PREPARED: Thursday, 18 May 2023

OAKCUTS FARM, ABBOTTS ANN

GRAIN DRYER NOISE IMPACT ASSESSMENT

CONTENTS

LIST OF ATTACHMENTS

Project Ref	AS12965	Title:	Oakcuts Farm, Abbotts Ann
Report Ref:	AS12965.230505.NIA	Title:	Grain Dryer Noise Impact Assessment
Client Name	Strutt & Parker		
Project Manage	Matthew Sugden		
Report Autho	Ian MacArthur		
Clarke Saunders Acoustics Winchester SO22 5BE		This report has been prepared in response to the instructions of our client. It is r intended for and should not be relied upon by any other party or for any other	

1.0 INTRODUCTION

1.1 A new grain drying and store facility is proposed at Oakcuts Farm, Abbotts Ann, Andover Hampshire, SP11 7RW.

1.2 Clarke Saunders Acoustics (CSA) has been appointed to conduct an impact assessment of the proposals and advise on any required noise mitigation measures.

1.3 An environmental sound survey has been conducted, in addition to attended survey measurements of a similar facility at the nearby Eastover Farm. This data has allowed an assessment of impact to be made, following the procedures within BS4142:2014+A.1:2019 *Methods for rating and assessing industrial and commercial sound* (BS4142).

1.4 A summary of the acoustic terminology used throughout this report is provided at Appendix A.

2.0 SITE DESCRIPTION & PROPOSALS

2.1 The grain drying and storage building is proposed to be located to the east of Oakcuts Farm, across Stockbridge Road, in the north-west corner of the existing agricultural field.

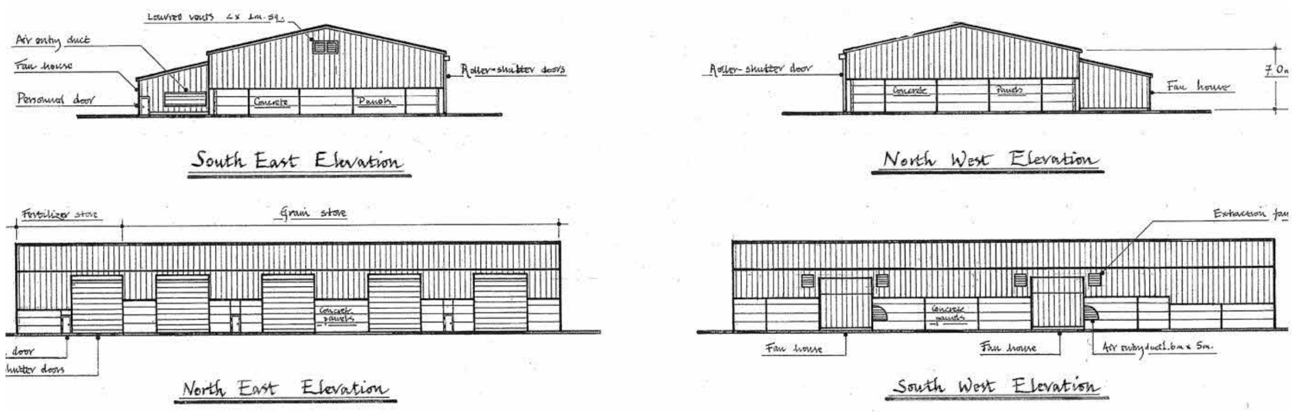
2.2 The attached site plan AS12965/SP1 shows the site and its surroundings.

2.3 Oakcuts Farm comprises a number of agricultural buildings, including an existing grain store with high level fans.

2.4 There are two residential properties adjacent to the farm, located across Stockbridge Road to the north of the proposed building. The farm and dwellings are relatively secluded and surrounded by woodland and agricultural fields. The next nearest residential properties are located 1km to the north west, and >1.4km to the south and southwest.

2.5 The proposed grain drying store comprises a single agricultural building measuring approximately 62mx27m, with the roof apex 10m above ground level.

2.6 The store is divided into five bays. On the south side of the building are the fan houses which each contain two pairs of in-line 22Kw axial fans. These fans supply air into internal air plenums, which feed into smaller plenums running under each bay to dry the grain. Air extraction is assisted by low speed axial fans via six high level louvres in the south and south east walls.



2.7 The load and airflow demand requirements of the intake fans is highly dependent on the moisture content of the grain and the ambient humidity conditions.

2.8 The worst-case airflow requirement would occur when all bays are full of wet grain, which would require all eight supply fans and extract fans to be run at highest design duty. This would continue on a 24hr basis until the grain is suitably dry.

2.9 For other drying scenarios, the fans are operated at lower duties and for shorter periods of time. The worst case 24hr scenario as described will therefore be considered for the purposes of assessment.

2.10 An additional scenario is considered, for daytime assessment purposes, where the fans may be run at a high duty when the grain bays are empty to assist in clearing and cleaning the floor plenums. With the grain bays empty, higher noise levles arise in the order 15dB arise in the grain bays, with similar emission from the associated building façade elements.

2.11 The roller shutter doors for access to the grain bays on are the northern façade and are typically kept shut, other than during deliveries.

3.0 RELEVANT STANDARDS AND GUIDANCE

3.1 BS4142:2014

3.1.1 BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS4142) provides a methodology to assess the likelihood of adverse impact arising from sound generated by industrial and commercial sound sources. Context forms an important part of the Standard.

3.1.2 A summary of the BS4142 assessment methodology is provided at Appendix B.

3.2 BS8233 GUIDELINES

3.2.1 BS8233: 2014 *Guidance on sound insulation and noise reduction for buildings* provides guidance on desirable internal ambient noise levels in residential dwellings due to ‘anonymous’ noise, such as that from road traffic.

3.2.2 The desirable ambient noise levels in dwellings are shown in Table 4.1.

ACTIVITY	LOCATION	07:00 TO 23:00	23:00 TO 07:00
Resting	Living Room	35 dB $L_{Aeq, 16 hour}$	-
Dining	Dining Room	40 dB $L_{Aeq, 16 hour}$	-
Sleeping (daytime resting	Bedroom	35 dB $L_{Aeq, 16 hour}$	30 dB $L_{Aeq, 8 hour}$

Table 4.1– *BS8233 Desirable internal ambient noise levels*

4.0 SURVEYS

4.1 PROCEDURE AND EQUIPMENT

4.11 A survey of the existing background and ambient sound levels was undertaken at the position shown in site plan AS12965/SP1. The monitoring location was selected to be as secure as practicable, whilst being fully representative of the acoustic climate nearest residential dwellings, located at a similar distance from Stockbridge Road.

4.1.2 Automated measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken ns between 12:00 hours on Monday 17th April and 15:00 hours on Wednesday 19th April 2023, following procedures in BS4142 and BS7445:1991 *Description and measurement of environmental noise Part 2: Acquisition of data pertinent to land use*.

4.1.3 Additional observations and measurements were undertaken at a similar grain drying store at Eastover Farm in order to verify operational procedures and validate calculation assumptions.

4.1.4 The following equipment was used during the course of the survey:

1 no. Rion data logging sound level meters type NL32;
1 no. Norsonic data logging sound level meter type 118;
1 no. Rion sound level calibrator type NC74;
1 no. Norsonic sound level calibrator type 1251.

4.1.5 The calibration of the sound level meters was verified before and after use. No significant calibration drift was detected in any meter.

4.1.6 The weather throughout the survey period was dry with light winds, which are suitable conditions for the measurement of environmental sound.

4.2 RESULTS

4.2.1 Background noise levels at the site are relatively low, owing to the remote location. Stockbridge Road is lightly trafficked, although road traffic contributes to daytime average and maximum noise levels. Agricultural equipment and vehicles in and around the farm also contribute to measured daytime average and maximum levels.

4.2.2 Figures AS12965/TH1-TH3 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at themeasurement position.

4.2.3 Table 4.1 shows the overall background and ambient sound levels measured at the monitoring position.

MONITORING PERIOD	AVERAGE AMBIENT $L_{Aeq,5mins}$	TYPICAL LOWEST BACKGROUND* $L_{A90,5mins}$
07:00 - 23:00 hours	54 dB	30 dB
23:00 - 07:00 hours	47 dB	25 dB

Table 4.1– *Measured environmental sound levels at monitoring position*
** derived from 10th percentile of relevant dataset*

5.0 ASSESSMENTS

5.1 BS4142 INITIAL ASSESSMENT

5.1.1 Based on the proposed fan manufacturer’s noise data at the design duty (Flaktwoods 22kW), calculations have been undertaken of anticipated noise emissions from the grain building.

5.1.2 Calculations have utilised CadnaA noise mapping software, implementing ISO9613-2 propagation algorithms. For the purpose of modelling noise emissions, the building has been split into various individual noise sources comprising:

Fan house air inlets

Fan house wall breakout noise

Grain Store wall lightweight cladding breakout

Grain Store Roof breakout noise

Grain Store air exhaust louvre breakout

Calculation Assumptions

5.1.3 The following calculation assumptions have been made, based on current design information and observations and measurements undertaken at Eastover Grain Dryer.

2m long circular intake silencer fitted to fans;

Fan house walls and roof comprise insulated profile steel cladding;

Main building cladding comprising single skin profiled steel;

Due to low power and size, extract fans have negligible contribution to high level louvre emission level;

Empty grain store bays result in ~15dB increase in internal reverberant levels compared to when full.

Grain Drying - Worst Case 24hr Use

5.1.4 Table 5.1 presents a summary of the initial BS4142 numerical assessment, showing the levels expected at the the nearest residential dwelling. The associated noise contour plot is shown in AS12965/NM1.

5.1.5 No specific acoustic corrections are deemed to be warranted for tonality, impulsivity or intermittency. As it is anticipated that the noise source may be readily distinctive against the residual acoustic environment, however, a penalty of +3dB could be justified as is assumed.

PARAMETER	LEVEL
Specific Level	$L_{Aeq,1hr}$ 25 dB
Character Correction	Yes: + 3dB for potentially being distinctive against the residual acoustic environmen
Rating Level	$L_{Ar,Tr}$ 28 dB
Background Level (night-time)	L_{A90} 25 dB
Assessment Level	+ 3dB

Table 5.1– *Summary of BS4142 assessment – grain drying*

5.1.6 This initial assessment outcome is between the level which BS4142 indicates '*low impact, depending on the context*' and the level which '*could be an indication of an adverse impact, depending on the context*'.

5.1.7 The calculated worst case scenario specific level is equal to the lowest night-time background level measured. Although not impossible, this operational scenario is unlikely to occur on any frequent basis, with more typical operational scenarios being between 5-10dB lower in level, i.e. below the background.

5.1.8 The context of the area is one of a rural agricultural nature. The nearest receptors are adjacent to the Oakcuts Farm. These premises represent established agricultural activity and processes, including large agricultural ventilation fans which are likely to be significantly higher in sound level than those of the proposal.

5.1.9 With the context of the site and source considered, the initial assessment can be modified such that it is '*an indication of low impact*'.

Grain Drying - Worst Case Daytime Scenario

5.1.10 On occasion, all fans may be run at a high duty when the grain bays are empty to assist in clearing and cleaning the floor plenums. This scenario is also likely to occur during commissioning of the facility. With the grain bays empty, slightly higher noise breakout would occur from the building façade elements.

5.1.11 It is noted that operating the fans at high duty with empty bays would represent the highest potential noise emissions from the facility. This scenario would occur rarely and only during daytime hours for limited periods. For completion, noise emissions associated with this scenario are assessed below.

PARAMETER	LEVEL
Specific Level	$L_{Aeq,1hr}$ 35 dB
Character Correction	Yes: + 3dB for potentially being distinctive against the residual acoustic environmen
Rating Level	$L_{Ar,Tr}$ 38 dB
Background Level (daytime)	L_{A90} 35 dB
Assessment Level	+3 dB

Table 6.2 – *Summary of BS4142 assessment – building clearing/cleaning*

5.1.12 Again, the initial assessment outcome is between the level which BS4142 indicates '*low impact, depending on the context*' and the level which '*could be an indication of an adverse impact, depending on the context*'.

5.1.13 With the context of the site and source considered as above, and given the infrequent circumstance, the initial assessment can be modified such that it is '*an indication of low im pact*'.

5.2 BS4142 UNCERTAINTY

5.2.1 As per the requirements of BS4142, the uncertainty in the assessment is considered and reported. This is not an indication of error, but an acknowledgement of possible variability of the factors contributing to this assessment.

5.2.2 Background levels were measured during an extended period of calm, dry weather and the typical lowest level used as the basis for the assessment. This has reduced as far as practicable uncertainty with regard to background levels.

5.2.3 Manufacturers' noise data combined with observation and surveys of a similar facility has reduced uncertainty with regard to noise emissions from the proposals.

5.2.4 Use of the loudest potential operational scenarios has reduced uncertainty with regard to variability in operation.

5.2.5 The potential environmental effects on sound propagation have been considered by assuming downwind propagation in all directions, minimising uncertainty in this respect.

5.2.6 Residual uncertainty of the assessment outcome is therefore considered to be low.

5.3 BS4142 FINAL ASSESSMENT

5.3.1 Following the BS4142 direction to frame the sound impact assessment in the context of its setting, the assessment suggests that, in the worst case, emissions associated with operation of the grain drying building would constitute a low impact. There would consequently be a low likelihood of the residents experiencing adverse sound impacts.

6.0 CONCLUSIONS

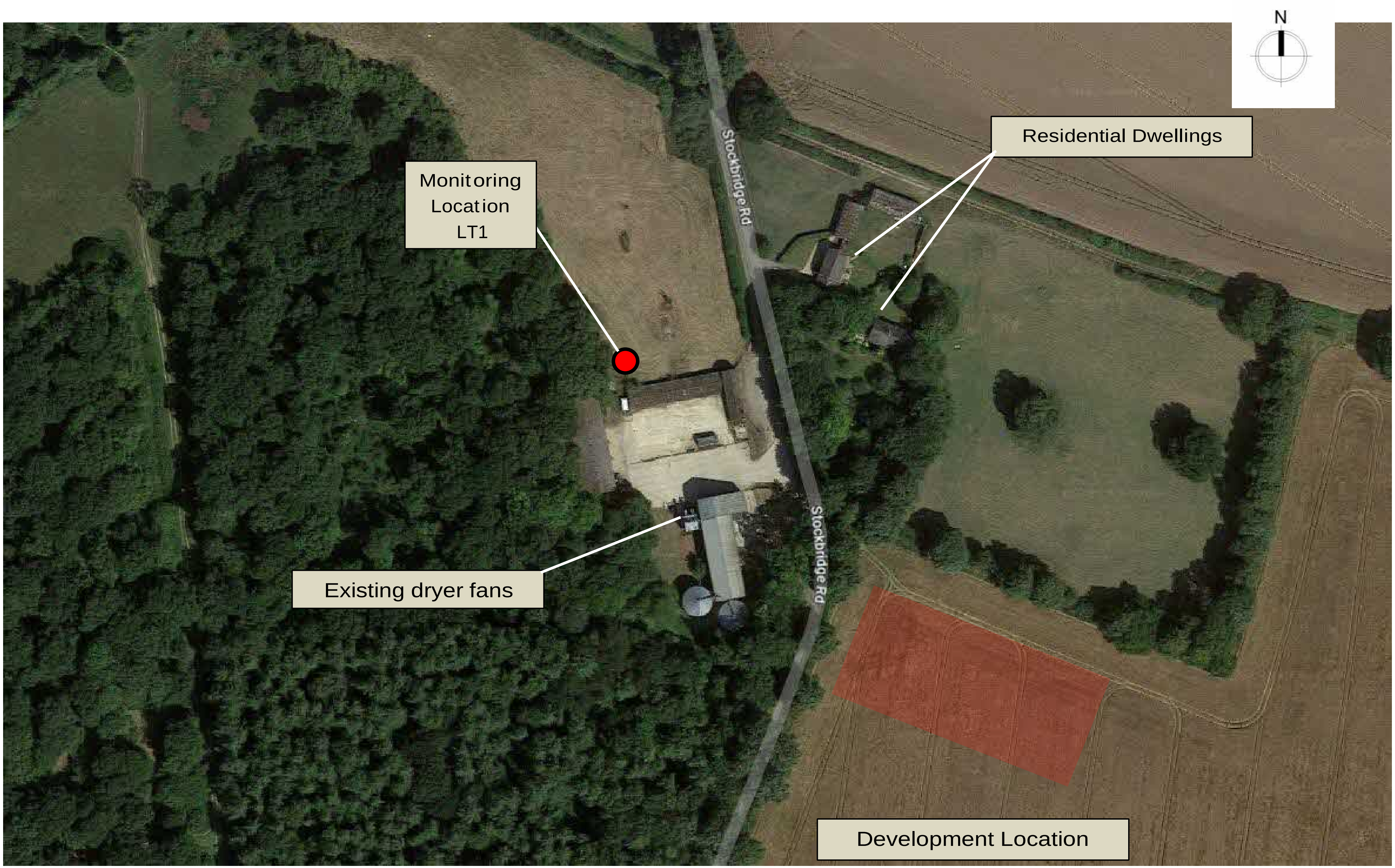
6.1 Clarke Saunders Acoustics has conducted an acoustic assessment of the potential noise emissions from the proposed grain dryer storage facility at Oakcuts Farm, Abbotts Ann on the nearest noise sensitive receptors.

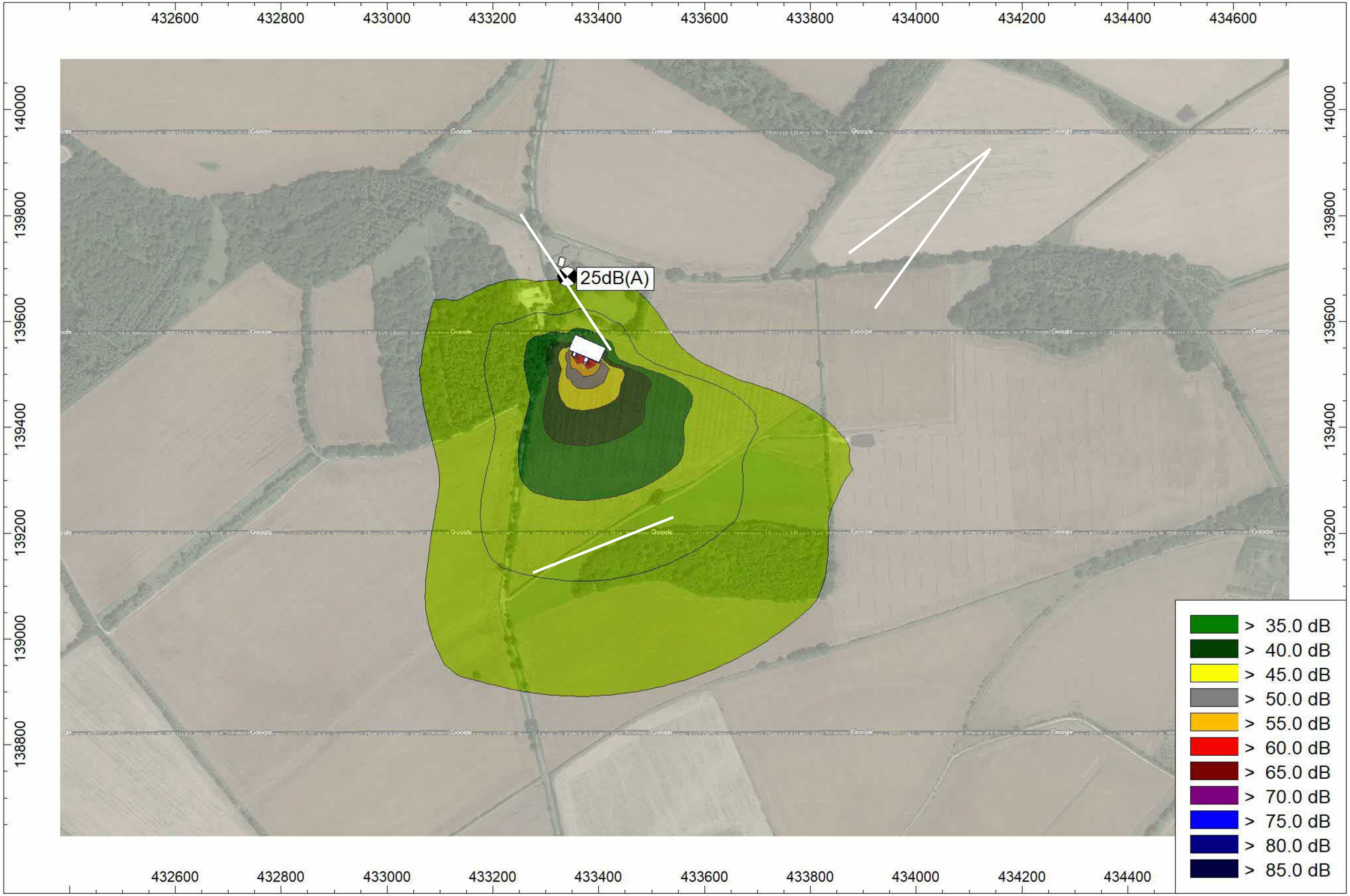
6.2 Environmental background monitoring has been undertaken to establish the current ambient and background noise climate upon which to base a BS4142 noise impact assessment.

6.3 The BS4142 assessment has indicated that in the context of the site and surroundings. The calculated worst case operational noise levels would represent a 'low impact' and that it is unlikely that residents will experience adverse sound impact as a result proposed operations.

[redacted]

Ian MacArthur MIOA
CLARKE SAUNDERS ACOUSTICS


N
Residential Dwellings
Monitoring Location LT1
Stockbridge Rd
Existing dryer fans
Stockbridge Rd
Development Location



432600
432800
433000
433200
433400
433600
433800
434000
434200
434400
434600
140000
139800
139600
139400
139200
139000
138800
25dB(A)
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB

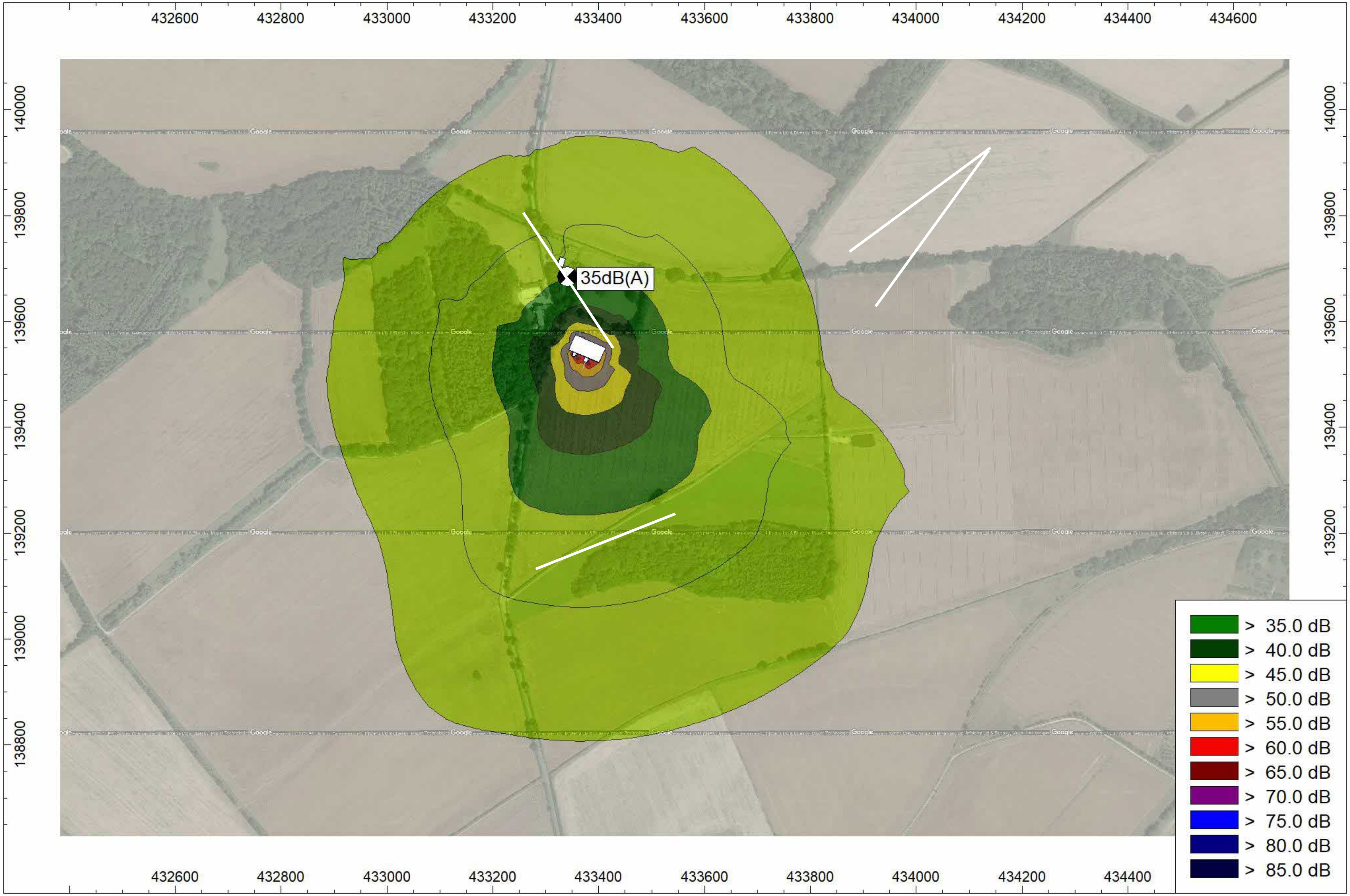
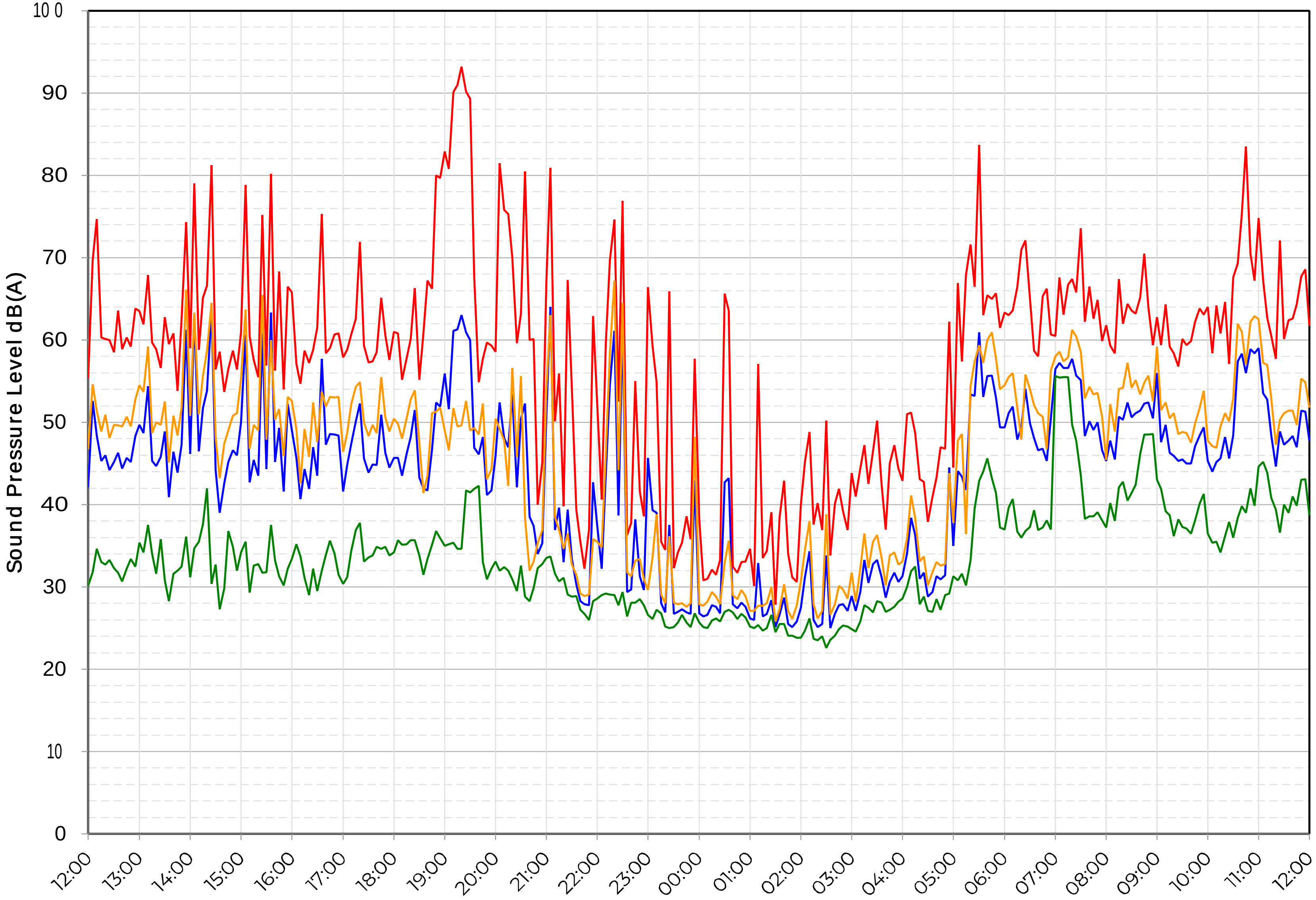


Figure AS12965/NM2

clarke saunders acoustics

Oakcuts Farm

Position LT1



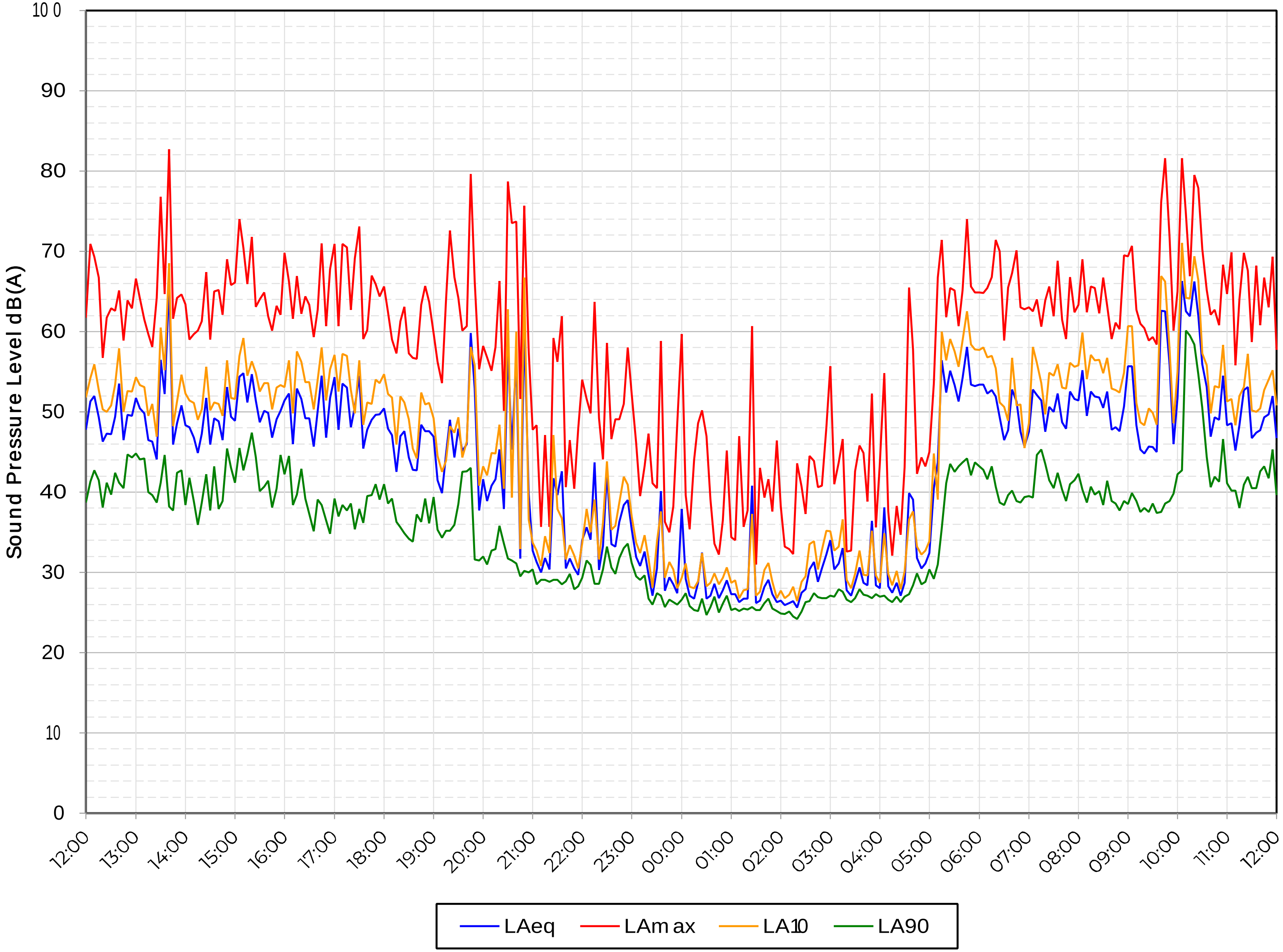
Mon 17 Apr to Tue 18 Apr

Figure AS12965/TH1

clarke saunders acoustics

Oakcuts Farm

Position LT1

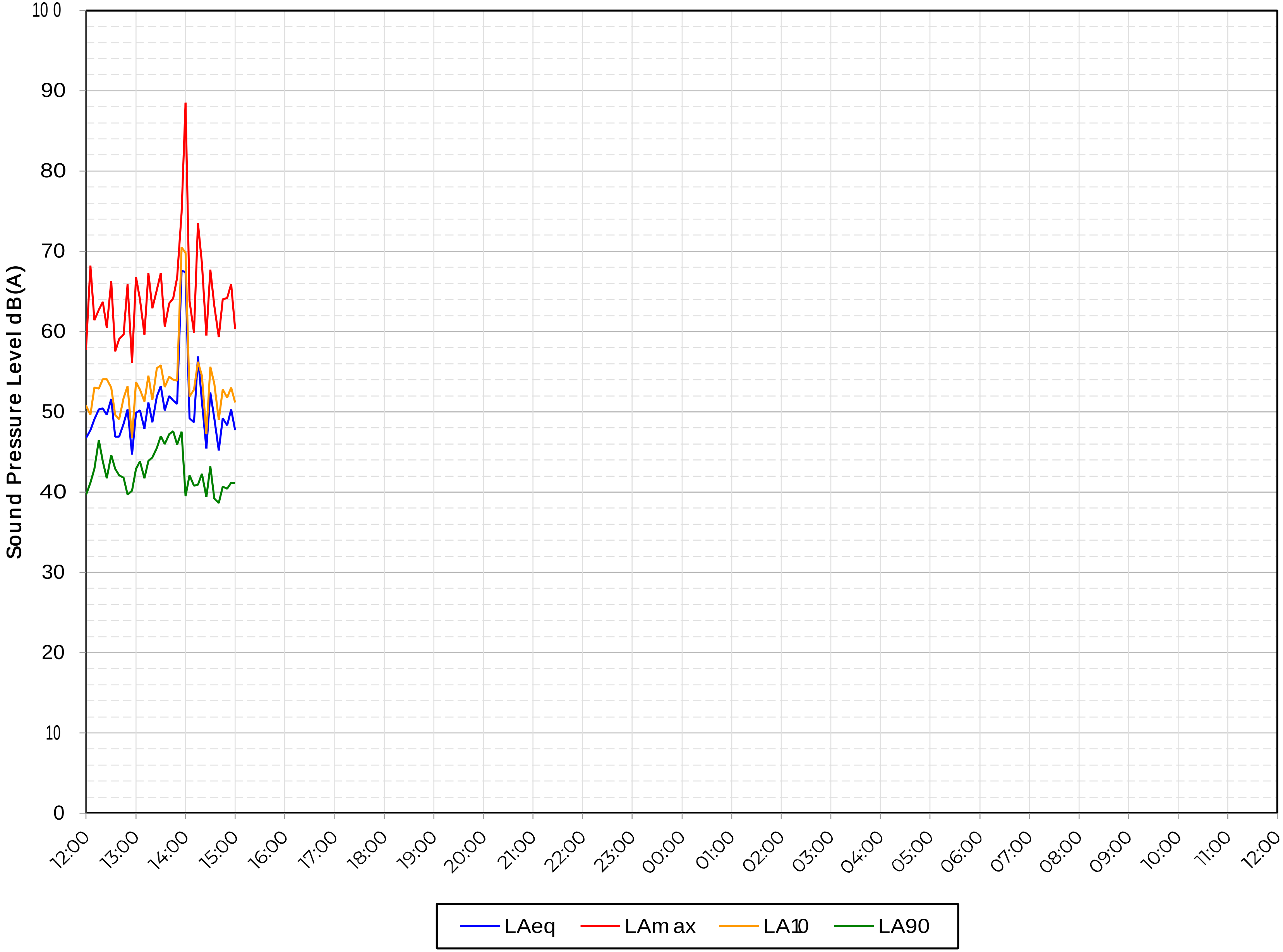


Tue 18 Apr to Wed 19 Apr

Figure AS12965/TH2

Oakcuts Farm

Position LT1



Wed 19 Apr to Thu 20 Apr

Figure AS12965/TH3

Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound Vibrations propagating through a medium (air, water, etc.) that are detec the auditory system.

Noise Sound that is unwanted by or disturbing to the perceiver.

Frequency The rate per second of vibration constituting a wave, measured in Hertz (H where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.

dB(A): Human hearing is more susceptible to mid-frequency sounds than thos and low frequencies. To take account of this in measurements and predi the 'A' weighting scale is used so that the level of sound corresponds rou the level as it is typically discerned by humans. The measured or calculate weighted sound level is designated as dB(A) or L_A.

L_{eq} : A notional steady sound level which, over a stated period of time, would c the same amount of acoustical energy as the actual, fluctuating sound m over that period (e.g. 8 hour, 1 hour, etc).

The concept of L_{eq} (equivalent continuous sound level) has primarily been u assessing noise from industry, although its use is becoming more widesp defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction.

Because L_{eq} is effectively a summation of a number of events, it does not ir limit the magnitude of any individual event, and this is frequently used i conjunction with an absolute sound limit.

L_{10} & L_{90} : Statistical L_n indices are used to describe the level and the degree of fluctu of non-steady sound. The term refers to the level exceeded for n% of the Hence, L_{10} is the level exceeded for 10% of the time and as such can be regar as a typical maximum level. Similarly, L_{90} is the typical minimum level and is o used to describe background noise.

It is common practice to use the L_{10} index to describe noise from traffic as, bei high average, it takes into account the increased annoyance that results non-steady nature of traffic flow.

L_{max} : The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud occur which might not be adequately represented by a time-averaged L_{eq} value.

Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band.

In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudnes	Substantial
21 or more	More than a quadrupling or quartering of loudı	Very Substantial

Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

AS12965 OAKCUTTS FARM

APPENDIX B

BS4142 METHODOLOGY

BS4142:2014+A.1:2019 *Methods for rating and assessing industrial and commercial sound* is designed to allow contextual assessment of impact from commercial, or industrial sound on sensitive receptors. Examples covered by the Standard include:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment.
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

In brief, the assessment procedure involves establishing sound levels from the items or processes of interest, (the specific sound source(s)), corrected for any acoustic features to derive the Rating Level, ($L_{Ar,Tr}$), at the relevant assessment position(s). The Rating Level is compared against the existing Background Sound Level, ($L_{A90,T}$), to provide an initial estimate of impact. The Standard offers the following guidance with regard to the significance of estimated impact:

a) *Typically, the greater this difference, the greater the magnitude of the impact;*

b) *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;*

c) *A difference of around +5dB could be an indication of an adverse impact, depending on the context;*

d) *Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context. The lower the rating level is relative to the background sound level, the less likely it is that the specific sound source will have an adverse impact.*

Where relevant, the initial estimate should then be modified by accounting for contextual aspects of the operation of the specific sound source and / or the context of the character of the area.

Other Assessment Parameters and Guidance on Character Corrections

The Specific Sound Level (L_s) is expressed in terms of an L_{Aeq} for a reference time interval, (T_r) of one-hour during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours). The Rating Level is also expressed in terms of the reference time interval, T_r.

The Specific Sound Level can be determined by various means, which can include prediction based on manufacturer's data and accompanying propagation calculations to the assessment position(s). This method could be used, for instance, where the specific sound source is not yet in-situ, or is in-situ but not yet operational.

Where the specific sound source is already operational and in-situ, measurements of the sound climate resulting from both the specific sound source and all other contributing sources, (knows as the Ambient Sound Level, $L_a = L_{Aeq,T}$) should be measured over a representative time period, ideally at the assessment position(s).

Depending on the relative contribution of other sources not related to the specific sound, (known as the residual sound), the Specific Sound Level can be derived by logarithmically subtracting the Residual Sound Level, $L_r = L_{Aeq,T}$, from the Ambient Sound Level.

With justification, representative proxy locations can be used for the measurement of the ambient and/or residual sound climate. Where these measurement locations are not fully representative of the assessment position(s), measurement can be supplemented with calculation.

The Background Sound Level should ideally also be measured at the assessment position(s) but can be measured at representative proxy locations where suitable reasons can be provided. The Background Sound Level should be measured over a period which is suitable to characterise the background sound climate during the period of interest and should normally be at least 15 minutes.

When deriving the Rating Level from the Specific Sound Level, consideration is given to the character of the sound. The Standard provides several methods for deriving appropriate character corrections, offering the following advice for subjective assessment:

Tonality

For sound ranging from not tonal to prominently tonal, the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be allocated as a penalty of 2 dB for a tone which is just perceptible at the sound receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9dB can be applied for sound that is highly impulsive considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be allocated as a penalty of 3dB for impulsivity which is just perceptible at the receiver, 6dB where it is clearly perceptible and 9dB where it is highly perceptible.

Other sound characteristics

Where the specific sound contains characteristics that are neither tonal nor impulsive, but are otherwise startling, disturbing or incongruous with the residual acoustic environment, a penalty of +3dB can be applied.

Intermittency

When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3dB can be applied.