



Acoustic Associates

P E T E R B O R O U G H

**Environmental noise assessment associated with noise emissions
from a proposed fan unit at Ashtree Farm, Little Dog Drove,
Holbeach St Johns**

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1 OBJECTIVES

- 1.1** To carry out an environmental *noise impact assessment associated with noise emissions from a proposed centrifugal fan unit serving the new grain store building at Ashtree Farm, Little Dog Drove, Holbeach St Johns, Spalding, PE12 8RR, in accordance with British Standard (BS) 4142 (Reference 1) and other relevant standards and guidance.
- 1.2** To recommend solutions to any problems identified by the assessment.

2 CONCLUSIONS

- 2.1** Based on the unattended daytime and night-time noise monitoring on site between 8th – 10th May 2024:
- The typical background noise level during the daytime period is estimated as $L_{A90,1\text{hour}}$ 30 dB(A), which was the modal value ($L_{A90,15\text{mins}}$) measured on site during the daytime period (07:00 – 23:00 hours).
 - The typical background noise level during the night-time period is estimated as $L_{A90,15\text{mins}}$ 21 dB(A), which was the modal value ($L_{A90,15\text{mins}}$) measured on site during the night-time period (23:00 – 07:00 hours).
- 2.2** Using computer noise model predictions and based on manufacturers noise emission data for the proposed fan unit, predicted specific noise emissions from the fan are assessed as having:
- A “low” impact when assessed at reception points in close proximity to the nearest residential receptors during ‘worst case’ daytime and night-time BS 4142 reference periods, whereby the fan is assumed to be running continuously at what the manufacturer quotes as being “maximum air development” (see Appendix 7).
- 2.3** When taking into account context whereby the predicted noise levels represent a worst-case noise scenario (the use of the fan is seasonal and for the majority of the year the fan will not be in use), this is regarded to be an acceptable noise situation. It should also be noted that acceptable internal and external noise levels in accordance with the WHO Guidelines and BS 8233 are shown to be achievable at the nearest residential receptors (even under circumstances where living room and bedroom windows are partially open). With the above in mind and provided the recommendations within this report are implemented this is deemed to be an acceptable noise situation.

*** See Appendix 1 for a Glossary of Terms**

3 RECOMMENDATIONS

3.1 In order to achieve acceptable noise levels the following noise control measures should be incorporated:

- The client has proposed that the Typhoon TC2 Centrifugal fan unit (see Appendix 4) will be installed on-site at the location shown in Drawing 4.3. The manufacturers datasheet for this unit shows that the sound power level (L_{WA}) of the unit is 91 dB(A). If any alternative fan unit is installed in the future, then the sound power level (L_{WA}) of the unit should not exceed 91 dB(A).
- All roller shutter doors and pedestrian door serving the proposed grain store should always be kept in the closed position whenever the fan unit is running.
- An acoustic barrier (3.5m in length and at least 2.4m in height should be installed at the location shown in Drawing 4.3. This acoustic barrier should be retained for the lifetime of the site. A minimum specification for the acoustic barrier is shown in Appendix 7.
- The fan unit should be regularly serviced to ensure that noise emissions from the plant do not increase over time. Particular attention should be paid to any change in overall amplitude or any change in tonal emissions from the equipment.

4 BACKGROUND

4.1 N & D Bacon were awarded planning permission H09-0818-23 (see Reference 6) by South Holland District Council for a proposed grain store building at Ashtree Farm, Little Dog Drove, Holbeach St Johns, Spalding, PE12 8RR, in April 2024.

The sites planning permission included a planning condition which addressed potential noise emissions from a proposed centrifugal fan unit that will serve the proposed building. Condition 5 of planning permission H09-0818-23 states:

"The rating level of the noise emitting from the fan should not exceed the background level at adjacent residential properties when assessed in accordance with BS4142 2014 +A1(2019). Prior to commencement of development, details of the noise attenuation to be installed shall be provided to the Local Planning Authority for approval. Those measures and works so approved by the Local Planning Authority shall be implemented in full before the development hereby granted is first brought into use"

The location of the site, the locations of the nearest residential receptors and monitoring location A are shown in Drawing 4.1, the proposed footprint of the grain store is shown in Drawing 4.2 and the location of the proposed fan unit and proposed acoustic barrier are shown in Drawing 4.3.

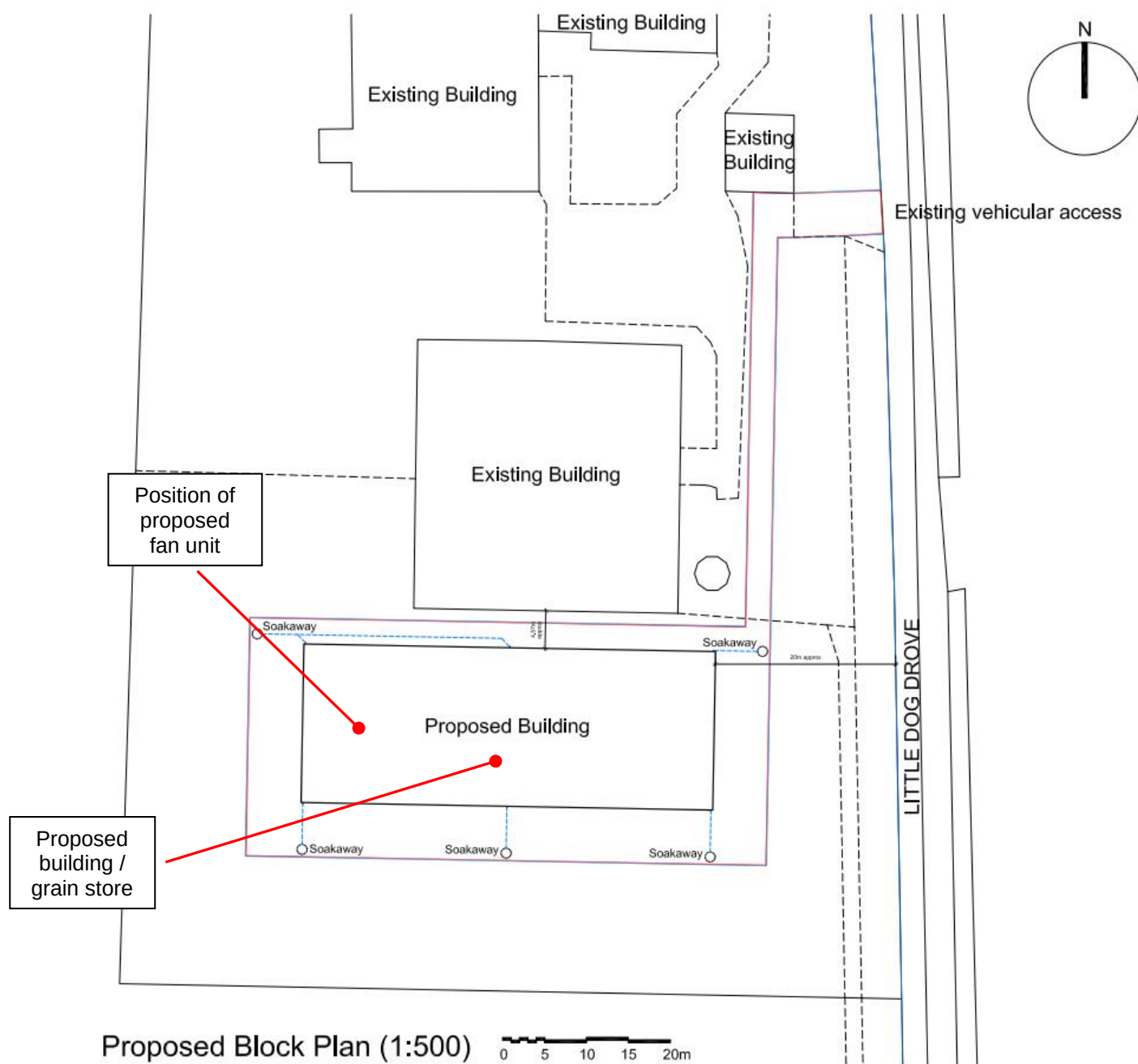


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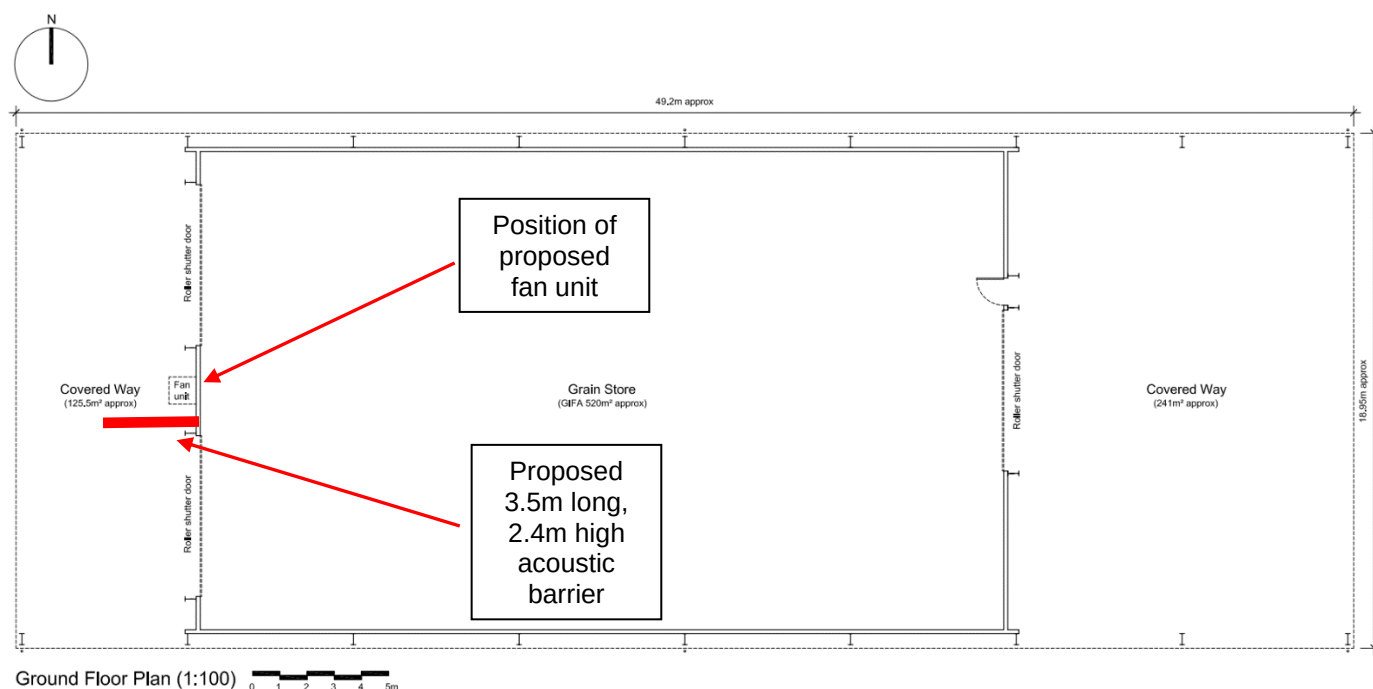
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Drawing 4.1 – Location Plan and Noise Monitoring Location



Drawing 4.2 – Location of New Building / Grain Store



Drawing 4.3 –New Building / Grain Store Floorplan and Location of Fan Unit

4.2 Acoustic Associates (Peterborough) were instructed by N & D Bacon to carry out an environmental noise assessment to assess the noise impact associated with the proposed fan unit.

5 POLICY, GUIDANCE AND STANDARDS

5.1 British Standard BS 4142:2014 (Reference 1)

5.1.1 BS 4142 is a standard which describes a method for assessing whether the 'specific noise' from an industrial source is likely to give rise to complaints from residents of the adjacent dwellings. The 'specific noise' levels are determined outside dwellings. The specific noise level is determined for reference time periods of 1-hour for the daytime (7am to 11pm) and 15 minutes for the night time. Tonal or impulsive characteristics of a noise are likely to increase the scope for complaints and this is taken into account by adding a value to the specific noise source level to obtain the 'rating level'. The value may be between 0 and 15 dB depending on objective and subjective measures detailed in the standard. The following table detail the values added for the subjective method.

Characteristics of noise	Noise at receptor	Value to add to specific noise level for rating level
Noise has tonal characteristics	Just perceptible	+2 dB
	Clearly perceptible	+4 dB
	Highly perceptible	+6 dB
Noise has impulsive characteristics	Just perceptible	+3 dB
	Clearly perceptible	+6 dB
	Highly perceptible	+9 dB
Other - characteristics that are neither tonal nor impulsive but are readily distinctive against the residual acoustic environment,	-	+ 3 dB
Intermittency	If intermittency is readily distinctive in the residual acoustic environment	+3 dB

Table 1 – BS 4142 – Corrections to noise to calculate rating level – subjective method

5.1.2 BS 4142 requires that the rating level of a noise is compared with the existing background noise ($L_{A90,T}$). Guidance given in the standard states the following regarding the difference between the rating Level and the background noise.

- A difference of 0 dB is indicative of a “*minor impact*”;
- A difference of +5 dB is indicative of an “*adverse impact*”;
- A difference of +10 dB is indicative of a “*significant adverse impact*”.

5.2 World Health Organisation (WHO) Guidance (Reference 4).

5.2.1 The WHO has published guidelines for community noise, as shown in Table 2. This WHO document gives guidance for the levels of noise both inside and outside of dwellings.

Specific Environment	Critical Health Effect(s)	L _{Aeq} (dB)	Time Base (hours)	L _{Amax, fast} (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

Note: The 'daytime' and 'night-time' periods are generally referred to as 0700 to 2300 and 2300 to 0700 hours respectively.

Table 2 - World Health Organisation Noise Guidance Levels

5.3 British Standard BS 8233:2014 (Reference 5)

5.3.1 BS 8233 also gives guidance on indoor ambient noise levels, as shown in Table 3.

Activity	Location	Noise criteria	
		07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB L _{Aeq,16hour}	-
Dining	Dining room/area	40 dB L _{Aeq,16hour}	-
Sleeping	Bedroom	35 dB L _{Aeq,16hour}	30 dB L _{Aeq,8hour}

Table 3 - BS 8233: 2014 guidance indoor ambient noise levels for dwellings.

5.3.2 With respect to external noise in amenity areas, BS 8233 states the following:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB L_{Aeq,T}, with an upper guideline value of 55 dB L_{Aeq,T} which would be acceptable in noisier environments.

5.4 South Holland District Council Planning Permission H09-0818-23 (Reference 6)

N & D Bacon were awarded planning permission H09-0818-23 (see Reference 6) by South Holland District Council for a proposed grain store building at Ashtree Farm, Little Dog Drove, Holbeach St Johns, Spalding, PE12 8RR, in April 2024.

The sites planning permission included a planning condition which addressed potential noise emissions from a proposed centrifugal fan unit that will serve the proposed building. Condition 5 of planning permission H09-0818-23 states:

“The rating level of the noise emitting from the fan should not exceed the background level at adjacent residential properties when assessed in accordance with BS4142 2014 +A1(2019). Prior to commencement of development, details of the noise attenuation to be installed shall be provided to the Local Planning Authority for approval. Those measures and works so approved by the Local Planning Authority shall be implemented in full before the development hereby granted is first brought into use”

6 NOISE ASSESSMENT

6.1 Background Noise Monitoring

Long-term unattended noise monitoring equipment was set up at Monitoring Location A (see Drawing 4.1), approximately 10m to the south-west of the nearest northern residential receptor to the proposed new building / grain store. The monitoring location was approximately 1.5m above the ground in free field conditions. Noise was continuously monitored throughout the period from 09:21 hours on Wednesday 8th May 2024 to 18:06 hours on Friday 10th May 2024. Weather conditions during the monitoring period were dry with a mixture of clear skies and light cloud cover, temperatures ranged between 10°C to 22°C, with wind speeds below 3 m/s throughout the monitoring period. Appendix 2 gives details of the noise instrumentation used. The long-term noise monitoring results from Monitoring Location A are shown in graphical form in Appendix 3.

6.2 Estimation of Background Noise Levels

The full results of the unattended monitoring at Monitoring Location A are shown in graphical form in Appendix 3. This shows the noise levels logged at 15-minute intervals in terms of average noise ($L_{Aeq,15minutes}$), maximum noise ($L_{Amax,15minutes}$) and background noise levels ($L_{A90,15minutes}$).

Based on detailed analysis of the measured data, the modal background noise level ($L_{A90,15minutes}$) during the daytime and night-time periods was 30 dB(A) and 21 dB(A) respectively.

Based on the above, typical background sound levels L_{A90} of **30 dB(A)** and **21dB(A)** have been assumed for the daytime and night-time BS 4142 Assessments respectively.

6.3 Specific Noise Levels

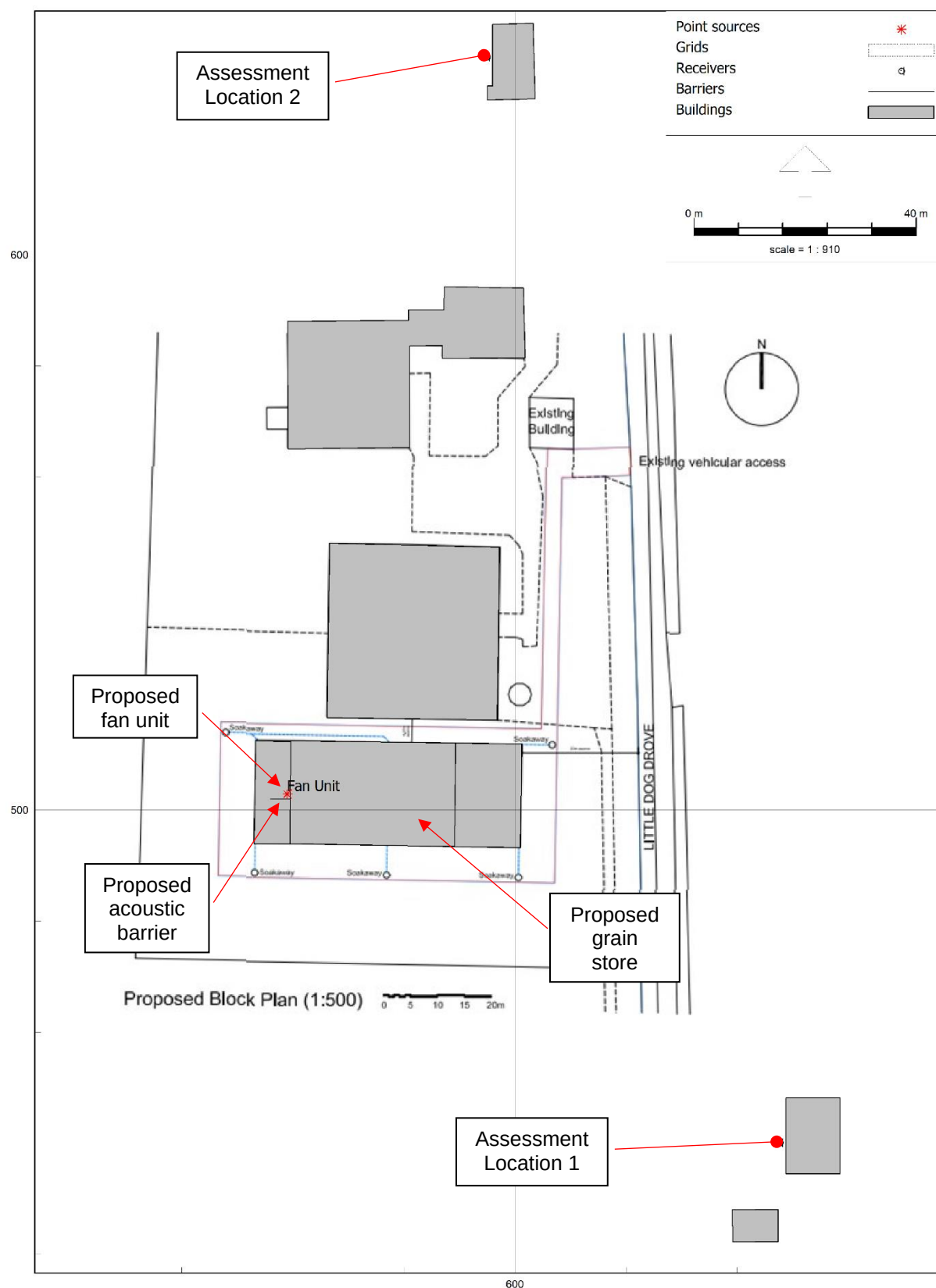
The client has proposed that the Typhoon TC2 Centrifugal fan unit will be installed on-site at the location shown in Drawing 4.3. The manufacturers datasheet for this unit shows that the sound power level (L_{WA}) of the unit is 91 dB(A). The manufacturers data has been used to calibrate the computer noise model for the site and a worst case noise scenario have been assumed whereby the fan is operating continuously throughout the daytime and night-time assessment periods.

6.4 Predictive noise model

A computer noise model of the site (see Drawing 6.1) was generated using proprietary iNoise software (Reference 2) which calculates noise emissions using ISO 9613-2 (Reference 3). The computer noise model was used to assess daytime and night-time noise emissions associated with the use of the proposed fan unit.

The computer noise model has been used to predict incident daytime and night-time specific noise emissions at Assessment Locations 1 and 2 (see Drawing 6.1).

Daytime predictions were undertaken at a height of 1.5m above the ground, whilst night-time predictions were undertaken at a height of 4.5m above the ground.



Drawing 6.1 – Computer Noise Model Showing Location Of Fan Unit and Assessment Locations

6.5 Predicted Specific Noise Levels

Specific noise levels associated with the use of the fan unit have been predicted at Assessment Locations 1 and 2, based on the assumptions detailed in Section 6.4 and are documented in Table 4. Predictive noise contours at a height of 1.5m above the ground (daytime) and 4.5m above the ground (night-time) are shown in Appendices 5 and 6 respectively.

Assessment Location (see Drawing 6.1)	Predicted Specific Noise Level - Daytime Period When The Fan Is In Use ($L_{Aeq,1hour}$) dB(A)	Predicted Specific Noise Level – Night-Time Period When The Fan Is In Use ($L_{Aeq,15minutes}$) dB(A)
Assessment Location 1 – Nearest Dwelling To The South-East	23	21
Assessment Location 2 – Nearest Dwelling To The North	23	21

Table 4 – Predicted Specific Noise Levels

6.6 British Standard (BS) 4142 Assessment

The following tables detail the BS 4142 assessment at Assessment Locations 1 and 2 during the daytime (Table 5) and night-time periods (Table 6).

Stage	Daytime – Assessment Locations 1 and 2 (1.5m Height)	Comments
Specific sound level $L_{Aeq,T}$ dB(A)	23 dB	Predicted specific sound level associated with the use of the fan unit (see Table 4).
Penalty dB	0 dB	See Table 1. Grain drying using a similar large fan unit already takes place within an existing building on the Ashtree Farm site and therefore noise emissions from the proposed fan unit will not be out of character with the existing noise climate. For this reason, no character corrections have been added. The octave band emission data for the fan unit selected also shows similar levels at all frequencies between 250 – 2000Hz (see Appendix 4) which indicates that tonal characteristics are unlikely to be present when the fan unit is operating.
Rating sound level dB(A) $L_{AR,TR}$	23 dB	Specific sound level + penalty
Assumed daytime background sound level L_{A90} dB(A)	30 dB	See section 6.2
Excess of “Rating” Level over background	-7 dB	See section 5.1.2
BS 4142 Initial Assessment	<i>“Low” Impact</i>	See section 5.1.2
Assessment when taking account of context	<i>“Low” Impact</i>	The assessment assumes that the fan unit will be used continuously throughout the daytime period. The fan will only be needed to operate seasonally. Acceptable noise levels in accordance with WHO and BS 8233 guidance are also likely to be achieved.
Uncertainty of the assessment	-	The background sound measurements were taken over a reasonable sample length, limiting the effect of uncertainties. The specific sound levels are based on manufacturers data based on “Maximum air development” figures (worst case).

Table 5 – Daytime BS 4142 Assessment at Assessment Locations 1 & 2

Stage	Night-Time – Assessment Locations 1 and 2 (4.5m Height)	Comments
Specific sound level $L_{Aeq,T}$ dB(A)	21 dB	Predicted specific sound level associated with the use of the fan unit (see Table 4).
Penalty dB	0 dB	See Table 1. Grain drying using a similar large fan units already takes place within an existing building on the Ashtree Farm site and therefore noise emissions from the proposed fan unit will not be out of character with the existing noise climate. For this reason, no character corrections have been added. The octave band emission data for the fan unit selected also shows similar levels at all frequencies between 250 – 2000Hz which indicates that tonal characteristics are unlikely to be present when the fan unit is operating.
Rating sound level dB(A) $L_{AR,TR}$	21 dB	Specific sound level + penalty
Assumed night-time background sound level L_{A90} dB(A)	21 dB	See section 6.2
Excess of “Rating” Level over background	0 dB	See section 5.1.2
BS 4142 Initial Assessment	<i>“Low” Impact</i>	See section 5.1.2
Assessment when taking account of context	<i>“Low” Impact</i>	The assessment assumes that the fan unit will be used continuously throughout the night-time period. The fan will only be needed to operate seasonally. Acceptable noise levels in accordance with WHO and BS 8233 guidance are also likely to be achieved.
Uncertainty of the assessment	-	The background sound measurements were taken over a reasonable sample length, limiting the effect of uncertainties. The specific sound levels are based on manufacturers data based on “Maximum air development” figures (worst case).

Table 6 – Night-Time BS 4142 Assessment at Assessment Locations 1 & 2

It can be seen from the assessment above that predicted noise levels from the fan unit are shown to have a “low impact” during both the daytime and night-time periods. When taking into account context whereby the predicted noise levels represent a worst-case noise scenario (the

use of the fan is seasonal and for the majority of the year the fan will not be in use), this is regarded to be an acceptable noise situation. It should also be noted that acceptable internal and external noise levels in accordance with the WHO Guidelines and BS 8233 are shown to be achievable at the nearest residential receptors (even under circumstances where living room and bedroom windows are partially open). With the above in mind and provided the recommendations within this report are implemented this is deemed to be an acceptable noise situation.

6.7 Assessment of Internal noise levels at the nearest residential receptor

The WHO Guidelines and BS 8233 offer guidance levels for acceptable noise levels inside living rooms and bedrooms during the daytime period of $L_{Aeq,16hour} < 35$ dB(A) and within bedrooms at night of $L_{Aeq,8hour} < 30$ dB(A) (see criteria given in sections 5.2.1 and 5.3.1).

Internal levels are typically around 15 dB less than external façade levels with a partially open window. The predicted incident specific noise level at Assessment Locations 1 & 2 (see Drawing 6.1), outside the worst affected residential façades is 23 dB(A) during the daytime period ($L_{Aeq,16hour}$) and 21 dB(A) during the night-time period ($L_{Aeq,8hour}$) when the fan unit is in use. Predicted Internal specific noise levels within the nearest residential receptor with a partially open window would be approximately 8 dB(A) during the daytime and 6 dB(A) during the night-time when the fan unit is in use. These levels achieve the criteria specified in the WHO and BS 8233 guidance. This is deemed to be an acceptable noise situation.

6.8 Assessment of outdoor amenity area noise levels

The WHO Guidelines offer guidance levels for acceptable daytime noise levels within outdoor amenity areas of $L_{Aeq,16hour} < 50$ dB(A) (see criteria given in sections 5.2.1). It can be seen in Appendix 5 that predicted specific noise levels within the outdoor amenity areas of the nearest residential receptor when the fan is in use are well below the WHO guidance criteria. This is deemed to be an acceptable noise situation.

7 DISCUSSIONS

7.1 Uncertainties

- Background noise monitoring was undertaken over a reasonable sample length which reduces the uncertainties relating to the background noise levels assumed as part of the assessment.
- The specific noise levels are based on manufacturers data based on “maximum air development” figures (worst case).
- Computer predictions to ISO 9613-2 carry an uncertainty of +/- 3 dB.

REFERENCES

1. *British Standard BS 4142:2014+A1:2019, Methods of rating and assessing industrial and commercial sound*; BSI, 2014, amended 2019.
2. *DGMR Software. iNoise V2024 Enterprise*
3. *ISO 9613-2 Acoustics of sound during propagation outdoors, Part 2: General method of calculation*; ISO, 1996.
4. *World Health Organisation Guidance, Guidelines for Community Noise*; WHO, 1999.
5. *British Standard BS 8233, Guidance on sound insulation and noise reduction for buildings*; BSI, 2014.
6. *South Holland District Council Planning Permission Reference: H09-0818-23*
Dated: 11th April 2024

Appendix 1 – Glossary of terms

Sound Pressure	The variation of ambient pressure that is detected by the ear as sound.
Noise	Unwanted sound
decibel (dB)	Ten times the logarithm of the square of the ratio of the Sound Pressure to a reference pressure (20 micro-Pascal's).
Sound Pressure Level (L_p)	The decibel version of the Sound Pressure.
A-Weighting	A frequency weighting which simulates the response of the ear. An A-Weighted Sound Pressure Level is denoted by L _{pA} and has units of dB(A)
L_{Aeq,T}	The value of the A-weighted sound pressure level, in decibels [dB(A)], of a continuous steady sound that within a specified time interval (T), for example 16 hours, has the same mean-square sound pressure as a sound that varies with time. Therefore, the average over a 16 hour period would be denoted as L _{Aeq,16h}
L_{Amax,T}	The maximum A-Weighted sound pressure level that was encountered during the measurement period.
L_{A90,T}	The A-Weighted sound pressure level that is exceeded for 90% of the time (T). This is usually used a measure of background noise.
Free Field	Where noise can propagate freely without any reflections from buildings etc.
Octave Band	A band of frequencies the upper limit of which is twice the lower limit. They are known by their centre frequency, e.g., 63, 125, 250, 500, 1000, 2000
NPSE Criteria	
NOEL	No Observed Effect Level
LOAEL	Lowest Observed Adverse Effect Level
SOAEL	Significant Observed Adverse Effect Level

BS 4142 Terms

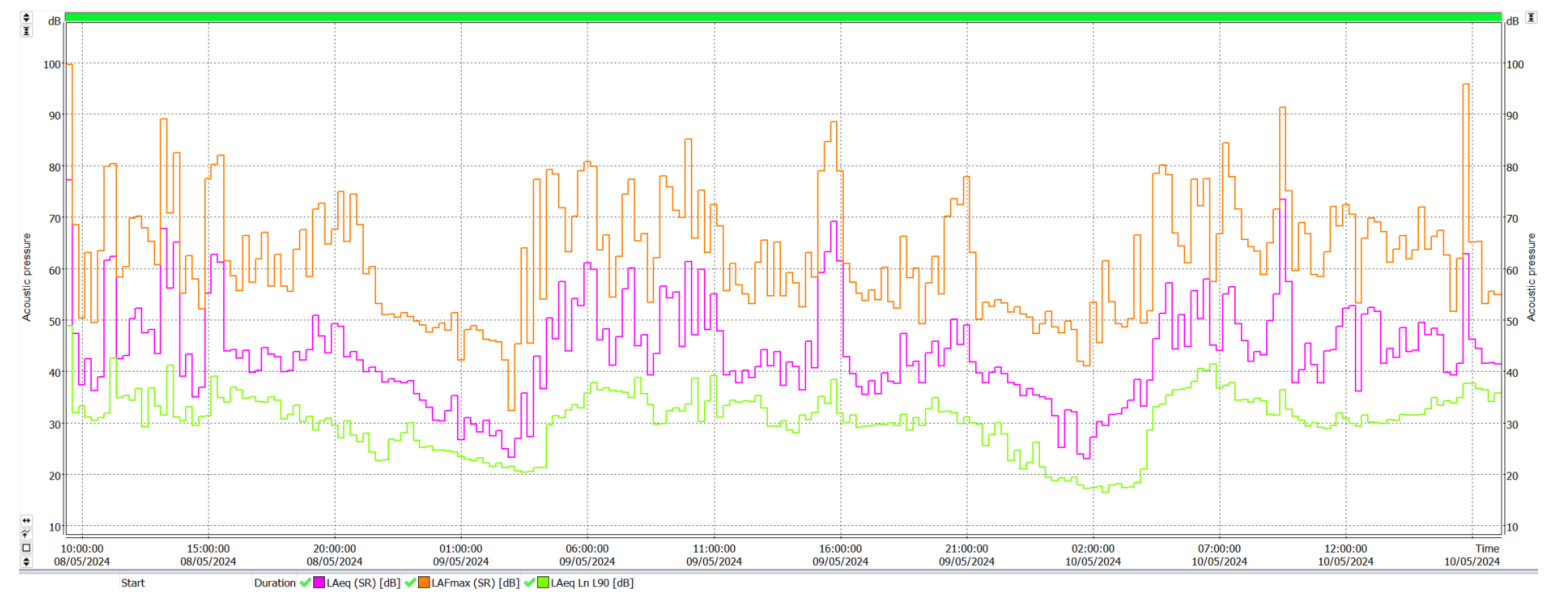
T_r	The reference time interval over which an equivalent continuous A-weighted sound pressure is determined. Day time = 1 hour Night-time = 15 minutes
T_m	The measurement time interval over which measurements are taken.
Ambient Noise	Total sound in a given situation at a given time.
Residual Noise	The ambient noise remaining at a given position in a given situation when the specific noise is suppressed to a degree such that it does not contribute to the ambient noise.
Specific Noise Level Rating Level L_{Ar,T_r}	The dB L_{Aeq,T_r} of the noise sources being assessed at a site. The specific noise level plus any correction for the character of the noise, known as the Rating Level.
Assessment Level	Difference between Rating Level (L_{Ar,T_r}) and Background Noise ($L_{A90,T}$)
Sound Power Level (L_{WA})	The noise level from the source in terms of sound power, in dB(A).

Appendix 2 – Noise instrumentation

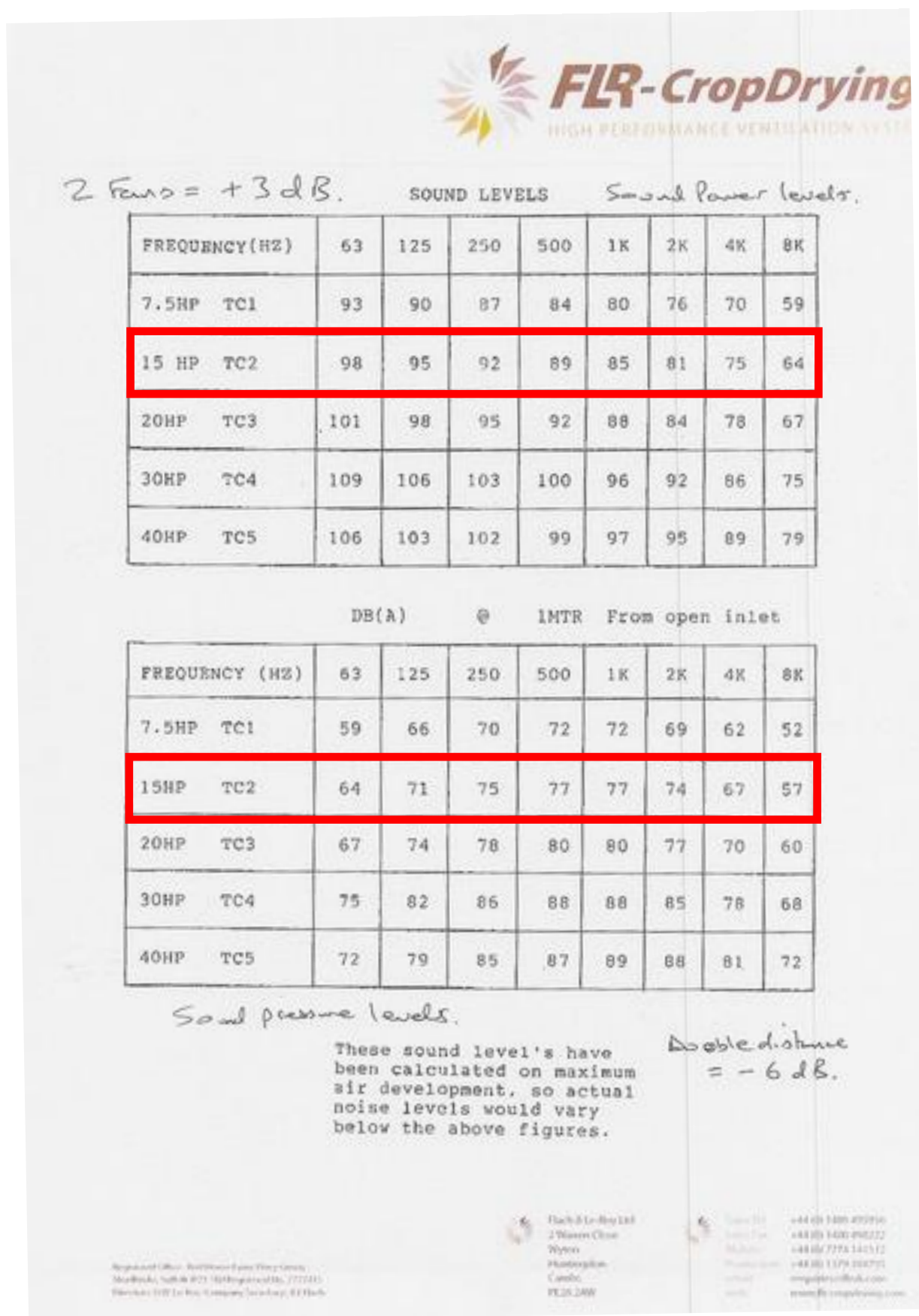
Type	Manufacturer	Description	Serial Number	Last Calibration Date	Calibration Certificate No.
Svan 971	Svantek	Sound level meter	28229	13/03/2023	1141321
GA 607	Castle	Sound level calibrator	043186	22/02/2024	1158111

The calibration of the instrumentation was checked at the start and end of the tests and there was no significant drift.

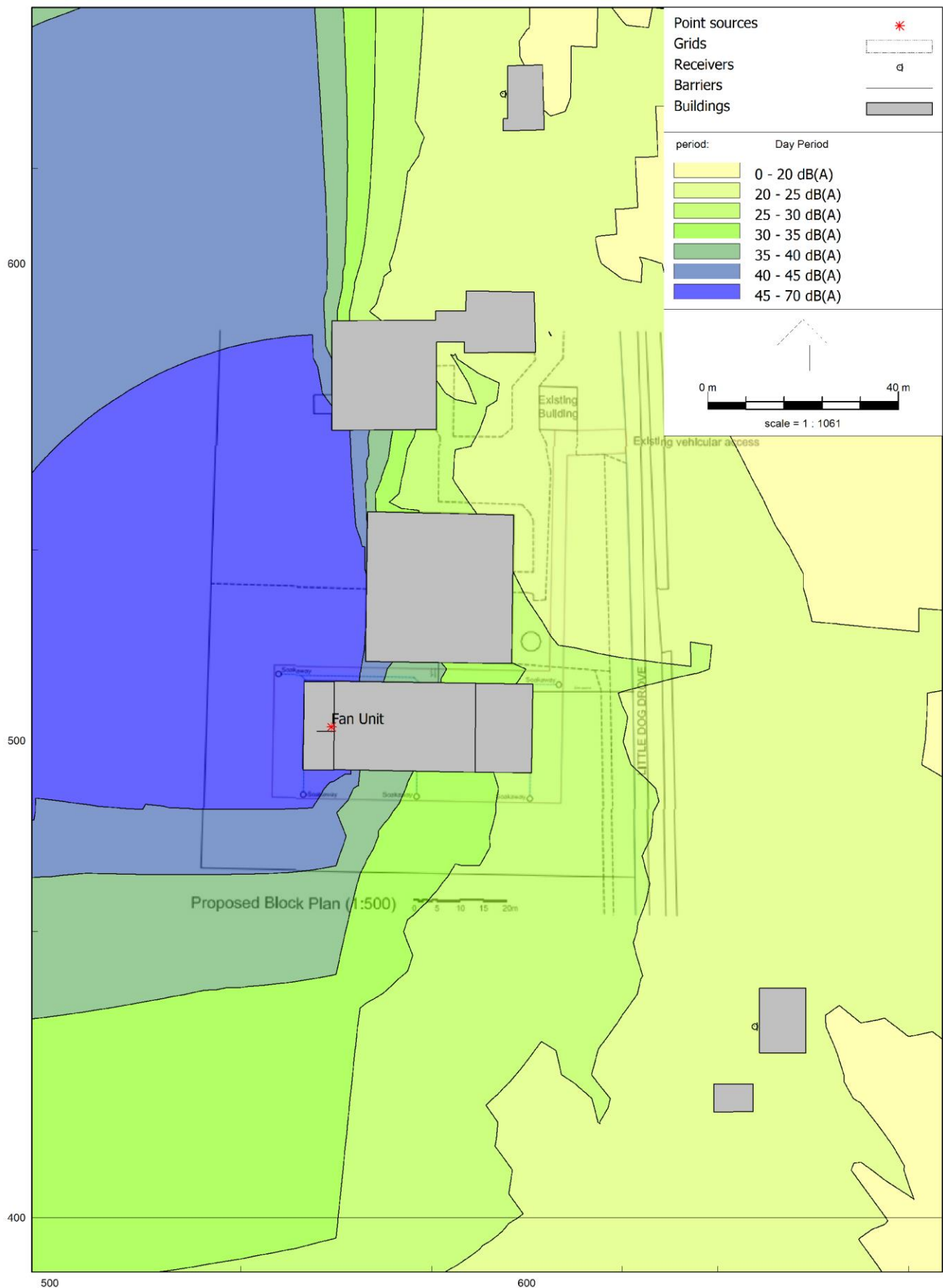
Appendix 3 – Results of long-term noise monitoring at Location A



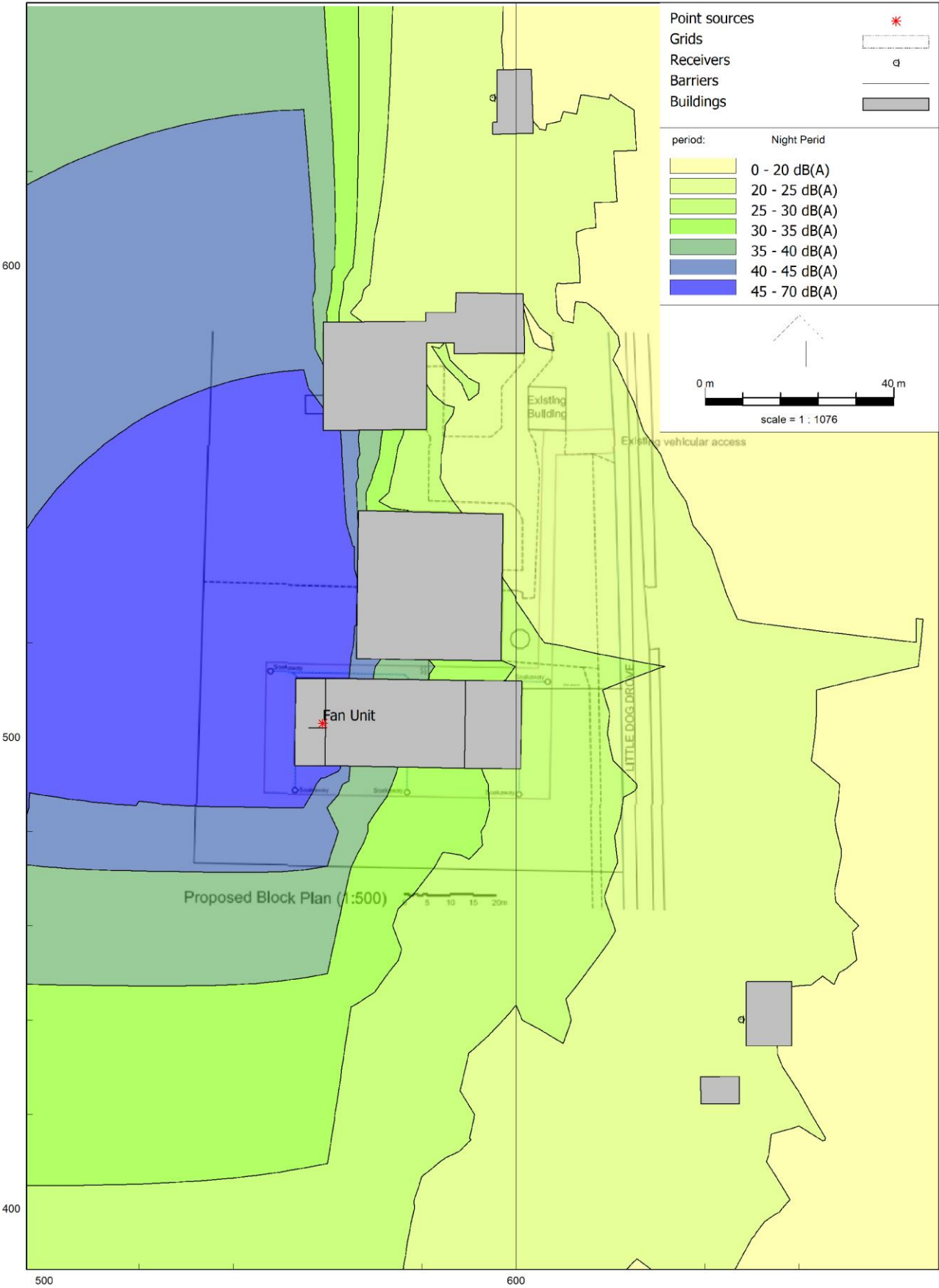
Appendix 4 – Manufacturers noise emission data for centrifugal fan unit



**Appendix 5 – Predicted daytime specific noise contours with the fan unit running
(1.5m above the ground)**



**Appendix 6 – Predicted night-time specific noise contours with the fan unit running
(4.5m above the ground)**



Appendix 7 – Acoustic Barrier Minimum Specification

Acoustic barrier specification

Any acoustic barrier should comprise of an impervious material, e.g. close-boarded timber and have a mass per unit area of at least 10 kg/m².

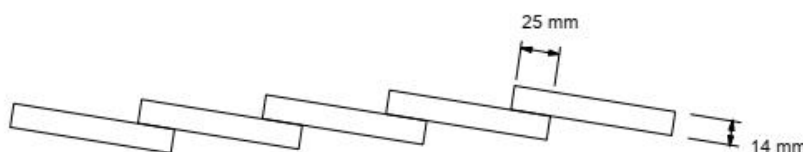
Any material can be used to construct the acoustic barrier, with a minimum surface density of 10 kg/m². This will give noise attenuation up to 20 dB.

It is advised that the minimum thickness of a wooden fence is at least 14mm and is overlapped as shown below.

Suitable Wooden Fence Configurations:



Plan Views



Note: All gaps should be sealed, including the area between the ground and bottom of the barrier.