Panther Environmental Solutions Ltd
Units 3 & 4, Innovation Centre
Institute of Technology
Green Road, Carlow
Ireland
R93 W248

Telephone: 059-9134222
Email: info@pantherwms.com
Website: www.pantherwms.com

ATTACHMENT 6.1

NOISE IMPACT ASSESSMENT REPORT

WOODVILLE PIG FARMS LIMITED
BALLYMACKEY
NENAGH
CO. TIPPERARY

2019

REPORT NO:	EIAR_NIA_19_9350	**AUTHOR:**	Nial Ryan, MSc.
DATE:	8th November 2019	**REVIEWED:**	Martin O'Looney, BSc. Mike Fraher, BSc.

TABLE OF CONTENTS

Table Of Contents 2

Executive Summary 4

1.0 Introduction 6
2.0 Relavent Noise Legislation & Guidance 7
3.0 Measurement Parameters 9
4.0 Equipment Used 12
5.0 Meteorological Conditions 12

6.0 Methodology 12
6.1 Baseline Noise Assessment Methodology 12
6.2 Predictive Noise Assessment 14

7.0 Results 16
7.1 Baseline Noise Assessment – Results 16
7.2 Predictive Analysis – Results 18

8.0 Discussion 21
9.0 Conclusions 26
10.0 Recommendations 27

11.0 References 28

Appendix A - Noise Sensitive Locations - 29
Appendix B - Site Layout Plans - 31
Appendix C - Noise Prediction Calculations - 33
Appendix D - Noise Meter Calibration Cert - 39
Appendix E - Ventilation Fan Specifications - 43

LIST OF TABLES

Table 6.1.1	Noise Monitoring Locations	**12**
Table 6.2.1	Noise Levels from Construction Plant (Ref: BS5228:2009)	**14**
Table 6.2.2	Operational Noise Levels of the Proposed Development	**15**
Table 7.1.1	Baseline Noise Monitoring Summary	**16**
Table 7.2.1	Predicted Noise Results Summary (dB)	**18**
Table 7.2.2	BS4142 Operational Noise Assessment (Max Ventilation)	**19**
Table 7.2.3	BS4142 Operational Noise Assessment (Normal Ventilation)	**19**
Table 7.2.4	BS4142 Construction Noise Assessment	**20**
Table 8.1	Examples of Temperatures Requirements for Pig Housing	**23**
Table 8.2	Gurteen-Average Days per Month where Max Temp ≥ 21°C	**23**

LIST OF FIGURES

Figure 8.1.1	Max Operation Noise Rating vs. Existing Baseline Noise (L_{90})	**22**
Figure 8.1.2	Normal Operation Noise Rating vs. Existing Baseline Noise (L_{90})	**24**
Figure 8.1.3	Construction Noise Rating vs. Existing Baseline Noise (L_{90})	**25**

EXECUTIVE SUMMARY

This Noise Impact Assessment Report has been prepared on behalf of and for the exclusive use by Woodville Pig Farms Ltd, by Panther Environmental Solutions Ltd in support of a Planning Application to Tipperary County Council. Construction will include two new poultry units, extensions to two existing buildings a remote slurry storage tank and all associated site works at Woodville, Ballymackey, Co. Tipperary. The proposed development would occur on an existing pig farm currently in the ownership of the applicant.

The closest noise sensitive location is c.390m to the west of the proposed operation site boundary. Mr. Nial Ryan of Panther Environmental Solutions Ltd conducted a baseline noise assessment, on Tuesday 24th and Wednesday 25th September 2019. This report presents the findings of this assessment and provides a predictive analysis of the impact of the construction and operation of the proposed development on noise sensitive locations (NSL) to determine the need for any mitigation measures.

Appendix A of this report contains a site location map identifying the nearest noise sensitive locations in each geographical direction from the proposed site.

In order to determine the impact of noise from the construction and operational phases of the proposed development on noise sensitive locations, the predicted noise levels at the nearest noise sensitive locations surrounding the farm have been calculated in accordance with the methodology prescribed in ISO 9613-2:1996 '*Attenuation of Sound during Propagation Outdoors*'. The resultant predicted noise levels have been assessed in accordance with the methodology prescribed in BS 4142:2014 '*Methods for Rating and Assessing Industrial and Commercial Sound*'.

Peak source noise levels would occur during short periods during the initial construction phase, such as excavation/site clearance activities. It is anticipated that the proposed development would have a short-term impact on the closest noise sensitive locations during the construction phase. The overall construction phase would be temporary (approx. 3-4 months) and works would be conducted during normal working hours, reducing the risk of negative impacts. Therefore, the subjective impact of noise from construction activities would be mitigated. Predicted construction noise levels would be in compliance with NRA guidance for construction noise.

The maximum noise from climate controlled ventilation fans on-site would be predicted to occur predominantly during the daytime periods of the warmest summer days. It is likely that ventilation fans would only be operating at maximum from May to September, for a number of days during these months and only for short periods of these days.

The maximum potential impact of noise from ventilation has been based upon fans working at maximum power and includes a correction for potential tonal noise from malfunctioning fans. Therefore, the predicted noise levels may be seen as a worst case scenario for ventilation noise during the operation of the site.

At the closest third-party noise monitoring locations, maximum worst case scenario ventilation fan noise has been predicted to be below the existing L_{90} background noise levels. Due to the low predicted resultant noise levels and the infrequency of occurrence, it is predicted that

maximum ventilation noise would have a slight to no significant impact upon noise sensitive locations.

During expected normal operation of fans, low fan noise would be the dominant noise source onsite. At the closest third-party noise monitoring locations, normal operations scenario ventilation fan noise has been predicted to be below the existing L_{90} background noise levels. The mid-range operation of the ventilation system is not predicted to be audible at the nearest noise sensitive locations during the daytime period, and would be slight audible during the night-time period.

Both predicted worst-case and normal operations noise levels would be in compliance with the existing EPA licence limits of 55dB for daytime and 45dB for night-time periods.

It is the conclusion of this report that there would be an impact for a limited period of time on noise sensitive locations as a result of the initial construction phase. There would be no significant impact on noise sensitive locations as a result of the operational phase of the proposed development at Woodville, Ballymackey, Co. Tipperary.

It has been recommended that all onsite workers, hauliers and contractors be informed of noise considerations, both on-site and on local access roads, during the operational and construction phases of the proposed development.

A draft Noise Management Plan, as per **Attachment 6.2**, should be prepared, updated and reviewed monthly.

1.0 INTRODUCTION

Woodville Pig Farms are proposes to construct two new poultry units, extensions to two existing buildings a remote slurry storage tank and all associated site works at Woodville, Ballymackey, Co. Tipperary. The site is licensed by the Environmental Protection Agency, licence ref: P0467-02.

Licence Condition 4.1 states:

'Noise from the installation shall not give rise to sound pressure levels (Leq, T) measured at noise sensitive locations of the installation which exceed the limit value(s) specified in Schedule B.4 Noise Emissions, of this licence.'

Schedule B.4: Noise Emissions

Daytime L_{Aeq}(30 minutes)	Night-time L_{Aeq}(30 minutes)
55 dB(A)	45 dB(A)

Note 1: '*There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at the boundary'*

The area is rural in character with residences in the area predominantly linearly aligned along the existing road network. The closest noise sensitive locations to the proposed development in each geographical direction are as follows:

- a residence 775 metres to the West of the site,
- a residence 390 metres to the West of the site,
- a residence 516 metres to the East-South-East of the site,
- a residence 870 metres to the East of the site,
- a residence 884 metres to the South of the site.

A map of the proposed site boundary and surrounding noise sensitive locations is provided in **Appendix A**.

Panther Environmental Solutions Ltd was commissioned by Woodville Pig Farms to carry out a Noise Impact Assessment in support of an Environmental Impact Assessment Report (EIAR).

The report presents and interprets the results of the survey with reference to the 2016 EPA *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).*

This Noise Impact Assessment included:

1. Description of noise and the noise monitoring methodology used.
2. Detailing the locations for noise monitoring stations.
3. Detailing the noise measurements obtained.
4. Details of predictive noise calculated.
5. Discussion, Conclusions & Summary.

2.0 RELAVENT NOISE LEGISLATION & GUIDANCE

Planning and Development Act (2000), as amended

Local authorities are responsible for the planning and environmental regulation of any proposed developments. The current planning and environmental regulatory framework requires these developments to comply with the Planning and Development Act (2000) and related regulations.

The local authorities and An Bord Pleanala attach conditions relating to environmental management of these developments to planning permissions granted. Local authorities consider the land use and planning issues associated with the proposed developments in their County Development Plans.

The EPA Act (Noise) Regulations 1994 (S.I. No. 179 of 1994)

The relevant part of the Environmental Protection Agency Act 1992 dealing with noise is Part VI, Sections 106 to 108. These Sections deal with the control of noise, the power of local authorities to prevent or limit noise and the issue of noise as a nuisance.

The 1994 Regulations came into effect in July 1994 and outline the procedures for dealing with noise nuisance. The Regulations allow affected individuals, local authorities or the EPA to take action against an activity causing a noise nuisance.

These Regulations replaced the procedures for noise complaints contained in the Local Government (Planning & Development) Act 1963. Companies must show that reasonable care was taken to prevent or limit the noise from their activities.

If the courts decide that a company is responsible for causing a noise nuisance, they can order the company to take measures to reduce, prevent or limit it.

EPA 'Guidance Note on Noise (NG4)' (2016)

The document relates primarily to noise surveys and assessments for EPA licensed facilities but in the absence of any other directly applicable guidance documents, it also is pertinent for the purposes of noise surveys and assessments accompanying planning applications.

It deals in general terms with the approach to be taken in the measurement and control of noise, and provides advice in relation to the settling of noise ELV's and compliance monitoring. In line with World Health Organisation (WHO) guidance, it recommends that the following noise levels not be exceeded at the facades of the nearest noise-sensitive receptors:

Period	Times	Standard dB(A)	Low Background Noise Area dB(A)
Day	(07:00 to 19:00hrs)	55dB $L_{Ar,T}$	45dB $L_{Ar,T}$
Evening	(19:00 to 23:00hrs)	50dB $L_{Ar,T}$	40dB $L_{Ar,T}$
Night	(23:00 to 07:00hrs)	45dB $L_{Aeq,T}$	35dB $L_{Ar,T}$

Other EPA general EIA guidelines such as Guidelines on the Information to be Contained in Environmental Impact Statements [2002] and Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements) [2003] have been considered in the preparation of this Noise and Vibration Chapter.

The National Roads Authority (NRA) Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004)

The NRA's guidance document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004) is the recognised Irish guidance document for the assessment of road traffic noise. This document sets out the key items that should be included in a noise and vibration assessment for any significant road scheme. As a minimum, it stipulates that the following items should be included:

- A series of noise surveys to quantify the prevailing noise climate at sensitive receptors along the existing and proposed routes
- Preparation and calibration of a suitable noise prediction model;
- Prediction of Do Minimum and Do Something noise levels for opening and design years;
- Comparison of predicted Do Something noise levels with the design goal and three conditions that must be satisfied before mitigation measures are deemed necessary;
- Specification and assessment of road traffic mitigation measures, where required;
- Assessment and review of construction impacts and mitigation measures;
- Assessment and review of vibration.

This document has been referred to in the consideration of road traffic noise associated with the proposed development. The document also presents maximum permissible noise levels at dwelling facades during construction activities. This provide a useful reference for assessing construction noise of the proposed development.

The National Roads Authority (NRA) Guideline Construction Noise Limits		
Period	**$L_{Aeq\ (1hr)}$ dB**	**$L_{pA\ (max)slow}$ dB**
Monday to Friday (07:00 to 19:00hrs)	70	80
Monday to Friday (19:00 to 22:00hrs)	60	65
Saturday (08:00 to 16:30hrs)	65	75
Sundays and Bank Holidays (08:00 to 16:30hrs)	60	65

3.0 MEASUREMENT PARAMETERS

The parameters used to assess the noise are as follows:

Leq, T: The noise values recorded continuously at every instant during the sampling period are integrated by the noise metre to give a single value that represents the continuous equivalent sound level over the period during this survey.

L_{10} and L_{90}: are both statistical noise levels. L_{10} indicates that for 10% of the monitoring period the sound levels were greater than the quoted value. L_{90} indicates that for 90% of the monitoring period, the sound levels were greater than the quoted value. L_{10} is used to express event noise. L_{90} is used to express background noise, usually filtering out loud and intermittent interferences such as traffic noise.

Continuous: noise produced without interruption.

Intermittent: noise that is punctuated with interruptions e.g. equipment operating in cycles or events such as single passing vehicle or aircraft.

Impulsive: a noise of short duration (typically less than one second), the sound pressure of which is significantly higher than the background; brief and abrupt.

Tonal: noise which contains a clearly audible tone i.e. a distinguishable, discrete or continuous note (whine, hiss, hum or screech etc).

For the purpose of this noise assessment, a tonal characteristic incurs a penalty of +5dB(A) in accordance with Section 4.3 of the EPA 2016 *Guidance Note for Noise in Relation to Scheduled Activities*.

In order for a tone or impulsive element to warrant a penalty, it should be clearly noticeable and audible. Situations in which a 5 dB penalty applies include the following:

- The noise contains a distinguishable, discrete continuous note (whine, hiss, screech, hum etc).
- The noise contains distinct impulses (bangs, clicks, clatters, or thumps).
- The noise is irregular enough to attract attention.
- The tonal components are clearly audible and the level in a 1/3rd octave band is greater than or equal to the following level in the two adjacent bands;
    - 15dB in low-frequency bands (25Hz to 125Hz);
    - 8dB in middle-frequency bands (160Hz to 400Hz), and;
    - 5dB in high-frequency bands (500Hz to 10,000Hz)

The noise measurements were 'A' weighted (to equate to human ear hearing) and the time-weighting 'Fast' was applied.

A-Weighted Decibels dB(A)

Noise, in its simplest form can be described as unwanted sound. Sound is the result of a propagating disturbance through a physical medium i.e. sound wave. Through air, it is perceived by the ear as a pressure wave superimposed upon the ambient air pressure about the ear of the listener. When the medium is a fixed body, it is called vibration.

'A' Weighting is standard weighting of the audible frequencies designed to reflect the response of the human ear to noise. At low and high frequencies, the human ear is not very sensitive, but between 500 Hz and 6 kHz the ear is much more sensitive. In the A-weighted system, the decibel values of sounds at low frequencies are reduced compared with un-weighted decibels, in which no correction is made for audio frequency.

Sound level (Lp dB) and sound power (L_W dB) are physical quantities which measure derivatives of the energy associated with a sound that can be measured by recording instruments.

Loudness is a psycho-physical subjective measure of the perceived response by the human auditory system to a sound. The loudness level of a sound is determined by adjusting a sound pressure level of a comparison pure tone of specified frequency until it is judged by normal hearing observers to be equal in loudness. Loudness level is expressed in phons.

In the mid-frequency range at sound pressures greater than approximately $2x10^{-3}$ Pa (40 dB re 20 µPa SPL), the following table summarises the average subjective perception of noise level changes.

WHO International: Fundamentals of Acoustics			
Change in Sound Level (dB)	Change in Power		Change in Apparent Loudness
	Decrease	Increase	
3	1/2	2	Just Perceptible
5	1/3	3	Clearly Noticeable
10	1/10	10	Half or Twice as Loud
20	1/100	100	Much Quieter or Louder

As can be seen in the above table, an increase of 3 dB is double the sound power level; however, the change in loudness is just perceptible.

The term Leq is used to express the average noise level. It is measured in dB (A) and measured over a defined period of time. Specifically, it is the constant level equivalent to the same acoustic energy as a given event. The Leq is written as LAeq when it is measured with the A frequency weighting.

ISO 9613-2:1996

The noise prediction methodology used in this report is based upon the international standard ISO 9613-2 "*Attenuation of Sound during Propagation Outdoors*". This standard outlines a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.

The central formula for this calculation is as follows:

$$\mathbf{A = A_{div} + A_{gr} + A_{bar} + A_{misc}}$$

Where:

A	is the attenuation due to site conditions
A_{div}	is the attenuation due to the geometrical divergence (distance from source)
A_{gr}	is the attenuation due to the ground effect
A_{bar}	is the attenuation due to a barrier
A_{misc}	is the attenuation due to miscellaneous other effects as appropriate

This attenuation factor is then subtracted from the predicted operational noise at the proposed activity. The resultant figure is the predicted noise from the proposed activity at a given noise sensitive location.

This figure may then be added logarithmically to the existing background noise at the noise sensitive location to attain the predicted noise level if the proposed activity were to begin.

Relevant Formulae

In order to carry out this predictive analysis, the following attenuation characteristics have been taken into account:

Divergence – A_{div}

The geometrical divergence accounts for the spherical spreading in the free field from the point sound source, causing attenuation due to the inverse square law. Divergence is calculated as follows:

$$\mathbf{A_{div} = 20.log_{10} (d/d_o) + 11}$$

Where:

d	is the distance from the source to the receiver (m)
d_o	is the reference distance (1 m)
11	is a constant relating the sound power level to the sound power level at a reference distance d_0 which is 1 meter from an omnidirectional point source.

4.0 EQUIPMENT USED

The equipment used for the noise monitoring was a Cirrus CR:171B Sound Level Meter, and CR:515 Acoustic Calibrator. Both the CR:171B meter and CR:515 calibrator were calibrated externally on 18th July 2019.

A calibration check of 94 dB(A) at 1kHz was carried out on the instrument before and after measurement. The calibrator is a Class 1 grade, which conforms to IEC 60942:2003.

The difference between the initial calibration value, any subsequent calibration check, and a final calibration check on completion of measurements did not exceed 0.5 dB, and the instrument calibration was found to be satisfactory.

Measurement periods were appropriate to establish a typical noise level reading at each location in order to establish a dB(A) $L_{Aeq}(T)$ reading.

5.0 METEOROLOGICAL CONDITIONS

Weather conditions during the survey were dry and calm with wind speeds of less than 5 m/s (the preferred limit for taking measurements).

The Sound Level Meter was also fitted with a windshield to minimise interference from meteorological conditions.

6.0 METHODOLOGY

6.1 BASELINE NOISE ASSESSMENT METHODOLOGY

Baseline noise monitoring was carried out in general accordance with the EPA, 2016 "*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (*NG4*)".

In order to predict the impact of the construction and operational phases of the proposed development, sample noise monitoring locations were selected based upon the nearest location within groups of NSL's sharing similar orientation with regard to the proposed site and intervening topography.

Table 6.1.1: Noise Monitoring Locations

Ref. No.	Grid Ref	Location Type	Location
NM1	R 95762 82178	Noise Monitoring Location	740m West of the site
NM2	R 96109 81997	Noise Monitoring Location	390m West of the site
NM3	R 96841 81805	Noise Monitoring Location	430m E-SE of the site
NM4	R 97324 81980	Noise Monitoring Location	835m East of the site
NM5	R 96329 81271	Noise Monitoring Location	795m South of the site

Grid Ref Source: http://irish.gridreferencefinder.com

The baseline environmental noise levels at NM1 – NM5 locations were determined by instrumented monitoring of existing noise levels. This was determined by taking 15-minute broadband noise measurements at these five noise monitoring locations.

It is considered that noise levels measured at each of the NM locations would be representative of existing noise levels at nearest residential property or Noise Sensitive Locations (NSL).

All measurements were taken at:

- 1.2 – 1.5 metres height above local ground level
- 1.0 – 5.0 metres away from reflective surfaces

These monitoring points are mapped in Appendix A. The results of the baseline noise assessment survey are detailed in Table 7.1.1.

6.2 PREDICTIVE NOISE ASSESSMENT

6.2.1 Source Noise Specifications

Construction Noise

The noisiest aspect of the proposed development is likely to be the construction phase of the project. During construction, the noisiest phases are typically site clearing, excavation and landscaping activities.

Table 6.2.1 contains typical noise levels from various construction plant that will be used during the construction phase. These standard noise emission data will be used for the purposes of the worst-case noise assessment of the proposed works.

Table 6.2.1: Noise Levels from Construction Plant (Ref: BS5228:2009)									
Sound Pressure Level (dBA) at Octave Band Centre Frequency									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
C2.5 - 16t Tracked excavator (clearing site)	83	85	94	96	98	98	105	95	107
C2.13 - 11t Dozer (excavation/earthworks)	79	98	100	102	105	102	99	92	110
C2.21 - 22t Tracked excavator (excavation/earthworks)	80	91	94	96	96	95	89	79	102
C2.28 - Wheeled Loader (excavation/earthworks)	91	97	99	102	101	98	94	85	107
Resultant Noise Level	**92**	**101**	**107**	**109**	**109**	**107**	**107**	**97**	**115**

Operational Noise

The proposed ventilation system for the proposed houses would be Mechanical Ventilation. Each of the sheds has inlet vents on the sides of the sheds and multiple vents

The site would have a total of c.80 fans, should the proposed development be granted planning permission. Fans on weaner houses operate continuously at a medium power level in order to provide sufficient fresh air to the weaners.

In sow and pre-finisher houses, the fans are the main method of climate control, and fan power is moderated by air temperature. When air temperature increases above 14°C, the fans begin to operate as a percentage of the temperature increase between 14°C and 21°C. Above 21°C, the fans operate at 100%.

The noise specifications for the proposed on-site fans or similar are presented in Appendix E, with fan type 'DA 600 LPC-11-2' being the likely choice. The rated maximum noise level for a single fan is Lw 65 dB(A), and there would be a total of c.80 fans in the proposed development. This information is presented in the following table:

Table 6.2.2: Operational Noise Levels for the Proposed Development									
Sound Pressure Level (dBA) @ Octave Band Centre Frequency									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Max Ventilation Noise (80 fans @ 100% power @ 1m)	60	81	83	86	89	89	87	80	95
Normal Ventilation Noise (80 fans @ <50% power @ 1m)	58	64	70	74	75	69	64	74	80

'Normal Ventilation' fan noise has been taken from the PES library of data from similar developments.

As the operation of ventilation at maximum would be extremely rare (only during very warm weather conditions), predictive noise was also carried out based upon typical ventilation noise levels present at such developments.

7.0 RESULTS

7.1 BASELINE NOISE ASSESSMENT – RESULTS

The table below show the daytime and night-time measurement results taken at the five monitoring locations outlined in **Section 6.1**. These points are mapped in **Appendix A**. Associated particulars such as a description of the noise environment, dominant noise source and any interferences/background noise recorded are also provided in the table.

Table 7.1.1: Baseline Noise Monitoring Summary

Ref	Time	Leq	L_{10}	L_{90}	Equipment Operational	Background Noise
Daytime						
NM1	09:27	50	41	30	None	Distant traffic noise to the south – Faint, Bird song, Pigeon Cooing & Crow Calls, Heavy plant operations and bucked knocking – Faint, Multiple planes passing overhead – Faint, Dog barking and cattle noise in the distance – Faint, Vehicles passing on local road: x2.
NM2	09:47	**60**	53	35	None	Distant traffic noise to the south – Faint, Bird song & Crow Calls, Heavy plant operations and bucked knocking – Faint, Multiple planes passing overhead – Faint, Cattle noise in the distance – Faint, Vehicles passing on local road: x3 (including 1x HGV).
NM3	10:22	51	48	39	None	Distant traffic noise to the south – Faint, Bird song, Pigeon Cooing & Crow Calls, Farm plant operations to the south – Faint, Multiple planes passing overhead – Faint, Post van entering and exiting adjacent property – low, Sludge removal tanker and pump on-site – Faint, Vehicles passing on local road: x4 (including x2 post van).

Table 7.1.1: Baseline Noise Monitoring Summary						
Ref	**Time**	**Leq**	**L_{10}**	**L_{90}**	**Equipment Operational**	**Background Noise**
NM4	10:42	55	40	32	None	Distant traffic noise to the south – Faint, Bird song & Crow Calls, Multiple planes passing overhead – Faint, Vehicles passing on local road: x1 (including x1 HGV).
NM5	11:48	44	41	35	None	Distant traffic noise to the south – Faint, Bird song - Low Heavy plant &Chainsaw operations to the south-west – Faint, Multiple planes passing overhead – Faint, Dog barking within adjacent property – Low, Vehicles passing on local road: x1.
Night-time						
NM1	22:12	28	29	20	None	Distant traffic noise to the south – Faint, Dog barking within adjacent property – Low, Vehicle horn to the south-west – Faint, Cattle noise to the south and west – Very Faint.
NM2	22:31	30	32	23	Fan Type Noise – Very Faint	Distant traffic noise to the south – Faint, Cattle noise to the south – Very Faint. Local wildlife noise to the south – Faint.
NM3	23:08	28	30	23	None	Distant traffic noise to the south – Faint, Cattle noise to the south-west – Very Faint. Cattle noise to the west – Low.
NM4	23:25	27	32	20	None	Distant traffic noise to the south – Very Faint, Dog barking to the west – Very Faint, Cattle noise to the south – Very Faint.
NM5	23:49	29	28	22	None	Distant traffic noise to the south – Faint, Cattle noise to the south and west – Faint.

7.2 PREDICTIVE ANALYSIS – RESULTS

In order to determine the impact of noise from the proposed development during construction activities, maximum and normal operation, the resultant noise levels at noise sensitive locations have been calculated.

Table 7.2.1 below summarises the findings of this predictive noise assessment. Detailed calculations are provided in Appendix C.

The source construction noise is based upon the operation of multiple construction equipment as shown in **Table 6.2.1**.

Operation noise takes into account maximum ventilation noise at the site, were the proposed development be constructed.

As maximum ventilation rates, large farm vehicles and delivery trucks would not be frequently operating at the farm, the noise at noise sensitive locations as a result of the ventilation fans (typical operation) included in this assessment. Climate controlled fans operating at maximum power would likely only occur during the daytime period of warm summers.

Table 7.2.1: Predicted Noise Results Summary (dBA)

Ref	Location	Construction	Operation (Maximum Ventilation)	Operation (Normal Ventilation)
Source Noise Level (dBA)		115	95	80
NSL1	NSL 775m West	46	26	11
NSL2	NSL 390m West	52	32	17
NSL3	NSL 516m E-SE	50	29	15
NSL4	NSL 870m East	45	25	10
NSL5	NSL 884m South	45	25	10

The methodology outlined in BS4142 requires that predicted noise levels be compared to existing L_{90} figures at noise sensitive locations in order to determine the likely noise impact.

BS4142:2014 Assessment

A noise character penalty of +3dB has also been applied to ventilation noise to account for potential distant tonal noise from fans.

The following table determines the likelihood of impacts from maximum theoretical noise levels on-site at sensitive locations following the BS4142 methodology:

Table 7.2.2: BS4142 Operational Noise Assessment (Max Ventilation)					
Location	Background Noise (L_{90})	Predicted Noise			Difference from Existing Background
		Predicted Noise	Predicted Penalty	Rating Level	
Daytime					
NSL1	35	26	+3	**29**	-6
NSL2	35	32	+3	**35**	-1
NSL3	35	29	+3	**32**	-3
NSL4	35	25	+3	**28**	-7
NSL5	35	25	+3	**28**	-8

A noise character penalty of +3dB has also been applied to ventilation noise to account for potential distant tonal noise from fans.

The following table determines the likelihood of impacts from normal operational noise levels on-site at sensitive locations following the BS4142 methodology:

Table 7.2.3: BS4142 Operational Noise Assessment (Normal Ventilation)					
Location	Background Noise (L_{90})	Predicted Noise			Difference from Existing Background
		Predicted Noise	Predicted Penalty	Rating Level	
Daytime					
NSL1	35	11	+3	**14**	-21
NSL2	35	17	+3	**20**	-15
NSL3	35	15	+3	**18**	-17
NSL4	35	10	+3	**13**	-22
NSL5	35	10	+3	**13**	-22
Night-time					
NSL1	22	11	+3	**14**	-7
NSL2	22	17	+3	**20**	-1
NSL3	22	15	+3	**18**	-4
NSL4	22	10	+3	**13**	-8
NSL5	22	10	+3	**13**	-9

A noise character penalty of +5 has been applied to predicted noise levels containing machine noise. This is to account for distant impulsive noise from operating machinery.

The following table determines the likelihood of construction noise impacts at noise sensitive locations following the BS4142 methodology:

Table 7.2.4: BS4142 Construction Noise Assessment

Location	Background Noise (L_{90})	Predicted Noise			Difference from Existing Background
		Predicted Noise	Predicted Penalty	Rating Level	
NSL1	35	46	+5	**51**	16
NSL2	35	52	+5	**57**	22
NSL3	35	50	+5	**55**	20
NSL4	35	45	+5	**50**	15
NSL5	35	45	+5	**50**	15

8.0 DISCUSSION

The principal factor influencing the mitigation of noise from site operations is its distance from noise sensitive locations. The closest third-party noise sensitive location is c.390m from the proposed operation. Increasing distance from a noise source significant increases the attenuation of noise as sound energy reduces by the inverse of the square of distance travelled (inverse square law).

The terrain between the closest noise sensitive locations and the existing site is composed of mature hedgerows, treelines and grassland. For the purpose of noise attenuation, these surfaces are considered 'porous', whereas made ground would be considered 'reflective'.

The baseline monitoring undertaken as part of this noise impact report, summarised in Table 7.1.1 above, shows that the site is compliant with is current licence limits of 55dB for the daytime and 45dB for the night-time period. All monitored Leq noise levels were below or equal to these licence limits, with the exception of the daytime NM2 figure of 60dB, which was elevated as a result of non-site related sources.

Therefore, existing site related noise does not appear to constitute a nuisance at the closest third-party noise sensitive locations.

The following sections compares the calculated noise rating arising from the proposed development and existing baseline noise at noise sensitive locations, as summarised above.

OPERATIONAL PHASE – WORST CASE SCENARIO

In order to predict the highest potential risk of impact from the proposed development during its operational phase, noise sources likely to contribute to the highest noise levels on-site at any one time were included in this assessment.

The impact of noise from the site has been based upon fans working at maximum power and includes a correction for potential tonal noise from malfunctioning fans. Therefore, the predicted noise levels may be seen as a worst-case scenario for ventilation noise during the operation of the site.

As can be seen in **Table 7.3.2** and **Figure 8.1.1**, noise arising from worst-case scenario on-site activities is predicted to be between 1 dB(A) and 8 dB(A) below the background noise level at each of the nearest noise sensitive locations. An 'inaudible' noise will typically be 10dB or more below the measured L_{90} background noise level at a noise sensitive locations.

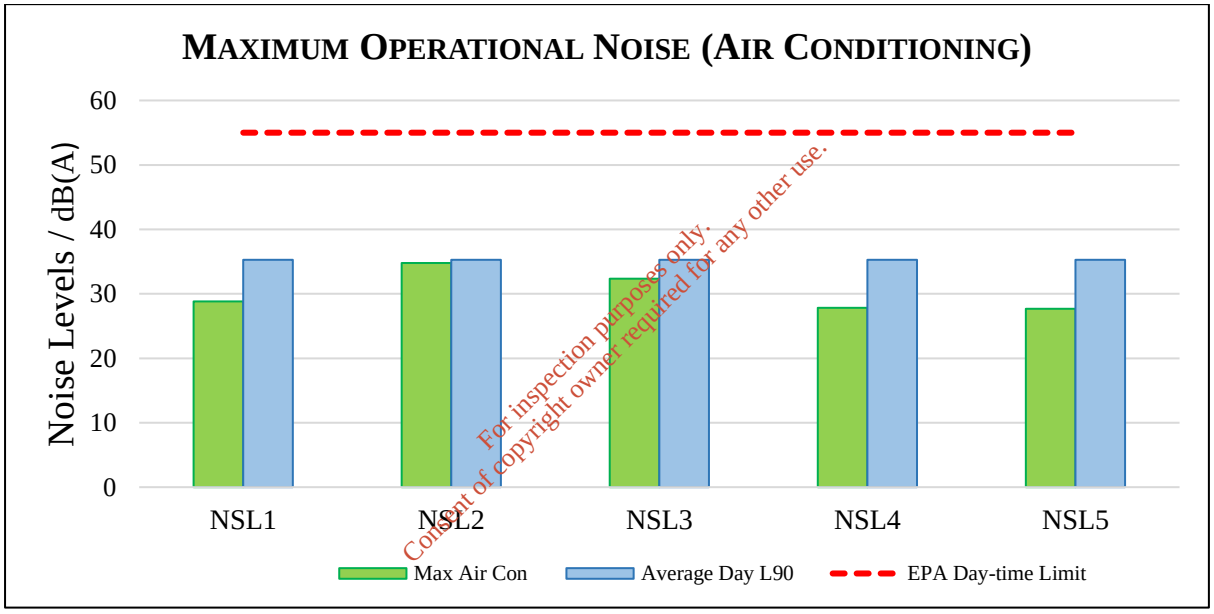


Figure 8.1.1: Max Operational Noise Rating vs. Existing Baseline Daytime Noise (L_{90})

The proposed development would each be fitted with ventilation fans, operated and controlled by a climate control system, similar to the existing site. The climate control system would monitor the internal air temperature of the houses and modulate the speed of the fans.

As can be seen in **Table 8.1** above, pig sheds are typically kept to a high temperature, relative to ambient air temperature. Fans on pig sheds are predominantly be used for the introduction of fresh air to the sheds and would not normally be required to regulate indoor temperature.

Therefore, these fans would normally be operating at a steady state and would only operate at maximum during the hottest periods of summer days.

Table 8.1: Example of temperature requirements in heated housing for different pig categories in healthy conditions (BREF, 2017)			
Farrowing Pen	**Weaned Pigs**	**Mating and Gestating Sows**	**Fattening Pigs**
Room and sow location: up to 20– 22 °C	7kg, up to 25°C	Mating, up to 20°C	20kg, up to 20–22 °C
	10kg, up to 24°C	Early gestation, up to 20°C	30kg, up to 18°C
Piglet area: first days after birth, 28–30 °C	15kg, up to 22°C	Middle gestation, up to 18°C	40kg, up to 16°C
	20kg, up to 20°C	End of gestation, up to 16°C	50kg, up to 15°C
	25kg, up to 18°C		

The following table details the average number of days per month where the maximum recorder air temperature at Gurteen Weather Station (17km north of the site) was at or above 21°C (years 2014 – 2018).

Table 8.2: Gurteen Station – Average Days per Month where Max Temp @ ≥ 21°C					
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**
0.0	0.0	0.0	0.0	2.28	8.25
Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
9.73	2.53	1.61	0.0	0.0	0.0

As can be seen from the above table, it is likely that ventilation fans would only be operating at maximum between May to September, and for a small number of days and only for short periods of these days (2.04% of yearly hours). It is not anticipated for maximum operation do occur during night-time hours.

Maximum worst-case scenario ventilation fan noise would only be expected to occur during the daytime in the summer, and only during short periods of these days.

Additionally, predicted worst-case scenario noise levels at all noise sensitive locations have been determined to be below the existing EPA licence daytime limit of 55dB.

Therefore, due to the low predicted resultant noise levels and the infrequency of occurrence it is predicted that maximum fan noise would have a slight to no significant impact upon noise sensitive locations.

It is noted that the noise levels have been predicted for the area external to the selected residences and facing the proposed farm. Predicted fan noise would not be expected to be audible within the residences.

OPERATIONAL PHASE – NORMAL NOISE LEVELS

During normal farm operations alone, the noise environment is likely to be characterised by noise from ventilation fans.

As can be seen in **Table 7.3.3** and **Figure 8.1.2** below, during periods of normal operational noise, all rating levels are significantly below the background L_{90}. An 'inaudible' noise will typically be 10dB or less below the measured L_{90} background noise level at a noise sensitive locations.

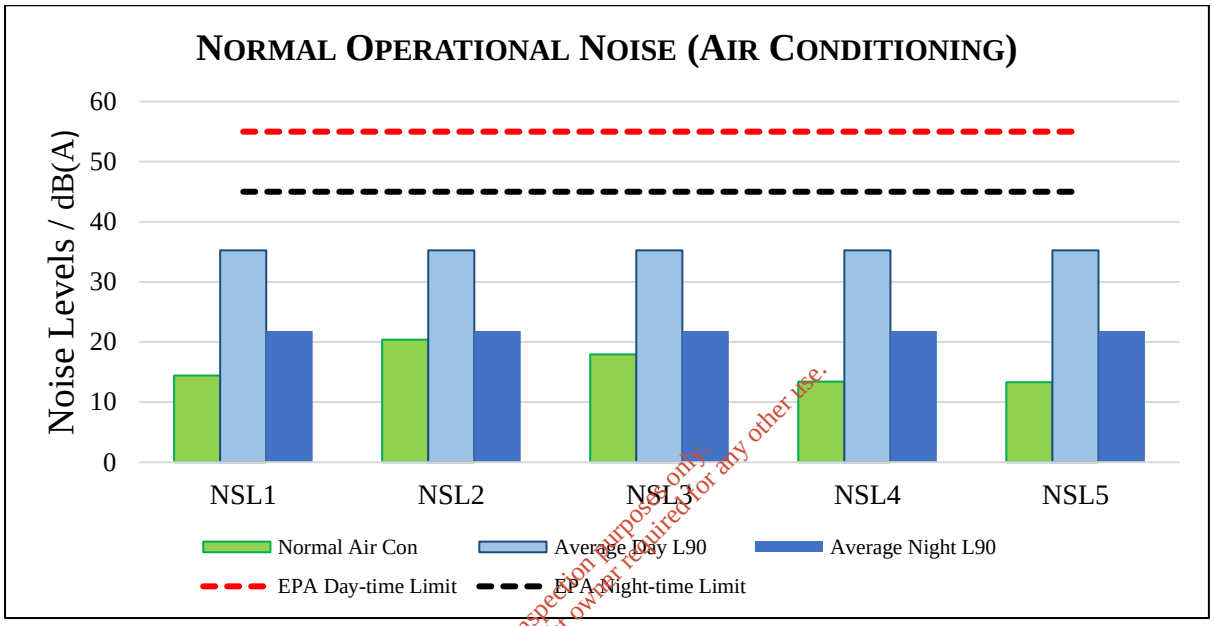


Figure 8.1.2: Normal Operational Noise Rating vs. Existing Baseline Day / Night Noise (L_{90})

Noise arising from the normal operations scenario on-site activities is predicted to be between 15 dB(A) and 22 dB(A) below the daytime background noise level and between 1 dB(A) and 9 dB(A) below the night-time background noise level at each of the nearest noise sensitive locations

Additionally, predicted normal operations noise levels at all noise sensitive locations have been determined to be below the existing EPA license daytime limit of 55dB and night-time limit of 45dB.

Therefore, it is predicted that there would be no significant impact upon noise sensitive locations during the daytime period and a slight to no significant impact upon noise sensitive locations during the night-time period.

CONSTRUCTION PHASE

As can be seen in **Table 7.3.4** and **Figure 8.1.3** below, noise levels are predicted to exceed existing background noise levels during the construction phase of the proposed development.

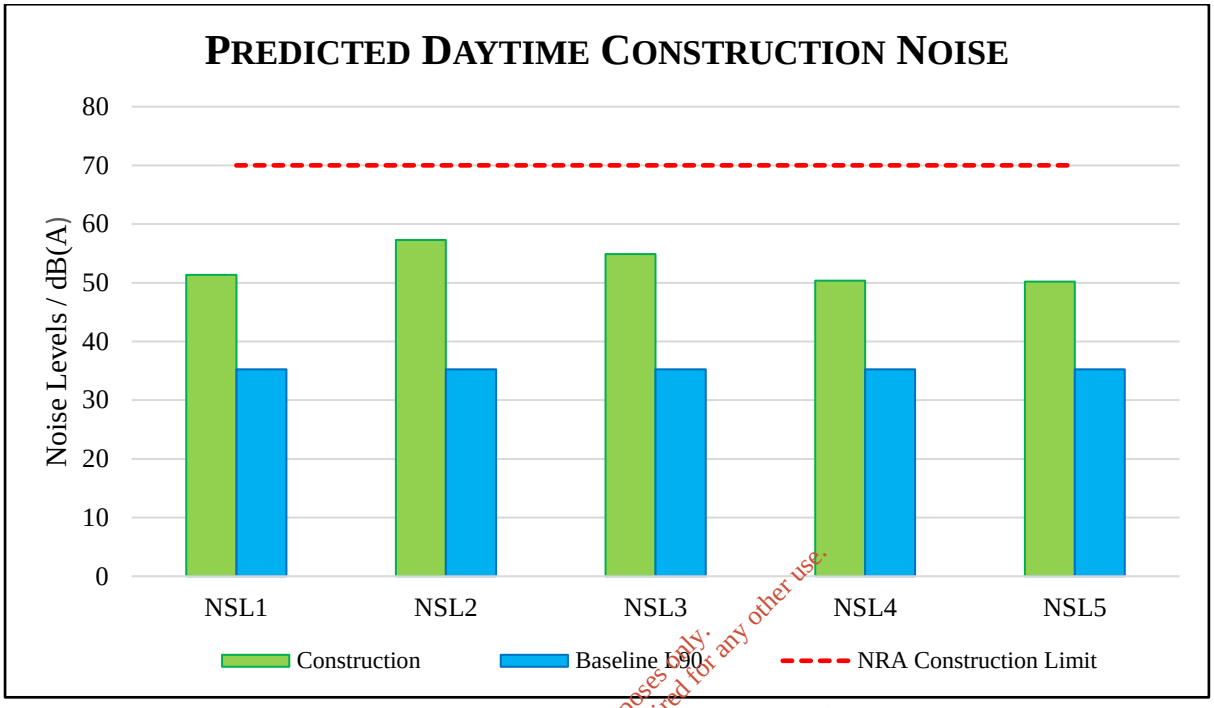


Figure 8.1.3: Construction Noise Rating vs. Existing Baseline Daytime Noise (L_{90})

Worst case scenario construction noise is predicted to range from L_{Ar} 50 to 57 dB at the closest noise sensitive locations.

Considering existing daytime background noise, predicted levels would range from 15dB at NSL4 & NSL5 and 22dB at NSL2 above background noise levels.

This is predominantly due to the high noise levels associated with excavation/site clearance works and the noise character-rating penalty applied to account for the subjective impact of impulsive noise.

It is anticipated that construction noise would be audible at all selected locations, with the character of construction type noise being more clearly audible during intermittent impulsive noise events (banging, falling stone etc.) on-site.

It should be noted that the theoretical peak noise level is a worst-case scenario and it would be unlikely that all site works would occur concurrently. Site clearance and excavation works would occur only during short periods during the initial phase of construction.

The construction phase itself would be temporary (3-4 months) and works would be conducted during normal working hours, reducing the risk of negative impacts. Therefore, the subjective impact of noise from the proposed development would be mitigated.

Predicted construction noise levels at all noise sensitive locations have been determined to be below the NRA guidance limit of 70 dBA for weekdays.

Therefore, during worst case scenario noise from initial construction works, it is predicted that there would be a short term impact for a limited period of time on noise sensitive locations. However, noise levels would be in compliance with Irish guideline standards for construction noise.

It is recommended that all likely high noise generating activities are carried out exclusively between the hours of 07:00 to 19:00 hours on weekdays, in order to minimise potential noise nuisances.

9.0 CONCLUSIONS

As a result of this baseline noise survey and predictive analysis, it is anticipated that the proposed development would have a short term impact on the closest noise sensitive locations during the initial construction phase. This impact would be mitigated by the short period of time over which construction activities are likely to occur and the carrying out of construction during normal working hours.

Predicted construction noise levels at all noise sensitive locations have been determined to be below the NRA guidance limit of 70 dBA for weekdays.

During the worst case scenario operational phase at the proposed development, it is anticipated that there would be a slight to no significant impact on the closest noise sensitive locations due to maximum ventilation noise.

Maximum worst-case scenario ventilation fan noise would only be expected to occur during the daytime in the summer, and only during short periods of these days. Due to the low predicted resultant noise levels and the infrequency of occurrence it is predicted that maximum fan noise would have a slight to no significant impact upon noise sensitive locations.

Predicted worst-case scenario noise levels at all noise sensitive locations have been determined to be below the sites existing EPA license daytime limit of 55dB.

The normal operation of the ventilation system it is predicted that there would no significant impact upon noise sensitive locations during the daytime period and a slight to no significant impact upon noise sensitive locations during the night-time period.

Predicted normal operations noise levels at all noise sensitive locations have been determined to be below the sites existing EPA license daytime limit of 55dB and night-time limit of 45dB.

It is the conclusion of this report that there would be an impact for a limited period of time on noise sensitive locations as a result of the initial construction phase. There would be no significant impact on noise sensitive locations as a result of the operational phase of the proposed development at Woodville, Ballymackey, Co. Tipperary.

10.0 RECOMMENDATIONS

It is recommended that:

- All construction activities should take place between 07:00 and 19:00, Monday to Friday. Any works that, by necessity, are required to be carried out outside of these times should be notified to any potentially effected local residents in good time and prior to specified works commencing.

- It is recommended that guidance on control of noise, as per The National Roads Authority's '*Guidelines for the Treatment of noise and vibration in National Road Schemes'* (2004) and British Standard 5228-1 *'Code of practice for Noise Control on Construction and Open Sites'* be followed during the construction phase.

- Timely and adequate maintenance of all onsite equipment, including preventative maintenance, to ensure efficient operation and minimisation of potential noise.

- All onsite workers, hauliers and contractors should be informed of noise considerations, both on-site and on local access roads, during the operational and construction phases of the proposed development.

- The site access laneway and other surfaces should be maintained in a state of good repair to reduce excessive noise from vehicle usage.

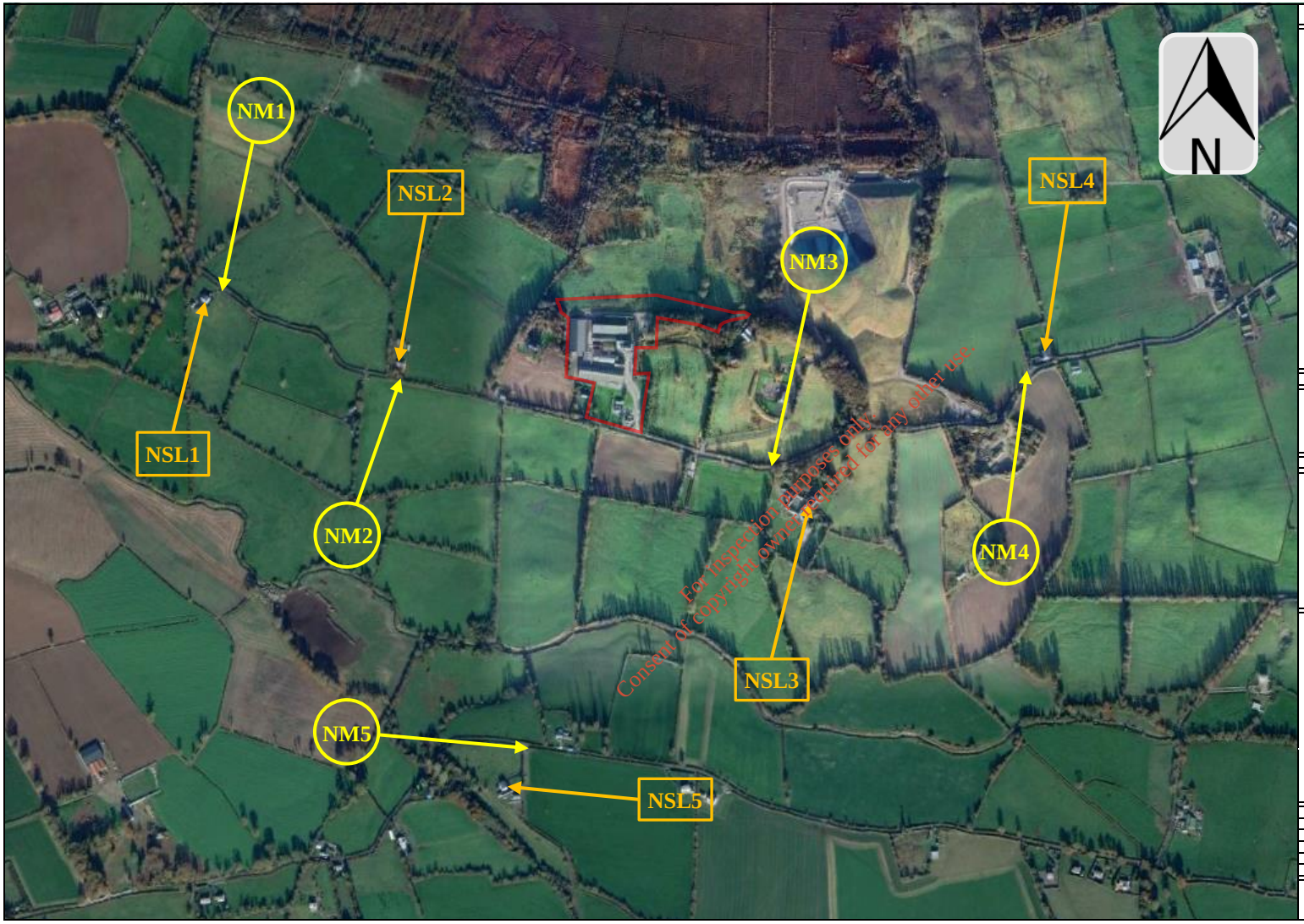
- The draft Noise Management Programme (see Attachment 7.2) should be implemented at the site and reviewed regularly to ensure effective management of potential noise.

11.0 REFERENCES

- ISO 9613-2:1996 *Attenuation of Sound during Propagation Outdoors*.
- BS 4142:2014 *Methods for Rating and Assessing Industrial and Commercial Sound*.
- National Roads Authority, (2004). *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*.
- EPA (2016) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).*
- BREF Document for Intensive Rearing of Poultry or Pigs (2017) Reference Document for the Intensive Rearing of Poultry or Pigs.
- EN BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites*.
- Grant S. Anderson and Ulrich J. Kurze, "*Outdoor Sound Propagation*," Chpt. 5 in Noise and Vibration Control Engineering – Principals and Applications, edited by L.L. Beranek and I.L. Vér, (John Wiley & Sons, NY, NY 1992).
- Joint Research Centre "*Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry and Pigs*" Draft 2, European IPPC Bureau, August 2013.

APPENDIX A

- NOISE SENSITIVE LOCATIONS -



Notes

- Boundary of Premises

NM – Noise Monitoring Location

NSL – Noise Sensitive Location

Project Title:

Noise Monitoring Locations

Client Name:

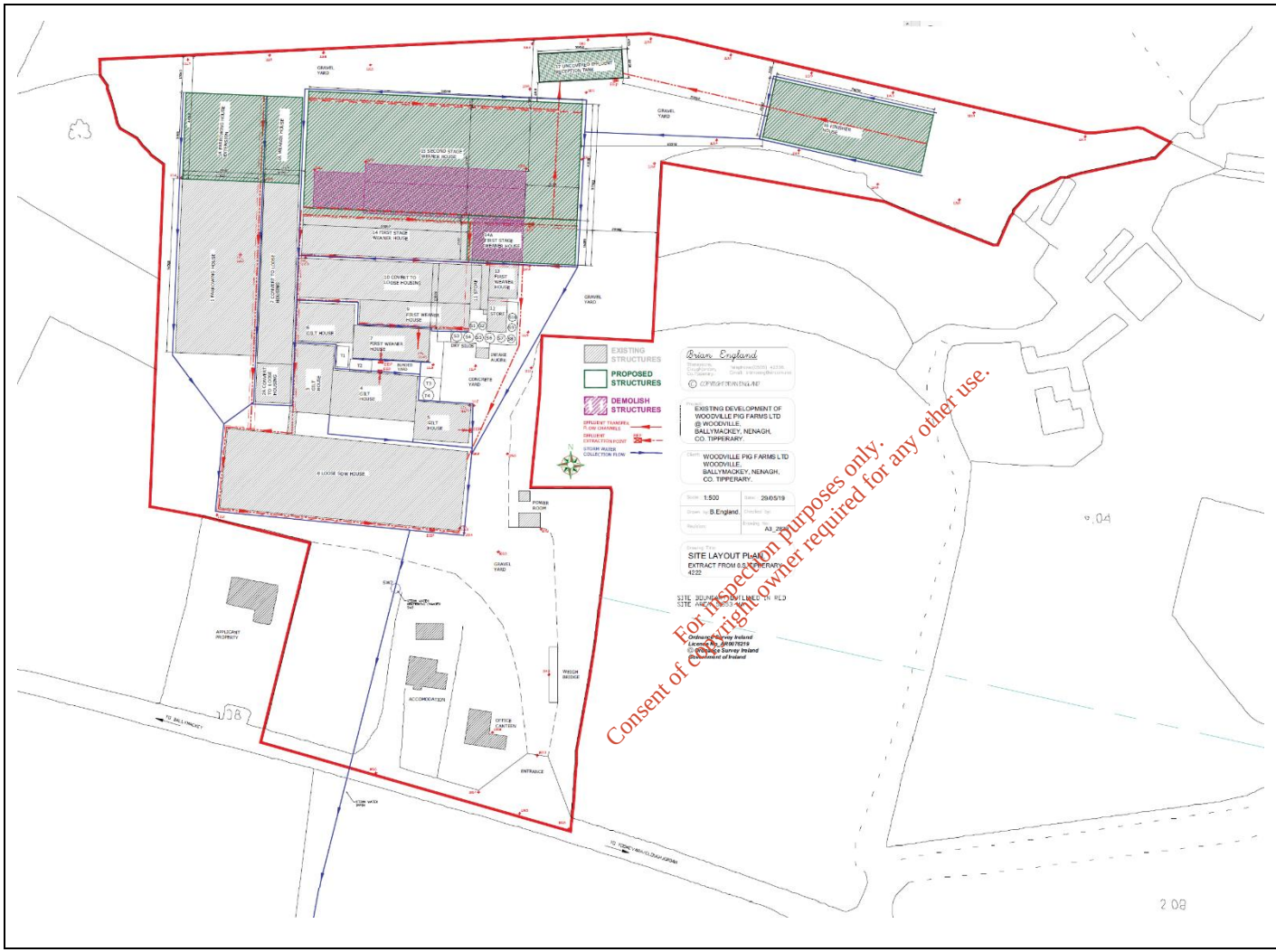
WOODVILLE PIG FARMS
BALLYMACKEY
NENAGH
CO. TIPPERARY

PANTHER ENVIRONMENTAL SOLUTIONS LTD
UNITS 3 & 4
INNOVATION CENTRE
GREEN ROAD
CARLOW
R93 W248
TELE: 059 91 34222
MOBILE: 087 851 9284
EMAIL: info@pantherwms.com
WEB: www.pantherwms.com

Drawing Status:	Scale:	NTS	A4
Report	Datum:	Google Pro	
Drawing Number:	Drawn:	NR	
	Checked:	MF	
Revision:	Approved:	-	
R0	Date:	24/09/2019	

APPENDIX B

- SITE LAYOUT PLANS -



Notes

Project Title:

PROPOSED SITE LAYOUT

Client Name:

WOODVILLE PIG FARMS
BALLYMACKEY
NENAGH
CO. TIPPERARY

PANTHER ENVIRONMENTAL SOLUTIONS LTD

UNITS 3 & 4
INNOVATION CENTRE
GREEN ROAD
CARLOW
R93 W248

TELE: 059 91 34222
MOBILE: 087 851 9284
EMAIL: info@pantherwms.com
WEB: www.pantherwms.com

Drawing Status:	**Scale:**	NTS	A4
Report	**Datum:**	Bing	
Drawing Number:	**Drawn:**	NR	
	Checked:	MF	
Revision:	**Approved:**	-	
R1	**Date:**	19/06/2018	

APPENDIX C

- NOISE PREDICTION CALCULATIONS -

C1: Attenuation Calculations

C1.1 Divergence Attenuation

Divergence Calculation - NSL1									
d		**775**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	69	69	69	69	69	69	69	69	78
Where:	Adiv = the attenuation due to divergence (Adiv = 20 log10 (d/d_0))+11)								
	d = the distance from the source to the receiver (m)								
	d_0 = the reference distance (1 m)								
	d_0 which is 1 meter from an omnidirectional point source.								

Divergence Calculation - NSL2									
d		**390**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	63	63	63	63	63	63	63	63	72
Where:	Adiv = the attenuation due to divergence (Adiv = 20 log10 (d/d_0))+11)								
	d = the distance from the source to the receiver (m)								
	d_0 = the reference distance (1 m)								
	d_0 which is 1 meter from an omnidirectional point source.								

Divergence Calculation - NSL3									
d		**516**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	65	65	65	65	65	65	65	65	74
Where:	Adiv = the attenuation due to divergence (Adiv = 20 log10 (d/d_0))+11)								
	d = the distance from the source to the receiver (m)								
	d_0 = the reference distance (1 m)								
	d_0 which is 1 meter from an omnidirectional point source.								

Divergence Calculation - NSL4									
d		**870**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	70	70	70	70	70	70	70	70	79
Where:	Adiv = the attenuation due to divergence (Adiv = 20 log10 (d/d_0))+11)								
	d = the distance from the source to the receiver (m)								
	d_0 = the reference distance (1 m)								
	d_0 which is 1 meter from an omnidirectional point source.								

Divergence Calculation - NSL5									
d		**884**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	70	70	70	70	70	70	70	70	79
Where:	Adiv = the attenuation due to divergence (Adiv = 20 log10 (d/d_0))+11)								
	d = the distance from the source to the receiver (m)								
	d_0 = the reference distance (1 m)								
	d_0 which is 1 meter from an omnidirectional point source.								

C.2: Predicted Noise Levels

C.2.1: Predicted Maximum Ventilation

Predicted Noise Calculation - NSL1									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	60	81	83	86	89	89	87	80	95
A_{div}	69	69	69	69	69	69	69	69	
A	69	69	69	69	69	69	69	69	
NSL dBA	**-9**	**12**	**15**	**17**	**20**	**20**	**19**	**11**	**26**
							Result	**Lp**	**26**

Predicted Noise Calculation - NSL2									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	60	81	83	86	89	89	87	80	95
A_{div}	63	63	63	63	63	63	63	63	
A	63	63	63	63	63	63	63	63	
NSL dBA	**-3**	**18**	**21**	**23**	**26**	**26**	**25**	**17**	**32**
							Result	**Lp**	**32**

Predicted Noise Calculation - NSL3									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	60	81	83	86	89	89	87	80	95
A_{div}	65	65	65	65	65	65	65	65	
A	65	65	65	65	65	65	65	65	
NSL dBA	**-5**	**15**	**18**	**21**	**23**	**24**	**22**	**14**	**29**
							Result	**Lp**	**29**

Predicted Noise Calculation - NSL4									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	60	81	83	86	89	89	87	80	95
A_{div}	70	70	70	70	70	70	70	70	
A	70	70	70	70	70	70	70	70	
NSL dBA	**-10**	**11**	**14**	**16**	**19**	**19**	**18**	**10**	**25**
							Result	**Lp**	**25**

Predicted Noise Calculation - NSL5									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	60	81	83	86	89	89	87	80	95
A_{div}	70	70	70	70	70	70	70	70	
A	70	70	70	70	70	70	70	70	
NSL dBA	**-10**	**11**	**13**	**16**	**19**	**19**	**17**	**10**	**25**
							Result	**Lp**	**25**

C.2.2: Predicted Normal Ventilation

Predicted Noise Calculation - NSL1									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	58	64	70	74	75	69	64	74	80
A_{div}	69	69	69	69	69	69	69	69	
A	69	69	69	69	69	69	69	69	
NSL dBA	**-11**	**-4**	**1**	**5**	**6**	**1**	**-5**	**5**	**11**
							Result	**Lp**	**11**

Predicted Noise Calculation - NSL2									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	58	64	70	74	75	69	64	74	80
A_{div}	63	63	63	63	63	63	63	63	
A	63	63	63	63	63	63	63	63	
NSL dBA	**-5**	**2**	**7**	**11**	**12**	**7**	**1**	**11**	**17**
							Result	**Lp**	**17**

Predicted Noise Calculation - NSL3									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	58	64	70	74	75	69	64	74	80
A_{div}	65	65	65	65	65	65	65	65	
A	65	65	65	65	65	65	65	65	
NSL dBA	**-7**	**-1**	**5**	**9**	**9**	**4**	**-2**	**9**	**15**
							Result	**Lp**	**15**

Predicted Noise Calculation - NSL4									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	58	64	70	74	75	69	64	74	80
A_{div}	70	70	70	70	70	70	70	70	
A	70	70	70	70	70	70	70	70	
NSL dBA	**-12**	**-5**	**0**	**4**	**5**	**0**	**-6**	**4**	**10**
							Result	**Lp**	**10**

Predicted Noise Calculation - NSL5									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	58	64	70	74	75	69	64	74	80
A_{div}	70	70	70	70	70	70	70	70	
A	70	70	70	70	70	70	70	70	
NSL dBA	**-12**	**-6**	**0**	**4**	**5**	**-1**	**-6**	**4**	**10**
							Result	**Lp**	**10**

C.2.3: Predicted Construction Noise

Predicted Noise Calculation - NSL1									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	92	101	107	109	109	107	107	97	115
A_{div}	69	69	69	69	69	69	69	69	
A	69	69	69	69	69	69	69	69	
NSL dBA	**23**	**33**	**38**	**40**	**41**	**38**	**38**	**28**	**46**
							Result	**Lp**	**46**

Predicted Noise Calculation - NSL2									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	92	101	107	109	109	107	107	97	115
A_{div}	63	63	63	63	63	63	63	63	
A	63	63	63	63	63	63	63	63	
NSL dBA	**29**	**39**	**44**	**46**	**47**	**44**	**44**	**34**	**52**
							Result	**Lp**	**52**

Predicted Noise Calculation - NSL3									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	92	101	107	109	109	107	107	97	115
A_{div}	65	65	65	65	65	65	65	65	
A	65	65	65	65	65	65	65	65	
NSL dBA	**27**	**36**	**41**	**44**	**44**	**42**	**41**	**32**	**50**
							Result	**Lp**	**50**

Predicted Noise Calculation - NSL4									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	92	101	107	109	109	107	107	97	115
A_{div}	70	70	70	70	70	70	70	70	
A	70	70	70	70	70	70	70	70	
NSL dBA	**22**	**32**	**37**	**39**	**40**	**37**	**37**	**27**	**45**
							Result	**Lp**	**45**

Predicted Noise Calculation - NSL5									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source Lw	92	101	107	109	109	107	107	97	115
A_{div}	70	70	70	70	70	70	70	70	
A	70	70	70	70	70	70	70	70	
NSL dBA	**22**	**31**	**37**	**39**	**39**	**37**	**37**	**27**	**45**
							Result	**Lp**	**45**

APPENDIX D

- NOISE METER CALIBRATION CERT -

Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Equipment Details

Instrument Manufacturer	Cirrus Research Plc
Instrument Type	CR:171B
Description	Sound Level Meter
Serial Number	G071199

Calibration Procedure

The instrument detailed above has been calibrated to the publish test and calibration data as detailed in the instrument hand book, using the techniques recommended in the latest revisions of the International Standards IEC 61672-1:2013, IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:2003, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable.
Sound Level Meters: All Calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

Calibration Traceability

The equipment detailed above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards {A.0.6}. The standards are:

Microphone Type	GRAS 40AP	Serial Number	173198	Calibration Ref.	0170
Calibrator Type	B&K 4231	Serial Number	2564324	Calibration Ref.	A1914
Calibrator Type	B&K 4231	Serial Number	2564325	Calibration Ref.	A1915
Calibrator Type	B&K 4231	Serial Number	2594796	Calibration Ref.	A1916

Calibrated by

Calibration Date 04 July 2019
Calibration Certificate Number 272682

Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH
Telephone: +44 (0) 1723 891655 Fax: +44 (0) 1723 891742
Email: sales@cirrusresearch.co.uk

Certificate of Calibration

Certificate Number: **130782**
Date of Issue: **18 July 2019**

Instrument

Manufacturer: **Cirrus Research plc** Serial Number: **54060**
Model Number: **CR:515**

Calibration Procedure

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer s data.

Date of Calibration: **18 July 2019**

Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	93.99	1000.0	0.26
2	93.98	1000.0	0.25
3	93.98	1000.0	0.25
Average	**93.98**	**1000.0**	**0.25**
Uncertainty	± 0.11	± 0.14	± 0.10

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

Cirrus Research plc, Acoustic House, Bridlington Road
Hunmanby, North Yorkshire, YO14 0PH, United Kingdom
Telephone: 0845 230 2434 **Int**: +44 1723 891655
Email: sales@cirrusresearch.co.uk
Web: www.cirrusresearch.co.uk
UK Registration No. 987160

bsi. ISO 9001:2015 Quality Management FM 531001 ISO 14001 Environmental Management EMS 552104

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18/07/19** CERTIFICATE NUMBER **130781**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 203537A

Calibration procedure

Date of calibration: 16 July 2019

Open circuit: 52.7 mV/Pa

Sensitivity at 1 kHz: -25.6 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 101.10 kPa

Temperature: 21.0 °C

Humidity: 58.0 %

APPENDIX E

- VENTILATION FAN SPECIFICATIONS -

8 Technical Data

Fan type	445070/445073 DA 600 LPC-11-2	445071/445074 DA 600 LPC-12-2	445072/445075 DA 600 LPC-13-2
Electric			
Rated voltage [V AC]	230 ± 10 %	230 ± 10 %	230 ± 10 %
Operational voltage [V AC]	160 - 280	160 - 280	160 - 280
Frequency [Hz]	50/60	50/60	50/60
Max. power consumption [A]	4.5	4.5	4.5
Power consumption at [A] - 40Pa	2.15	2.67	3.24
Power [W]	800	800	800
Earth leak circuit breaker	To be installed in accordance with applicable laws and standards. RCCB 300 mA (type B) is applicable in front of the power supply to LPC regulated fans.		
Leak current to earth	Max. 3 mA Pay attention to other leak current sources in the house.		
Adjustment ability	Adjustable	Adjustable	Adjustable
Motor protection	Thermistor	Thermistor	Thermistor
Motor relay	None	None	None
Interface			
Inputs Analogue in [V DC]	10-0-10		
Digital in	2		
Digital in accessories	1		
Digital out	7A; 30 V DC/24 V AC		
Mechanic			
Cable length [m]	2 shielded cable	2 shielded cable	2 shielded cable
Min. duct diameter [mm]	636	636	636
Blade diameter [mm]	625	625	625
Number of blades [pcs.]	3	3	3
Blade pitch [°]	Periferi 25 Nav 45	Periferi 25 Nav 45	Periferi 25 Nav 45
Fan output			
Revolutions [per minute] (mark)	300-1,100	300-1,200	300-1,300
Air output [m^3/h] (at –10 Pa)	13,600	14,700	15,800
Air output [m^3/h] (at –20 Pa)	13,200	14,500	15,500
Air output [m^3/h] (at –30 Pa)	12,900	14,100	15,200
Air output [m^3/h] (at –40 Pa)	12,500	13,900	14,900
Air output [m^3/h] (at –50 Pa)	12,200	13,500	14,600
Air output [m^3/h] (at –60 Pa)	11,700	13,100	14,300
Power consumption [W] (at -10 Pa)	534	543	668
Specific output [m^3/kWh] (at -10 Pa)	30,500	26,500	23,000
Specific energy [Watt/1000 m^3/h] (at -10 Pa)	33	38	43

SKOV
DA 600 LPC-2

Fan type	445070/445073 DA 600 LPC-11-2	445071/445074 DA 600 LPC-12-2	445072/445075 DA 600 LPC-13-2
Pressure stability, change from 0 to -20 Pa [%]	4	3	3
Test authorities	Bygholm AAU/ SKOV A/S	Bygholm AAU/ SKOV A/S	Bygholm AAU/ SKOV A/S
Environment			
Operating temperature	÷ 40 °C to +40 °C (÷40 to 104 °F)		
Start temperature	÷ 40 °C to +50 °C (÷40 to 122 °F)		
Storage temperature	÷ 40 °C to +70 °C (÷40 to 158 °F)		
Ambient humidity, operation	10-95 % RH		
Protection class	Motor control: IP65. Fan motor: IP55		
Fan noise, outside [dB (A)] (2 m, 45 degrees)	65	67	69
Shipping			
Motor control - dimensions H x W x D [mm]	185 x 231 x 90		
Fan - dimensions H x W x D [mm]	310 x 636 x 636		
Dimensions crated H x W x D [mm]	375 x 660 x 660		
Motor control - weight [g]	2100		
Fan - weight [g]	10500		
Shipping weight [g]	16500		

8.1 ErP/Ecodesign

Fan type	DA 600 LPC-11-2	DA 600 LPC-11-2 w/thermal cutout	DA 600 LPC-12-2	DA 600 LPC-12-2 w/thermal cutout	DA 600 LPC-13-2	DA 600 LPC-13-2 w/thermal cutout
Ecodesign	ErP 2015(N58)	ErP 2015(N58)	ErP 2015(N58)	ErP 2015(N58)	ErP 2015(N58)	ErP 2015(N58)
Efficiency classification [N]	78	78	75.5	75.5	73.6	73.6
Efficiency (η) [%]	62.9	62.9	61.7	61.7	60.8	60.8
Measurements set-up	D	D	D	D	D	D
Fan efficiency	Total	Total	Total	Total	Total	Total
Optimal efficiency [%]	49.8	49.8	50.5	50.5	51.0	51.0
VSD required	X	X	X	X	X	X
Year of manufacture	2012	2012	2012	2012	2012	2012
The manufacture name	SKOV A/S	SKOV A/S	SKOV A/S	SKOV A/S	SKOV A/S	SKOV A/S
Item number	445070	445073	445071	445074	445072	445075
Motor power input [kW]	0.505	0.505	0.642	0.642	0.785	0.785
Volume flow rate [m³/s]	3.39	3.39	3.7	3.7	3.98	3.98
Optimum pressure [Pa]	50	50	55	55	60	60
Total pressure [Pa]	94	94	107	107	120	120
Rotations per minute (RPM)	1120	1120	1225	1225	1325	1325
Pressure conditions	1.0	1.0	1.0	1.0	1.0	1.0
Recycling/Disposal	The product is designed to be recycled and customers will be able to deliver their used products to SKOV A/S or their local collection points/recycling centres in accordance with local instructions.					
Environmental impact	-	-	-	-	-	-
Components used for identifying the energy efficiency of the fan	Bell mouth, flap, air direction baffle, 0.5 m DA 600 duct and outlet cone.					