ACOUSTIC CONSULTANTS LTD

# Noise Impact Assessment

**Proposed Artificial Grass Pitch**
**Ysgol Bryn Alyn High School**

**Reference: 11267/FD**

## Client:

SPORTS LABS
TESTING TECHNOLOGY FOR SPORT

## Document Control

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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# 1. Introduction

Sports Lab Limited appointed Acoustic Consultants Limited (ACL) to undertake an environmental noise assessment for the proposed new artificial grass pitch (AGP) in the grounds located at Ysgol Bryn Alyn High School. The assessment considered the impact of noise produced from the proposed AGP on the nearby noise-sensitive residential properties.

The assessment includes the prediction of noise emission from the existing and proposed AGP at the nearby noise-sensitive properties, based on noise level data from activities measured at existing AGPs.

The author of this report is a technician Member of the Institute of Acoustics and is considered suitably qualified to undertake this noise impact assessment. This report has been approved by a Member of the Institute of Acoustics (MIOA) and Director of the company with over 19 years' experience in the industry.

# 2. The Site

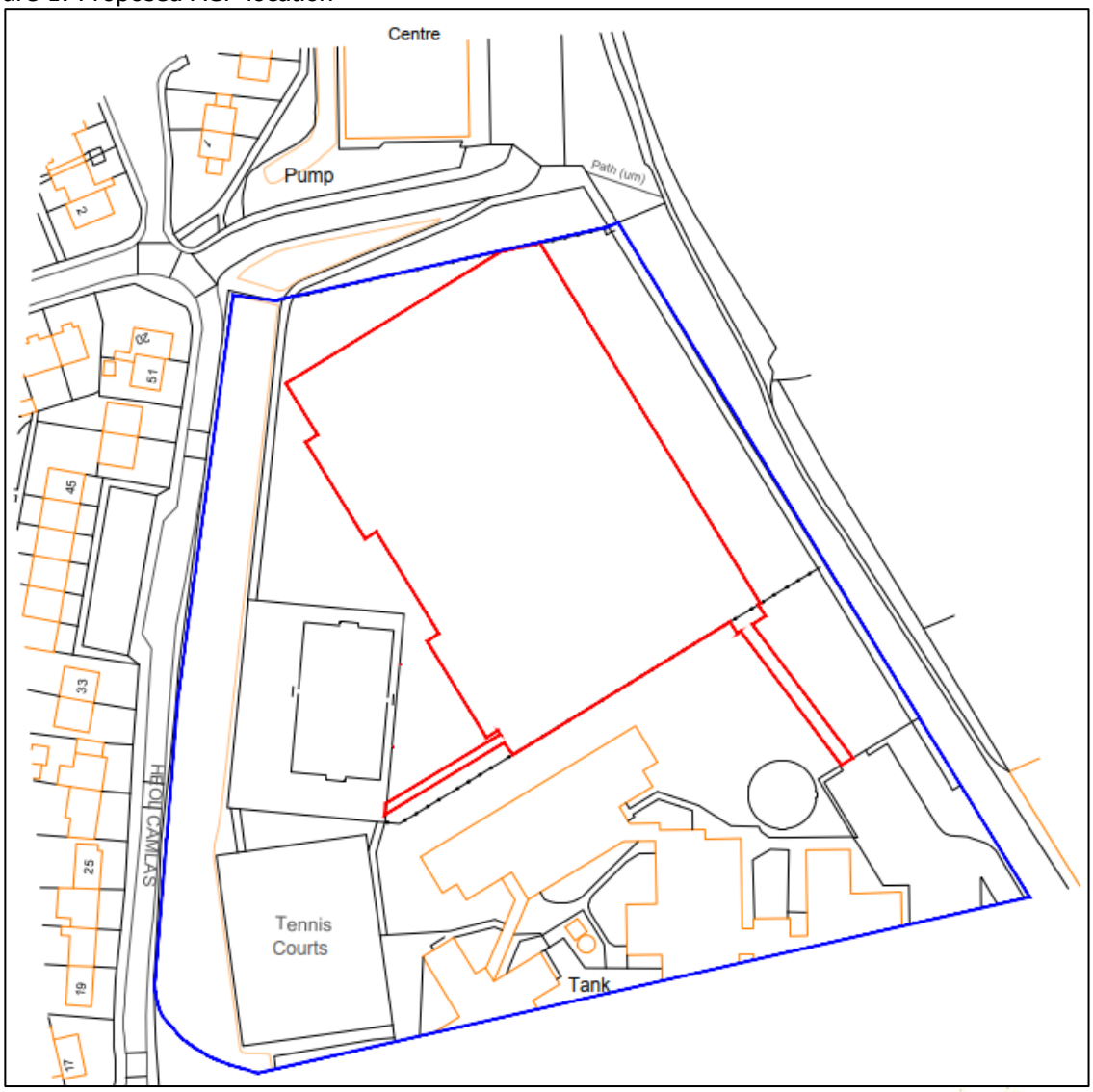
The site is to be located within grounds associated with Ysgol Bryn Alyn High School, to the north of the school buildings. The nearest noise-sensitive residential receivers (NSRs) in respect to the proposed AGP are understood to be approximately 40 metres away to the west.

We do not currently know the exact proposed hours of use, but we have presumed a worst-case typical operation of:

- 08:00 to 22:00 Monday to Friday
- 08:00 to 18:00 Saturday & Sunday

The proposed AGP location is provided on the figure below.

Figure 1: Proposed AGP location



# 3. Planning and Noise

## 3.1. Planning Policy Wales (PPW)

Planning Policy Wales (PPW) Edition 12 dated February 2024 sets out the land use planning policies of the Welsh Government. Section 1 states:

*1.1 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. PPW, the TANs1, MTANs2 and policy clarification letters comprise national planning policy.*

The most relevant statements for noise affecting a residential use are provided in Section 6.7 and summarised below:

*6.7.1 Clean air and an appropriate soundscape, contribute to a positive experience of place as well as being necessary for public health, amenity and well-being. They are indicators of local environmental quality and integral qualities of place which should be protected through preventative or proactive action through the planning system. Conversely, air, noise and light pollution can have negative effects on people, biodiversity and the resilience of ecosystems and should be reduced as far as possible.*

*6.7.4 The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.*

*6.7.5 In taking forward these broad objectives the key planning policy principle is to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments. Air Quality and soundscape influence choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor air quality or inappropriate soundscapes. The agent of change principle says that a business or person responsible for introducing a change is responsible for managing that change. In practice, for example, this means a developer would have to ensure that solutions to address air quality or noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable.*

*6.7.6 In proposing new development, planning authorities and developers must, therefore:*

- *address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;*
- *not create areas of poor air quality or inappropriate soundscape; and*
- *seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.*

*6.7.7 To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer."*

*6.7.8 Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose, and could include those related to:*

- *traffic management and road safety;*
- *ensuring progress towards a shift to low or zero emissions means of road transport, such as electrical charging points;*
- *supporting low or zero emissions public transport;*
- *providing active travel infrastructure; and*
- *incorporating green infrastructure, where it can improve air quality by removing air pollution and aiding its dispersal, reduce real or perceived noise levels by absorbing and scattering noise and introducing natural sounds to soften man-made noise, provide areas of relative tranquillity, and reduce exposure by putting a buffer between sources of pollution and receptors.*

*6.7.14 Proposed development should be designed wherever possible to prevent adverse effects to amenity, health and the environment but as a minimum to limit or constrain any effects that do occur. In circumstances where impacts are unacceptable, for example where adequate mitigation is unlikely to be sufficient to safeguard local amenity in terms of air quality and the acoustic environment it will be appropriate to refuse permission.*

*6.7.19 The health imperative of good air quality and appropriate soundscapes in contributing to the overall character and quality of places and the health and well-being of people and wildlife should be fully recognised. It will not be appropriate to locate sensitive uses, such as hospitals, schools, care homes and housing adjacent to busy roads or other transport routes, where there are no connectivity benefits to be gained and where health and amenity impacts associated with increased exposure of people to pollution will be unacceptable. Whilst some uses may be appropriate with the aid of good design air quality and soundscape considerations can be overriding*

*factors, especially for sensitive uses, if they cannot be adequately mitigated and impacts minimised.*

*6.7.20 Where sensitive developments need to be located close to existing transportation infrastructure for sustainable movement and access they should be designed, as far as practicable, to limit harmful substances and noise levels within and around those developments both now and in the future. This may include employing the principles of good acoustic design and the inclusion of active travel or travel management measures as part of development proposals. Such development, however, should preferably be located away from existing sources of significant noise, which may include aircraft noise or roads, particularly new roads or those with programmed route improvements.*

*6.7.21 Regard should be paid to current air quality and noise levels and the quality of the existing soundscape and account taken of any relevant local air quality action plan, noise action plan and/ or local or regional air quality strategy as part of development strategies and proposals in development plans and before determining planning applications.*

*6.7.24 The potential impacts of noise pollution arising from existing development, be this commercial, industrial, transport related or cultural venues (such as music venues, theatres or arts centres), must be fully considered to ensure the effects on new development can be adequately controlled to safeguard amenity and any necessary measures and controls should be incorporated as part of the proposed new development. This will help to prevent the risk of restrictions or possible closure of existing premises or adverse impacts on transport infrastructure due to noise and other complaints from occupiers of new developments. It will be important that the most appropriate level of information is provided and assessment undertaken.*

PPW does not provide any quantifiable criteria and directs you to the Technical Advice Notes (TAN 11).

## 3.2. Technical Advice Note (Wales) - Noise

The relevant planning criteria for proposed residential development is in Technical Advice Note (Wales) 11 entitled "Noise" which was published in October 1997. The introduction states:

*"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources".*

Table 1 provides Noise Exposure Categories (NECs), which relate to proposed residential developments near to a transportation and mixed noise sources. NECs are addressed in ranges according to the free-field equivalent noise levels ($L_{Aeq,\ T}$) measured at the position of the proposed dwellings.

Table 1: TAN 11 noise exposure categories

| **NOISE SOURCE** | **NOISE EXPOSURE CATEGORY** | | | |
|---|---|---|---|---|
| **Mixed Noise** | **A** | **B** | **C** | **D** |
| 07.00 - 23.00 hours | <55 | 55 – 63 | 63 – 72 | >72 |
| 23.00 - 07.00 hours | <45 | 45 – 57 | 57 – 66 | >66 |

The Technical Advice Note (Wales) 11 gives advice to Local Planning Authorities on assessing proposals for residential developments near a source of noise, depending upon which of the four Noise Exposure Categories the proposed site falls into:

NEC A. *Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.*

NEC B. *Noise should be taken into account when determining planning applications and where appropriate, conditions imposed to ensure an adequate level of protection.*

NEC C. *Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.*

NEC D. *Planning permission should normally be refused.*

In addition, it states: *"Night-time noise levels (23.000 - 07.00): sites where individual noise events regularly exceed 82 dB $L_{Amax}$ (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$ (except where the $L_{Aeq,8h}$ already puts the site in NEC D)."*

Where the Noise Exposure Category for a site falls into NEC B, C or D mitigation will be necessary to control external noise observed within a dwelling.

# 4. Relevant Noise Guidance for AGP Assessment

The following sections outline what we consider to be relevant guidance and suitable noise criteria within the context of the planning policy.

This includes advice contained within the Sport England Design Guidance Note 'Artificial Grass Pitch (AGP) Acoustics – Planning Implications' which refers to the following documents.

## 4.1. World Health Organisation 'Guidelines for Community Noise'

The World Health Organisation 'Guidelines for Community Noise' published in 1999 gives the following description of community noise.

*"Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighbourhood. Typical neighbourhood noise comes from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.); from live or recorded music; sport events including motor sports; playgrounds; car parks; and domestic animals such as barking dogs."*

This includes "sport events" and, as such, the use of AGP sites.

For noise levels internally and externally to dwellings it states:

*"In Dwellings. The effect of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 LAeq for continuous noise and 45 LAmax for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source. At night-time, outside sound levels about 1 metre from façades of living spaces should not exceed 45 dB LAeq, so that people may sleep with bedroom windows open. This value was obtained by assuming the noise reduction from outside to inside with the window open is 15 dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35 dB LAeq. The maximum sound pressure level should be measured with the sound pressure meter set at "fast"."*

Based on the same methodology used to determine the night-time noise level (with a 15 dB(A) for an open window) outside a residential property, the daytime noise level about 1 metre from façades of living spaces should not exceed 50 dB LAeq.

Table 4.1 of the document provides guidelines for community noise in specific environments, suggesting noise levels at which adverse health and annoyance effects are likely. The relevant noise criteria are as follows:

Table 2: WHO Noise Criteria

| Specific Environment | Critical Health Effect | $L_{eq(T)}$ dB(A) |
|---|---|---|
| Outdoor living area | Serious annoyance, daytime and evening | 55 |
| | Moderate annoyance, daytime and evening | 50 |
| Dwelling indoors | Speech intelligibility & moderate annoyance, daytime & evening | 35 |

According to the WHO guidance, moderate annoyance is caused by noise levels exceeding 50 $L_{Aeq(T)}$ dB externally and 35 $L_{Aeq(T)}$ dB internally. With relation to the adverse effect level, we would consider this the threshold of the Lowest Observed Adverse Effect Level.

Therefore, where noise levels from the proposed development do not exceed 50 $L_{Aeq(T)}$ dB externally and 35 $L_{Aeq(T)}$ dB internally, the effect is below the Lowest Observed Adverse Effect Level and will have no adverse effect. The noise level of the AGP may be noticeable but not intrusive and is considered acceptable in planning terms.

The equivalent noise level is determined over a specific time period. The World Health Organisation guidelines for residential developments are typically equivalent noise levels calculated over a 16-hour daytime period.

In our opinion, an AGP 16-hour assessment period may not truly reflect the noise impact as it takes into account times of use and non-use. We would propose an alternative, more stringent but appropriate assessment time period of one hour, $L_{Aeq\ (1\ hour)}$, as this is the typical time period for a community sports session on an AGP. Therefore, we would suggest the more stringent target noise level of 50 dB $L_{Aeq\ (1\ hour)}$ is more suitable for the more sensitive evening time.

The WHO criteria were reviewed in a report by the National Physical Laboratory (reference CMAM16) which states:

*"Exceedance of the WHO guideline values does not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher levels of noise exposure are reached."*

Therefore, it is not necessarily the case that where these levels are exceeded the noise will adversely affect nearby residential properties.

## 4.2. Comparative Assessment

The criteria set out in Section 4.1 is an absolute level in a dwelling or external amenity area. As such, it does not consider existing noise levels on or around the site. However, for certain applications it may be more suitable to consider a comparative assessment as part of the overall impact assessment.

For example, this would be a site where the existing noise levels already exceed the WHO guideline values. This existing noise for example, could be due to transportation noise or other sporting facilities.

In terms of noise level changes, withdrawn Planning Policy Guidance 24 states in the Glossary under dB (A) the following:

*"Measurements in dB (A) broadly agree with people's assessment of loudness. A change of 3 dB (A) is the minimum perceptible under normal conditions, and a change of 10 dB (A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB (A); normal conversation about 60 dB (A) at 1 metre; heavy road traffic about 80 dB (A) at 10 metres; the level near a pneumatic drill about 100 dB (A)."*

The Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment, Version 1.2 published in November 2014 categorises the significance of a change in noise level, this is summarised as follows and taken from Table 7-14 of the guidance.

Table 3: IEMA Impact from the Change in Sound Levels (Table 7-14)

| **Sound Level Change LpT** | **Long-term impact classification** | **Short-term impact classification** |
|---|---|---|
| $\geq$ 0 dB and < 1 dB | Negligible | Negligible |
| $\geq$ 1 dB and < 3 dB | | Minor |
| $\geq$ 3 dB and < 5 dB | Minor | Moderate |
| $\geq$ 5 dB and < 10 dB | Moderate | Major |
| $\geq$ 10 dB | Major | |

Where noise from the proposed development does not exceed the existing noise climate, the increase in noise will be no more than 3 decibels. It is expected there will be no observed effect on nearby residential properties. This would be applicable where noise levels currently exceed the WHO guidelines which would be used as a lower limit. The noise levels are both measured in the $L_{Aeq(T)}$ parameter over the same time period, T.

Where noise levels do not exceed the WHO guidelines, a higher change could be considered acceptable without having an observed adverse effect as the noise levels are suitably low.

## 4.3. Transient Sounds

To assess noise from short-term sources, we have considered separately the noise from shouts, whistles and the impact of balls on the perimeter fence. There is no specific guidance for the maximum noise level of environmental noise during the daytime and, as such, we have taken a pragmatic approach in considering the most appropriate available guidance.

By assessing both the equivalent noise level for continuous use of the AGP and the maximum noise level of discrete events, we consider that this addresses the character of the noise.

## 4.4. Proposed Assessment Methodology

The aim of the assessment is to determine whether noise from the proposed pitch can be controlled to acceptable levels during the proposed hours of use.

It is proposed to assess the development against the WHO guidelines. Where the predicted noise level of the AGP is below the WHO guidelines threshold for the onset of 'moderate annoyance' in terms of the PPG, the development will have 'no observed adverse effect'.

The PPG states that the perception of 'No Observed Adverse Effect' is 'noticeable and not intrusive' and gives an example outcome as follows:

*"Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life."*

The 'No Observed Adverse Effect' level falls below the Lowest Observed Adverse Effect Level of the PPG.

It is also considered necessary to consider the maximum noise levels generated by the use. However, there is no directly appropriate criteria for daytime maximum noise levels and as such we provide this information and assessment for consideration by the Local Planning Authority.

# 5. Site Noise Monitoring

An attended site noise survey was undertaken on 19th March 2025. The purpose of the noise survey was to determine the existing ambient noise climate at a location representative of the nearest noise-sensitive residential property during the proposed AGP hours of use.

## 5.1. Monitoring Equipment

Sound Pressure Levels were measured using Class 1 sound level meters with a half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 4: Equipment and Calibration Status

| Equipment Description / Manufacturer / Type | Serial Number | Date of Calibration | Calibration Certification Number |
|---|---|---|---|
| SLM, NTI, XL2 | A2A-11053-E0 | 14/05/2024 | 1508623-1 |
| Pre-Amp, NTI, MA220 | 5871 | 14/05/2024 | 1508623-1 |
| Microphone, NTI, MC230A | 9276 | 14/05/2024 | 1508623-1 |
| Calibrator, Nor-1251 | 35227 | 27/02/2025 | 1511387-1 |

The measurement equipment was checked before and after use with the noted calibrators and no significant drift was detected.

## 5.2. Weather Conditions

During the measurement, the weather was dry with no rain and the temperature ranged between 6 and 12 degrees centigrade. Wind speeds during the noise monitoring exercise were between 3 and 5 metres per second, with a predominantly northerly direction. The weather conditions are not expected to have affected the measured noise data.

## 5.3. Monitoring Procedure

Noise monitoring was undertaken in a location representative of the nearest noise-sensitive receivers to the proposed AGP. Noise measurements were undertaken between 18:00 hours and 22:00 hours.

During the measurements the noise climate was primarily determined by road traffic. The microphone was in free-field position, approximately 1.5 metres above ground on a tripod. The monitoring location is shown on the figure below:

Figure 2: Monitoring Location.

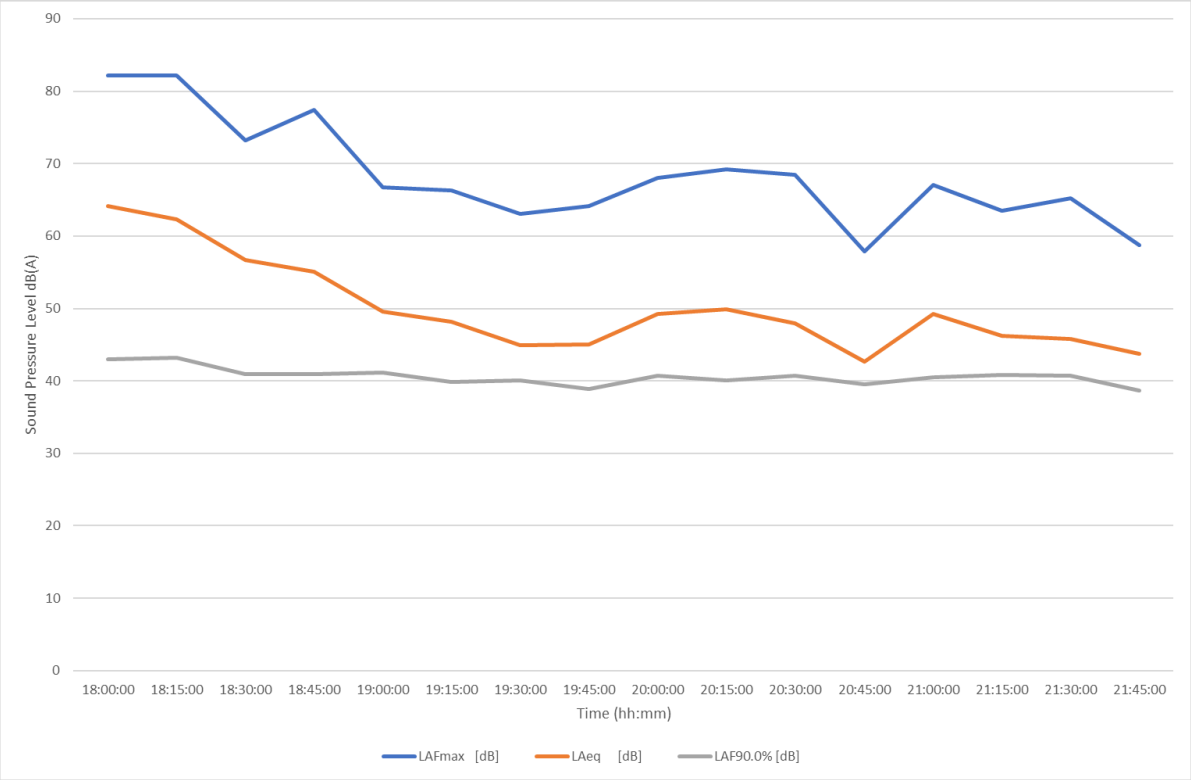


## 5.4. Measured Noise Levels

### 5.4.1. Monitoring Location 1

The following chart provides the measured noise levels for the duration of the measurement period:

Chart 1: Measured Noise Levels at Monitoring Location 1




The following table provides the equivalent noise level over each hour.

Table 5: Measured Noise Levels at Monitoring Location 1

| Time | $L_{Aeq,1\ hour}$ (dB) |
|---|---|
| 18:00 | 61 |
| 19:00 | 47 |
| 20:00 | 48 |
| 21:00 | 47 |

# 6. Noise Levels of AGP Use

Noise levels were measured at nine sports sessions on three separate AGPs. The measurements included football, hockey and rugby, with men, women and children participating in different sessions. The purpose of the measurements was to determine a 'typical' noise level for an AGP sports session.

Measurements were undertaken behind the goal line and to the side-line at the halfway line. It was found that noise levels at the halfway line were generally higher than behind the goal.

Noise levels from sporting activity were generally determined by people's voices. This is except for hockey where the balls hitting the backboard of the goal and perimeter boards of the pitch are the main noise sources. The pitch surface is primarily for football and can be used for rugby. It is not suitable for hockey and is not expected to be used for hockey.

From the measurement data, a typical free-field noise level of 58 dB $L_{Aeq\ (1\ hour)}$ at a distance of 10 metres from the side-line at the halfway line has been determined as representative for noise from an AGP. The following table summarises the measurement data undertaken.

Table 6: Summary of Measured Noise Levels

| Monitoring Session | AGP Activity | Measured Noise Level, $L_{Aeq\ (1\ hour)}$ dB |
|---|---|---|
| 1 | Rugby training on one half of the pitch with approximately 20 players and football training on the other half with approximately 20 players. | 60 |
| 1 | Eight-a-side training match on one half of the pitch only with the other half unused. | 56 |
| 1 | Football training for a single club of approximately 22 players. The start of the session involved heading drills before the full pitch was used to play an 11 a-side game. | 56 |
| 1 | Ladies Hockey Club training involving stick drills, passing etc., with multiple balls per team and therefore a lot of impact noise from stick on ball. Approximately 30 players on the pitch. | 56 |
| 1 | Ladies Hockey Club undertaking defence/attack drills on different halves of the pitch. Single ball used per team with less stick-on-ball impacts than previous training. Approximately 30 players on the pitch. | 58 |
| 1 | Men's six-a-side social football match using half the pitch and hockey goals (12 players). | 51 |
| 2 | Under-16 football training with the pitch divided into four quarters and a total of approximately 50 players. | 58 |
| 2 | Two adult football games using half the pitch each with a total of 28 players. | 56 |
| 2 | Two eight-a-side adult football games using half the pitch each with a total of 32 players. | 56 |

The following sections provide information on the measurements undertaken to determine the typical AGP noise levels stated above.

## 6.1. Noise monitoring session 1 – 18th February 2014

Measurements were undertaken at two AGP pitches at Coombe Dingle Sports Complex in Bristol. The Complex is owned and operated by the University of Bristol. The complex has one sand-dressed pitch and a newer synthetic pitch.

Noise measurements were undertaken using CEL and B&K sound level meters. The equipment information and calibration status are as follows:

Table 7: Measurement Equipment – session 1

| Equipment Description / Manufacturer / Type | Serial number | Date of calibration | Calibration Certification Number |
|---|---|---|---|
| Real Time Analyser, B & K Type 2250-A | 3000994 | 12/03/13 | K017112 |
| Pre-Amplifier, B & K, Type ZC0032 | 14611 | 12/03/13 | K017112 |
| Microphone, B & K, Type 4189 | 2638388 | 12/03/13 | K017112 |
| Calibrator, B&K Type 4231 | 1934013 | 12/03/13 | K017111 |
| | | | |
| Real Time Analyser, CEL, Type 593 | 100972 | 17/06/2013 | K031407 |
| Pre-Amplifier, CEL, Type 527 | 3/0232063 | 17/06/2013 | K031407 |
| Microphone, GRAS 40AE | 34509 | 17/06/2013 | K031407 |
| Calibrator, CEL, Type 284/2 | 5819051 | 17/06/2013 | K031408 |

During the noise monitoring the conditions were calm, dry and overcast with an air temperature of 7 degrees centigrade. The conditions were considered suitable for noise monitoring.

Measurements of the synthetic pitch were undertaken at monitoring location 'A', 10 metres from the edge of the pitch on a slightly raised bund. The monitoring location had a full view of the pitch.

Measurements of the sand-based pitch were undertaken at monitoring location 'B' 10 metres from the edge of the pitch on a slightly raised bund. The monitoring location had a full view of the pitch.

After the monitoring session, when there was no use of the pitch a five-minute ambient noise measurement was undertaken, this was due to distant road traffic on the M5 to the south west.

The monitoring locations and pitches are shown below. The monitoring locations were selected to reduce, as far as feasible, noise contributions from the other pitch.

Figure 3: Monitoring Location Site Plan – session 1




The activities that took place during the monitoring session on each pitch are as follows:

## Synthetic AGP

### 19:00 hours to 20:00 hours

Clifton Hockey Club Ladies First Team. For the first 30 minutes: exercise and running drills without sticks or balls. The most significant noise was from players' voices but some extraneous noise from the other pitch (rugby and football training) was observed. Approximately 15 players on the pitch.

The second 30 minutes of the session involved the first team on one half and the third team on the other. The activities involved stick drills, passing etc, with multiple balls per team and therefore a lot of impact noise from stick on ball. Approximately 30 players on the pitch.

**20:00 hours to 21:00 hours**

Clifton Hockey Club Ladies first and third teams (approximately 30 players) undertaking defence/attack drills on different halves of the pitch. Single ball used per team so less stick-on-ball impacts than previous training.

**21:00 hours to 22:00 hours**

Men's six-a-side social football match using half the pitch and hockey goals. It was observed that noise from the other pitch during this session was significant at the monitoring location.

## Sand-Dressed Pitch

**19:00 hours to 20:00 hours**

Rugby training on one half of the pitch with approximately 20 players and football training on the other half with approximately 20 players.

**20:00 hours to 21:00 hours**

Eight-a-side training match on one half of the pitch only with the other half unused.

**21:00 hours to 22:00 hours**

Football training for a single club of approximately 22 players. The start of the session involved heading drills before the full pitch was used to play an 11-a-side game.

## Measured Noise Levels

Noise measurements were undertaken at monitoring locations 'A' and 'B'; the measured noise levels have been corrected for ambient noise determined from the noise measurements undertaken after the pitches were in use.

The pitch noise levels are as follows:

Table 8: Measured Noise Levels

| Session Period | Synthetic pitch Monitoring location 'B' | | Sand dressed pitch Monitoring location 'A' | |
|---|---|---|---|---|
| | $L_{Aeq\ (1\ hour)}$ | $L_{Amax\ (fast)}$ | $L_{Aeq\ (1\ hour)}$ | $L_{Amax\ (fast)}$ |
| 19:00 to 20:00 hours | 56 | 83 | 60 | 78 |
| 20:00 to 21:00 hours | 58 | 86 | 56 | 82 |
| 21:00 hours to 22:00 hours | 51 | 78 | 56 | 78 |

## 6.2. Noise monitoring session 2 – 5th March 2014

Measurements were undertaken at a 3G AGP pitch at Clifton College Sports Ground on the outskirts of Bristol. The complex has a number of artificial pitches, the newest one being the 3G pitch on which monitoring took place.

Noise measurements were undertaken using Svantek and B&K sound level meters. The equipment information and calibration status are as follows:

Table 9: Measurement Equipment – session 2

| Equipment Description / Manufacturer / Type | Serial number | Date of calibration | Calibration Certification Number |
|---|---|---|---|
| Real Time Analyser, B & K Type 2250-A | 3000994 | 12/03/13 | K017112 |
| Pre-Amplifier, B & K , Type ZC0032 | 14611 | 12/03/13 | K017112 |
| Microphone, B & K, Type 4189 | 2638388 | 12/03/13 | K017112 |
| Calibrator, B&K Type 4231 | 1934013 | 12/03/13 | K017111 |
| | | | |
| Sound Level Meter, Svantek 959 | 14784 | 08/04/13 | K0200009 |
| Calibrator, CEL, Type 110 | 045169 | 08/04/13 | K020983 |
| Microphone, GRAS 40AE | 98073 | 08/04/13 | K0200009 |

During the noise monitoring the conditions were calm, dry and overcast with an air temperature of 8 degrees centigrade. The conditions were considered suitable for noise monitoring.

Measurements of the pitch were undertaken at monitoring location 'A' 10 metres behind the goal line of the pitch and monitoring location 'B' 10 metres from the halfway line of the pitch. The monitoring locations had a full view of the pitch.

The monitoring locations are shown below.

Figure 4: Monitoring Location Site Plan – session 2




The activities that took place during the monitoring session are as follows:

**18:00 hours to 19:00 hours**

Under-16 football training with the pitch divided into four quarters and a total of approximately 50 players.

**19:00 hours to 20:00 hours**

Two adult football games using half the pitch each with a total of 28 players.

**20:00 hours to 21:00 hours**

Two eight-a-side adult football games using half the pitch each with a total of 32 players.

## Measured Noise Levels

Noise measurements were undertaken at monitoring locations 'A' and 'B'; the pitch noise levels are as follows:

Table 10: Measured Noise Levels

| Session Period | Monitoring location 'A' Behind Goal Line | | Monitoring location 'B' On Halfway Line | |
|---|---|---|---|---|
| | $L_{Aeq(1\ hour)}$ | $L_{Amax(fast)}$ | $L_{Aeq(1\ hour)}$ | $L_{Amax(fast)}$ |
| 18:00 to 19:00 hours | 42 dB | 71 dB | 58 dB | 82 dB |
| 19:00 to 20:00 hours | 39 dB | 71 dB | 56 dB | 76 dB |
| 20:00 to 21:00 hours | 39 dB | 65 dB | 56 dB | 85 dB |

# 7. Noise Modelling Methodology

The measured AGP noise emission data has been used to generate a noise map of the site, in order to predict the noise level at the nearby noise-sensitive residential properties.

The modelling has been undertaken using noise mapping software CadnaA by DataKustik. This uses the calculation method of ISO 9613 to predict noise levels.

The assessment is based on the noise modelling methodology using an area source covering the playing surface as the noise source. The area source is at a height of 1.5 metres representative of head height.

To validate the modelling methodology, we have created a noise map of one of the sites where AGP noise was measured (Coombe Dingle in Bristol). The noise map in Figure 5 shows the noise propagation of an area source created from 30 moving point sources. The second noise map (Figure 6) shows the noise propagation of 30 individual point sources spread across the playing surface.

Figure 5: Noise Model Using an Area Source

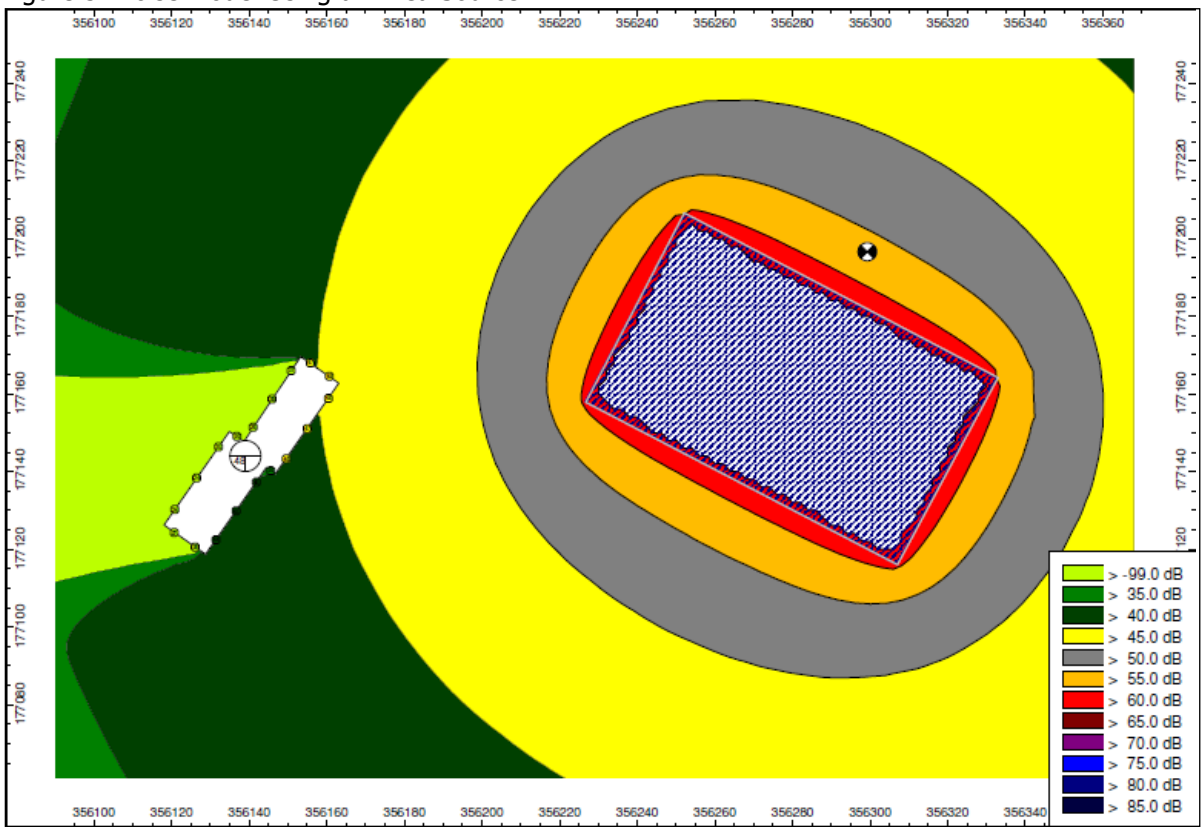
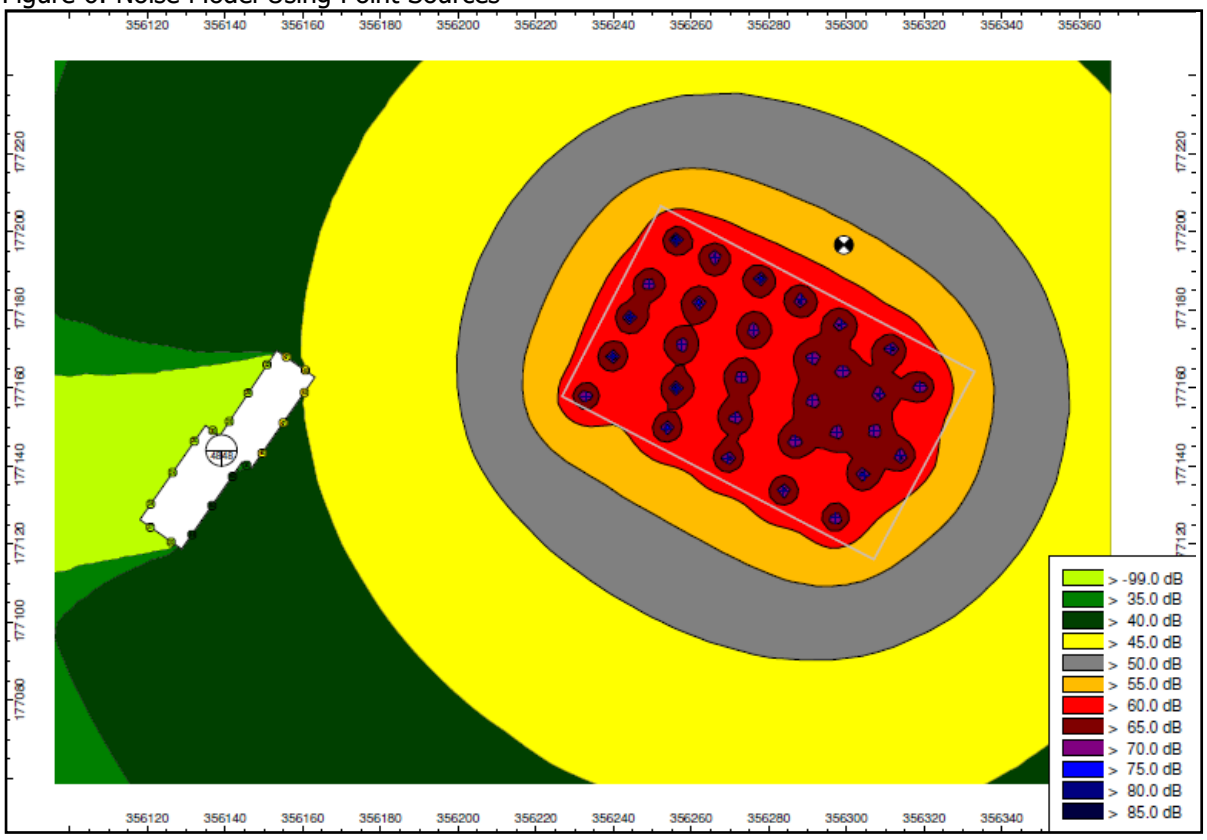


Figure 6: Noise Model Using Point Sources




As can be seen from the two maps, there is no significant difference in the noise propagation and as such, it is our opinion that an area source is suitable for noise modelling of AGPs.

# 8. AGP Noise Emission Prediction

A noise model has been generated of the development site. The AGP locations have been determined from the provided drawings and Google Maps imagery.

Ysgol Bryn Alyn High School and residential buildings in the vicinity of the playing fields have been built within the model. The height of these buildings has been determined via Google Maps imagery.

The noise from an AGP is primarily from voice. The noise source is at a height of 1.5 metres above the ground (approximately head height).

Third-order reflections are calculated.

The variation in topography is determined from LIDAR and the provided drawings and has been imported in the models.

The sound reduction provided by the boundary fences around the gardens is not considered in the modelling as it cannot be demonstrated that the construction complies with the requirements of ISO 9613.

A 4m high noise barrier has been proposed to the north west corner of the pitch. This is to be close boarded with a minimum surface density of at least 10 $kgm^3$. Please note the barrier is only included in the proposed and cumulative model and not in the model of the existing MUGA and is shown in red.

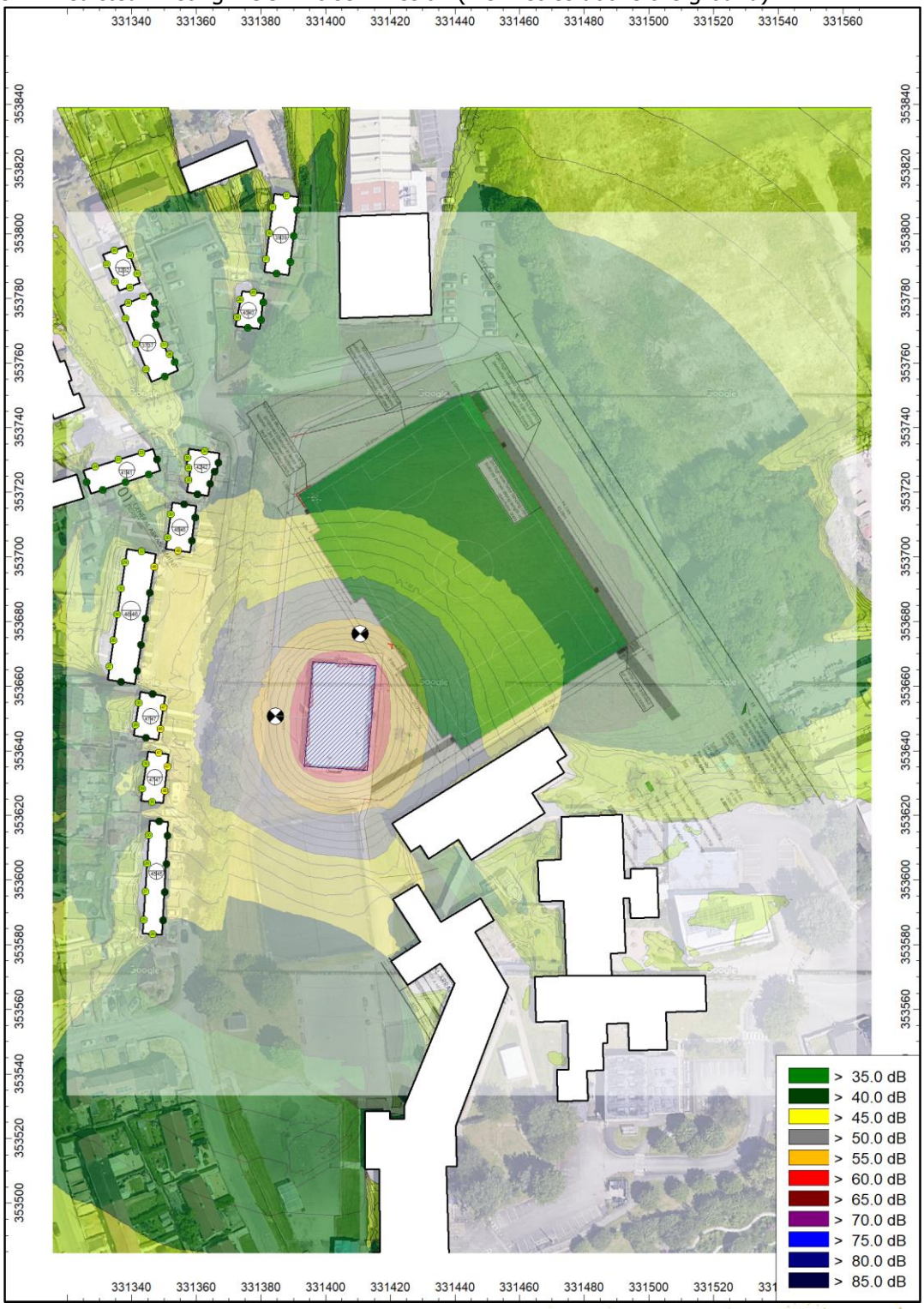
The noise map in Figure 7 below shows noise emission from the AGPs predicted at ground floor level (1.5 metres above the ground), which is typical of a 'daytime' habitable room in a house and external amenity areas.

# 9. AGP Predicted Noise Levels

## 9.1. **Existing MUGA**

The following figure shows the predicted noise emission from the existing MUGA.

Figure 7: Predicted Existing MUGA Noise Emission (1.5 metres above the ground).

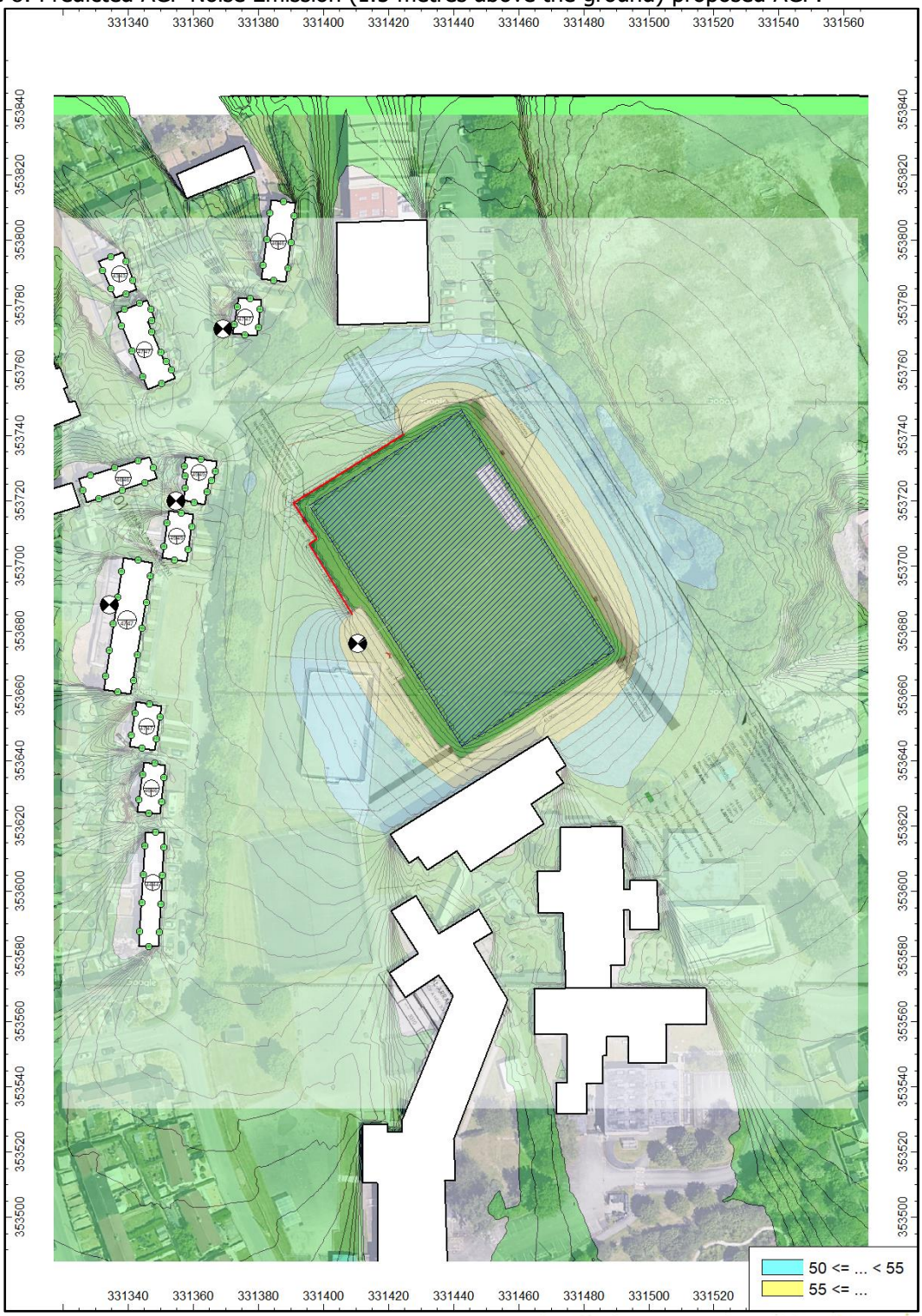


The highest predicted noise level from the existing AGP is 47 dB $L_{Aeq\ (1\ hour)}$ at the nearest noise-sensitive dwellings.

## 9.2. **Proposed AGP**

The following figure shows the predicted noise emission from the proposed AGP.

Figure 8: Predicted AGP Noise Emission (1.5 metres above the ground) proposed AGP.



The highest predicted noise level from the proposed AGP is 48 dB $L_{Aeq\ (1\ hour)}$ at the worst-case noise sensitive dwellings.

The predicted noise level is below the proposed criterion of 50 dB $L_{Aeq\ (1\ hour)}$ derived from WHO 1999 as being the threshold for the onset of moderate community annoyance.

The World Health Organisation provides a sound reduction through an open window of 15 dB(A) which results in a predicted internal equivalent noise level of 33 dB $L_{Aeq\ (1\ hour)}$ at the houses.

The highest predicted noise level in the worst effected garden is 45 dB $L_{Aeq\ (1\ hour)}$, which is within the proposed criterion of 50 dB $L_{Aeq\ (1\ hour)}$.

## 9.3. Comparison with Existing Noise Climate

The following table gives overall change in noise level and IEMA classification at the most noise-sensitive location based on the existing ambient noise level and predicted AGP noise levels above.

Table 11: Change in Noise Levels at the NSRs to the North

| Time | Existing Equivalent Noise Level, $L_{Aeq,1hr}$ | Predicted Equivalent Noise Level, $L_{Aeq,1hr}$ | Change | Long Term Impact |
|---|---|---|---|---|
| 18:00 | 61 | 48 | 0.2 | Negligible |
| 19:00 | 47 | | 3.5 | Minor |
| 20:00 | 48 | | 3.0 | Minor |
| 21:00 | 47 | | 3.5 | Minor |

As can be seen in the table above the pitch has a 'Negligible' to 'Minor' impact on the existing noise climate at the NSRs.

Based on the above the change in noise levels across the site due to the introduction of the new AGP would is acceptable when assessed to the IEMA guidelines.

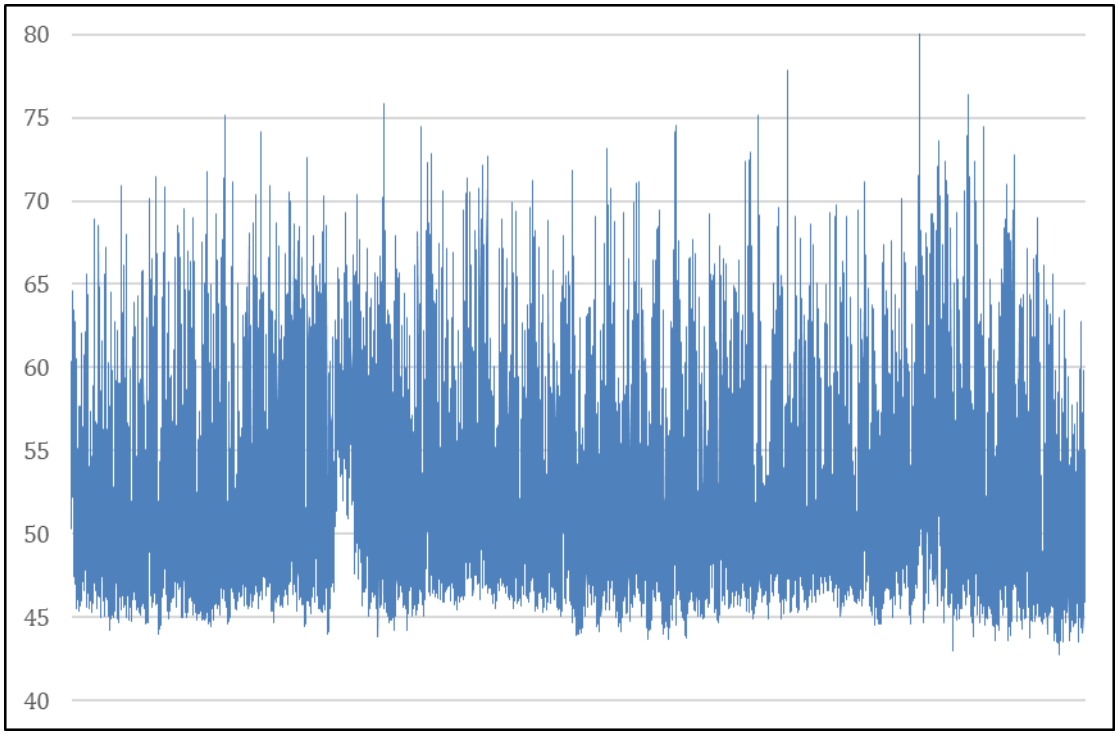
## 9.4. Assessment of Transient Noise Levels

The following section addresses the maximum noise levels generated by AGP activity. This would include whistles, voice and ball impact.

In our opinion, considering the maximum noise level parameter as well as the equivalent noise level would address the character of the noise. Maximum noise levels would include sounds that make up the general noise from an AGP and would also determine the equivalent noise level. Examples of this would be the voices of players and coaches and impacts of balls on the fences.

The following figure shows the time trace (100ms) of noise from one of the measured AGP sessions stated in the noise impact assessment previously provided during the one-hour measurement period. During this measurement exercise there was football training for a single club of approximately 22 players. The start of the session involved heading drills before the full pitch was used to play an 11 a-side game. During the monitoring exercise maximum noise levels were generated by occasional shouts, whistles and balls hitting the fence.

Figure 9: Time Trace of AGP Session




The maximum noise levels are typically in the range of 70-75 dB(A).

It is not possible to accurately undertake a prediction for a maximum noise level in the same way as an equivalent noise level. This is because the maximum noise level by its nature takes place at a finite location whereas the equivalent noise level over a time period takes place over many locations across the pitch. The following considers three noise sources, that from voice, whistle and that from the impact of ball on fence.

## 9.5. Noise from Voice

If we consider the maximum noise level from voice, a typical level of shouting is in the order of 90dB $L_{Afmax}$ at 1 metre.

Noise modelling has been undertaken using noise mapping software Cadna:A by Datakustik. This uses the calculation method of ISO 9613 to predict noise levels. Predictions have been undertaken to determine the maximum noise levels from an individual point source at multiple locations around the pitch.

The highest predicted maximum noise levels from the highest individual source location at the worst-case facade of an NSR is 50dB $L_{Afmax}$.

## 9.6. Noise from Whistle

Measurements have been previously undertaken to determine the noise level from an Acme Thunderer referees' whistle. The measured maximum noise level was 85dB $L_{Amax(fast)}$ at a distance of 10 metres.

Noise modelling has been undertaken using noise mapping software Cadna:A by Datakustik. This uses the calculation method of ISO 9613 to predict noise levels. Predictions have been undertaken to determine the maximum noise levels from an individual point source at multiple locations around the pitch.

The highest predicted maximum noise levels from the highest individual source location at the worst-case facade of an NSR is 65dB $L_{Afmax}$.

## 9.7. Noise from Ball Impact

Noise is generated when a ball hitting the fence panel causes it to rattle against the supporting post and adjoining and overlapping adjacent fence panel. To minimise this noise, it is recommended that neoprene isolators are located between the panels and the posts.

Measurements of ball impacts upon a fence were undertaken at a recently completed AGP in Swindon, Wiltshire. The fence under tests was 4.5 metres tall with neoprene isolators between the panels and posts as proposed for this project. The neoprene isolators, fence and monitoring set up is shown in the figures below.

Figure 10: Image Showing Neoprene Isolators

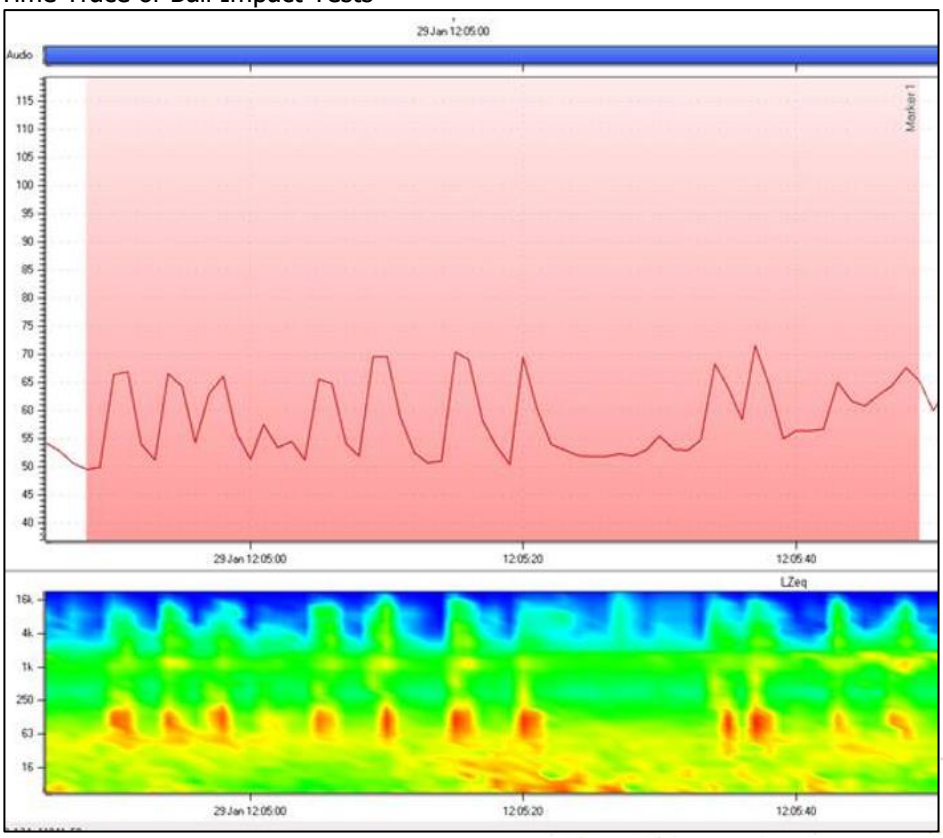


Figure 11: Fence and Tests Setup



Figure 12 shows the time trace and spectral content of the fence impact tests.

Figure 12: Time Trace of Ball Impact Tests



The typical level of a loud ball impact is around 66-70 dB $L_{Amax(fast)}$ at 20 metres.

To determine the possible reduction of an acoustic fence, noise modelling has been undertaken using noise mapping software Cadna:A by DataKustik. This uses the calculation method of ISO 9613 to predict noise levels.

The highest predicted maximum noise levels from the highest individual source location at the worst-case facade of an NSR is 60dB $L_{Afmax}$.

## 9.8. Assessment of Maximum Noise Levels

There are no specific noise criteria for maximum noise levels from this type of noise during the day. There is a night-time maximum noise criterion of 45dB $L_{Amax(fast)}$ for bedrooms at night in BS8233:2014 and WHO1999. With sound reduction through an open window this would equate to 60dB $L_{Amax(fast)}$ outside a dwelling.

During the daytime, a higher maximum noise level is likely to be permissible but is not stated in any relevant guidance documents. The difference between the daytime and night-time equivalent noise criteria in both WHO and BS8233:2014 is 5 decibels, it may therefore be that a 5 decibel increase to the maximum noise level is appropriate.

The predicted maximum noise levels from all sources apart from whistles are within the criteria of 65dB $L_{Amax(fast)}$ externally and thus, considered acceptable. Please note this is with the inclusion of the 4m tall acoustic barrier as detailed in Section 7 of this report.

# 10. Noise Management Plan

The assessment undertaken in this report considers noise levels against relevant criteria to avoid an adverse effect on nearby residential properties.

In addition to the level of noise, it is also important to consider the content. From experience, we have found that where complaints have been made it is often due to anti-social behaviour such as swearing. Anti-social behaviour is not necessarily related to the noise level and is something that cannot effectively be 'engineered out'.

As such, it is proposed that a noise management plan is implemented as part of the development.

The noise management plan should include a method of informing the users that swearing and anti-social behaviour is unacceptable and that the centre reserves the right to dismiss users from the pitch and ban future use if this is the case.

It is advised that neighbours are given a facility to report excessive noise or anti-social behaviour directly to the operator. This will allow the complaint to be investigated and addressed quickly.

It is important that complaints are investigated swiftly, that action is taken where necessary and that the complainant is kept informed of progress, especially where it is not possible to address or resolve complaints straight away.

Staff at the site should have a written action plan to deal with complaints. This would include the ability to warn or ban user groups from the pitches. A log of complaints should also be kept.

A no-whistle-policy should be implemented as part of the scheme for evening periods (19:00hrs – 22:00hrs).

# 11. Summary and Conclusions

Sports Lab Limited appointed Acoustic Consultants Limited to undertake an environmental noise assessment for the proposed new artificial grass pitch (AGP) located at Ysgol Bryn Alyn High School. The assessment considered the impact of environmental noise on the nearby noise-sensitive residential properties.

We do not currently know the exact proposed hours of use, but we have presumed a worst-case typical operation of 08:00 to 22:00 Monday to Friday and 08:00 to 18:00 Saturday and Sunday.

The assessment includes the prediction of noise emission from the existing MUGA and proposed AGP as well as a comparison between noise levels experienced at the nearby noise-sensitive properties, based on noise level data from activities measured at existing AGPs.

Noise levels were measured at nine sports sessions on three separate AGPs. The measurements included football, hockey and rugby, with men, women and children participating in different sessions. The purpose of the measurements was to determine a 'typical' noise level for an AGP sports session.

A noise model has been generated of the development site, utilising these previous measurements as its basis.

A 4m high noise barrier has been proposed to the north west corner of the site. This is to be close boarded with a minimum surface density of at least 10 $kgm^3$.

The highest predicted noise level from the proposed AGP, is 48 dB $L_{Aeq\ (1\ hour)}$ at the façade of the nearest residential properties.

The highest predicted noise level from the existing AGP, is 45 dB $L_{Aeq\ (1\ hour)}$ at the façade of the residential houses.

The predicted noise level is below the proposed criterion of 50 dB $L_{Aeq\ (1\ hour)}$ derived from WHO 1999 as being the threshold for the onset of moderate community annoyance.

The World Health Organisation provides a sound reduction through an open window of 15 dB(A) which results in a predicted internal equivalent noise level of 33 dB $L_{Aeq\ (1\ hour}$) at the houses.

The predicted noise level in the gardens is within the proposed criterion of 50 dB $L_{Aeq\ (1\ hour)}$.

When compared to the existing noise climate the proposals are expected to have a negligible to minor noise impact and are considered acceptable.

The predicted maximum noise level from voice and ball impact are within the criteria and is thus considered acceptable.

This indicates a low impact and acceptable level of noise and achieves the aims of Planning Policy Wales where the development will have been "designed wherever possible to prevent adverse effects to amenity".

Based on the above, the proposals are considered acceptable in terms of noise.

# 12. Appendix 1 – Glossary of Acoustic Terminology

*A-weighted sound pressure pA* – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

*A-weighted sound pressure level, $L_{pA}$* - quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$L_{pA} = 10 \log_{10} (p_A/p_0)^2$

where:

$p_A$ is the A-weighted sound pressure in pascals (Pa);
$p_0$ is the reference sound pressure (20 µPa)

*Background sound level, $L_{A90,T}$*– A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

*Break-in* - noise transmission into a structure from outside.

*Decibel (dB)* – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

*Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$* – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{AeqT} = 10\lg_{10}\left\{(1/T)\int_{t_1}^{t_2}[p_A(t)^2/p_0^2]dt\right\} \quad (1)$$

where:

$p_0$ is the reference sound pressure (20 µPa); and
$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time $t$

*NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.*

*Facade level* – sound pressure level 1 m in front of the façade. Facade level measurements of $L_{pA}$ are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

*Free-field level* – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

*Octave and Third Octave Bands* – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

*Sound pressure level* – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

*Sound reduction index, R* – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

*Specific sound level,* $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, $T_r$.

*Structure-borne noise* – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

*Rating level,* $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

*Reverberation Time, T* – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

*Vibration Dose Value, VDV* – measure of the total vibration experienced over a specified period of time.

*Estimated Vibration Dose Value, eVDV* – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

*Weighted sound reduction index, $R_w$* – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).




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