

Appendix C

Gilston Village 7 SLMP

Heritage Assessment: Lighting Impact

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Gilston Village 7 SLMP

November 2025

PREPARED FOR

**Taylor
Wimpey**

savills

Document History

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1. Heritage Assessment

- 1.1 Savills Heritage and Townscape has been instructed by Taylor Wimpey to provide built heritage consultancy services in relation to the SLMP for Gilston Village 7, Hertfordshire. The potential impact of floodlighting for the consented Football Hub on relevant heritage assets has been a key consideration during the SLMP development. This document sets out key heritage considerations and impact assessment in relation to this aspect of the SLMP.
- 1.2 The key heritage assets in relation to the Football Hub are:
- Grade I listed Hunsdon House
 - Grade I listed Church of St Dunstan
 - Associated Grade II listed monuments within St Dunstan's Churchyard
- 1.3 In order to inform this assessment of impact, a site visit was undertaken on 24.07.25 to review intervisibility between these assets and the consented Football Hub location, as well as to select suitable viewpoint locations for the production of verified views.
- 1.4 During this site visit the setting and interrelationship between other nearby heritage assets and the location of the consented Football Hub was also reviewed, including the Grade II listed Brickhouse Farm buildings and Hunsdon Brook Fishponds scheduled monument.
- 1.5 The viewpoint locations below were selected following this site visit, and are considered to be the key publicly accessible locations where the proposed Football Hub lighting may have an impact on the setting of relevant heritage assets, with other potential locations from footpaths around the perimeter of Hunsdon House grounds obscured by mature vegetation.



- 1.6 Verified views were produced by visualisation specialists Realm from these three viewpoint locations, and additional photography was also taken from within St Dunstan's Churchyard to demonstrate lack on intervisibility from this location towards the consented Football Hub location.
- 1.7 These verified views and photography are presented within Realm's report below. Two potential scenarios were tested within these views, showing both eastern and western options for the floodlit pitches within the consented Football Hub. Day and night time conditions are shown for each option.
- 1.8 The central pitch option was not tested due to archaeological considerations, though following further discussion with the LPA Archaeological Advisor this is now also considered to be an option for the floodlit pitch location.
- 1.9 As demonstrated by the verified views (fully informed by Hoare Lea's Lighting Assessment) the proposed options for the floodlit pitch locations result in negligible or no visual impact within the wider setting of these heritage assets. This is due to both mature vegetation and the distance between these assets and the consented location of the Football Hub.
- 1.10 The siting of the floodlit pitches in either the eastern or western location is therefore considered to make no meaningful difference to the overall impact of the Football Hub lighting on the setting of these heritage assets, and would result in **no adverse impact or harm** to the significance of these assets by way of a change in their setting. Though not tested, this is also considered to be a reasonable conclusion for the central pitch location based on these views.
- 1.11 Should any adverse impact be found in relation to non-publicly accessible locations within the setting of these heritage assets, this would be **limited in extent** and at the **lowest end of less than substantial harm**, which should be weighed against public benefits of the proposal as per Paragraph 215 of the NPPF.

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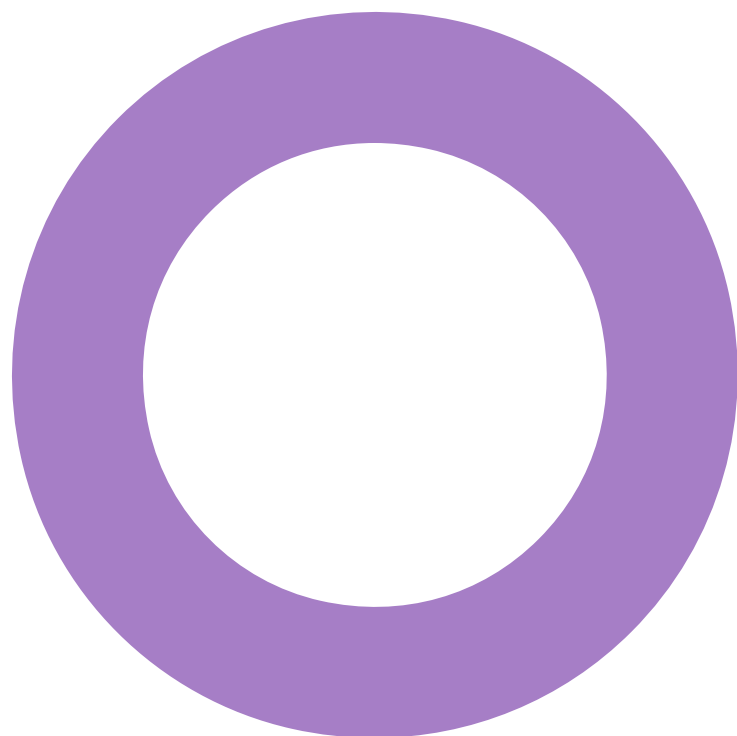
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ENVIRONMENTAL LIGHTING.
LIGHTING IMPACT ASSESSMENT.
16-18084-HRL-ZZ-XX-RP-LD-708001-P01
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Audit sheet.

Rev	Date	Description	Prepared	Verified	Authorised
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Glossary of terms.

- Adaptive lighting: Lighting systems that can adjust their intensity, timing, or colour temperature based on specific needs or conditions. Adaptive lighting can optimize energy efficiency, enhance safety, and minimize light pollution by tailoring the lighting to actual requirements.
- Adverse impact: The negative or detrimental effect that a particular action, development, or policy may have on the environment, community, or stakeholders.
- Ambient lighting: General, overall lighting that provides uniform illumination to a space.
- AONB: Areas of Outstanding Natural Beauty.
- Astronomical twilight: The period before sunrise and after sunset when the sky is dark enough for astronomical observations. Light pollution can significantly impact the visibility of celestial objects during this time.
- Baffle: A mechanical device for the control of luminance (brightness) and light spill. Sometimes referred to as a louvre.
- Beam angle: The angular spread of light emitted by a luminaire. It determines the width of the light beam and is typically measured in degrees.
- Beneficial impact: The positive or advantageous effect that a specific action, development, or policy can have on the environment, community, or stakeholders. (See also magnitude).
- Candela: (cd) is the base unit of luminous intensity in the International System of unit (SI); that is, luminous power per unit solid angle emitted by a point light source in a particular direction.
- CIE, Commission Internationale de l'Eclairage (International Commission on Illumination).
- Colour Rendering Index (CRI): A measure of how accurately a light source reveals the true colours of objects compared to a reference light source. CRI is typically rated on a scale from 0 to 100, with higher values indicating better colour rendering.
- Colour temperature: A measure of the colour appearance of light, expressed in Kelvin (K). Lower colour temperatures represent warmer or more yellowish light, while higher colour temperatures represent cooler or bluish light.
- Curfew times: often referred to as pre or post curfew, typically post curfew is regarded as 11pm, however different times may be applied by the LPA.
- Dark sky reserve: is a public or private land possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, educational, cultural, heritage and/or public enjoyment- see IDA.
- Dimming: The process of reducing the light output of a luminaire. It is often used for adjusting illuminance (lux) levels and saving energy
- Direct sky glow: the direct upward spill of light into the sky, which can cause a 'glowing' effect and is often seen above cities when viewed from a dark area.
- Driver: is the name used to refer to the power supply component for LED lighting systems
- EIA, Environmental Impact Assessment.
- Energy waste: The unnecessary consumption of energy due to poorly designed or inefficient lighting systems.
- Environmental Zones: The characteristics of a locality are defined in ILP GN01. "It is recommended that Local Planning Authorities specify the ...Environmental Zones for exterior lighting control within their Development Plans."
- ES, Environmental Statement.
- Fluorescent: A type of light source that emits light when an electrical current passes through a gas-filled tube, causing the phosphor coating inside the tube to fluoresce.
- Full cut-off luminaire: A type of luminaire that directs all of the light output downward, with no light emitted above the horizontal plane, (ideally below 85 degrees). It is designed to minimize light pollution by eliminating upward light and reducing glare.
- Glare: A visual discomfort caused by excessive brightness or uncontrolled light sources, which can impair visibility and cause discomfort to the eyes.
- Glare control: Measures and design techniques implemented to minimize excessive brightness and glare from lighting sources. These include shielding, diffusing or redirecting light, by selecting the appropriate luminaire.
- High-Intensity Discharge (HID): A type of light source that produces light by passing an electric current through a gas or vapour, such as metal halide or high-pressure sodium lamps. HID lamps are commonly used in streetlights and large commercial spaces.
- IDA, International Dark-Sky Association: is the recognized authority on light pollution and is the leading organization combating light pollution worldwide.
- Illuminance: is calculated as the density of lumen's per unit area and is expressed using lux (lumen's/square meter). Illuminance can be measured using a light meter.
- ILP, Institution of Lighting Professionals.
- Incandescent: A type of light source that produces light by heating a filament inside a bulb until it glows. Incandescent bulbs are less efficient compared to newer lighting technologies.
- Kelvin (K): A unit of measurement for the colour temperature of light. Lower Kelvin values represent warmer or more yellowish light, while higher Kelvin values represent cooler or bluish light.
- LED (Light-Emitting Diode): A semiconductor device that emits light when an electric current passes through it. LEDs are energy-efficient and have a longer lifespan compared to traditional light sources.
- LIA: Light Impact Assessment.
- Lighting master plan: A comprehensive plan that outlines the long-term vision and strategy for lighting within a city, town, or region. It includes guidelines for different types of lighting, such as street lighting, architectural lighting, and landscape lighting, to create a cohesive and sustainable lighting environment.
- Lighting plan: A document or design that outlines the placement, type, and characteristics of luminaires in a specific area of a project. It can include details on the intended lighting levels, distribution, and control strategies.

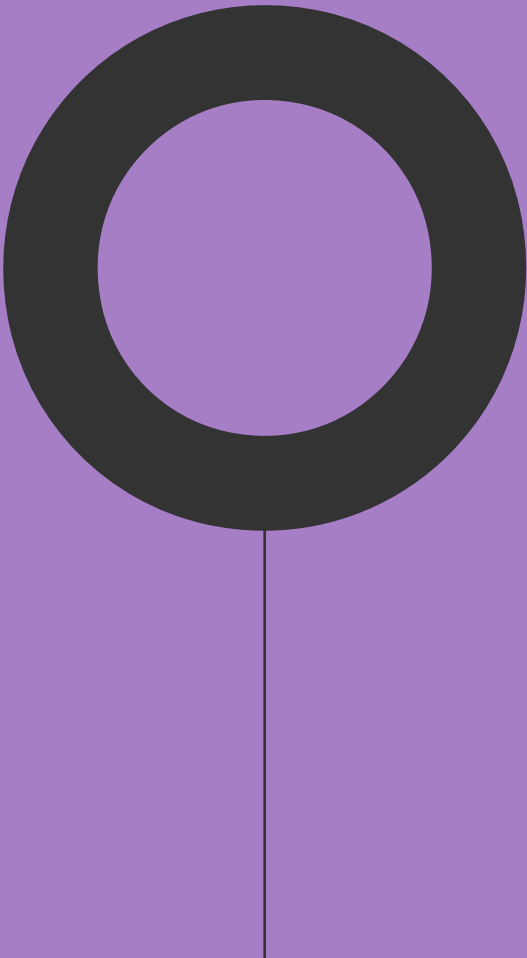
Glossary of terms.

- Lighting retrofit: The process of upgrading or replacing existing lighting systems with more energy-efficient and environmentally friendly alternatives.
- Louvre: A mechanical device for the control of luminance (brightness) and light spill. Sometimes referred to as a baffle.
- LPA: Local Planning Authority.
- Lighting simulation/modelling: The use of computer software or tools to create virtual models and simulations of lighting designs. It helps assess and visualize the expected lighting performance, distribution, and impact of a proposed lighting plan before implementation.
- Light pollution: The excessive or misdirected artificial light produced by human activities that adversely affects the natural darkness of the night sky and interferes with the environment, human health, and astronomical observations.
- Light Spill (vertical and horizontal): the spilling of light beyond the boundary of a property, which may cause nuisance to others.
- Lumen (lm): The unit of measurement for the total amount of visible light emitted by a light source. For example, a 60-watt incandescent bulb provides about 840 lumen's.
- Luminance (cd/m²) is a photometric measure of the luminous intensity per unit area of light travelling in a given direction. It describes the amount of light that passes through, is emitted or reflected from a particular area. This can be measured using a luminance meter but is more often calculated.
- Luminaire: A complete lighting unit that includes a light source, optical control, housing, and any necessary control components such as a driver.
- Lux: is the SI derived unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is equal to one lumen per square metre.
- LVIA: Landscape Visual Impact Assessment.
- Magnitude: refers to the size, extent, or scale of something. It is a measure of the quantity, intensity, or importance of a particular attribute or phenomenon. Usually used in assessing the significance of effects.
- Maintenance factor: usually a percentage is allowed for in lighting calculations to allow for the effects of time on fittings and their surroundings. Light sources, drop in output, fittings and surroundings become dirtier, several factors combine to reduce the amount of light available. A typical maintenance factor would be 70% this would ensure an installation was still meeting required light levels in for example 3 years. For this report a factor of 100% (unity) has been used, that is a day one, worst case scenario.
- Motion sensor: A device that detects motion and triggers the lighting system to turn on or off automatically. It is commonly used for security and energy-saving purposes. (Sometimes referred to as a PIR).
- NTS: Non-Technical Summary (NTS).
- Photometry: is the light intensity and distribution of a luminaire. Luminaire manufacturers should provide electronic photometric data files, which are composed of light quantities and measurements, to illustrate

the performance of a specific luminaire product.

- PIR: Passive Infrared (detector). – See motion sensor.
- Planning condition: A condition imposed on a grant of planning permission (in accordance with the Town and Country Planning Act 1990) or a condition included in a Local Development Order or Neighbourhood Development Order.
- Ramsar sites: Wetlands of international importance, designated under the 1971 Ramsar Convention.
- Receptors: Light sensitive receptors are often sub categorized as - ecological, human, heritage and transport. Different receptors have various degrees of tolerance to increased light levels.
- Scattering: The process by which light is dispersed or deflected in different directions as it interacts with particles or molecules in the atmosphere. Scattering plays a significant role in the formation of sky-glow.
- Shielding: The use of fixtures and design techniques to control the direction of light and minimize its upward or sideways emission. Proper shielding helps reduce light pollution by directing light towards the intended area.
- Sky-glow: The brightening of the night sky caused by scattered and upward-directed artificial light. It reduces visibility of stars, constellations, and other celestial objects.
- SLL: Society of Light and Lighting.
- Site, Proposed Development area, usually denoted by a “red-line” boundary.
- A Site of Special Scientific Interest (SSSI): is a formal conservation designation. Usually, it describes an area that's of particular interest to science due to the rare species of fauna or flora it contains - or even important geological or physiological features that may lie in its boundaries.
- SQM: Sky quality meter, measures the darkness of the night sky in magnitudes per square arcsecond.
- Upward Light Flux (ULF): The total amount of light emitted upward from a luminaires or source. High ULF contributes significantly to light pollution.
- ULR, Upward Light Ratio. Expressed as a percentage of upward light compared to downward light.
- UNESCO, United Nations Educational, Scientific and Cultural Organization.
- Watt (W): A unit of electrical power that measures the rate at which energy is consumed by a light source.
- Wildlife corridor: Areas of habitat connecting wildlife populations.
- Zone of influence (ZOI) refers to the area or region that is affected or influenced by a particular factor, phenomenon, or entity.

1.0 Introduction.



1.0 Introduction.

1.1 Overview.

Hoare Lea (HL) has been commissioned to provide a Lighting Impact Assessment (LIA) for proposed sports pitch lighting scenarios at the development identified as Gilston Village 7.

With reference to the adjacent **Figure 1.1**, which illustrates the approximate scoped areas, HL is delivering and assessing an external lighting design aligned with RIBA Stage 2/early Stage 3. The assessment process includes allowing for a Maintenance Factor (MF) to analyse the effects of dimming the lighting to the required lighting levels. The following scenarios were assessed:

West

Scenario 1a - MF1

Day 1 - worst case scenario, I.E. no control system, no depreciation for LED degradation or dirt etc.

Scenario 1b - MF 0.68

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 200 lux

Scenario 1c - MF 0.26

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 75 lux

East

Scenario 2a - MF1

Day 1 - worst case scenario, I.E. no control system, no depreciation for LED degradation or dirt etc.

Scenario 2b - MF 0.68

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 200 lux

Scenario 2c - MF 0.26

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 75 lux

East - Relocated residential receptors. I.E. moved 10m further from the pitches in a southerly direction

Scenario 3a - MF1

Day 1 - worst case scenario, I.E. no control system, no depreciation for LED degradation or dirt etc.

Scenario 3b - MF 0.68

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 200 lux

Scenario 3c - MF 0.26

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 75 lux

All scenarios will be assessed for light spill (intrusion) and glare in accordance with ILP Guidance Note 01/21 (GN01/21).

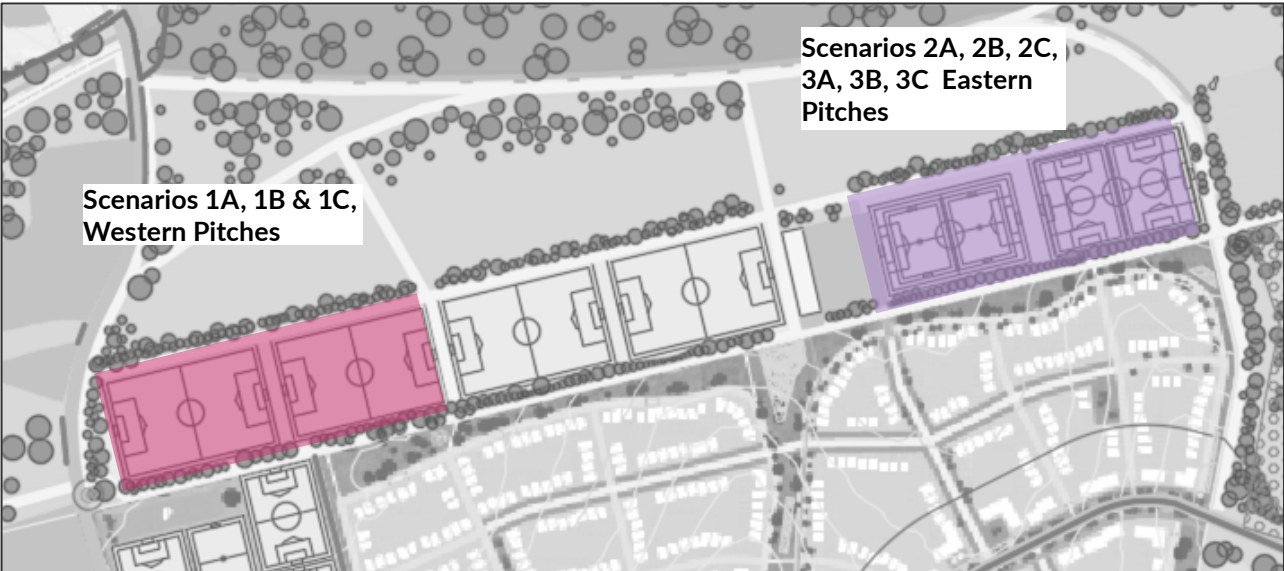


Figure 1.1 Extract from Stantec Drawing RG-LD-03, Rev A. Note, drawing indicates location of Scenario 1A, 1B, 2, 3A, 3B & 4 sports pitches, which will be updated to reflect 2 x full size football pitches.

Purpose of this report

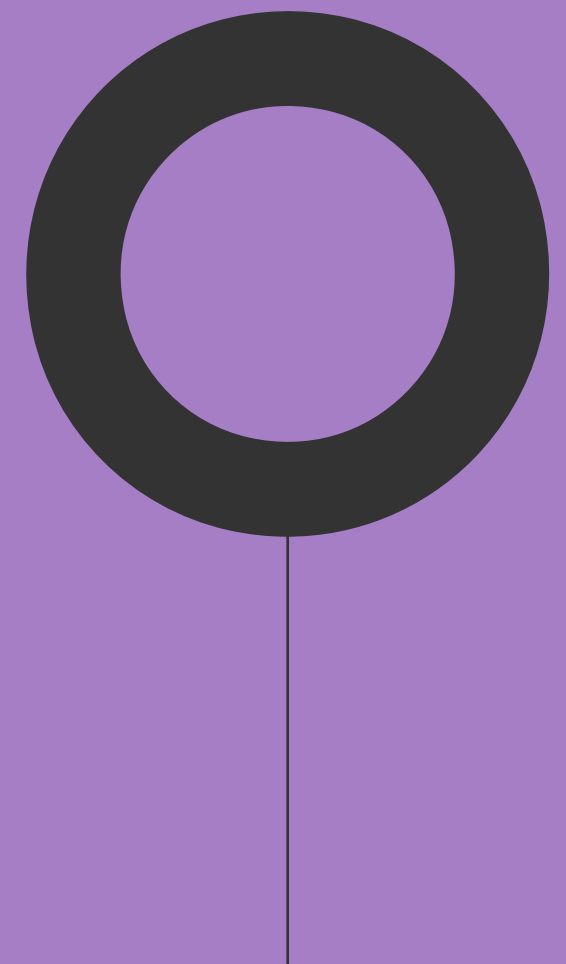
This LIA is based on the core principles outlined in the Institution of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light (GN01/2021).

The report assesses how the proposed sports pitch lighting scenarios may affect the area's illumination profile and identifies potential impacts of Artificial Light at Night (ALAN). Specifically, the assessment focuses on light spill (intrusion) and glare impacts, with particular attention to heritage and residential receptors only.

Competent person

As noted in PLG04 these assessments "should only be undertaken by competent lighting professionals. The educational qualifications, training and experience will need to be summarised." This report has been prepared by Sean Kielthy, a full member of the Society of Light and Lighting (SLL), and an Associate member of the ILP. He has 29 years experience in lighting, spending the last 6 years specifically carrying out environmental lighting impact assessments.

2.0 Obtrusive light standards and guidance.



2.0 Obtrusive light standards and guidance.

2.1 Guidance.

International guidance

Commission Internationale De L'Eclairage (CIE) 150: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (2017 2nd edition)

The purpose of CIE 150 is to aid in formulating guidelines for assessing the environmental effects of exterior lighting and to provide limits for relevant lighting parameters to contain the obtrusive effects obtrusive effects of exterior lighting to tolerable levels. CIE 150 refers to the potentially adverse effects of exterior lighting on both natural and man-made environments.

CIE 126: Guidelines for Minimising Sky Glow (1997)

This gives general guidance for lighting designers and policy makers on the reduction of sky glow. The report gives recommendations about maximum permissible values for exterior lighting installations. These values are regarded as limiting values. Lighting designers should strive to meet the lowest criteria for the design. Practical implementation of the general guidance is left to national regulations.

National guidance

ILP's PLG04: Guidance on Undertaking Environmental Lighting Impact Assessments (2013)

The aim of this guidance is to outline good practice in lighting design and provide practical guidance on the production and assessment of potential lighting impacts from new developments. A key guidance in this document states:

'In cases where the Planning Authority has not set Environmental Zones for its area, the lighting professional may have to make decisions on the nature of the area and explain the reasoning in the LIA. Ensuring that the objective assessment is based on the nature of the area in general and not on the presence of various types and levels of lighting within it, is a crucial step' (highlight by HL).

ILP's GN01/21: Guidance Notes for the Reduction of Obtrusive Light (2021)

This document gives the core, quantitative, guidance for assessing light pollution and offers extra, UK appropriate, information on the topic. In its' introduction it states:

'This Guidance Note supersedes GN01/20 to reflect the changes in international guidance regarding obtrusive light as detailed in CIE 150: 2017 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations. It also considers industry comment regarding the assessment and definition of obtrusive lighting.'

The ILP has proposed lighting guidance and criteria for local authorities with a recommendation that these are incorporated at the local plan level.



Figure 2.1 Cover pages of various guidances on minimising light pollution.

2.0 Obtrusive light standards and guidance.

2.2 Light pollution.

What is light pollution

Light pollution (sometimes referred to as obtrusive light) is the excessive or misdirected use of artificial light produced by human activities that can disrupt the natural darkness of the night sky and can interfere with the environment, ecological and human receptors as well as interfering with astronomical observations by creating sky glow.

As stated in ILP's GN01/21: "Obtrusive light, whether it keeps you awake through a bedroom window, impedes your view of the night sky or adversely affects the performance of an adjacent lighting installation, is a form of pollution. It may also be a nuisance in law and can be substantially mitigated without detriment to the requirements of the task."

GN01/21 sets out acceptable, quantifiable limitations for light pollution based on the Environmental Zone in which a Proposed Development is to be located. These lighting limitations are set out for the following:

- **Light spill** is the spilling of light beyond the boundary of the area being lit and **Light intrusion ('Nuisance')** are all forms of obtrusive light which may cause nuisance to others, or adversely affect fauna and flora as well as waste money and energy. This is measured in illuminance, unit lumens/m² or lux (lighting levels)
- **Glare** is the uncomfortable brightness of a light source, also known as source intensity which is measured in luminance, unit cd/m², when viewed against a darker background
- **Sky glow** is a brightening of the night sky, caused by artificial light directed upwards into the sky from poorly aimed, or installed, luminaires which is measured as a percentage

What is not light pollution

It is not the observation of an artificially lit site from a distance if it complies with current guidance. It is important to understand that the subjective impression of an artificially lit site at night, when there was no prior artificial lighting, does not itself constitute light pollution.

Figure 2.2 illustrates the types of light pollution. Note that the 'Task light' area is **not** regarded as light pollution if it's function is to create a safe and secure environment at night.

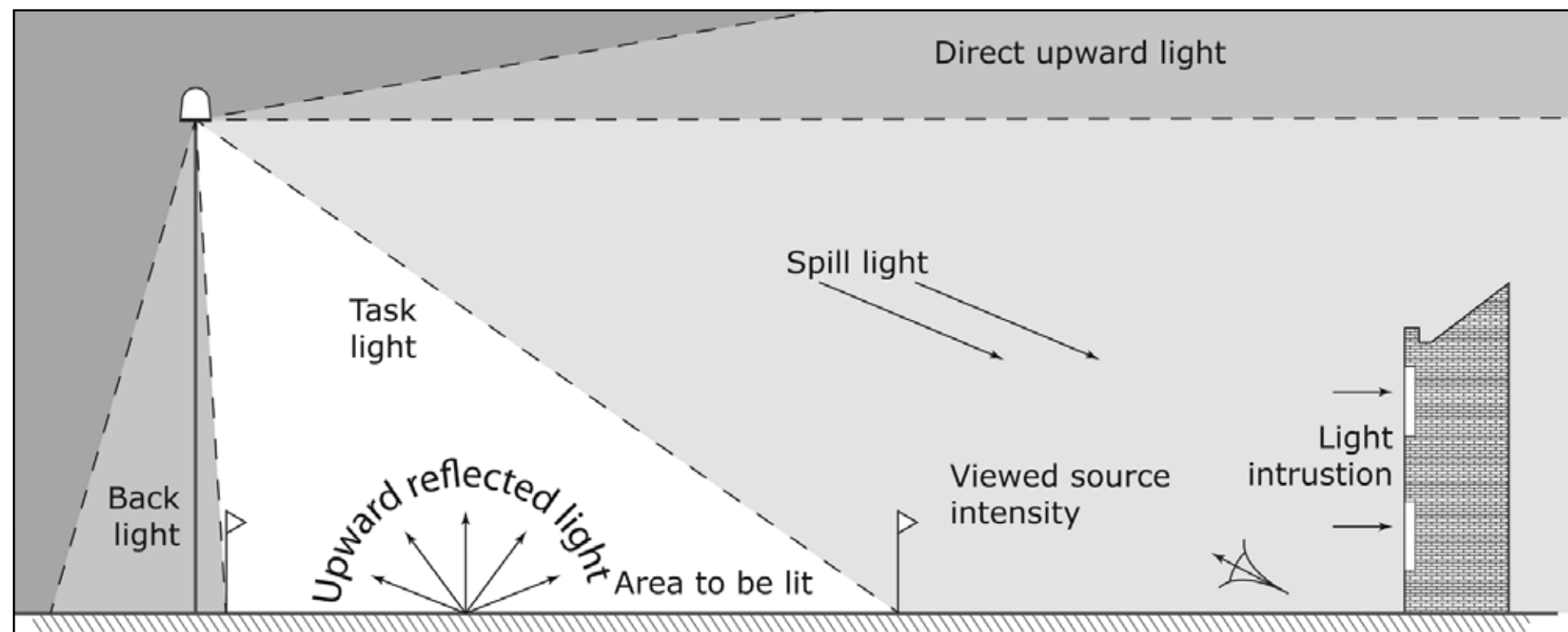


Figure 2.2 Types of light pollution - image from ILP GN01/21.

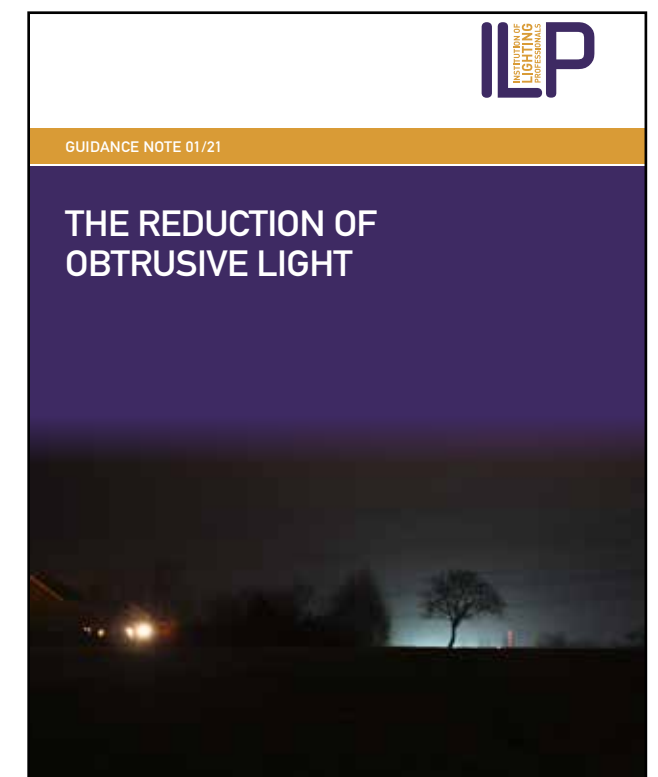


Figure 2.3 Cover page of ILP guidance note GN01/21.

2.0 Obtrusive light standards and guidance.

2.3 Environmental Zones.

Overview

Whilst current legislation (CNEA) covers light pollution issues, it doesn't define the criteria or methodology for classifying the sensitivity of an area in relation to acceptable artificial light at night. This classification is known as an Environmental (E#) Zone. To classify an area and set limits on acceptable light at night, several nationally recognised documents, by the CIE & ILP, can be referenced. Both apply a common environmental zoning system, summarised in **Table 2.1: Environmental Zones** from the ILP's GN01/21 guidance.

The amount of current human activity in an area is the key indicator in classifying an existing zone, as per the definitions in the 'Examples' column below, rather than the amount of artificial light already present in an area to be assessed, as previously highlighted in the PLG04 guidance.

Table 2.1: Environmental Zones (taken from ILP GN/01, 2021 (Table 2))			
Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places.
E1	Natural	Dark (SQM 20 to 20.5+)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~ 15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations.
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations.
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity.

Table 2.1 Environmental Zones notes

1. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.
2. Rural zones under protected designations should use a higher standard of policy.
3. Zone E0 must always be surrounded by an E1 Zone.
4. Zoning should be agreed with the local planning authority and due to local requirements a more stringent zone classification may be applied to protect special/specific areas.
5. SQM (Sky Quality Measurements) referenced by the International Dark-Sky Association (IDA), the criteria for E0 being revised in mid 2019 but not retrospective.
6. Astronomical observable dark skies will offer clearer views of the Milky Way and of other objects such as the Andromeda galaxy and the Orion Nebula.
7. Although values of SQM 20 to 20.5 may not offer clear views of astronomical dark sky objects such as the Milky Way, these skies will have their own relative intrinsic value in the UK.

2.0 Obtrusive light standards and guidance.

2.3 Environmental Zones.

Environmental Zones - adjacent zone consideration

GN01/21 provides guidance on zones that are adjacent to each other. As stated in the introduction to this report, some Survey Locations were visited which do not relate to specific sensitive receptors. The reason for this is so that an exterior lighting design required for the safe and secure use of the Proposed Development, can be assessed to ensure it is not causing light pollution into the wider environment. The guidance stresses that although the Proposed Development site may change the pre development zone categorisation (based on the development type), it should **not** change the existing categorisation of any adjacent zones in its vicinity.

GN 01/21 states: 'Where an area to be lit lies within visual distance of the boundary between two zones then the obtrusive light values applicable to the most rigorous zone shall apply. Figure 5 (shown in **Figure2.4** below) demonstrates this. For an observer located within or at the boundary of a more rigorous zone (E(X-1)) compared to the adjacent less rigorous zone (E(X)) then when the observer faces the less rigorous zone they will only be exposed to obtrusive lighting level pertinent to the zone within which they are located'.

Figure 2.5 provides a graphical representation of the statement above, in three scenarios, A, B and C.

Scenario A shows two neighbouring baseline condition E1 zones, with the one on the left proposing the development of a distribution centre. A survey location (SL) is shown in the adjacent zone, on the right. This SL records the existing lighting levels (lux) in that zone. Scenario B shows that if the proposal is approved, then it is likely that the E1 on the left (where the proposed distribution centre will be developed), will change to an E3 zone. However, in order to follow the guidance, the lighting design must be assessed and ideally show that any adjacent zone to the Proposed Development will not experience quantitative values above those acceptable to its existing categorisation. Scenario C shows however, should light pollution from the Proposed Development impact the adjacent zone, then measures must be set out to mitigate the aspects of light pollution impacting the zone. In order to clarify the GN01/21 requirements, lighting levels (lux) may be collected at a range of Survey Locations, other than those identified as sensitive receptors, and included in this BLS for quantitative assessment later.

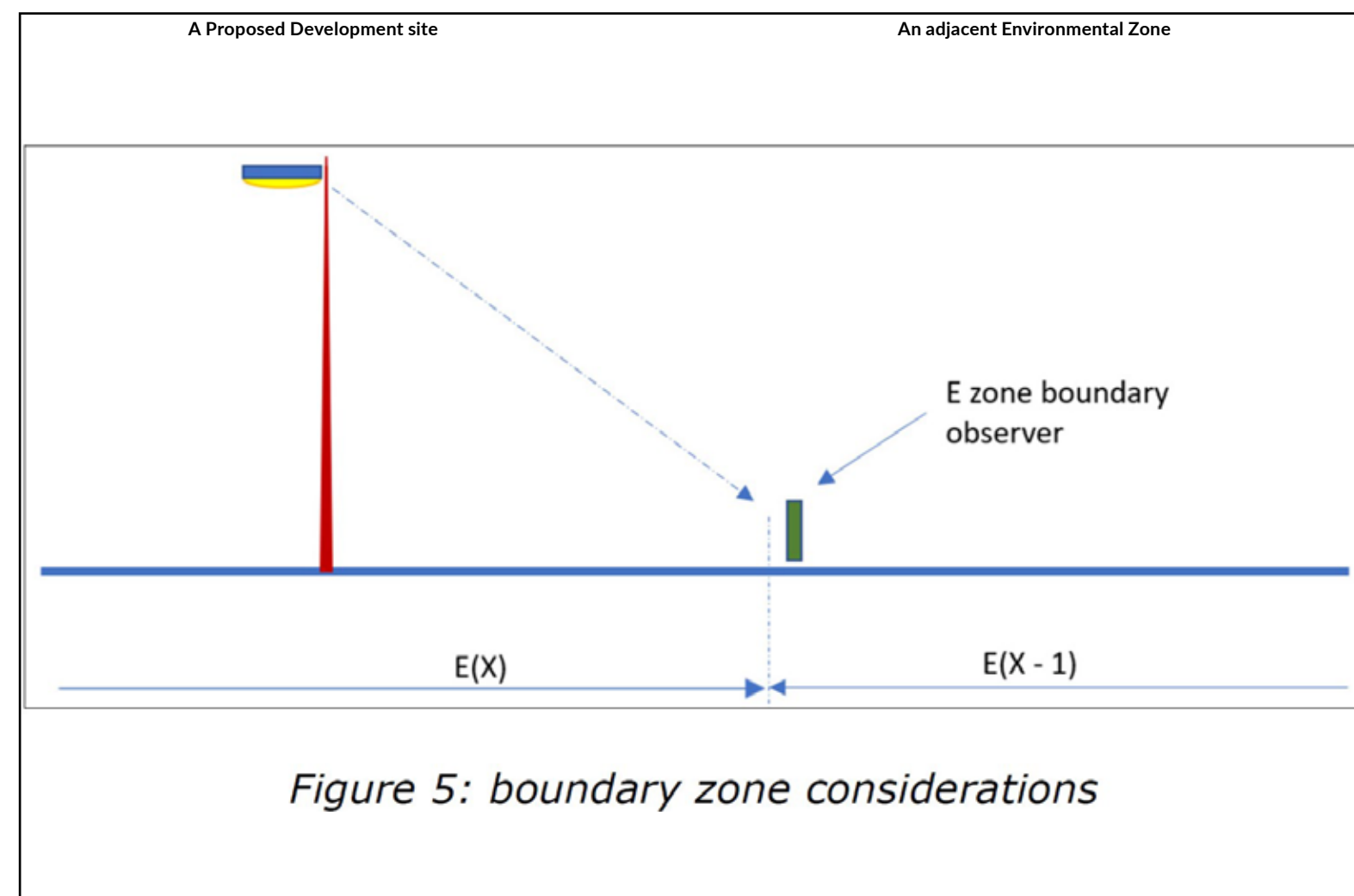


Figure 2.4 Extract from ILP guidance note GN01/21 - Figure 5

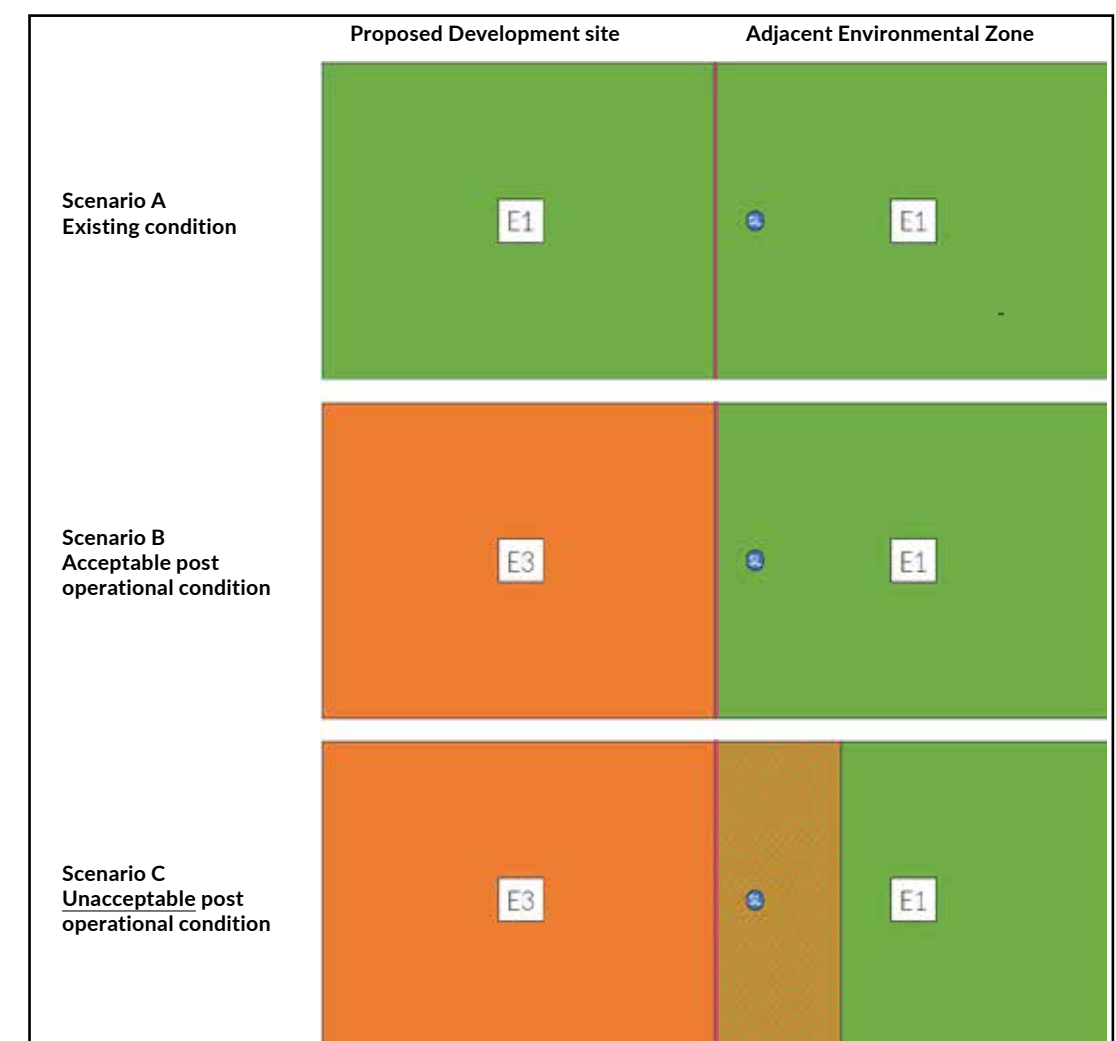


Figure 2.5 Diagram showing adjacent Environmental Zones, with survey location on boundary (SL) pre and post planning permission and site operational

2.0 Obtrusive light standards and guidance.

2.4 Light pollution guidance for residential.

Overview

To avoid intrusion or nuisance lighting to residential properties the ILP's GN01/21 provides threshold limits for maximum permitted light spill (**Table 2.2: Maximum values of vertical lighting levels on premises**) and visible glare (**Table 2.3: Limits for the luminous intensity of bright luminaires**) on the windows of nearby dwellings, or potential dwelling, the limits varying depending on the Environmental Zone in which the receptor is located.

It should be noted the guidance also states: 'These notes are intended as guidance only and the application of the values given in the various tables should be given due consideration along with all other factors in the lighting design. Lighting is a complex subject with both objective and subjective criteria to be considered. The notes are therefore no substitute for professionally assessed and designed lighting, where the various and maybe conflicting visual requirements need to be balanced'.

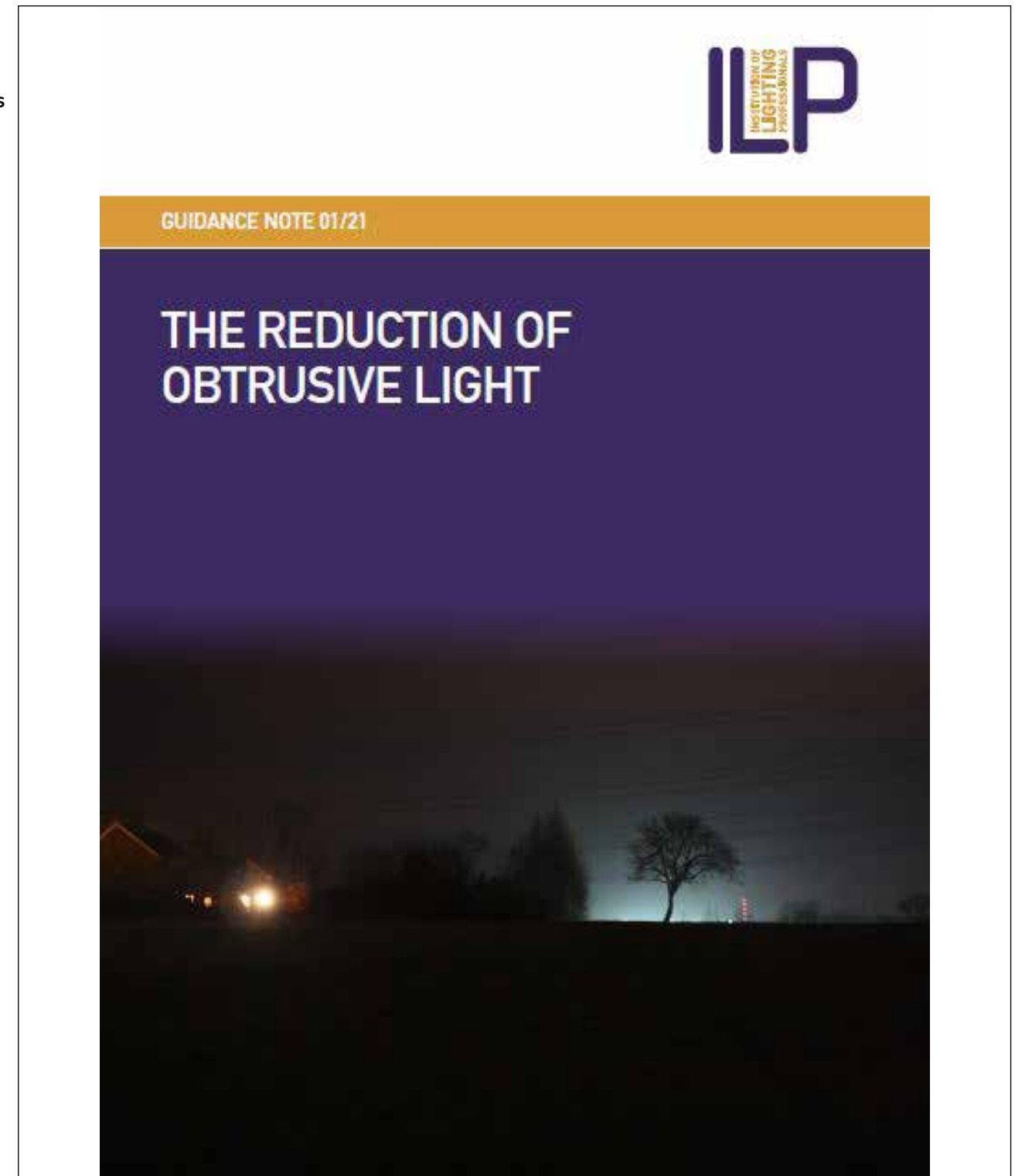


Figure 2.6 Cover page of ILP guidance note GN01/21.

2.0 Obtrusive light standards and guidance.

2.4 Light pollution guidance for residential, natural (sky) and transport receptors.

Residential receptors - light spill

Taken from the GN01/21 the thresholds for permitted spill light onto windows is shown in **Table 2.2 Maximum values of vertical lighting levels on premises**, the maximum value being the summation of all lighting installations. On the issue of curfew times GN01/21 states: *'Depending upon application curfew times often commence between 21:00 to 23:00 and may run until 07:00'*. Further BS EN 12464-2: 2014 Light and Lighting at work places (BSI, 2014) states the following with regard to obtrusive light, pre and post curfew regulations, *'In case no curfew regulations are available, the higher values shall not be exceeded and the lower values should be taken as preferable limits'*.

Table 2.2: Maximum values of vertical lighting levels on premises. (Taken from ILP GN/01, 2021 (Table 3)).						
Light technical parameter	Application conditions	Environmental Zone				
		E0	E1	E2	E3	E4
Lighting level on the vertical plane (Ev)	Pre-curfew	n/a	2 lux	5 lux	10 lux	25 lux
	Post-curfew	n/a	<0.1 lux*	1 lux	2 lux	5 lux
Note: * If the installation is for public (road) lighting then this may be up to 1 lux.						

Finally GN01/21 also state that; 'Table 3 [Table above in this document] can also be considered for the management of spill light; however, designers must consider the task performance requirements of any adjacent lit areas and ensure that any spill light does not adversely affect these performance parameters as this could affect their safe use. This may result in a need to minimise spill and intrusive lighting values to less than might be expected for the Environmental Zone within which the installation lies'.

Table 2.2 Maximum values of vertical lighting levels on premises notes

1. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.
2. Rural zones under protected designations should use a higher standard of policy.
3. Zone E0 must always be surrounded by an E1 Zone.
4. Zoning should be agreed with the local planning authority and due to local requirements a more stringent zone classification may be applied to protect special/specific areas.
5. SQM (Sky Quality Measurements) referenced by the International Dark-Sky Association (IDA), the criteria for E0 being revised in mid 2019 but not retrospective.
6. Astronomical observable dark skies will offer clearer views of the Milky Way and of other objects such as the Andromeda galaxy and the Orion Nebula.
7. Although values of SQM 20 to 20.5 may not offer clear views of astronomical dark sky objects such as the Milky Way, these skies will have their own relative intrinsic value in the UK.

2.0 Obtrusive light standards and guidance.

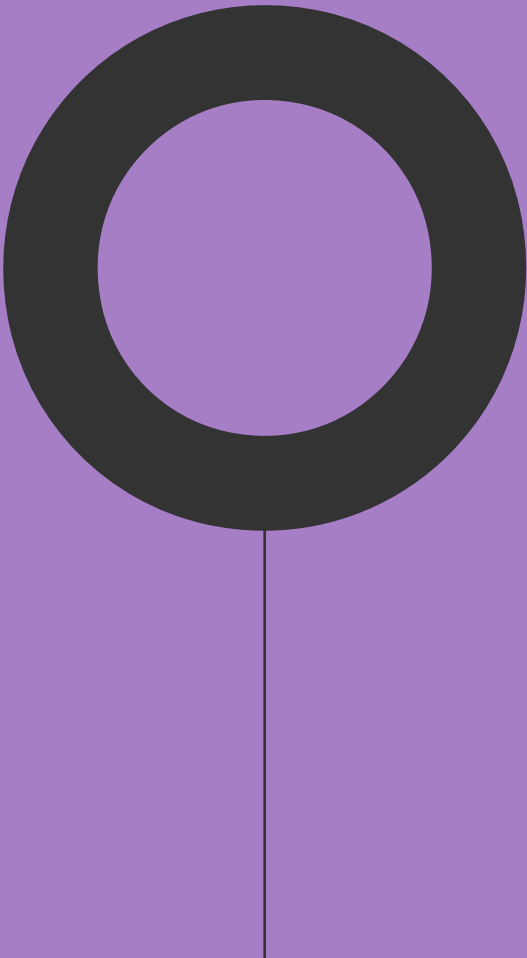
2.4 Light pollution guidance for residential, natural (sky) and transport receptors.

Residential receptors - luminous intensity (glare)

The limits for the luminous intensity (glare) of luminaires are dependent on the viewing distance *d* (between the observer and the bright luminaire(s)) and the projected area *Ap*, of the bright part of the luminaire in the direction of the observer. The table below from ILP GN01/21 gives values for luminous intensity of bright luminaires.

Table 2.3: Limits for the luminous intensity of bright luminaires - (CIE 150 table 3 (amended)): (Taken from ILP GN/01, 2021 (Table 4)).							
Light technical parameter	Application conditions	Luminaire group (projected area <i>Ap</i> in m2)					
		0< <i>Ap</i> ≤0.002	0.002< <i>Ap</i> ≤0.01	0.01< <i>Ap</i> ≤0.03	0.03< <i>Ap</i> ≤0.13	0.13< <i>Ap</i> ≤0.50	<i>Ap</i> >0.5
Maximum luminous intensity emitted by luminaire (<i>I</i> in cd)	E0						
	Pre-curfew	0	0	0	0	0	0
	Post-curfew	0	0	0	0	0	0
	E1						
	Pre-curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.30 <i>d</i>	2.50 <i>d</i>	5.10 <i>d</i>	2,500
	Post-curfew	0	0	0	0	0	0
	E2						
	Pre-curfew	0.57 <i>d</i>	1.30 <i>d</i>	2.50 <i>d</i>	5.00 <i>d</i>	10.00 <i>d</i>	7,500
	Post-curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.30 <i>d</i>	2.50 <i>d</i>	5.10 <i>d</i>	500
	E3						
	Pre-curfew	0.86 <i>d</i>	1.90 <i>d</i>	3.80 <i>d</i>	7.50 <i>d</i>	15.00 <i>d</i>	10,000
	Post-curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.30 <i>d</i>	2.50 <i>d</i>	5.10 <i>d</i>	1,000
	E4						
	Pre-curfew	1.40 <i>d</i>	3.10 <i>d</i>	6.30 <i>d</i>	13.00 <i>d</i>	26.00 <i>d</i>	25,000
	Post-curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.30 <i>d</i>	2.50 <i>d</i>	5.10 <i>d</i>	2,500
Aid to gauging <i>Ap</i>		2 to 5 cm	5 to 10cm	10 to 20 cm	20 to 40 cm	40 to 80 cm	>80 cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding <i>Ap</i> representative area (m2)		0.0008	0.004	0.016	0.063	0.251	>0.5
Notes:							
1. <i>d</i> 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. <i>Ap</i> is the apparent surface of the light source seen from the observer position.							
4. For further information refer to Annex C of CIE 150.							
5. Upper limits for each zone shall be taken as those with column <i>Ap</i> >0.5.							

3.0 Methodology.



3.1 Assessment locations

To assess the impact of proposed sports lighting scenarios, the following locations have been selected based on their close proximity to the Site.

The assessment locations for this report are shown in the adjacent **Figure 3.1 & 3.2** with descriptions provided below:

Figure 3.1 shows:

Heritage receptors (V1-V2)

Grade I listed buildings at both St. Dunstan’s Church and Hundson House.

Potential future residential receptors (V3-V31)

Potential future residential dwellings in proximity to the Proposed Development based on client information.

The location of the eastern residential receptors (V16-V31) were relocated approximately 10 metres away from the Site in Scenarios 3A, 3B and 3B.

Figure 3.2 shows:

Heritage receptors (V1-V2)

Grade I listed buildings at both St. Dunstan’s Church and Hundson House.

Potential future residential receptors (V3-V31)

Potential future residential dwellings in proximity to the Proposed Development based on client information (V3 -V15). The location of the eastern residential receptors (V16-V31) were relocated approximately 10 metres away from the pitches (in a southerly direction) in Scenarios 3A, 3B and 3B.

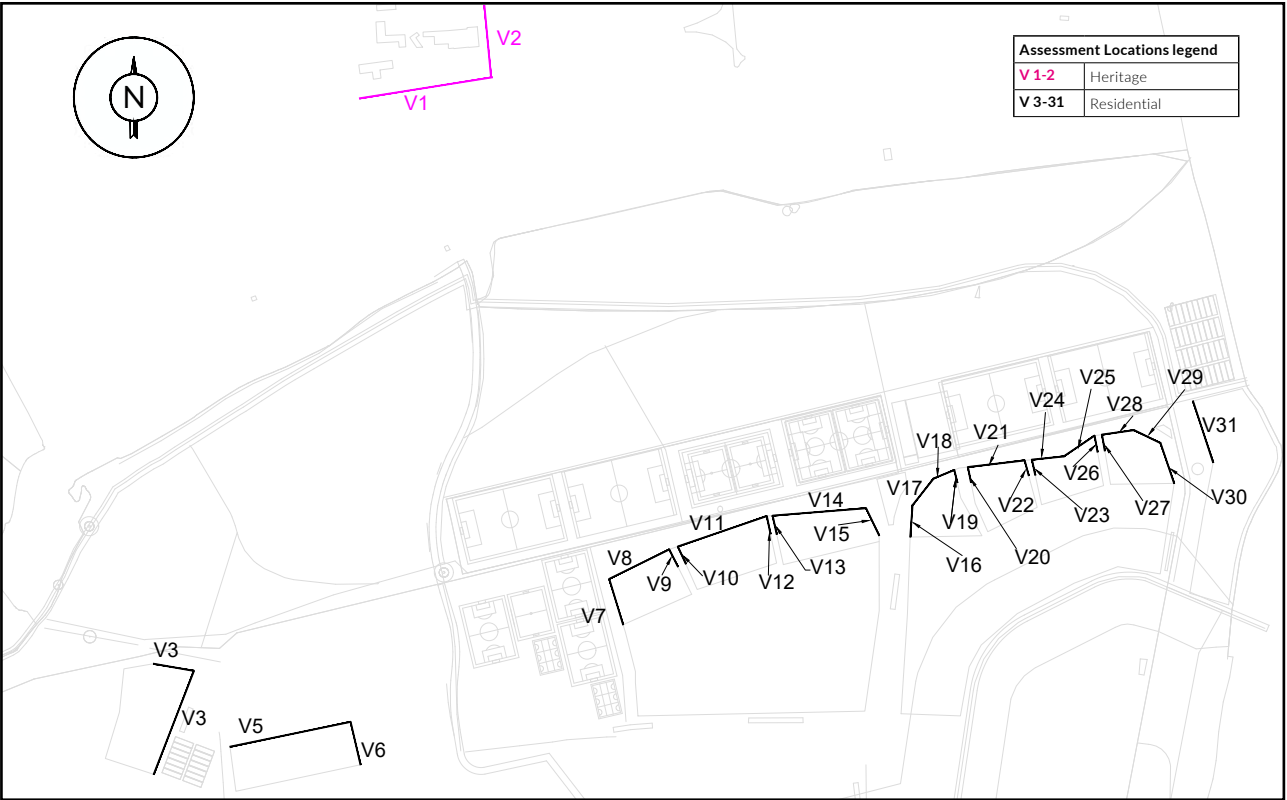


Figure 3.1 Aerial map showing all Assessment Locations.

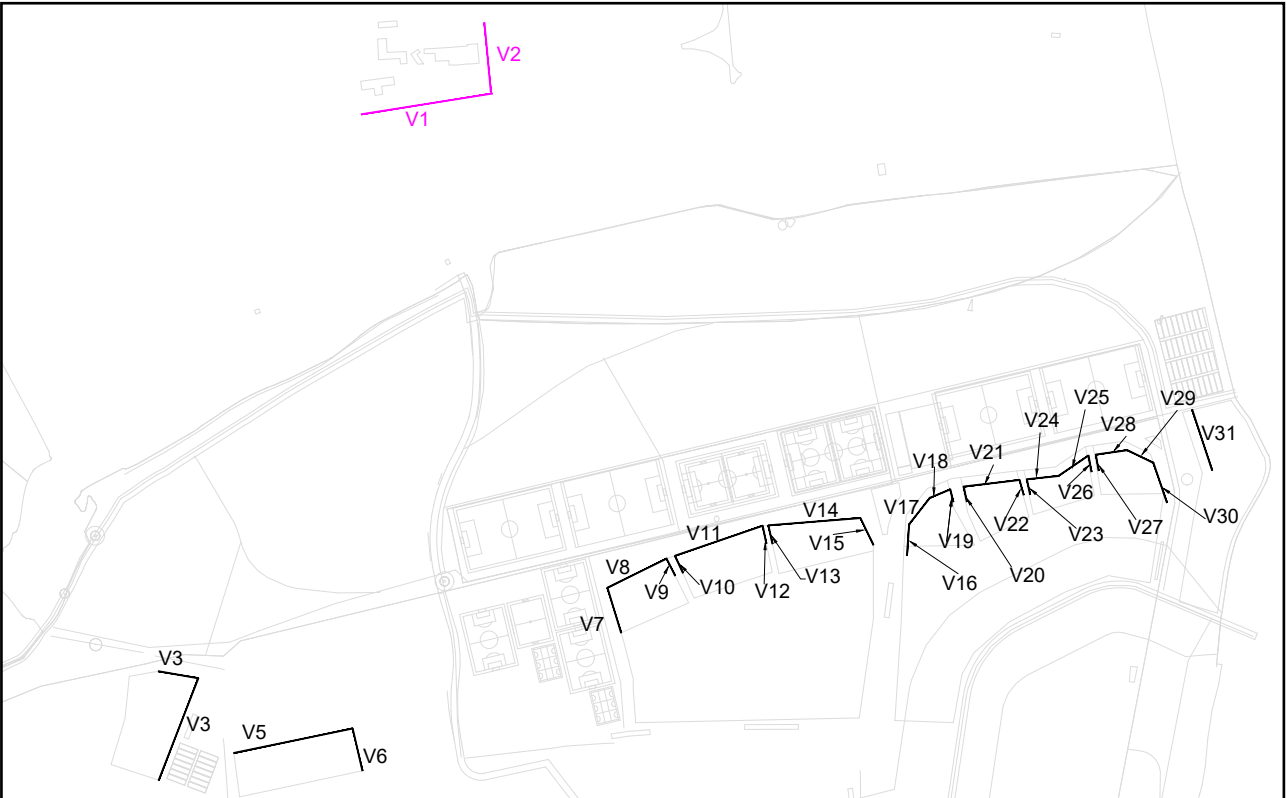


Figure 3.2 Aerial map showing all Assessment Locations. The location of the eastern residential receptors (V16-V31) were relocated approximately 10 metres away from the pitches (in a southerly direction).

3.0 Methodology.

3.2 Lighting design methodology.

External Lighting.

The client has requested HL create nine sport pitch lighting design scenario's based on conversations with Sport England:

West

Scenario 1A - MF1

Day 1 - Worst case scenario, I.E. no control system, no depreciation for LED degradation or dirt etc.

Scenario 1B - MF 0.68

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 200 lux

Scenario 1C - MF 0.26

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 75 lux

East

Scenario 2A - MF1

Day 1 - Worst case scenario, I.E. no control system, no depreciation for LED degradation or dirt etc.

Scenario 2B - MF 0.68

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 200 lux

Scenario 2C - MF 0.26

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 75 lux

East - Relocated residential receptors. I.E. moved 10m further from the pitches in a southerly direction

Scenario 3A - MF1

Day 1 - Worst case scenario, I.E. no control system, no depreciation for LED degradation or dirt etc.

Scenario 3B - MF 0.68

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 200 lux

Scenario 3C - MF 0.26

Sport England lighting specification met (to include optics optimisation and backshields). Target average luminance level 75 lux

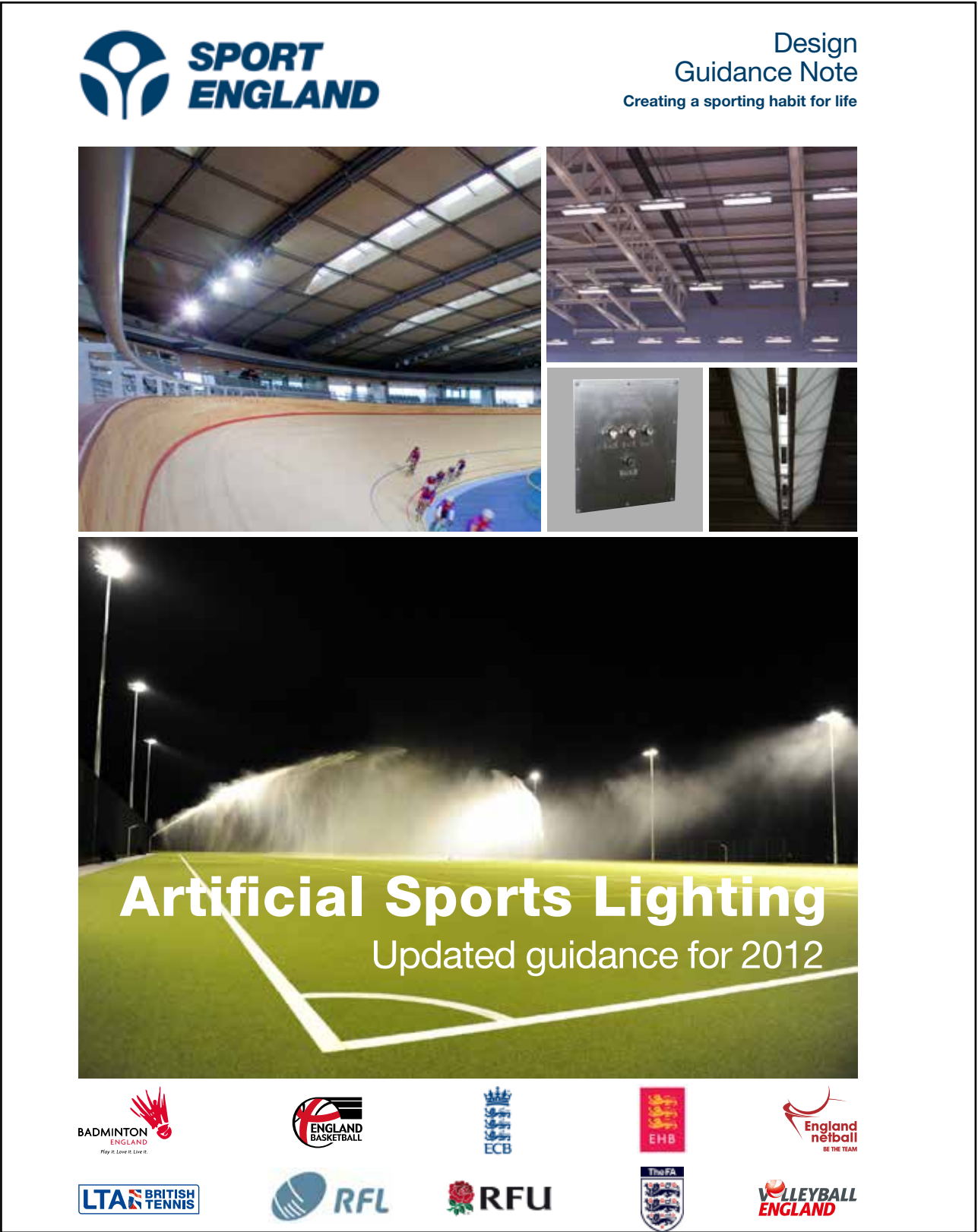


Figure 3.2 Cover pages of various guidances on lighting design.

3.0 Methodology.

3.3 IIP Assessment methodology.

Calculation modelling methodology

To enable accurate assessment of the lighting design for each scenario, the following criteria are used to set out the parameters for the calculation model.

- The lighting on the site was modelled utilising the lighting calculation software AGI32. The accuracy of the software has been proven in independent testing as per the requirements of ‘CIE 171:2006 Test Cases to Assess the Accuracy of Lighting Computer Programs’. However, no current software or methodology is able to guarantee exact replication of real-world lighting conditions. Recipients may not rely on the results of lighting software calculations conducted by Hoare Lea and reproduced in this report.
- The site was modelled as a flat level plain, within and around the site there are no significant changes in topography.
- Scenarios 1A, 2A and 3A are MF 1 calculations, which represent the maximum adverse condition at initial installation – i.e. the “day one” lumen output of the luminaires, with no allowance for cleaning or light source depreciation. It has been assumed that all the external lighting is operational simultaneously for the relevant pre or post curfew operational condition (i.e. a maximum adverse scenario).
- Scenario 1B, 2B and 3B maintained average luminance of 200lux. Scenario 1C, 2C, 3C maintained average luminance of 75lux. These scenarios include calculations based on maintenance factors (MF) of 0.68 and 0.26. The MF 0.68 and 0.26 calculations reflect a dimming control regime.
- The calculation includes direct illumination (light emitted from a luminaire directly to a position) and indirect illumination (light reflected from the ground or building surfaces.) This method generates more accurate results particularly with regard to vertical receptor locations.
- Ground surface reflectance was taken as 22% based on data from CIBSE LG11: Surface Reflectance and Colour. This is an Area Weighted Reflectance based on typical surfaces and natural landscaping.
- The calculation does not account for atmospheric attenuation. The atmosphere (air) will absorb light particularly at extended distances.
- As per standard industry practice to demonstrate a reasonable worst case scenario, existing planting and trees have not been included within the assessment calculations. As such they are excluded from the calculation and assessment process. The presence of vegetation may act as screens, lowering light spill in real life conditions.

The data created by the model is assessed against relevant guidelines in **Section 5.0 Illumination Impact Profile** of this report.

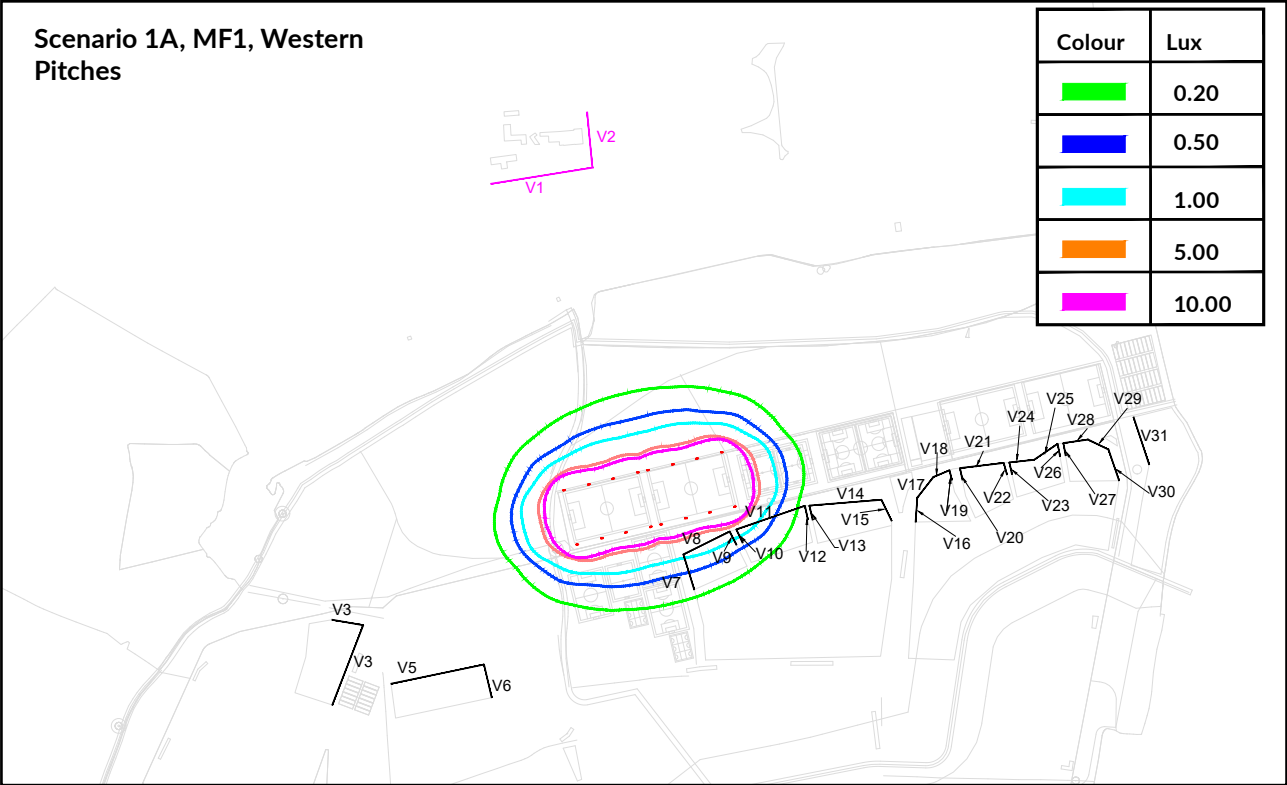


Figure 3.3 Scenario 1A MF 1 achieving ave 298lux. Aerial view showing lighting level isolines as per the BCT/ILP guidance note 08/23 “Bats and artificial lighting at night” 0.2 lux to 10 lux at ground level.

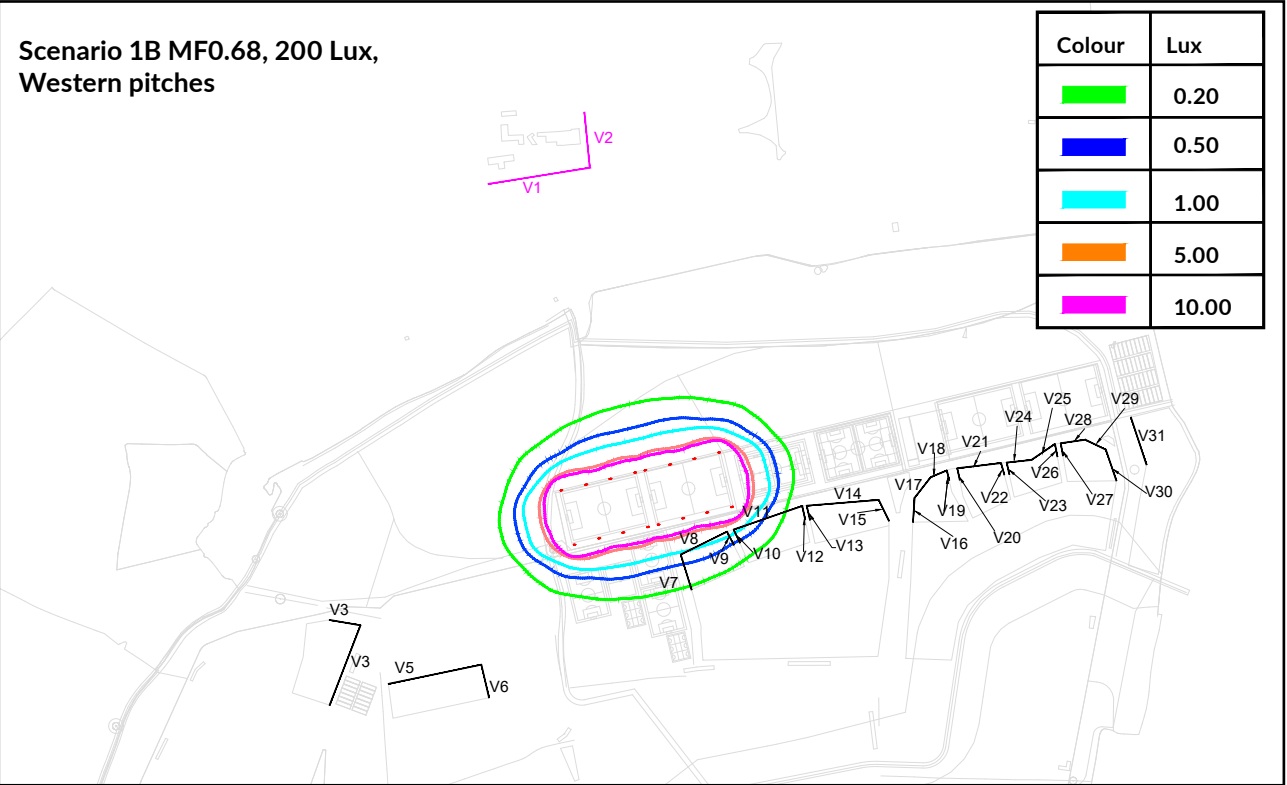
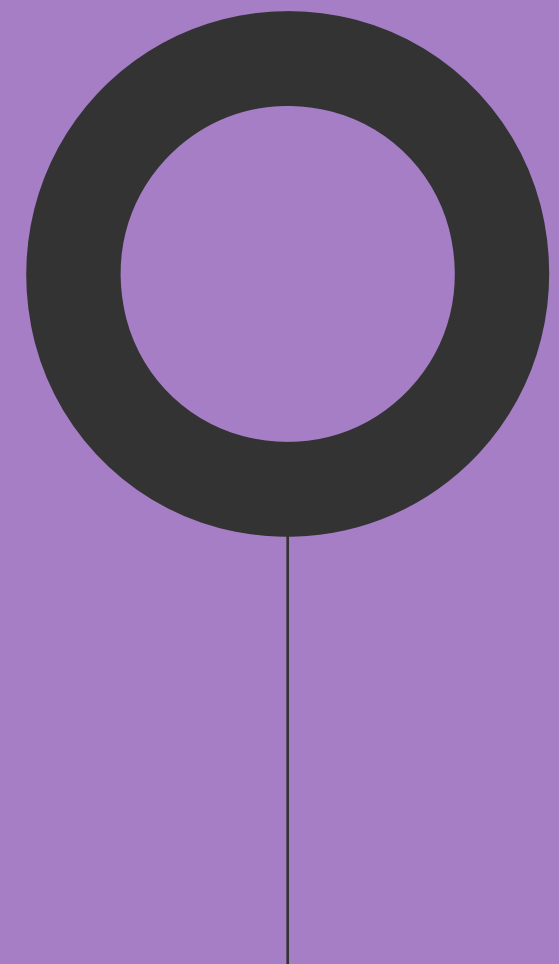


Figure 3.4 Scenario 1B MF 0.68 achieving ave 200lux. Aerial view showing lighting level isolines as per the BCT/ILP guidance note 08/23 “Bats and artificial lighting at night” 0.2 lux to 10 lux at ground level.

4.0 Sports pitch lighting concept design.



4.0. Sports pitch lighting concept design

4.1 Sports pitch - Scenario 1A, 1B & 1C

Concept design layout

Figure 4.1 presents a conceptual luminaire layout for sports pitch lighting on the western site, using eight 15 metre columns, each fitted with three luminaires.



Figure 4.1 Plan view showing external lighting layout.

4.0. Sports pitch lighting concept design

4.2 Sports pitch - Scenario 2A, 2B, 2C, 3A, 3B, 3C

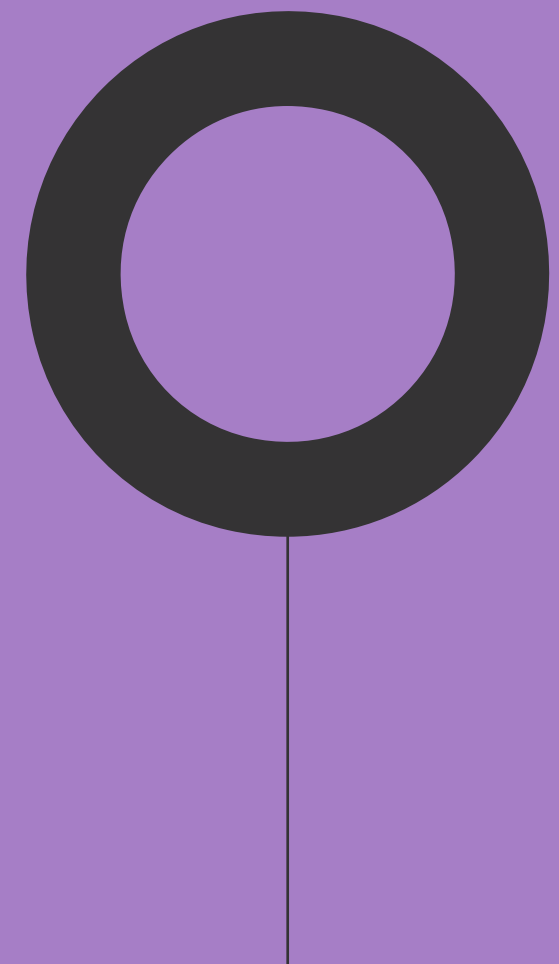
Concept design layout

Figure 4.2 presents a conceptual luminaire layout for sports pitch lighting on the eastern site, using eight 15 metre columns, each fitted with three luminaires.



Figure 4.2 Plan view showing external lighting layout.

5.0 Illumination Impact Profile.



5.0 Illumination Impact Profile.

5.1 Calculation results - Scenario 1A: Target average illuminance 200lux - Achieved average illuminance 298lux

Horizontal light spill results - Maintenance Factor 1

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

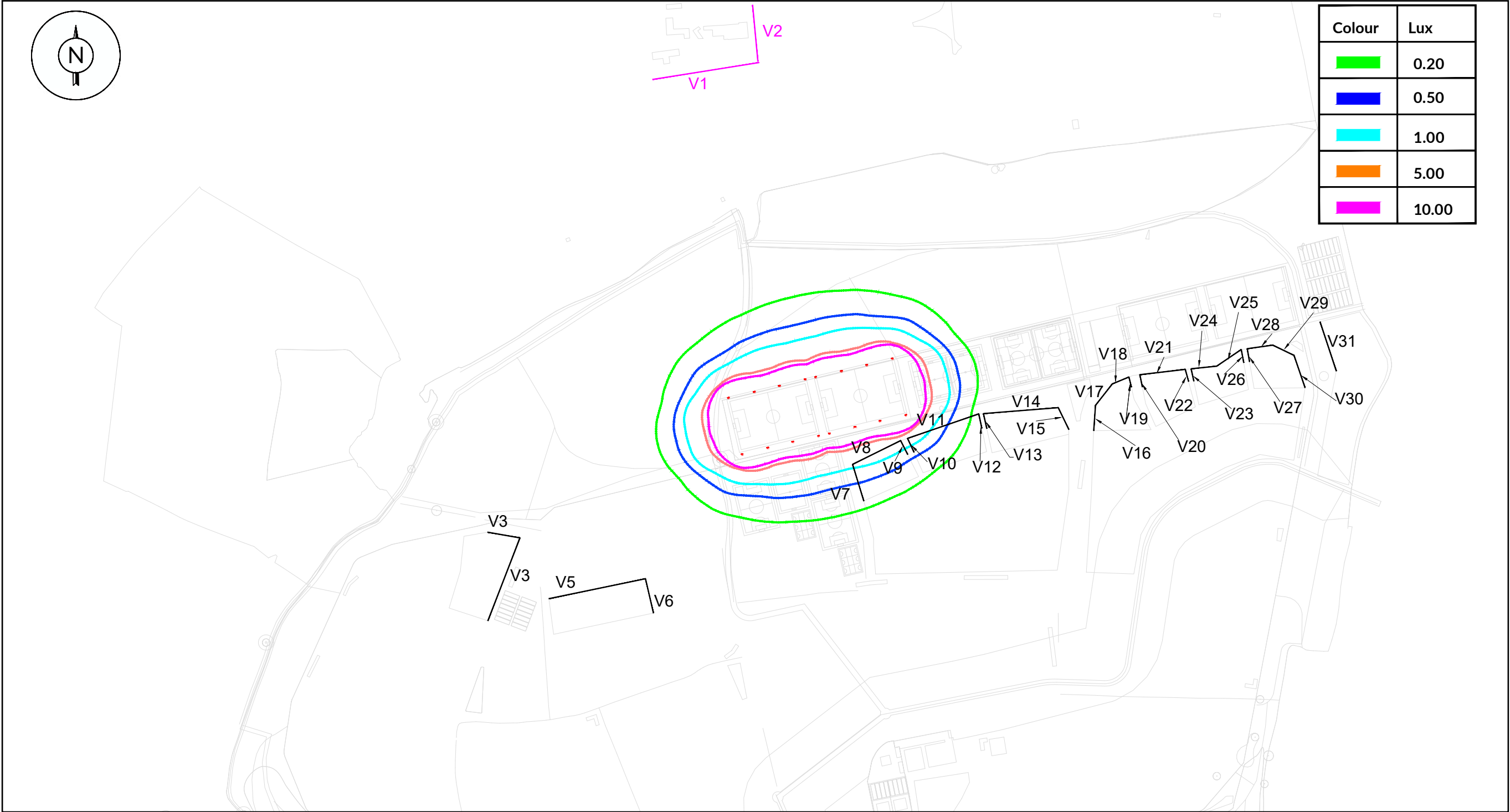


Figure 5.1 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.1 Calculation results - Scenario 1A: Target average Illuminance 200 lux - Achieved average illuminance 298 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 1

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.1 Assessment locations- vertical assessment - MF 1							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0.00	PASS	PASS
V2	Heritage	E2	5	1	0.00	PASS	PASS
V3	Residential	E3	10	2	0.00	PASS	PASS
V4	Residential	E3	10	2	0.00	PASS	PASS
V5	Residential	E3	10	2	0.00	PASS	PASS
V6	Residential	E3	10	2	0.00	PASS	PASS
V7	Residential	E3	10	2	2.00	PASS	FAIL
V8	Residential	E3	10	2	11.00	FAIL	FAIL
V9	Residential	E3	10	2	2.00	PASS	FAIL
V10	Residential	E3	10	2	3.00	PASS	FAIL
V11	Residential	E3	10	2	9.00	PASS	FAIL
V12	Residential	E3	10	2	0.00	PASS	PASS
V13	Residential	E3	10	2	1.00	PASS	PASS
V14	Residential	E3	10	2	0.00	PASS	PASS
V15	Residential	E3	10	2	0.00	PASS	PASS
V16	Residential	E3	10	2	0.00	PASS	PASS
V17	Residential	E3	10	2	0.00	PASS	PASS
V18	Residential	E3	10	2	0.00	PASS	PASS
V19	Residential	E3	10	2	0.00	PASS	PASS
V20	Residential	E3	10	2	0.00	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.1 Calculation results - Scenario 1A: Target average illuminance 200 lux - Achieved average illuminance 298 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 1

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.1 Assessment locations- vertical assessment - MF 1							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Heritage	E3	10	2	0.00	PASS	PASS
V22	Heritage	E3	10	2	0.00	PASS	PASS
V23	Residential	E3	10	2	0.00	PASS	PASS
V24	Residential	E3	10	2	0.00	PASS	PASS
V25	Residential	E3	10	2	0.00	PASS	PASS
V26	Residential	E3	10	2	0.00	PASS	PASS
V27	Residential	E3	10	2	0.00	PASS	PASS
V28	Residential	E3	10	2	0.00	PASS	PASS
V29	Residential	E3	10	2	0.00	PASS	PASS
V30	Residential	E3	10	2	0.00	PASS	PASS
V31	Residential	E3	10	2	0.00	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.2 Calculation results - Scenario 1B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Horizontal light spill results - Maintenance Factor 0.68

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.'

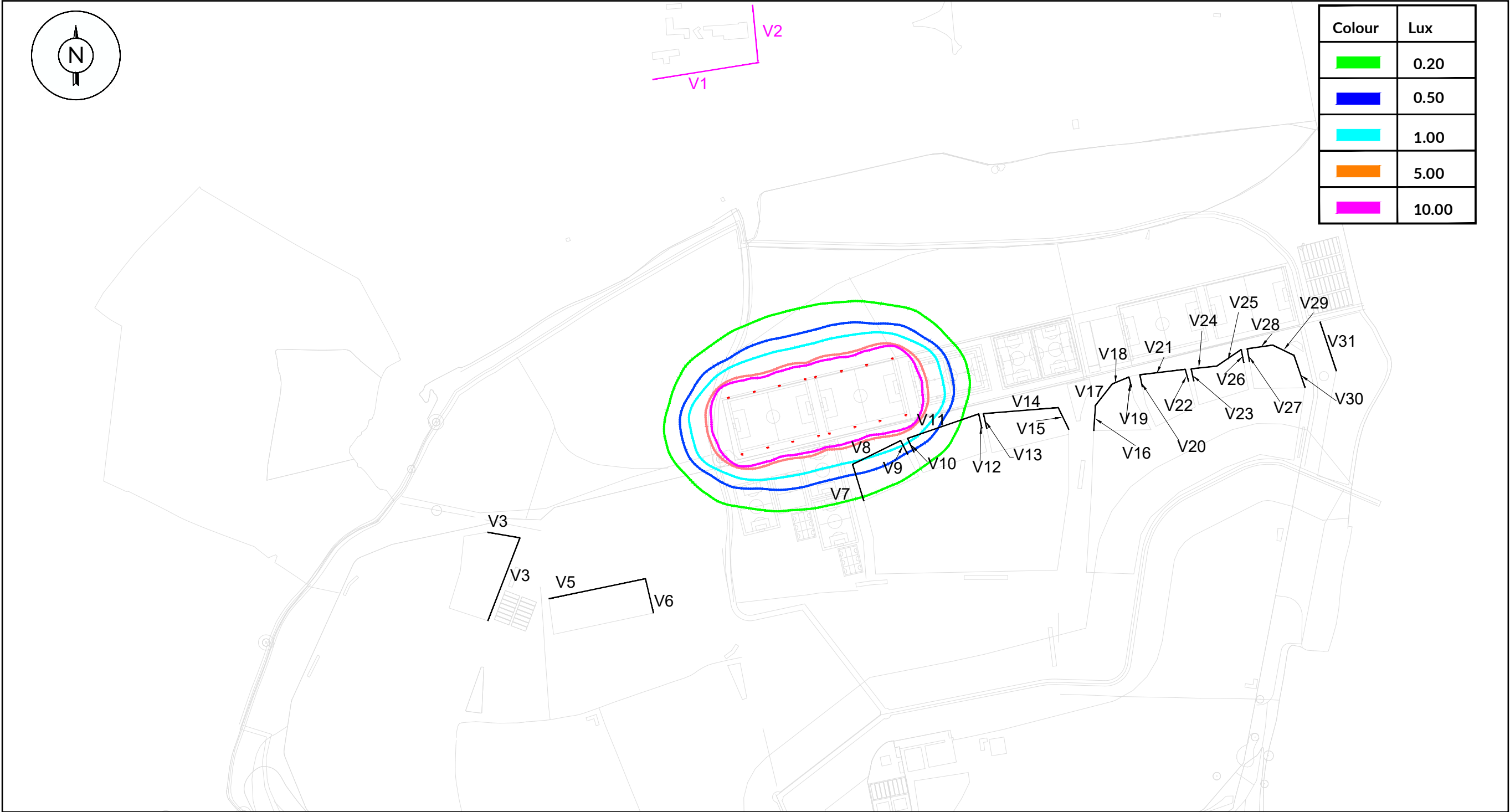


Figure 5.2 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.2 Calculation results - Scenario 1B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.68

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.2 Assessment locations- vertical assessment - MF 0.68							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0.00	PASS	PASS
V2	Heritage	E2	5	1	0.00	PASS	PASS
V3	Residential	E3	10	2	0.00	PASS	PASS
V4	Residential	E3	10	2	0.00	PASS	PASS
V5	Residential	E3	10	2	0.00	PASS	PASS
V6	Residential	E3	10	2	0.00	PASS	PASS
V7	Residential	E3	10	2	1.00	PASS	PASS
V8	Residential	E3	10	2	7.00	PASS	PASS
V9	Residential	E3	10	2	1.00	PASS	PASS
V10	Residential	E3	10	2	2.00	PASS	PASS
V11	Residential	E3	10	2	6.00	PASS	FAIL
V12	Residential	E3	10	2	0.00	PASS	PASS
V13	Residential	E3	10	2	1.00	PASS	PASS
V14	Residential	E3	10	2	0.00	PASS	PASS
V15	Residential	E3	10	2	0.00	PASS	PASS
V16	Residential	E3	10	2	0.00	PASS	PASS
V17	Residential	E3	10	2	0.00	PASS	PASS
V18	Residential	E3	10	2	0.00	PASS	PASS
V19	Residential	E3	10	2	0.00	PASS	PASS
V20	Residential	E3	10	2	0.00	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.2 Calculation results - Scenario 1B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.68

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.2 Assessment locations- vertical assessment - MF 0.68							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Residential	E3	10	2	0.00	PASS	PASS
V22	Residential	E3	10	2	0.00	PASS	PASS
V23	Residential	E3	10	2	0.00	PASS	PASS
V24	Residential	E3	10	2	0.00	PASS	PASS
V25	Residential	E3	10	2	0.00	PASS	PASS
V26	Residential	E3	10	2	0.00	PASS	PASS
V27	Residential	E3	10	2	0.00	PASS	PASS
V28	Residential	E3	10	2	0.00	PASS	PASS
V29	Residential	E3	10	2	0.00	PASS	PASS
V30	Residential	E3	10	2	0.00	PASS	PASS
V31	Residential	E3	10	2	0.00	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.3 Calculation results - Scenario 1C: Target average Illuminance 75 lux - Achieved average illuminance 77 lux

Horizontal light spill results - Maintenance Factor 0.26

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

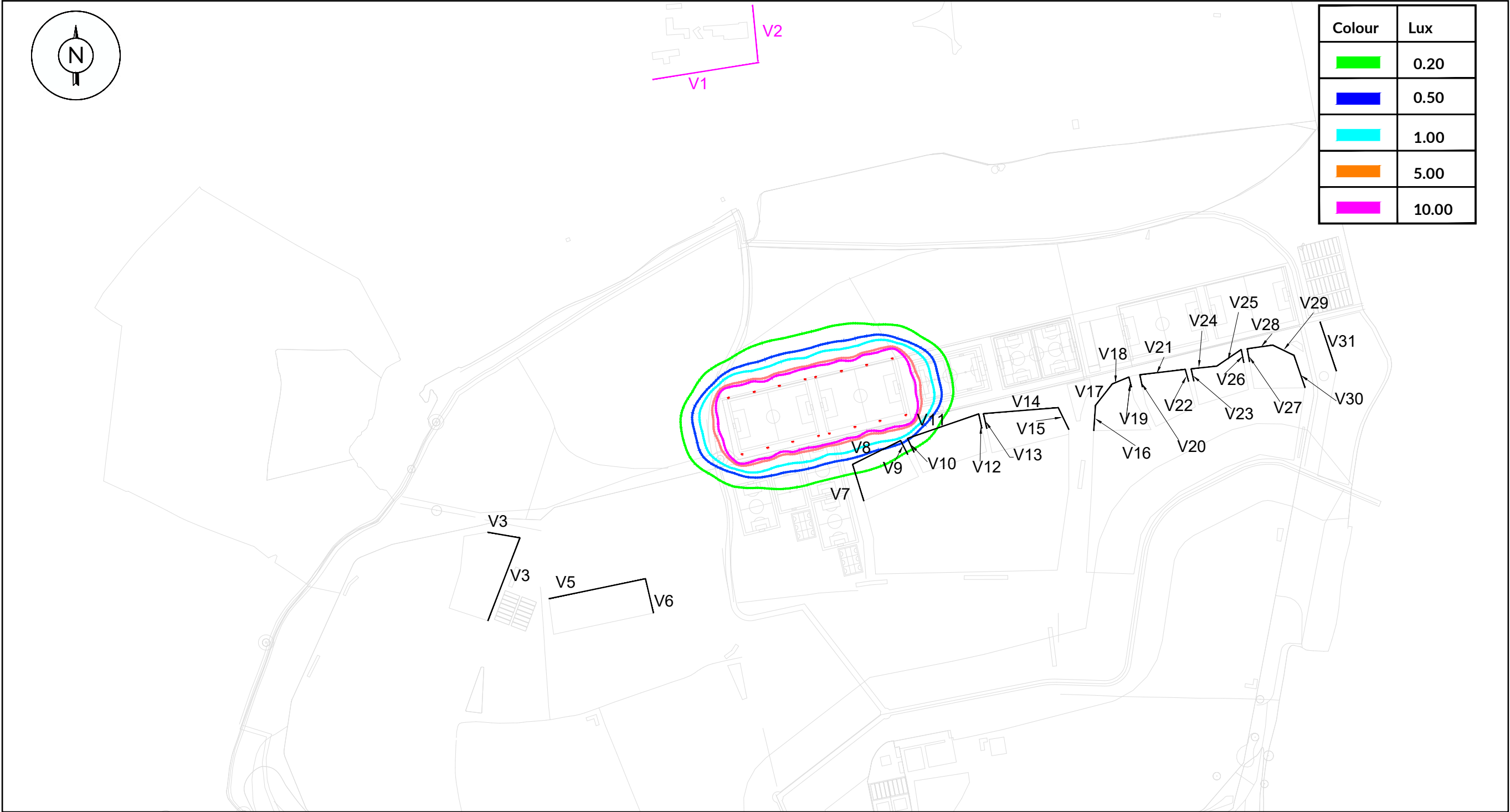


Figure 5.3 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.3 Calculation results - Scenario 1C: Target average Illuminance 75 lux - Achieved average illuminance 77 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.26

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.3 Assessment locations- vertical assessment - MF 0.26							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0.00	PASS	PASS
V2	Heritage	E2	5	1	0.00	PASS	PASS
V3	Residential	E3	10	2	0.00	PASS	PASS
V4	Residential	E3	10	2	0.00	PASS	PASS
V5	Residential	E3	10	2	0.00	PASS	PASS
V6	Residential	E3	10	2	0.00	PASS	PASS
V7	Residential	E3	10	2	0.00	PASS	PASS
V8	Residential	E3	10	2	3.00	PASS	PASS
V9	Residential	E3	10	2	0.00	PASS	PASS
V10	Residential	E3	10	2	1.00	PASS	PASS
V11	Residential	E3	10	2	2.00	PASS	PASS
V12	Residential	E3	10	2	0.00	PASS	PASS
V13	Residential	E3	10	2	0.00	PASS	PASS
V14	Residential	E3	10	2	0.00	PASS	PASS
V15	Residential	E3	10	2	0.00	PASS	PASS
V16	Residential	E3	10	2	0.00	PASS	PASS
V17	Residential	E3	10	2	0.00	PASS	PASS
V18	Residential	E3	10	2	0.00	PASS	PASS
V19	Residential	E3	10	2	0.00	PASS	PASS
V20	Residential	E3	10	2	0.00	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.3 Calculation results - Scenario 1C: Target average Illuminance 75 lux - Achieved average illuminance 77 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.26

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.3 Assessment locations- vertical assessment - MF 0.26							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Heritage	E3	10	2	0.00	PASS	PASS
V22	Heritage	E3	10	2	0.00	PASS	PASS
V23	Residential	E3	10	2	0.00	PASS	PASS
V24	Residential	E3	10	2	0.00	PASS	PASS
V25	Residential	E3	10	2	0.00	PASS	PASS
V26	Residential	E3	10	2	0.00	PASS	PASS
V27	Residential	E3	10	2	0.00	PASS	PASS
V28	Residential	E3	10	2	0.00	PASS	PASS
V29	Residential	E3	10	2	0.00	PASS	PASS
V30	Residential	E3	10	2	0.00	PASS	PASS
V31	Residential	E3	10	2	0.00	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.4 Calculation results - Scenario 2A: Target average illuminance 200 lux - Achieved average illuminance 298 lux

Horizontal light spill results - Maintenance Factor 1

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

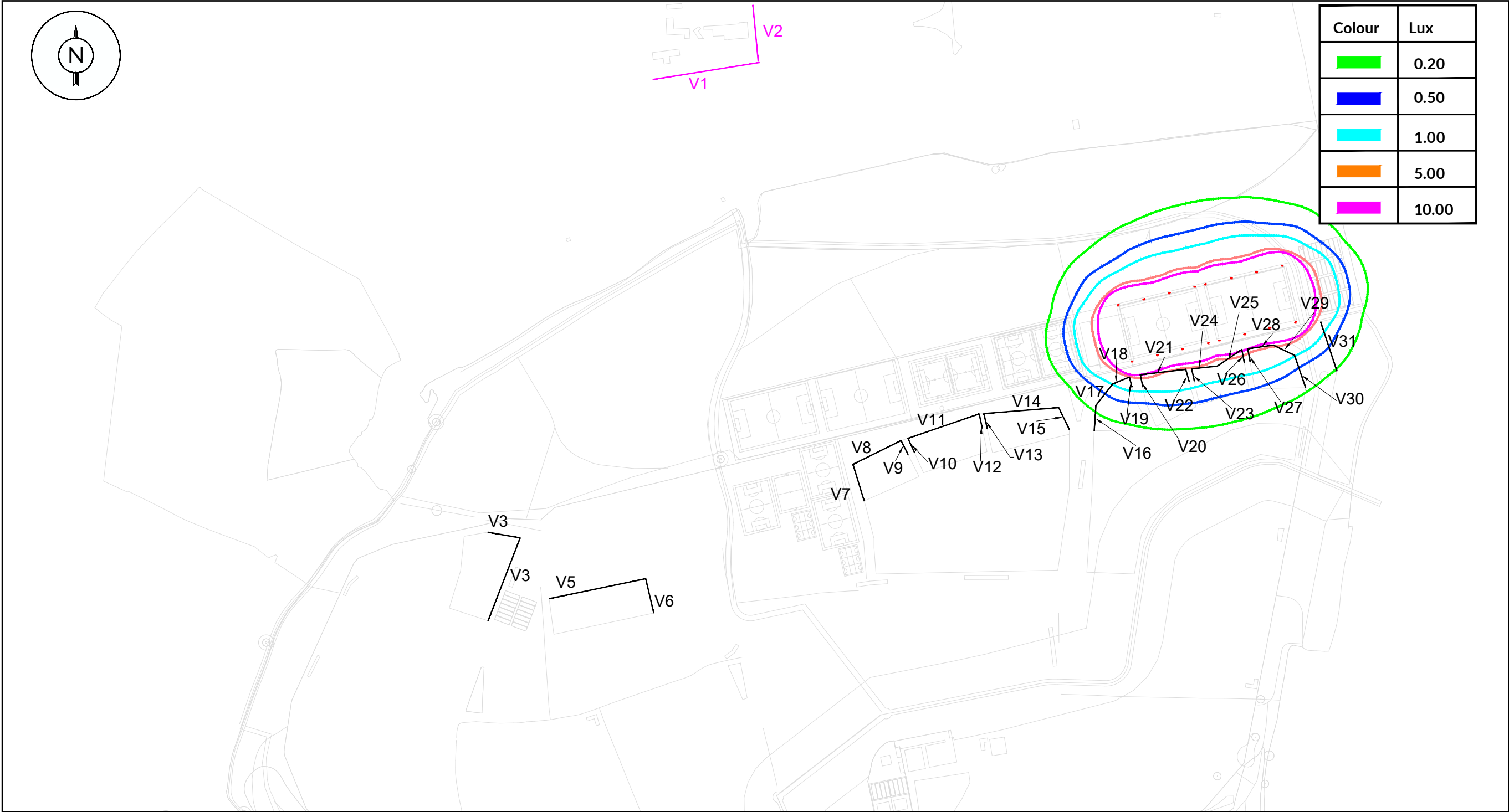


Figure 5.4 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.4 Calculation results - Scenario 2A: Target average illuminance 200 lux - Achieved average illuminance 298 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 1

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.4 Assessment locations- vertical assessment - MF 1							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0.00	PASS	PASS
V2	Heritage	E2	5	1	0.00	PASS	PASS
V3	Residential	E3	10	2	0.00	PASS	PASS
V4	Residential	E3	10	2	0.00	PASS	PASS
V5	Residential	E3	10	2	0.00	PASS	PASS
V6	Residential	E3	10	2	0.00	PASS	PASS
V7	Residential	E3	10	2	0.00	PASS	PASS
V8	Residential	E3	10	2	0.00	PASS	PASS
V9	Residential	E3	10	2	0.00	PASS	PASS
V10	Residential	E3	10	2	0.00	PASS	PASS
V11	Residential	E3	10	2	0.00	PASS	PASS
V12	Residential	E3	10	2	0.00	PASS	PASS
V13	Residential	E3	10	2	0.00	PASS	PASS
V14	Residential	E3	10	2	1.00	PASS	PASS
V15	Residential	E3	10	2	1.00	PASS	PASS
V16	Residential	E3	10	2	0.00	PASS	PASS
V17	Residential	E3	10	2	2.00	PASS	FAIL
V18	Residential	E3	10	2	9.00	PASS	FAIL
V19	Residential	E3	10	2	7.00	PASS	FAIL
V20	Residential	E3	10	2	2.00	PASS	FAIL
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.4 Calculation results - Scenario 2A: Target average illuminance 200 lux - Achieved average illuminance 298 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 1

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.4 Assessment locations- vertical assessment - MF 1							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Residential	E3	10	2	21.00	FAIL	FAIL
V22	Residential	E3	10	2	6.00	PASS	FAIL
V23	Residential	E3	10	2	3.00	PASS	FAIL
V24	Residential	E3	10	2	16.00	FAIL	FAIL
V25	Residential	E3	10	2	26.00	FAIL	FAIL
V26	Residential	E3	10	2	6.00	PASS	FAIL
V27	Residential	E3	10	2	9.00	PASS	FAIL
V28	Residential	E3	10	2	23.00	FAIL	FAIL
V29	Residential	E3	10	2	13.00	FAIL	FAIL
V30	Residential	E3	10	2	0.00	PASS	FAIL
V31	Residential	E3	10	2	6.70	PASS	FAIL
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.5 Calculation results - Scenario 2B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Horizontal light spill results - Maintenance Factor 0.68

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

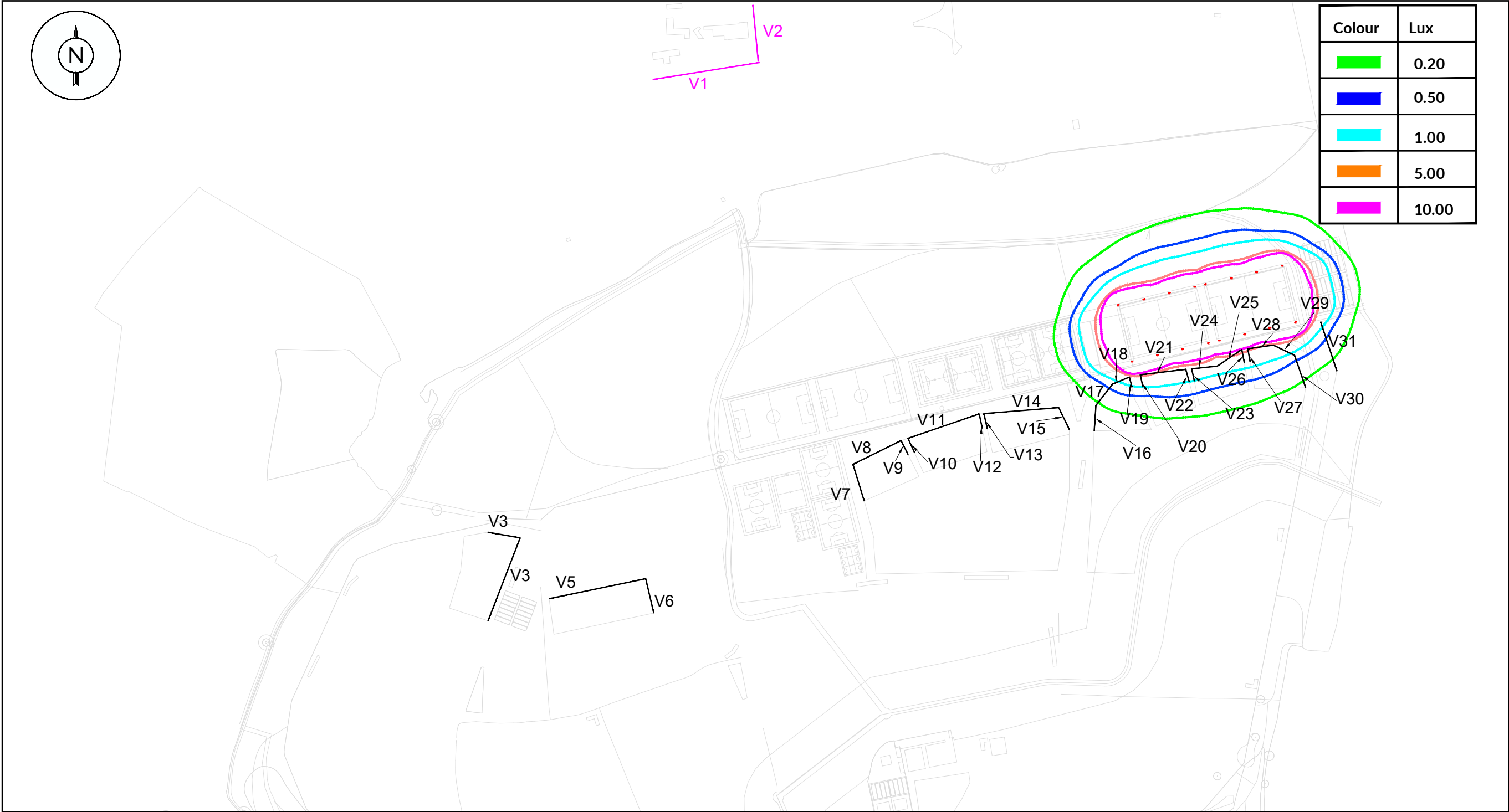


Figure 5.5 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.5 Calculation results - Scenario 2B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.68

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.5 Assessment locations- vertical assessment - MF 0.68							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0.00	PASS	PASS
V2	Heritage	E2	5	1	0.00	PASS	PASS
V3	Residential	E3	10	2	0.00	PASS	PASS
V4	Residential	E3	10	2	0.00	PASS	PASS
V5	Residential	E3	10	2	0.00	PASS	PASS
V6	Residential	E3	10	2	0.00	PASS	PASS
V7	Residential	E3	10	2	0.00	PASS	PASS
V8	Residential	E3	10	2	0.00	PASS	PASS
V9	Residential	E3	10	2	0.00	PASS	PASS
V10	Residential	E3	10	2	0.00	PASS	PASS
V11	Residential	E3	10	2	0.00	PASS	PASS
V12	Residential	E3	10	2	0.00	PASS	PASS
V13	Residential	E3	10	2	0.00	PASS	PASS
V14	Residential	E3	10	2	0.00	PASS	PASS
V15	Residential	E3	10	2	1.00	PASS	PASS
V16	Residential	E3	10	2	0.00	PASS	PASS
V17	Residential	E3	10	2	1.00	PASS	PASS
V18	Residential	E3	10	2	6.00	PASS	FAIL
V19	Residential	E3	10	2	5.00	PASS	FAIL
V20	Residential	E3	10	2	2.00	PASS	FAIL
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.5 Calculation results - Scenario 2B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.68

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.4 Assessment locations- vertical assessment - MF 0.68							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Heritage	E3	10	2	14.00	FAIL	FAIL
V22	Heritage	E3	10	2	4.00	PASS	FAIL
V23	Residential	E3	10	2	2.00	PASS	FAIL
V24	Residential	E3	10	2	11.00	FAIL	FAIL
V25	Residential	E3	10	2	18.00	FAIL	FAIL
V26	Residential	E3	10	2	4.00	PASS	FAIL
V27	Residential	E3	10	2	6.00	PASS	FAIL
V28	Residential	E3	10	2	15.00	FAIL	FAIL
V29	Residential	E3	10	2	9.00	PASS	FAIL
V30	Residential	E3	10	2	0.00	PASS	PASS
V31	Residential	E3	10	2	4.50	PASS	FAIL
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.6 Calculation results - Scenario 2C: Target average illuminance 75 lux - Achieved average illuminance 77 lux

Horizontal light spill results - Maintenance Factor 0.26

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

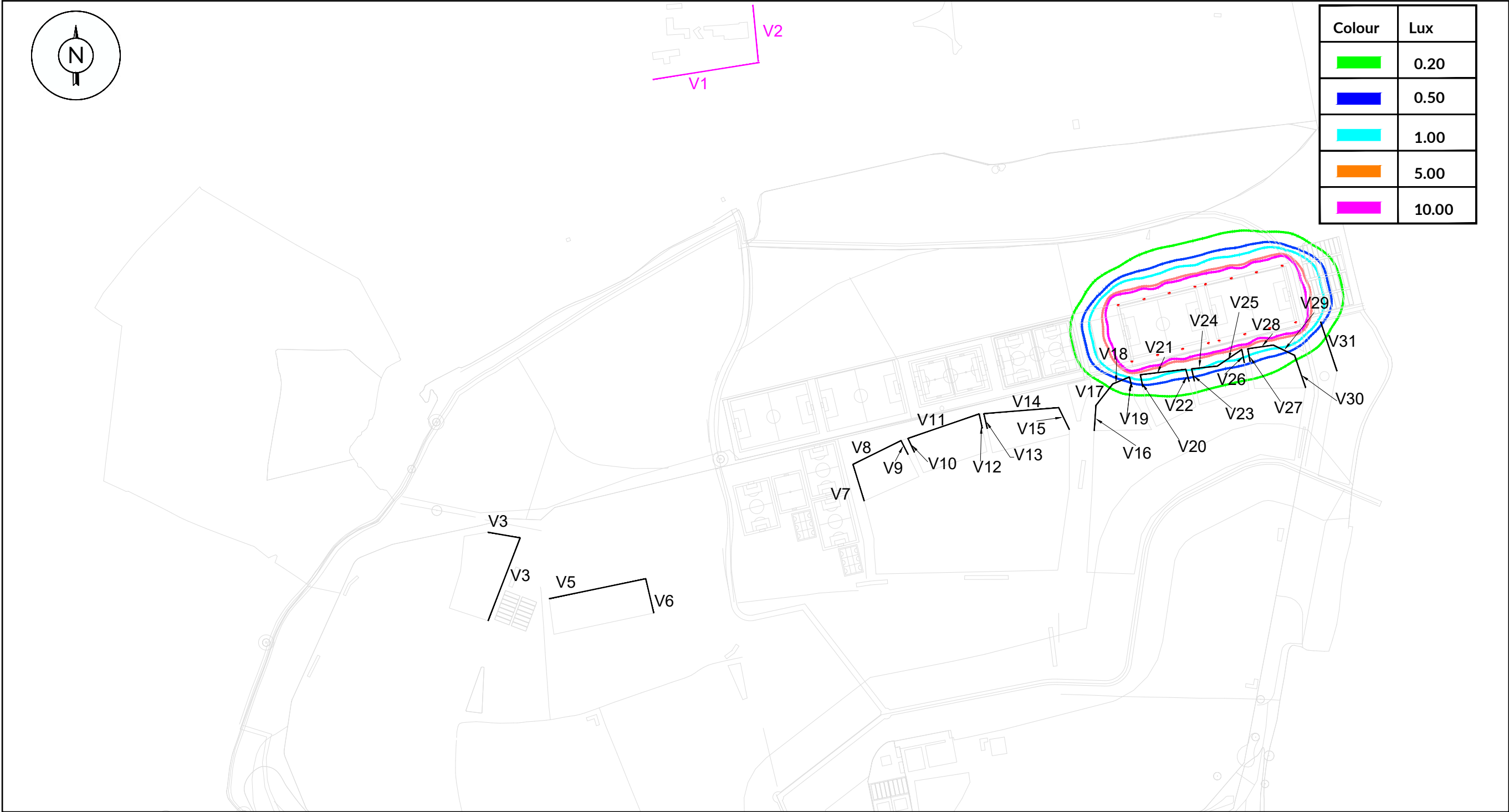


Figure 5.6 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.6 Calculation results - Scenario 2C: Target average illuminance 75 lux - Achieved average illuminance 77 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.26

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.6 Assessment locations- vertical assessment - MF 0.26							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0.00	PASS	PASS
V2	Heritage	E2	5	1	0.00	PASS	PASS
V3	Residential	E3	10	2	0.00	PASS	PASS
V4	Residential	E3	10	2	0.00	PASS	PASS
V5	Residential	E3	10	2	0.00	PASS	PASS
V6	Residential	E3	10	2	0.00	PASS	PASS
V7	Residential	E3	10	2	0.00	PASS	PASS
V8	Residential	E3	10	2	0.00	PASS	PASS
V9	Residential	E3	10	2	0.00	PASS	PASS
V10	Residential	E3	10	2	0.00	PASS	PASS
V11	Residential	E3	10	2	0.00	PASS	PASS
V12	Residential	E3	10	2	0.00	PASS	PASS
V13	Residential	E3	10	2	0.00	PASS	PASS
V14	Residential	E3	10	2	0.00	PASS	PASS
V15	Residential	E3	10	2	0.00	PASS	PASS
V16	Residential	E3	10	2	0.00	PASS	PASS
V17	Residential	E3	10	2	0.00	PASS	PASS
V18	Residential	E3	10	2	2.00	PASS	PASS
V19	Residential	E3	10	2	2.00	PASS	PASS
V20	Residential	E3	10	2	1.00	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.6 Calculation results - Scenario 2C: Target average illuminance 75 lux - Achieved average illuminance 77 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.26

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.6 Assessment locations- vertical assessment - MF 0.26							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Heritage	E3	10	2	5.00	PASS	PASS
V22	Heritage	E3	10	2	1.00	PASS	PASS
V23	Residential	E3	10	2	1.00	PASS	PASS
V24	Residential	E3	10	2	4.00	PASS	PASS
V25	Residential	E3	10	2	7.00	PASS	PASS
V26	Residential	E3	10	2	1.00	PASS	PASS
V27	Residential	E3	10	2	2.00	PASS	PASS
V28	Residential	E3	10	2	6.00	PASS	PASS
V29	Residential	E3	10	2	3.00	PASS	PASS
V30	Residential	E3	10	2	0.00	PASS	PASS
V31	Residential	E3	10	2	1.70	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.7 Calculation results - Scenario 3A: Target average Illuminance 200 lux - Achieved average illuminance 298 lux

Horizontal light spill results - Maintenance Factor 1

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

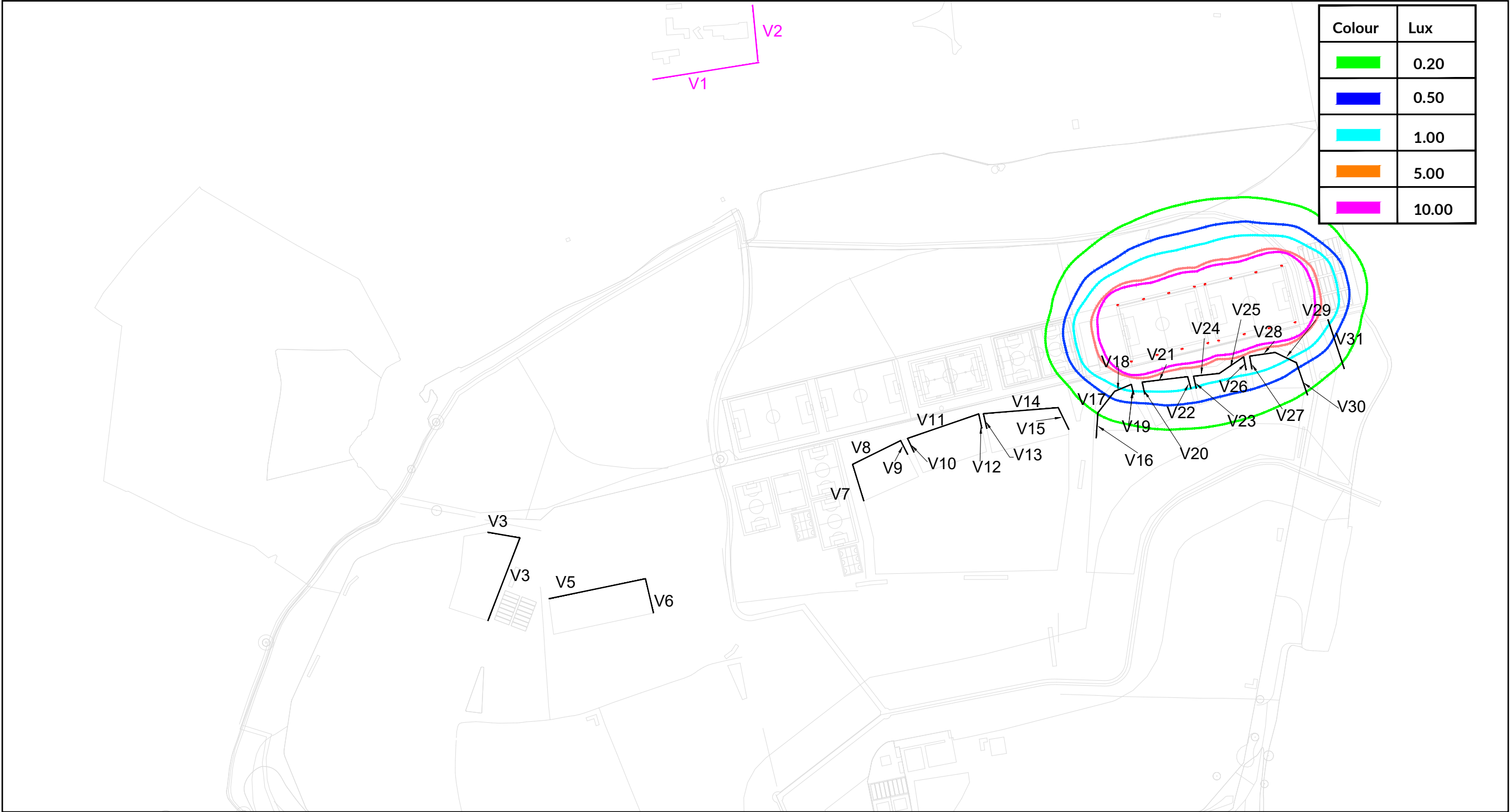


Figure 5.7 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.7 Calculation results - Scenario 3A: Target average Illuminance 200 lux - Achieved average illuminance 298 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 1

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.7 Assessment locations- vertical assessment - MF 1							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0	PASS	PASS
V2	Heritage	E2	5	1	0	PASS	PASS
V3	Residential	E3	10	2	0	PASS	PASS
V4	Residential	E3	10	2	0	PASS	PASS
V5	Residential	E3	10	2	0	PASS	PASS
V6	Residential	E3	10	2	0	PASS	PASS
V7	Residential	E3	10	2	0	PASS	PASS
V8	Residential	E3	10	2	0	PASS	PASS
V9	Residential	E3	10	2	0	PASS	PASS
V10	Residential	E3	10	2	0	PASS	PASS
V11	Residential	E3	10	2	0	PASS	PASS
V12	Residential	E3	10	2	0	PASS	PASS
V13	Residential	E3	10	2	0	PASS	PASS
V14	Residential	E3	10	2	1	PASS	PASS
V15	Residential	E3	10	2	1	PASS	PASS
V16	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
V17	Residential - relocated approximately 10m	E3	10	2	2	PASS	FAIL
V18	Residential - relocated approximately 10m	E3	10	2	6	PASS	FAIL
V19	Residential - relocated approximately 10m	E3	10	2	4	PASS	FAIL
V20	Residential - relocated approximately 10m	E3	10	2	1	PASS	FAIL
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.7 Calculation results - Scenario 3A: Target average Illuminance 200 lux - Achieved average illuminance 298 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 1

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.7 Assessment locations- vertical assessment - MF 1							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Residential - relocated approximately 10m	E3	10	2	11	FAIL	FAIL
V22	Residential - relocated approximately 10m	E3	10	2	4	PASS	FAIL
V23	Residential - relocated approximately 10m	E3	10	2	2	PASS	FAIL
V24	Residential - relocated approximately 10m	E3	10	2	11	FAIL	FAIL
V25	Residential - relocated approximately 10m	E3	10	2	15	FAIL	FAIL
V26	Residential - relocated approximately 10m	E3	10	2	2	PASS	FAIL
V27	Residential - relocated approximately 10m	E3	10	2	5	PASS	FAIL
V28	Residential - relocated approximately 10m	E3	10	2	14	FAIL	FAIL
V29	Residential - relocated approximately 10m	E3	10	2	8	PASS	FAIL
V30	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
V31	Residential - relocated approximately 10m	E3	10	2	6.5	PASS	FAIL
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.8 Calculation results - Scenario 3B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Horizontal light spill results - Maintenance Factor 0.68

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

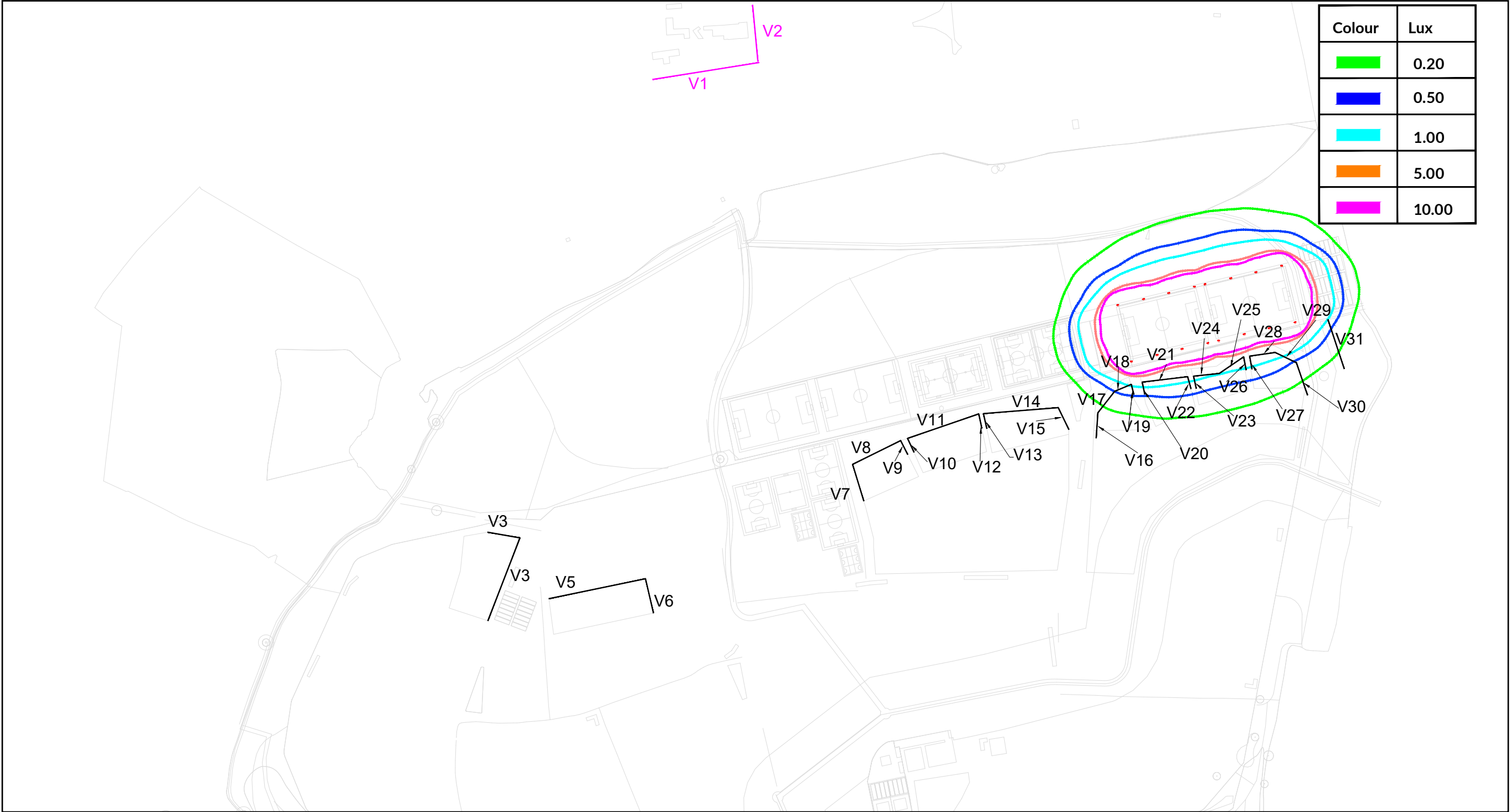


Figure 5.8 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.8 Calculation results - Scenario 3B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.68

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.7 Assessment locations- vertical assessment - MF 0.68							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0	PASS	PASS
V2	Heritage	E2	5	1	0	PASS	PASS
V3	Residential	E3	10	2	0	PASS	PASS
V4	Residential	E3	10	2	0	PASS	PASS
V5	Residential	E3	10	2	0	PASS	PASS
V6	Residential	E3	10	2	0	PASS	PASS
V7	Residential	E3	10	2	0	PASS	PASS
V8	Residential	E3	10	2	0	PASS	PASS
V9	Residential	E3	10	2	0	PASS	PASS
V10	Residential	E3	10	2	0	PASS	PASS
V11	Residential	E3	10	2	0	PASS	PASS
V12	Residential	E3	10	2	0	PASS	PASS
V13	Residential	E3	10	2	0	PASS	PASS
V14	Residential	E3	10	2	0	PASS	PASS
V15	Residential	E3	10	2	1	PASS	PASS
V16	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
V17	Residential - relocated approximately 10m	E3	10	2	1	PASS	PASS
V18	Residential - relocated approximately 10m	E3	10	2	4	PASS	PASS
V19	Residential - relocated approximately 10m	E3	10	2	3	PASS	PASS
V20	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.8 Calculation results - Scenario 3B: Target average illuminance 200 lux - Achieved average illuminance 202 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.68

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.7 Assessment locations- vertical assessment - MF 0.68							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Residential - relocated approximately 10m	E3	10	2	8	PASS	PASS
V22	Residential - relocated approximately 10m	E3	10	2	2	PASS	PASS
V23	Residential - relocated approximately 10m	E3	10	2	1	PASS	PASS
V24	Residential - relocated approximately 10m	E3	10	2	7	PASS	PASS
V25	Residential - relocated approximately 10m	E3	10	2	10	PASS	FAIL
V26	Residential - relocated approximately 10m	E3	10	2	2	PASS	FAIL
V27	Residential - relocated approximately 10m	E3	10	2	3	PASS	FAIL
V28	Residential - relocated approximately 10m	E3	10	2	9	PASS	FAIL
V29	Residential - relocated approximately 10m	E3	10	2	5	PASS	PASS
V30	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
V31	Residential - relocated approximately 10m	E3	10	2	4.4	PASS	FAIL
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

5.9 Calculation results - Scenario 3C: Target average illuminance 75 lux - Achieved average illuminance 77 lux

Horizontal light spill results - Maintenance Factor 0.26

The figure below shows a plan with horizontal lighting level contours (isolines) for the scheme described in **Section 4.0 Sports pitch lighting concept design**, with a lux legend shown to the right. The plan is included in line with BCT/ILP GN08/23 guidance, which states: 'A horizontal illuminance contour plan can be prepared by a suitably experienced and competent lighting professional...' and 'Contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown, along with appropriate higher values.

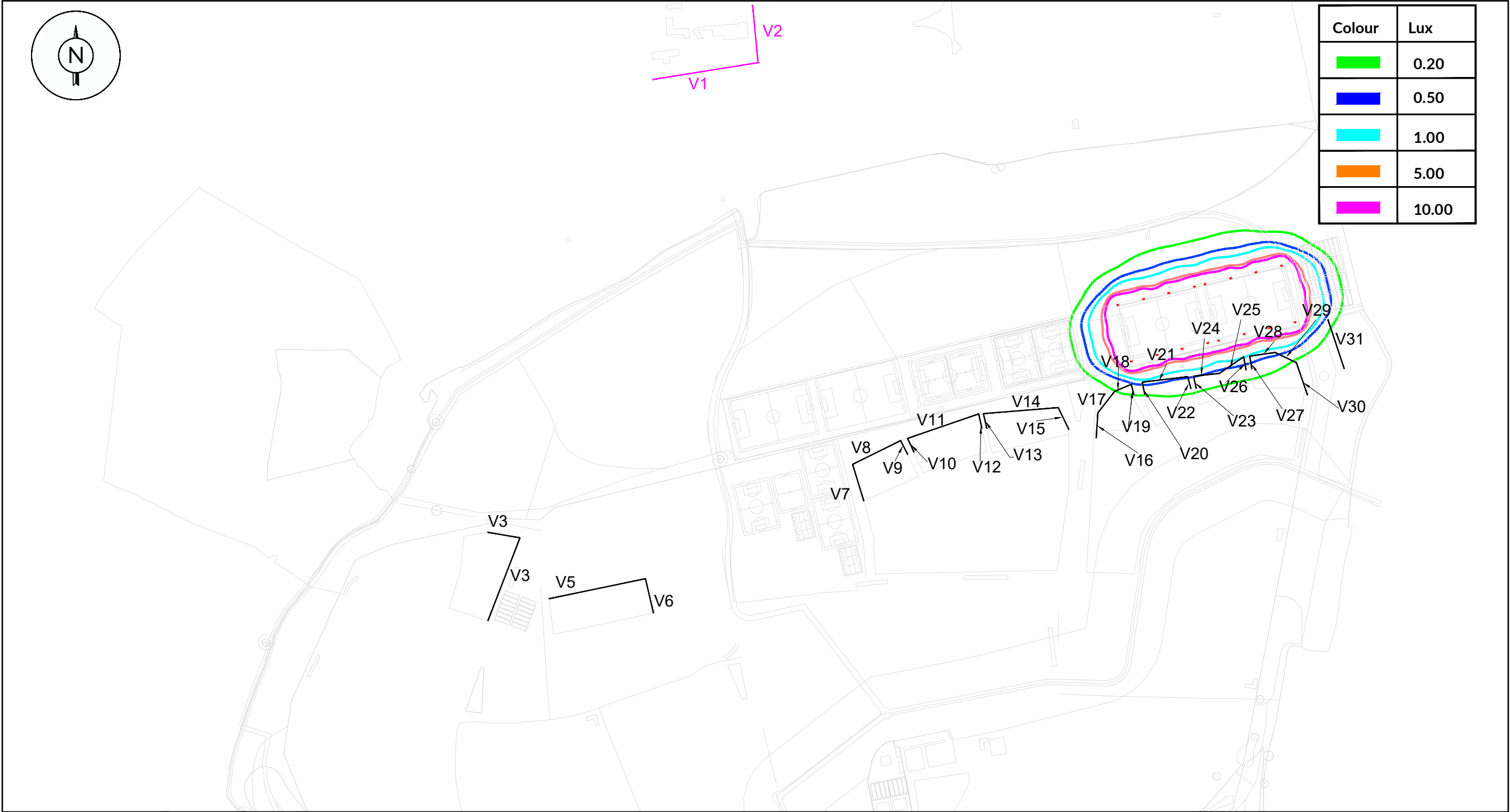


Figure 5.9 Plan view showing external lighting contours as per the BCT/ILP GN08/23 at ground level and vertical assessment locations.

5.0 Illumination Impact Profile.

5.9 Calculation results - Scenario 3C: Target average illuminance 75 lux - Achieved average illuminance 77 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.26

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.6 Assessment locations- vertical assessment - MF 0.26							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V1	Heritage	E2	5	1	0	PASS	PASS
V2	Heritage	E2	5	1	0	PASS	PASS
V3	Residential	E3	10	2	0	PASS	PASS
V4	Residential	E3	10	2	0	PASS	PASS
V5	Residential	E3	10	2	0	PASS	PASS
V6	Residential	E3	10	2	0	PASS	PASS
V7	Residential	E3	10	2	0	PASS	PASS
V8	Residential	E3	10	2	0	PASS	PASS
V9	Residential	E3	10	2	0	PASS	PASS
V10	Residential	E3	10	2	0	PASS	PASS
V11	Residential	E3	10	2	0	PASS	PASS
V12	Residential	E3	10	2	0	PASS	PASS
V13	Residential	E3	10	2	0	PASS	PASS
V14	Residential	E3	10	2	0	PASS	PASS
V15	Residential	E3	10	2	0	PASS	PASS
V16	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
V17	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
V18	Residential - relocated approximately 10m	E3	10	2	2	PASS	PASS
V19	Residential - relocated approximately 10m	E3	10	2	1	PASS	PASS
V20	Residential - relocated approximately 10m	E3	10	2		PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

5.0 Illumination Impact Profile.

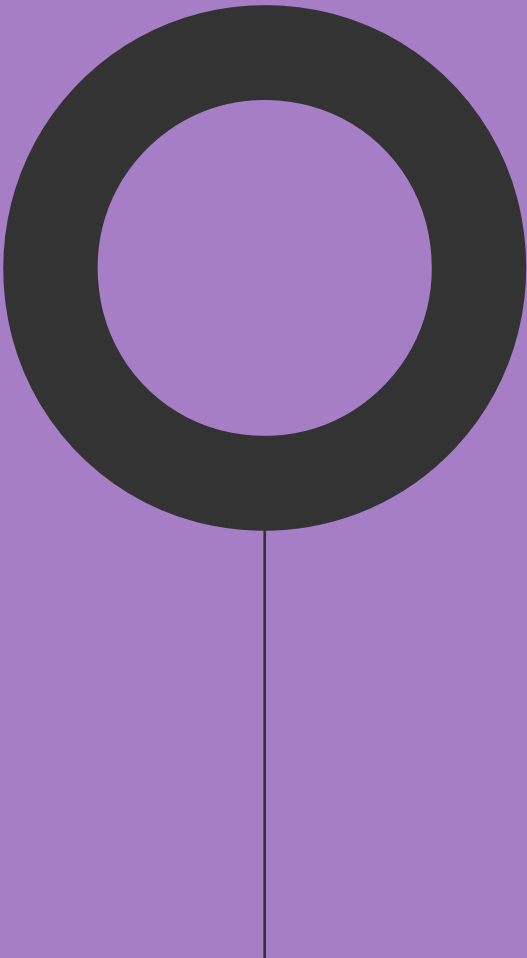
5.9 Calculation results - Scenario 3C: Target average illuminance 75 lux - Achieved average illuminance 77 lux

Assessment locations - Light spill (intrusion) and Glare results- Maintenance Factor 0.26

The table below summarises calculated lighting levels and luminance (glare) at vertical assessment points, along with their compliance with ILP guidelines. While vertical lighting levels on windows are straightforward to assess, glare (luminous intensity) is more complex, as it depends on viewing angle and luminaire surface area. Compliance criteria are outlined in ILP GN01/21 Tables 2.2 and 2.3, with pass/fail results shown in the final column below.

Table 5.6 Assessment locations- vertical assessment - MF 0.26							
Heritage and residential locations - vertical (ILP Guidance notes 2021)			Light spill				Glare (Luminous source intensity)
Survey Location	Location name	Environmental Zone	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Pre curfew	Vertical lighting level Max. into windows (ILP guidance notes 2021) (Lux). Post curfew	Calculated vertical lighting level (Lux) (maximum value to elevation) *1	Compliant with ILP guidelines for noted zone. (Residential) *1	Compliant with ILP guidelines for noted zone. (Residential)*1 *2
V21	Residential - relocated approximately 10m	E3	10	2	3	PASS	PASS
V22	Residential - relocated approximately 10m	E3	10	2	1	PASS	PASS
V23	Residential - relocated approximately 10m	E3	10	2	1	PASS	PASS
V24	Residential - relocated approximately 10m	E3	10	2	3	PASS	PASS
V25	Residential - relocated approximately 10m	E3	10	2	4	PASS	PASS
V26	Residential - relocated approximately 10m	E3	10	2	1	PASS	PASS
V27	Residential - relocated approximately 10m	E3	10	2	1	PASS	PASS
V28	Residential - relocated approximately 10m	E3	10	2	4	PASS	PASS
V29	Residential - relocated approximately 10m	E3	10	2	2	PASS	PASS
V30	Residential - relocated approximately 10m	E3	10	2	0	PASS	PASS
V31	Residential - relocated approximately 10m	E3	10	2	1.7	PASS	PASS
*1) These calculated values and pass/fail notations are based on a virtual surface 10m high, length as shown in the Figure below.							
*2) Glare, Maximum allowable value calculated is from CIE 150:2017 referenced in ILP Guidance Note 01/21 - Table 5.							

6.0 Result Summary.



6.0 Result Summary.

Summary

Results below are based on pre-curfew compliance thresholds.

Western pitches

Scenario 1A – Western Pitches, 200 lux (MF 1):
Achieved average illuminance: 298 lux

Results:

Light spill: Failed at 1 residential location (V8)

Glare: Failed at 5 residential locations (V7-V11)

Scenario 1B – Western Pitches, 200 lux (MF 0.68):
Achieved average illuminance: 202 lux

Results:

Light spill: All locations passed

Glare: Failed at 1 residential location (V11)

Scenario 1C – Western Pitches, 75 lux (MF 0.26):
Achieved average illuminance: 77 lux

Results:

Light spill and glare: All locations passed compliance standards

Eastern Pitches

Scenario 2A – Eastern Pitches, 200 lux (MF 1):
Achieved average illuminance: 298 lux

Results:

Light spill: Failed at 5 residential locations (V21, V24, V25, V28 & V29)

Glare: Failed at 15 locations, (V17-V31)

Scenario 2B – Eastern Pitches, 200 lux (MF 0.68):
Achieved average illuminance: 202 lux

Results:

Light spill: Failed at 4 residential locations (V21, V24, V25 & V28)

Glare: Failed at 13 residential locations (V18-V29 & V31)

Scenario 2C – Eastern Pitches, 75 lux (MF 0.26):
Achieved average illuminance: 77 lux

Results:

Light spill and glare: All locations passed compliance standards

Eastern pitches, relocated residential receptors. I.E. moved 10m further from the pitches in a southerly direction

Scenario 3A – Eastern Pitches, 200 lux (MF 1):
Achieved average illuminance: 298 lux
Light spill: Failed at 4 residential locations (V21, V24, V25, V28)

Glare: Failed at 14 locations, (V17-V29, V31)

Scenario 3B – Eastern Pitches, 200 lux (MF 0.68):
Achieved average illuminance: 202 lux

Results:

Light spill: All locations passed

Glare: Failed at 5 residential locations (V25-V28, V31)

Scenario 3C – Eastern Pitches, 75 lux (MF 0.26):
Achieved average illuminance: 77 lux

Results:

Light spill and glare: All locations passed compliance standards

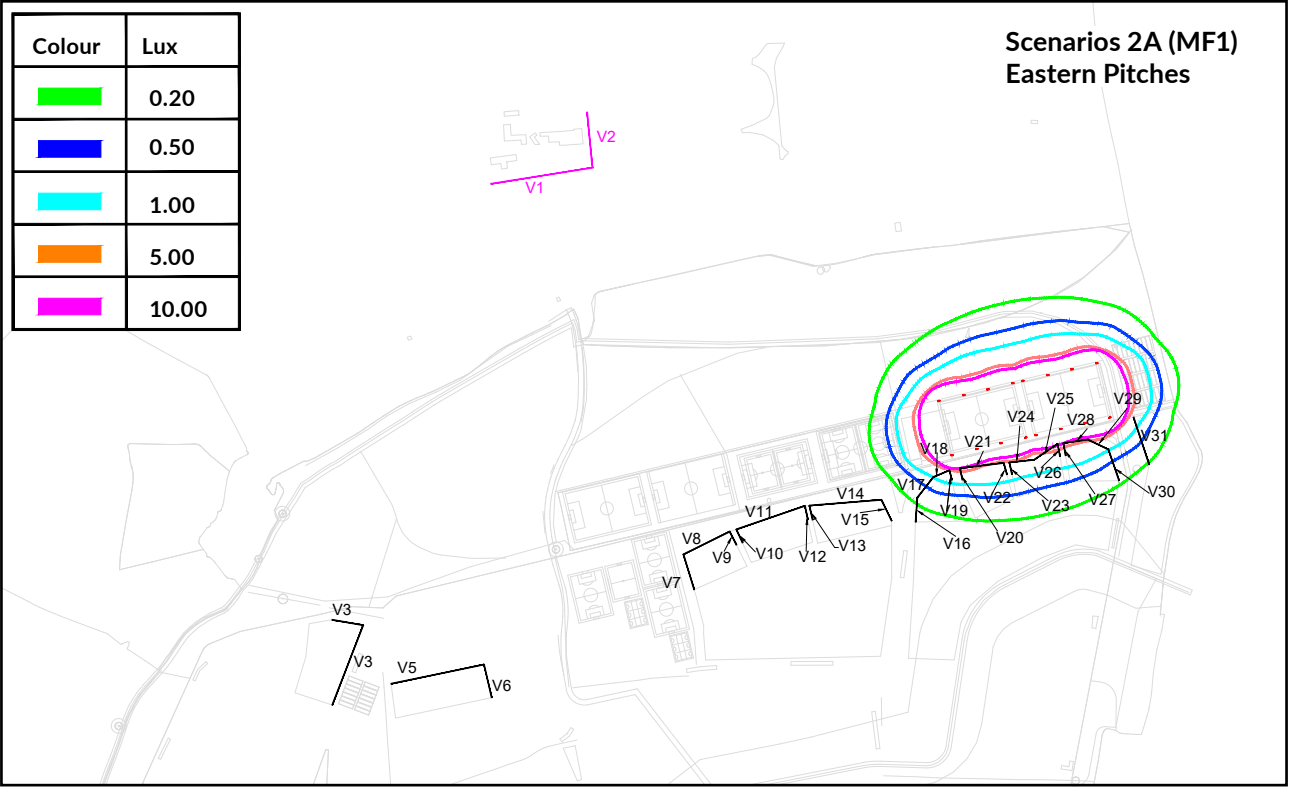
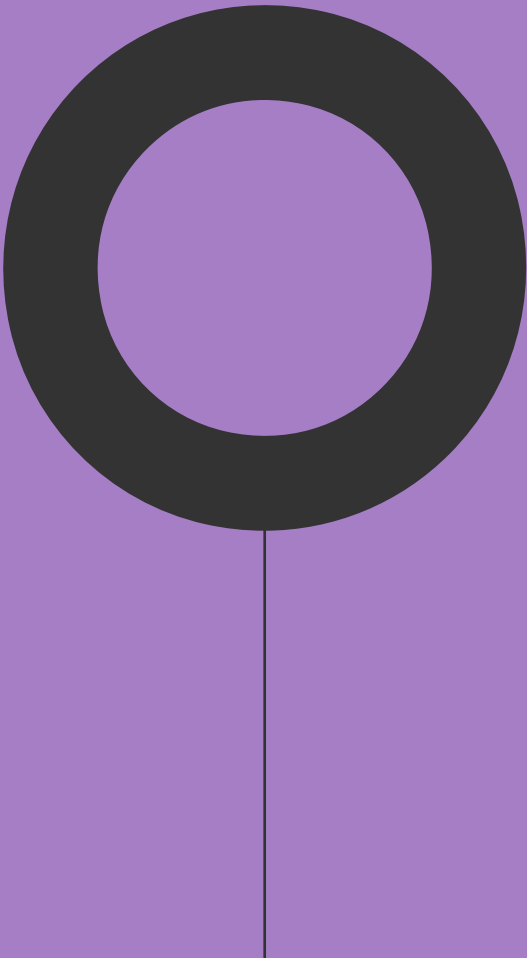


Figure 6.2 Scenario 3A MF 1. Aerial view showing lighting level isolines as per the BCT/ILP guidance note 08/23 "Bats and artificial lighting at night" 0.2 lux to 10 lux at ground level.

7.0 Conclusion.



7.0 Conclusion.

This Lighting Impact Assessment (LIA), prepared by Hoare Lea, evaluates the potential effects of proposed sports pitch lighting installations across multiple scenarios at Gilston Village 7. The assessment considers nine lighting configurations, differentiated by location (Western and Eastern pitches), lighting intensity (200 lux vs. 75 lux), and maintenance factor (MF 1, MF 0.68/0.26 representing operational scenarios). The assessment utilises guidance from ILP GN01/21 to assess light spill and luminous source intensity (glare) to residential property. For the purposes of this report the residential properties have been professionally judged as an Environmental Zone (EZ) 3 category and Pre Curfew guidance values have been used.

Key Findings:

- Reduced lighting scenarios (75 lux): Scenarios 1C (Western) and 2C & 3C (Eastern) fully complied with ILP GN01/21 guidance for light spill and glare to a Pre Curfew EZ3 receptor across all assessed locations. These represent the lowest-impact solutions, posing minimal risk of light spill or glare to nearby receptors.

Standard lighting scenarios (200 lux) with typical operation settings (MF 0.68):

- Scenario 1B (Western) met all light spill limits and failed glare thresholds at only one residential receptor (V11).
- Scenario 2B (Eastern) exceeded both light spill and glare limits at several locations, indicating a greater impact in this zone even under controlled dimming.

Scenario 3B Relocated residential receptors. I.E. moved 10m further from the pitches in a southerly direction exceeded both light spill and glare limits at several locations. However compared to scenario 2B there are no failures for light spill and only 5 failures for exceeding glare compared to 13 for 2B.

Initial installation scenarios (MF 1): Scenarios 1A, 2A & 3A showed more widespread non compliance, particularly for glare, due to peak light outputs and lack of depreciation allowances.

The Eastern pitch location consistently exhibited a higher level of non-compliance, due to the proximity to receptors.

Recommendations:

All scenarios would require a dimming control regime from the outset.

Scenarios 1C, 2C & 3C (75 lux) are the most compliant options for an ILP EZ 3 category and with design development suitable for implementation without further mitigation.

If 200 lux performance is required (to meet Sport England specification), Scenario 1B (Western pitches) is preferred, subject to mitigation for glare at receptor V11.

Scenario 2B (Eastern pitches, 200 lux) would require additional design optimisation and secondary mitigation, such as additional shielding and screening.

Scenario 3B (Eastern pitches, 200 lux, relocated receptors) would require additional design optimisation and secondary mitigation, such as additional shielding and screening. However there are fewer locations impacted therefore this proposal may be potentially less onerous to develop.

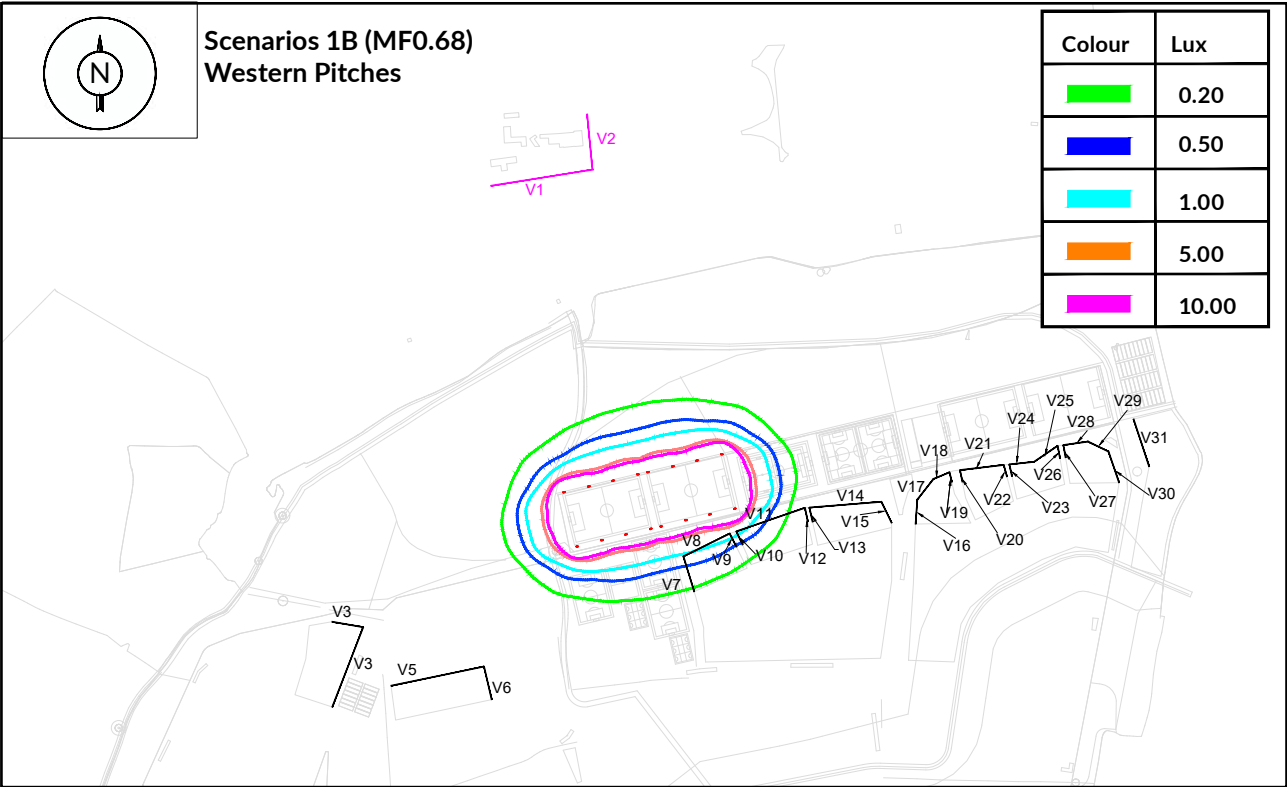


Figure 7.1 Scenario 1B MF 0.68. Aerial view showing lighting level isolines as per the BCT/ILP guidance note 08/23 "Bats and artificial lighting at night" 0.2 lux to 10 lux at ground level.

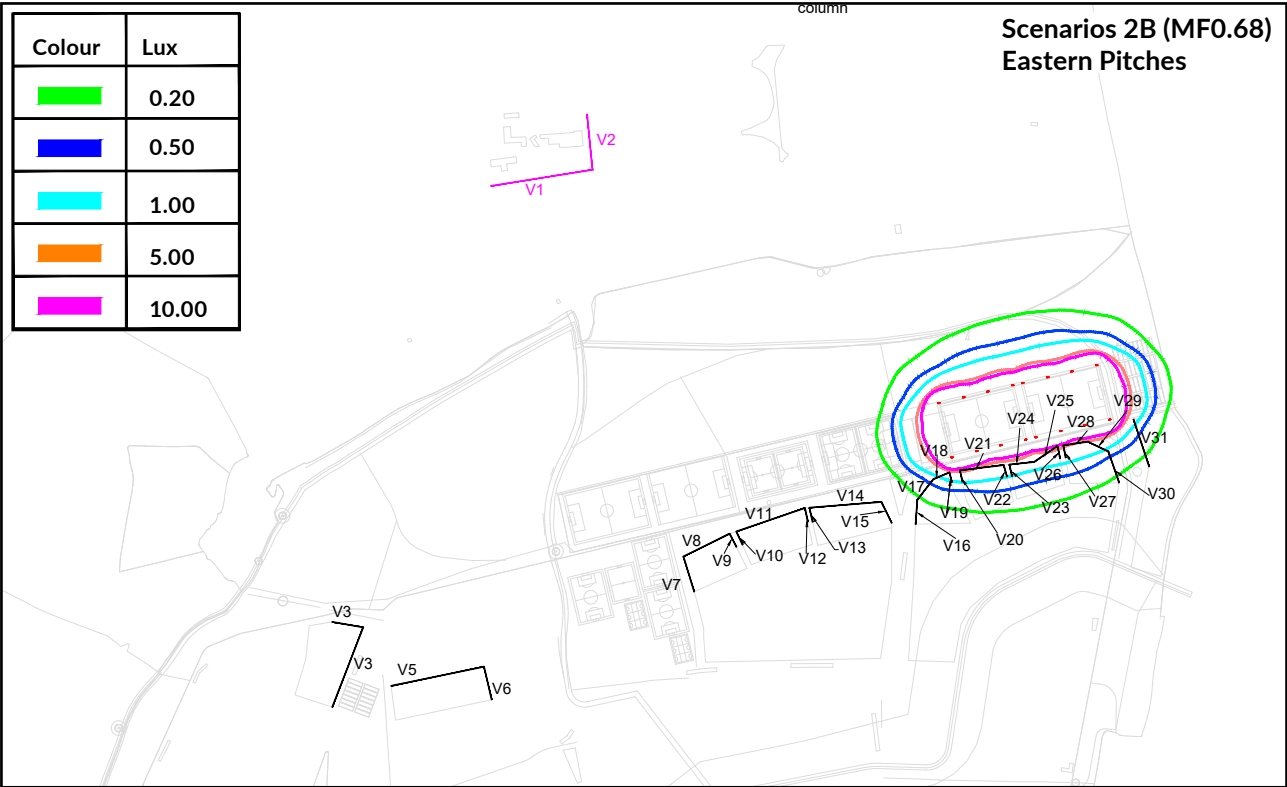


Figure 7.2 Scenario 3B MF 0.68. Aerial view showing lighting level isolines as per the BCT/ILP guidance note 08/23 "Bats and artificial lighting at night" 0.2 lux to 10 lux at ground level.



EWAN RAMSDEN

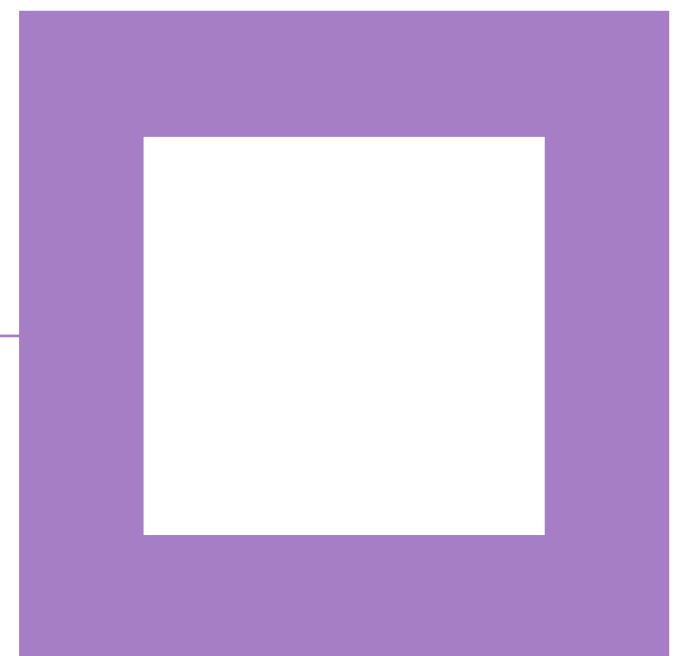
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Gilston V7SLMP Site, East Herts

**Verified Photomontages:
Methodology and Supporting Evidence**

August 2025

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1.0 Overview

This document has been prepared by Realm Communications to explain the methodology used to create accurate visual representations (AVRs) of the proposed development at Gilston V7, East Herts. The visual assessment of the proposed development reflects current best practice in relation to the verification of images, a process which is constantly being refined and improved with advances in technology and industry experience.

The purpose of the photomontages is to present an accurate overview of the proposed development which enables its effect on the landscape and views to be objectively evaluated. Every image contained within this document is verified unless otherwise stated. Final images should not be used as a standalone tool to assess the suitability of a development, but should be used in conjunction with a site visit. This audit trail demonstrates the key stages of production (that can, if required, be checked by a third party) including photography, surveying, 3D modelling and camera matching processes - all critical to ensuring the accuracy of the final photomontages. These methodologies are in accordance with current best practice and follow recommendations from The Landscape Institute’s Technical Guidance Note (TGN 06/19) : Visual Representation of Development Proposals. The entities responsible for the preparation of the views set out in the following pages comprise:

The entities responsible for the preparation of the views set out in the following pages comprise:

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Arcminute Ltd
62 Grove Park Terrace
London W4 3QE

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Survey of existing views and camera locations

Datum Survey Services Ltd
Brickfield Business Centre, Brickfield House
High Road, Thornwood, Epping CM16 6TH
Phone: 07977 111935

Production and checking of verified photomontages

Realm
The Workshop, Old Barn Cottage, Down Lane
Compton, Guildford
GU3 1DQ

Phone: 01483 813888

2.0 Methodology

2.1 Photography

The professional architectural photographer employed on this project was briefed by Realm to work to a methodology which conforms to the principles specified in section 1.0 Overview. The following methodology statement has been supplied by Arcminute:

Photography brief The following methodology applies to the production of photographic images originated in July 2025 which form the pictorial basis for visual impact assessment photomontages for 3 views for the proposed development at Gilston V7, East Herts.

Equipment Images are captured on a 36mm x 24mm 21 megapixel digital sensor in combination with the following shift lenses:

- Focal length 24mm | Horizontal FOV 74° (for close views in built-up streetscapes)
- Focal length 35mm | Horizontal FOV 55° (for close views requiring selective framing)
- Focal length 50mm | Horizontal FOV 40° (for long distance views)

Lenses outside these parameters are also available for use in certain circumstances but these 3 lenses have been found to cover the vast majority of situations required in this type of work.

Choice of lens We prefer to replicate (as far as possible) what may have already been provided in terms of preliminary view studies as typically these would have been generated using pre-considered factors as to what each view would need to illustrate e.g. context, key visual receptors etc. In the absence of a definitive steer, we will generally use a 74° HFOV lens for medium to close views in an urban environment and a 40° HFOV lens for long distance views. However, the actual size and nature of a scheme (single building or large multibuilding development) and its location will also be considered before lens selection. The Landscape Institute’s latest guidelines have been relaxed with regard to lens choice and they are no longer insistent that a ‘standard’ lens be used wherever possible.

Photography The camera is mounted on a tripod at eye level which on level ground is 1.65m within a +/- 100mm tolerance. The camera is then levelled in roll and pitch to a tolerance of 30mm per 100m using a precision spirit level. The point on the lens which coincides with the virtual render camera is horizontally referenced to a survey mark (nail or paint) to +/- 2mm using a survey standard procedure and the height above this is measured using a steel tape measure to the same tolerance. A photograph is taken of the tripod in its location, the survey point on the ground and the tape measure reading against a reference point on the camera mount. During image capture particular emphasis is placed on the following:

- Rendering all points in the scene as sharply as possible to avoid any sense of selective focus.
- Capturing all tonal detail in the scene and avoiding ‘blown out’ highlights and ‘blocked up’ shadows.

Where a scene’s brightness range exceeds that of the sensors dynamic capture range it may be necessary to combine two or more different exposures to create a final image to overcome this limitation and to maintain a realistic tonal rendering closer to that of the human eye.

Post production The camera images are captured using a native camera or ‘RAW’ format and a software application is used to turn these into universally accessible RGB raster images. At this conversion stage colour and tonal adjustments are made to recreate as honestly as possible the scene as was presented to the photographer at the time of capture. RGB images are corrected using specialist software to remove non-perspective optical distortion in order to create a geometrically accurate 2D projection which can be precisely aligned with CGI renderings and survey data.

The image is then placed in a standard sized image template and the calibrated lens axis position is aligned with the documents centre. This accounts for both deliberate offset through lens shift and manufacturing tolerances in lens to camera body alignment. A text file in the image document records camera height above the survey point, lens focal length, film gate, date and time, nominal lens offset and document pixel dimensions. All images are also accompanied with photographic evidence of camera location, survey point location and height above survey point.

Where temporary survey targets have been set up in the scene the before and after images are included as separate TIFF layers to enable both accurate camera alignment and seamless removal of the targets for final output.

For panoramic images, proprietary software creates a seamless and accurate cylindrical projection from an overlapping sequence of images (10 stitched together for a 120° panoramic, 14 for a 180° and 27 for a 360°) which share a single camera coordinate. The image is then placed in a pre-prepared template where the centre of the optical axis is aligned with the image centre to account for any offset used in vertical farming adjustments or mechanical misalignment of the lens' optical axis and that of the sensor.

2.1.2 Production of Panoramic Photography

This section explains the technical and practical processes for image capture and processing of panoramic photographs for the project , undertaken by Arcminute Ltd in respect of the project. The methodology is compliant with the principles of the Landscape Institute but exceeds them in technical sophistication to meet the higher accuracy standards of VVM practice, where a camera is aligned to a sub cm GNSS survey.

Equipment

- Sony A7rIV 61mp 'full frame' Camera in portrait orientation
- Sigma 35mm F2 DG DN Lens
- In-house designed and manufactured rotating panoramic head with <0.02deg runout under load.

The choice of lens and camera orientation is to overcome the technical limitations for VVM purposes of a 50mm lens in landscape orientation. It is equivalent in resolution to a 27mp sensor and 50mm lens and resolves more detail than that which is observable by the naked eye.

Image Capture: The camera was set at a nominal height of 1.6m above the ground and picture of this setup including an actual height measurement was recorded on a mobile phone camera. A sequence of overlapping images at an angular interval of 18 degrees and sharing the same point of perspective were captured in a RAW file format. A survey for each viewpoint was undertaken at the same time as the photography to record the precise camera location and features in the scene for use in the camera alignment process. If there were insufficient fixed surveyable features near the camera then supplementary temporary survey targets were placed in the view.

Image Editing: The RAW images were converted in an image editing

application into tiff images at native resolution. A panoramic stitching application assembled the individual frames into an accurate seamless cylindrical panorama matching the projection geometry of the end users 3d render panoramic camera model. Further tonal adjustments were made to the assembled panorama to match the visual impression of the scene as experienced at the time of capture.

Deliverables

- A standard working background tiff of 180x55/45 degrees at a 0.01mm pixel size which provides the customer with enough resolution to crop the image to their required framing while retaining a manageable data size for rendering. It also contains a text layer with all the technical information required for the camera matching operator.

- A photographic record of the camera in position.
- This methodology statement.

2.2 Survey

All of the baseline photographs were taken by a professional architectural photographer. Each viewpoint location is surveyed and identified by Ordnance Survey co-ordinates. The heights and distances of significant points within each view that are easily distinguishable have also been recorded as Ordnance Survey grid and level datum and their accuracy has been checked relative to the fixed camera position. The survey points for each view provide an effective check for ensuring that the 3D model and existing views are accurately merged together.

The following methodology statement has been supplied by Datum Survey Services:

Survey brief We were commissioned to survey and record co-ordinates (Easting, Northings and AOD Height) of known points of detail in respect of the proposed development at Gilston V7, East Herts. Digital files of the 3 views together with camera point locations were provided by the photographer.

Date of surveys July 2025

Camera point positioning Network RTK solutions were established using a Leica GPS + GLONASS SmartRover receiver. The equipment was set-up directly over the camera position (survey nail) and multiple observations were recorded. A second (reference) point was taken approximately 100m away from the camera position using the same method.

Data capture Traditional survey techniques were employed to record the points of detail within each view. A Leica TCRA TS15 Total Station with long range reflector-less distance measurement capabilities was set-up directly over the camera point and orientated to Ordnance Survey National Grid using the two sets of co-ordinates determined by the SmartRover receiver.

Deliverables The completed survey data was issued as follows:

- Microsoft Excel Spreadsheet comprising point numbers, coordinate data and descriptions

- PDF copies of each photo with point locations and view specific point numbers clearly marked
- AutoCAD DWG file containing 3D survey points with view specific point numbers

2.3 Lighting and structures

Supplied by Hoare Lea

2.4 Landscape and planting information

Stantec

2.5 Camera matching

The verification process confirms the accuracy of the 3D model in relation to each view. The camera matching process involves accurately matching the position of the virtual camera with the real world camera in OS space, and the location of the 3D model of the proposed development within each (existing) view. This is achieved through aligning the imported 3D cloud of survey points within the base photo and 3D environment, creating a virtual camera that replicates the exact position and height of the real world camera to produce an image where the rendered survey points match in visual location those recorded by the survey team and photographer.

The specifications of the lens type relating to each existing view is also entered into 3DS Max to help guide with alignment. An alignment is deemed correct only when all survey points sit exactly over the pixel in the photo that corresponds with the marked-up survey photo. If all points match, the virtual camera must therefore be correctly aligned.

For each view we measure the distance from camera to target and apply respective equations to establish the potential adjustment necessary to compensate for both curvature of the earth and light refraction. Typically, when the real world camera is positioned within 1.5km from the target, the effects of curvature of the earth and light refraction are deemed to be negligible in terms of their visual impact and therefore no adjustment is made to the Z axis of the building model within the view.

2.6 Lighting and rendering

To accurately light the 3D model, 3DS Max's 'daylight system' is set to replicate the solar time, date and geographic location (longitude and latitude) as recorded in the base photograph. The settings used for each base photograph (F stop, shutter speed etc) are replicated in both this 'daylight system' and the virtual camera set-up. This process mimics the virtual sun so that the lighting falls upon the 3D model as it would in real life at the point when the photograph was captured. Fine tuning is sometimes necessary to better match the resultant lighting and shadows to the base photograph. Once the camera matching and lighting processes are complete, the render of the 3D model is output to the same pixel resolution as per each respective base photograph.

2.6 Lighting and rendering (Continued)

Lighting levels for night views are indicative and based on qualitative assessments between the lighting consultant and verified view visualisation team. resulting in an agreement as to how the lighting would look given its placement and on the ambient conditions captured in the baseline photography. Please note that the lighting scenario used for views A and E is scenario A (max lighting). However, this is not visible in view and so the only view to show the differing scenarios is View B (clearly titled at the top of each of the relevant pages).

2.7 Post production

Wireline views These photomontages show the outline of the maximum envelope of built form in accordance with development parameters as a red line (a solid line where visible, a dotted line when obscured by foreground objects)

Fully rendered views The render of the three-dimensional model was superimposed on the existing still views in Adobe Photoshop. The foreground of the existing views was then copied and placed over the rendered model in order to ensure that the depth is accurate within the photomontage view between the foreground, background and the rendered model. At this stage, for the fully rendered photomontages, the textured model can be further adjusted to match the resolution, colouring and saturation of the photograph taken to create a close impression of what the textures of the buildings and structures would look like. This is a qualitative exercise and requires interpretation by the designer on how the structure will look. A final qualitative check of all of the photomontage images has been carried out to ensure that they provide objectively accurate views of the proposed development.

2.8 Recommended viewing distances

It is recommended that final images are viewed at an optimum viewing distance (in relation to the size of printed photomontage) to give a correct sense of scale. We recommend that images are printed to A3 size that creates a comfortable viewing distance of up to 525mm.

2.9 Caveats

Please note that while the position, height and scale of lighting columns is verified (relying on placement info provided to us) Lux levels themselves are not verified, in line with standard industry practice, as light levels vary dependent upon a variety of factors including (but not restricted to) time of year/seasonality, prevailing meteorological and atmospheric conditions (impact of mositure in the area, weather, cloud cover etc) and lighting specification. Lighting levels shown are therefore indicative. Lighting columns and associated information shown are based on generic examples supplied and do not represent a specific OEM item or specification.

2.10 Scenarios

Two scenarios are shown. The first is the Western siting of the floodlit pitches and the second is the Eastern siting, as shown in the extract below:

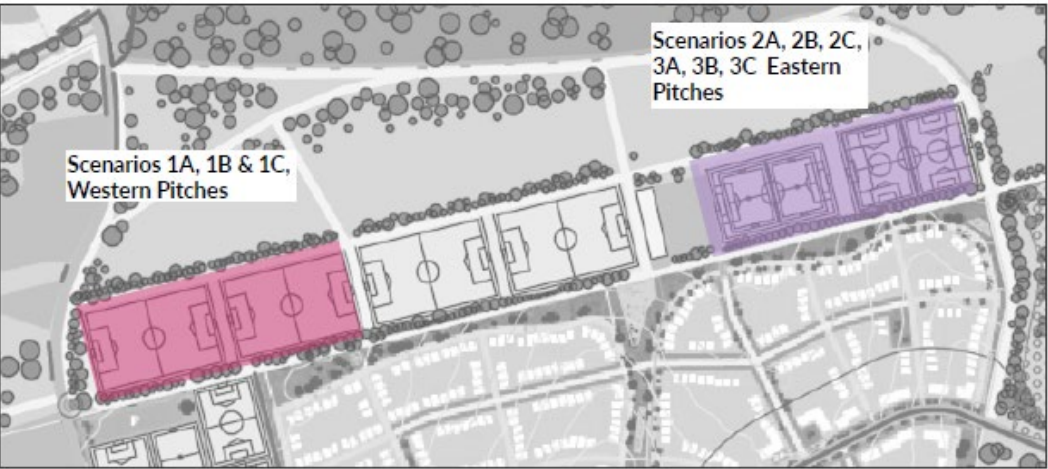


Figure 1.1 Extract from Stantec Drawing RG-LD-03, Rev A. Note, drawing indicates location of Scenario 1A, 1B,2, 3A, 3B & 4 sports pitches, which will be updated to reflect 2 x full size football pitches.

3.0 Supporting evidence

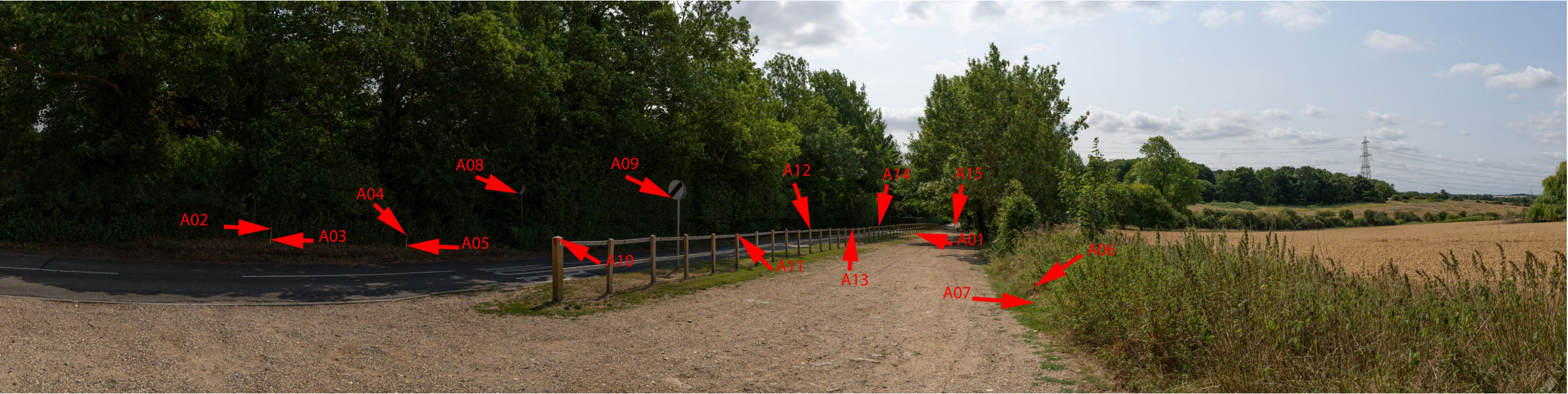
[illegible]

View A (Day & Night)

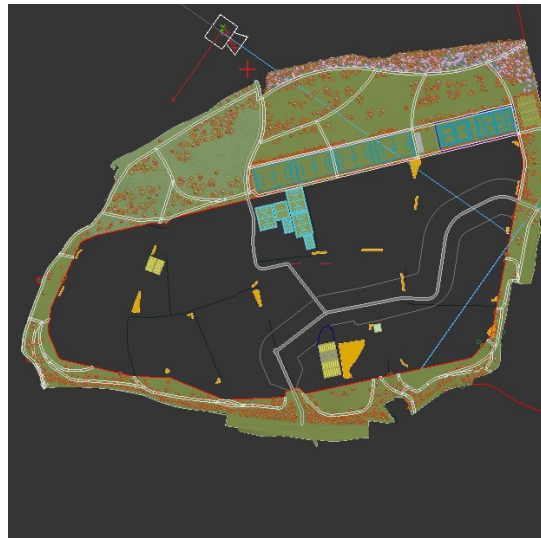
01.1 Ordnance Survey coordinates			
Point Ref	Eastings	Northings	AOD height
A01	541845.646	212605.175	64.629
A02	541822.646	212655.251	67.941
A03	541822.617	212655.265	67.611
A04	541825.420	212651.588	67.614
A05	541825.402	212651.598	67.268
A06	541813.067	212640.657	67.189
A07	541813.075	212640.648	66.863
A08	541828.984	212647.563	69.029
A09	541823.261	212643.298	68.871
A10	541818.199	212647.710	68.137
A11	541823.620	212640.759	67.613
A12	541828.867	212633.469	67.212
A13	541833.763	212625.953	66.719
A14	541838.556	212618.375	66.329
A15	541882.666	212544.661	61.004

01.3 View A Day camera location

Eastings 541808.879m
Northings 212649.217m
AOD height 68.940m
Distance to centre of site 672m
Bearing from North 125°



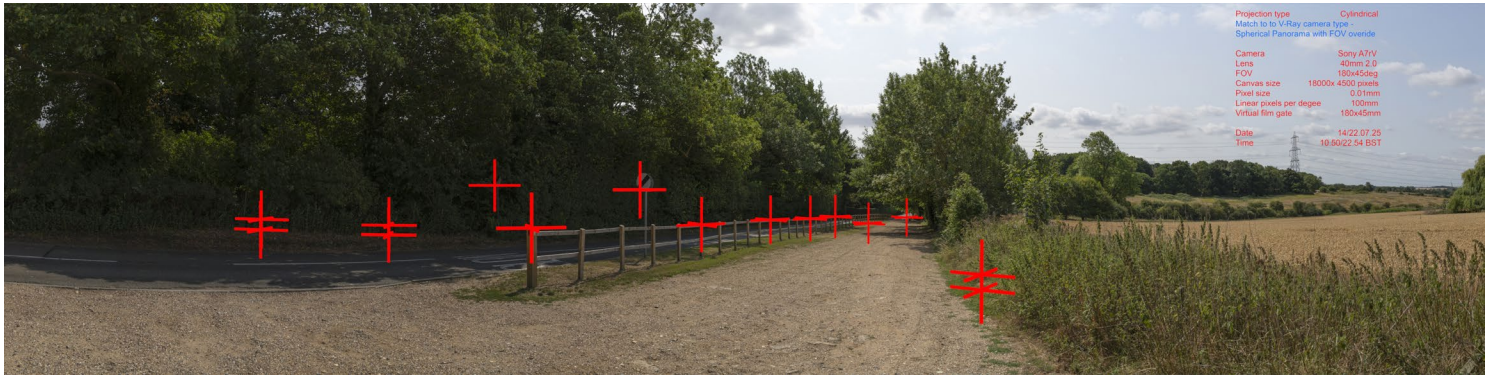
01.2 OS survey points marked on photograph



01.4 Screen grab of camera location in 3D Studio Max software



01.5 Screen grab of calculated horizon line



01.6 Screen grab of camera matching to OS data



01.7 Screen grab of model matched to photograph



01.8 Final camera matched photomontage

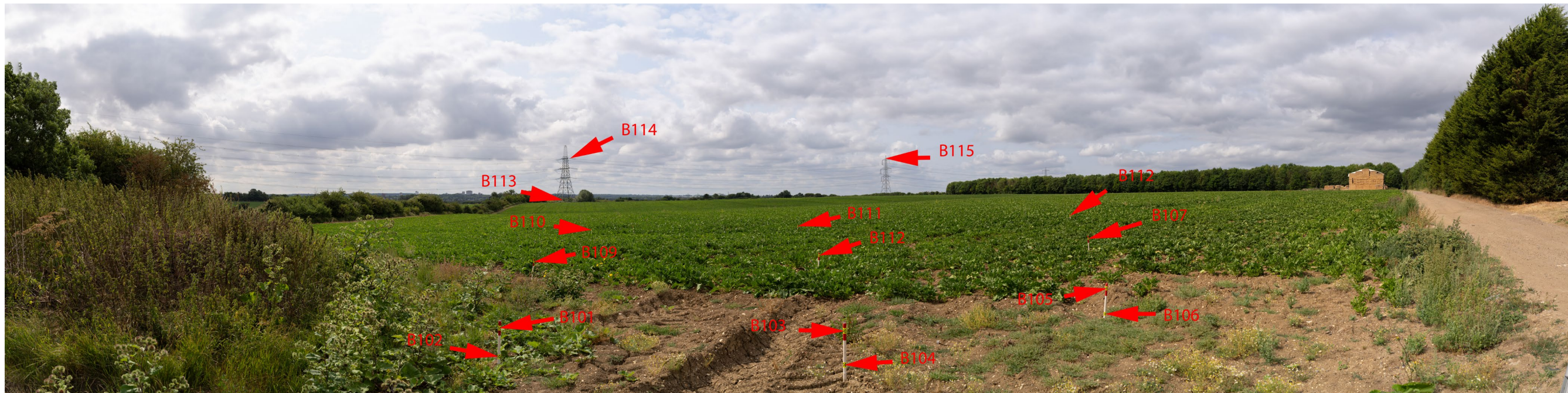
View B (Day & Night)

01.1 Ordnance Survey coordinates

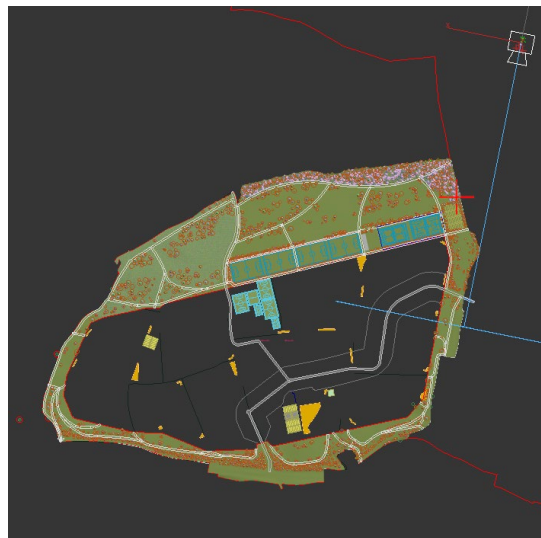
[illegible]

01.3 View B Day camera location

Eastings	542901.884m
Northings	213027.456m
AOD height	68.481m
Distance to centre of site	1288m
Bearing from North	191°



01.2 OS survey points marked on photograph



01.4 Screen grab of camera location in 3D Studio Max software



01.5 Screen grab of calculated horizon line



01.6 Screen grab of camera matching to OS data



01.7 Screen grab of model matched to photograph



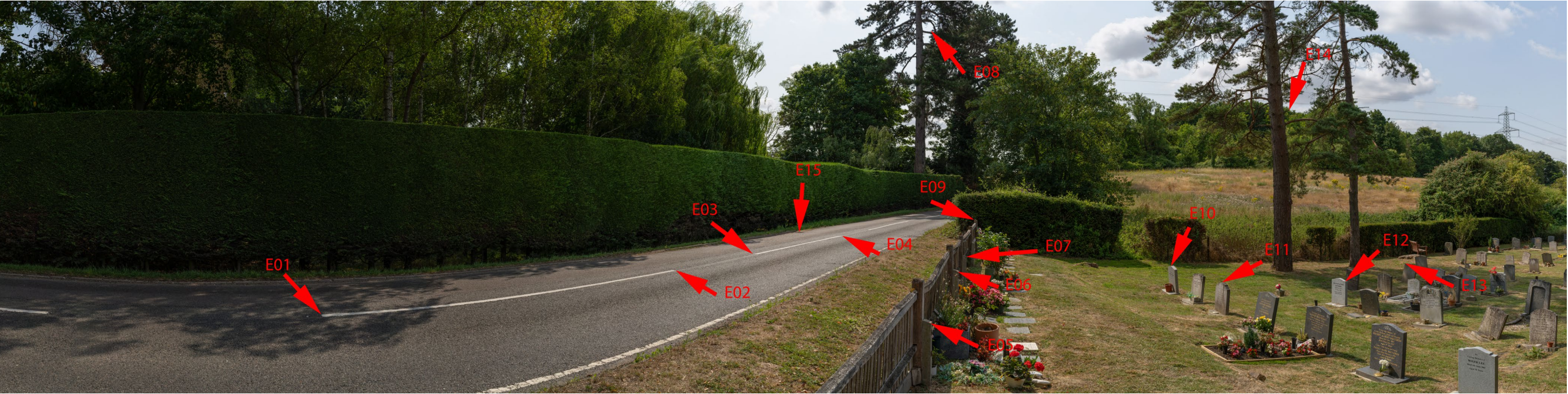
01.8 Final camera matched photomontage

View E (Day & Night)

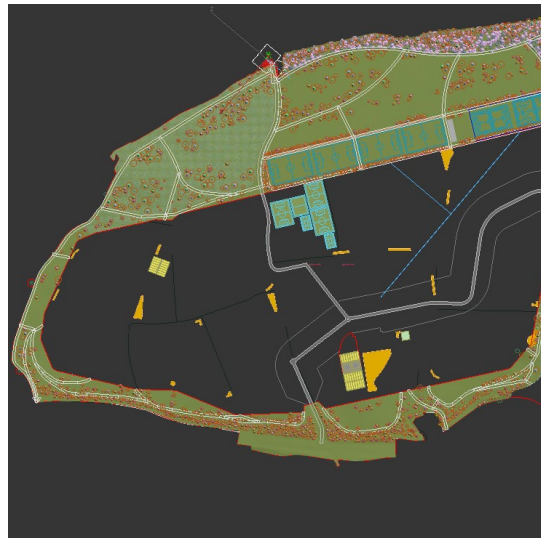
01.1 Ordnance Survey coordinates			
Point Ref	Eastings	Northings	AOD height
EE01	541900.251	212522.766	59.310
EE02	541902.973	212517.068	59.283
EE03	541904.471	212514.163	59.267
EE04	541906.923	212508.354	59.245
EE05	541896.940	212517.922	59.604
EE06	541898.101	212515.433	59.641
EE07	541899.076	212513.417	59.574
EE08	541921.746	212479.458	77.778
EE09	541901.800	212507.976	59.956
EE10	541895.884	212508.181	58.807
EE11	541894.550	212510.556	58.791
EE12	541891.386	212509.034	58.473
EE13	541887.691	212503.848	58.106
EE14	541892.083	212502.948	63.929
EE15	541910.270	212507.461	59.154

01.3 View E Day camera location

Eastings 541894.639m
Northings 212521.476m
AOD height 60.712m
Distance to centre of site 521m
Bearing from North 130°



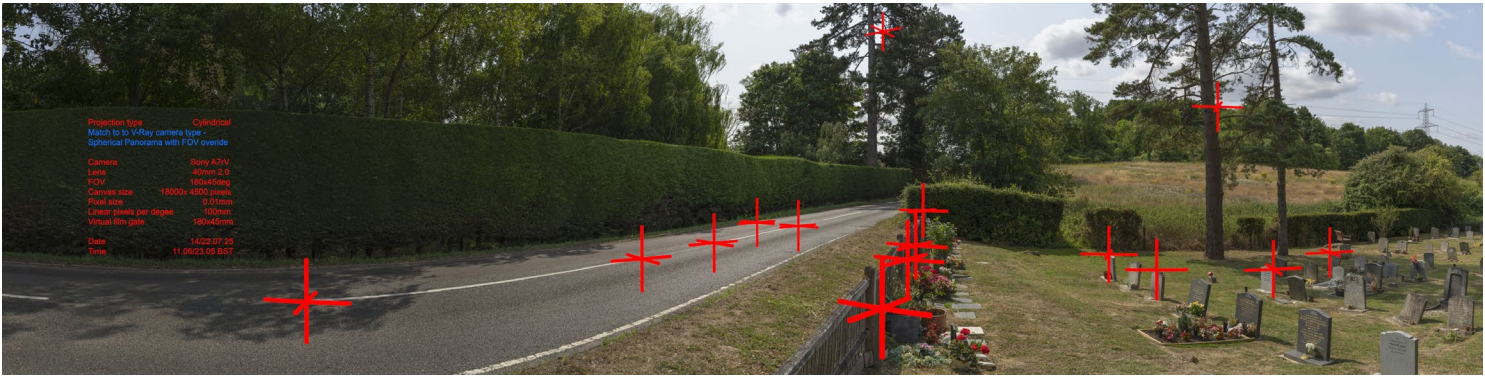
01.2 OS survey points marked on photograph



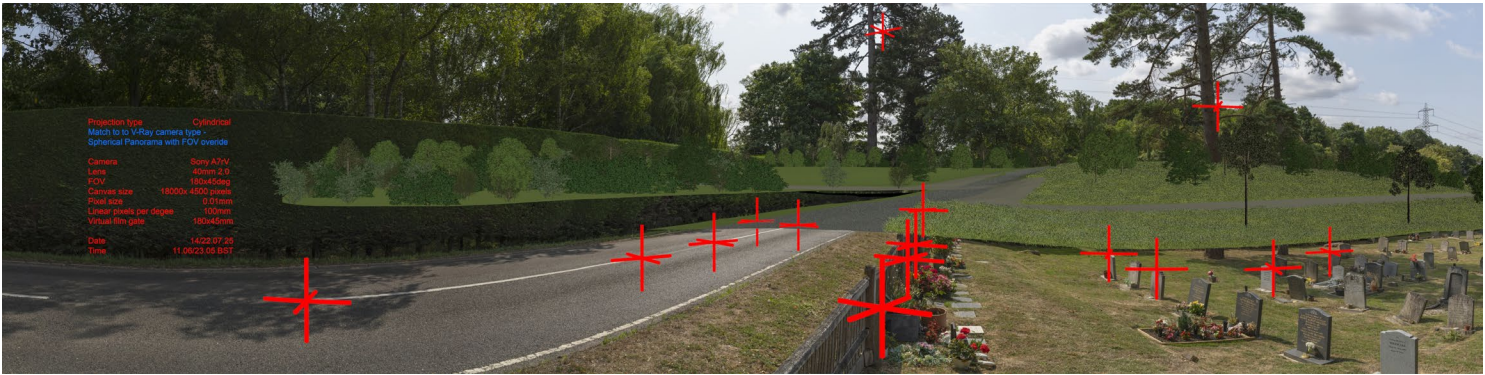
01.4 Screen grab of camera location in 3D Studio Max software



01.5 Screen grab of calculated horizon line



01.6 Screen grab of camera matching to OS data



01.7 Screen grab of model matched to photograph



01.8 Final camera matched photomontage

4.0 Final verified photomontages

View A (Day) Existing baseline

10 frame stitched image | FOV 180 x 45 degrees | Camera height above survey point 1600m | Nominal lens rise 0mm | Date 04.07.25 | Time 10:50



View A (Day) Proposed shown at Yr 1



View A (Day) Proposed shown at Yr 15

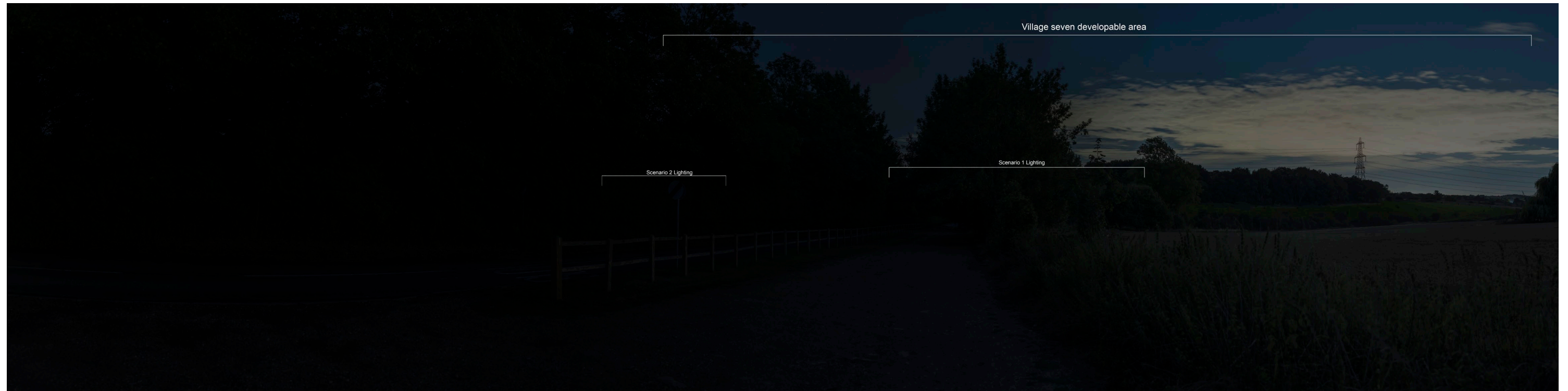


View A (Night) Existing baseline

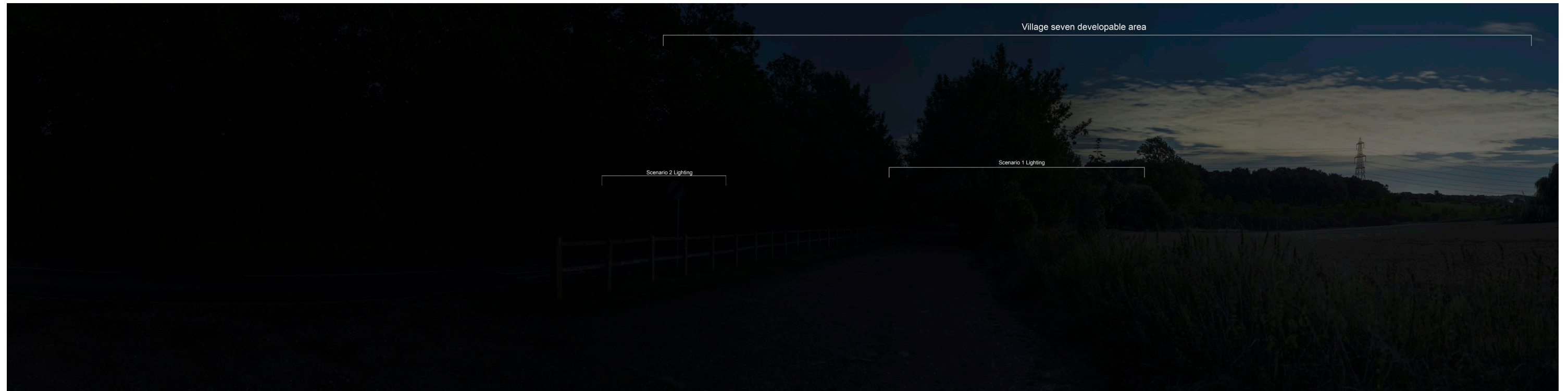
10 frame stitched image | FOV 180 x 45 degrees | Camera height above survey point 1600m | Nominal lens rise 0mm | Date 22.07.25 | Time 22:54



View A (Night) Proposed shown at Yr 1



View A (Night) Proposed shown at Yr 15



View B (Day) Existing baseline

10 frame stitched image | FOV 180 x 45 degrees | Camera height above survey point 1600m | Nominal lens rise 0mm | Date 04.07.25 | Time 10:12



View B (Day) Proposed shown at Yr 1 (Lighting Scenario 1 and 2)



View B (Day) Proposed shown at Yr 15 (Lighting Scenario 1 & 2)



View B (Night) Existing baseline

10 frame stitched image | FOV 180 x 45 degrees | Camera height above survey point 1600m | Nominal lens rise 0mm | Date 22.07.25 | Time 22:33



View B (Night) Proposed shown at Yr 1 (Lighting Scenario 1a & 2a)



View B (Night) Proposed shown at Yr 1 (Lighting Scenario 1b & 2b)



View B (Night) Proposed shown at Yr 1 (Lighting Scenario 1c & 2c)



View B (Night) Proposed shown at Yr 15 (Lighting Scenario 1a & 2a)



View B (Night) Proposed shown at Yr 15 (Lighting Scenario 1b & 2b)



View B (Night) Proposed shown at Yr 15 (Lighting Scenario 1c & 2c)



View E (Day) Existing baseline

10 frame stitched image | FOV 180 x 45 degrees | Camera height above survey point 1600m | Nominal lens rise 0mm | Date 04.07.25 | Time 11:06



View E (Day) Proposed shown at Yr 1



View E (Day) Proposed shown at Yr 15



View E (Night) Existing baseline

10 frame stitched image | FOV 180 x 45 degrees | Camera height above survey point 1600m | Nominal lens rise 0mm | Date 22.07.25 | Time 22:07



View E (Night) Proposed shown at Yr 1



View E (Night) Proposed shown at Yr 15





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