)	37.38	0.77
		Kerb Edge (West)	36.16	0.63
		Centre of Crossing	38.06	0.60
		Kerb Edge (East)	39.20	0.70
		Rear of Waiting Area (East)	36.07	0.81

11.3.77 All zebra crossing luminaires located on Francis Crick Avenue are to be mounted post-top at 0° tilt on 5m belisha beacon columns. For luminaire schedule summary refer to Table A11.3.28.

Table A11.3.28 Luminaire schedule Francis Crick Avenue zebra crossings

Luminaire	Lamp/ Optic	Shield	Output (klm)	Luminous Intensity	Colour Temperature	Quantity
Luma Micro BGP702	DPL1	-	4	G6	3000K	8

Table A11.3.29 Achieved lighting levels A11 Travel Hub zebra crossings

Lit Area Descriptor	Maintained Average Horizontal Road Illuminance (Lux)	Calculation Grid Location	Average Illuminance (Lux)	Uniformity (Uo)
A11 Travel Hub Northern Crossing	26.31	Carpet	150.13	0.87
		Rear of Waiting Area (South)	89.26	-
		Kerb Edge (South)	104.63	-
		Centre of Crossing	59.44	-
		Kerb Edge (North)	52.98	-
		Rear of Waiting Area (North)	54.12	-
A11 Travel Hub Southern Crossing	18.93	Carpet	134.51	0.87
		Rear of Waiting Area (West)	47.98	-
		Kerb Edge (West)	53.72	-
		Centre of Crossing	47.92	-
		Kerb Edge (East)	39.76	-
		Rear of Waiting Area (East)	41.98	-

11.3.78 All zebra crossing luminaires located within the A11 Travel Hub are to be mounted post-top at 0° tilt on 6m belisha beacon columns. For luminaire schedule summary refer to Table A11.3.30

Table A11.3.30 Luminaire schedule A11 Travel Hub zebra crossings

Luminaire	Lamp/ Optic	Shield	Output (klm)	Luminous Intensity	Colour Temperature	Quantity
Luma Mini BGP703	DPL1	-	9.5	G6	4000K	4

Predicted impacts – obtrusive light assessment

Maintenance factor for obtrusive light calculations

11.3.79 To ensure that Obtrusive Light calculations cover the worst-case scenario the maintenance factor has been set at 1.0, as recommended by ILP guidance notes.

Construction phase obtrusive light assessment

11.3.80 Temporary site lighting will either be provided for the purposes of health and safety or site security. The main causes for concern for the lighting used during construction will be spill light and glare (luminous intensity).

11.3.81 Lighting for health and safety will be needed where work is required to take place during the hours of diminishing ambient lighting levels which is likely to occur due to the construction works being carried out during the winter months, in accordance with the proposed programme, or if night working is carried out. This form of lighting should become non-operational outside of the operational working hours of the construction site. The effects caused by this type of lighting are predicted to be None/negligible due to the unlikelihood that this lighting will be operational for a lengthy period during the hours of darkness, and the majority of properties in the vicinity of the Proposed Development are located in areas of existing highway lighting or are separated from the proposed compound locations.

11.3.82 Security lighting will be operational during the night with the location, levels of light and hours of operation being dependent on the individual security concerns of the construction site. Security lighting is normally concentrated towards the perimeter and entrances to the construction site. It is not considered that significant lighting for security will be required as the minimum operational value of illumination at the fenced perimeter of each site is 3 Lux at 100mm above the ground level. This is to support the CCTV system, patrolling guarding and response; therefore, security lighting is predicted to have None/negligible effects.

Operational phase obtrusive light assessment – sky glow - upward light ratio (ULR)

11.3.83 Upward Light Ratio or ULR is the maximum permitted percentage of the luminaires flux that goes directly into the sky, the general term for ULR over a large area such as a city or town is referred to as Sky Glow. Please note that Upward Light Ratio is not subject to differing limits dependant on time and hence there are no pre and post curfew results, as they are not required.

Operational phase obtrusive light assessment - glow calculation

11.3.84 The following calculation is used to calculate sky glow.

$$ULR = \frac{Ev_{(MaximumUpwardSpill)}}{Ev_{(AverageIlluminance)}}$$

11.3.85 Photometric data and lighting model analysis, detailed in Annex F show a total ULR of 0% therefore the level of effect has been classified as None/Negligible effect, refer to Table A11.3.31 for further details.

Table A11.3.31 Calculation summary

Label	Calculation Type	Units	Results
ULR Achieved	Ratio	%	0%
Maximum Limit (E2 Zone)	Ratio	%	2.5%
Maximum Limit (E3 Zone)	Ratio	%	5%

Operational phase obtrusive light assessment - light intrusion

11.3.86 The quantitative assessment checks the level of spill light experienced at the identified receptor locations and onto windows of residential properties that are representative of the identified receptor locations. The spilling of light beyond the boundary of the area being lit onto adjacent areas may affect sensitive receptors, particularly residential properties. Spill light is calculated at ground level, in the north, east, south and west directions at a height of 1.5 m and has been undertaken both pre and post curfew.

Operational phase obtrusive light assessment - luminous intensity

11.3.87 The quantitative assessment checks the level of luminous intensity experienced at the identified receptor locations. Luminous intensity is a direct calculation, measured in Candelas, from an observer location at a given height looking at the luminaire. It is standard practice for the observer height to be 1.5 m above ground level and which has been used. Luminous intensity is calculated in the north, east, south, and west directions and has been undertaken both pre and post curfew.

Operational phase obtrusive light assessment - light Intrusion and luminous Intensity – Assessment

11.3.88

11.3.89 Table A11.3. lists the baseline survey light readings, modelled light intrusion, luminous intensity calculations, the qualitative assessment, and summary of overall predicted impacts for the 19 identified lighting survey receptor locations. This element of the assessment considers that the embedded mitigation has been implemented. For further information relating to the location of the identified lighting survey receptors refer to the Lighting Receptor and Environmental Zone Plan in Annex A.

11.3.90 Please refer to Table A11.36 for the qualitative assessment for all additional receptor locations identified by Landscape and Visual Assessment.

Operational phase obtrusive light assessment - light intrusion and luminous intensity – baseline and calculated lighting levels

11.3.91 Table A11.35 provides the baseline survey light readings, modelled light intrusion and luminous intensity calculation results for the 12 receptors identified by biodiversity and landscape visual.

Operational phase obtrusive light assessment - threshold increment (TI)

11.3.92 In traffic route and residential lighting (M and P Class) TI is used as a measure of discomfort or disability glare. For conflict areas (C Class) TI cannot always be calculated and in these situations, luminous intensity classes should be used to limit TI.

11.3.93 For the P Class areas in the Proposed Development, Reality Roadway straight-line calculations have been created to confirm that the maximum and minimum column spacings do not exceed the maximum permissible TI specified in BS EN 13201-2:2015.

11.3.94 As TI calculations cannot be created for the C Class and Car Park areas in the Proposed Development detailed in the tables above, the luminaires used in these areas have been limited to a luminous intensity class of G4 or greater. This will reduce the potential for discomfort or disability glare.

11.3.95 All luminaires have been specified as G4 or greater and all TI calculations are within the required limits therefore the level of effect has been classified as None/negligible.

Operational phase obtrusive light assessment - veiling iuminance (L_v)

11.3.96 In traffic route lighting (M Class) L_v is used to describe the contrast-reducing effect of a glare source in the field of view.

11.3.97 For the M Class areas in the Proposed Development, Reality Roadway straight-line calculations have been created to confirm that the maximum spacings do not exceed the maximum permissible Lv specified in Table A11.3.7.

11.3.98 All veiling luminance calculations are within the required limits therefore the level of effect has been classified as None/negligible

11.3.99 Table A11.3.32 provides the baseline survey light r eadings, modelled light intrusion, luminous intensity calculations, the qualitative assessment and summary of overall predicted impacts for the 19 identified lighting survey receptor locations. Refer to Annex F for full calculation results.

Table A11.3.32 Lighting Receptors Light Intrusion and Luminous Intensity Assessment – Combined Quantitative and Qualitative

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
LR01	19.2	North	2.59	Pre-Curfew 10.5	North	6.7	1343	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	5.4	1209	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		East	7.87		South	11.2[*1]	1715	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	6.3	1788	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		South	25.97	Post-Curfew 6.3	North	4.0[*1]	806	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	3.2[*1]	725	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		West	7.21		South	6.7[*1]	1029[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	3.8[*1]	1073[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
LR02	8.45	North	4.7	Pre-Curfew 8.1	North	3.8	2224	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	9.3	1289	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		East	2.03		South	5.5	2059	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	1.4	111	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		South	6.49	Post-Curfew 4.8	North	2.3[*1]	1334[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	5.6*1	774	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		West	9.28		South	3.3[*1]	1235[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	0.8	67	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
LR03	0.46	North	1.29	21.8	North	7.8	3074	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
				Pre-Curfew	East	12.9[*1]	3471	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		East	0.48		South	8	2740	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	5.4	1699	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		South	0.7	Post-Curfew 13.1	North	4.7[*1]	1844[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	7.7[*1]	2083[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		West	2.2		South	4.8[*1]	1644[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	3.2[*1]	1019[*2]	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
LR04	0.03	North	0.01	Pre-Curfew 0	North	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		East	0.02		South	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		South	0.02	Post-Curfew 0	North	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		West	0		South	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
LR05	0.03	North	0.02	Pre-Curfew 0	North	0	2	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		East	0.13		South	0	2	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		South	0.23	Post-Curfew 0	North	0	1	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
		West	0.02		South	0	1	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
LR06	2.41	North	1.1	Pre-Curfew 0	North	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		East	4.82		South	0	13	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	0	13	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		South	0.19	Post-Curfew 0	North	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					East	0	0	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
		West	0.15		South	0	8	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
					West	0	8	None/ Negligible	None/ Negligible	None/ Negligible	None/ Negligible
LR07	2.11	North	0.76	Pre-Curfew 7.3	North	11.9[*3]	1720	Major/Adverse	None/Negligible	None/Negligible	Major/Adverse
					East	1.5	105	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0.14		South	1.4	121	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	10.7[*3]	1730	Major/Adverse	None/Negligible	None/Negligible	Major/Adverse
		South	0.72	Post-Curfew 4.4	North	7.1[*3]	1032[*4]	Major/Adverse	Major/Adverse	None/Negligible	Major/Adverse
					East	0.9	63	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	1.88		South	0.9	73	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	6.4[*3]	1038[*4]	Major/Adverse	Major/Adverse	None/Negligible	Major/Adverse
LR07a	0.17	North	0.02	Pre-Curfew 0	North	0	528	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	525	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0.09		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0.07	Post-Curfew 0	North	0	317	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	315	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.02		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR08	0.68	North	0.02	Pre-Curfew 0.6	North	0.3	260	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	1.6	314	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0.04		South	1.8	277	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0.4	107	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0.92	Post-Curfew 0.4	North	0.2	156	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0.9	188	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.98		South	1.1[*5]	166	Minor/Adverse	None/Negligible	None/Negligible	Minor/Adverse
					West	0.2	64	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR09	0.47	North	0.36	Pre-Curfew 0	North	0.1	303	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	6	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0.02		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	301	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0.02	Post-Curfew 0	North	0.1	182	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	4	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.21		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	180	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
LR10	9.15	North	2	Pre-Curfew 0	North	0	2	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	2	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	2.5		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	8	Post-Curfew 0	North	0	1	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	1	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.85		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR10a	0	North	0	Pre-Curfew 0	North	0	5	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0.2	54	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0		South	0.1	55	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0	Post-Curfew 0	North	0	3	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0.1	33	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0		South	0.1	33	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR10b	0.02	North	0.02	Pre-Curfew 0	North	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0.02		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0.04	0	North	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
				Post-Curfew	East	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.09		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR12	0	North	0	Pre-Curfew 0	North	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0	Post-Curfew 0	North	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0		South	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR13	0.12	North	0.36	Pre-Curfew 0	North	0	3	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	9	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0.08		South	0	9	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0.04	Post-Curfew 0	North	0	3	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	5	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.11		South	0	5	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR14	0.09	North	0.02	Pre-Curfew 0	North	0	6	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	7	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
		East	0.11		South	0	7	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0.04	Post-Curfew 0	North	0	5	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	5	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.03		South	0	4	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR15	0.1	North	0.03	Pre-Curfew 0	North	0	5	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	14	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0.07		South	0	10	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0.03	Post-Curfew 0	North	0	4	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	11	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0		South	0	6	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
LR16	0.01	North	0.01	Pre-Curfew 4.8	North	6.7[*6]	743	Moderate/Adverse	None/Negligible	None/Negligible	None/Negligible
					East	0.6	195	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0		South	1	111	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	10.3[*6]	899	Major/Adverse	None/Negligible	None/Negligible	None/Negligible
		South	0	Post-Curfew 2.9	North	4.0[*6]	446	Major/Adverse	None/Negligible	None/Negligible	None/Negligible
					East	0.4	117	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0.01		South	0.6	67	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				Quantitative Assessment		Qualitative Assessment	Summary of Overall Predicted Impact
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum			Luminous Intensity Candelas – Maximum	Light Intrusion Lux – Maximum	Luminous Intensity Candelas - Maximum	Light Intrusion & Luminous Intensity	
				Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)					
					West	6.2[*6]	539[*7]	Major/Adverse	Minor/Adverse	None/Negligible	None/Negligible
LR17	0	North	0	Pre-Curfew 0	North	0.1	7	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		East	0		South	0	7	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0.1	7	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		South	0	Post-Curfew 0	North	0	4	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					East	0	0	None/Negligible	None/Negligible	None/Negligible	None/Negligible
		West	0		South	0	4	None/Negligible	None/Negligible	None/Negligible	None/Negligible
					West	0	4	None/Negligible	None/Negligible	None/Negligible	None/Negligible

*1 – Lighting exceeds limits for light intrusion due to the receptor being located within an area to be lit. The limits shown apply to nearby or potential dwellings/premises. Back shields have been proposed for the luminaires in these locations to limit spill light beyond the lit area boundary in the vicinity of this receptor. Refer to Table 6.3 for further spill light calculation limits achieved at the assumed building frontages after back shields have been applied to luminaires. These calculations predict that the spill light is within guidance levels both pre and post curfew therefore the effect is classified as None/Negligible.

*2 –Lighting exceeds limits for luminous intensity. Additional luminous intensity calculations were undertaken to demonstrate that the results do not exceed the limits. TI calculations have been undertaken where possible to demonstrate that the required standards to limit discomfort or disability glare have been met. Where TI cannot be calculated, the luminous intensity class for all luminaires have been specified as G4 or greater. Refer to Table A11.3.32 for luminous intensity calculation limits achieved at the assumed building frontages. These calculations predict that the luminous intensity is within guidance levels both pre and post curfew therefore the effect is classified as None/Negligible.

*3 – Lighting exceeds limits for light intrusion due to the receptor being located within an area to be lit, additional calculations undertaken to demonstrate results at the approximate window locations of 154 Hinton Way; refer to Table A11.3.33 noting that spill light from the Proposed Development lighting is shown without brackets and spill light from both the existing lighting and Proposed Development lighting are shown in brackets.

*4 – Lighting exceeds limits for luminous intensity, additional luminous intensity calculations were undertaken to demonstrate that the results on the house frontage do not exceed the limits. Refer to Table A11.3.34 noting that spill light from the Proposed Development lighting is shown without brackets and spill light from both the existing lighting and Proposed Development lighting are shown in brackets.

*5 –Lighting exceeds limits for light intrusion in the south direction, refer to Table A11.3.34 for further illuminance calculation results at the approximate window locations for 11, 13 and 15 Haverhill Road.

*6 – Lighting exceeds limits for light intrusion due to the close proximity to a pedestrian crossing. There are no dwellings/premises in this location the calculated values are therefore deemed acceptable given that the lighting is also required to provide sufficient light levels for pedestrian safety in this area.

*7 – Lighting exceeds limits for luminous intensity due to the close proximity to a pedestrian crossing. This location has been assumed to provide only momentary or short-term views of the luminaires, therefore an increase in intensity over the required limits is deemed acceptable given that the lighting also serves to provide sufficient light levels for pedestrian safety in this area.

Table A11.3.33 Francis Crick Avenue assumed building frontages calculation results

Survey Viewpoint	Property Location	Light Intrusion Lux – Maximum		Luminous Intensity Candelas – Maximum	
		Pre-Curfew	Post-Curfew	Pre-Curfew	Post-Curfew
LR01	Archigen Biotech	1.0	0.6	1291	774
LR02	Anne McLaren Building	1.2	0.7	108	65
	Biomedical Campus	1.6	1.0	71	42
LR03	Biotechnology Centre	0.4	0.2	40	24

Table A11.3.34 154 Hinton Way house frontage luminous intensity calculation results

Survey Viewpoint	Property Location	Luminous Intensity Candelas – Maximum	
		Pre-Curfew	Post-Curfew
LR07	154 Hinton Way	53 (5156)	32 (3093)

11.3.100 Table A11.3.35 provides the calculated results for spill light levels experienced at the assumed window locations in proximity to the identified receptors. Where existing lighting infrastructure is present in close proximity to a window and the results from the Proposed Development is not zero lux, the spill light from the Proposed Development lighting are shown without brackets and the combined results of spill light from both the existing lighting and the Proposed Development lighting are shown in brackets.

Table A11.3.35 Light intrusion results – receptor window locations

Survey Viewpoint	Property Location	Window Location			Calculated Light Level Intrusion (Lux) Pre-Curfew	Calculated Light Level Intrusion (Lux) Post-Curfew
		Aspect	Floor	Location		
LR06	173/175 Hinton Way	Front	Basement	Left	0.0	0.0
				Middle	0.0	0.0
			Ground	Left	0.0	0.0
				Right	0.0	0.0
			First	Left	0.0	0.0
				Middle	0.0	0.0
				Right	0.0	0.0
		Side	Basement	Left	0.0	0.0
			Ground	Left	0.0	0.0
				Right	0.0	0.0
			First	Left	0.0	0.0
				Right	0.0	0.0
LR07	154 Hinton Way	Front	Ground	Far Left	0.2 (1.0)	0.1 (0.6)
				Left	0.1 (2.3)	0.1 (1.4)
				Middle Left	0.2 (2.2)	0.1 (1.3)
				Middle Middle	0.1 (24.5)	0.1 (14.7)
				Middle Right	0.0 (1.5)	0.0 (0.9)
				Far Right	0.0 (3.7)	0.0 (2.2)
			First	Far Left	0.3 (1.1)	0.2 (0.6)
				Left	0.2 (1.4)	0.1 (0.9)
				Middle	0.1 (1.5)	0.1 (0.9)
				Right	0.1 (1.5)	0.1 (0.9)
			First	Left	0.0	0.0
				Middle	0.0	0.0
				Right	0.0	0.0
		Side	First	Left	0.0	0.0
LR06	186 Hinton Way	Side	Ground	Left	0.0	0.0
				Right	0.0	0.0
			First	Left	0.0	0.0
				Right	0.0	0.0
LR07	154 Hinton Way	Side	First	Left	0.4 (0.4)	0.2 (0.2)
				Right	0.4 (0.4)	0.3 (0.3)
		Front	Ground	Far Left	0.2 (1.0)	0.1 (0.6)
				Left	0.1 (2.3)	0.1 (1.4)
				Middle Left	0.2 (2.2)	0.1 (1.3)
				Middle Middle	0.1 (24.5)	0.1 (14.7)
				Middle Right	0.0 (1.5)	0.0 (0.9)
				Far Right	0.0 (3.7)	0.0 (2.2)
			First	Far Left	0.3 (1.1)	0.2 (0.6)
				Left	0.2 (1.4)	0.1 (0.9)
				Middle	0.1 (1.5)	0.1 (0.9)
				Right	0.1 (1.5)	0.1 (0.9)

Survey Viewpoint	Property Location	Window Location			Calculated Light Level Intrusion (Lux)	Calculated Light Level Intrusion (Lux)
		Aspect	Floor	Location	Pre-Curfew	Post-Curfew
				Far Right	0.1 (1.5)	0.1 (0.9)
LR08	15 Haverhill Road	Front	Ground	Left	0.2 (3.9)	0.1 (2.3)
				Middle	0.3 (3.4)	0.2 (2.0)
				Right	0.3 (1.4)	0.2 (0.8)
LR08	13 Haverhill Road	Front	Ground	Left	0.2 (3.7)	0.1 (2.2)
				Right	0.2 (5.2)	0.1 (3.1)
LR08	11 Haverhill Road	Front	Ground	Left	0.1 (1.8)	0.1 (1.1)
				Right	0.1 (2.6)	0.1 (1.5)
LR09	88 Haverhill Road	Side	Ground	Left	0.0	0.0
				Middle	0.0	0.0
				Right	0.0	0.0
			First	Middle	0.0	0.0
		Front	First	Left	0.0	0.0
				Middle	0.0	0.0
				Right	0.0	0.0
LR10a	The Hawthorns, Babraham	Rear	Ground	Right	0.0	0.0
			First	Left	0.0	0.0
	Road. Newly constructed house (Plot number 4)			Right	0.0	0.0
LR10a	The Hawthorns, Babraham Road. Newly constructed house (Plot number 3)	Rear	Ground	Left	0.0	0.0
			First	Left	0.0	0.0
				Right	0.0	0.0
LR10a	The Hawthorns, Babraham Road. Newly constructed house (Plot number 2)	Rear	Ground	(single window)	0.0	0.0
			First	(single window)	0.1	0.0
LR10a	The Hawthorns, Babraham Road. Newly constructed house (Plot number 1)	Rear	Ground	(single window)	0.1	0.1
			First	(single window)	0.2	0.1

11.3.101 Table A11.3.36 provides the baseline survey light readings, modelled light intrusion and luminous intensity calculation results for the 12 receptors identified by biodiversity and landscape visual. Refer to Annex F for full calculation results.

Table A11.3.36 Biodiversity & LVIA lighting receptors light intrusion and luminous intensity

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum				Luminous Intensity Candelas – Maximum
				Ground Level (Lux)		Direction of Sensor	1.5m Above Ground Level (Lux)	
B01	0.02	North	0.02	Pre-Curfew	22.1	North	14.9	794
						East	5.2	941
		East	0.01			South	4.3	39
						West	3.1	40
		South	0.01	Post-Curfew	13.2	North	8.9	477
						East	3.1	565
		West	0.02			South	2.6	23
						West	1.8	24
B02	0.03	North	0.04	Pre-Curfew	1.7	North	3.8	405
						East	0.5	176
		East	0.02			South	0.6	717
						West	4.2	865
		South	0.02	Post-Curfew	1.0	North	2.3	243
						East	0.3	105
		West	0.00			South	0.3	430
						West	2.5	519
B03	0.17	North	0.02	Pre-Curfew	0.0	North	0.0	0
						East	0.0	0
		East	0.09			South	0.0	1
						West	0.0	0
		South	0.10	Post-Curfew	0.0	North	0.0	0

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum				Luminous Intensity Candelas – Maximum
				Ground Level (Lux)		Direction of Sensor	1.5m Above Ground Level (Lux)	
						East	0.0	0
		West	0.02			South	0.0	0
						West	0.0	0
B08	0.00	North	0.01	Pre-Curfew	0	North	0.0	35
						East	0.1	31
		East	0.00			South	0.0	2
						West	0.0	2
		South	0.02	Post-Curfew	0	North	0.0	3
						East	0.0	1
		West	0.02			South	0.0	2
						West	0.0	3
B09	0.00	North	0.02	Pre-Curfew	0	North	0.0	36
						East	0.3	31
		East	0.00			South	1.1	2
						West	0.2	2
		South	0.01	Post-Curfew	0	North	0	22
						East	0	18
		West	0.02			South	0	1
						West	0	1
B10	0.00	North	0.00	Pre-Curfew	5.2	North	2.9	182
						East	2.0	91
		East	0.00			South	11.0	1461

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum				Luminous Intensity Candelas – Maximum
				Ground Level (Lux)		Direction of Sensor	1.5m Above Ground Level (Lux)	
						West	1.8	1500
		South	0.00	Post-Curfew	3.1	North	1.7	109
						East	1.2	55
		West	0.02			South	6.6	876
						West	1.1	900
LA18	0.00	North	0.00	Pre-Curfew	0.0	North	0.0	0
						East	0.0	0
		East	0.00			South	0.0	0
						West	0.0	0
		South	0.01	Post-Curfew	0.0	North	0.0	0
						East	0.0	0
		West	0.01			South	0.0	0
						West	0.0	0
B11	0.00	North	0.00	Pre-Curfew	8.4	North	10.3	1835
						East	1.5	28
		East	0.00			South	1.8	69
						West	16.5	1892
		South	0.00	Post-Curfew	5.1	North	6.2	1101
						East	0.9	17
		West	0.00			South	1.1	41
						West	9.9	1135
B12	0.00	North	0.01	Pre-Curfew	0.0	North	0.1	216

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum				Luminous Intensity Candelas – Maximum
				Ground Level (Lux)		Direction of Sensor	1.5m Above Ground Level (Lux)	
						East	0.1	220
		East	0.00			South	0.0	0
						West	0.0	0
		South	0.00	Post-Curfew	0.0	North	0.1	130
						East	0.1	132
		West	0.00			South	0.0	0
						West	0.0	0
B13	0.00	North	0.00	Pre-Curfew	3.0	North	7.0	191
						East	6.6	536
		East	0.00			South	1.8	701
						West	25.9	694
		South	0.00	Post-Curfew	2.9	North	6.9	114
						East	6.5	321
		West	0.00			South	1.4	421
						West	25.7	417
B15	0.00	North	0.00	Pre-Curfew	0.0	North	0.0	24
						East	0.0	0
		East	0.00			South	0.2	70
						West	0.3	65
		South	0.00	Post-Curfew	0.0	North	0.0	19
						East	0.0	0
		West	0.00			South	0.1	42

Viewpoint Number	Baseline – Light Measurements			Calculated Light Levels				
	Ground Level (Lux)	Direction of Sensor	1.5m Above Ground Level (Lux)	Light Intrusion Lux - Maximum				Luminous Intensity Candelas – Maximum
				Ground Level (Lux)		Direction of Sensor	1.5m Above Ground Level (Lux)	
						West	0.2	39
B16	0.00	North	0.00	Pre-Curfew	22.1	North	7.3	4373
						East	19.5	4435
		East	0.00			South	7.3	2583
						West	4.5	493
		South	0.00	Post-Curfew	17.7	North	5.9	3499

11.3.102 Table A11.3.37 provides the qualitative assessment for all 25 additional receptor locations identified by landscape visual. The qualitative assessments are carried out based upon professional judgement and experience to predict the likely levels of light intrusion, luminous intensity, and sky glow at a receptor and whether the distance from the Proposed Development , viewing angle, and backdrop provide enough mitigation to prevent the obtrusive light limitations from being exceeded.

Table A11.3.37 Light intrusion, luminous intensity and sky glow assessment - qualitative

Viewpoint Number		Light Intrusion	Luminous Intensity	Sky Glow	Summary of Overall Predicted Impact
VP1	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP2	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP4	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP5	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP6	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Viewpoint Number		Light Intrusion	Luminous Intensity	Sky Glow	Summary of Overall Predicted Impact
VP7	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP8	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP9	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP10	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP11	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP12	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP14	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP15	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP17	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP18	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP19	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP20	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP21	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Viewpoint Number		Light Intrusion	Luminous Intensity	Sky Glow	Summary of Overall Predicted Impact
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP22	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP23	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP25	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP26	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP28	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP29	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP31	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP32	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
VP33	Pre-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible
	Post-Curfew	None/Negligible	None/Negligible	None/Negligible	None/Negligible

Mitigation

11.3.103 The design development process has applied the embedded mitigation measures as outlined in Table A11.3.38 where legally compliant, practicable and safe to do so, considering the operational requirements of the Proposed Development.

Table A11.3.38 Embedded mitigation measures

No.	Impact Description	Embedded Mitigation (included in design)	Permanent or Temporary	Phase (Construction: C Operation: O)
1	Obtrusive light (Risk of human response to lighting)	Increased levels of blue light exposure in the evening have been shown to cause melatonin suppression and subsequent phase delays in the melatonin cycle. To mitigate potential adverse effects on melatonin production lower colour temperature light sources (≤3000K) have been selected in rural and residential areas as they contain less blue light1.	Permanent	C/O
2	Obtrusive light (Impact on wildlife)	Selection of warmer white LED light sources in rural areas, ≤3000K. The warmer white colour temperature has a lower relative attractiveness to insects, resulting in a greater number of insects in dark areas, which in turn increases the availability of the main food source of multiple types of bats.2	Permanent	C/O
3	Obtrusive light (Impact on wildlife)	Where required lighting column mounted luminaires shall feature peak wavelengths higher than 550nm to avoid the component most disturbing to bats. (Source: GN08/18:2018)	Permanent	C/O
4	Obtrusive Light (Increased skyglow)	Selection of lower colour temperatures for light sources in rural areas, ≤3000K. Lower colour temperatures have less of an effect in terms of skyglow. (Source: International Dark-Sky Association). Luminaires used to light the zebra crossings have been specified with a change in colour temperature to contrast with the surrounding lighting, as recommended in ILP TR12-2007.	Permanent	C/O
5	Over lighting (increased energy use and potentially higher levels of obtrusive light)	Selection of appropriate lighting standard from relevant British and European standards to ensure lighting is appropriate to; the task being undertaken, the area being lit, and that areas are not over lit.	Permanent	O
6	Obtrusive light (Increased Skyglow, glare and luminous intensity)	Consideration of luminous intensity classes. Specification of a minimum luminous intensity class of G4, with suitable photometric distribution to ensure that there is zero direct upward light. A luminaire with a minimum of a G4 rating and zero direct upward light will contribute to reduce sky glow. It will also help to control spill light, luminous intensity and minimise disability glare.	Permanent	C/O
7	Obtrusive light (Reduction of backlight beyond the boundary of the area being lit)	Specification of luminaires with integral light shields included in photometry (such as the Luma Gen2) to significantly reduce the level of backlight beyond the area required to be lit. These luminaires will be utilised on boundaries where there is a requirement to restrict backlight.	Permanent	O

[1] Source: Human responses to lighting based on LED lighting Solutions, Public Health England CRCE-RDD 01-2016
[2] Source: Bats and Lighting, Overview of current evidence and mitigation. E Stone 2014

No.	Impact Description	Embedded Mitigation (included in design)	Permanent or Temporary	Phase (Construction: C Operation: O)
8	Over lighting (correct level of lighting on the highway in accordance with the time and level of usage)	When designing the highway lighting, specify the use of a Central Management System (CMS) and propose the use of suitable dimming profiles in line with CCC P class and M class dimming profiles. CCC P Class dimming profile (one stage) 100% Output 06:00 – 22:00 60% Output 22:00 – 06:00 CCC M Class dimming profile (two stage) 100% Output 06:00 – 22:00 80% Output 20:00 – 24:00 60% Output 24:00 – 06:00	Permanent	O
9	Over lighting (Correct level of lighting on the HQPT route for the time and usage)	To provide consistency when designing the HQPT route lighting, the use of dimming profiles in line with the CCC dimming profiles used on the highway has been agreed with the CCC Bus Operations & Facilities Management team. Agreed dimming profile (one stage): 100% Output 06:00 – 22:00 60% Output 22:00 – 06:00	Permanent	O
10	Obtrusive light	Consideration of luminaire position, tilt, orientation, and mounting heights of luminaires. Specifying the tilt angle of luminaires at 00 to ensure zero direct upward light. Distribution of the light source to be specified so that luminaires that are located on a boundary to distribute the majority of light in a forward throwing manor, reducing spill light beyond the boundaries of the areas being lit. Reduced mounting heights from 8m proposed within the lighting strategy to 6m for signalised crossings and reduced from 10m to 8m within the A11 Travel Hub.	Permanent	O
11	Obtrusive light	Ensuring sensitive receptors and areas are considered during the lighting design process with a view to minimising obtrusive light.	Permanent	C/O
12	Energy efficiency	Specifying in accordance with BREEAM credit Ene 03 External lighting3, which states that external light fittings used for car parking, associated roads and floodlighting should achieve luminous efficacy not less than 70 lumens per watt. External lighting installations included within the Proposed Development designs should aspire to achieve efficacy figures of 100 lumens per watt.	Permanent	C/O
13	Excessive energy use.	Specifying the use of solar powered in ground studs on unlit areas of the active travel route as this is a low energy solution that uses renewable solar energy to charge the in ground illuminated markers.	Permanent	O
14	Excessive lighting (extent of lighting on the HQPT route)[4]	The speed limit on HQPT approaches to each signalised crossing has been specified as 20mph. This allows the amount of lighting required on each approach to be reduced because the required distances to be lit are calculated based on speed. The ‘5 second rule’ specified in ILP PLG02:2013 has been used to calculate all approach distances.	Permanent	O

[3] BREEAM 6.0 Energy – Ene 03 External Lighting

No.	Impact Description	Embedded Mitigation (included in design)	Permanent or Temporary	Phase (Construction: C Operation: O)
15	Obtrusive light	Provision of obtrusive light calculations in line with ILP GN01:2021. The limitations for obtrusive light provided within Section **Error! Reference source not found.** of the ELIA should be adhered to during the c onstruction and operational phase where legally compliant, practicable and safe to do so.	Permanent	C/O
16	Obtrusive Light	To limit the spill light on receptor reference B13 located on footpath 12/4 from Babraham village to A11 footbridge (Easting and Northing: 551869 and 249791). Illuminated bollards were utilised to provide wayfinding lighting for the nearby footpath. By using illuminated bollards instead of lighting columns for this area the maximum height of the vertical illuminance was reduced to 1m from the ground. The bollards have a colour temperature of 2700K and zero direct upward light ratio to mitigate potential effects.	Permanent	O
17	Inefficient use of energy and potential increase of obtrusive light	Lighting levels should be selected from relevant British / European standards to ensure lighting is appropriate to the work that is being undertaken and that areas are not over lit. Refer to BS EN 12464-2 2014	Temporary	C

11.3.104 Additional mitigation methods have been developed and specified to assist with mitigation of any residual effects that have not been mitigated to a negligible level by the embedded mitigation measures. These should be applied where legally compliant, practicable and safe to do so, taking into account the operational requirements of the Proposed Development and are as outlined in Table A11.3.39.

Table A11.3.39 Additional mitigation measures

No.	Impact Description	Additional Mitigation	Permanent or Temporary	Phase (Construction: C Operation: O)
1	Obtrusive light	Asset manager to carry out periodic inspection and maintenance regime in line with the recommendations of BS 5489-1:2020, to include as a minimum: light source replacement, luminaire cleaning, renewal of failed parts, checking of gaskets, optical components and screens or baffles, checking of alignment and monitoring of operation.	Permanent	O
2	Obtrusive light	Consideration of alternatives lighting for security purposes. Where security lighting is considered as a form of deterrent for vandalism and theft, the appointed contractor will consider alternative forms of security to limit the burden on visual spectrum lighting for example, the use of infrared spectrum security lighting.	Temporary	C
3	Obtrusive light	Temporary floodlighting should be mounted at a tilt of 0° and utilise a double asymmetrical photometric configuration. The ILP advises in GN01:2021 that a maximum main beam angle of 70° should be utilised to minimise the effects of glare along with spill and upward light.	Temporary	C
4	Obtrusive Light	Consideration of placements for temporary lighting, temporary lighting will be located and directed away from residential properties and other areas of sensitivity.	Temporary	C
5	Obtrusive Light	The use of solid site hoarding to contain and limit spill light and improve security, should be considered by the appointed Contractor.	Temporary	C
6	Obtrusive Light	If any changes are implemented during design development or as a consequence of value engineering that have potential to increase the levels of obtrusive light, it is recommended that the lighting assessment is re-performed.	Permanent	O

No.	Impact Description	Additional Mitigation	Permanent or Temporary	Phase (Construction: C Operation: O)
7	Obtrusive Light	Re-alignment of footpath route in vicinity of receptor reference B13 located on footpath 12/4 from Babraham village to A11 footbridge (Easting and Northing: 551869 and 249791) to allow British Standard lighting to be installed whilst ensuring receptor has minimal obtrusive light.	Permanent	O
8	Obtrusive Light	Back light shield fitted to existing column outside 11/13/15 Haverhill Road (column ref. L11VQF)	Permanent	O
9	Obtrusive Light	Back light shield fitted to existing column outside 154 Hinton Way (column ref. L25VHR)	Permanent	O
10	Obtrusive light	Monitor the effectiveness of lighting mitigation measures for the Proposed Development. Monitoring will consist of surveys that will involve the measurement of lighting levels following the baseline assessment methodology with measurements compared against the ELIA. Improvements will be carried out where necessary, legally compliant, practicable and safe to do so.	Temporary	C/O
11	Obtrusive light	Consider switching off lighting after the operational hours of the Proposed Development in areas were lighting is not required for security and safety where legally compliant, practicable and safe to do so.	Permanent	O
12	Obtrusive Light – excessive upward reflected light	The use of high reflectance materials should be avoided directly under light sources to limit upward reflected light contributions to skyglow.	Permanent	C/O
13	Obtrusive Light (Increased skyglow)	Specifying the use of solar powered in ground studs on unlit areas of the active travel route. Consider the use of warm white (≤3000K) solar powered ground stud for use on the active travel route, as lower colour temperatures have less of an effect in terms of skyglow.	Permanent	O

Residual effects

11.3.105 There are two lighting receptors with residual obtrusive light effects, LR07 and LR08.

11.3.106 LR07 has a Major/Adverse impact of light intrusion and luminous intensity, it is recommended that additional mitigation method 9 from Table A11.3.38 is applied to this location to reduce the obtrusive light.

11.3.107 LR08 has a Minor/Adverse impact of light intrusion, it is recommended that additional mitigation method 8 from Table A11.3.39 is applied to this location to reduce the obtrusive light.

11.3.108 The predicted results from these additional mitigation methods are shown below in Table A11.3.40. All receptors within the Proposed Development have an overall predicted impact for light intrusion and luminous intensity of None/Negligible.

Table A11.3.40 Additional mitigation measures

Viewpoint Number	Summary of Overall Predicted Impact	Additional Mitigation Applied	Summary of Overall Predicted Impact (With Additional Mitigation Applied)
LR07	Major/Adverse	9 – Backlight shield fitted to existing column L25VHR.	None/Negligible
LR08	Minor/Adverse	8 – Backlight shield fitted to existing column L11VQF.	None/Negligible

ANNEX A LIGHTING RECEPTORS AND ENVIRONMENTAL ZONE PLAN

ANNEX B ILP GUIDANCE NOTES FOR THE REDUCTION OF OBTRUSIVE LIGHT (GN01:2021)

ANNEX C LIGHT METER CALIBRATION CERTIFICATE

ANNEX D BASELINE SURVEY PHOTOGRAPHY

Viewpoint Location LR01 – Francis Crick Avenue (Signalised Junction)

Viewpoint Location LR01 – Day - Direction South

Viewpoint Location LR01 – Night – Direction South

Viewpoint Location LR01 – Day - Direction West

Viewpoint Location LR01 – Night - Direction West

Viewpoint Location LR02 – Francis Crick Avenue (Middle)

Viewpoint Location LR02 – Day - Direction South

Viewpoint Location LR02 – Night - Direction South

Viewpoint Location LR03 – Francis Crick Avenue (Roundabout)

Viewpoint Location LR03 – Day - Direction North-East

Viewpoint Location LR03 – Night - Direction North-East

Viewpoint Location LR03 – Day - Direction South-East

Viewpoint Location LR03 – Day - Direction South-West

Viewpoint Location LR03 – Night - Direction South-East

Viewpoint Location LR03 – Night - Direction South-West

Viewpoint Location LR03 – Day - Direction North-West

Viewpoint Location LR03 – Night - Direction North-West

Viewpoint Location LR04 – White Hill House, Granham's Road, Great Shelford

Viewpoint Location LR04 – Day - Direction South-West

Viewpoint Location LR04 – Night - Direction South-West

Viewpoint Location LR05 – 50, Granham's Road, Great Shelford

Viewpoint Location LR05 – Day - Direction North

Viewpoint Location LR05 – Night - Direction North

Viewpoint Location LR05 – Day - Direction North-East

Viewpoint Location LR05 – Night - Direction North-East

Viewpoint Location B01 – Granham's Road, Great Shelford

Viewpoint Location B01 – Day - Direction South-West

Viewpoint Location B01 – Night - Direction South-West

Viewpoint Location B02 – Granham's Road, Great Shelford

Viewpoint Location B02 – Day - Direction North-East

Viewpoint Location B02 – Night - Direction North-East

Viewpoint Location LR06 – 173, Hinton Way, Great Shelford

Viewpoint Location LR06 – Day - Direction South-West

Viewpoint Location LR06 – Night - Direction South-West

Viewpoint Location LR06 – Day - Direction West South-West

Viewpoint Location LR06 – Night - Direction West South-West

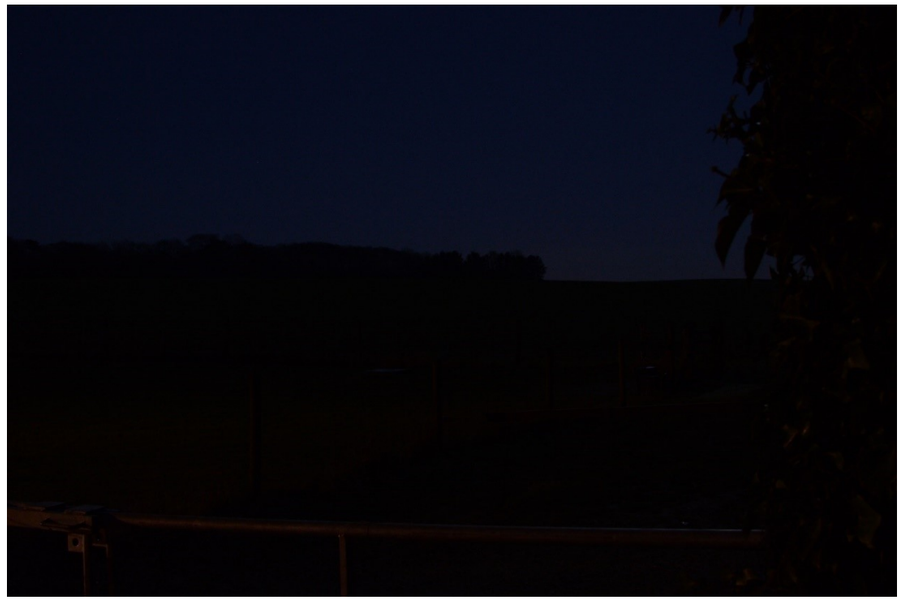
Viewpoint Location LR07 – 154, Hinton Way, Great Shelford

Viewpoint Location LR07 – Day - Direction North-East

Viewpoint Location LR07 – Night - Direction North-East

Viewpoint Location LR07 – Day - Direction East

Viewpoint Location LR07 – Night - Direction East



Viewpoint Location LR07a – Rear of 18, Coppice Way, Great Shelford

Viewpoint Location LR07a – Day - Direction East

Viewpoint Location LR07a – Night - Direction East

Viewpoint Location B03 – Hinton Way, Great Shelford

Viewpoint Location B03 – Day - Direction South-East

Viewpoint Location B03 – Night - Direction South-East

Viewpoint Location LR08 – 15, Haverhill Road, Stapleford

Viewpoint Location LR08 – Day - Direction North-East

Viewpoint Location LR08 – Night - Direction North-East

Viewpoint Location LR08 – Day - Direction East

Viewpoint Location LR08 – Night - Direction East

Viewpoint Location LR09 – 88, Haverhill Road, Stapleford

Viewpoint Location LR09 – Day - Direction North-East

Viewpoint Location LR09 – Night - Direction North-East

Viewpoint Location B08 – Haverhill Road, Stapleford

Viewpoint Location B08 – Day - Direction North

Viewpoint Location B08 – Night - Direction North

Viewpoint Location B08 – Day - Direction South South-West

Viewpoint Location B08 – Night - Direction South South-West

Viewpoint Location B09 – Haverhill Road, Stapleford

Viewpoint Location B09 – Day - Direction South-West

Viewpoint Location B09 – Night - Direction South-West

Viewpoint Location LR10 – Sutton House, Babraham Road, Sawston

Viewpoint Location LR10 – Day - Direction East

Viewpoint Location LR10 – Night - Direction East

Viewpoint Location LR10a – North of The Hawthorns, Babraham Road, Sawston

Viewpoint Location LR10a – Day - Direction North-East

Viewpoint Location LR10a – Night - Direction North-East

Viewpoint Location LR10a – Day - Direction East

Viewpoint Location LR10a – Night - Direction East

Viewpoint Location B10 – Babraham Road/Sawston Road, Sawston

Viewpoint Location B10 – Day - Direction East

Viewpoint Location B10 – Night - Direction East

Viewpoint Location LR10b – North Farm, West Way, Sawston

Viewpoint Location LR10b– Day - Direction South-East

Viewpoint Location LR10b – Night - Direction South-East

Viewpoint Location LA18 – Sawston Road, Babraham

Viewpoint Location LA18 – Day - Direction South-East

Viewpoint Location LA18 – Night - Direction South-East

Viewpoint Location LA18 – Day - Direction West North-West

Viewpoint Location LA18 – Night - Direction West North-West

Viewpoint Location LR12 – High Street, Babraham

Viewpoint Location LR12 – Day - Direction South South-West

Viewpoint Location LR12 – Night - Direction South South-West

Viewpoint Location B11 – High Street, Babraham

Viewpoint Location B11 – Day - Direction East

Viewpoint Location B11 – Night - Direction East

Viewpoint Location B11 – Day - Direction West North-West

Viewpoint Location B11 – Night - Direction West North-West

Viewpoint Location LR13 – Home Farm Agricultural Buildings, Babraham

Viewpoint Location LR13 – Day - Direction South-East

Viewpoint Location LR13 – Night - Direction South-East

Viewpoint Location LR14 – Field near Honeysuckle Lane, Babraham

Viewpoint Location LR14 – Day - Direction South-East

Viewpoint Location LR14 – Night - Direction South-East

Viewpoint Location LR15 – Field behind Oak Lane, Babraham

Viewpoint Location LR15 – Day - Direction South-East

Viewpoint Location LR15 – Night - Direction South-East

Viewpoint Location LR16 – Footpath 12/4 next to and west of footbridge over A11

Viewpoint Location LR16 – Day - Direction North

Viewpoint Location LR16 – Night - Direction North

Viewpoint Location LR16 – Day - Direction South-West

Viewpoint Location LR16 – Night - Direction South-West

Viewpoint Location LR16 – Day - Direction North-West

Viewpoint Location LR16 – Night - Direction North-West

Viewpoint Location B12 – Field adjacent to A11, Little Abington

Viewpoint Location B12 – Day - Direction North-East

Viewpoint Location B12 – Night - Direction North-East

Viewpoint Location B13 – Footpath 12/4 from Babraham village to A11 footbridge

Viewpoint Location B13 – Day - Direction North-East

Viewpoint Location B13 – Night - Direction North-East

Viewpoint Location B13 – Day - Direction South-West

Viewpoint Location B13 – Night - Direction South-West

Viewpoint Location B15 – Field adjacent to A1307/A11 and Four Went Ways roundabout, Little Ablington

Viewpoint Location B15 – Day - Direction South-West

Viewpoint Location B15 – Night - Direction South-West

Viewpoint Location B16 – Field adjacent to A1307/A11 and Four Went Ways roundabout, Little Ablington

Viewpoint Location B16 – Day - Direction South

Viewpoint Location B16 – Night - Direction South

Viewpoint Location LR17 – Newmarket Road, Little Abington

Viewpoint Location LR17 – Day - Direction South-West

Viewpoint Location LR17 – Night - Direction South-West

Viewpoint Location LR17 – Day - Direction North-West

Viewpoint Location LR17 – Night - Direction North-West

Viewpoint Location LR17 – Day - Direction North North-West

Viewpoint Location LR17 – Night - Direction North North-West

ANNEX E HORIZONTAL LIGHT SPILL CALCULATIONS

ANNEX F LIGHTING CALCULATIONS