LIGHTING IMPACT ASSESSMENT

PROJECT: LAND AT PETERSFIELD ROAD, GREATHAM, HAMPSHIRE

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1 Introduction

1.1 Outline

1.1.1 This report has been prepared by Designs for Lighting Ltd; a specialist exterior lighting consultancy with knowledge and experience in lighting impact assessments and mitigation. The purpose of this report is to assess the effects resulting from artificial lighting that will be required for safe and secure operation of the **Proposed Development**.

1.1.2 The aim of this lighting impact assessment is to analyse the existing **Application Site** and assess the potential effects associated with any proposed lighting required for the **Proposed Development**.

1.1.3 The **Application Site** is located in the centre of Greatham village with the residential street of Bakers Field to the north-east, Greatham Primary School to the south-west, and Greatham Village Hall to the west. The Greatham Conservation Area lies just over 100m to the south of the site, and there are listed buildings nearby, including Deal Farm opposite the site. To the east is open countryside, then the A3 trunk road and the town of Liphook is beyond.

1.1.4 The **Proposed Development** includes the development of 37 dwellings, alterations to existing access onto Petersfield Road, hard and soft landscaping, drainage and all other associated development works at the Land at Petersfield Road, Greatham. Further details relating to the development proposals are included within the Planning Statement accompanying the application.

1.1.5 This report assesses the current effects from obtrusive light associated with the existing lighting within the vicinity of the **Application Site**, and the potential effects of obtrusive light that could arise from the artificial lighting associated with the **Proposed Development**. The principal objective is to identify the impact associated with obtrusive light on various sensitive receptors, propose suitable mitigation and assess the significance of any residual effects from artificial lighting.

1.1.6 The lighting impact assessment considers the maximum adverse scenario in relation to the artificial lighting associated with the **Proposed Development** to adequately assess the significance of the potential effects on the identified sensitive receptors.

2 Legislative and Policy Framework

2.1 National Policy and Legislation

Environmental Protection Act 1990 / Clean Neighbourhoods and Environment Act 2005

2.1.1 Since 2005, artificial light was incorporated as a potential statutory nuisance. An amendment to section 79 of the Environmental Protection Act 1990, contained within the Clean Neighbourhoods and Environment Act 2005 states:

"Artificial light emitted from premises so as to be prejudicial to health and nuisance constitutes a 'Statutory Nuisance' and it shall be the duty of every local authority to cause its area to be inspected from time to time to detect any statutory nuisances which ought to be dealt with under section 80 and, where a complaint of a statutory nuisance is made to it by a person living within its area, to take such steps as are reasonably practicable to investigate the complaint".

2.2 National Planning Policy Framework 2019

2.2.1 The National Planning Policy Framework (NPPF) sets out the government's planning policies for England and how they are expected to be applied and provides a framework for local plans. With regard to light pollution, the NPPF was updated in November 2019 and states that the following elements are to be considered:

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

2.2.3 a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

2.2.4 b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

2.2.5 c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

2.3 Planning Practice Guidance

2.3.1 Guidance for assessing the effects of proposed artificial lighting is outlined in the planning practice guidance (PPG). The guidance states:

"Does a new development proposal, or a major change to an existing one, materially alter light levels outside the development and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?

Does an existing lighting installation make the proposed location for a development unsuitable? For example, this might be because:

- *the artificial light has a significant effect on the locality;*
- *users of the proposed development (e.g. a hospital) may be particularly sensitive to light intrusion from the existing light source.*

Does a proposal have a significant impact on a protected site or species e.g. located on, or adjacent to, a designated European site or where there are designated European protected species that may be affected?

Is the development in or near a protected area of dark sky or an intrinsically dark landscape where it may be desirable to minimise new light sources?

Are forms of artificial light with a potentially high impact on wildlife (e.g. white or ultraviolet light) being proposed close to sensitive wildlife receptors or areas, including where the light shines on water?

Does the proposed development include smooth, reflective building materials, including large horizontal expanses of glass, particularly near water bodies (because it may change natural light, creating polarised light pollution that can affect wildlife behaviour)?"

2.4 Local Policy

2.4.1 The most relevant local authority policy that should be considered in relation to the **Proposed Development** is the South Downs Local Plan (2014- 2033)- **Policy SD8: Dark Night Skies:**

2.4.2 Strategic Policy **SD8:** *Dark Night Skies* applies to any proposal which involves the installation of external lighting, and where the design of developments may result in light spill from internal lighting, which could adversely affect the Dark Night Sky.

Policy **SD8** states the following:

(1) *Development proposals will be permitted where they conserve and enhance the intrinsic quality of dark night skies and the integrity of the Dark Sky Core as shown on the Policies Map.*

(2) *Development proposals must demonstrate that all opportunities to reduce light pollution have been taken, and must ensure that the measured and observed sky quality in the surrounding area is not negatively affected, having due regard to the following hierarchy:*

(a) *The installation of lighting is avoided;*

(b) *If lighting cannot be avoided, it is demonstrated to be necessary and appropriate, for its intended purpose or use:*

(i) any adverse impacts are avoided; or

(ii) if that is not achievable, then adverse impacts are mitigated to the greatest reasonable extent.'

2.4.3 Paragraph **5.59** goes on to state the following:

'The Authority will encourage further reductions, for example towards the limits of an E0 dark sky zone, or by removing below or near horizontal light paths from fixtures. Often this can be achieved with little further disruption. Examples of how this can be done include:

- *Lighting should be subject to control measures to reduce unnecessary light pollution. Examples include:*
  - *'Curfews' or automatic timers;*
  - *Proximity 'PIR' sensors, timers or any additional shielding or coving, including angling the front surface of lights to the horizontal;*
  - *Different surface types to reduce the amount of reflectivity;*
  - *Appropriate use of glazing to reduce light transmittance; and*
  - *Screening or shielding to reduce the impact of reflectivity.*

Location	Requirements for level of protection				
Dark Sky Zone description	ILP guidance[35]	Landscape impact	Maximum Lux level (suggested 10 Lux)	Preferred lights-off curfew	Astronomical darkness curfew
E0 Dark Sky Core and areas outside this zone with a SQM[36] of 20.5+	✓	✓	✓		✓
E1(a) 2km Buffer Zone and areas outside this and the above zone which are of intrinsic rural darkness with a SQM range of 20 to 20.5	✓	✓	✓	✓	
E1(b) Transition Zone and areas outside this and the above zones with a SQM range of ~15 to 20	✓	✓	✓		
E3/4 Urban zone with an SQM of <15	✓	✓			
4. Outdoor lighting proposals are required to provide a statement to justify why the proposed lighting is required.					

Table 1 Policy SD8

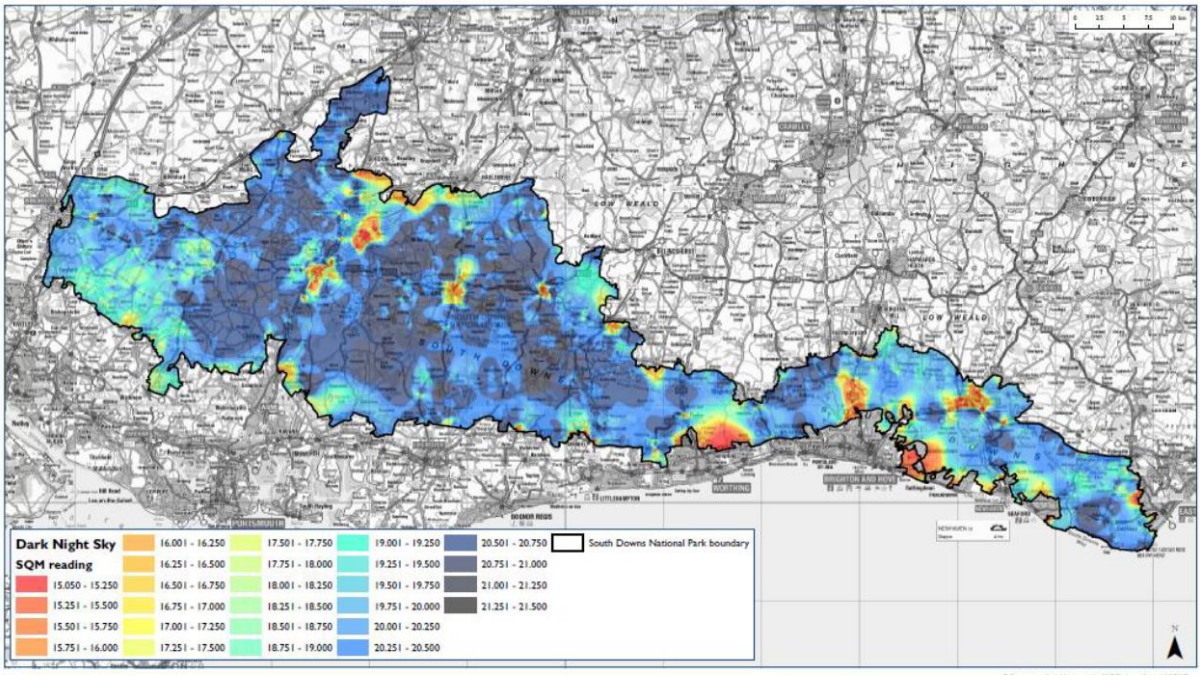


Figure 1 SDNP International Dark-Skies Reserve Sky Quality Map

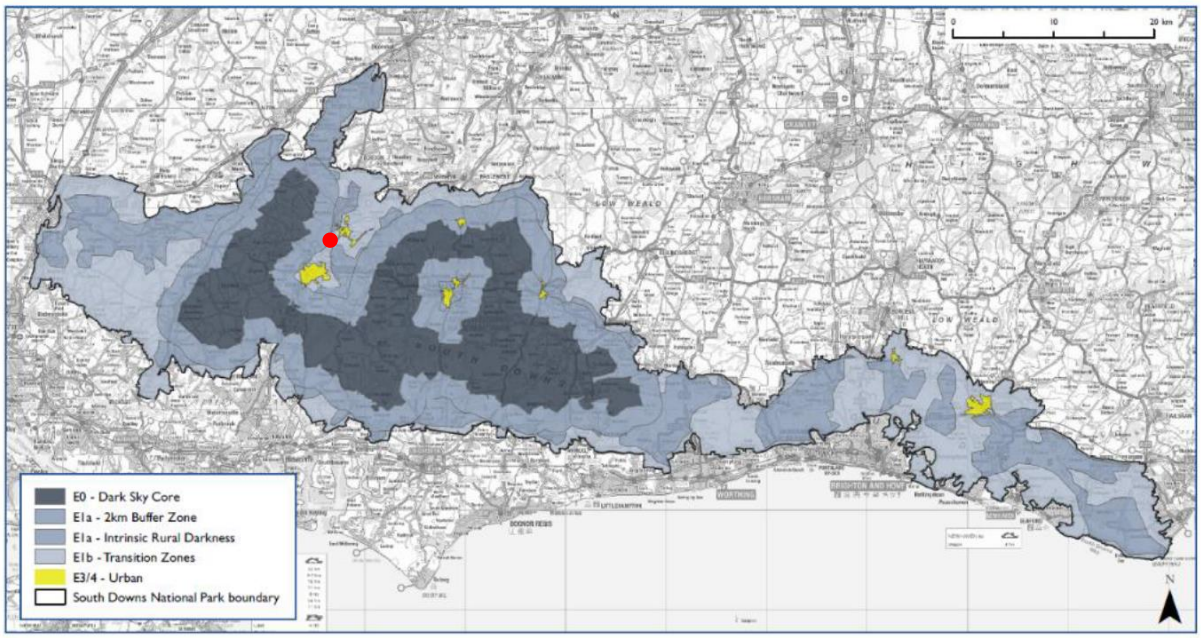


Figure 2 SDNP Dark Sky Core (Policy / Environmental Zone Map) (Approximate site location shown in red)

2.5 Hampshire County Council Technical Guidance Note TG13- Street Lighitng (2019)

2.5.1 This guidance is relevant to the adoptable street lighting specification and informs the lighting impact assessment.

3 Standards and Guidance

3.1 Relevant British Standards

3.1.1 The most applicable British Standards for lighting that relate to the **Proposed Development** are:

- **BS5489-1: 2020** – *Lighting of Roads and Public Amenity Areas (Code of Practice).* – This guidance is applicable to the internal roads that help to facilitate movement of vehicular and pedestrian traffic about the site.
- **BS EN 12464-2: 2014** - *Lighting of Work Places (Outdoor work places)* – This guidance is important as it contains guidance for task lighting of work-based tasks, as well as providing guidance for car park lighting.

3.2 Guidance Notes for the Reduction of Obtrusive Light; 2021 Institution of Lighting Professionals (ILP)

3.2.1 Guidance notes produced by the Institution of Lighting Professional are among the most commonly referenced guidance notes for good practice within the lighting design industry.

3.2.2 Obtrusive light (or sometimes referred to as light pollution) refers to any light emitted in a direction in which it is not required or wanted and as such is detrimental to other users.

3.2.3 The assessment has been carried out in accordance with the published guidance documents from the ILP and CIE. The quantitative limits are the same for both guidance documents. They quantify the levels of direct upward light, light intrusion, viewed source intensity and glare regarded as acceptable for varying environmental zones.

3.2.4 Light intrusion refers to the spilling of light beyond the boundary of the area to be lit. This includes the intrusion of light into bedroom windows.

3.2.5 Sky glow refers to the brightening of the sky above towns cause by direct or reflected upward light.

3.2.6 Glare refers to the uncomfortable brightness of a light source when viewed against a dark background. **Figure 3** illustrates the different types of obtrusive light.

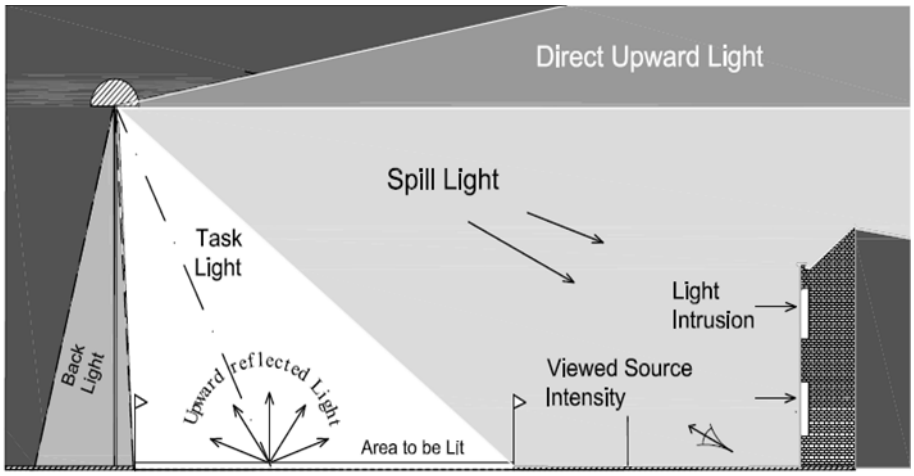


Figure 3 Obtrusive light diagram

Professional Lighting Guide PLG 04 "Guidance on Undertaking Environmental Lighting Impact Assessments" Institution of Lighting Professionals (ILP):2013

3.2.7 PLG 04 is used to ensure that the lighting impact assessment is correctly carried out:

"...this document is designed to provide an explanation of, and guidance on, the process for producing a Lighting Assessment…to remove or minimise environmental problems".

Professional Lighting Guide PLG 05 "The brightness of Illuminated Advertisements" Institution of Lighting Professionals (ILP) 2014

3.2.8 PLG 05 is applicable to the retail component of the proposed development, to ensure the lighting associated with any signage is adequately controlled.

Bats and Artificial Lighting in the UK (GN08/18 (2018) Institution of Lighting Professionals (ILP) and Bat Conservation Trust (BCT).

3.2.9 This document provides guidance for artificial exterior lighting in close proximity to light sensitive ecology. The following guidance is contained within the document:

'Lighting in the vicinity of a bat roost causing disturbance and potential abandonment of the roost could constitute an offence both to a population and to individuals (Garland and Markham, 2007).

It is therefore important that the use of an area by bats is thoroughly assessed before artificial lighting is changed or added in the vicinity of a roost or where bats may commute or forage.'

3.3 South Downs National Park- Dark Skies: Technical Advice Note (April 2018)

3.3.1 This document is applicable to the **Proposed Development** as it outlines the South Downs National Park Authority requirements for exterior lighting, which aims to protect the International Dark Skies Reserve.

4 Assessment Methodology and Significance Criteria

4.1 Methodology

4.1.1 The methodology employed for this assessment was appropriate to the location of the **Application Site**. It included a desk-top survey, and a site visit during which the baseline conditions were assessed. In addition, the potential effects of the proposed lighting were evaluated using appropriate assessment criteria (Outlined in **Section 4**).

4.1.2 The methodology takes guidance from the Institution of Lighting Professionals PLG 04 document "Guidance on Undertaking Environmental Lighting Impact Assessments". This sets out good practice for conducting the assessment.

4.1.3 The desktop study involved research into relevant local and national legislation, policy and guidance relating to obtrusive light. It also involved consultation with relevant parties and studying of ordnance survey maps, plans and aerial photography views to identify likely receptor locations prior to the site visit.

4.1.4 Research undertaken during the desktop study was used to clearly define the assessment locations which formed the basis of the site visit. Baseline conditions were also assessed in these locations, along with the extent of any receptor viewpoints in the direction of existing artificial lighting and potential artificial lighting associated with the **Application Site**.

4.2 Study Area

4.2.1 The study area was determined during the desk-top survey by assessing the potential areas that could be affected by a change in artificial lighting. This included the **Application Site** and areas identified as having bat roosts and commuting paths.

4.2.2 The study area is detailed in **Appendix 2**.

4.3 Surveys

4.3.1 A survey of the site was carried out after astronomical twilight to assess the existing baseline lighting and its effect on surrounding receptors, as well as to assess the potential effect from the artificial lighting associated with the **Application Site**. During the survey, the **Application Site** was visited, along with the surrounding areas from where the **Application Site** may be visible to potentially sensitive receptors.

4.3.2 The site visit allowed an assessment of potential receptor types and locations to be made, the night-time visual scene was recorded in accordance with guidance from the ILP document PLG04 (as detailed in **Section 3**).

4.4 Potential Effects from Artificial Light

4.4.1 There are a limited number of potential effects that can arise from inappropriately designed artificial lighting. These are as follows:

Effects from light intrusion through windows on residents

4.4.2 Light intrusion (or light spill) is the term for the spilling of light beyond the boundary of the area being lit. The ILP Guidance Notes places a limit on the amount of vertical Illuminance which falls upon the centre of a dwelling window. The suggested maxima values quoted are relative to the amount of light measured as a baseline without the presence of the obtrusive light source.

Effects from viewed source intensity on residents and sightseers

4.4.3 **Table 1** below advises limits on luminaire intensity or viewed source intensity from luminaires to an observer. The greatest problems are usually encountered from poorly aimed floodlights or security lighting, or from lighting which is located too close to properties.

Effects from upward light (or sky glow)

4.4.4 Light emitted above the horizontal either directly from luminaires or indirectly as reflected light from surfaces such as the landscape or buildings, has the potential to cause sky glow. The ILP "Guidance Notes for the Reduction of Obtrusive Light" places limits on the percentage of direct upward light emitted from the luminaires in their installed attitude, which is dependent upon the environmental zone in which the **Application Site** lies.

4.4.5 Indirect upward light is subject to material reflectance properties. It is not easily quantifiable but is unlikely to be as significant as direct upward light and is not an assessment criterion used in the ILP guidance notes.

Effects from disability glare on transport users

4.4.6 The proposed lighting strategy includes requirements for lighting to be installed such that glare is minimised in accordance with the ILP guidance notes.

Effects from light on bats roosts and insects

4.4.7 Light falling on a roost access point will at least delay some species of bats from emerging and this shortens the amount of time available to them for foraging. As the main peak of nocturnal insect abundance occurs at and soon after dusk, a delay in emergence means this vital time for feeding is missed.

4.4.8 Insects and foraging in addition to causing disturbance to bats at the roost, artificial lighting can also affect the feeding behaviour of bats. There are two aspects to this. One is the attraction that light from certain types of lamps has to a range of insects; the other is the presence of lit conditions.

4.5 Obtrusive light limitations

4.5.1 In the absence of suitable statutory guidance, it is proposed that the Institution of Lighting Professionals (ILP) "Guidance notes for the reduction of obtrusive light" GN01:2020 is used, in order to provide suitable assessment criteria against which to assess the potential effects of artificial lighting.

4.5.2 The relevant criteria of upward light, light intrusion and direct source intensity are discussed below and **Table 1** sets limits for each criterion.

Table 1 Obtrusive light criteria relating to each Environmental Zones

Environmental Zones	Sky Glow ULR (Max %)	Light Trespass (into Windows) E_v (lux)		Building Luminance Average, Pre-curfew
		Pre- Curfew	Post-Curfew	Average L (cd/m^2)
E0	0	0	0	0
E1	0	2	0 (1*)	0
E2	2.5	5	1	5
E3	5	10	2	10
E4	15	25	5	25

Notes to Table:

- ***ULR (Upward Light Ratio) is the maximum permitted percentage of luminaire flux that goes directly into the sky;***
- ***E_v is Vertical Illuminance in Lux;***
- ***I is Light Intensity in Candelas;***
- ***L is Luminance in Candelas per square metre; and***
- ***Curfew refers to a time when the local planning authority has agreed that the lighting installation should be switched off; this typically refers to 23h00 – 07h00.***
- ***(*) Permitted only from Public road lighting installations.***

4.6 Classification of Environmental Zone

4.6.1 The ILP Guidance Notes Guide quantify the levels of Obtrusive light regarded as acceptable for varying environmental zones E0 to E4.

4.6.2 The **Application Site** is described as 'Low district brightness', therefore categorised as an **E2** Environmental Zone in accordance with the ILP Guidance Notes. However, as the **Application Site** is part of the South Downs National Park and following guidance from the South Downs National Park the area of the **Application Site** should be considered in conjunction with the guidance outlined in the *South Downs National Park- Dark Skies: Technical Advice Note (April 2018)* as detailed in **Figure 2.**

Table 2 Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5 +)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty 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	Small town centres or suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity

4.6.3 In accordance with the Dark Sky Zone Map presented in **Figure 2**, the application is located within an E1/a – Intrinsic Rural Darkness Zone. Within the SDNP Dark Skies Technical Advice note, these zones are described as:

'Intrinsic Rural Darkness and Buffer – between 20 and 20.5 SQM. (E1a)

These are areas that measure 20 SQM and above, excluding the core zone. They include other areas in the National Park that would be classified as a 'dark sky' and includes isolated areas that may not be connected to the main core. The Milky Way will be visible, and, in some areas, measurements may approach 21 SQM and are therefore of great importance. The ILP would classify this as E1 – National Park.

4.6.4 Comparison of the baseline conditions measured during the site assessment combined with the criteria outlined in the above table and the dark sky zone map define the environmental zone.

4.7 Significance Criteria

4.7.1 The significance of an effect from artificial lighting will be based upon the sensitivity of the receptor and the magnitude of change at that receptor due to the revised conditions.

4.7.2 The sensitivity of the receptor has been classified as High, Medium, or Low according to the descriptions provided in **Table 3.**

4.7.3 The magnitude of change is determined as being High, Medium, Low or Negligible and descriptions for each are provided in **Table 4.**

4.7.4 The significance of the change is derived through the sensitive matrix (**Table 5**), matching the sensitivity of the receptor, with the magnitude of the change.

4.7.5 The significance criteria are derived from the combination of the relevant receptor sensitivity and the magnitude of change which that receptor will experience as an effect from the lighting of the **Application Site**. These significance criteria are shown in **Table 6** and they can be either beneficial or adverse effects.

Table 3 Criteria for Receptor Sensitivity

Sensitivity	Description of Criteria
High	The environment is fragile, and an impact is likely to leave it in an altered state from which recovery would be difficult or impossible. Human (Amenity) – receptors which are sensitive to a change in lighting such that the quality of life would be affected (i.e. lighting is designated a statutory nuisance) Human (Safety) - receptors where a change in the lighting has the potential to either dramatically improve or reduce safety (for pedestrians, drivers or workers). Ecological – where a change in the lighting affects the habitats, breeding or feeding of fauna (e.g. protected habitats or other special areas) or growth patterns of fauna / crops.
Medium	The environment has a degree of adaptability and resilience and is likely to accommodate the changes caused by an impact, although there may still be some residual modification as a result. Human (Amenity) – receptors which are sensitive to a change in lighting however not such that the quality of life would be affected. Human (Safety) - receptors where a change in the lighting has the potential to either improve or reduce safety (for pedestrians, drivers or workers). Ecological – where a change in the lighting affects the movement or feeding patterns of fauna but the receptor can adapt.
Low	The environment is adaptable and is resilient to change. Nearly all impacts can be absorbed within it without modifying the baseline conditions. Human (Amenity) – receptors which would not noticeably be aware of a change in lighting. (i.e. in areas of medium to high luminance) Human (Safety) - receptors where a change in the lighting has limited potential to affect safety (for pedestrians, drivers or workers). Ecological – area with limited wildlife.
Negligible	Receptor has little or no night-time activity

Table 4 Criteria for Magnitude of Change

Magnitude of Change	Description of Criteria
High	A large change compared to the natural variations in background levels. A clear breach of limits and standards may occur. For example, levels of obtrusive light in the form of sky glow, light trespass or glare towards a receptor which exceeds the limits set within the ILP guidance for a higher environmental zone might classify as a high magnitude of change.
Medium	Change which is noticeable and may be a breach of limits and standards. In terms of the limits set in the ILP guidance this might equate to exceeding the limit but within the limits set for the next Environmental Zone.
Low	Change which, when compared to background levels, is only just noticeable.
Negligible	Change is not noticeable.

Table 5 Sensitivity of Receptor Matrix

Magnitude of Change	Sensitivity of Receptor				
		High	**Medium**	**Low**	**Negligible**
	High	Major	Major	Moderate	Negligible
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor to Moderate	Negligible	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Table 6 Significance Criteria

Significance Criteria	Significance Criteria
Major beneficial	Substantial reduction in obtrusive light at sensitive receptors and/or users of the **Application Site** such that large scale improvements to visual amenity, human safety or health is delivered. Significantly improves ecological habitats
Moderate beneficial	Moderate reduction in obtrusive light at sensitive receptors and/or users of the **Application Site** such that noticeable improvements to visual amenity, human safety or health are delivered. Improves ecological habitats
Minor beneficial	Minor reduction in obtrusive light at sensitive receptors and/or users of the **Application Site** such that perceptible improvements to visual amenity, human safety or health is delivered; perceptible improvement to ecological habitats.
Neutral/Not significant	No appreciable effect on sensitive receptors. Effects are reversible.
Minor adverse	Minor increase in obtrusive light at sensitive receptors and / or users of the **Application Site** such as an increase in Glare, Light Trespass to properties, increase in Sky Glow or effects on flora and fauna. Effects are reversible or temporary.
Moderate adverse	Moderate increase in obtrusive light at sensitive receptors and / or users of the **Application Site** such as an increase in Glare, Light Trespass to properties, increase in Sky Glow or effects on flora and fauna. Requires monitoring and local remedial work. For example, lighting which is visible and causes nuisance to a sensitive receptor outside the **Application Site**.
Major adverse	Major increase in obtrusive light at sensitive receptors and / or users of the **Application Site** such as an increase in Glare, Light Trespass to properties, increase in Sky Glow or effects on flora and fauna. Requires extensive remedial works. For example, a floodlighting installation which directs light into the eyes of oncoming motorists causing disability glare and potential reduction in visual performance leading to an increased risk of collision.

4.8 Assumptions and Limitations

4.8.1 It is assumed that the proposed lighting will be designed by qualified and competent lighting professionals, in compliance with relevant lighting design standards; mentioned in **Section 3** above.

4.8.2 The assessment is limited to the lighting conditions as found at the time of the survey. It is assumed that these conditions are representative of the typical conditions on the site.

5 Baseline Conditions

5.1 Site Description and Context

5.1.1 The **Application Site** is approximately 2.35ha (5.8 acres) in size, located in the village of Greatham, Hampshire within the South Downs National Park. The **Application Site** is currently occupied by Liss Forest Nurseries and consists of glass houses, storage barns and a single residential dwelling.

5.1.2 The **Proposed Development** is for the construction of 37 dwellings, alterations to existing access onto Petersfield Road, hard and soft landscaping, drainage and all other associated development works at the Land at Petersfield Road, Greatham. Further details relating to the development proposals are included within the Planning Statement accompanying the application.

5.2 Existing Lighting

5.2.1 Artificial lighting is currently present within the boundaries of the **Application Site** including within the glass houses and barns. There is also a flood lit area within the middle of the **Application Site.**

5.2.2 Luminaires in use on the site comprise a combination of linear fluorescent (within the glass houses) and light emitting diode (LED) (within the barns and exterior flood lit area).

5.2.3 To the east of the **Proposed Development,** there is a small residential development that has two LED street lighting luminaires installed in accordance with Hampshire County Council street lighting specification.

5.2.4 Street lighting luminaires are installed to the specification of Hampshire County Council, who use Light Emitting Diode (LED) based street lighting luminaires, with a colour temperature of 5700K (also referred to as cold white). Local Authority luminaires are column mounted at a height of between 5 to 6 metres with a 0-degree inclination.

5.2.5 Petersfield Road is immediately North of the proposed development and provides access into the **Application Site**. The road does have a sporadic installation of luminaires along it, which appear to be in accordance with the adoptable specification for Hampshire, as these are of the LED variant.

5.2.6 Greatham Village Hall, North of the **Application Site** has exterior flood lighting visible from Petersfield Road.

5.2.7 Greatham Primary School is situated immediately West of the **Application Site** and has exterior lighting of the car park and building.

5.3 Baseline Survey Information

5.3.1 The site survey was undertaken on 30th October 2018 starting at 19:00 hours, the weather was dry with mostly clear skies. The moon was 64% visible [Waning Gibbous] therefore, low levels of moonlight were present during the baseline survey.

5.3.2 The survey involved assessing the baseline artificial lighting; identifying sensitive receptors and assessing potential effects of the proposed lighting on the identified sensitive receptors.

5.3.3 An independently calibrated Konica Minolta T-10 illuminance meter was used to measure illuminance for the baseline lighting survey. It had a validated calibration certificate, which expires in August 2019.

5.3.4 Vertical illuminance measurements were recorded during the survey, to assess the potential light spill from the site**.** The highest vertical illuminance recorded at the **Application Site** boundaries was: 0.94 lux at survey point 29, the lowest: 0.01 lux was recorded in numerous locations throughout the site. This is typical of an intrinsically dark area.

5.3.5 Light spill from interior lighting of existing residential properties overlooking the **Application Site** from the west did not exceed 0.44 lux at a distance of approximately 20 metres.

5.3.6 Horizontal illuminance measurements were also recorded to assess the light levels falling onto the ground within the **Application Site.** The highest of these recordings was 17.5 lux at survey point 96, which was measured inside one of the glasshouses.

5.3.7 It can be seen from the vertical illuminance measurements recorded on the **Application Site** boundary that the existing lighting has minimal contribution to obtrusive light.

5.3.8 Trees provide a natural barrier between the **Application Site** and surrounding residential areas, this provides shielding of potential light spill from the **Application Site**.

5.3.9 The existing lighting on the application site is uncontrolled and gives rise to upward light. This is caused by flood lighting and internal lighting within the glass houses.

5.3.10 Whilst there has been a reduction in functioning luminaires in operation within the glass houses, these could be brought back into operation with minimal effort. This would significantly increase the levels of obtrusive light emanating from the **Application Site.**

5.4 Sensitive Receptors

5.4.1 As part of the baseline review, the survey area was visited to identify potential sensitive receptors to artificial light. This includes consideration towards potential human and ecological receptors.

5.4.2 There were few residential receptors identified due to the remote location of the **Application Site**.

5.4.3 Potential human residential receptors were identified immediately east of the **Application Site**. These are people living in properties situated in Bakers Field.

5.4.4 Ecological receptors are outlined in the Ecological Impact assessment

5.4.5 Greatham Village Hall and Greatham Primary school are not considered sensitive receptors to lighting as obtrusive light guidance (GN01) only applies to residential receptors.

Table 7 Summary of receptor locations and sensitivity

Receptor Type	Receptor Location (See Appendix 3)	Description	Sensitivity
Human - Residential	Location 1	Residential Properties *(Bakers Field)*	Medium

6 Lighting Requirements

6.1 Artificial Lighting requirements

6.1.1 Whilst the **Proposed Development** will not necessarily require a high level of artificial lighting, lighting will be required to facilitate the safe and secure operation of the site, during the construction and operation phase of the development.

6.1.2 Lighting will be required for the car parking areas, internal roadways and the footpaths within the site landscaping which will comply with Hampshire County Council's adoptable street lighting specification (as outlined in TG13).

6.1.3 Artificial lighting within the car parking areas and on the access, roadways shall be designed in compliance with **BS 5489-1: 2020** *(Lighting of Roads and Public Amenity Areas)*

6.1.4 Artificial lighting of footpaths through the site will be suitably illuminated to reduce the potential for obtrusive light, and to create a soft ambience. Exterior lighting will also be designed in accordance with the Guidance Notes for the Reduction of Obtrusive Light (ILP-GN01:2020).

7 Potential Effects

7.1 Potential Effects from Construction Artificial Lighting (without mitigation)

7.1.1 As a result of the use of construction lighting (i.e. without mitigation) during the development process, there is a potential for obtrusive light due to poorly designed or installed lighting equipment. Generally, construction lighting is provided by inexpensive flood lighting luminaires, designed to provide as much light as possible with minimal control.

7.1.2 Without mitigation, there is potential for construction flood lighting to contribute the following components of obtrusive light.

- Light spill into windows;
- Upward light causing sky glow;
- Intrusive light affecting bat roosts;
- Glare due to high light source intensity from floodlights; and
- Intrusive light affecting ecology.

7.1.3 The potential effects from construction lighting without mitigation are likely to be of **Moderate** significance, based on the above components of obtrusive light, all of which could occur unless mitigation measures are implemented.

7.2 Potential Effects from Operational Artificial Lighting (without mitigation)

7.2.1 As a result of the exterior lighting detailed above (i.e. without mitigation), there is a potential for obtrusive light due to poorly designed or installed lighting equipment.

7.2.2 Poorly designed lighting generally consists of the installation of a limited number of luminaires that are being used to light a wide area. Due to this, the lighting is normally installed with tilt angles that are too great, because there is a need to spread the light as far as possible, lighting the intended area, as well as surfaces where the lighting was not intended. This also has the effect of producing high levels of vertical illuminance.

7.2.3 Poorly designed lighting can contribute the following obtrusive light components:

- Light spill into windows: this is typical of wall mounted luminaires with high tilt angles;
- Upward light causing sky glow: this is typical of up-lighting;
- Glare: due to high light source intensity from floodlights; and
- Intrusive light affecting ecology: caused by excessive height and tilt.

7.2.4 The potential effects from construction lighting without mitigation are likely to be of **Moderate** significance, based on the above components of obtrusive light, all of which could occur unless mitigation measures outlined in **Section 9** are implemented.

8 Outline Lighting Strategy

8.1 Adopted Site Access / Internal Site Road and Footpaths.

8.1.1 The criteria detailed in Table 8 below will ensure that the lighting of the site access and internal site road will be strictly controlled and designed in accordance with Hampshire County Council's specification (TG13) and BS 5489 – 1:2020 *(Lighting of Roads and Public Amenity Areas)* to reduce the potential for obtrusive light.

8.1.2 The following criteria will apply to road and footpath lighting:

Table 8 Site Access and Site Road

Equipment Specification	Description
Location	Site Access, Internal Site Road and Footpaths.
Light Source	LED [Light Emitting Diode]
Luminnaire Type	In accordance with Hampshire County Council Specification.
Ra of light source	70+
CCT of Light Source	3000k or less
Luminous Intensity Class	G3 or better
Luminaire Tilt	0 degrees from horizontal
Dimming requirements	To be in accordance with Hampshire County Council Specification (TG13)
Design Guidance	**Notes**
Lighting Standard	**BS 5489-1: 2020** - *Code of practice for the design of road lighting*
Lighting Class	As per Hampshire County Council Specification.
Mounting Arrangement	Post Top
Luminaire spacing	To be determined by lighting calculation to suit the proposed site layout. Where possible columns to be setback at the rear of the carriageway at a distance no less than as stated in BS 5489-1:2020
Restrictions	The peak beam angle of all lights directed towards any potential observer is not to be more than 70 degrees when the luminaire is installed with a tilt angle of 0 degrees. 6.0 metre maximum column height Shields should be considered where design measures cannot limit light spill onto sensitive receptor areas.

8.2 Unadopted Footpaths & Parking Areas

8.2.1 The lighting of unadopted footpaths which are not part of the roadway will be provided by light from column mounted luminaires (maximum height 6.0 metres).

8.2.2 Whilst the equipment installed in the undopted areas will not be adopted by Hampshire County Council, the equipment will match the adoptable specification to allow consitancy across the site.

8.2.3 Lighting controls are to be used allowing the lighting to be switched off or dimmed late at night, when the illuminated area is not being used.

8.2.4 The specification of luminaires in these areas will ensure the potential for obtrusive light to affect the Dark Sky reserve is mitigated.

Table 9 Footpaths & Landscaped Areas

Equipment Specification	Description
Location	Unadopted footpaths and parking areas.
Light Source	LED [Light Emitting Diode]
Luminaire Type	To match adoptable specification luminaires.
Ra of light source	70+
CCT of Light Source	3000k or less
Luminous Intensity Class	G3 or better
Luminaire Tilt	0 degrees from horizontal
Dimming requirements	Lighting controls should be utilised to enable dimming during times of reduced traffic movements. This measure would conserve energy and reduce the potential amounts of obtrusive light emanating from the development.
Design Guidance	**Notes**
Lighting Standard	**BS 5489-1: 2020** - *Code of practice for the design of road lighting*
Lighting Class	P6
Mounting Arrangement	Post Top
Luminaire spacing	To be determined by lighting calculation to suit the proposed site layout. Where possible columns to be setback at the rear of the carriageway at a distance no less than as stated in BS 5489-1:2020
Restrictions	The peak beam angle of all lights directed towards any potential observer is not to be more than 70 degrees when the luminaire is installed with a tilt angle of 0 degrees. 6.0 metre maximum column height Shields should be considered where design measures cannot limit light spill onto sensitive receptor areas.

8.3 Residential Access Points

8.3.1 Localised lighting for each main residential access point will enable safe entrance / egress from the front and rear of individual properties. These should be controlled via a PIR sensor whereby they are switched on when the sensor is activated and automatically switched off after a time period of 10mins or less has elapsed.

Table 10 Residential Access points

Equipment Specification	Description
Location	Each main residential access point
Light Source	LED [Light Emitting Diode]
Luminaire Type	Wall mounted Unilamp Bronco (or similar approved)
Luminaire Light Distribution	Downwards only (medium beam) with shielded top section.
Ra of light source	70+
Max Lumen output	500 lumens (maximum) or less
CCT of Light Source	3000k or less
Dimming requirements	Lighting controls such as PIR sensors should be utilised to enable automatic switching.
Design Guidance	**Notes**
Lighting Standard	**N/A**
Lighting Class	N/A
Luminaire spacing	One per dwelling frontage and rear.
Maximum Height	2.0m

9 Scope of Mitigation

9.1 Mitigation by Design - Construction

9.1.1 Many of the potential effects of artificial lighting can be effectively mitigated by a suitable lighting strategy, good lighting design and selection of suitable lighting equipment. The following paragraphs detail good practise for the lighting of the **Application Site** during the Construction phase.

9.1.2 Construction lighting will be detailed and controlled by the Construction Environmental Management Plan.

9.1.3 All efforts should be made to avoid construction work during the hours of darkness, however, if construction is to take place during the hours of darkness, lighting will comply with *BS EN 12464-2: 2014.* Lighting for the construction phase is most likely to be provided by mobile lighting towers. Where possible, the luminaires should be focussed in to the site to limit the possibility of obtrusive light occurring.

9.1.4 If construction does not take place during the hours of darkness, construction lighting should be switched off, unless required for security purposes, at which point, the minimum illuminance level required for security lighting should be implemented in compliance with *BS EN 12464-2:2007.*

9.2 Mitigation by Design - Operation

9.2.1 Many of the potential effects of artificial lighting can be effectively mitigated by a suitable lighting strategy), good lighting design and choice of suitable lighting equipment and the lighting design being carried out by a suitably qualified and competent lighting professional. The following paragraphs detail good lighting practices to be applied to the design of the artificial lighting required within the **Application Site** during the operation phase.

9.2.2 Exterior lighting of the **Application Site** will comply with guidance outlined above for lighting of roadways and outdoor work places, as well as following ILP guidance for the reduction of obtrusive light. (BS 5489-1:2020, *BS EN 12464-1:2011 and ILP- GN01)*

9.2.3 Lighting within adoptable areas of the site will be designed in accordance with **BS 5489-1: 2020 – *Code of practice for the design of road lighting***, or Hampshire County Council adoptable Specification (as outlined in TG13) where the road is to be adopted.

9.2.4 The proposed lighting strategy is to use high quality luminaires throughout the design to ensure that light is focussed downwards onto the ground or other surfaces in the horizontal plane, minimising the potential for direct upward light, glare, light spill and light trespass. Luminaires of this type are designed to ensure that they are optically efficient, thus reducing the amount of light spilled onto the vertical plane, thereby reducing the potential for obtrusive light. It is proposed that column mounted luminaires are only intended for the lighting of the site access, internal site road and the unadopted footpaths / parking areas.

9.2.5 Where luminaires are installed close to the **Application Site** boundaries, the designer shall ensure that luminaires are orientated away from the boundary to focus light into the **Proposed Development**, especially on the southern side of the **Application Site**, to minimise the potential for obtrusive light to occur outside of the **Application Site** boundary.

9.2.6 Luminaires will be used that have good optical control and an option for installing shields. This can be an effective method of shielding the source intensity and reducing both horizontal and vertical spill light. If during the design of the lighting installation it is decided that luminaires are to be installed with shields, then photometry with the effects of shields should be considered to ensure that the calculated lighting levels are as accurate as possible. However, this type of photometry is not available from every manufacturer.

9.2.7 Footpaths will be illuminated by luminaires mounted at a maximum height of 6.0 metres. Equipment installed in these areas will be designed in accordance with **BS5489-1: 2020 – *Code of practice for the design of road lighting***, or Hampshire County Council adoptable Specification (as outlined in TG13) where the area is to be adopted.

9.2.8 Roadway lighting shall be provided by luminaires that produce the minimum amount of light required to safely and adequately illuminate the roadway. Luminaires that contribute minimal amounts of obtrusive light should be specified. Luminous Intensity should be adequately controlled by using luminaires that have flat glass and achieve a luminous intensity class of G3

(or better). This applies solely to column mounted luminaires that are proposed for the lighting of the site accesses, small sections of entrance roads and the car parking / courtyard areas.

9.2.9 All proposed lighting must be of a warm white colour temperature (3000K or less) to ensure the lighting design to reduce the potential for adverse effects on potential ecological receptors.

9.2.10 To help keep glare to a minimum, the peak beam angle of all lights directed towards any potential observer is not to be more than 70 degrees when the luminaire is installed with a tilt angle of 0 degrees. This applies solely to column mounted roadway lighting luminaires, to the access roads, courtyards / parking areas.

9.2.11 It is only intended that localised lighting is required for property entrance areas, to allow safe entrance / egress from each dwelling.

9.2.12 All wall mounted luminaires are to be mounted at a height not exceeding 2.0 metres; this will limit the levels of any potential obtrusive light.

9.2.13 All luminaires mounted on the exterior façade of the **Proposed Development** must be installed with a 0° tilt angle.

10 Residual Effects Assessment

10.1.1 The effects associated with the lighting strategy would be minimised by the application of the mitigation measures outlined above.

10.1.2 Lighting associated with the **Proposed Development** would be mitigated by limiting the number of exterior luminaires and ensuring that lighting is designed in compliance with recognised and relevant British Standards. This measure would see light focussed carefully in the location where it is required, rather than area lighting the whole **Proposed Development**.

10.1.3 It is unlikely that potential human receptors, with views of the **Application Site** from the east within Bakers Field, would be subjected to an increase in obtrusive light due to the mitigation measures, site layout and compliance with lighting standards. Implementation of the lighting strategy will also minimise light spill, ensuring that lighting is focussed only to areas where it is required.

10.1.4 The artificial exterior lighting within proximity to potential ecological receptors is unlikely to give rise to significant effects, given the lighting strategy proposed within **Section 8** of this document. This is through the use of minimal lighting levels, as well as luminaire mounting height, tilt and the implementation of effective lighting control. An indicative lighting layout is provided in **Appendix Six,** which demonstrates that the light levels at ground height will be minimised to less than 0.5 lux not extending outside the **Application Site** boundaries.

10.1.5 It is also assessed that artificial light associated with the **Proposed Development** is unlikely to adversely affect potential sensitive receptors given the sensible lighting strategy applied.

10.1.6 The application of the above mitigation measures would ensure that light intrusion, light source intensity (glare) and upward light onto surrounding receptors is minimised, resulting in the residual effects detailed in **Table 11**.

10.1.7 The **Proposed Development** will be typical of a residential development in terms of light spill from windows, thus it I unlikely light spill from interior lighting associated with the **Proposed Development** would give rise to obtrusive light towards existing properties overlooking the **Application Site** from the east.

Table 11 Significance of Effects (after mitigation)

Environmental Effect	Receptor Type	Sensitivity of Receptor	Impact Magnitude	Nature of Impact (Permanent / Temporary)	Residual Effects
Construction					
Direct Source Luminance or Glare	Human Residential (Loc 1)	Medium	Negligible	Temporary	**Negligible**
Sky Glow or Upward Light	National Park	Medium	Negligible	Temporary	**Negligible**
Light Intrusion	Human Residential (Loc 1)	Medium	Negligible	Temporary	**Negligible**
Light Spill	Ecology	Medium	Negligible	Temporary	**Negligible**
	Human Residential (Loc 1)	Medium	Negligible	Temporary	**Negligible**
Operation					
Direct Source Luminance or Glare	Human Residential (Loc 1)	Medium	Low	Permanent	**Minor (Beneficial)**
Sky Glow or Upward Light	National Park	Medium	Low	Permanent	**Minor (Beneficial)**
Light Intrusion	Human Residential (Loc 1)	Medium	Low	Permanent	**Minor (Beneficial)**
Light Spill	Ecology	Medium	Low	Permanent	**Minor (Beneficial)**
	Human Residential (Loc 1)	Medium	Low	Permanent	**Minor (Beneficial)**

10.1.8 Following the implementation of mitigation measures as outlined in **Section 9**, the maximum potential residual effects are assessed to be of **Minor (Beneficial)** significance because although the general level of light upon the **Application Site** will increase, it is not likely to be obtrusive in nature, as it will be low in intensity and carefully focussed. Furthermore, the quality of the lighting will be improved in line with relevant British Standards and local Authority specification which the existing lighting on the **Application Site** is not controlled by.

10.1.9 Additionally, it is unlikely that all interior lighting will be switched on at once, with windows covered by fabric or blinds, which reduces the potential for light spill from interior lighting to impact the adjacent development (Bakers Field) to the east.

10.1.10 There will be a reduction in upward light with the potential to impact the Dark Sky, as a result of removing existing barns that have operational lighting internally, with translucent ceiling panels that allow light to pass through them.

11 Conclusions

11.1 Introduction

11.1.1 This report addresses the effects resulting from artificial lighting associated with the **Proposed Development** on the **Application Site** and its surroundings. It assesses the potential effects from obtrusive light associated with the proposed exterior lighting design. The principal objective is to assess the significance of potential residual effects.

11.2 Baseline Conditions

11.2.1 The **Application Site** is within a relatively dark suburban environment within the South Downs National Park. In accordance with the SDNP Technical Advice Note, the area is assessed to be an **E1/a Environmental Zone.** However, there is lighting in use on the **Application Site** (within the nursery buildings) and within close proximity to the **Application Site**, associated with the adjacent road (Petersfield Road), Greatham Village Hall and Greatham Primary School**.**

11.2.2 There is some existing lighting associated with the commercial nursery currently built upon the **Application Site**, which will be removed as part of the **Proposed Development**. (See **Appendix 4**).

11.3 Potential Significant Effects

11.3.1 The requirement for artificial lighting to support the **Proposed Development** means that there could be some potential effects caused by some parts of the required lighting including; light spill (from windows), direct source luminance or glare (onto receptor views) and sky glow or upward light.

11.3.2 However, the mitigation measures deployed through the lighting strategy in **Section 8**, along with the additional mitigation measures outlined in **Section 9** will ensure that artificial lighting is not obtrusive, presenting minimal significance in the assessment of potential effects. **(Minor)**

11.4 Mitigation and Enhancement

11.4.1 The result of incorporating the mitigations identified in **Section 9** will reduce the significance of the potential effects, ensuring the maximum potential significance of effects is **Minor.**

11.4.2 Mitigation measures includes the use of high-quality luminaires to provide low level lighting in the right place at the right time at the right level.

11.5 Residual Effects

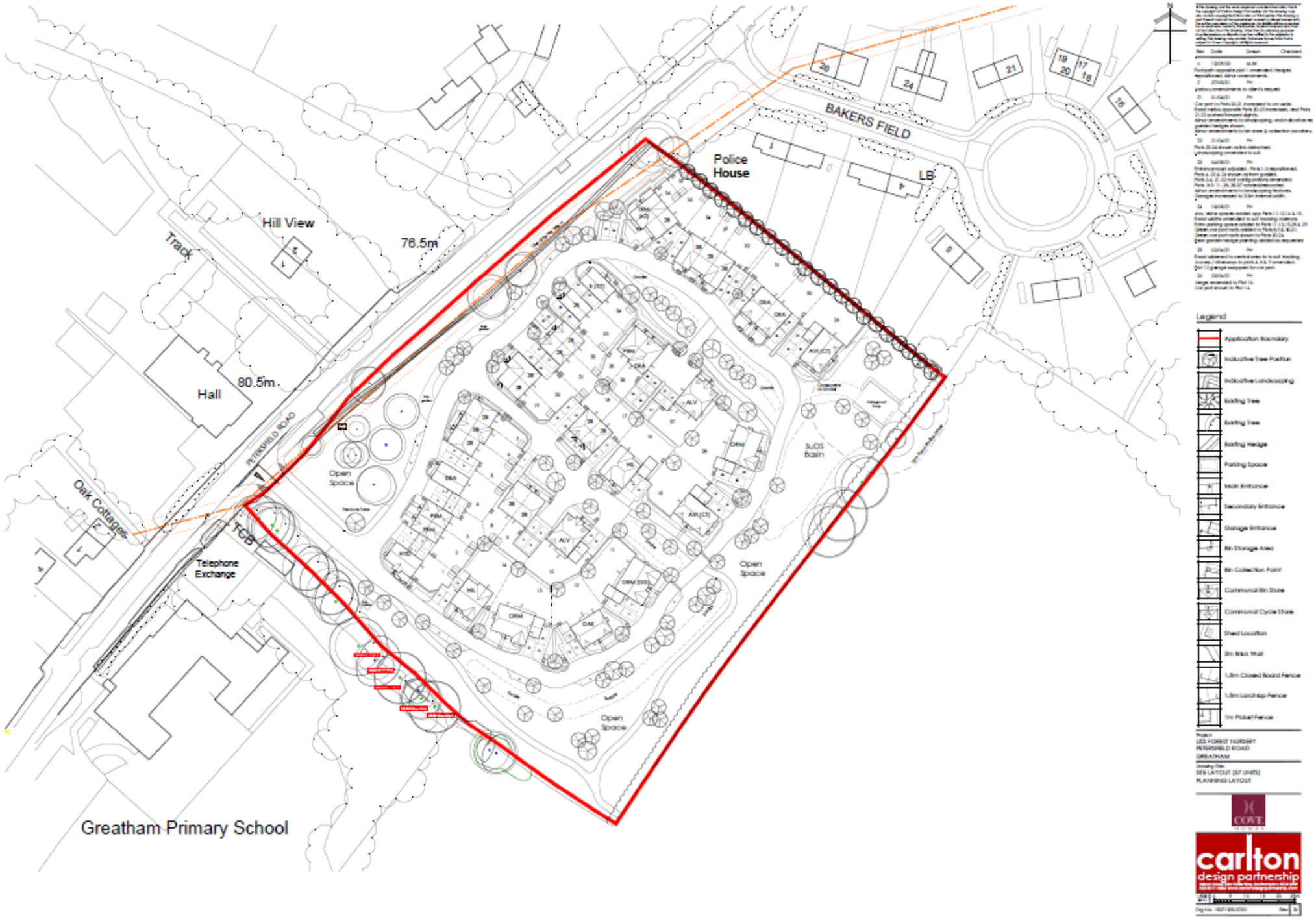
11.5.1 Following the lighting strategy and the mitigation measures outlined in **Section 8 and 9**, the residual effects are assessed to be of **Minor to Negligible Significance**. This is due to the low potential for obtrusive light to affect human and ecological receptors, through the through implementation of the lighting strategy.

11.5.2 Potential human sensitive receptors located outside the east boundaries of the **Application Site**, on Bakers Field are unlikely to be subjected to obtrusive light from the **Proposed Development** due to the natural screening that the existing trees produce and also by following the full implementation of the lighting strategy outlined in **Section 8** of this document.

11.5.3 In combination, the lighting strategy implementation which seeks to ensure that light is only focussed where it is needed, and the layout of the site will provide shielding of the luminaires to sensitive receptors within Bakers Field. This will help to reduce the potential for the levels of glare and light spill to be greater than those permitted within **Table 1.**

11.5.4 In conclusion, there are unlikely to be significant effects from artificial lighting installed as part of the **Proposed Development**.

Appendix One – Proposed Development Site Plan



Appendix Two - Application Site Study Area

Survey area (approximate).

Appendix Three – Potential Receptor Locations

Key:

Location 1 – *Bakers Field:*

Appendix Four – Site Survey Photos

Image 1: Light Spill from Existing lighting installed on the Application Site

Image 2: Light Spill from Existing lighting installed on the Application Site

Image 4: Existing lighting installed on the Application Site

Image 3: Effect of residential lighting overlooking the Application Site

Appendix Five – Baseline Lighting Survey Results

See separate file: 0904-DFL-S-001

Survey Point	Horizontal Illuminance (Lux)	Vertical Illuminance (Lux)	Survey Point	Horizontal Illuminance (Lux)	Vertical Illuminance (Lux)
1	2.13	3.04	51	0.14	0.01
2	1.14	2.89	52	0.14	0.01
3	6.87	4.36	53	0.14	0.01
4	0.92	0.03	54	0.14	0.01
5	0.09	0.03	55	0.14	0.01
6	0.1	0.03	56	0.14	0.01
7	0.18	0.03	57	0.14	0.01
8	0.03	0.03	58	0.14	0.01
9	0.03	0.03	59	0.14	0.01
10	0.03	0.03	60	0.14	0.01
11	0.03	0.03	61	0.14	0.01
12	0.03	0.03	62	0.14	0.01
13	0.03	0.03	63	0.14	0.01
14	0.03	0.03	64	0.14	0.01
15	0.03	0.03	65	0.14	0.02
16	0.03	0.03	66	0.01	0.02
17	0.03	0.03	67	0.01	0.06
18	0.03	0.03	68	0.05	0.15
19	0.03	0.03	69	0.19	0.73
20	0.03	0.03	70	0.03	0.21
21	1.18	4.4	71	0.07	0.21
22	24.1	32.1	72	0.07	1.86
23	0.03	0.03	73	0.12	1.04
24	0.09	0.03	74	0.16	0.47
25	0.02	0.03	75	0.03	0.07
26	0.09	0.03	76	0.01	0.06
27	0.22	0.03	77	0.02	0.3
28	0.42	0.03	78	0.03	0.1
29	0.94	0.03	79	0.08	0.33
30	0.14	0.03	80	0.01	0.1
31	0.14	0.03	81	0.01	0.1
32	0.14	0.03	82	0.01	0.1
33	0.14	0.03	83	0.01	0.1
34	0.14	0.03	84	0.01	0.1
35	0.14	0.03	85	0.01	0.1
36	0.14	0.03	86	0.01	0.1
37	0.14	0.03	87	0.01	0.09
38	0.14	0.03	88	0.01	0.09
39	0.14	0.03	89	0.01	0.09
40	0.14	0.03	90	0.01	0.09
41	0.14	0.03	91	0.01	0.1
42	0.14	0.03	92	0.03	0.26
43	0.14	0.03	93	0.01	0.05
44	0.14	0.44	94	0.01	0.1
45	0.14	0.01	95	0.06	0.41
46	0.14	0.01	96	17.51	24.3
47	0.14	0.01	97	1.58	4.94
48	0.14	0.01	98	0.01	1.51
49	0.14	0.01	99	0.3	1.58
50	0.14	0.01	100	0.03	0.27

Appendix Six- Indicative Lighting Layout

See separate file: 0904-DFL-LSD-001