

NoiseAssess

Acoustics, Noise and Vibration Consultants

Project: Jowett House Farm, Jowett House Lane, Cawthorne, Barnsley S75 4AS
Subdivision of farmhouse into two dwellings

Scope of Report Assessment of noise from proposed Air Source Heat Pumps

Client: Jowett House Farm Ltd

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CONTENTS

	PAGE
1.0 INTRODUCTION	3
2.0 CRITERIA	4
3.0 BASELINE NOISE SURVEY	8
4.0 NOISE IMPACT ASSESSMENT AND RECOMMENDATIONS	10
5.0 CONCLUSIONS	14
6.0 REFERENCES	15
FIGURE 1. SITE AND NOISE MONITORING LOCATIONS	16
FIGURE 2. PROPOSED SITE LAYOUT	17
FIGURE 3. PROPOSED ACOUSTIC FENCE	18
APPENDIX A1: ACOUSTIC TERMINOLOGY	19
APPENDIX A2: NOISE SURVEY RESULTS	21

1.0 INTRODUCTION

- 1.1 This noise assessment has been commissioned by Jowett House Farm Ltd in support of a planning application for the conversion of a farmhouse into two dwellings with associated air source heat pumps (ASHPs).
- 1.2 The site is in a rural area and is surrounded by agricultural fields. There are existing residential properties to the north-east of the proposed dwellings and farm buildings further north. The nearest dwellings are in the applicant's ownership but have been assessed to the criteria used for uninvolved properties to give a robust assessment. The site location is shown in Figure 1.
- 1.3 The proposed plans show that the proposed ASHPs will be located to the east and west of the proposed dwellings as shown in Figure 2.

2.0 CRITERIA

BS4142

2.1 The noise impact of mechanical services noise sources on existing residential properties is normally assessed in accordance with BS4142¹.

2.2 The scope of BS4142 is given in the extract below.

"1.1 This standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

- a) Sound from industrial and manufacturing processes;
- b) Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- c) Sound from the loading and unloading of goods and materials at industrial and / or commercial premises; and
- d) Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and / or commercial site.

The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident."

2.3 The standard compares sound from industrial / commercial sources with the background sound level. The standard states in Clause 9.1 that "Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level". Such features are taken into account by adding a correction to the specific sound level depending on the extent to which the distinguishing acoustic characteristics will attract attention. The standard states the following in Clause 9.2:

"Tonality: For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone that 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 3dB 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."
- "NOTE 2: If characteristics likely to affect perception and response are present in the specific sound, within the same reference period, then the applicable corrections ought normally to be added arithmetically. However, if a single feature is dominant to the exclusion of the others then it might be appropriate to apply a reduced or even zero correction for the minor characteristics."
- "Intermittency: When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied".
- "Other sound characteristics: Where the specific sound features characteristics that are neither tonal, nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied."

2.4 BS4142 provides guidance on the assessment of impacts in Clause 11.

"11 Assessment of the impacts

COMMENTARY ON CLAUSE 11.

The significance of sound of an industrial / commercial nature depends upon both the margin by which the rating of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs / will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following:

- a) Typically, the greater this difference, the greater the magnitude of the impact.
- b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

- d) 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".

- 2.5 BS4142 recommends that the specific sound level during daytime periods 07:00 - 23:00 hrs should be determined over a reference time interval of 1 hour and during night-time periods 23:00 - 07:00 hrs over a reference time interval of 15 minutes.

Assessment in Context

- 2.6 BS4142 recommends that the industrial sound should also be assessed in context. Therefore, the sound levels have been assessed in the context of the character of the area; the existing ambient noise levels and the criteria given in BS8233².
- 2.7 The BS8233 recommendations for indoor ambient noise levels are given below.

Table 1: BS8233 recommendations for indoor ambient noise levels

Activity	Location	07:00 to 23:00 hrs	23:00 to 07:00 hrs
Resting	Living room	35 dBL _{Aeq,16hour}	-
Dining	Dining room/area	40 dBL _{Aeq,16hour}	-
Sleeping (daytime resting)	Bedroom	35 dBL _{Aeq,16hour}	30 dBL _{Aeq,8hour}

- 2.8 Paragraph 7.7.3.2 of BS8233 recommends that for traditional external amenity areas such as gardens and patios, it is desirable that during the daytime the external noise level does not exceed 50 dBL_{Aeq,T} with an upper guideline value of 55 dBL_{Aeq,T} which would be acceptable in noisier environments. The time period is not stated but is assumed to be 16 hours (07:00 hours to 23:00 hrs) as in the previous version of BS8233.

MCS

- 2.9 The Microgeneration Certification Scheme (MCS-020) gives a methodology for determining whether the ASHPs can be considered as permitted development. This methodology involves calculating the ASHP noise at the receptor and combining it with an assumed residual noise level of 40 dBL_{Aeq} (note: this is

called Background Noise Level in the MCS but is the Residual Noise Level in BS4142 terminology). The combined level must not exceed 42 dBL_{Aeq} for the development to be considered permitted. This is a more relaxed standard than BS4142 for sites where background noise levels are low particularly at night. This assessment has been based on the BS4142 methodology rather than the MCS to reduce the likelihood of complaints due to the low background noise levels in the area. Comments have also been made on the mitigation requirements under the MCS.

3.0 BASELINE NOISE SURVEY

- 3.1 A survey of the current noise levels at the site was carried out from 16:00 hrs on Thursday 02/05/2024 to 14:00 hrs on Wednesday 08/05/2024.
- 3.2 Noise levels were measured in a location representative of the closest existing residential property. The microphone was in freefield conditions and at a height of approximately 1.8m above ground level. The survey location is marked A on Figure 1.
- 3.3 Noise levels were measured using an unattended auto-logging Rion NL-31 sound level meter (s/n 583274). The sound level meter was calibrated using a portable Norsonic 1251 calibrator (s/n 32860) at the start and finish of the survey periods with no variation in the calibration level. Broadband noise levels were measured using 5-minute sample periods.
- 3.4 Weather conditions when the site was visited to install and retrieve the sound level meter were dry with low wind speeds (<5m/s). Past weather reports indicate that weather conditions were similar throughout the survey except for a period of rain on the afternoon of Friday 03/05/2024 (source: www.timeanddate.com).
- 3.5 The results of the noise survey are presented in full in Appendix A2 and summarised below.

Table 2. Summary of free field daytime noise levels.

Day	Period	Lowest dBL _{Aeq,1hr}	Lowest dBL _{A90,1hr}	Modal dBL _{A90,1hr}
02/05/2024	16:00 - 23:00	33	27	38
03/05/2024	07:00 - 23:00	33	28	36
04/05/2024	07:00 - 23:00	33	28	39
05/05/2024	07:00 - 23:00	39	32	36
06/05/2024	07:00 - 23:00	34	31	36
07/05/2024	07:00 - 23:00	39	34	37
08/05/2024	07:00 - 14:00	44	39	39

Table 3. Summary of free field night-time noise levels.

Night of	Period	Lowest dBL_{Aeq,15mins}	Lowest dBL_{A90,15mins}	Modal dBL_{A90,15mins}
02/05/2024	23:00 - 07:00	23	22	22
03/05/2024	23:00 - 07:00	28	25	35
04/05/2024	23:00 - 07:00	28	25	27
05/05/2024	23:00 - 07:00	26	24	26
06/05/2024	23:00 - 07:00	25	24	24
07/05/2024	23:00 - 07:00	30	27	28

- 3.6 During the two site visits to install and retrieve the auto-logging sound level meter the main noise sources were road traffic on New Road and bird song.

4.0 NOISE IMPACT ASSESSMENT AND RECOMMENDATIONS

Criteria and Methodology

- 4.1 The potential noise impact of the proposed ASHPs has been assessed in accordance with BS4142¹.

Closest noise sensitive properties

- 4.2 The closest residential property is located on Jowett House Lane to the northwest of the proposed dwellings, marked as R1 on Figure 1.

Proposed ASHPs

- 4.3 Each of the new dwellings will have a single ASHP unit assigned to it with the proposed ASHPs to be located to the east and west of the converted properties, as shown in Figure 2.
- 4.4 Calculations of noise from the ASHPs have been based on the manufacturer's noise data as provided by the client and summarised below.

Table 4. Manufacturer's noise data for external plant

Item	Sound Power Level
Mitsubishi PUZ-WM60VAA	58 dB(A)

- 4.5 It is understood that the ASHPs will run intermittently 24 hours a day, 7 days a week.

Recommendations for the control of noise from the ASHPs

- 4.6 It is recommended that a 1.8m high acoustic barrier be installed around the ASHP unit located off the east gable end. To provide sufficient attenuation at R1, the acoustic barrier should along the northeast and northwest boundaries of the rectangular area assigned for the ASHP as shown on Figure 3. No additional attenuation measures are required for the ASHP located off the west gable end as the building itself will provide sufficient screening to reduce noise levels at R1.

4.7 The acoustic barrier should be imperforate and have a minimum mass of 10 kg/m². The acoustic barrier should be fully sealed to the ground at the base and should be designed so that gaps do not open between panels or at the base due to weathering over the lifespan of the barrier. This will normally mean that panels are interlocking or have cover strips and that gravel boards at the base are designed to limit deterioration due to contact with the ground. Consideration should be given to the procedures for maintenance or replacement of the barriers as necessary to ensure their continued effectiveness. The acoustic barriers may consist of one of the following:

- An acoustic fence meeting the above specification. Acoustic fences are available in various materials with varying lifespans as can be seen from the examples of proprietary acoustic fences below.
- A masonry wall with no gaps.

4.8 Examples of suppliers of proprietary acoustics fences are as follows:

Gramm Barriers:	http://www.grammbarriers.com/our-products/acoustic-barriers/
Jacksons Fencing:	https://www.jacksons-fencing.co.uk/acoustic-fencing
Premier Acoustic Fencing:	http://www.premieracousticfencing.co.uk/

4.9 It is the Client's responsibility to check with the manufacturer of the fence and ASHP that this proposal is suitable in non-acoustic respects. The sound insulation performance of the proposed construction will be dependent upon correct installation and workmanship. The safety implications of the installation of the recommended products / material should be checked by the Client before use and appropriate systems of work put in place.

Calculation of noise from the ASHPs

4.10 Noise levels from the proposed ASHPs have been calculated for the closest noise sensitive property to the north, R1. The calculations are shown below and assume that the proposed ASHPs will operate continuously and simultaneously at full load. The calculations include corrections for distance and barrier attenuation. The sound power level for the ASHPs have been converted to sound pressure levels at 1m by the subtraction of 8 dB(A).

Table 5. Noise from ASHPs to R1

	Day		Night	
	Orchard Cottage ASHP	Jowett Farmhouse ASHP	Orchard Cottage ASHP	Jowett Farmhouse ASHP
Source noise level, dB(A)	50	50	50	50
Source noise measurement distance, m	1	1	1	1
Distance, m	24	12	24	12
Distance correction, dB(A)	-28	-22	-28	-22
Acoustic screening, dB(A)	-20	-13	-20	-11
Noise level at receptor, $dB_{Leq,1hr}$	2	15	2	17
Total noise level at receptor, $dB_{Leq,1hr}$	15		17	

BS4142 Assessment of noise from ASHPs

- 4.11 The BS4142 assessment of noise from the ASHPs at R1 is shown below. A 2dB tonal penalty and a 3 dB intermittency penalty have been added as a precaution. The cumulative noise levels from ASHPs have been compared against the lowest of the measured daytime 1-hour and night-time 15-min background noise levels below.

Table 6. BS4142 assessment of noise from ASHPs.

Receptor	Day	Night
Specific noise level, dB_{Leq}	15	17
Tonal Penalty, dB	2	2
Impulsive/Intermittency penalty, dB	3	3
Rating, dB	20	22
Background noise level, dB_{LA90}	27	22
Rating - background, dB	-7	0

- 4.12 The differences between the daytime and night-time rating levels and the background noise levels normally indicate a low noise impact depending on the context.

Plant noise considered in context

- 4.13 BS4142 recommends that the noise also be judged in context.

- 4.14 The existing residential properties on site already have the same ASHP units installed. Therefore, noise from ASHPs is already present and is not out of character for the area.
- 4.15 To assist with the consideration of the noise in context, the cumulative noise level of the ASHPs at the R1 has been compared with the lowest existing daytime $dB_{LAeq,1hr}$ and night-time $dB_{LAeq,15min}$ noise levels. In addition, the ASHP levels have been compared with the criteria given in BS8233. It is recognised that this standard is generally used for anonymous noise sources, and it is used here only to provide additional information on the scale of the noise levels. The results of these comparisons are given below.

Table 7. ASHP noise comparison with ambient noise levels and BS8233 criteria.

	R1	
	Day	Night
Source noise level, dB_{LAeq}	15	17
Comparison with ambient noise levels		
Ambient noise level, dB_{LAeq}	33	23
Difference between ambient & source noise level, dB(A)	-18	-6
Ambient + source noise level, dB_{LAeq}	33	24
Increase in ambient noise level, $dB_{LAeq}^{\dagger}$	0	1
Comparison with BS8233 criteria for gardens		
BS8233 upper limit for private gardens	55	N/A
Difference between source noise & desired limit, dB(A)	-40	N/A
Comparison with BS8233 internal noise limiting criteria		
Internal noise level due to source noise, dB(A) ^{††}	0-5	2-7
BS8233 recommended internal noise criteria dB(A)	≤ 35	≤ 30

[†]An increase in ambient noise level of up to 3dB(A) is not considered to be significant

^{††}Attenuation due to partially open window taken as 10-15dB(A)

- 4.16 The consideration of the noise in context supports the conclusion of the BS4142 assessment that the ASHPs will have a low noise impact at R1 during both daytime and night-time hours.
- 4.17 It should also be noted that the proposed ASHPs would comply with the MCS criterion without the installation of the proposed acoustic barrier.

5.0 CONCLUSIONS

- 5.1 New ASHPs are to be installed at Jowett House Farm, Jowett House Lane, Cawthorne, Barnsley S75 4AS. It is understood that the proposed ASHPs may operate 24 hours a day
- 5.2 A survey of the existing noise levels representative of the closest residential property has been carried out.
- 5.3 The level of noise from the proposed ASHPs have been calculated for the closest residential property using manufacturer's noise data as provided by the client.
- 5.4 It has been recommended that a 1.8m high acoustic fence be constructed around the ASHP to the east of the proposed dwellings.
- 5.5 With the acoustic fence in place, noise from the proposed ASHPs will have a low noise impact during both daytime and night-time hours at R1 when assessed in accordance with BS4142 and considered in context.

6.0 REFERENCES

1. BS4142: British Standard 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound.
2. BS8233: British Standard 8233, Guidance on sound insulation and noise reduction for buildings, BSI 2014.

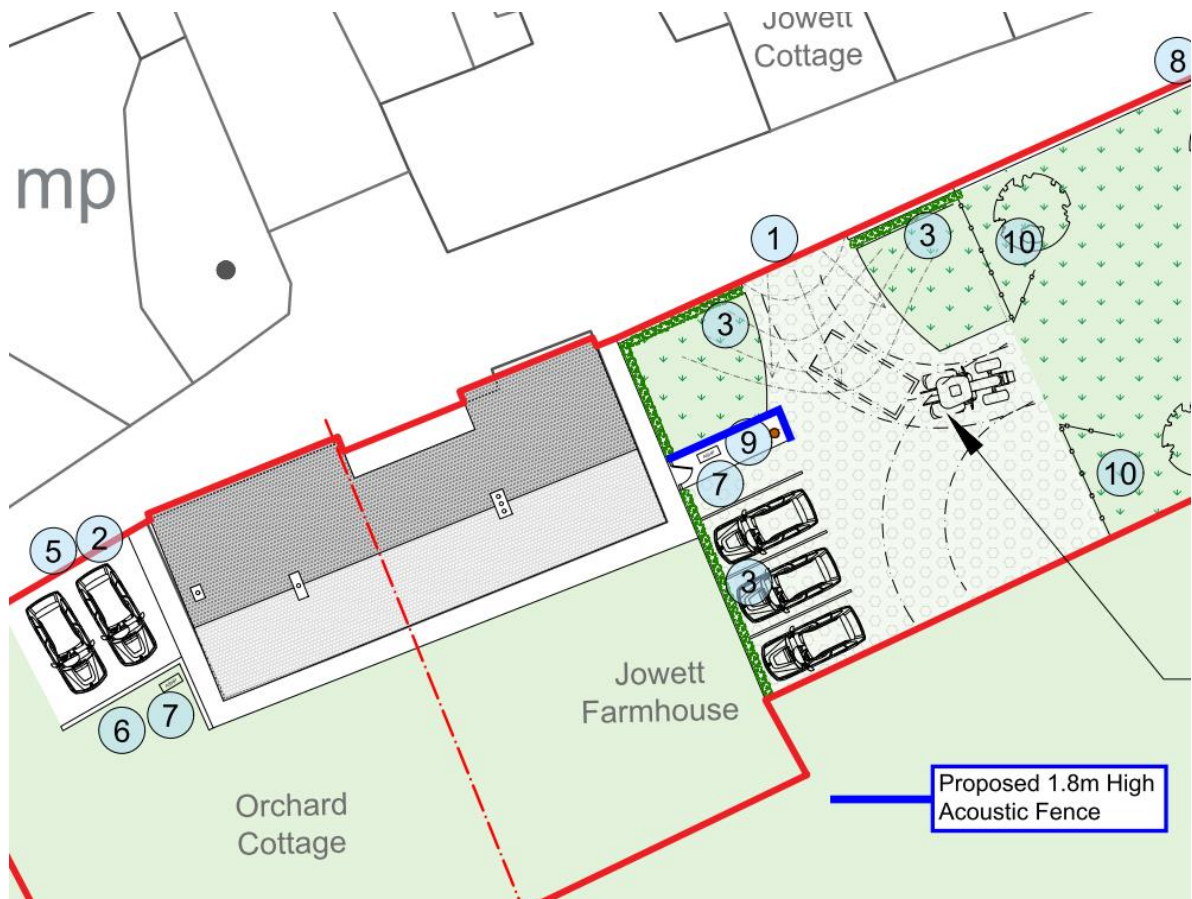
FIGURE 1. SITE AND NOISE MONITORING LOCATIONS



FIGURE 2. PROPOSED SITE LAYOUT



FIGURE 3. PROPOSED ACOUSTIC FENCE



APPENDIX A1: ACOUSTIC TERMINOLOGY

Ambient noise	The sound pressure level at a given location (i.e. sound from all sources) usually measured using the L_{Aeq} parameter.
A-weighting	A weighting applied to the frequencies which make up a sound pressure level to mimic the response of the human ear which is less responsive to low frequency sounds as it is to high frequency sounds. The resultant level after application of the weighting is called the 'A-weighted sound pressure level' and is denoted by dB(A) or by using a subscript A (e.g. dB_{Aeq}).
Background noise	The noise measured in the absence of the noise under investigation usually using the statistical parameter L_{90} which represents the quietest parts of the measurement period.
Broadband sound	Sound which contains all the frequencies.
Decibel (dB)	A logarithmic measurement scale used for sound pressure levels. This scale is used because the simple use of sound pressures would be unwieldy as the range of pressures to which the human ear responds is very large. The normal threshold of hearing at 1kHz is 0dB. A level of $120dB_{Aeq}$ is very loud (L signifies level and the A and eq are explained under A-weighting and L_{eq}). Some night club dance floors can have sound levels of around $110 dB_{Aeq}$. In the workplace the wearing of hearing protection is compulsory for staff who experience a noise level of over $85dB_{Aeq}$ averaged over an 8-hour day and is normally used when the levels are over $80dB_{Aeq}$ averaged over the 8-hour day. Noise intrusion levels into bedrooms (e.g. from traffic noise) are often controlled to below $30dB_{Aeq}$ in the design of new properties (standards sometimes vary between authorities). Noise levels of below $20dB_{Aeq}$ are very quiet and would normally only be achieved in a well designed recording studio. Although noise calculations are normally carried out using figures to 1 decimal place the results are often presented to the nearest dB as changes of a fraction of a dB are not normally perceptible even in controlled conditions.
Facade noise level	Noise level including a contribution from the reflection from a building facade, usually measured at 1m from the facade.
Free field	Noise levels with no contribution from reflections from nearby structures.
Hertz	The units used for frequency denoted by Hz, i.e. the number of cycles of pressure fluctuation per second. K used in front of Hz represents 1000 (1kHz = 1000Hz). High frequency sounds (e.g. 8kHz) are high pitched and low frequency sounds (e.g. 63Hz) are the bass notes.

L_{eq}	A parameter used to denote the 'equivalent continuous sound pressure level'. This is the sound pressure level of a continuous sound that would contain the same energy as the varying sound being measured or investigated. L_{Aeq} is the parameter used to denote the 'A-weighted equivalent continuous sound pressure level' (see A-weighting).
L_{10}	A statistical parameter often used for the measurement of road traffic noise. It is the level exceeded for 10% of the time period being considered. If A-weighted a subscript A is included and the time period can also be included in subscript, e.g. $L_{A10, 1hour}$.
L_{90}	A statistical parameter often used for the measurement of background noise levels. It is the level exceeded for 90% of the time period being considered. If A-weighted a subscript A is included and the time period can also be included in subscript, e.g. $L_{A90, 5min}$.
L_{max}	The maximum noise level which occurred during the monitoring period. $L_{Amax,f}$ denotes the maximum A-weighted sound pressure level using the fast time constant of 125ms.
Loudness	Although a 3dB increase is equivalent to a doubling of the sound power level of a sound source this increase is the minimum perceptible under normal conditions. It takes a 10dB change in noise level for it to sound roughly twice (or half) as loud subjectively.
Rating Level	A term used in BS4142. The 'Specific Noise Level' plus a weighting if the noise has certain characteristic features which may make it more disturbing.
Residual noise	The ambient noise remaining when the specific noise source being investigating is not contributing to the noise level at that location (normally measured using the L_{Aeq} parameter).
Specific Noise Level	A term used in BS4142. The L_{Aeq} noise level produced at the assessment position by the noise source being investigated over the reference time period (1-hour in the day and 15-mins at night).
SEL	Single Event Level. The total sound energy of a noise event (e.g. a train pass-by) compressed into 1 second. i.e. the 1 second L_{Aeq} which has the same total A-weighted energy as the entire event.

APPENDIX A2: NOISE SURVEY RESULTS

Daytime noise levels**Table A2.1: Location A: Freefield daytime noise levels
Thursday 02/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
02/05/2024	16:00:02	46.7	76.6	38.3
02/05/2024	17:00:02	44.2	65.9	38.1
02/05/2024	18:00:02	42.5	60.6	36.9
02/05/2024	19:00:02	41.9	60.9	35.6
02/05/2024	20:00:02	37.9	55.8	34.5
02/05/2024	21:00:02	33.8	53.9	30.1
02/05/2024	22:00:02	32.6	54.8	27.2
Average		42.2	-	34.4
Highest		46.7	76.6	38.3
Lowest		32.6	53.9	27.2
Mode		-	-	38

**Table A2.2: Location A: Freefield daytime noise levels
Friday 03/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
03/05/2024	07:00:02	43.5	60.0	37.3
03/05/2024	08:00:02	44.0	68.5	37.0
03/05/2024	09:00:02	42.8	59.8	36.2
03/05/2024	10:00:02	46.5	70.0	34.8
03/05/2024	11:00:02	43.3	59.4	35.4
03/05/2024	12:00:02	41.9	64.7	36.1
03/05/2024	13:00:02	42.6	65.2	33.6
03/05/2024	14:00:02	40.4	61.0	36.2
03/05/2024	15:00:02	40.2	56.6	36.1
03/05/2024	16:00:02	43.3	63.2	37.0
03/05/2024	17:00:02	42.9	68.7	34.6
03/05/2024	18:00:02	42.3	63.2	34.3
03/05/2024	19:00:02	39.7	59.8	32.3
03/05/2024	20:00:02	38.7	55.8	29.6
03/05/2024	21:00:02	32.9	53.3	28.3
03/05/2024	22:00:02	34.0	52.8	29.6
Average		42.2	-	34.3
Highest		46.5	70.0	37.3
Lowest		32.9	52.8	28.3
Mode		-	-	36

**Table A2.3: Location A: Freefield daytime noise levels
Saturday 04/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
04/05/2024	07:00:02	44.4	66.6	36.9
04/05/2024	08:00:02	44.7	63.6	37.8
04/05/2024	09:00:02	47.3	68.9	38.7
04/05/2024	10:00:02	45.1	64.8	39.1
04/05/2024	11:00:02	44.5	62.5	39.0
04/05/2024	12:00:02	43.2	58.9	38.8
04/05/2024	13:00:02	44.4	69.3	38.8
04/05/2024	14:00:02	42.3	60.5	38.7
04/05/2024	15:00:02	42.6	60.3	38.9
04/05/2024	16:00:02	43.1	65.4	38.0
04/05/2024	17:00:02	40.0	60.1	35.1
04/05/2024	18:00:02	41.9	60.5	33.4
04/05/2024	19:00:02	50.2	67.9	32.4
04/05/2024	20:00:02	43.6	66.1	31.0
04/05/2024	21:00:02	39.3	58.4	28.5
04/05/2024	22:00:02	32.8	47.1	27.8
Average		44.4	-	35.8
Highest		50.2	69.3	39.1
Lowest		32.8	47.1	27.8
Mode		-	-	39

**Table A2.4: Location A: Freefield daytime noise levels
Sunday 05/02/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
05/05/2024	07:00:02	47.2	70.7	36.4
05/05/2024	08:00:02	42.9	64.7	35.3
05/05/2024	09:00:02	43.8	64.2	36.4
05/05/2024	10:00:02	46.5	67.9	36.7
05/05/2024	11:00:02	47.6	72.2	35.9
05/05/2024	12:00:02	42.8	67.1	35.3
05/05/2024	13:00:02	42.2	66.9	37.2
05/05/2024	14:00:02	41.5	62.2	37.1
05/05/2024	15:00:02	44.9	65.0	38.4
05/05/2024	16:00:02	43.1	62.2	37.5
05/05/2024	17:00:02	47.5	70.9	35.2
05/05/2024	18:00:02	39.0	59.0	32.4
05/05/2024	19:00:02	43.9	65.3	34.2
05/05/2024	20:00:02	45.6	67.2	37.4
05/05/2024	21:00:02	41.5	63.4	35.4
05/05/2024	22:00:02	39.1	54.7	36.2
Average		44.5	-	36.1
Highest		47.6	72.2	38.4
Lowest		39.0	54.7	32.4
Mode		-	-	36

**Table A2.5: Location A: Freefield daytime noise levels
Monday 06/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
06/05/2024	07:00:02	45.9	72.5	36.2
06/05/2024	08:00:02	45.7	66.2	34.8
06/05/2024	09:00:02	47.4	67.8	36.5
06/05/2024	10:00:02	45.3	66.8	38.9
06/05/2024	11:00:02	45.9	74.4	38.6
06/05/2024	12:00:02	44.6	64.0	38.3
06/05/2024	13:00:02	42.9	65.5	37.5
06/05/2024	14:00:02	43.4	60.4	36.4
06/05/2024	15:00:02	50.9	68.7	39.5
06/05/2024	16:00:02	48.6	66.7	40.9
06/05/2024	17:00:02	45.6	64.0	38.8
06/05/2024	18:00:02	44.0	68.7	38.2
06/05/2024	19:00:02	44.6	57.3	43.0
06/05/2024	20:00:02	45.3	61.9	41.7
06/05/2024	21:00:02	42.3	64.8	35.5
06/05/2024	22:00:02	33.6	49.0	31.3
Average		45.8	-	37.9
Highest		50.9	74.4	43.0
Lowest		33.6	49.0	31.3
Mode		-	-	36

**Table A2.6: Location A: Freefield daytime noise levels
Tuesday 07/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
07/05/2024	07:00:02	45.4	61.7	38.7
07/05/2024	08:00:02	45.6	64.9	39.4
07/05/2024	09:00:02	46.3	74.0	37.8
07/05/2024	10:00:02	44.4	62.6	37.4
07/05/2024	11:00:02	46.2	62.8	37.6
07/05/2024	12:00:02	44.8	65.5	37.3
07/05/2024	13:00:02	43.2	60.2	36.9
07/05/2024	14:00:02	43.0	61.9	36.7
07/05/2024	15:00:02	42.9	60.9	36.4
07/05/2024	16:00:02	41.9	63.7	35.8
07/05/2024	17:00:02	43.2	63.0	37.3
07/05/2024	18:00:02	45.4	72.2	37.4
07/05/2024	19:00:02	42.7	64.0	37.1
07/05/2024	20:00:02	44.3	63.1	38.7
07/05/2024	21:00:02	41.2	58.5	36.5
07/05/2024	22:00:02	38.6	58.9	33.7
Average		44.1	-	37.2
Highest		46.3	74.0	39.4
Lowest		38.6	58.5	33.7
Mode		-	-	37

**Table A2.7: Location A: Freefield daytime noise levels
Wednesday 08/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
08/05/2024	07:00:02	45.9	70.3	41.1
08/05/2024	08:00:02	47.9	70.6	44.1
08/05/2024	09:00:02	47.5	65.6	40.7
08/05/2024	10:00:02	45.2	62.8	39.1
08/05/2024	11:00:02	44.5	65.6	38.8
08/05/2024	12:00:02	44.6	63.0	39.4
08/05/2024	13:00:02	43.7	61.0	39.2
Average		45.9	-	40.3
Highest		47.9	70.6	44.1
Lowest		43.7	61.0	38.8
Mode		-	-	39

Night-time noise levels**Table A2.8: Location A: Freefield night-time noise levels
Thursday 02/05/2024 – Friday 03/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
02/05/2024	23:00:02	28.7	42.9	26.0
02/05/2024	23:15:02	29.0	48.4	25.5
02/05/2024	23:30:02	30.5	45.3	26.2
02/05/2024	23:45:02	27.6	46.8	26.1
03/05/2024	00:00:02	27.3	38.0	25.9
03/05/2024	00:15:02	27.9	48.1	24.3
03/05/2024	00:30:02	36.5	54.3	22.9
03/05/2024	00:45:02	25.8	34.7	24.4
03/05/2024	01:00:02	24.7	36.6	23.6
03/05/2024	01:15:02	24.9	32.1	23.4
03/05/2024	01:30:02	28.4	43.9	23.9
03/05/2024	01:45:02	23.8	30.1	22.8
03/05/2024	02:00:02	25.0	37.5	23.4
03/05/2024	02:15:02	26.9	40.6	24.6
03/05/2024	02:30:02	25.5	42.1	23.9
03/05/2024	02:45:02	24.7	40.5	23.3
03/05/2024	03:00:02	23.2	30.3	22.4
03/05/2024	03:15:02	22.6	33.0	21.8
03/05/2024	03:30:02	22.7	38.8	21.5
03/05/2024	03:45:02	22.5	30.4	21.5
03/05/2024	04:00:02	23.5	33.8	21.5
03/05/2024	04:15:02	24.0	40.4	21.7
03/05/2024	04:30:02	28.8	54.0	24.8
03/05/2024	04:45:02	40.2	60.4	31.4
03/05/2024	05:00:02	43.0	58.0	34.4
03/05/2024	05:15:02	37.5	53.4	32.1
03/05/2024	05:30:02	45.7	62.0	34.5
03/05/2024	05:45:02	39.8	54.7	33.5
03/05/2024	06:00:02	40.4	52.2	34.6
03/05/2024	06:15:02	42.6	58.6	35.9
03/05/2024	06:30:02	42.3	54.6	36.9
03/05/2024	06:45:02	43.0	61.1	37.2
Average		37.1	-	26.7
Highest		45.7	62.0	37.2
Lowest		22.5	30.1	21.5
Mode		-	-	22

**Table A2.9: Location A: Freefield night-time noise levels
Friday 03/05/2024 – Saturday 04/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
03/05/2024	23:00:02	32.0	46.3	27.8
03/05/2024	23:15:02	35.1	46.2	31.9
03/05/2024	23:30:02	39.4	46.6	37.6
03/05/2024	23:45:02	41.0	47.0	39.9
04/05/2024	00:00:02	36.8	51.2	33.0
04/05/2024	00:15:02	31.1	38.7	29.3
04/05/2024	00:30:02	32.9	45.6	30.5
04/05/2024	00:45:02	30.1	43.2	26.1
04/05/2024	01:00:02	29.2	42.5	25.4
04/05/2024	01:15:02	28.4	37.8	25.4
04/05/2024	01:30:02	33.6	43.0	30.3
04/05/2024	01:45:02	38.1	44.9	37.0
04/05/2024	02:00:02	36.4	44.1	35.2
04/05/2024	02:15:02	29.1	40.8	26.9
04/05/2024	02:30:02	27.7	41.8	25.0
04/05/2024	02:45:02	27.5	40.5	25.0
04/05/2024	03:00:02	27.6	40.9	25.6
04/05/2024	03:15:02	32.8	40.6	30.8
04/05/2024	03:30:02	32.7	38.9	31.3
04/05/2024	03:45:02	38.6	45.6	35.8
04/05/2024	04:00:02	36.2	44.4	34.0
04/05/2024	04:15:02	31.7	45.2	29.1
04/05/2024	04:30:02	40.6	61.7	28.9
04/05/2024	04:45:02	46.8	60.6	36.3
04/05/2024	05:00:02	49.1	63.1	36.6
04/05/2024	05:15:02	47.7	64.9	34.4
04/05/2024	05:30:02	46.1	65.5	34.6
04/05/2024	05:45:02	39.2	56.5	32.5
04/05/2024	06:00:02	40.7	58.7	33.8
04/05/2024	06:15:02	41.2	55.1	34.7
04/05/2024	06:30:02	41.8	58.1	34.9
04/05/2024	06:45:02	39.7	57.3	34.6
Average		40.6	-	31.7
Highest		49.1	65.5	39.9
Lowest		27.5	37.8	25.0
Mode		-	-	35

**Table A2.10: Location A: Freefield night-time noise levels
Saturday 04/05/2024 – Sunday 05/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
04/05/2024	23:00:02	32.3	43.9	27.9
04/05/2024	23:15:02	29.7	41.2	26.3
04/05/2024	23:30:02	31.5	41.8	28.0
04/05/2024	23:45:02	30.8	48.9	26.9
05/05/2024	00:00:02	27.7	37.2	24.7
05/05/2024	00:15:02	31.6	44.3	28.9
05/05/2024	00:30:02	34.8	46.6	31.1
05/05/2024	00:45:02	31.1	40.1	28.7
05/05/2024	01:00:02	30.2	42.5	26.6
05/05/2024	01:15:02	29.5	42.8	27.1
05/05/2024	01:30:02	28.9	39.1	26.5
05/05/2024	01:45:02	33.8	45.8	29.4
05/05/2024	02:00:02	33.3	46.4	29.8
05/05/2024	02:15:02	32.2	43.4	29.5
05/05/2024	02:30:02	36.2	50.7	30.9
05/05/2024	02:45:02	36.1	47.2	33.1
05/05/2024	03:00:02	32.0	46.6	29.1
05/05/2024	03:15:02	32.9	45.5	30.2
05/05/2024	03:30:02	33.0	44.7	30.2
05/05/2024	03:45:02	30.4	48.1	28.1
05/05/2024	04:00:02	28.5	46.3	25.7
05/05/2024	04:15:02	31.6	60.1	27.3
05/05/2024	04:30:02	44.8	60.0	35.3
05/05/2024	04:45:02	45.6	60.0	37.5
05/05/2024	05:00:02	41.7	59.3	36.4
05/05/2024	05:15:02	48.0	66.7	36.1
05/05/2024	05:30:02	42.3	57.8	35.7
05/05/2024	05:45:02	50.5	67.4	37.2
05/05/2024	06:00:02	46.7	64.3	35.0
05/05/2024	06:15:02	46.8	67.4	34.6
05/05/2024	06:30:02	41.5	52.9	36.4
05/05/2024	06:45:02	41.1	58.9	34.9
Average		41.3	-	30.8
Highest		50.5	67.4	37.5
Lowest		27.7	37.2	24.7
Mode		-	-	27

**Table A2.11: Location A: Freefield night-time noise levels
Sunday 05/05/2024 – Monday 06/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
05/05/2024	23:00:02	38.0	49.6	35.1
05/05/2024	23:15:02	34.4	41.8	32.9
05/05/2024	23:30:02	35.2	44.3	33.5
05/05/2024	23:45:02	32.8	41.8	30.9
06/05/2024	00:00:02	31.1	44.4	28.2
06/05/2024	00:15:02	27.3	37.9	25.2
06/05/2024	00:30:02	27.3	46.3	23.6
06/05/2024	00:45:02	32.6	48.8	25.8
06/05/2024	01:00:02	29.2	42.9	24.5
06/05/2024	01:15:02	28.0	42.0	24.0
06/05/2024	01:30:02	26.2	37.2	24.3
06/05/2024	01:45:02	28.5	41.8	25.8
06/05/2024	02:00:02	28.4	37.8	25.5
06/05/2024	02:15:02	28.4	39.5	25.8
06/05/2024	02:30:02	28.9	51.8	25.7
06/05/2024	02:45:02	28.4	40.1	24.9
06/05/2024	03:00:02	27.7	41.1	25.4
06/05/2024	03:15:02	29.5	44.6	26.5
06/05/2024	03:30:02	31.9	42.2	29.6
06/05/2024	03:45:02	34.6	45.5	31.3
06/05/2024	04:00:02	32.6	54.9	29.3
06/05/2024	04:15:02	34.7	56.5	30.9
06/05/2024	04:30:02	49.2	59.5	39.5
06/05/2024	04:45:02	47.1	65.6	38.4
06/05/2024	05:00:02	51.4	67.4	38.3
06/05/2024	05:15:02	43.5	58.9	38.3
06/05/2024	05:30:02	46.5	65.0	38.3
06/05/2024	05:45:02	49.8	64.8	40.1
06/05/2024	06:00:02	43.3	60.6	38.4
06/05/2024	06:15:02	43.8	62.7	38.6
06/05/2024	06:30:02	44.4	62.6	39.0
06/05/2024	06:45:02	45.7	63.2	39.2
Average		42.6	-	31.2
Highest		51.4	67.4	40.1
Lowest		26.2	37.2	23.6
Mode		-	-	26

**Table A2.12: Location A: Freefield night-time noise levels
Monday 06/05/2024 – Tuesday 07/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
06/05/2024	23:00:02	34.3	42.6	32.6
06/05/2024	23:15:02	34.3	42.6	32.6
06/05/2024	23:30:02	31.8	43.9	30.1
06/05/2024	23:45:02	35.0	50.5	30.7
07/05/2024	00:00:02	30.6	39.0	28.8
07/05/2024	00:15:02	34.0	52.6	27.5
07/05/2024	00:30:02	28.0	36.0	26.7
07/05/2024	00:45:02	35.8	55.1	25.6
07/05/2024	01:00:02	33.7	51.3	24.4
07/05/2024	01:15:02	24.6	40.9	23.6
07/05/2024	01:30:02	26.3	33.0	25.2
07/05/2024	01:45:02	26.5	34.2	25.4
07/05/2024	02:00:02	25.5	29.3	24.8
07/05/2024	02:15:02	26.1	40.7	24.8
07/05/2024	02:30:02	25.6	36.5	24.2
07/05/2024	02:45:02	25.5	36.8	24.4
07/05/2024	03:00:02	24.6	30.0	23.8
07/05/2024	03:15:02	25.5	32.2	24.3
07/05/2024	03:30:02	25.5	36.9	24.4
07/05/2024	03:45:02	29.4	46.7	24.3
07/05/2024	04:00:02	28.2	47.5	25.4
07/05/2024	04:15:02	29.6	49.3	26.8
07/05/2024	04:30:02	45.9	62.2	33.0
07/05/2024	04:45:02	45.3	62.1	39.2
07/05/2024	05:00:02	45.0	60.6	37.5
07/05/2024	05:15:02	44.8	61.0	37.4
07/05/2024	05:30:02	42.8	61.3	35.1
07/05/2024	05:45:02	46.6	65.5	35.1
07/05/2024	06:00:02	43.5	60.5	34.2
07/05/2024	06:15:02	50.8	65.4	38.4
07/05/2024	06:30:02	42.1	60.0	36.1
07/05/2024	06:45:02	41.8	62.2	35.8
Average		41.0	-	29.4
Highest		50.8	65.5	39.2
Lowest		24.6	29.3	23.6
Mode		-	-	24

**Table A2.13: Location A: Freefield night-time noise levels
Tuesday 07/05/2024 – Wednesday 08/05/2024**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
07/05/2024	23:00:02	34.5	44.0	31.9
07/05/2024	23:15:02	35.3	46.2	32.3
07/05/2024	23:30:02	36.7	45.6	33.9
07/05/2024	23:45:02	37.7	46.3	34.7
08/05/2024	00:00:02	36.7	45.2	32.7
08/05/2024	00:15:02	34.3	42.6	31.1
08/05/2024	00:30:02	34.2	45.8	29.5
08/05/2024	00:45:02	30.7	42.8	27.4
08/05/2024	01:00:02	30.2	41.5	27.3
08/05/2024	01:15:02	29.9	37.8	28.4
08/05/2024	01:30:02	30.2	44.8	28.4
08/05/2024	01:45:02	30.6	39.7	28.5
08/05/2024	02:00:02	30.4	38.8	27.8
08/05/2024	02:15:02	29.7	44.7	27.3
08/05/2024	02:30:02	31.4	41.9	29.0
08/05/2024	02:45:02	30.3	36.2	28.0
08/05/2024	03:00:02	30.4	38.8	28.0
08/05/2024	03:15:02	30.2	39.6	28.3
08/05/2024	03:30:02	30.5	40.3	28.3
08/05/2024	03:45:02	30.0	42.4	27.9
08/05/2024	04:00:02	32.5	42.0	29.4
08/05/2024	04:15:02	32.5	44.5	28.6
08/05/2024	04:30:02	46.0	58.4	37.2
08/05/2024	04:45:02	44.5	61.3	37.4
08/05/2024	05:00:02	51.2	64.6	37.1
08/05/2024	05:15:02	46.1	65.5	35.4
08/05/2024	05:30:02	41.3	60.9	35.3
08/05/2024	05:45:02	41.5	59.2	35.1
08/05/2024	06:00:02	43.6	58.7	36.4
08/05/2024	06:15:02	45.5	63.6	37.0
08/05/2024	06:30:02	45.6	64.6	38.0
08/05/2024	06:45:02	45.4	60.1	39.4
Average		41.4	-	31.8
Highest		51.2	65.5	39.4
Lowest		29.7	36.2	27.3
Mode		-	-	28