



New Keystone Centre
Eldon Way, Littlehampton

Noise Impact Assessment

9th September 2021
First Issue



New Keystone Centre

Eldon Way, Littlehampton

Noise Impact Assessment

9th September 2021

First Issue

Revision History

Version	Comments	Author	Date
First Issue	First issued version of the report	Chris Parker-Jones Director and Acoustic Consultant BSc (Hons) MSc MIOA	9th September 2021

ParkerJones Acoustics Limited

Bristol	London	Glasgow
11 Bankside Road	29 Lincoln's Inn Fields	126 West Regent Street
Brislington	Holborn	Glasgow
Bristol	London	G2 2RQ
BS4 4LB	WC2A 3EE	

This document has been prepared using all reasonable skill and care. ParkerJones Acoustics Limited (PJA) accepts no liability or responsibility for any third-party data present in this report. The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in PJA unless the terms of appointment with the Client state otherwise. PJA shall not be liable for the use of or reliance on any information, advice, recommendations, and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only if PJA and the third party have executed a reliance agreement or collateral warranty.

Executive Summary and Conclusions

This document has been written to assess the impact of noise ‘pollution’ generated by the proposed development (of a new Youth Centre with associated parking, play area, and MUGA) on noise-sensitive receptors (residential properties) in the surrounding area, once it is fully operational. The objective is to ensure that the risk of noise impact will be controlled sufficiently. The most noise risk is considered to occur from external play on the new MUGA, and from plant noise generated by a possible air conditioning system.

In summary, PJA believes that noise from the MUGA should mean an acceptably low level of adverse impact on residents (see **Section 5.1**).

The assessment indicates that noise from the MUGA at the worst affected properties should be around 49 dB $L_{Aeq,1hr}$ outside the worst affected façade, and 47 dB $L_{Aeq,1hr}$ midway down the worst affected gardens. These 1-hour average levels are seen to be below the 16-hour average level criteria of 50 – 55 dB $L_{Aeq,16hr}$ suggested criteria – which is considered to correspond to the LOAEL (Lowest Observed Adverse Effect Level), which planning policies typically seek to limit impacts to. Therefore, this suggests an acceptably **low** impact.

The existing site is also already used as a community area with a playground, a field and a climbing frame, as well as the cycle track to the south, hence to some extent this site is already used for sports and play activities that would occur with the new MUGA.

However, it is recognised that meeting suggested noise level criteria does not automatically rule out an adverse impact or stem the possibility of complaints, as the perception of noise is relatively subjective. Therefore, PJA suggests that a suitable Noise Management Plan is put in place and adhered to – as outlined in **Section 6.0**.

Plant noise rating level targets have been set at the boundary of the residential neighbouring properties based upon the lowest background sound levels recorded during the environmental noise survey. Plant noise should be designed to not exceed these targets (**Table 5.2 – Section 5.2**).

At the time of writing the mechanical plant design had not been fully developed – though it is understood that there may be 3 no. external air conditioning condensers/air source heat pumps on the lower wall of the eastern elevation. The indicative calculations suggest that this plan may be appropriate providing sufficiently quiet condensers are installed (with a source sound power level of <65 dB L_{WA}).

If mitigation is required, then this should be relatively easy to implement, i.e. by moving the units away from the eastern elevation, currently, the closest position possible to the residents, to position them further away or out of sight. Alternatively, a small screen or ventilated enclosure could be constructed. Or a unit with a lower source sound power level could be installed.

It is anticipated that the plant noise assessment may be conditioned and therefore a further assessment would be required at the detailed design stage of the project to demonstrate compliance, once a more finalised design of the building services plant has been developed.

Contents

Executive Summary and Conclusions	3
1.0 Introduction.....	5
2.0 Site and Development Description.....	6
3.0 Relevant Guidelines	9
3.1 Sport England Artificial Grass Pitch Acoustics ´ Planning Implications	9
3.2 World Health Organisation (WHO) Environmental Noise Guidelines.....	9
3.3 BS 8233:2014	10
3.4 National Planning Policy	10
3.5 BS 4142:2014.....	11
3.6 Other Planning Applications.....	12
4.0 Baseline Noise Survey	13
4.1 Methodology.....	13
4.2 Results	14
5.0 Assessment	17
5.1 MUGA Activity Noise	17
5.2 Plant Noise	19
6.0 Noise Management Plan	23
6.1 Mitigation	23
6.2 Operator Responsibilities.....	24
6.3 Complaints Management.....	24
Appendix A ´ Acoustic Terminology and Concepts.....	27
Appendix B ´ Relevant Planning Policies and Guidelines	28
Appendix C ´ Noise Survey Methodology	32
Appendix D ´ Modelling/Calculations.....	34

1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed to undertake a Noise Impact Assessment (NIA) to accompany the planning application for the new Keystone Centre on Eldon Way, Littlehampton, involving the development of a new youth and community centre building, with associated parking, equipped play area, and multi-use games area (MUGA), to replace the existing facility on the opposite side of the road.

This NIA Report has been written to assess the impact of noise ‘pollution’ generated by the proposed development on residential properties in the surrounding area. The most noise risk is considered to occur from external play on the new MUGA, and from plant noise generated by a possible air conditioning system.

There are no clear specific guidelines that explicitly outline how noise emissions from MUGAs should be assessed. Therefore, PJA has assessed against several guidelines including:

- 2 The World Health Organisation (WHO) document ‘Guidelines for Community Noise’ (1999) and the more recently published ‘Environmental Noise Guidelines for the European Region’ (2018), which suggest suitable internal noise levels in residential properties for good living/sleeping conditions, and external noise levels which would constitute a ‘moderate’ or ‘serious’ annoyance in gardens/patio areas; and
- 2 British Standard BS 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’, which provides similar guidance based on the aforementioned WHO documents, and is commonly used for assessing the noise impact on new residential developments.

The Sport England Design Guidance Note Artificial Grass Pitch (AGP) Acoustics – Planning Implications which is perhaps the most relevant guidance, cites WHO guidelines (Guidelines for Community Noise’ (1999)) as providing appropriate noise level targets.

The assessment of plant noise is conducted in accordance with British Standard BS 4142:2014+A1:2019 ‘Methods for rating and assessing industrial and commercial sound’, which assesses the risk of adverse impact of noise pollution from new sound source(s) of a commercial or industrial nature (i.e. mechanical/electrical plant). PJA has also reviewed the planning conditions applied to other developments in the Arun District Council area to gauge what noise criteria would be appropriate.

The assessment is aimed at limiting the impacts to no greater than the LOAEL – the Lowest Observed Adverse Effect Level (the level above which adverse effects on health and quality of life can be detected) – as referenced in national planning policies including the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the Planning Practice Guidance on Noise (PPG-N), summarised in **Appendix B**.

Whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in **Appendix A**.

2.0 Site and Development Description

The proposed site sits on the south side of Eldon Way in Littlehampton (easting: 501892, northing: 103002), on the opposite side of the road to the existing Keystone Centre.

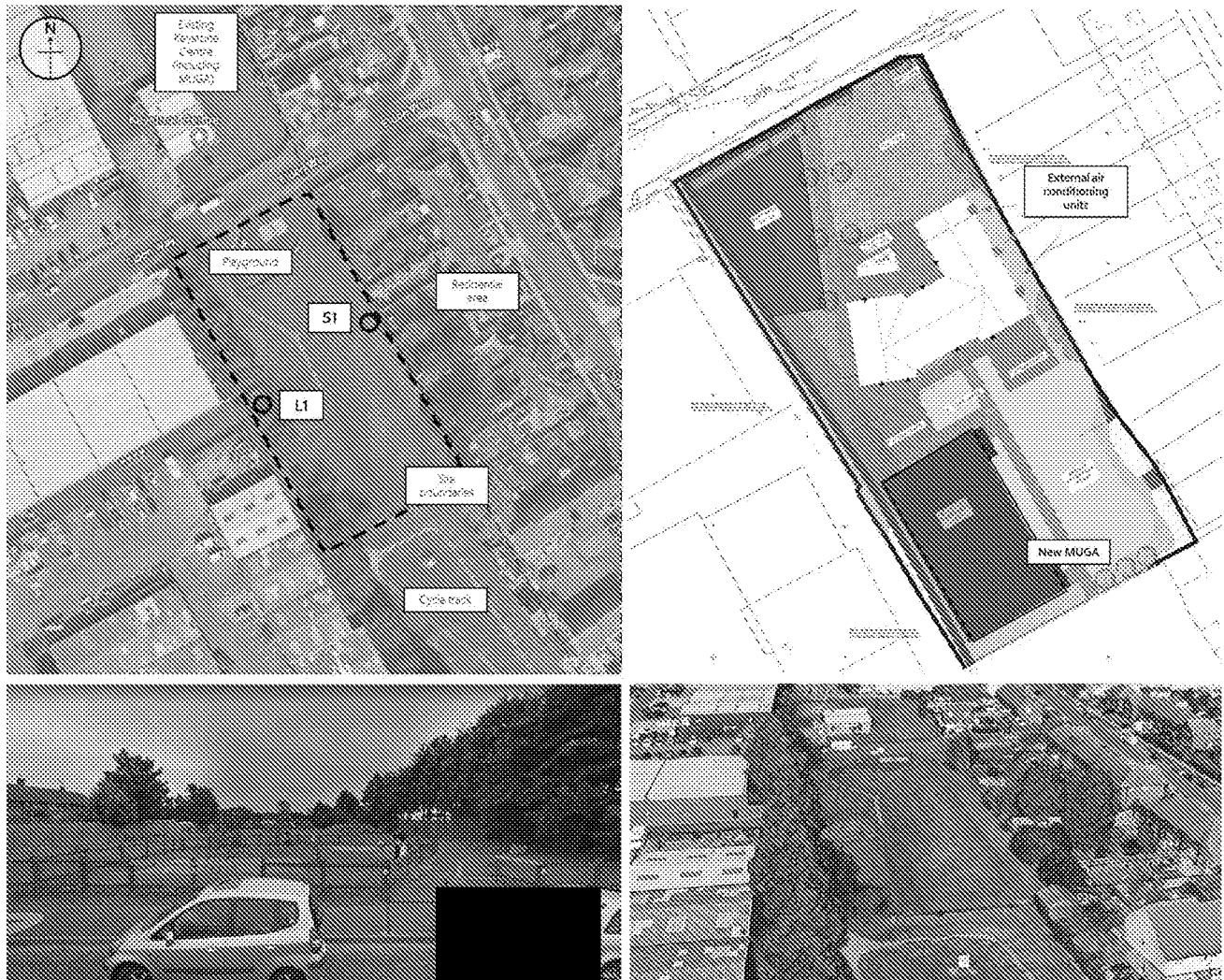
As shown in **Figure 2.1** overleaf, the site is an existing greenfield space with a playground area and climbing frames. The field is situated between an industrial estate on the west boundary and residential properties to the east. To the south is a purpose-made BMX track which would be retained. Hence it is evident that this area is already used as a communal/recreational space for children. The existing Keystone Centre on the north side of Eldon Way consists of the main building and a MUGA (‘multi-use games area’).

The proposals as shown in **Figure 2.2**, are to erect a new youth and community centre building, with associated parking, equipped play area, and a new MUGA.

It is possible that air conditioning system will be installed, which according to early plans may have 3 no. external units, though the exact design of the system will unlikely be finalised until after planning approval.

The applicant anticipates that the building will be open from 08:00 until 22:00 and that the air conditioning plant would operate from 07:00 – 23:00.

Figure 2.1 ' Site and surrounding area



3.0 Relevant Guidelines

3.1 Sport England Artificial Grass Pitch Acoustics – Planning Implications

The Sport England Design Guidance Note Artificial Grass Pitch (AGP) Acoustics – Planning Implications document published in 2015 was written to provide guidance on the planning implications of artificial pitches, particularly with regards to acoustics, the main stumbling block in the design of such pitches close to sensitive residential areas.

It indicates that there are no specific noise criteria for an AGP, but that the WHO document Guidelines for Community Noise 1999 are often followed – see **Section 3.2**;

With regards to the WHO fixed noise level guidelines, it 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’.

Given the similar nature of noise produced by a MUGA to an AGP, this guidance is considered to be applicable.

3.2 World Health Organisation (WHO) Environmental Noise Guidelines

The WHO document Guidelines for Community Noise 1999 has recently been superseded by the Environmental Noise Guidelines for the European Region. However, the updated guidance states that ‘all WHO guidelines for community noise (CNG) indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid’.

The 1999 document 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.’

The document sets out guidance as to noise levels at which there will be an unacceptable impact on the local community. WHO guidelines state:

- ⌚ To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise.
- ⌚ To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq} .

3.3 BS 8233:2014

BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' suggests appropriate criteria and limits for different situations. This includes internal noise criteria for residential developments. The limits with BS 8233:2014 are similar to those in the WHO's 'Guidelines for Community Noise and Night Noise Guidelines for Europe' document.

Table 4 of BS 8233:2014 provides internal ambient noise level (IANL) limits for dwellings from 'steady external noise sources'. These are summarised in **Table 3.1** below.

Table 3.1 ' BS 8233:2014 internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 - 23:00)	Night-time (23:00 - 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

In Annex G.1 of BS 8233:2014 it suggests that 'if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB'. Therefore, a noise limit directly outside of the nearest residential windows could be set based upon the values above plus 15 dB.

Therefore, to meet internal noise targets in nearby residential dwellings, noise should not exceed 50 dB $L_{Aeq,16hrs}$ during the daytime and 45 dB $L_{Aeq,8hrs}$ during the night-time when measured/calculated directly outside of a residential bedroom or living room window.

3.4 National Planning Policy

National planning policies including the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the Planning Practice Guidance on Noise (PPG-N), are detailed in **Appendix B**. Whilst these policies don't provide explicit noise targets or refer to specific standards which do, they introduce the concept of categorising the impact from noise pollution into different observed effect level categories, such as the following:

- ⌌ **NOEL ' No Observed Effect Level** - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- ⌌ **LOAEL ' Lowest Observed Adverse Effect Level** - This is the level above which adverse effects on health and quality of life can be detected.
- ⌌ **SOAEL ' Significant Observed Adverse Effect Level** - This is the level above which significant adverse effects on health and quality of life occur.

There is very little guidance to establish at what noise level either of these effect levels would occur. However, PJA believes that relevant standards/guidelines would presumably provide noise level targets based upon the LOAEL.

Therefore, if taking the criteria from WHO and BS 8233:2014 guidelines summarised in previous sections, it would be reasonable to assume that an **external noise target in gardens or outside of residential windows of 50 – 55 dB $L_{Aeq,16hrs}$ would be equivalent to the LOAEL.**

The aim of planning policy is usually to limit adverse impacts from factors such as noise to no greater than the LOAEL. If the impact falls between the LOAEL and the SOAEL, then NPSE aims state that:

“all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur.”

Therefore, taking an overview of national policy it is clear that when considering the impact of noise, one must consider the significance of any impact. The presence of an adverse impact in itself is not sufficient to refuse permission.

3.5 BS 4142:2014

BS 4142:2014 ‘Methods for rating and assessing industrial and commercial sound’ is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations (i.e. residential windows) within the context of the existing sound environment.

The method is based upon assessing the predicted noise emissions from plant/equipment against the existing background sound levels at NSRs, the latter of which is determined by a noise survey conducted at the site.

The predicted noise emissions are termed as a ‘rating level’, which is the ‘specific sound level’ from plant (the actual measurable noise level), plus ‘penalties’ which account for whether the noise has distinguishing characteristics such as tonality, intermittency, impulsivity, or is generally distinguishable from the ambient noise environment. Such features may attract attention and be considered annoying, hence sounds with these qualities should be penalised over sounds at the same specific noise level which is less intrusive.

The general aim is for the ‘rating level’ (plant noise emissions) to not exceed the existing background sound levels outside of residential windows. BS 4142:2014 states that ‘the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.’

Appendix B.4 explains the methodology in further detail.

However, BS 4142:2014 explicitly states that it should be used to assess sound from people or recreational activities and is therefore not seen to be appropriate in assessing noise from the multi-use games area (MUGA), only the plant noise.

3.6 Other Planning Applications

PJA has reviewed a small number of similar planning applications in the area which include the installation of new plant, i.e. air conditioning systems, as is planned in this case.

WA/48/19/RES

Condition 8

_Details, including acoustic specifications, of all fixed plant, machinery and equipment associated with air moving equipment (including fans, ducting and external openings), compressors, generators or plant or equipment of a like kind, installed within the site which has the potential to cause noise disturbance to any noise sensitive receivers, shall be submitted to and approved by the Local Planning Authority before installation. **The rating level of noise emitted from the use of this plant, machinery or equipment shall not exceed the measured background sound level** when assessed by a competent acoustician using BS 4142:2014, at any adjoining or nearby noise sensitive premises.

Reason: To protect the amenity of local residents in accordance with Policy QE DM1 of the Adopted Arun Local Plan 2011-2031.:

LU/177/17/DOC

Condition 10

_Details, including acoustic specifications, of all fixed plant, machinery and equipment associated with air moving equipment (including fans, ducting and external openings), compressors, generators or plant or equipment of a like kind, installed within the site which has the potential to cause noise disturbance to any noise sensitive receivers, shall be submitted to and approved by the local planning authority before installation. The rating level of noise emitted from the use of this plant, machinery or equipment shall not exceed 30 dBA between 07.00 - 23.00 hours and 28 dBA between 23.00 - 07.00 hours, when measured according to British Standard BS4142: 2014, at any adjoining or nearby noise sensitive premises.

Reason: To protect the amenities of occupiers of adjoining properties in accordance with Arun District Local Plan policies GEN7 and GEN32.:

4.0 Baseline Noise Survey

4.1 Methodology

PJA has attended the site to conduct a baseline noise survey between Wednesday 21st and Thursday 22nd July 2021 over a 24-hour period.

A fixed monitoring position (L1) was employed with a sound level meter installed on the western boundary metal fence with the industrial estate. Given the open nature of the site, this position allowed the equipment to be secured (by chaining to the fence) with minimal risk of theft (that could not be achieved elsewhere in the site). This position was left to monitor for over 24 hours between 10:30 on the 21st until 11:30 on the 22nd.

A second 'spot' position (S1) was used for a 30-minute period closer to the residential properties boundary on the eastern side, to allow comparison between measurements taken closer to the industrial facility, to make any necessary corrections to the survey result. Background and ambient noise levels were relatively consistent at both positions given that the site appeared to be most consistently affected by distant road traffic from the A259, with a low level hum of plant noise from the industrial estate, with other sporadic noise from the industrial estate (i.e. vehicles) and the use of the playground/fields (children playing).

Weather conditions were hot and dry during the survey; hence it is thought that the existing playground would have been in use.

The locations of the monitoring position are shown in **Figure 2.1 (Section 2.0)**.

The sound level meters were set to log noise levels over continuous 5-minute averaging periods with a 1-second time history rate. The following noise indices were recorded (amongst others):

- ∫ $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the average ambient sound level;
- ∫ $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise levels 'events' i.e. emergency services sirens; and
- ∫ $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level;

Appendix C contains further information on the methodology of the survey, including photographs taken from site; the equipment used; and the weather conditions at the time of the survey.

4.2 Results

4.2.1 24-hour Position (L1)

Figure 4.1 overleaf shows the time history of measured noise levels at the monitoring position. Noise levels follow a typical diurnal pattern which is standard from a site that is mostly affected by road traffic noise. Ambient (L_{Aeq}) and background (L_{A90}) levels regularly converged to within 2 dB of each other throughout the day and night, which is indicative of a consistent noise source affecting the position, i.e. distant traffic from the A259 (which emits a low consistent hum) and low level plant noise from the industrial estate (though not into the evening and overnight).

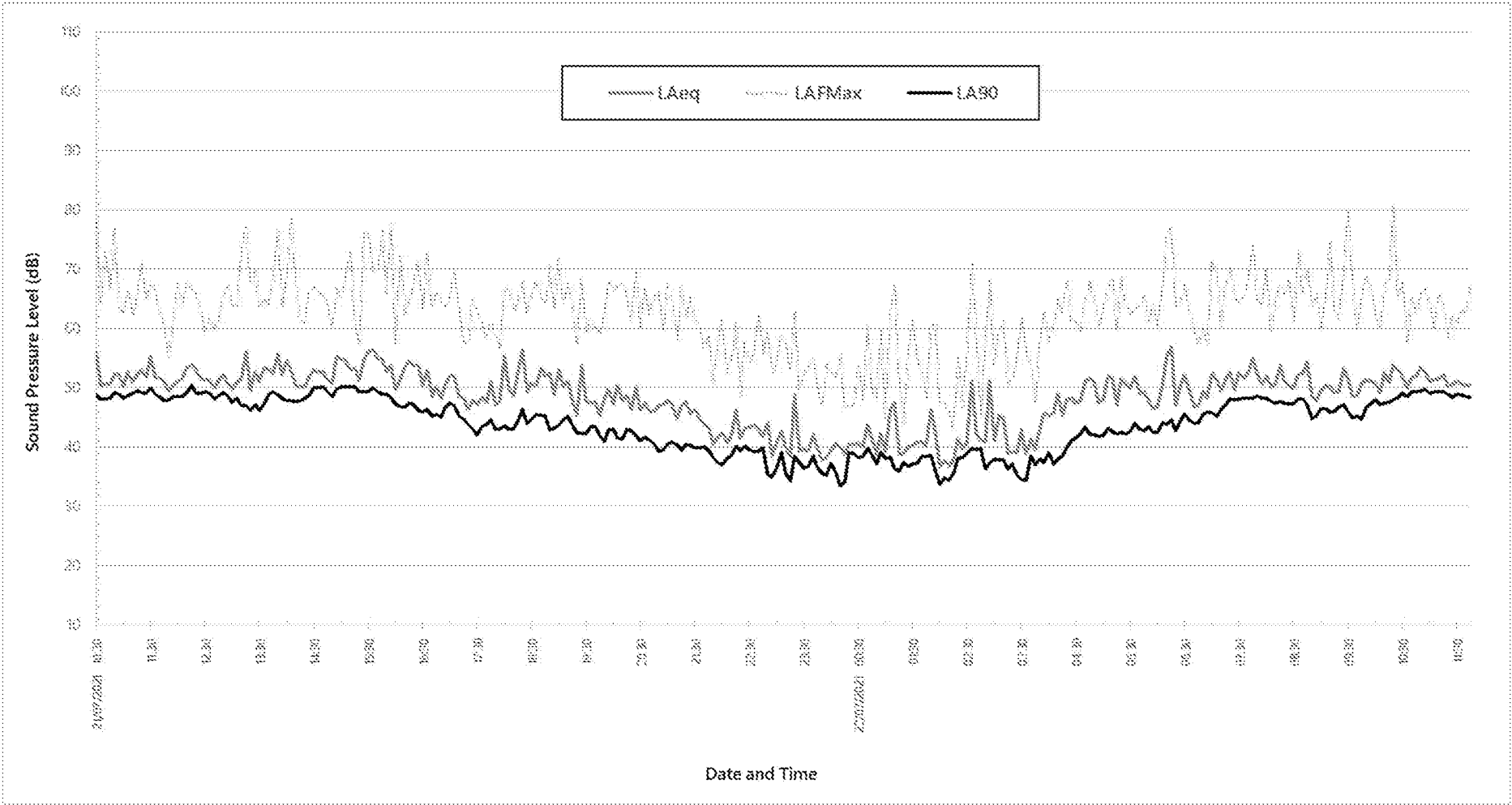
Table 4.1 summarises the results across the daytime (07:00 – 23:00) and night-time (23:00 – 07:00) periods.

The most relevant parameter in terms of the 'representative background sound level' referenced in BS 4142:2014 is the $L_{A90,5min}$. **Table 4.1** indicates minimum daytime values of 35 dB, though on average levels are around 46 – 49 dB.

Table 4.1 – Summary of measured noise levels at position L1

Period	Parameter	Maximum	Minimum	Logarithmic Average	Mean Average	Modal Average	Median Average
Daytime (07:00 – 23:00)	$L_{Aeq,5min}$ (dB)	57	39	51	50	51	51
	$L_{AFMax,5min}$ (dB)	81	49	N/A	65	66	65
	$L_{A90,5min}$ (dB)	50	35	N/A	46	49	47
Night-time (23:00 – 07:00)	$L_{Aeq,5min}$ (dB)	57	37	47	44	41	43
	$L_{AFMax,5min}$ (dB)	77	43	N/A	58	60	59
	$L_{A90,5min}$ (dB)	46	34	N/A	39	37	39

Figure 4.1 ' Time history of measured noise levels at position L1



4.2.2 Short-term Position (S1)

The last 30-minutes of the measurements at the position on the western boundary (L1) exhibited consistent ambient levels of 50 ´ 51 dB L_{Aeq} and background levels of 48 ´ 49 dB L_{A90} . Hence the ambient and background levels at position S1 on the western/residential property boundary were on average 3 dB lower than at the eastern boundary. Maximum levels (L_{AFmax}) were more variable but at around the same level on average between the two positions.

Table 4.2 ´ Measured noise levels at position S1

Start Time (on 22 nd July)	$L_{Aeq,5min}$ (dB)	$L_{AFmax,5min}$ (dB)	$L_{A90,5min}$ (dB)
12:00	48	66	45
12:05	49	58	46
12:10	47	57	45
12:15	48	69	45
12:20	49	66	45
12:25	49	64	45

5.0 Assessment

5.1 MUGA Activity Noise

5.1.1 Criteria

Interpreting Sport England's document 'Artificial Grass Pitch (AGP) Acoustics – Planning Implications, New guidance for 2015' and the relevant guidance from WHO, BS 8233:2014, and National Planning Policy, the following criteria would appear to be a useful benchmark in the assessment:

- 2 Noise emissions from the MUGA should be no greater than **50 – 55 dB $L_{Aeq,1hr}$** in nearby residential gardens or outside of residential windows to avoid 'moderate' and 'serious' annoyance;

This criterion would appear to correspond to the LOAEL (Lowest Observed Adverse Effect Level) at most. The aim of planning policy is usually to limit adverse impacts from factors such as noise to no greater than the LOAEL. This provides a good guideline to assess against.

It is also important to consider the context of the existing use of the site, which in this case is already used as a community area with a playground, a field and a climbing frame, as well as the cycle track to the south, hence to some extent this site is already used for sports and play activities that would occur with the new MUGA.

5.1.2 Source Noise Levels

Sport England's document 'Artificial Grass Pitch (AGP) Acoustics – Planning Implications, New guidance for 2015', provides advice on typical noise levels generated from a typical AWP sports session – relevant to the proposed MUGAs.

The most significant noise source from a typical session is from the voices of the players and to a lesser extent the impact of balls onto fences/boards (though these are usually mitigated with shock-absorbing material/resilient fixings to stop fences from rattling).

In this instance with a MUGA, the surface material is likely to be asphalt or similar. However, this should not affect the noise from the pitch on the basis that an artificial grass pitch is constructed from a solid layer covered with a thin layer of artificial grass. Therefore, an artificial grass pitch may not act as a more efficient acoustic absorber than a hard-surfaced area. The guidance identifies that the primary noise source from the use of such pitches is participants' voices. It is therefore considered that the methodology of assessment would apply to the MUGA.

The Sport England study measured nine sports sessions on three separate AWP, including football, hockey, and rugby, ranging from 12 to 50 players involved. Noise measurements were taken 10m behind the mid-way points along goal lines and side lines – finding it to be the highest behind the side-line halfway line. It states:

A typical free-field noise level from an AGP (at 10 m from the side-line halfway marking) = **58 dB $L_{Aeq}(1 \text{ hour})$**

From surveys conducted for other noise impact assessments^{1 2 3}, it appears the average levels from a 5-a-side to an 11-a-side football match are usually around the 51 dB – 58 dB $L_{Aeq,1hr}$ range when measured 10m from the side-line halfway marking – hence the 58 dB figure appears appropriate. At 10m behind the goal line levels are usually lower during matches, but not always the case if shooting practice is being conducted at one end, so it is not assumed that behind the goals are quieter for the purpose of the assessment.

5.1.3 Residents Noise Levels

The noise predictions within this report have been undertaken using the proprietary software CadnaA[®] by DataKustik, a 3-D noise mapping package that implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996 – as detailed in **Appendix C**.

Noise maps from the modelling are given in the same appendix. **Figure C.1** indicates how the model has been set up. **Figures C.2 and C.3** show the predicted noise levels in the gardens/outside of facades of the nearby residential receptors, based upon a 1-hour period with the MUGA in full use (the figures show the same noise map, with one showing a wider view of the surrounding area).

The most affected façade appears to be a dwelling on the corner of Latham Close to the south-east, exhibiting levels of up to 49 dB $L_{Aeq,1hr}$ outside of the 1st floor.

Levels at head height in back gardens to the east/north-east (houses along Clun Road) appear to be around 47 dB $L_{Aeq,1hr}$ halfway down the garden.

These predictions are based upon a 1-hour period, whereas WHO/BS 8233 guidelines are an assessment of a 16-hour level. If the MUGA was in full continuous use for 16 hours a day, the levels above would be directly comparable to WHO targets as an $L_{Aeq,16hr}$ level. If the MUGA were used for 8 hours a day, or 4 hours a day, the $L_{Aeq,16hr}$ level would be 3 and 6 dB lower than the $L_{Aeq,1hr}$ level respectively.

Nonetheless, if directly comparing the 1-hour noise level as a worst-case against the 16-hour limit, the predicted $L_{Aeq,1hr}$ levels are below the range of noise levels (> 50 dB $L_{Aeq,16hr}$) from which WHO guidelines suggest that ‘moderate’ annoyance would occur. It is also below the threshold (50 dB $L_{Aeq,16hr}$) at which internal ambient noise level targets (of 35 dB $L_{Aeq,16hr}$) would be exceeded with open windows (based on a typical 15 dB reduction). These criteria are considered to correspond to the LOAEL (Lowest Observed Adverse Effect Level), which planning policies typically seek to limit impacts to.

Therefore, when assessing against WHO and BS 8233 guidelines, this suggests an acceptably **low** impact.

1 - Proposed Artificial Grass Pitch Emmbrook School, Wokingham, RG41 1JP – Noise Impact Assessment 7544/DO – Acoustic Consultants Limited – January 2019

2 - Uplands Community College Lower High Street, Wadhurst, East Sussex - Proposed 3g Synthetic Sports Pitch – Noise Impact Assessment MRL/100/698.1v1 – MRL Acoustics – July 2014

3 - Proposed AGP – Beeston – Noise Assessment 31674.2v1 – Hepworth Acoustics – September 2014

5.1.4 Summary

The assessment indicates that noise from the MUGA at the worst affected properties should be around 49 dB $L_{Aeq,1hr}$ outside the worst affected facade, and 47 dB $L_{Aeq,1hr}$ midway down the worst affected gardens. These 1-hour average levels are seen to be below the 16-hour average level criteria of 50 – 55 dB $L_{Aeq,16hr}$ suggested criteria – which is considered to correspond to the LOAEL (Lowest Observed Adverse Effect Level), which planning policies typically seek to limit impacts to.

Therefore, this suggests an acceptably low impact.

However, it is recognised that meeting suggested noise level criteria does not automatically rule out an adverse impact or stem the possibility of complaints, as the perception of noise is relatively subjective. Therefore, PJA suggests that a suitable **Noise Management Plan** is put in place and adhered to – as outlined in **Section 6.0**.

5.2 Plant Noise

5.2.1 Methodology

The assessment of the noise impact on nearby residential noise-sensitive receptors (NSRs) concerning the operational noise produced by the proposed development has been undertaken in accordance with BS 4142:2014, which is used to assess the risk of adverse impact from noise generated by new building services plant.

The assessment at this stage is based upon setting a rating level $L_{A,r,Tr}$ for noise emissions from plant based upon the existing background noise level, $L_{A90,Tr}$. The rating level is the specific noise level L_s plus the addition of any ‘penalties’ which account for the characteristic features of the sound which may attract attention to it, such as tonality, impulsivity, intermittency, and any other sound characteristics that are readily distinctive against the residual acoustic environment. Further information on BS 4142:2014 is given in **Appendix B.4**.

At the time of writing the mechanical plant design had not been fully developed – though it is understood that there may be 3 no. external air conditioning condensers on the lower wall of the eastern elevation, as shown in **Figure 2.1**.

An indicative calculation has been made based upon the likely size of the external air conditioning units and the likely sound power levels of them, based upon the indicative plan with 3 units on the eastern external wall. This is to demonstrate whether this position will work in principle, providing that the units meet a certain sound power level, or whether they will likely require relocating, or a screen/fence or enclosure constructed around them. PJA would anticipate that the plant noise would be conditioned (similar to the conditions in **Section 3.6**) so that further details and calculations are submitted at the detailed design stage to demonstrate that the noise limits can be met.

The assessment of the noise impact from mechanical plant/equipment should be undertaken in accordance with BS 4142:2014. At this stage this is based upon setting a rating level $L_{A,r,Tr}$ for noise emissions from plant based upon the existing background noise level, $L_{A90,Tr}$. PJA would anticipate that this aspect may be conditioned as part of any planning permission to require details to be submitted which demonstrates that the noise criteria herein are complied with.

5.2.2 Background Sound Levels

In accordance with BS 4142:2014, the predicted rating level should be assessed against a 'representative' background sound level. This is commonly determined through the results of a baseline sound survey, as has been done in this case.

BS 4142:2014 states that 'in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular Periods'. BS 4142:2014 further states that 'a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value'.

However, for the purpose of a robust assessment, the minimum recorded value of $L_{A90,5mins}$ has been taken as the representative background sound level (see **Table 4.1**), for the day and night-Periods. A minus 3 dB correction has been applied to this based upon the differences between the 24-hour monitoring position and the shorter position closer to the eastern/residents' boundary (see **Section 4.2.2**).

Table 5.1 ' Derived representative background sound level $L_{A90,T}$ at nearby residential NSRs

Noise Sensitive Receptor (NSR)	Period	Representative Background Sound Level $L_{A90,5mins}$ (dB)
All nearby residential windows	Daytime (07:00 ' 23:00)	32
	Night-time (23:00 ' 07:00)	31

5.2.3 Maximum Rating Levels

When assessing using the BS 4142:2014 methodology the significance of the impact depends on both the margin by which the rating level $L_{A,r,T}$ exceeds the background sound level $L_{A90,T}$ and the context in which the sound occurs. In general, 'the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context'.

The context is that the pre-existing background levels in **Table 5.1** are low. Therefore, a rating level limit matching the background-noise level should be appropriate, as at this level the noise is unlikely to be perceived by residents. This is also consistent with planning conditions applied to other developments in the district.

Therefore, the target rating levels when measured within the garden or outside of the fa'ade of a neighbouring residential property are given in **Table 5.2**. The plant is expected to run in line with opening hours of the building, which would be daytime only, hence the night-time limit may not apply. Having said this, the night-time limit is only 1 dB lower than the daytime limit anyway.

Table 5.2 ' Maximum plant noise rating level $L_{A,T,r}$ at nearby residential windows

Noise Sensitive Receptor (NSR)	Period	Maximum plant noise rating level $L_{A,T,r}$ (dB)
All nearby residential windows	Daytime (07:00 ' 23:00)	32
	Night-time (23:00 ' 07:00)	31

It is seen to be the responsibility of the developer and design team involved with the mechanical plant design to ensure that the rating levels above are not exceeded. It must be remembered that the rating level included for plus the addition of any 'penalties' which account for the characteristic features of the sound which may attract attention to it, such as tonality, impulsivity, intermittency, and any other sound characteristics that are readily distinctive against the residual acoustic environment.

In the case of a mechanical ventilation system, the noise is unlikely to be intermittent or impulsive. It could, however, be tonal (a 2 to 6 dB penalty). Therefore, the M&E design should take this into account when specifying plant, silencers, louvres, and other forms of mitigation.

It is anticipated that this aspect may be conditioned and therefore a further assessment would be required at the detailed design stage of the project to demonstrate compliance.

5.2.4 Indicative Plant Noise Emissions

At the time of writing the mechanical plant design had not been fully developed ' though it is understood that there may be 3 no. external air conditioning condensers/air source heat pumps on the lower wall of the eastern elevation, as shown in **Figure 2.1**.

In PJA's experience, the average A-weighted sound power level of a single fan condenser (under 1m tall) is around 60 - 65 dB L_{WA} , and around 65 - 70 dB L_{WA} for a twin fan condenser (i.e. two stacked fans at a height of around 1.2 ' 1.5m).

Assuming at this stage a single fan 15 kW output model, the typical sound power level would be around 65 dB L_{WA} . For example, a Mitsubishi PUHZ-HW140VHA2(-BS) single fan model ⁴ would achieve this, as would a Daikin ERLQ011CAV3 twin fan model ^{5 6}.

Figure D.5 in Appendix D shows the predicted noise emissions from 3 no. external condensers at a height of 1m, situated on the eastern external wall, as per the indicative plans.

This indicates that the proposed rating level targets could be met when assessed mid-way down the gardens and at the fa'ade of the property. Right at the end of the garden when stood by the fence, the noise level may be

4 - https://www.mitsubishi-les.info/database/servicemanual/files/201803_ATW_DATABOOK.pdf

5 - <https://www.wolseley.co.uk/product/daikin-altherma-erk016cv3-1-phase-low-temperature-heat-pump-16kw/>

6 - https://www.daikin.co.uk/en_gb/products/erlq-cv3.table.html

marginally over the rating level target. However, it would not be excessively high (at around 33 – 34 dB), at a level well below WHO and BS 8233 targets.

Noise levels at the façade (25 dB) would be sufficiently low to ensure inaudibility inside the dwellings with windows open - at around 10 dB inside assuming a 15 dB reduction across a partially open window. Research suggests that the majority of people cannot perceive external noise sources of <20 dB inside their dwelling (when noise sources inside the dwelling are silent, i.e. the occupant is sleeping).

5.2.5 Summary

Plant noise rating level targets have been set at the boundary of the residential neighbouring properties based upon the lowest background sound levels recorded during the environmental noise survey. Plant noise should be designed to not exceed these targets (**Table 5.2**).

At the time of writing the mechanical plant design had not been fully developed – though it is understood that there may be 3 no. external air conditioning condensers/air source heat pumps on the lower wall of the eastern elevation. The indicative calculations suggest that this plan may be appropriate providing sufficiently quiet condensers are installed (with a source sound power level of <65 dB L_{WA}).

If mitigation is required, then this should be relatively easy to implement, i.e. by moving the units away from the eastern elevation, currently, the closest position possible to the residents, to position them further away or out of sight. Alternatively, a small screen or ventilated enclosure could be constructed. Or a unit with a lower source sound power level could be installed.

It is anticipated that the plant noise assessment may be conditioned and therefore a further assessment would be required at the detailed design stage of the project to demonstrate compliance, once a more finalised design of the building services plant has been developed.

6.0 Noise Management Plan

The assessment has provided an indication that the proposed development could operate with an acceptable impact on residents in the local area.

It is recognised that meeting suggested noise level criteria does not automatically rule out an adverse impact or stem the possibility of complaints, as the perception of noise is somewhat subjective. As with any development, there is always the possibility that the applicants may receive complaints, though the suggested criteria provide a way of determining what is a 'valid' complaint.

Therefore, the applicant is committed to further mitigating the noise impact within reasonable measures and maintaining engagement with the local community and local residents to keep good public relations that can benefit by partially offsetting any impact, keeping annoyance to a minimum.

This section provides an example that can be directly adopted as a Noise Management Plan or adapted into a separate document. Some of the content may not be directly relevant, as it is not clear whether objects like perimeter boards, or goals will be installed at this stage.

The aim is that any noise impact that occurs from early use of the development can be investigated and responded to, ensuring that the impact from future events is mitigated well. This will be an ongoing improvement of review and control (to a reasonable degree, as the assessment herein has demonstrated that the development should not cause an unreasonable adverse impact compared to the other similar venues which follow the same guidelines). This should be considered to be a live document that may be revised to create an acceptable balance between the requirements for a successful recreation facility and the protection of local residents' amenity.

6.1 Mitigation

6.1.1 Ball Impact Noise

- ⌘ Noise generated by ball impacts on the metal ball stop fencing will be reduced by the use of fence mounting systems that employ resilient connections between the perimeter fencing and the supporting structural columns. The fence panels will be securely clamped together and to supporting posts with resilient fixings/neoprene isolators to minimise noises from ball impacts causing the fence to vibrate and rattle.
- ⌘ The state of repair of the inner perimeter fence will be reviewed on an annual basis.
- ⌘ Similar anti-vibration fixings will be applied to any other signs or structures in proximity to the playing surface. Any objects likely to rattle (such as sheet metal advertising signs) will be avoided or positioned where they cannot be hit by footballs ' and if they cannot be repositioned, soft vinyl signs will instead be used.
- ⌘ Football goals consisting of a fabric net rather than a metal backing that does not rattle when goals are scored will be selected.
- ⌘ If low-level perimeter boards are used around any of the MUGA, including behind goals, then these will be covered with impact-absorbing material, i.e. soft padding, rubber, or artificial turf ' to minimise noise from ball impacts.

-
- ⌚ If complaints are received or if a ball stop mechanism is required above the 3m high fence then netting could be installed at high level or in front of the fence, as ball impacts on this would be virtually silent.

6.1.2 Whistles

- ⌚ The use of whistles will only be allowed during the daytime when being used by the Youth Centre. External users who wish to book the facilities will be informed during the booking process and the induction that whistles are not permitted after 19:00.

6.2 Operator Responsibilities

The operator will:

- ⌚ Appoint a noise monitoring supervisor to regularly monitor activities on the MUGA and associated facilities.
- ⌚ Employ a maintenance regime will ensure that all equipment is maintained so that it does not generate excessive noise. This includes tightening fixings to the mesh fencing, so they do not excessively rattle.
- ⌚ Maintain a log of all received complaints and actions.
- ⌚ Respond to all complaints within three working days via email.
- ⌚ Provide a clear and reliable mechanism whereby noise complaints can be made and logged.
- ⌚ Provide the Local Authority with details of logged complaints and any actions taken.
- ⌚ Liaise with the Local Authority to ensure the noise management plan remains effective and revise the noise management plan accordingly.
- ⌚ Install relevant signage around the MUGA and any associated parking facilities to encourage quiet and considerate behaviour.

6.3 Complaints Management

The Operator will implement a clear noise complaints management procedure. Neighbours will be given a clear route to report excessive noise or anti-social behaviour directly to the operator. This will allow the complaint to be investigated and addressed quickly.

The operator will provide a telephone number and email address to residents' associations and any other organisations including the Council and community groups ' so that any issues can be reported. Complaints records will (as a minimum) include the following:

- ⌚ date, time, and the name of the complainant (if given);
- ⌚ nature of the complaint;
- ⌚ the locality of complaint; and
- ⌚ a summary of the investigation into the noise complaint, the actions that were taken and the outcome.

The response to the complaint will have the objective of investigating the incident and preventing any continuing issue by putting in place additional control or management measures to prevent the re-occurrence of the incident.

The investigation into the complaint will include but not be limited to:

-
- 2 a visit by a representative of the MUGA operator or phone call/email correspondence with the complainant to verify the issue, including whether the complaint is made 'after' rather than 'during' a noise event;
 - 2 a review of activities at the time of the incident to investigate potential sources; and
 - 2 a review of noise control measures and management actions at the time of the incident;

The investigation will be accompanied by a written record detailing any failures, incidents and what mitigation was (at the time) employed or will be used in future. The operator shall keep records of all noise monitoring, investigations, and complaints and these shall be made available to the EHO to examine on request.

An example complaints management form is given in **Table 6.1** overleaf.

Table 6.1 ' Complaints management form

Complaint made by:	
Date of complaint:	
Complaint received by:	
Time of occurrences:	
Number of occurrences:	
Details of complaint:	
Action(s) taken:	
Review of action (s):	
Details of adjustment(s) made to the noise management plan if required:	
Signed (Noise supervisor):	
Date:	

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4000Hz (4kHz). This is roughly equal to the range of frequencies on a piano.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{A10,T}$	The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level';
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.

A.2 – Subjective Changes in Noise Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – Relevant Planning Policies and Guidelines

B.1 – National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local people and their council can produce their own distinctive local and neighbourhood plans. With explicit reference to noise, the NPPF states that 'Planning policies and decisions should contribute to and enhance the natural and local environment by – preventing new and existing development from contributing to, being put at unacceptable risk from – noise pollution:.

B.2 – Noise Policy Statement for England (NPSE)

The NPPF refers to the Noise Policy Statement for England (NPSE), which applies to most forms of noise including environmental noise. The NPSE sets out the long-term vision of Government policy which is to 'Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development:'. It aims that 'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life:.

The use of the terms 'significant adverse: and 'adverse: are key phrases within the NPSE. The guidance establishes the concept of how the level of adverse effect on health and quality of life can be referenced including:

- **NOEL – No Observed Effect Level** - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- **LOAEL – Lowest Observed Adverse Effect Level** - This is the level above which adverse effects on health and quality of life can be detected.
- **SOAEL – Significant Observed Adverse Effect Level** - This is the level above which significant adverse effects on health and quality of life occur.

Under the first aim of the NPSE ('avoid significant adverse impacts on health and quality of life:), an impact in line with SOAEL should be avoided. Under the second aim ('mitigate and minimise adverse impacts on health and quality of life:), where the impact lies somewhere between LOAEL and SOAEL, requiring that all reasonable steps are taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, but does not mean that such adverse effects cannot occur.

B.3 - Planning Practice Guidance on Noise (PPG-N)

The Planning Practice Guidance on Noise (PPG-N) is part of a suite of web-based guidance which is intended to support the implementation of the policies in the NPPF and the NPSE.

It aids in expanding on the definitions from the NPSE of NOEL, LOAEL and SOAEL, by linking these terms to 'examples of outcomes', i.e. changes in behaviour and/or attitude to noise. The table below summarises the guidance from PPG-N in this regard.

Table B.1 ' Noise exposure hierarchy based on the likely average response ' adapted from PPG-N

Perception	Examples of outcomes	Increasing effect level	Action
NOEL - No Observed Effect Level ¹			
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
LOAEL - Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up the volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL - Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to a change in the acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent
¹ This line is an assumption of the adverse effect level and is not explicitly referenced by PPG-N, though this appears to be a safe assumption.			

B.4 - BS 4142:2014

BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment.

B.4.1 - Definitions

BS 4142:2014 provides the following definitions which are relevant at this pre-construction stage of assessment:

- ⌚ **Background Sound Level, $L_{A90,T}$:** A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
- ⌚ **Rating Level, L_{A,r,T_r} :** Specific sound level plus any adjustment for the characteristic features of the sound.
- ⌚ **Reference Time Interval, T_r :** Specified interval over which the specific sound level is determined. This is 60-minutes during the day (07:00 - 23:00) and 15-minutes at night (23:00 - 07:00).
- ⌚ **Specific Sound Level, $L_s = L_{Aeq,T_r}$:** 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 .
- ⌚ **Specific Sound Source:** Sound source being assessed.

The BS 4142:2014 definition of sound of an industrial and/or commercial nature includes 'sound from fixed installations which comprise mechanical and electrical plant and equipment'. The scope of BS 4142:2014 is not intended for sound from the passage of vehicles on public roads; people; and 'other sources falling within the scopes of other standards or guidance'.

B.4.2 - Specific Sound Level

The specific sound level L_s is the 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 , of 60-minutes during the day (07:00 - 23:00) and 15-minutes at night (23:00 - 07:00).

B.4.3 - Rating Level

The rating level L_{A,r,T_r} is the specific sound level L_s plus any 'penalties' which account for the characteristic features of the sound.

BS 4142:2014 provides the following with respect to the application of penalties to account for 'the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention':

- ⌚ **Tonality** - For sound ranging from not tonal to predominantly tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible;

- ⌘ **Impulsivity** – A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible;
- ⌘ **Intermittency** – When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the Period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied; and
- ⌘ **Other Sound Characteristics** – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.:

PJA consider the word ‘perceptible’ to be important, and variable depending on the context of a site. For example at a site with a relatively high background sound level of 50 dB(A), an ‘impulsive’ sound source with a specific sound level of 30 dB(A) at an NSR is unlikely to be perceptible and should probably not be penalised.

However, the same source at a site with a lower background level of 30 dB(A) would be perceptible, and therefore a penalty of 3 or 6 dB could be applied to the rating level, with possibly a 9 dB penalty being applied if the specific sound level were to rise from 30 to 40 dB(A). Therefore the context is important in applying rating level penalties.

B.4.4 - Background Sound Level

BS 4142:2014 states that ‘in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular Periods.’

BS 4142:2014 further states that ‘a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value.’. Hence BS 4142:2014 does not provide a ‘black and white’ method of obtaining the assessment level for background sound $L_{A90,T}$. Note that it is standard practice that the $L_{A90,T}$ is determinable from the results of a baseline sound survey conducted at positions representative of sound levels at the nearest or worst affected NSRs.

B.4.5 - Assessment of Adverse Impact

The assessment of adverse impact contained in BS 4142:2014 is undertaken by comparing the rating level $L_{A,r,Tr}$ to the measured representative background sound level $L_{A90,T}$ outside the sensitive receptor location.

The significance of the impact of an industrial or commercial sound source depends on both the margin by which the rating level $L_{A,r,Tr}$ exceeds the background sound level $L_{A90,T}$ and the context in which the sound occurs. It is therefore essential to place the sound in context. But in general, ‘the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.’

Appendix C ' Noise Survey Methodology

C.1 ' Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meter was calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter has been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of as BS EN 60942:2003 Class 1 device.

Table C.1 ' Equipment used for the noise survey

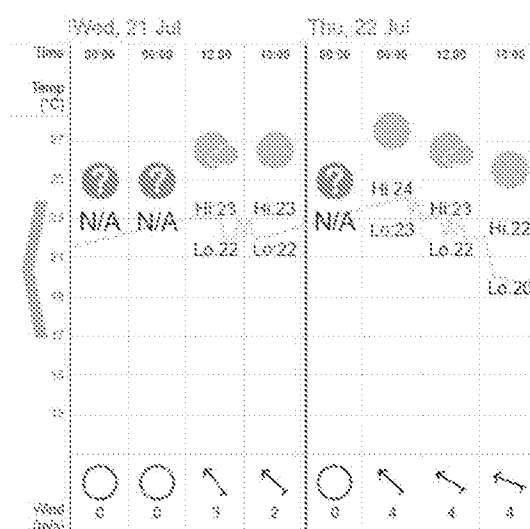
Name	Serial Number	Last Calibrated	Calibration Due
SVAN 949 Class 1 Sound Level Meter	9720	Oct-19	Oct-21
SV22 Class 1 Microphone	4012386	Oct-19	Oct-21
SV 30A Acoustic Calibrator	10511	Oct-19	Oct-21

C.2 ' Meteorological Conditions

During the survey, weather conditions were hot and dry with wind speeds of less than 4 ms^{-1} (the microphone was fitted with a weather protection kit/windshield). These weather conditions are suitable for the measurement of environmental noise in accordance with BS 7445 'Description and Measurement of Environmental Noise'. The weather data below has been sourced from

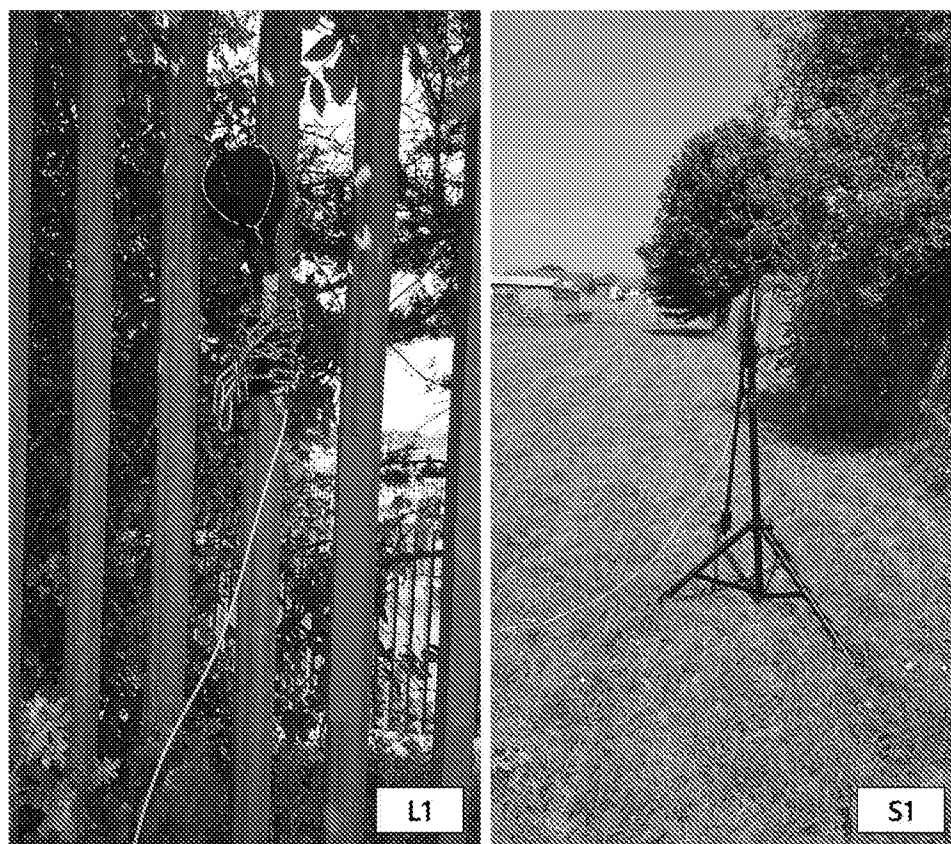
<https://www.timeanddate.com/weather/@2644319/historic?month=7&year=2021>.

Figure C.1 ' Meteorological conditions during the survey



C.3 ' Photographs

Figure C.2 ' Photographs of the monitoring positions from the baseline noise survey



Appendix D – Modelling/Calculations

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package which implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The noise model accounts for the topography of the land based on data available from the Ordnance Survey. All of the objects within the model (buildings, roads, barriers, foliage, etc) have been imported from OpenStreetMap. The scaled site plan, floor plans, and elevations for the proposed development have been accounted for in the model.

The noise model has assumed:

- ⌚ downwind propagation, i.e. a wind direction that assists the propagation of sound from source to receptor, as a worst-case.
- ⌚ a ground absorption factor of:
 - 0 on the car parking areas, buildings, and roads;
 - 1 in greenfield areas; and
 - 0.5 to represent mixed ground in gardens.
- ⌚ a maximum reflection factor of three where buildings and barriers are assumed to have a 'smooth' reflective façade, as a worst-case;
- ⌚ receptor heights representing the windows at each floor of the building(s) in the proposed development when assessing noise ingress.
- ⌚ atmospheric sound absorption based upon a temperature of 10°C and a humidity level of 70%, as per Table 2 of ISO 9613-2:1996.

The images on the following pages contain screenshots from the mapping. Note that:

- ⌚ The receptor points away from buildings are plotted at a height of 1.5m above ground.
- ⌚ The noise contours are also plotted at a height of 1.5m.
- ⌚ Points have been placed in the MUGA, as well as 10m from the edges of the MUGA (to demonstrate that the quoted source noise level of 58 dB @ 10m has been correctly modelled). Points have also been placed near to/inside resident's gardens.
- ⌚ The façade noise levels on the edge of buildings show the highest level from that façade, it is not a fixed height. Hence in some areas the façade level appears higher than receptor point close to it (which is at a 1.5m height), this is because the façade level may be representing the top floor of the building and not the ground floor.

D.1 ' MUGA

Figure D.1 ' 3D views of the noise model (of MUGA noise emissions)

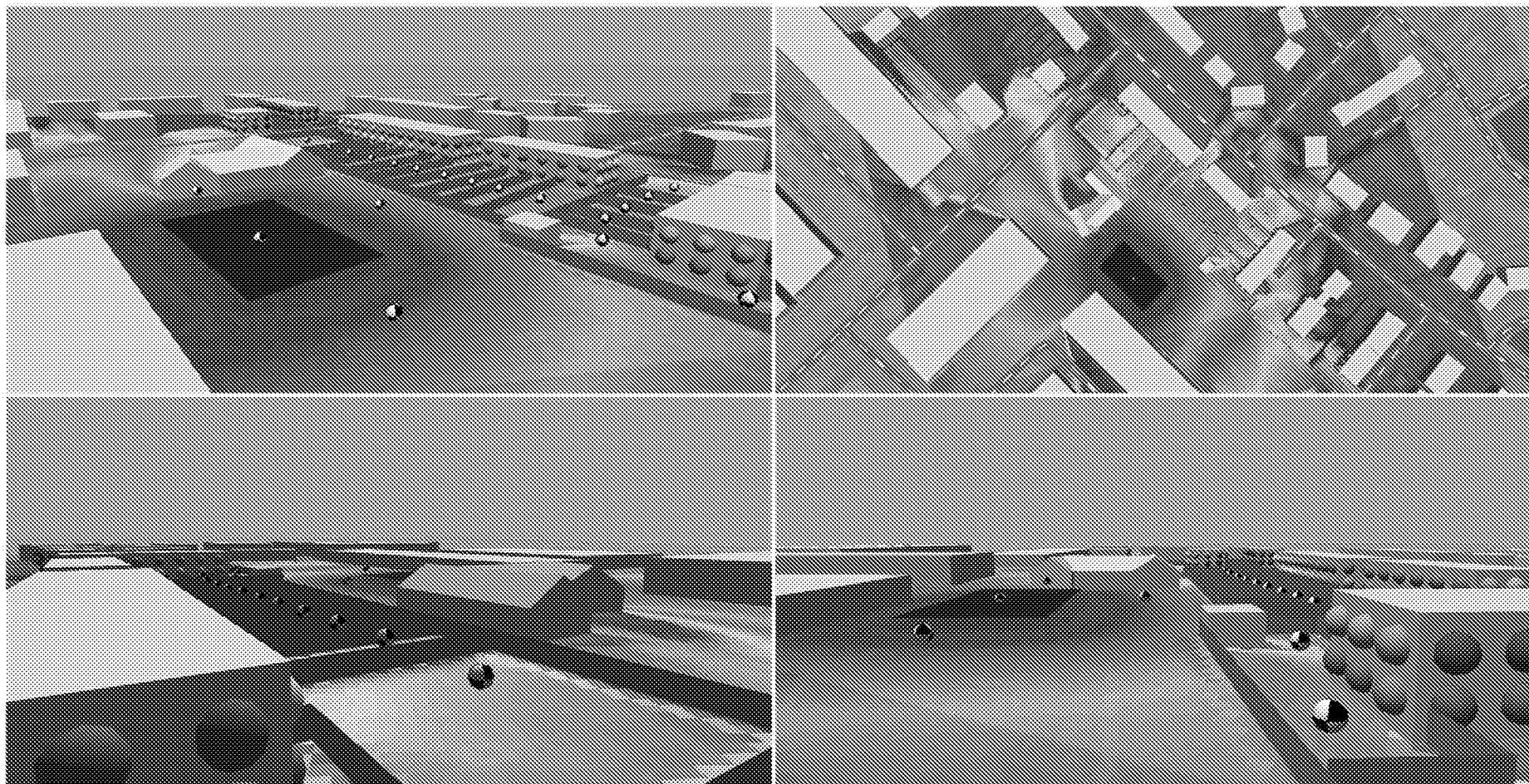
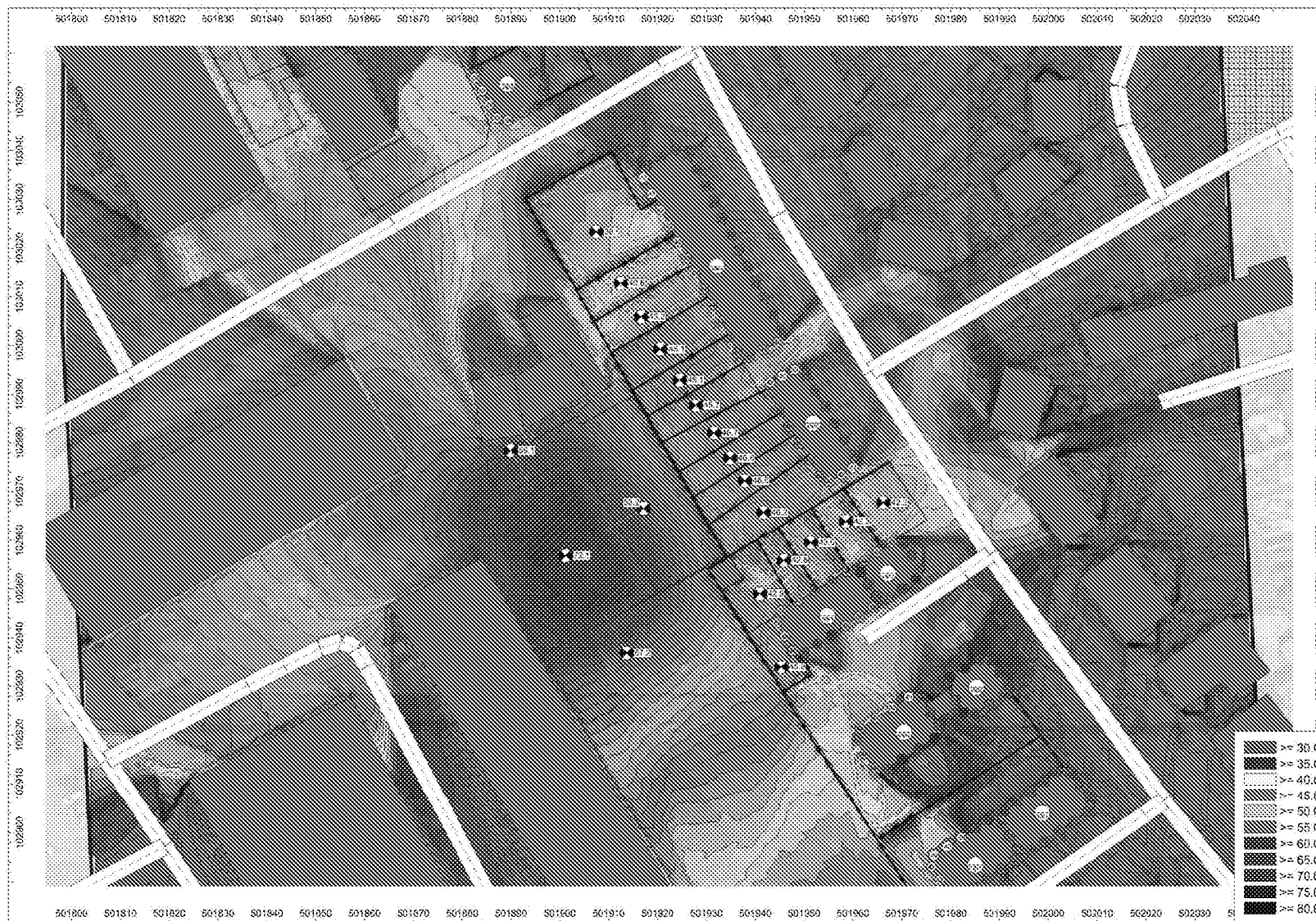


Figure D.2 ' Typical average noise levels (dB $L_{Aeq,1hr}$) from the proposed MUGA ' wide view



D.2 ' Air Conditioning Plant

Figure D.4 ' 3D view of the noise model (of plant noise emissions)

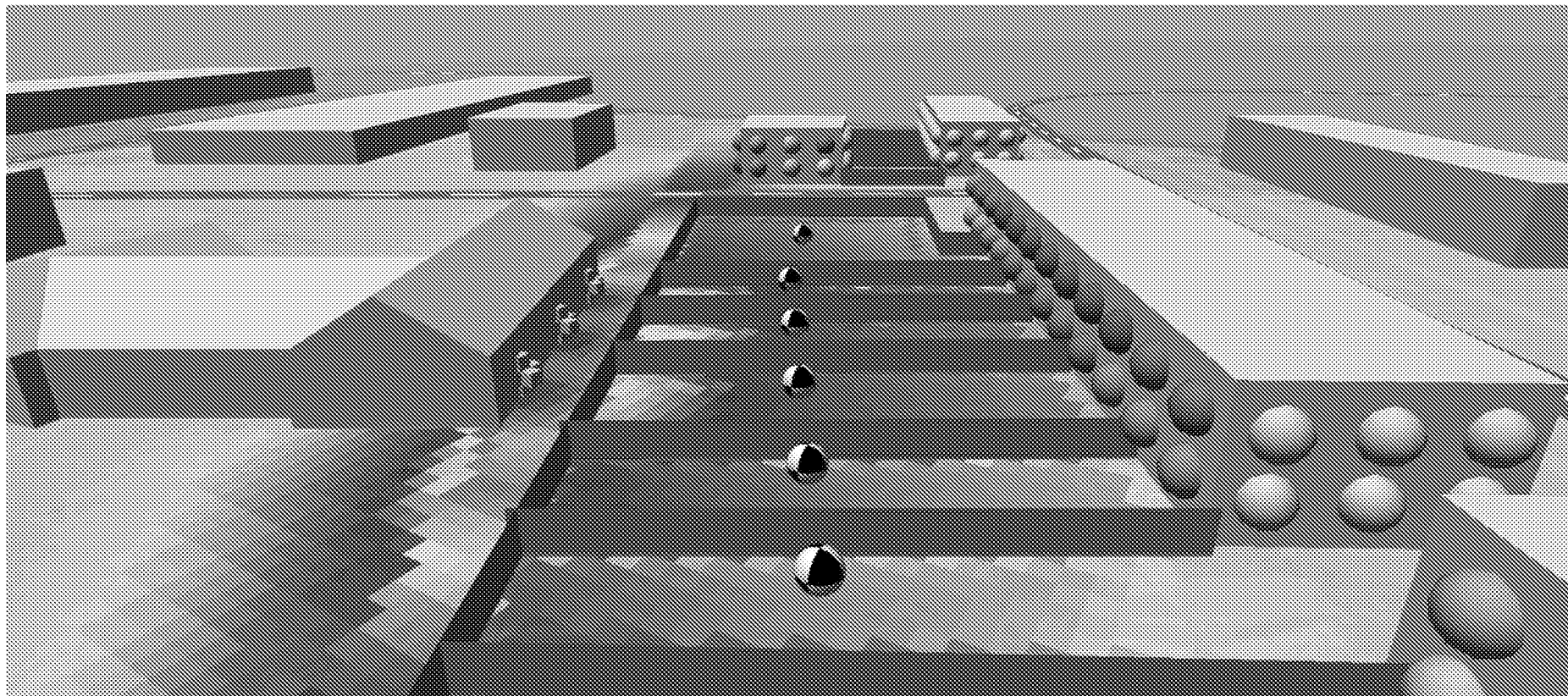
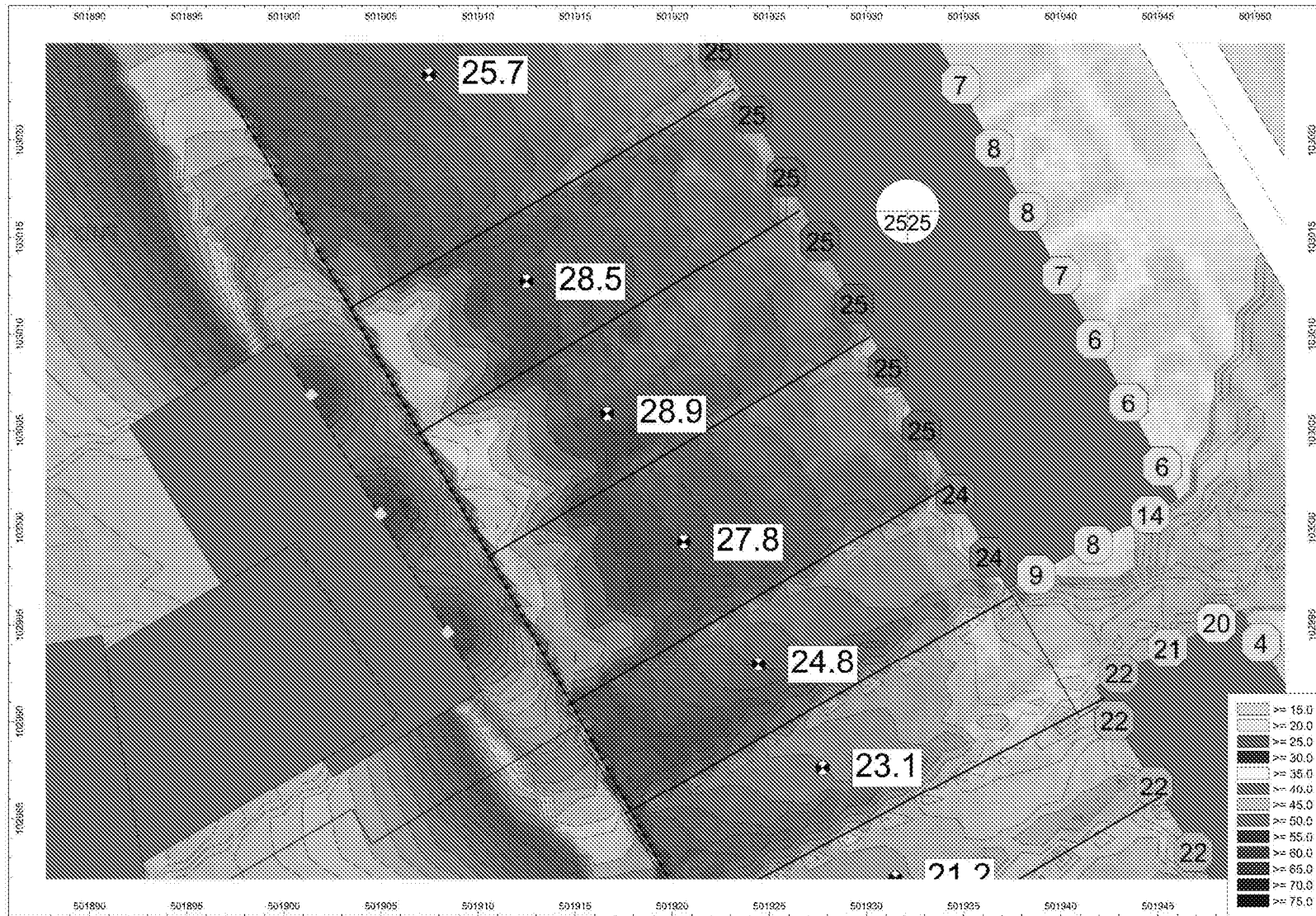


Figure D.5 ' Specific plant noise emissions (dB $L_{Aeq,1hr}$) from 3 no. external air conditioning units on the east elevation with a sound power level (each) of 65 dB L_{WA}



ParkerJones Acoustics Limited

Bristol	London	Glasgow
11 Bankside Road	29 Lincoln's Inn Fields	126 West Regent Street
Brislington	Holborn	Glasgow
Bristol	London	G2 2RQ
BS4 4LB	WC2A 3EE	

