Aberavon

Lighting Assessment

10th June 2021

PRESENTED TO

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EXECUTIVE SUMMARY

Tetra Tech were commissioned by Permission Homes West Wales to undertake a Lighting Assessment in support of a residential development at Aberavon, immediately to the south of two floodlit football pitches as part of the Afan Lido Football Club.

This Fifth Issue of the Lighting Assessment has been undertaken to account for the potential floodlighting at the neighboring “astro turf” Pitch, located west of Afan Lido Football Club

The site has been identified as falling within Environmental Zone E3. This is considered representative of an area of medium district brightness, and as such the pre curfew ILP criteria for E3 for new lighting installations is set at 10 lux.

The light spill from the adjacent sports pitch has been assessed with the conclusion that lighting levels at the proposed receptors would be over the ILP criteria of 10lux. However, this does not necessarily represent the onset of an *‘unacceptable adverse effect’* of existing lighting levels on proposed dwellings at this location, especially within the context of the surrounding existing residential receptors from which it is understood that there have been no complaints.

An onsite survey showed that the installation of baffle plates to the adjacent Afon Lido Football Clubs lighting would not significantly reduce lighting levels at the proposed and would also exacerbate the problems posed by the current floodlighting to try to achieve the required illuminance on the pitch.

It is considered that the only direct (on the pitch site) mitigation that could be used, if the 10 lux criteria was required, would be the installation of replacement floodlighting (LED System) that can significantly reduce the spillage onto the neighbouring site without reducing the capacity to light the pitch. However, other forms of mitigation such as orientation of sensitive rooms within the dwellings or fitting internal blinds and louvers to the proposed dwellings could to be considered.

An updated floodlighting design produced by *Floodlighting and Electrical Services* for Afan Lido Football Club, based on 500, 350 and 250 lux averages for the football pitch have been assessed. All three lighting scenarios are expected to have lighting levels within the ILP pre-curfew criteria of 10 lux at all proposed receptors.

It is considered that the potential floodlighting at the neighboring “astro turf” pitch, located west of Afan Lido Football Club does not alter the findings of the assessment.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
CIBSE	Chartered Institute of Building Services Engineers
CIE	Commission on Illumination
ILP	Institution of Lighting Professionals
LDF	Local Development Framework
LP	Local Plan
CS	Core Strategy
DPD	Adopted Development Plan Documents
SPD	Adopted Supplementary Planning Documents
SG	Endorsed Supplementary Guidance Documents
NGR	National Grid Reference
PPS	Planning Policy Statement
NPPF	National Planning Policy Framework
Lx	Lux
ULR	Upward Lighting Ratio

1.0 INTRODUCTION

Tetra Tech were commissioned by Permission Homes West Wales to undertake a Lighting Assessment in support of a proposed residential development at Aberavon, Neath Port Talbot.

This fifth issue of the report has been updated to account for potential floodlights at the neighboring “astro turf” Pitch, located west of the proposed site.

1.1 SITE LOCATION AND CONTEXT

The development site is situated on a derelict former lido site, the approximate national grid reference is 274662: 189553. The site is on the seafront of Port Talbot. The site is directly bounded by:

- Afan Lido Football Club with a floodlit sports pitches directly to the north of the site, with residential buildings beyond;
- Residential buildings to the east of the site on Channel View and Victoria Road, with Tywyn Primary School off Channel View;
- Residential buildings to the south of the site, with Port Talbot Beach, Hollywood Park, and the Sunken Garden also situated south;
- Port Talbot Beach and a mix of residential buildings and service-providing buildings (e.g. Burger King) to the west, with Swansea Bay beyond.

Reference should be made to **Figure 1** for a visual representation of the site and surrounding area.

1.2 LIGHTING DESIGN AND ASSESSMENT - OVERVIEW

The site is located within the vicinity of existing light sources. A significant light source is that of the adjacent floodlit sports pitches at the Afan Lido Football Club north of the proposed development site.

Alternative light sources include streetlights and residential properties on the roads around the site, such as The Princess Margaret Way, Channel View, and Victoria Road. These light sources, particularly the floodlights of the adjacent sports pitches, have the potential to cause light intrusion onto the site.

Floodlighting located adjacent to Afan Lido Football Club at the “astro turf” pitch has been accounted for. The astro turf pitch is currently not in use, however proposed floodlights, similar to those to be installed at the football pitches have been modelled as a worst-case assessment.

The following stages have therefore been undertaken to assess potential impacts:

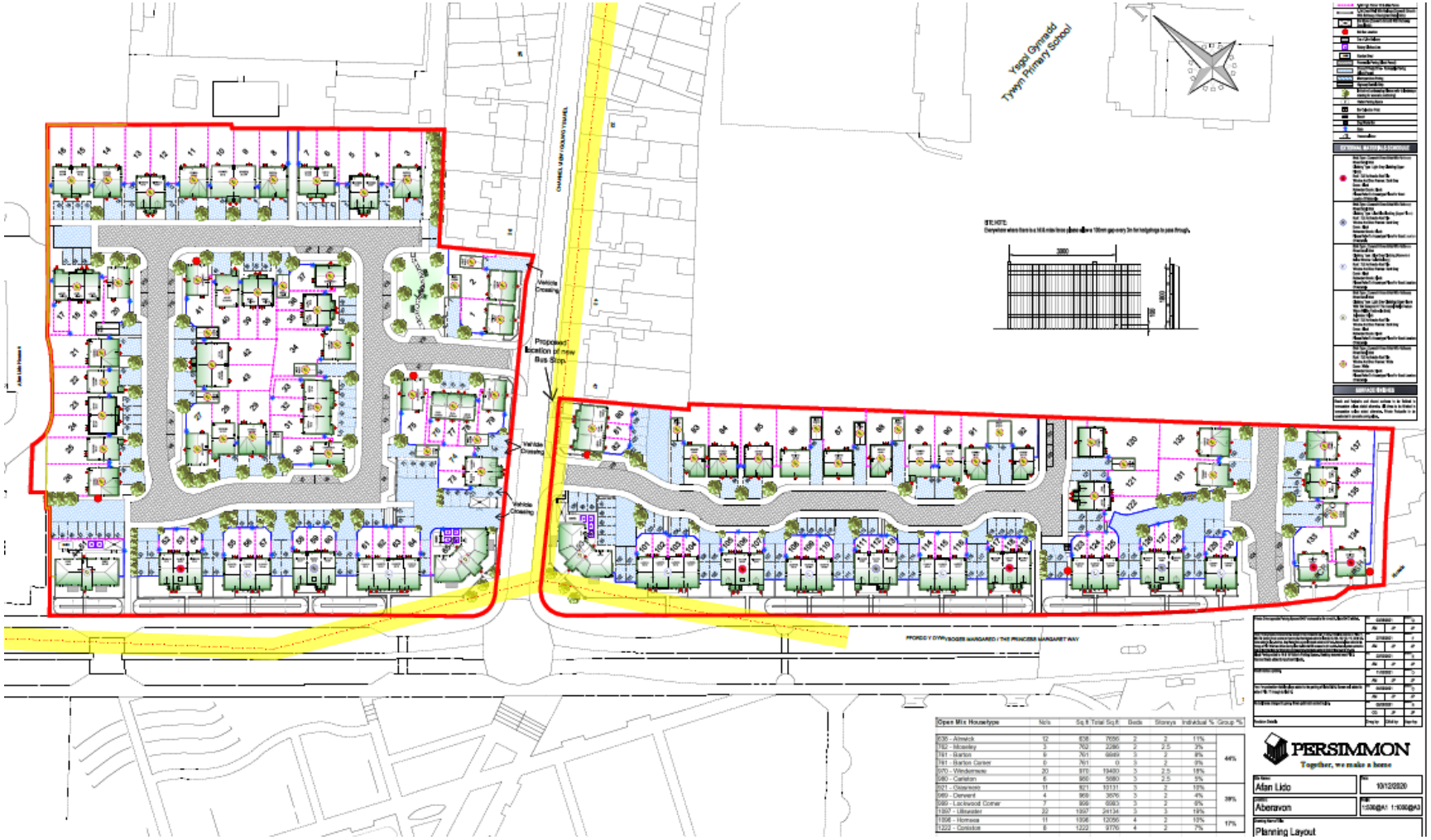
- Baseline survey;
- Modelling of an indicative lighting layout to meet recommended lighting levels for operational activity at the proposed development;
- Quantitative assessment of potential lighting impacts at existing light sensitive receptors bordering the

proposed development site, based on the proposed external lighting design;

- Formulation of appropriate mitigation measures, where necessary, to minimise the potentially detrimental impacts of the proposed lighting scheme.

The results of the assessment are detailed in the following section of this report.

Figure 1 – Site Boundary



2.0 POLICY, LEGISLATION AND RELEVANT AGENCIES

2.1 DOCUMENTS CONSULTED

The following documents were consulted during the undertaking of this assessment:

- Guidance Notes for the Reduction of Obtrusive Light, The Institution of Lighting Professionals, 2020;
- National Planning Policy Framework, Ministry of Housing, Communities & Local Government, February 2019;
- Planning Practice Guidance on Light Pollution, Ministry of Housing, Communities & Local Government, 1st November 2019;
- Environmental Protection Act, 1990;
- Statutory Nuisance from Insects and Artificial Light, Guidance on Sections 101 to 103 of the Clean Neighborhoods and Environment Act 2005, DEFRA 2006;
- Artificial Lighting and Wildlife Interim Guidance: Recommendations to Help Minimise the Impact of Artificial Lighting, Bat Conservation Trust, 2014;
- BS EN 12464-2: Lighting of Work Places - Outdoor Work Places, British Standards Institute, 2007;
- BS EN 13201-4: Road Lighting – Methods of Measuring Lighting Performance, 2003;
- BS 5489-1: Code of Practice for the Design of Outdoor Lighting - Lighting of Roads and Public Amenity Areas, British Standards Institute, 2013;
- PLG 04- Guidance on Undertaking Environmental Lighting Impact Assessments, ILP, 2013; and,
- Neath Port Talbot County Borough Council Local Development Plan (2011-2026) Adopted January 2016.

2.2 LEGISLATIVE FRAMEWORK

Light pollution was introduced within the Clean Neighbourhoods and Environment Act (2005) as a form of statutory nuisance under the Environmental Protection Act (1990), which was amended to include the following definition:

"(fb) artificial light emitted from premises so as to be prejudicial to health or nuisance;"

Although light was described as a statutory nuisance, no prescriptive limits or rules have been set for assessment. Guidance within the National Planning Policy Guidance with regards to Light pollution has been referred to while producing this assessment as well as documents produced by the International Commission on Illumination (CIE), Institution of Lighting Professionals (ILP) and the Chartered Institute of Building Services Engineers (CIBSE).

2.3 PLANNING POLICY AND GUIDANCE

2.3.1 National policy

The National Planning Policy Framework (NPPF), February 2019 principally brings together and summarises the suite of Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) which previously guided planning policymaking. The NPPF broadly retains the principles of PPS 23: Planning and Pollution Control and with regard to light pollution, paragraph 180 states that;

> *"180 Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *c. limits the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

The National Planning Practice Guidance web-based resource was launched by the Department for Communities and Local Government (DCLG) on 6 March 2014 and updated for lighting on the 1st November 2019 to support the National Planning Policy Framework and make it more accessible. It states that "for maximum benefit, the best use of artificial light is about getting the right light, in the right place and providing light at the right time". In light of this guidance, the assessment has considered the following implications of the proposed lighting design:

- *Does an existing lighting installation make the proposed location for a development unsuitable? For example, this might be because:*
    - the artificial light has a significant effect on the locality;
    - users of the proposed development (e.g. a hospital) may be particularly sensitive to light intrusion from the existing light source.
- *Will a new development, or a proposed change to an existing site, be likely to materially alter light levels in the environment around the site and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?*
- *Will the impact of new lighting conflict with the needs of specialist facilities requiring low levels of surrounding light (such as observatories, airports and general aviation facilities)? Impacts on other activities that rely on low levels of light such as astronomy may also be a consideration but will need to be considered in terms of both their severity and alongside the wider benefits of the development.*
- *Is the development in or near a protected area of dark sky or an intrinsically dark landscape where new lighting would be conspicuously out of keeping with local nocturnal light levels, making it desirable to minimise or avoid new lighting?*

- *Would new lighting have any safety impacts, for example in creating a hazard for road users?*
- *Is a proposal likely to have a significant impact on a protected site or species? This could be a particular concern where forms of artificial light with a potentially high impact on wildlife and ecosystems (e.g. white or ultraviolet light) are being proposed close to protected sites, sensitive wildlife receptors or areas, including where the light is likely to shine on water where bats feed.*
- *Does the proposed development include smooth, reflective building materials, including large horizontal expanses of glass, particularly near water bodies? (As it may change natural light, creating polarised light pollution that can affect wildlife behaviour.)*

If the answer to any of the above questions is 'yes', consideration should be made for:

- *Where the light shines;*
- *When the light shines;*
- *How much light shines; and*
- *Possible ecological impact.*

2.3.2 Local policy

The Neath Port Talbot County Borough Council Local Development Plan (2011-2026) Adopted January 2016 includes the following policy in relation to development and lighting:

"Policy EN 8

Pollution and Land Stability

Proposals which would be likely to have an unacceptable adverse effect on health, biodiversity, and/or local amenity or would expose people to unacceptable risk due to the following will not be permitted:

- *Air pollution;*
- *Noise pollution*
- *Light pollution*
- *Contamination*
- *Land instability*
- *Water (including groundwater) pollution.*

Proposals which would create new problems or exacerbate existing problems detailed above will not be acceptable unless mitigation measures are included to reduce the risk of harm to public health, biodiversity, and/or local amenity to an acceptable level."

This report seeks to demonstrate that the lighting used will be compliant with this local policy.

3.0 METHODOLOGY

The Lighting Assessment includes the establishment of baseline ambient light conditions, an examination of where light spill from existing sources has the potential to affect the residential development.

Light modelling was undertaken using DIALux software, an independent lighting model which is capable of calculating daylight and artificial lighting scenes in interior and exterior scenarios. The model incorporates ILP, CIE 112, and BS EN 12464-2 calculation methodologies and is commonly used for lighting impact assessment.

3.1 LIGHTING DESIGN

The proposed lighting design on the existing football pitch was used and modelled within the assessment.

Modelling of the updated floodlighting design based on the 500, 350 and 250lx scenarios produced by *Floodlighting and Electrical Services* for Afan Lido Football Club on the proposed residential receptors has also been undertaken.

A worst-case assumption that potential floodlighting for the neighboring “astro turf” pitch has also been also been accounted for in the updated modelling. This has utlised the same floodlighting design for the 350lx scenario produced by *Floodlighting and Electrical Services* to achieve the 350lx competitive minimum requirement stated by Sports England.

3.2 QUANTITATIVE LIGHTING ASSESSMENT

3.2.1 Obtrusive Light

Baseline light conditions were determined during a site survey of the existing site and the surrounding area. A lighting model was subsequently developed to represent the proposed external lighting scheme and to enable the obtrusive light from the proposed development to be calculated at local receptors.

3.2.2 Proposed Lighting Within the Proposed Housing Scheme

The ILP has developed an Environmental Zone classification system for the categorisation of sensitive receptor locations based on typical levels of baseline obtrusive light. This is summarised in **Table** 3-1.

Table 3-1– Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 t 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.

Zone	Surrounding	Lighting Environment	Examples
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

For each Environmental Zone, recommended obtrusive light limits for exterior lighting installations have also been determined. These are summarised in **Table *3-2*** – **Table *3-4***. Table 3-2 shows the maximum allowable illuminance in the vertical plane for each Environmental Zone for Pre-curfew scenarios (after 07:00 hours) and Post-curfew scenarios (after 23:00). **Table 3-3** shows the maximum allowable luminous intensity emitted by the luminaires relative to the position of each luminous intensity receptor location depending on what the environmental zone is. **Table 3-4** shows the maximum allowable Upward Light Ratio (ULR) for each environmental zone. If the modelled maximum values of vertical illuminance, the modelled maximum luminous intensity and the ULR are below the criteria in the tables below, they pass the assessment.

Table 3-2 - Maximum Values of Vertical Illuminance on Properties

Light technical parameter	Application conditions	Environmental Zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (Ev)	Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
	Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

Table 3-3- Limits for the Luminous Intensity of Bright Luminaires

Light technical parameter	Application conditions		Luminaire group (projected area Ap in m^2)					
			$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p>0.5$
Maximum luminous intensity emitted by luminaire (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 d	0.63 d	1.3 d	2.5 d	5.1 d	2,500
		Post-curfew	0	0	0	0	0	0

Light technical parameter	Application conditions		Luminaire group (projected area Ap in m^2)					
			$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p>0.5$
	E2	Pre-curfew	0.57 d	1.3 d	2.5 d	5.0 d	10 d	7,500
		Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	500
	E3	Pre-curfew	0.86 d	1.9 d	3.8 d	7.5 d	15 d	10,000
		Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	1,000
	E4	Pre-curfew	1.4 d	3.1 d	6.3 d	13 d	26 d	25,000
		Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	2,500
Aid to gauging Ap			2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)			3.2	7.1	14.1	26.3	56.6	>80
Corresponding AP representative area (m2)			0.0008	0.004	0.016	0.063	0.251	>0.5

NOTE:

1. D is the distance between the observer and the glare source in meters;
2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut off in the designated directions;
3. A_P 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 $A_p>0.5$

Table 3-4 – Maximum Values of Upward Light Ratio (ULR) of Luminaires

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

The assessment determined the lighting levels and Environmental Zone classification in the vicinity of the proposed development through the baseline survey. Modelling of the lighting scheme was undertaken and predicted obtrusive light values compared with the relevant guidelines, as detailed within **Table 3-2**– **Table 3-4.**

The potential environmental effects of the proposed development are identified, in so far as current knowledge of

the site and development allows. The significance of potential environmental effects is assessed according to their scale (magnitude) and the sensitivity of the receptors.

3.2.2.1 Effects of Existing Lighting Levels on The Proposed Dwellings

The test for the effects of existing lighting levels on the proposed dwellings is from policy EN8 'unacceptable adverse effect' or 'significant adverse effect' from NPPF. Whilst the ILP limitations for Lighting Installations in **Table 3-2** above are designed for new lighting installations, there is no commentary within the guidance that considers whether this is the onset of a significant effect or whether this represents the onset of effects on amenity that should be mitigated for new installations. As such, it is considered that unacceptable adverse effects may actually be higher than the levels in **Table 3-2** above, particularly in the context of this site, where the football pitch is surrounded by close by existing dwellings where there are understood to be no complaints regarding lighting. Similarly, it is considered that mitigation measures, such as provision of blinds may be sufficient to be 'suitable mitigation measures in place to avoid those activities having a significant adverse effect on residents or users of the proposed scheme'.

4.0 BASELINE

This section provides a review of the existing lighting levels at the site in order to provide a benchmark against which to assess potential impacts associated with the development. The floodlights of the adjacent sports pitches north of the site were switched on during the survey.

4.1 BASELINE SURVEY

4.1.1 Survey Conditions

A baseline lighting survey was undertaken on Friday 21st February 2020. Due to the time of year, the survey was undertaken after 20:00 to establish the existing pre-curfew lighting conditions.

A baseline lighting survey was undertaken on 1st September 2020 at Afon Lido Football Club. focusing on the north-west region of the proposed residential development.

The survey was conducted using a Digital Lux Meter which meets CIE photopic spectral response, with a maximum resolution of 0.01 lux. The survey was undertaken with a meter resolution of 0.01 lux.

4.1.2 Existing Light Sources

Existing light sources surrounding the site include the floodlights on the adjacent floodlit football pitches, as well as street lighting and residential lighting from the surrounding streets such as The Princess Margaret Way, Channel View, and Victoria Road. There are two pitches north of the proposed development. Each pitch has eight floodlights; four equally spaced on each touchline. However, it is important to note that the adjacent NPTCBC pitch to the north of the Afon Lido Football Club is (as of August 2020) no longer operational. There are also leisure facilities west of the proposed development in the form of Aberavon Leisure and Fitness Centre and the Reel Cinema.

4.1.3 February 2020 Survey Locations

Light monitoring was undertaken at a number of survey locations to determine variations in baseline light levels within and around the site. Where possible, monitoring at the boundary of the receptor locations was undertaken to provide the best possible representation of existing light obtrusion. Where this was not possible, monitoring was undertaken at the most appropriate representative location. Reference should be made to Figure 3 and **Error! Reference source not found.** for an illustrative site map of the monitoring locations on and around the site. Figure 3 represents monitoring locations on and surrounding the site. **Error! Reference source not found.** represents monitoring locations in the form of a grid transect for the western part of the residential development southwest of the Afan Lido Football Club.

The purpose of the survey is fourfold:

- The survey enables quantified light levels at (or as near as possible to) local sensitive receptor locations to be measured;

- The site survey also provides an understanding of any significant landforms and vegetation that can potentially provide a pathway screen between light sources and receptors;
- The survey enables the ILP environmental zone to be determined based on sound, quantified evidence; and,
- The survey enables existing significant sources of artificial light and natural screens to be accounted for outside of the quantified model predictions.

The survey, therefore, provides a robust understanding of the artificial lighting illuminance levels currently experienced around the site. The locations of all the light monitoring locations relative to Figure 3 are summarized in Table 4-1 and the results from this survey are contained in Table 4-2.

A series of measurements were taken at key points; a horizontal ground level measurement and four vertical measurements at 1.5m facing towards the floodlit sports pitches in general accordance with the recommended monitoring method in the statutory guidance issued by the ILP. Illuminance levels can vary quite significantly over relatively small distances and even with slight changes in the plane of the lens. Therefore, the range of measurements taken over a monitoring length was recorded, in order to determine the minimum and maximum illuminance at receptor façades.

Table 4-1 – Base Light Monitoring Locations

Reference	Monitoring Location
L1	Cappacha, Indoor Sports Centre, The Princess Margaret Way, Sandfields, SA12 6QW
L2	2 Afan Lido House, Princess Margaret Way, Port Talbot, SA12 6QW
L3	Flat 32, Carmarthen House, Bevin Avenue, Port Talbot, SA12 6JN
L4	Cinnamon Kitchen, The Princess Margaret Way, Sandfields, SA12 6QW
L5	Cinnamon Kitchen, The Princess Margaret Way, Sandfields, SA12 6QW
L6	Cinnamon Kitchen, The Princess Margaret Way, Sandfields, SA12 6QW
L7	Kiosk, Afan Lido Aquadrome, The Princess Margaret Way, Sandfields, SA12 6QN
L8	47 Channel View, Port Talbot, SA12 6JF
L9	47 Channel View, Port Talbot, SA12 6JF
L10	36 Channel View, Port Talbot, SA12 6JG
L11	16 Channel View, Port Talbot, SA12 6JG
L12	22 Sunnybank Road, Port Talbot, SA12 6JQ

Reference	Monitoring Location
L13	36 Sunnybank Road, Port Talbot, SA12 6JE
L14	47 Channel View, Port Talbot, SA12 6JF
L15	47 Channel View, Port Talbot, SA12 6JF
L16	70 Jersey Quay, Port Talbot, SA12 6QN
L17	70 Jersey Quay, Port Talbot, SA12 6QN
L18	Kinsale, Princess Margaret Way, Port Talbot, SA12 6QW
L19	81 Jersey Quay, Port Talbot, SA12 6QN
L20	Kinsale, Princess Margaret Way, Port Talbot, SA12 6QW
L21	173 Victoria Road, Port Talbot, SA12 6QJ
L22	116 St. Pauls Road, Port Talbot, SA12 6PH

4.1.4 Off-site Survey Results (February 2020)

The results of the light monitoring locations relative to **Figure 3** are displayed in **Table 4-2**.

Table 4-2 – Survey Results

Reference	Recorded Illuminance (Lux)					
	Facing Up	Facing North	Facing East	Facing South	Facing West	SQM
L1	1.39	3.55	6.96	0.34	0.49	17.47
L2	0.23	0.57	0.48	0.18	0.70	17.28
L3	1.65	2.19	3.17	0.74	1.52	16.98
L4	3.91	3.89	1.14	3.38	6.09	16.72
L5	0.24	0.54	0.24	0.56	0.78	17.06
L6	4.17	5.52	3.02	4.06	6.09	15.57
L7	1.23	2.52	2.79	3.68	3.05	16.82
L8	5.91	1.81	2.99	8.79	2.65	11.17
L9	0.84	0.58	0.68	1.57	0.50	16.97
L10	0.46	0.33	0.47	2.40	2.04	17.32
L11	0.82	1.17	1.92	0.52	0.62	16.94
L12	0.18	0.25	0.12	0.97	0.26	17.25
L13	1.03	0.94	0.27	0.29	2.27	17.28
L14	0.12	0.21	0.16	0.19	0.17	17.67
L15	0.82	0.19	0.29	1.62	1.77	16.82
L16	0.14	0.15	0.20	0.31	0.23	16.93
L17	1.31	0.26	0.31	2.10	1.80	16.54

L18	0.20	0.53	0.48	0.75	0.52	16.30
L19	1.23	0.97	2.26	3.39	2.58	16.69
L20	0.38	0.18	0.29	1.44	0.63	16.82
L21	2.15	2.49	6.18	3.14	2.97	16.55
L22	0.81	1.57	0.49	0.73	0.99	16.91

Following the environmental lighting survey, it was concluded that the development is in a village location and the site should be classified as 'Environmental Zone E3 – Medium district brightness', in accordance with the ILP guidance limits outlined within **Table 3-2**. Therefore, the worst-case permitted light trespass limit at any proposed or existing receptors in the pre-curfew period (typically considered to be 07:00-23:00) is 10 lux and in the post curfew period (typically considered to be 23:00-07:00) is 5 lux.

4.1.5 On-site Survey Results (February 2020)

Based on the February 2020 Survey, a lighting lux plot has been produced, to determine the lux level contours that spill from the football club onto the north-western section of the proposed development. This is shown visually in **Figure 2** below.

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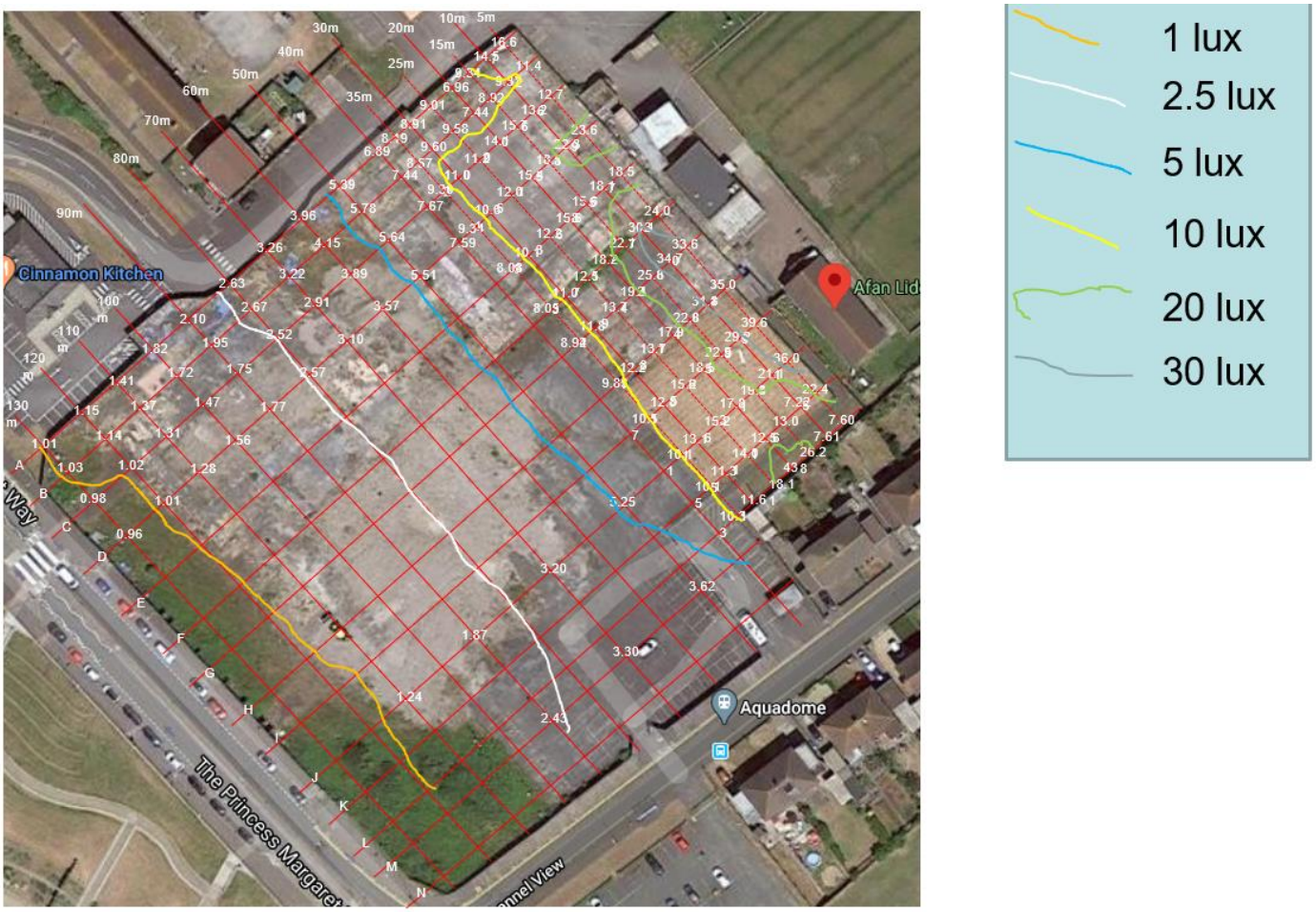
Figure 2 -Lux Contour Plot



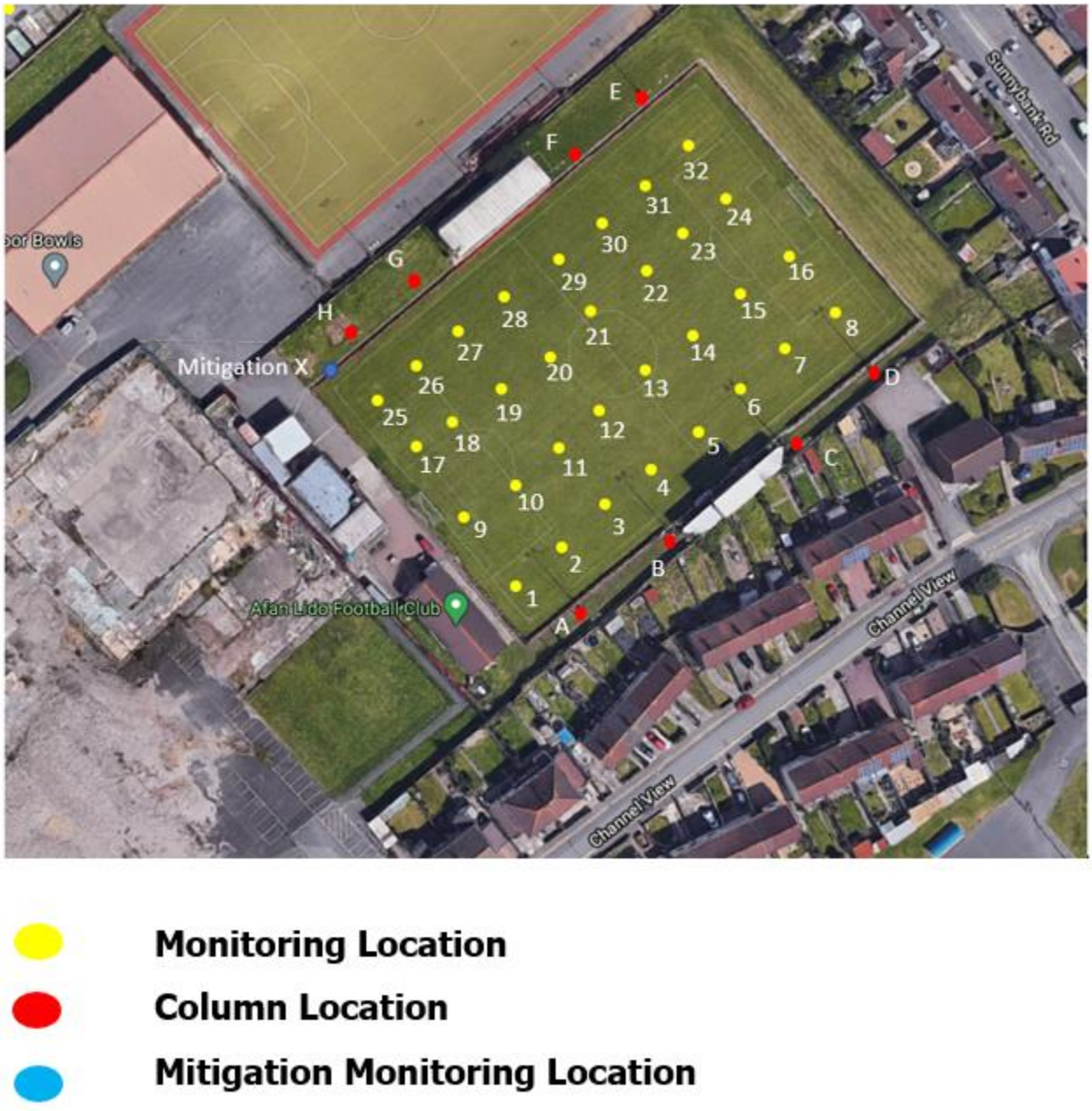
4.1.6 September 2020 Survey

As well as an updated onsite (proposed development site) lighting survey, the September 2020 survey included lighting measurements on the pitch and gathering information regarding the operation of the football club site, physical constraints for direct on-site mitigation (such as re-angling or baffle-plate), and whether there have been any complaints from existing nearby receptors. The survey was undertaken before 23:00 to establish the existing post curfew lighting conditions and was conducted using a Digital Lux Meter which meets CIE photopic spectral response, with a maximum resolution of 0.01 lux.

Light monitoring on the proposed development site was undertaken at the same number of survey locations to determine variations in baseline light levels within the vicinity of the site from between the September survey and the February survey.

Light monitoring of the Afon Lido Football Club pitch to monitor the current lighting conditions on the pitch. Reference should be made to **Figure 3** for an illustrative site map of the monitoring locations.

Figure 3 – Light Monitoring Locations



4.1.7 Survey Observations

Following discussions with the club, they have confirmed that the operational hours of the sports lighting never exceed 23:00 hours with most matches finishing at 22:00 at the latest. The club confirmed there have also been no complaints received from surrounding residents in regard to lighting on the pitch.

During the survey each of the floodlight locations contained 2 lamps, except location D which had 1 lamp, there is normally a capacity for 4 lamps at each location. Also, the floodlights at the football pitch were subject to wear and tear (exacerbated by the elevated saline corrosion) with some not being able to function and some were not orientated towards the pitch correctly.

It is important to note that the adjacent NPTCBC pitch to the north of the Afon Lido Football Club is no longer operational therefore these lights were not on during the September survey which affects some of the results particularly in the northern corner of the proposed development site.

The survey, therefore, provides a robust understanding of the current artificial lighting illuminance levels currently experienced around the development site, and how they might differ as a result of mitigating the floodlights. The September survey results for the football pitch are shown in **Table 4-3** and **Figure 3**.

Table 4-3 – Football Pitch Light Monitoring Results

ID	Horizontal (Upward) Light Levels on Football Pitch	
	Range (lux)	Average (lux)
L1	92 - 175	134
L2	200 - 205	203
L3	196 - 202	199
L4	185 - 201	193
L5	165 - 196	181
L6	162 - 178	170
L7	135 - 155	145
L8	75 - 96	86
L9	94 - 102	98
L10	140 - 150	145
L11	110 - 126	118
L12	110 - 150	130
L13	97 - 105	101
L14	129 - 139	134
L15	109 - 111	110
L16	45 - 65	55
L17	120 - 132	126
L18	198 - 124	161
L19	117 – 176	147
L20	102 - 123	113
L21	129 - 182	156

L22	176 - 190	183
L23	104 - 140	122
L24	96 - 123	110
L25	80 - 92	86
L26	113 - 129	121
L27	144 - 175	160
L28	111 - 121	116
L29	103 - 126	115
L30	124 - 197	161
L31	146 - 168	157
L32	120 - 135	128

The current levels of the sports pitch as below in;

- Average - 136
- Min -45
- Max 205
- Uniformity 0.33

The recommended criteria for a football pitch of this size and use is an average of 250 lux as recommended by FA Wales. It is expected that if all 4 lamps on each column were fully working, the 250 lux criteria would be met across the majority of the pitch, but that there would be some areas that would not quite achieve this.

Figure 4 – Light Monitoring Results (lux)

4.1.8 Proposed Site Monitoring (September 2020)

From the initial February survey, a contour plot was produced based on the baseline data collected in a grid format – see **Figure 2**. The results of this survey are shown in **Table 4-4**. The results for the September Survey are shown in **Table 4-5**

The results show that the lux levels from the February survey are brighter, this can be attributed to several factors including the adjacent sports pitch lights no longer being operational and during the February Survey more Afon Lido Football club lamps being operational, however even with fewer lights being operational lighting levels at 15m from the site boundary are still above the 10 lux ILP pre-Curfew criteria

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Table 4-4 – Light Monitoring Results (lux) February 2020 Survey

	A	B	C	D	E	F	G	H	I	J	K	L
5	16.60	10.40	12.70	23.60	18.50	24.00	33.60	35.00	39.60	36.00	22.40	7.60
10	14.50	9.32	13.60	22.00	18.70	30.20	34.07	34.30	29.90	21.10	7.23	7.61
15	9.34	8.92	15.60	18.80	15.60	22.70	25.80	22.60	22.90	19.80	13.00	26.20
20	6.96	7.44	14.00	15.90	15.80	18.72	19.20	17.40	18.50	17.80	12.50	43.80
25	9.01	9.58	11.20	12.00	12.60	12.50	13.70	13.70	15.80	15.32	14.00	18.10
30	8.91	9.60	11.00	10.60	10.10	11.00	11.80	12.20	12.50	13.16	11.30	11.61
35	8.19	8.57	9.39	9.34	8.03	8.05	8.92	9.80	10.50	10.11	10.50	10.30
40	6.89	7.44	7.67	7.59					7.00	1.00	5.00	3.00
50	5.39	5.78	5.64	5.51								
60	3.96	4.15	3.89	3.57								
70	3.26	3.22	2.91	3.10								

Table 4-5 – Light Monitoring Results (lux) September 2020 Survey

	A	B	C	D	E	F	G	H	I	J	K	L
5		7.00	6.00	15.00	7.70	9.00	33.00	38.80	39.90	26.30	10.20	8.80
10	12.00	6.00	5.00	15.00	14.00	11.00	27.00	22.00	27.20	25.50	17.60	7.50
15	6.00	6.00	5.40	12.50	15.50	15.70	21.00	23.20	20.00	21.50	15.00	4.50
20	5.00		5.00		7.00		17.00		20.00			
25												
30	5.00		6.00		8.00		8.00		9.00			
35												
40	3.00		3.00		5.00		5.00		3.00			
50												
60			3.00		1.00		1.00		1.00			
70												

5.0 DISCUSSION AND POTENTIAL MITIGATION MEASURES

Based upon the February and September Surveys some of the proposed receptors will be above the 10 lux criteria for proposed new lighting installations, however as discussed in section 3.2 this does not necessarily represent the onset of an *'unacceptable adverse effect'* at this location, especially within the context of the surrounding existing residential receptors from which it is understood that there have been no complaints. It is important to note that the football pitch floodlights lights on site will not be operational past the curfew limit of 23:00hr.

Modelling of the site and the adjacent football lights was undertaken to assess what impact different mitigation measures would have on the light levels at the proposed properties.

5.1 MODELLING METHODOLOGY

A lighting model was created using DIALux (based on the February 2020 survey) which incorporated the DWG plans provided by the client for the housing layout.

As a worst case assumption, the sports pitch has been lit within the model to an average of 300lux.

The model was verified based on measurements of lights surrounding the site and observations made during the survey.

The models were verified by modelling the lighting intervals for the 'existing' scenario and then comparing the monitoring and modelling results as shown in the table below. These are shown in **Figure 5**.

Figure 5 – Verification Location

Table 5-1 – Modelled vs. Monitored Results (February 2020

Location (Distance from Boundary Edge)	Monitored Lux	Modelled Lux	Difference between Monitored and Modelled Results
1 -35m	10.5	10	-0.5
2 -35m	10.5	9.25	-1.3
3 -35m	9.8	7.28	-2.5
4 -35m	8.9	8.6	-0.3
5 -35m	8	6.71	-1.3
6 -35m	9.3	6.5	-2.8
7 -15m -	22	27	5.0
8 -15m	25	22	-3.0
9 -15m	22	23	1.0
10 -15m	18	19	1.0

The verification points show a divergence between monitored and modelled results of no more than 3.0 lux except point 7 which the model over-predicts to be higher than the monitoring. The models are therefore considered to be suitably verified.

5.2 RESULTS AND MITIGATION OPTIONS

Key proposed residential properties were identified which have the potential to be affected by obtrusive light as highlighted in **Table 5-1**. Receptors were located at heights of 4m and 1.5m to represent first and ground floor receptors of the proposed development which will be most affected upon by existing light from the sports pitch. Reference should be made to **Figure 6** for an illustration of the residential receptors used for this assessment.

Figure 6 – Proposed Receptor Locations

The results of the assessments with modelling undertaken to include the existing lighting from the car park to the north of the development site are shown in **Table 5-2**, below.

Table 5-2 -Proposed Receptors Without Mitigation

ID	Predicted Model Illuminance First Floor (lux)	Predicted Model Illuminance Ground Floor (lux)
R1	2.74	1.99
R2	5.24	4.81
R3	9.25	10.00
R4	33.00	53.00
R5	37.00	64.00

ID	Predicted Model Illuminance First Floor (lux)	Predicted Model Illuminance Ground Floor (lux)
R6	23.00	41.00
R7	27.00	49.00
R8	37.00	66.00
R9	32.00	54.00
R10	1.07	0.10
R11	0.98	0.39
R12	0.91	0.06
R13	1.09	0.05
R14	0.16	0.07
R15	0.71	0.99

The results show that without mitigation in place, the majority of properties on the boundary of the site are expected to exceed the ILP pre-curfew criteria of 10 lux.

The latest mitigation options included the following:

- Option 1 Redesigning the football pitch lights;
- Option 2 The use of inbuilt blackout blinds and non-sensitive rooms overlooking the floodlit football pitch;

5.2.1 Option 1 – Replacement Floodlighting

This mitigation option would involve replacement floodlighting (typically LED), incorporating, where necessary, cowls and baffles to the sides and top of the floodlights closest to the proposed development. The cowling and used of LED's would essentially give significantly more control and direction for the light distribution from the floodlights of the adjacent football pitch.

Table 5-3 -Proposed Receptor Results with Mitigation – Option 1 Replacement Floodlighting

ID	Predicted Model Illuminance First Floor (lux)	Predicted Model Illuminance Ground Floor (lux)
R1	1.94	0.88
R2	2.66	1.73
R3	3.15	3.14
R4	4.50	6.80
R5	3.24	6.11
R6	3.87	4.15
R7	4.43	5.06
R8	3.47	5.04
R9	4.57	5.85
R10	0.13	0.04
R11	0.17	0.28
R12	0.03	0.01
R13	0.02	0.01
R14	0.02	0.01
R15	0.23	0.26

The results show that with replacement floodlighting, all of the proposed properties on the proposed development site of the site are expected to have lighting levels within the ILP pre-curfew criteria of 10 lux for new installations.

5.2.2 Option 2 – Potential Retrofit Baffle Mitigation

As part of the September lighting survey, different sizes of baffles were simulated adjacent to the lighting column labelled “H” in Figure 3. Lighting measurements were taken pitchside (location X in Figure 3) and at locations 30D and 30F. The different baffle sizes used whereas followed,

Large Panel- 800*500mm

Medium Panel – 500*300mm

Small Panel – 300*200mm

The results of the mitigation can be found in **Table 5-4** below,

Table 5-4 – Light Monitoring Results (lux): September Survey – Baffle Mitigation

Baffle Size	Location 30F			Location 30D			Location X (Pitch Side)		
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Large	9.2	8.9	-0.3	8.5	7.9	-0.6	51	29	-22
	9.9	9.2	-0.7	8.5	8.2	-0.3	50	22	-28
	9.1	8.8	-0.3	8.5	7.9	-0.6	49	-	
Medium	9.8	9.6	-0.2	8.5	8.2	-0.3	51	33	-18
	9.8	9.5	-0.3	8.5	8.2	-0.3	50	27	-23
	10.4	10.4	0	8.5	8.1	-0.4	51	36	-15
Small	10.3	10.3	0	8.5	8.0	-0.5	50	36	-14
	9.2	8.9	-0.3	8.5	7.9	-0.6	51	29	-22
	9.9	9.2	-0.7	8.5	8.2	-0.3	50	22	-28

The results in **Table 5-4** show that introducing the baffles would not have a significant reduction in the results on the proposed development site. Furthermore, as the pitch is not currently adequately lit, and would only just be adequately lit in the unlikely event that all of the current lamps were able to be repaired, it is considered that the use of retrofit baffles to the existing floodlighting would only exasperate the lighting requirements on the pitch.

As such, it is considered that the only direct (on the pitch site) mitigation that could be used, if the 10 lux criteria was required, would be the installation of new floodlighting (LED System) that can significantly reduce the spillage onto the neighbouring site without reducing the capacity to light the pitch. Therefore, if the 10 lux criteria was considered to be required other forms of mitigation such as the orientation of sensitive rooms within the dwellings or fitting internal blinds and louvers to the proposed dwellings would need to be considered, such as option 3 below.

5.2.3 Option 3 – Onsite Mitigation

Option 3 - The use of built-in blackout blinds and non-sensitive rooms overlooking the floodlit football pitch;

Through the use of inbuilt blackout blinds, the effect of the floodlights on the rears of plots 5-20 would be reduced. For light sensitive rooms, this would assist in helping to meet the criteria internally during the use of the floodlights and by having non-sensitive rooms (e.g. bathrooms, kitchens, hallways, utility rooms) the reduces the impact of the floodlights on the proposed properties.

Figure 7 – Example of Inbuilt Blackout Blinds ©Theshutterstudio

Following recent discussions with Persimmon Homes West Wales, it is understood that the preferred mitigation option is option 1, the replacement of the floodlighting.

6.0 FLOODLIGHTING DESIGN SCENARIOS

Modelling of the updated floodlighting design based on the 500, 350 and 250lx scenarios produced by *Floodlighting and Electrical Services* for Afan Lido Football Club on the proposed residential receptors has been undertaken.

Potential floodlighting located adjacent to Afan Lido Football Club at the “astro turf” pitch has been accounted for. The “astro turf” pitch is currently not in use, however floodlights, similar to those to be installed at the football pitches have been modelled as a worst-case assessment. Based on the Sports England criteria, hockey pitches should be illuminated to minimum of 350 lx for competitive play. As such the 350 lx football pitch scenario has been used to accurately illuminate the “astro turf” pitch as the dimensions of both pitches are very similar.

Figure 8 below illustrates the potential lighting design for the adjacent “astro turf” pitch using the lighting design for the 350lx football pitch scenario.

Figure 8 – Potential Lighting Design for “Astro Turf” Pitch using 350lx Football Pitch Lighting Design.

6.1 MODELLING METHODOLOGY

Three lighting models were created using DIALux which incorporated the DWG plans provided by the client for the housing layout.

Based on the lighting design, the sports pitch has been lit within the model to an average of 500, 350 and 250lux.

6.2 RESULTS

Receptors were located at heights of 4m and 1.5m to represent first and ground floor receptors of the proposed development which will be most affected upon by proposed levels of light from the new lighting design for the sports pitch. Reference should be made to Figure 6 for an illustration of the residential receptors used for this assessment.

6.2.1 Scenario 1 – Floodlight Design Results 500 Lux

This scenario would involve replacement LED floodlighting to illuminate the sports pitch to an average of 500lux.

Table 6-1 -Proposed Receptor Results – Scenario 1 500lux

ID	Predicted Model Illuminance First Floor (lux)	Predicted Model Illuminance Ground Floor (lux)
R1	3.86	2.92
R2	0.01	0.01
R3	4.94	4.50
R4	0.01	0.02
R5	0.04	0.06
R6	0.04	0.08
R7	0.05	0.08
R8	7.32	8.42
R9	0.01	0.02
R10	0.27	0.07
R11	0.24	0.25
R12	0.03	0.03
R13	0.03	0.03
R14	0.05	0.04
R15	0.45	0.44

The results show that with replacement floodlighting for the 500lx scenario, all of the properties on the proposed development site assessed are expected to have lighting levels within the ILP pre-curfew criteria of 10 lux for new installations.

6.2.2 Scenario 2 – Floodlight Design Results 350 Lux

This scenario would involve replacement LED floodlighting to illuminate the sports pitch to an average of 350lux.

Table 6-2 -Proposed Receptor Results – Scenario 2 350lux

ID	Predicted Model Illuminance First Floor (lux)	Predicted Model Illuminance Ground Floor (lux)
R1	3.25	2.58
R2	0.00	0.01
R3	3.99	3.63
R4	0.01	0.01
R5	0.03	0.05
R6	0.04	0.07
R7	0.04	0.08
R8	6.09	7.34
R9	0.01	0.02
R10	0.25	0.06
R11	0.35	0.37
R12	0.03	0.02
R13	0.03	0.02
R14	0.06	0.03
R15	0.37	0.27

The results show that with replacement floodlighting for the 500lx scenario, all of the properties on the proposed development site assessed are expected to have lighting levels within the ILP pre-curfew criteria of 10 lux for new installations.

6.2.3 Scenario 3 – Floodlight Design Results 250 Lux

This scenario would involve replacement LED floodlighting to illuminate the sports pitch to an average of 250lux.

Table 6-3 -Proposed Receptor Results – Scenario 1 250lux

ID	Predicted Model Illuminance First Floor (lux)	Predicted Model Illuminance Ground Floor (lux)
R1	2.81	2.20
R2	0.00	0.01
R3	3.95	3.50
R4	0.01	0.01
R5	0.02	0.03
R6	0.02	0.04
R7	0.02	0.04
R8	5.19	6.13
R9	0.01	0.01
R10	0.13	0.05
R11	0.25	0.27
R12	0.02	0.02
R13	0.03	0.02
R14	0.06	0.03
R15	0.50	0.43

The results show that with replacement floodlighting for the 500lx scenario, all of the properties on the proposed development site assessed are expected to have lighting levels within the ILP pre-curfew criteria of 10 lux for new installations.

Overall the results show that all of the proposed properties on the proposed development site for all three lighting scenarios with the replacement floodlighting as well as the neighboring “astro turf” pitch illuminated to Sports England’s 350 lx criteria, are expected to have lighting levels within the ILP per-curfew criteria of 10 lux for new installations. As such, no further mitigation is required.

7.0 CONCLUSIONS

Tetra Tech were commissioned by Permission Homes West Wales to undertake a Lighting Assessment in support of a residential development at Aberavon, immediately to the south of two floodlit football pitches as part of the Afan Lido Football Club.

This Fifth Issue of the Lighting Assessment has been undertaken to account for the potential floodlighting at the neighboring “astro turf” Pitch, located west of Afan Lido Football Club

The site has been identified as falling within Environmental Zone E3. This is considered representative of an area of medium district brightness, and as such the pre curfew ILP criteria for E3 for new lighting installations is set at 10 lux.

The light spill from the adjacent sports pitch has been assessed with the conclusion that lighting levels at the proposed receptors would be over the ILP criteria of 10lux. However, this does not necessarily represent the onset of an *‘unacceptable adverse effect’* of existing lighting levels on proposed dwellings at this location, especially within the context of the surrounding existing residential receptors from which it is understood that there have been no complaints.

An onsite survey showed that the installation of baffle plates to the adjacent Afon Lido Football Clubs lighting would not significantly reduce lighting levels at the proposed and would also exacerbate the problems posed by the current floodlighting to try to achieve the required illuminance on the pitch.

It is considered that the only direct (on the pitch site) mitigation that could be used, if the 10 lux criteria was required, would be the installation of replacement floodlighting (LED System) that can significantly reduce the spillage onto the neighbouring site without reducing the capacity to light the pitch. However, other forms of mitigation such as orientation of sensitive rooms within the dwellings or fitting internal blinds and louvers to the proposed dwellings could to be considered.

An updated floodlighting design produced by *Floodlighting and Electrical Services* for Afan Lido Football Club, based on 500, 350 and 250 lux averages for the football pitch have been assessed. All three lighting scenarios are expected to have lighting levels within the ILP pre-curfew criteria of 10 lux at all proposed receptors.

It is considered that the potential floodlighting at the neighboring “astro turf” pitch, located west of Afan Lido Football Club does not alter the findings of the assessment.

APPENDIX A

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