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NOISE IMPACT ASSESSMENT

PATRICK LALOR
GRENNAN,
ATTANAGH,
CO. LAOIS

2019

REPORT NO:	NIA_19_9345	**AUTHOR:**	Martin O'Looney, BSc.
DATE:	08th April 2019	**REVIEWED:**	Mike Fraher, BSc.

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EXECUTIVE SUMMARY

Panther Environmental Solutions Ltd (PES Ltd) were commissioned by Mr Patrick Lalor to carry out a Noise Monitoring Survey and Impact Assessment for the proposed retention of a slatted tank, animal housing which includes cubicle area, calving boxes, milking parlour, dairy, office, plant room, slatted feeding area, calving boxes, collecting area, steel uprights at slatted feeding area, and all ancillary works and services at Grennan, Attanagh, Co. Laois.

The closest noise sensitive location is 113m north of the main development building. Baseline noise assessments were conducted on Monday 11th February 2019, and between Thursday 28th February and Monday 04th March 2019. This report presents the findings of this assessment and provides an analysis of the noise impact from the operation of the development on noise sensitive receptors (NSR).

Appendix A of this report contains a site map identifying the noise assessment monitoring locations and nearest noise sensitive receptor in relation to the site.

As a result of this baseline noise survey and predictive analysis, it is anticipated that the operation of the milking parlour equipment and tractors operation within the farmyard would have no significant impact upon the nearest noise sensitive receptor.

It has been predicted that existing maximum pass-by traffic noise along the lane is resulting in a significant noise level which is in exceedance of recommended guidance limits for noise within rooms of dwellings.

It is considered that this traffic noise is representative of maximum noise levels occurring prior to and post development of the new shed for retention, as similar traffic has been accessing the applicants farm hub and the adjacent third party residence over both periods.

Noise levels arising due to pass-by traffic noise from the operation of the development alone would be reduced below existing noise impact levels should the construction of the access lane. However, noise levels from site activities would remain above recommended noise levels.

It has been recommended that speed bumps be installed at the entrance and exit to the proposed access lane to maintain existing traffic speeds.

However, it should be noted that maximum noise levels on the existing lane would remain unaltered due to tractors and lorries accessing the third-party farmyard behind the residence.

It is the main conclusion of this report that there would be no significant impact upon noise levels at the nearest noise sensitive location as a result of the retention of the proposed development.

1.0 INTRODUCTION & SCOPE OF WORK

Panther Environmental Solutions Ltd (PES Ltd) were commissioned by Mr Patrick Lalor to carry out a Noise Monitoring Survey and Impact Assessment for the proposed retention of a slatted tank, animal housing which includes cubicle area, calving boxes, milking parlour, dairy, office, plant room, slatted feeding area, calving boxes, collecting area, steel uprights at slatted feeding area, and all ancillary works and services at Grennan, Attanagh, Co. Laois.

The site is accessed by a cul-de-sac laneway, which runs adjacent to a neighbouring residence and associated farmyard and sheds, before entering the Lalor farmstead. The development is approximately 113 metres from the nearest residence, and approximately 300 metres from the local L5750 road.

Planning permission for retention was previously submitted for this development to Laois Co. Co. (Planning Ref: 17/218) and was accepted with conditions. The application was appealed to *An Bord Pleanala* (Ref: APB-300315-17), where it was refused on the grounds of potential impacts to the residential amenity of an adjoining property with regard to noise, traffic and odour, justification for the siting of the structure, and the absence of appropriate assessment screening for the development.

A map of the surrounding noise sensitive locations, and monitoring locations is provided in Appendix A.

In support of a planning application, the primary aims of this survey were to:

1. Identify noise monitoring locations used to represent the existing noise environment;
2. Determine the baseline noise levels at the closest sensitive receptors;
3. Assess the potential for noise impact from the development on the noise sensitive receptors.

2.0 NOISE LEGISLATIVE REQUIREMENTS

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.

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 emission limit values (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 receptor for most situations:

Divisions	Times	Standard dB(A)	Low Background Noise Area dB(A)
Day	(07:00 to 19:00hrs)	55dB $_{LAr,T}$	40dB $_{LAr,T}$
Evening	(19:00 to 23:00hrs)	50dB $_{LAr,T}$	35dB $_{LAr,T}$
Night	(23:00 to 07:00hrs)	45dB $_{LAeq,T}$	30dB $_{LAeq,T}$

The guidance also sets out a method of classifying "Quiet Areas" and "Low Background Noise Areas", where more stringent noise limits may apply.

3.0 MEASUREMENT PARAMETERS

The parameters used to assess the noise are as follows:

Leq(30): The noise values recorded continuously at every instant during the 30 minute sampling period are integrated by the noise metre to give a single value that represents the continuous equivalent sound level over the 30 minute 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 2016 EPA "*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (*NG4*)".

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)

As per top-right-hand corner of each results table, NP indicates *no penalty* for tonal noise and P indicates *a penalty* for tonal noise.

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 L_{eq} 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 L_{eq} is written as LA_{eq} when it is measured with the A frequency weighting.

4.0 EQUIPMENT USED

The equipment used for the onsite source noise monitoring was a Cirrus CR:171B Sound Level Meter and CR:515 Acoustic Calibrator. The CR:515 calibrator was calibrated externally on 28th August 2018, while the CR:171B meter was calibrated externally on 8th November 2018.

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.

The equipment used for the environmental noise monitoring was a Brüel & Kjœr Type 2250 Sound Level Meter, which was calibrated externally on 19th July 2017.

5.0 METEOROLOGICAL CONDITIONS

Weather conditions during the survey were generally dry and gentle to moderate winds.

The Sound Level Meters were also fitted with a windshield to minimise interference from meteorological conditions.

6.0 BASELINE NOISE ASSESSMENT

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*)".

Selection of Sample Noise Monitoring Locations

In order to predict the impact of the operational phase of the development, sample long term noise monitoring locations were selected.

Table 6.1: Noise Monitoring Locations

Ref. No.	Grid Ref	Location Type	Location
NM 1	243204, 177619	Noise Monitoring Location	Within agricultural field, c. 15m from local residence and c.110m from shed.

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

Additional short-term monitoring (SN) was also carried out at onsite noise sources, and set-back distances from these sources.

The baseline environmental noise levels at NM1 and NM2 locations were determined by instrumented monitoring of existing noise levels. This was determined by taking long term 24-hour broadband noise measurements at these noise monitoring locations. It is considered that noise levels measured at each of the NM locations would be representative of noise levels at the nearest residential property or noise sensitive receptor.

These monitoring points are mapped in Appendix A, and summarised in Table 6.2, 6.3 and 6.5. *Quiet Area* and *Low Background Noise Area Screening*, as per the EPA NG4 methodology, has been carried out in Table 6.3 and 6.4.

All measurements were taken at:

- 1.2 – 1.5 metres height above local ground level
- 1 – 5 metres away from reflective surfaces

6.2 BASELINE NOISE ASSESSMENT – RESULTS

The tables below show the long-term measurement results taken at the noise monitoring location outlined in **Section 6.1**. These points are mapped in Appendix A.

For this assessment, the monitoring was carried out between 17:13pm on Thursday 28th February and 17.30pm on Monday 04th March 2019.

Table 6.2: Long Term Noise Monitoring Results – NM1

Time	LAeq,30	LAFMax	LAF90
28/02/2019 17:30	39.4	56.2	36.3
28/02/2019 18:00	41.6	59.0	38.8
28/02/2019 18:30	42.2	58.9	40.3
28/02/2019 19:00	37.6	55.3	34.9
28/02/2019 19:30	35.4	56.1	31.7
28/02/2019 20:00	30.1	44.7	29.5
28/02/2019 20:30	36.8	55.3	33.1
28/02/2019 21:00	41.0	60.3	38.1
28/02/2019 21:30	39.2	56.4	36.7
28/02/2019 22:00	36.5	53.9	34.5
28/02/2019 22:30	33.8	51.6	32.2
28/02/2019 23:00	29.2	39.9	28.7
28/02/2019 23:30	30.4	49.1	29.1
01/03/2019 00:00	29.4	39.7	29.1
01/03/2019 00:30	27.9	41.4	27.6
01/03/2019 01:00	31.0	52.2	28.2
01/03/2019 01:30	28.0	31.3	27.7
01/03/2019 02:00	28.9	47.9	28.0

Time	LAeq,30	LAFMax	LAF90
01/03/2019 02:30	31.6	54.6	29.1
01/03/2019 03:00	32.9	56.9	30.8
01/03/2019 03:30	34.7	54.1	32.6
01/03/2019 04:00	32.3	51.1	29.4
01/03/2019 04:30	28.8	44.0	27.8
01/03/2019 05:00	29.5	44.8	28.4
01/03/2019 05:30	30.8	49.4	29.3
01/03/2019 06:00	30.9	45.7	30.0
01/03/2019 06:30	33.2	54.0	30.7
01/03/2019 07:00	34.8	54.4	31.4
01/03/2019 07:30	36.8	56.2	32.0
01/03/2019 08:00	38.9	58.6	32.3
01/03/2019 08:30	38.7	64.1	31.2
01/03/2019 09:00	41.1	58.4	33.2
01/03/2019 09:30	40.3	66.8	33.0
01/03/2019 10:00	38.2	58.8	32.5
01/03/2019 10:30	35.0	54.0	30.6
01/03/2019 11:00	33.3	54.2	27.0
01/03/2019 11:30	33.3	56.0	27.2
01/03/2019 12:00	34.4	56.3	26.7
01/03/2019 12:30	35.7	61.1	25.9
01/03/2019 13:00	29.0	51.9	24.7
01/03/2019 13:30	39.9	75.7	26.2
01/03/2019 14:00	36.7	55.2	30.2
01/03/2019 14:30	31.4	57.7	25.3
01/03/2019 15:00	34.5	61.2	27.5
01/03/2019 15:30	31.8	53.4	25.8
01/03/2019 16:00	39.1	63.8	26.8
01/03/2019 16:30	37.2	56.9	28.0
01/03/2019 17:00	37.7	61.3	28.8
01/03/2019 17:30	29.1	54.0	27.4
01/03/2019 18:00	35.1	53.4	30.2
01/03/2019 18:30	32.2	58.4	27.0
01/03/2019 19:00	30.9	48.4	29.3
01/03/2019 19:30	31.5	51.7	29.8

Time	LAeq,30	LAFMax	LAF90
01/03/2019 20:00	33.1	54.8	30.8
01/03/2019 20:30	27.3	37.5	26.9
01/03/2019 21:00	26.0	36.0	25.7
01/03/2019 21:30	27.4	44.9	25.8
01/03/2019 22:00	26.1	41.3	25.2
01/03/2019 22:30	30.3	55.7	25.5
01/03/2019 23:00	26.2	36.6	25.8
01/03/2019 23:30	29.3	47.7	27.6
02/03/2019 00:00	28.9	51.2	26.5
02/03/2019 00:30	26.2	31.7	25.9
02/03/2019 01:00	25.5	31.5	25.1
02/03/2019 01:30	25.4	36.5	25.0
02/03/2019 02:00	27.2	41.2	26.6
02/03/2019 02:30	29.9	43.0	29.0
02/03/2019 03:00	28.9	43.8	28.3
02/03/2019 03:30	27.1	38.6	26.6
02/03/2019 04:00	26.8	33.9	26.5
02/03/2019 04:30	26.3	40.9	25.7
02/03/2019 05:00	25.2	33.8	25.0
02/03/2019 05:30	25.9	34.7	25.5
02/03/2019 06:00	26.2	38.4	25.8
02/03/2019 06:30	30.1	46.2	26.4
02/03/2019 07:00	33.0	55.6	29.0
02/03/2019 07:30	40.0	57.9	30.0
02/03/2019 08:00	41.7	63.2	30.8
02/03/2019 08:30	40.1	56.2	30.2
02/03/2019 09:00	39.3	55.7	30.9
02/03/2019 09:30	33.6	50.3	28.4
02/03/2019 10:00	35.8	56.9	30.3
02/03/2019 10:30	35.2	60.5	28.8
02/03/2019 11:00	33.1	52.5	27.4
02/03/2019 11:30	38.3	59.5	29.6
02/03/2019 12:00	38.9	61.8	31.1
02/03/2019 12:30	35.1	60.1	29.5
02/03/2019 13:00	35.7	55.1	32.0

Time	LAeq,30	LAFMax	LAF90
02/03/2019 13:30	37.2	55.6	32.7
02/03/2019 14:00	38.4	59.7	34.1
02/03/2019 14:30	30.9	49.3	29.1
02/03/2019 15:00	41.3	58.1	35.1
02/03/2019 15:30	35.3	53.8	32.2
02/03/2019 16:00	39.6	70.3	32.5
02/03/2019 16:30	35.1	56.3	30.8
02/03/2019 17:00	34.0	53.8	29.3
02/03/2019 17:30	37.4	56.2	30.9
02/03/2019 18:00	34.5	53.6	29.6
02/03/2019 18:30	30.3	49.2	26.7
02/03/2019 19:00	33.3	54.4	28.2
02/03/2019 19:30	29.8	52.6	28.6
02/03/2019 20:00	31.7	55.4	27.7
02/03/2019 20:30	27.2	44.5	26.2
02/03/2019 21:00	29.4	51.5	24.5
02/03/2019 21:30	27.4	44.4	25.2
02/03/2019 22:00	35.6	55.0	27.1
02/03/2019 22:30	26.2	40.4	25.2
02/03/2019 23:00	27.1	45.2	26.3
02/03/2019 23:30	25.0	37.0	24.6
03/03/2019 00:00	28.5	43.0	27.5
03/03/2019 00:30	25.9	37.4	25.4
03/03/2019 01:00	26.2	36.9	25.6
03/03/2019 01:30	28.0	44.3	27.2
03/03/2019 02:00	27.7	43.4	26.6
03/03/2019 02:30	25.9	38.3	25.4
03/03/2019 03:00	26.2	39.5	25.7
03/03/2019 03:30	27.5	39.9	27.0
03/03/2019 04:00	25.8	33.3	25.5
03/03/2019 04:30	29.9	47.8	27.0
03/03/2019 05:00	28.0	35.8	27.5
03/03/2019 05:30	27.5	36.0	27.1
03/03/2019 06:00	27.3	43.1	26.8
03/03/2019 06:30	33.7	53.0	28.9

Time	LAeq,30	LAFMax	LAF90
03/03/2019 07:00	36.5	55.8	31.7
03/03/2019 07:30	41.1	59.7	33.5
03/03/2019 08:00	42.2	58.8	33.9
03/03/2019 08:30	42.5	57.5	32.9
03/03/2019 09:00	41.7	59.6	32.3
03/03/2019 09:30	41.4	61.2	30.9
03/03/2019 10:00	38.8	59.5	28.3
03/03/2019 10:30	38.4	56.5	29.1
03/03/2019 11:00	36.5	55.0	27.9
03/03/2019 11:30	37.5	55.8	27.2
03/03/2019 12:00	37.3	65.9	26.3
03/03/2019 12:30	31.5	54.7	25.2
03/03/2019 13:00	32.7	53.8	26.9
03/03/2019 13:30	31.7	53.0	25.0
03/03/2019 14:00	33.1	53.4	25.1
03/03/2019 14:30	38.0	56.8	25.8
03/03/2019 15:00	35.0	55.5	25.9
03/03/2019 15:30	32.9	54.8	25.6
03/03/2019 16:00	31.5	53.2	25.4
03/03/2019 16:30	35.2	55.9	27.4
03/03/2019 17:00	35.1	53.4	28.7
03/03/2019 17:30	39.6	58.0	36.1
03/03/2019 18:00	37.1	61.9	32.4
03/03/2019 18:30	33.5	51.2	30.4
03/03/2019 19:00	35.3	54.9	32.1
03/03/2019 19:30	36.2	57.3	33.5
03/03/2019 20:00	35.4	52.2	33.9
03/03/2019 20:30	38.8	56.0	35.2
03/03/2019 21:00	38.1	55.5	36.1
03/03/2019 21:30	32.2	44.2	30.8
03/03/2019 22:00	44.2	59.1	41.3
03/03/2019 22:30	39.7	50.0	37.6
03/03/2019 23:00	31.7	39.9	31.0
03/03/2019 23:30	34.5	51.3	33.3
04/03/2019 00:00	33.8	47.6	31.4

Time	LAeq,30	LAFMax	LAF90
04/03/2019 00:30	32.4	47.2	30.8
04/03/2019 01:00	30.1	38.3	29.4
04/03/2019 01:30	29.7	38.8	29.2
04/03/2019 02:00	28.4	38.6	28.1
04/03/2019 02:30	27.0	36.1	26.5
04/03/2019 03:00	25.2	31.1	24.9
04/03/2019 03:30	27.2	49.9	26.4
04/03/2019 04:00	26.3	36.9	25.9
04/03/2019 04:30	27.2	34.2	26.8
04/03/2019 05:00	27.2	39.8	26.9
04/03/2019 05:30	30.5	48.0	29.9
04/03/2019 06:00	34.4	49.1	33.8
04/03/2019 06:30	38.8	55.3	37.0
04/03/2019 07:00	39.2	57.1	37.7
04/03/2019 07:30	38.5	57.1	33.1
04/03/2019 08:00	39.4	58.6	32.2
04/03/2019 08:30	35.1	54.2	31.2
04/03/2019 09:00	35.0	55.5	30.4
04/03/2019 09:30	35.5	56.2	27.5
04/03/2019 10:00	36.6	57.9	28.5
04/03/2019 10:30	31.4	51.1	28.4
04/03/2019 11:00	34.9	61.9	30.7
04/03/2019 11:30	35.1	51.7	32.0
04/03/2019 12:00	34.8	53.0	30.9
04/03/2019 12:30	32.1	56.9	29.9
04/03/2019 13:00	36.9	53.3	34.2
04/03/2019 13:30	34.2	53.3	32.5
04/03/2019 14:00	47.8	76.6	38.6
04/03/2019 14:30	48.1	74.9	45.5
04/03/2019 15:00	47.8	67.3	45.3
04/03/2019 15:30	44.8	67.6	41.5
04/03/2019 16:00	45.8	64.1	43.3
04/03/2019 16:30	42.4	59.4	39.4
04/03/2019 17:00	36.6	54.5	33.9

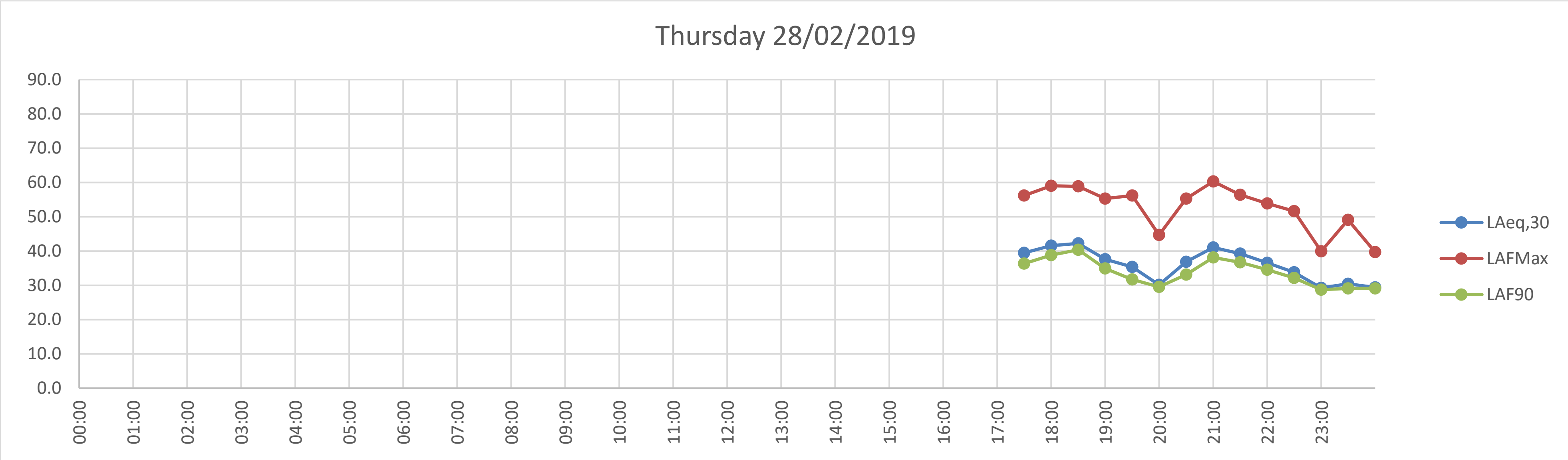


Figure 6.1: Long Term Noise Monitoring Results (NM1 – 28/02/2019)

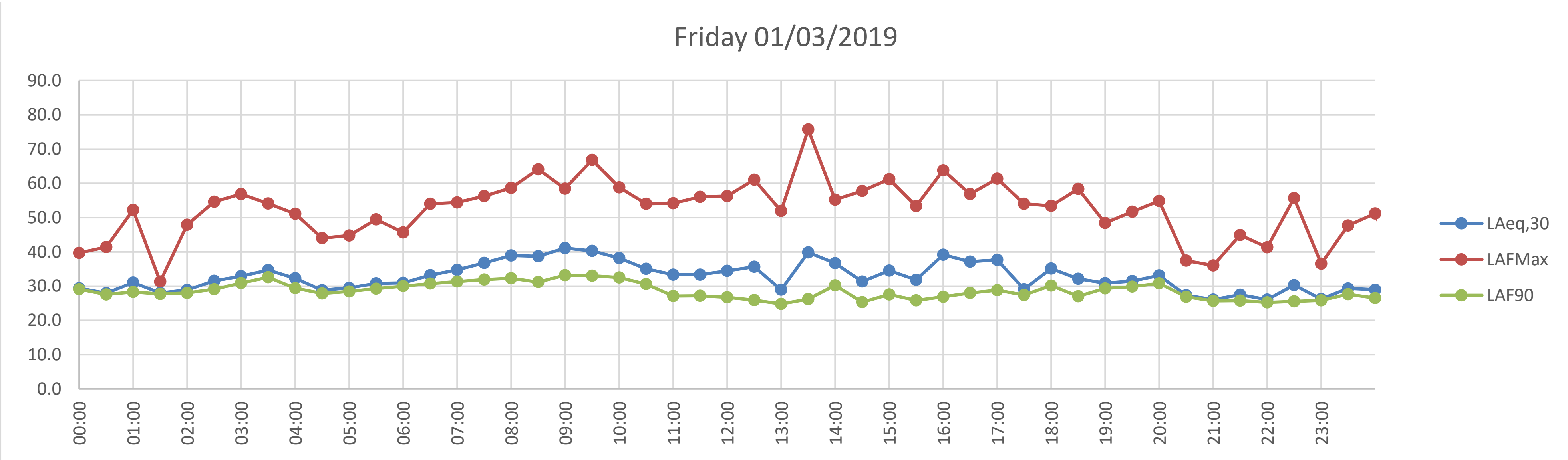


Figure 6.2: Long Term Noise Monitoring Results (NM1 – 01/03/2019)

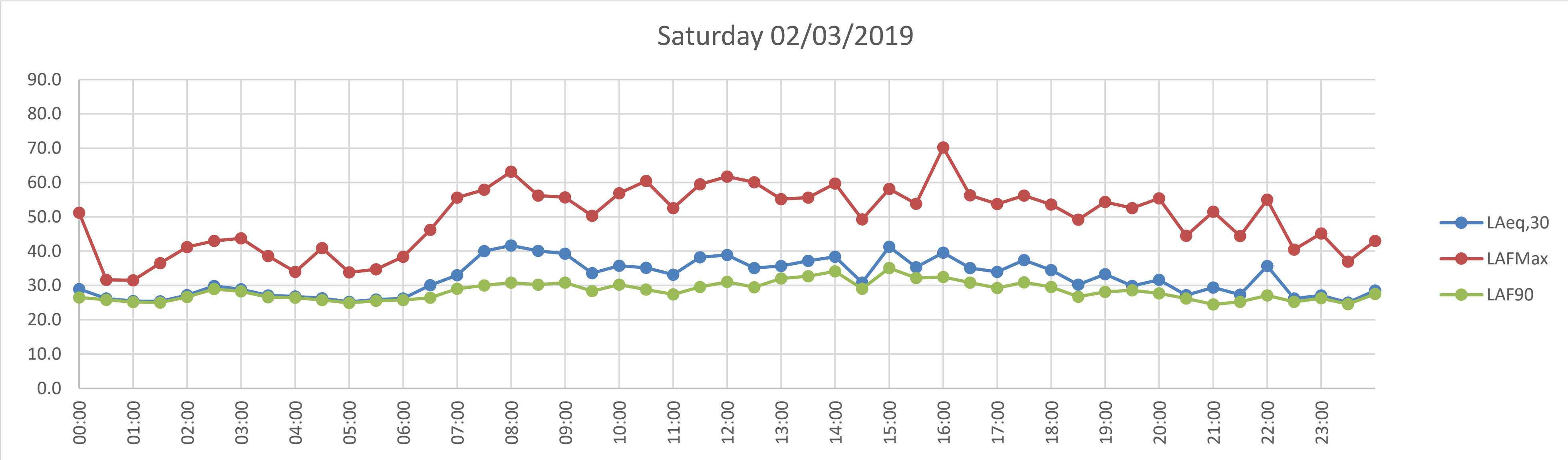


Figure 6.3: Long Term Noise Monitoring Results (NM1 – 02/03/2019)

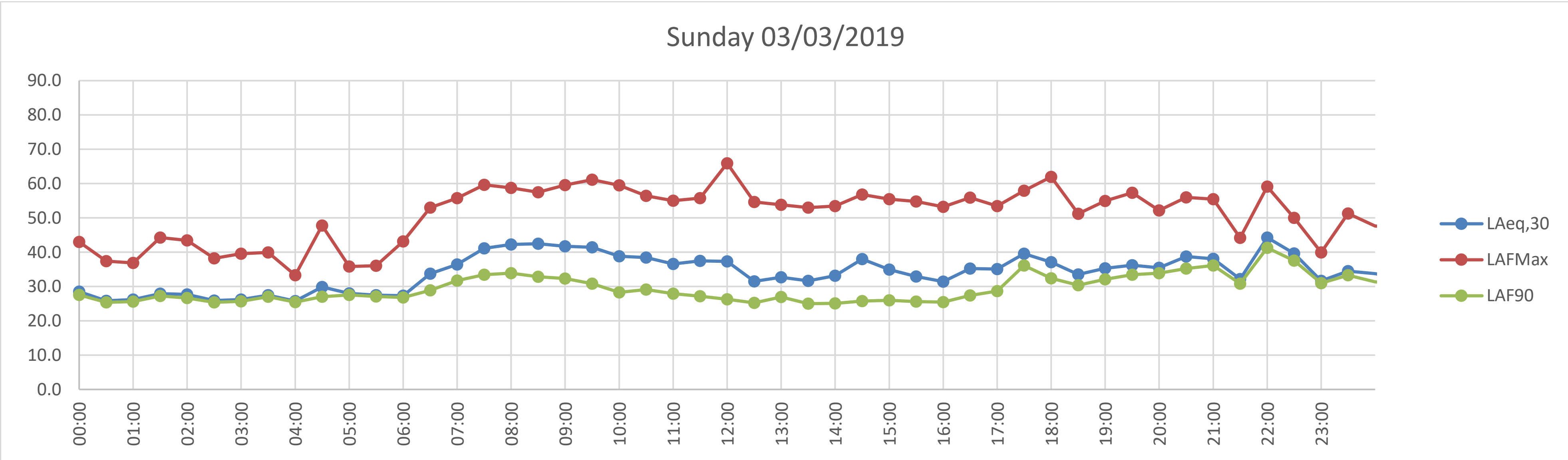


Figure 6.4: Long Term Noise Monitoring Results (NM1 – 03/03/2019)

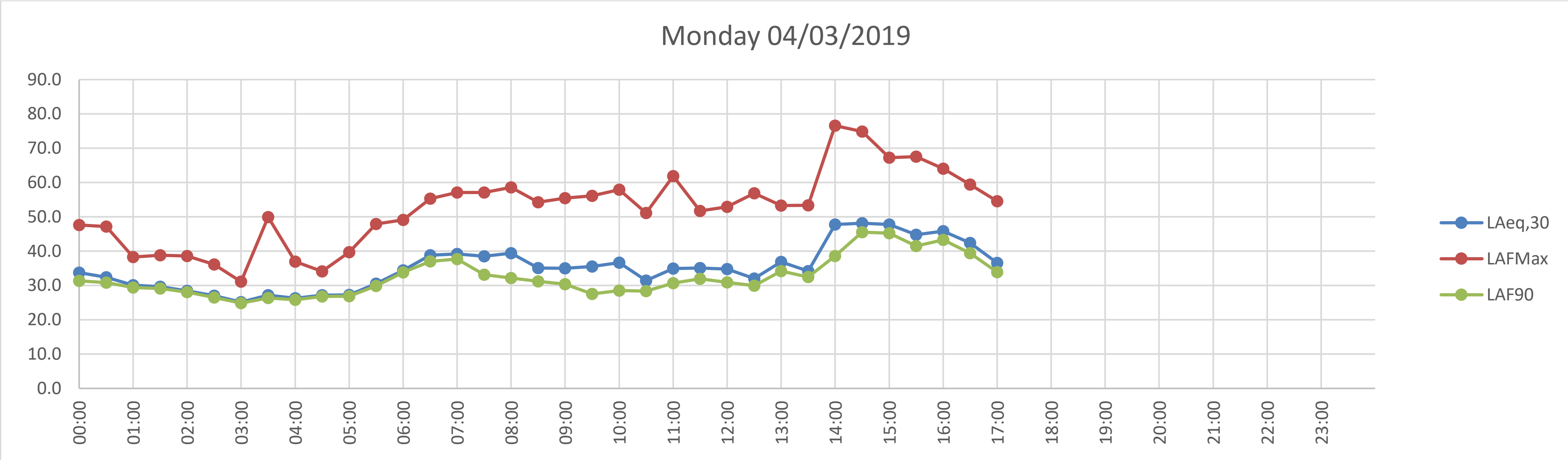


Figure 6.5: Long Term Noise Monitoring Results (NM1 – 03/03/2019)

6.3 QUIET AREA SCREENING

The location of the development has been screened in order to determine if it is located in an area that could be considered a 'Quiet Area' according to the EPA NG4 Guidance, which states:

The location of the proposed development should be screened in order to determine if it is to be located in or near an area that could be considered a 'Quiet Area' in open country according to the Agency publication Environmental Quality Objectives - Noise in Quiet Areas.

This is achieved using the following checklist:

Table 6.3: Quiet Area Screening Checklist		
Screening Question	**Answer**	
	Yes	**No**
Is the site >3km away from urban areas with a population >1,000 people?	✓	
Is the site >10km away from urban areas with a population >5,000 people?	✓	
Is the site >15km away from urban areas with a population >10,000 people?	✓	
Is the site >3km away from any local industry?	✓	
Is the site >10km away from any major industry centre?	✓	
Is the site >5km away from any national primary route?		✓
Is the site >7.5km away from any motorway or dual carriageway?	✓	
QUIET AREA?		✓
Other Relevant Comments	N77 primary route – 1.5 km NW. M8 Motorway – 8.5 km W. Durrow (pop: 843) – 2.5 km W. Abbyleix (pop: 1,770) – 6.5km N. Ballyragget (pop: 1,451) – 6.5km S. Glanbia (Ballyragget) – 5 km S	

The proposed development location does not comply with all criteria, as per the above checklist. Therefore, it is considered that the development would not be classified as being within a '*Quiet Area*'.

6.4 AREAS OF LOW BACKGROUND NOISE SCREENING

When an area is not identified as being *a 'Quiet Area'*, the existing background noise levels measured during the environmental noise survey should be examined to determine if they satisfy the following criteria:

- Average Daytime Background Noise Level ≤ 40dB L_{AF90}
- Average Evening Background Noise Level ≤ 35dB L_{AF90}
- Average Night-time Background Noise Level ≤ 30dB L_{AF90}

Noise monitoring has indicated that background L_{AF90} noise levels do not fall below the levels as outlined in Step 3, Chapter 4.4.2 of the EPA *Guidance Note on Noise from Scheduled* Activities (NG4), at any of the monitoring locations.

Table 6.4: Low Background Noise Assessment Table

	LAF_{90} Daytime	**LAF_{90} Evening**	**LAF_{90} Night**
DATE	**07:00 - 19:00**	**19:00 - 23:00**	**23:00 - 07:00**
28/02/2019	38.8	34.6	29.4
01/03/2019	29.6	27.9	26.5
02/03/2019	30.9	26.8	26.6
03/03/2019	30.2	36.3	30.8
04/03/2019	38.4	-	-
Average	33.6	31.4	28.3

Background LAF_{90} noise levels at the monitoring locations are generally influenced by road traffic and agricultural activity. The monitored background-noise environment at the site is consistent, as shown in the above table.

Given the noise monitoring results obtained, it is considered that this area would be classified as a "Low Background Noise Area".

6.5 SOURCE NOISE ASSESSMENT

The principal permanent onsite noise source is the motor on the milking machine.

The motor is a WEG®: Model W22 Premium, Frame: 160M-04. This motor is rated to generate sound levels at 67 dBA (operating on a 50Hz electricity supply). Other equipment within the milking parlour include a BouMatic® Model BP-200 vacuum pump and a Universal® Model URB-2½ noise silencer.

The source noise assessment was carried out on the 11th February 2018. The following tables detail the actual noise levels from onsite equipment within the milking parlour room, and at set back distances from this noise source.

Table 6.5: Source Noise Monitoring (Motor-on)

Location	Time	LAeq,T	LAF_{10}	LAF_{90}
SN1 (motor start-up) @ 1m	14:42	78	82	59
SN1 (Idling) @1m	14:45	75	78	64
SN2 (at southern door)	14:49	49	50	48
SN3 @ c.35m	14:53	39	42	34
SN4 @ c.30m	14:57	47	49	44
SN5 @ c.65m	15:00	43	45	38
SN5 (plus tractor offsite)	15:03	48	50	44
SN6 @ c.105m	15:06	43	47	31

Table 6.6: Source Noise Monitoring (Motor-off)

Location	Time	LAeq,T	LAF_{10}	LAF_{90}
SN1 @ 1 m	15:19	47	49	44
SN2 (at southern door)	15:22	48	50	45
SN3 @ c.35m	15:24	43	46	36
SN4 @ c.30m	15:15	46	46	40
SN5 @ c.65m	15:12	41	43	33
SN6 @ c.105m	15:09	44	48	33

7.0 PREDICTIVE NOISE ASSESSMENT

The International Standards Authority guidance ISO 9613-2:1996 has been used in the prediction of the propagation of potential noise from the proposed works and development to the nearest noise sensitive receptors. The British Standard BS4142:2014 has been used to assess the potential for noise impact at local noise receptors as a result of the proposed development.

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:

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

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 monitoring location.

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

BS 4142:2014

The British Standard EN BS 4142 "*Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*" provides a method for predicting the likelihood of impact from noisy activities such as industrial activities, quarries and landfills etc.

A correction factor, typically of up to +6dB for tonal elements and +9dB for impulsive elements, may be applied arithmetically to the predicted noise from the proposed activity based upon the character of the noise and its likelihood to cause nuisance. This is termed the 'rating level'.

If the rating level exceeds the background L_{90} by 10 dBA or more is likely to be an indication of a significant adverse impact. A positive difference of around 5 dBA could be an indication of a significant adverse impact, depending on the context. The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact.

7.1 SOURCE NOISE SPECIFICATIONS & FORMULAE

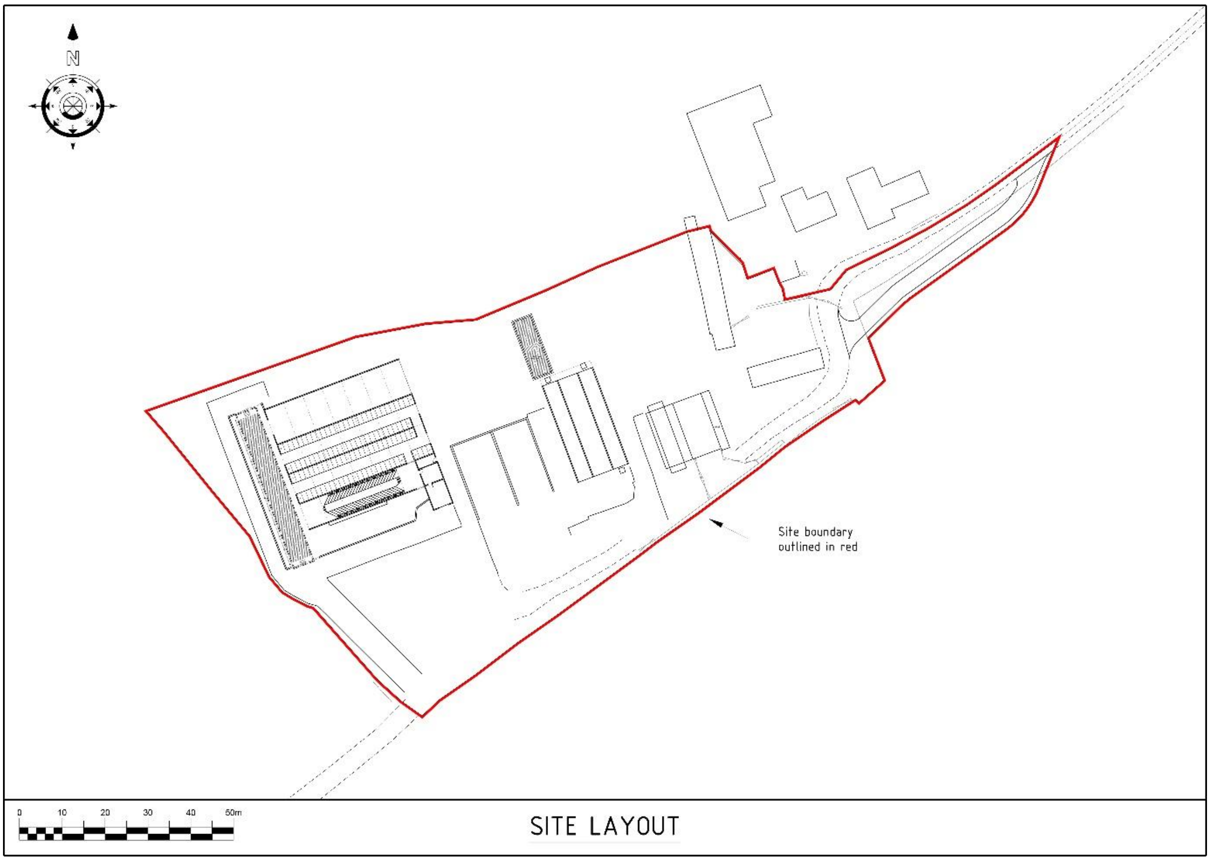


Figure 7.1: Site Layout

Figure 7.2: Proposed routes for development traffic

The development includes the retention of a slatted tank and animal housing with milking parlour.

The principal most frequent onsite noise sources would be the operation of parlour equipment during milking and intermittent operation of agricultural machinery within the site.

Existing traffic passes the adjacent residential receptor within approximately c.1-2m from the façade. This includes traffic accessing the adjacent residence and associated dairy farm hub, and accessing the existing beef farm hub on the applicant's site.

Traffic associated with the new dairy shed and existing beef operation would use a new access lane to the east of the farm hub.

The applicant's son would access the site for daily farm inspections as a continuation of previous farm visits for the beef operation at the site. The lane proposed to be constructed within the applications land and parallel to the existing lane.

The site would be visited by the milk lorry for milk collections, which is a shared service with the adjacent residence and associated dairy farm hub.

New traffic would also include approximately 1 additional trip by cattle lorries for delivery of dairy herd calves brought to mart, where calves are not kept for replacement stock. Intermittent additional traffic may also be expected due to cattle illness or equipment malfunction.

The pre-existing traffic for beef operations would remain the same. This would include delivery of beef feed (concentrates / nuts), collection of finished beef cattle for market and some of the traffic associated with the harvesting of silage.

The intensity of farm traffic bringing grass to the existing onsite silage pit during silage harvesting would be expected to increase to meet the demand for the dairy operation. The route of silage traffic would be dependent upon the location of the field which is being harvested.

Additional traffic associated with the new dairy development would include the collection of slurry from the winter housing of dairy cattle. However, the slurry produced on this site is applied to the adjoining lands, which are accessed via the western lane, as shown in Figure 7.2 above.

It should be noted that the majority of traffic associated with these operations occur over short periods, with slurry being landspread during spring and silage being harvested in late summer and autumn.

The highest LAFmax for pass-by traffic recorded during the long-term monitoring survey, of Lp 80 dBA at 1m or Lw 91 dBA at 1m, has been used to represent the maximum pass-by traffic noise on the existing lane, the new lane and noise from tractors operating within the farm area.

It should be noted that there is a speed bump on the existing lane just to the east of the residence's front yard as a traffic calming measure.

The noise information to be used to characterise these sources is presented in the following tables.

Table 7.1: Operational Noise Level for Farm

Sound Power Level (Lw) @ Octave Band Centre Frequency									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Tractor Operating @1m	90	83	73	73	70	69	61	56	91
SN1 – Motor Start Up @ 1m	54	58	61	72	73	68	79	61	78
Resultant Noise Level	**90**	**83**	**74**	**76**	**75**	**72**	**79**	**62**	**92**

Table 7.2: Pass-by Traffic on Lane (Maximum Pass-by Noise Level)

Sound Power Level (Lw) @ Octave Band Centre Frequency									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Pass-by Traffic @1m	90	83	73	73	70	69	61	56	91
Resultant Noise Level	**90**	**83**	**73**	**73**	**70**	**69**	**61**	**56**	**91**

<u>Relevant Formulae</u>

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:

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

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 pressure level at a reference distance d_0 which is 1 meter from an omnidirectional point source.

Barrier Effect – A_{bar}
The barrier effect was calculated using the Anderson and Kurze calculation as follows:

$$D_Z = 20\log10 (\Omega/\text{Tan.h } \Omega) + 5\text{dB}$$

Where:
$\Omega = (2.\pi.N)^{1/2}$

N is the Fresnel number given by: $N = 2.d / \lambda$

Where:
d is the differential path length
λ wavelength of the sound

7.2 PREDICTIVE ANALYSIS - RESULTS

In order to determine the impact of noise from the proposed development during maximum potential noise from the operation of the site, the resultant noise levels at nearest noise sensitive receptor have been calculated.

Table 7.3 below summarises the findings of this predictive noise assessment. Detailed calculations may be found in Appendix B below.

Two noise sources have been considered to account for potential noise from the proposed retained development:

- Noise from the milking parlour (retention) and tractor operations onsite,
- Noise from pass-by traffic on the existing and proposed lane.

Intermittent arrival / exit of operator vehicles would also be expected, however, this would be considered similar to existing noise from the public road.

Table 7.3: Predicted Noise Results Summary (dBA)

NSR Ref	Distance	Milking Parlour Only	Tractor & Parlour Noise	Pass by Traffic
Source Noise Level (dBA)		78	92	91
NSR1	NSR 113m	28	33	-
NSR1	NSR 5m	-	-	66
NSR1	NSR 15m	-	-	57

BS4142:2014 Impact Assessment

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.

An L_{90} of a dataset of noise is the number at which 90% of the data is larger than the number and 10% of the data is equal to or below that number. The L_{90} noise level is commonly used to give an approximation of background noise levels in the absence of intermittent noise sources.

Representative baseline noise levels have been taken as the averages of long-term noise monitoring carried out at NM1 above.

A noise character penalty of +3 has been applied to predicted noise levels containing machine or heavy vehicle noise.

The following table determines the likelihood of operational noise impacts at noise sensitive locations following the BS4142 methodology;

Table 7.4: BS4142 Operational Noise Assessment (Tractor & Milking Parlour)

Receptor	Source	Predicted Noise			Difference from Day L_{AF90}	Difference from Evening L_{AF90}	Difference from Night L_{AF90}
		Predicted Noise	Predicted Penalty	Rating Level			
				Background L_{AF90}	**34**	**31**	**28**
NSR1	**Milking Parlour**	28	0	**28**	-5	-3	0
NSR1	**Tractor & Parlour**	33	+3	**36**	3	5	8

The following table determines the likelihood of pass by traffic noise from lorries causing impacts at noise sensitive locations following the BS4142 methodology;

Table 7.5: BS4142 Operational Noise Assessment (Pass by Traffic)

Receptor	Source	Predicted Noise			Difference from Day L_{AF90}	Difference from Evening L_{AF90}	Difference from Night L_{AF90}
		Predicted Noise	Predicted Penalty	Rating Level			
				Background L_{AF90}	**34**	**31**	**28**
NSR1	**Traffic @ 5m**	66	+3	**69**	36	38	41
NSR1	**Traffic @15m**	57	+3	**60**	26	28	31

8.0 DISCUSSION

The area of Grennan, Attanagh, Co. Laois is generally rural in character, with no large urban areas or significant industrial installations in the vicinity. However, the presence of a nearby national road (N77) precludes it from being classified as a "Quiet Area", as this would add to background noise levels.

While this is not a "Quiet Area", long term monitoring determined that the area would be classified as a "Low Background Noise Area", and the area would be considered more sensitive to changes in the existing noise environment.

However, this does not mean that there are no noise sources endemic to the area. Noise from agricultural activities would be common in the area, and an expected aspect of the existing noise environment. Agricultural noise sources would consist mainly of equipment noise from feed mills and milking equipment in the vicinity of farm hubs, and noise from tractors operating in surrounding fields and entering and exiting farm hubs. Daily visits to sheds to feed and monitor animals, intermittent deliveries of feed, and collections of beef cattle or milk would also be commonplace.

It should be noted that the Lalor farm has been in operation for many years prior to the construction of the buildings to which this retention application applies. Therefore, due to synergies with existing operations, there is not a direct pro-rata correlation between the increased numbers of animals housed and an increase in noise generated.

As there is an existing farm at this location, there would be no increase in the number of farm visits by farm managers, other than intermittent increases due to illness or equipment malfunction.

The existing farmhouses at the site are used for beef farming, while the constructed development is a dairy parlour and associated services, and it is not anticipated that there would be a significant increase in deliveries of feed. Silage would be used for both operations, and feed delivery would remain at current levels for the beef operation. The intensity of farm traffic during silage harvesting would be would be expected to increase to meet the demand for the dairy operation. However, the route of silage traffic would be dependent upon the location of the field which is being harvested.

Lorry traffic for the collection of beef animals for market would also remain the same, as this operation would not change should the new development be retained. However, an additional 1 truck load per annum to the mart would be expected from the dairy development.

The slurry produced on this site is applied to the adjoining lands, which are accessed via the western lane.

The principal changes to the existing noise environment would occur as a result of the new development would arise from the new milking parlour equipment and milk lorry collections. These factors have been discussed further below.

The adjacent residence is associated with a similar dairy farming hub, and identical operations and traffic types would continue to occur in the access lane. Therefore, while there may be an increase in some types of farm traffic, the noise character would remain the same.

Noise Impacts from Operations within the Farm Hub

Milking Parlour

The principal change to the ongoing noise environment at the proposed shed is the new milking equipment within the new building. The new milking equipment would operate during milking time in the morning or evening and would remain turned off at all other times.

Onsite noise measurements provided in Table 6.5 above detail that the milking equipment generated a noise level of 78 dB LAeq,T at 1m during start up, and 75 dB LAeq,T at 1m while idling.

Noise monitoring carried out with the milking equipment turned on and off at surrounding locations found that the noise from the equipment had fallen to existing average noise levels within 35m to the south (SN3) and 65m (SN5) to the east. The operating equipment was audible at these locations and added an average of 1 dBA to existing noise levels.

Noise from the operating equipment was not audible at the farm entrance near the closest noise sensitive receptor (SN6) and monitoring showed no significant influence upon existing average noise levels. The negligible influence during the assessment period are due to the intervening farm buildings blocking noise, and distant noise from traffic and tractors operating in fields. A tractor operating in the vicinity of the adjacent third-party farmyard intermittently added to the noise environment in the area.

Table 7.4 above provides an assessment of the theoretical impact of noise from the milking parlour equipment in the context of the long-term average baseline L_{90} noise level during the day, evening and night time at the neatest noise sensitive receptor (NSR1).

Taking into account the distance between the milking parlour and NSR1 and barrier attenuation from intervening buildings, it has been predicted that noise from milking equipment would result in a noise level of 28 dB LAr,T at NSR1.

During times of low background noise, it is predicted that milking parlour noise would range from 5 dBA to 0 dBA below background noise levels during the day-time, evening and night-time. At these noise levels, it would be anticipated that the milking parlour would be lowly audible at external locations to the west and south of the NSR1 residence.

However, it should be noted that, with the milking parlour door closed, a reduction of a further 10 dBA would be expected and the milking parlour would not be audible at the residence.

All predicted noise levels for the milking parlour fall below the recommended EPA NG4 noise limits of 40 dBA day-time, 35 dBA evening and 30 dBA night-time.

Assuming a 10 dBA noise reduction for an open window, the resultant internal noise level within rooms of NSR1 would be 18 dBA which would fall below the 30 dB LAeq night-time guidance limit for bedrooms recommended as per WHO / BS8233 guidance.

As predicted noise levels would be below existing noise levels, would only be lowly audible in external areas during low noise periods, and would be in compliance with accepted noise impact standards, it is considered that noise from the milking equipment would not have a significant impact upon the noise sensitive receptor.

Tractors operating within Farm Hub

Prior to the erection of the developments onsite, it would have been common practice for tractors to be operating within the farm area. While the operation of tractors onsite would be expected to occur over longer periods due to increased cattle numbers, it is not anticipated that the character, average or maximum noise levels from tractors would change. Therefore, it is considered that the operation of tractors at the new development would not significantly alter the existing noise environment of the area.

As can be seen in Table 7.4 above, an assessment of existing tractor noise in combination with new milking equipment noise has been assessed against the long-term average baseline L_{90} noise level during the day, evening and night time at the neatest noise sensitive receptor (NSR1).

Taking into account the distance between the milking parlour and NSR1 and barrier attenuation from intervening buildings, it has been predicted that noise from tractors within the farmyard would result in a noise level of 36 dB LAr,T at NSR1.

During times of low background noise, it is predicted that farmyard tractor noise would range from 3dBA to 8dBA above background noise levels during the day-time, evening and night-time. At these noise levels, it would be anticipated that the farmyard tractors would be audible (day) to clearly audible (night) at external locations of the NSR1 residence, particularly during evening and night-time.

Predicted noise levels for tractors operating at the site would fall above the recommended EPA NG4 noise limits of 35 dBA evening and 30 dBA night-time. The predicted noise level is in compliance with the recommended daytime noise limit of 40 dBA.

While tractors operating at the site would be audible during periods of low background noise conditions and fall above evening and night time recommended noise levels, it should be noted that the noise character and magnitude would be identical to the pre-development conditions.

Assuming a 10dBA noise reduction for an open window, the resultant internal noise level within rooms of NSR1 would be 26 dBA which would fall below the 30 dB LAeq night-time guidance limit for bedrooms recommended as per WHO / BS8233 guidance.

As tractor activity was an established part of the noise environment prior to the proposed development and predicted internal room noise levels at NSR1 are in compliance with the BS8233 noise standard, it is considered that noise from farmyard tractors would not have a significant impact upon the noise sensitive receptor.

Noise Impacts from Pass-by Traffic on the Access Lane

At present, the local lane passes within 1-2 meters from the façade of NSR1, with the centre of the carriage being approximately 5m from the façade. There is a speed bump on the road just to the east of the residence’s front yard as a traffic calming measure.

As can be seen in Figures 6.1 to 6.5 above, the noise environment of the area is characterised by a generally low background noise level ($L_{Aeq, 30min}$ and L_{AF90}), with intermittent increases in noise due to traffic passing on the local lane and nearby local road or tractors operating in local fields (L_{AFmax}).

Prior to the construction of the developments for this retention application, traffic accessing the applicant's farmyard and the farmyard located behind NSR1 were via an existing use of the laneway for existing operations at the farmyard, daily site visits by farm mangers, and intermittent lorries for the delivery of feed, collection of cattle for market, harvesting of silage and land-spreading of farm slurry were in place.

The proposed development introduces a dairy operation in addition to the existing beef operation. This would result in an additional stop for the milk lorry. However, it should be noted that the milk lorry already uses the existing lane to collect milk from the adjacent third-party farmyard.

The slurry produced on this site is applied to the adjoining lands, which are accessed via the western lane, and the route of silage traffic would be dependent upon the location of the field which is being harvested.

Due to the above criteria, it is not considered that the proposed retention development would significantly change the existing noise environment in the area. While there would be an increase in the frequency of traffic movements in spring / summer for slurry and late summer / autumn due to silage harvesting, the noise character and maximum noise level would remain unaltered from existing conditions. The numbers and intermittency of traffic movements during these operations would also not be anticipated to significantly increase the existing average background noise levels at these times.

As can be seen in Table 7.5 above, existing maximum traffic noise levels have been assessed against the long-term average baseline L_{90} noise level for the area at NSR1 during day, evening and night times. Both figures have been derived from the long-term monitoring dataset at NM1.

It has been predicted that existing maximum traffic noise along the lane would result in a noise level of 69 dB LAFmax at the NSR1 façade. It is considered that this noise level is representative of maximum noise levels occurring prior to and post development of the new shed for retention.

During times of low background noise, it is predicted that existing maximum traffic noise would range from 36dBA to 41dBA above background noise levels during the day-time, evening and night-time.

Assuming a 10dBA noise reduction for an open window, the resultant internal noise level within rooms of NSR1 would be 59 dB LAFmax which would fall above the 35 dB LAFmax night-time guidance limit for bedrooms recommended as per WHO / BS8233 guidance. This noise level would be the case prior to or post the development for retention, or in the absence of activity within the applicants farm hub due to farm related traffic at NSR1.

The option of constructing a new access lane to remove site related traffic passing the directly adjacent to the residence has also been assessed. The access lane has been included at a set-back distance of approximately 15m from the centre of the road to the residence façade.

This set back distance would result in a maximum noise level of 60 dB LAFmax, a fall of 9 dBA from existing levels.

Assuming a 10dBA noise reduction for an open window, the resultant internal noise level within rooms of NSR1 would be 50 dB LAFmax which would fall above the 35 dB LAFmax night-time guidance limit for bedrooms recommended as per WHO / BS8233 guidance.

It is concluded that there would be no significant change in the existing noise environment as a result of traffic from the retention of the proposed development as it is currently constructed, as the frequency of use of the lane would not change significantly and the character of the traffic noise would be similar.

The construction of a new road at 15m distance from the nearest residence would result in a reduction of noise impact upon the nearest residence, however, maximum noise levels would remain in exceedance of recommended noise levels.

In order to minimise potential noise impacts due to traffic on the new lane, it is recommended that speed bumps be installed on the entrance and exit to the new access lane. This would prevent traffic speeds exceeding existing speeds on the existing access lane.

However, it should be noted that maximum noise levels on the existing lane would remain unaltered due to tractors and lorries accessing the farmyard behind NSR1.

9.0 CONCLUSIONS

As a result of this baseline noise survey and predictive analysis on the potential impact of the proposed development on noise at sensitive receptor, the following conclusions have been made;

- As a result of long-term background monitoring, it has been determined that this is a low background noise area where noise levels usually fall below 40 dBA during the day-time, 35 dBA during evenings and 30 dBA during the night-time.
- This low background noise environment is intermittently influenced by increased noise from traffic passing along the access lane, local road and tractors operating in the surrounding farmland.
- There would be a minor increase in operational traffic, minimised due to synergies with existing operations at the applicant farmyard and the adjacent farmyard. The main changes in the noise environment would be as a result of the new milking parlour equipment and an increase in the duration / frequency of some activities at times of the year.
- As predicted noise levels would be below existing noise levels, equipment would be lowly audible in external areas during low noise periods, and would be in compliance with accepted noise impact standards, it is considered that noise from the milking equipment would not have a significant impact upon the local noise sensitive receptor.
- As tractor activity in the farmyard was an established part of the noise environment prior to the proposed development and predicted internal room noise levels at NSR1 are in compliance with the BS8233 noise standard, it is considered that noise from tractors in the farmyard would not have a significant impact upon the noise sensitive receptor.
- It has been predicted that existing maximum pass-by traffic noise along the lane would result in a noise level of 69 dB LAFmax at the façade NSR1. It is considered that this noise level is representative of maximum noise levels occurring prior to and post development of the new shed for retention.
- The set-back of the new lane, approximately 15m from the façade, would reduce noise levels at the noise sensitive receptor, however, noise levels would remain above recommended limits for internal room noise.
- It should be noted that maximum noise levels on the existing lane would remain unaltered due to tractors and lorries accessing the farmyard behind NSR1.

It is the main conclusion of this report that there would be no significant impact upon noise levels at the nearest noise sensitive location as a result of the retention of the proposed development. The noise environment would not be significantly different from existing conditions.

10.0 RECOMMENDATIONS

Implement noise mitigation measures during design and operational phases of the project. This should include:

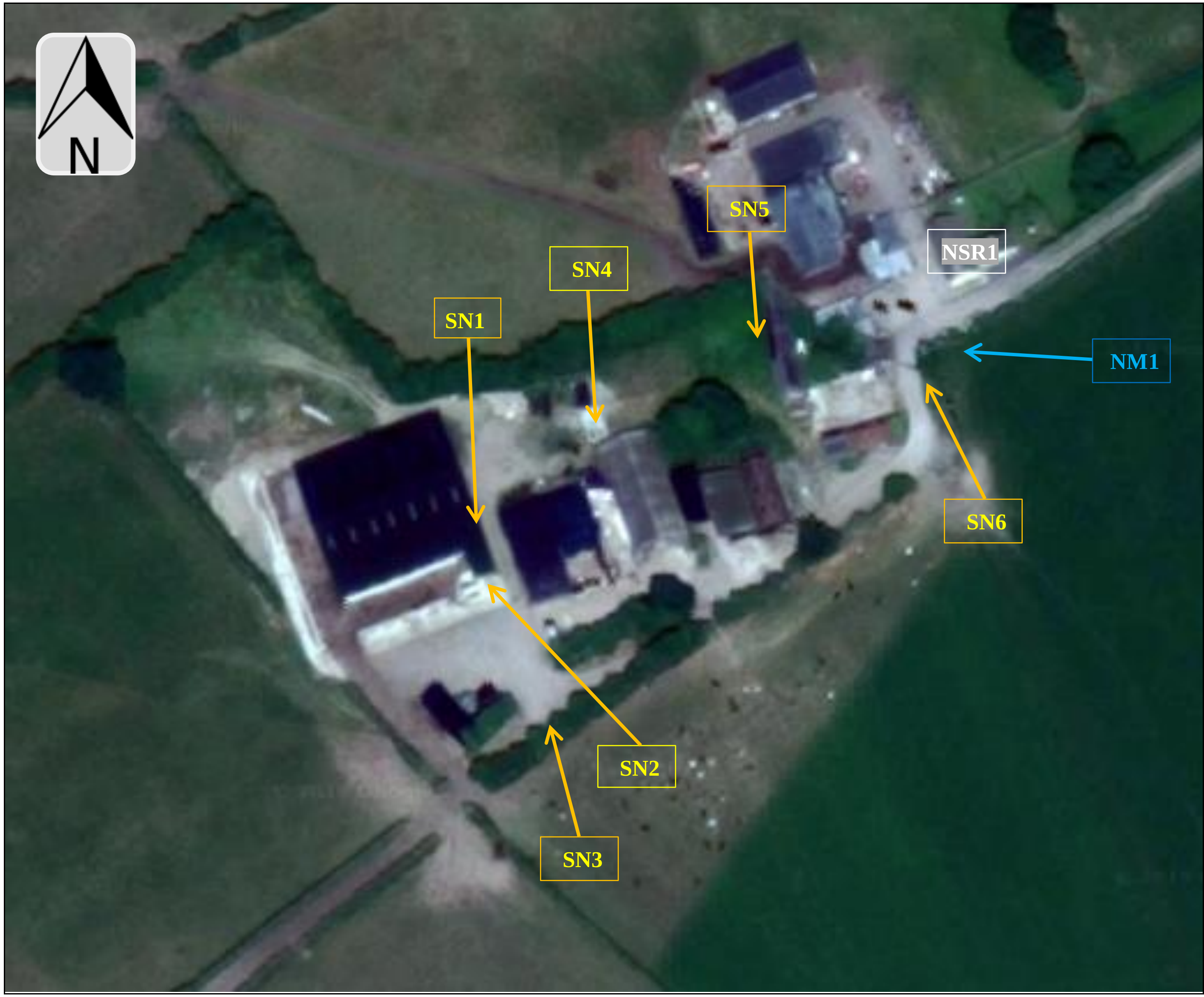
1. Speed bumps should be installed at the entrance and exit of the new access lane.

11.0 REFERENCES

- ISO 9613-2:1996 "*Attenuation of Sound during Propagation Outdoors*".
- 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).
- British Standard EN BS 4142:2014 "*Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*"
- British Standard EN BS 8233:2014"*Guidance on sound insulation and noise reduction for buildings"*
- EPA (2016) '*Guidance Note on Noise* (NG4)'
- National Roads Authority, (2004). *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*.

APPENDIX A

- NOISE MONITORING LOCATIONS-



Notes

NM – 24-hour Monitoring

SN – Noise Source Monitoring

NSR – Noise Sensitive Receptor

Project Title:

Noise Monitoring

Client Name:

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Drawing Status:	**Scale:**	NTS	A4
Report	**Datum:**	Bing	
Drawing Number:	**Drawn:**	NR	
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APPENDIX B

- NOISE PREDICTION CALCULATIONS -

B1: Noise Attenuation Calculations

B1.1 Divergence Attenuation

Divergence Calculation - NSR1 (Parlour)									
d		**113**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	52	52	52	52	52	52	52	52	61
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 - NSR1 (Traffic @ 5m)									
d		**5**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	25	25	25	25	25	25	25	25	34
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)								

Divergence Calculation - NSR1 (Traffic @ 15m)									
d		**15**		**d_0**		**1**			
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB**
A_{div}	35	35	35	35	35	35	35	35	44
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)								

B1.2 Barrier Attenuation

Barrier Attenuation Calculation - NSR1 (Parlour)								
dss (m)	70	**dsr (m)**	43	**d_{direct} (m)**	113	**h (m)**	4	
f(Hz)	63	125	250	500	1000	2000	4000	8000
λ (m)	5.46	2.75	1.38	0.69	0.34	0.17	0.09	0.04
d	0.117242	0.11724	0.11724	0.11724	0.11724	0.11724	0.11724	0.11724
N	1.2803	0.6448	0.3236	0.1618	0.0797	0.0399	0.0199	0.0101
Ω	2.84	2.01	1.43	1.01	0.71	0.50	0.35	0.25
Dz/Abar	9	6	4	2	1	1	0	0
Where:	dss = distance from noise source to top of barrier (m)							
	dsr = distance from noise receiver to top of barrier (m)							
	d_{direct} = shortest distance between source and receiver (m)							
	h = height of barrier							
	f(Hz) = centre of third octave band frequency							
	λ (m) = wavelength at centre of third octave band frequency							
	d = differential path length (dss+dsr-d_{direct})							
	N = the Fresnel Number (N = 2 d / λ)							
	Ω = is the coefficient of attenuation due to the sound barrier							
	Dz / A_{bar} = is the attenuation due to the barrier							

B2: Predicted Noise Levels

B2.1: Predicted Operational Noise Calculation

Predicted Noise Calculation - NSR1 (Milking Parlour)									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source dBA	54	58	61	72	73	68	79	61	78
A_{div}	52	52	52	52	52	52	52	52	
A_{bar}	9	6	4	2	1	1	0	0	
A	61	58	56	54	53	53	52	52	
NSR dBA	**-7**	**0**	**4**	**17**	**20**	**15**	**27**	**8**	**28**
								Result	**28**

Predicted Noise Calculation - NSR1 (Combined Tractor and Parlour)									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source dBA	90	83	74	76	75	72	79	62	92
A_{div}	52	52	52	52	52	52	52	52	
A_{bar}	9	6	4	2	1	1	0	0	
A	61	58	56	54	53	53	52	52	
NSR dBA	**29**	**25**	**17**	**21**	**21**	**19**	**27**	**10**	**33**
								Result	**33**

B2.2: Predicted Pass-by Traffic Noise Calculation

Predicted Noise Calculation - NSR1 (Traffic @ 5m)									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source dBA	90	83	73	73	70	69	61	56	91
A_{div}	25	25	25	25	25	25	25	25	
A	25	25	25	25	25	25	25	25	
NSR dBA	**65**	**58**	**48**	**48**	**45**	**44**	**36**	**31**	**66**
								Result	**66**

Predicted Noise Calculation - NSR1 (Traffic @ 15m)									
Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Source dBA	90	83	73	73	70	69	61	56	91
A_{div}	35	35	35	35	35	35	35	35	
A	35	35	35	35	35	35	35	35	
NSR dBA	**56**	**49**	**39**	**39**	**36**	**35**	**27**	**22**	**57**
								Result	**57**

APPENDIX C

- NOISE METER CALIBRATION CERTIFICATE -

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	2594796	Calibration Ref.	A1811

Calibrated by	T. A. Goodwil.
Calibration Date	08 November 2018
Calibration Certificate Number	265284

This Calibration Certificate is valid for 12 months from the date above.

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

Cirrus Research plc
dedicated to noise measurement

Certificate Number: **121599**
Date of Issue: **28 August 2018**

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: **28 August 2018**

Initial Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	94.14	1000.1	0.25
2	94.13	1000.1	0.24
3	94.12	1000.1	0.25
Average	**94.13**	**1000.1**	**0.25**
Uncertainty	± 0.13	± 0.1	± 0.10

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

Adjusted Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	93.99	1000.1	0.24
2	93.99	1000.1	0.25
3	94.00	1000.1	0.25
Average	**93.99**	**1000.1**	**0.25**
Uncertainty	± 0.13	± 0.1	± 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
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Web: www.cirrusresearch.co.uk
UK Registration No. 987160

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

Environmental Conditions

Pressure:	**100.91 kPa**
Temperature:	**21.6 °C**
Humidity:	**51.4 %**

Evidence of Pattern Approval

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC 60942:2003 Annex A to Class 1. This has been confirmed with the PhysikalischTechnische Bundesanstalt (PTB).

Statement of Calibration

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003.

Calibration Laboratory

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

Test Engineer: Terry Goodrich

T. A. Goodrich.

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Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

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CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 3000588	Id: - 3000855
Microphone:	Brüel & Kjær Type 4950	No: 2778445	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 16743	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2615338	
Software version:	BZ7222 Version 2.1	Pattern Approval:	PTB1.63-4046158
Instruction manual:	BE1712-18		

CUSTOMER

Enfonic Ltd
Tecpro House
Dublin
D17 NX50
Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.9 - DB: 4.90) by using procedure 2250-4189.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2017-07-19

Date of issue: 2017-07-19

Mikail Önder
Calibration Technician

Susanne Jørgensen
Approved Signatory