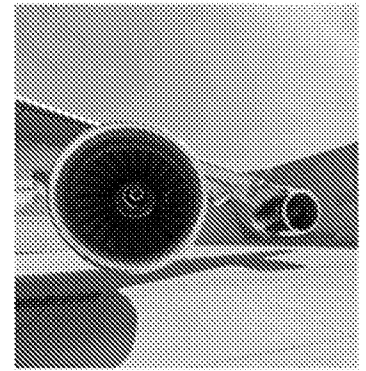
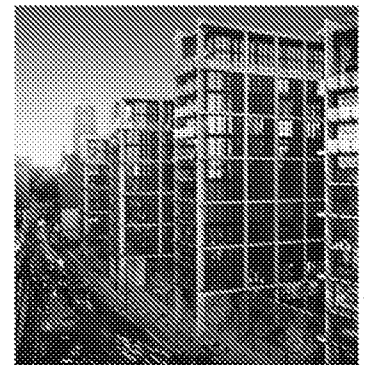




REPORT AS7839.150513.NIA



WINDROOS NURSERY, LITTLEHAMPTON



NOISE IMPACT ASSESSMENT



Prepared: 13 May 2015



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AS7839/SP1	Indicative Site Plan
AS7839/MSP	Mitigation Strategy Plan
AS7839/TH1-TH6	Environmental Noise Time Histories
Appendix A	Acoustic Terminology

1.0 INTRODUCTION

Planning approval has been sought to develop land at Windroos Nursery, Littlehampton for residential use.

Clarke Saunders Associates has been commissioned by Savills to undertake an assessment of the current environmental noise impact on the site, with the aim of discharging Condition 18 of the Arun District Council Planning Decision Notice. Noise will be assessed in accordance with the guidance specified in the World Health Organisation Guidelines for Community Noise.

This assessment will propose outline mitigation measures for the proposed residential development, as required by the Planning Decision Notice.

2.0 SITE DESCRIPTION AND PLANNING PERMISSION CONTEXT

The southern half of the site is currently occupied by Stuart Lyons Haulage company, containing a vehicle maintenance shop, two residential properties and a large amount of hard standing for heavy goods vehicles to manoeuvre and park. The northern half of the site is largely unoccupied, containing only the remains of a glass-house previously belonging to the nursery. The rest of the northern half of the site is empty waste ground.

Immediately to the north and west of the site lies existing residential development. A stretch of national rail runs from west-to-east beyond the residential development to the north, though the noise impact of this on the site is minimised by a combination of distance and screening provided by the intermediate residential development and the neighbouring Watersmead Business Park industrial buildings.

Immediately to the east of the site lies Norway Lane which serves the business park - containing light industrial warehouses, office buildings and car park space. The light industrial buildings receive a regular amount of heavy goods vehicle traffic via Norway Lane. A dual carriageway stretch of the A259 lies beyond the industrial buildings and is audible toward the northern end of the Windroos Nursery site. A single carriageway stretch of the A259 (Worthing Road) borders the south of site, with The Body Shop Roundabout approximately 80 metres to the south east.

Condition 18 of Arun District Council Planning Decision Notice LU/229/10/ states the following:

CONDITION 18 *No development shall take place until the following information, relating to noise attenuation has been submitted to, and approved by, the Local Planning Authority, in consultation with the Council's Environmental Health Officers:-*

- Details of façade attenuation measures proposed to habitable rooms fronting the A259 and the adjacent Watersmead Business Park (current plans do not indicate a boundary with the railway line;
- A specification of boundary attenuation measures indicated in the north-east corner of the site;
- A survey of the background noise adjacent to the north east boundary.

The development shall be carried out in accordance with the approved details.

Reason: To protect the amenities of occupiers of adjoining properties in accordance with Arun District Council Local Plan Policies GEN7 and GEN32.

In addition, it is understood that the Highway Authority proposes to potentially widen the carriageway of the A259 (Worthing Road) at the southern border of the site. The project traffic consultants have advised that the proposals include widening of the carriage way on both sides by approximately two metres.

In order to make allowance for this, assessment of road traffic noise impact on the nearest proposed plot locations in the development will be undertaken on this basis.

2.1 WHO Guidelines for Community Noise (1999)

The guidance in this document details suitable noise levels for various activities within residential and commercial buildings.

The relevant sections of this document are shown in Table 2.1.

Criterion	Environment	Design range $L_{Aeq,T}$ dB
Maintain speech intelligibility and avoid moderate annoyance, daytime and evening	Living Rooms	35
Prevent sleep disturbance, night time	Bedrooms	30

Table 2.1 - Excerpt from WHO

[dB ref. 20µPa]

This guidance also states that individual noise events should not normally exceed 45 dB $L_{Amax,fast}$ within bedrooms at night.

For outdoor living areas, it is stated that:

'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq} . Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development.'

2.2 BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*

The guidance in this document indicates acceptable noise levels for various activities within residential dwellings.

The relevant section of this standard is shown in the following table:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16 \text{ hour}}$	-
Dining	Dining Room	40 dB $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 \text{ hour}}$	30 dB $L_{Aeq, 8 \text{ hour}}$

Table 2.2 - Excerpt from BS8233: 2014

[dB ref. 20µPa]

For external areas the standard states the following:

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

However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

3.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at the locations shown in site plan AS7839/SP1. Measurements of consecutive 5-minute L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels were taken between 12:30 hours on Friday 6th June and 11:15 hours on Monday 9th June 2014.

Additional synchronous 5-minute manual measurements were undertaken on Friday 6th June at various locations around the site, also shown in site plan AS7839/SP1.

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

- 3 no. Norsonic data logging sound level meter type 118;
- 1 no. Norsonic sound level calibrator type 1253.

The calibration of sound level meters was verified before and after use. No significant calibration drift was detected.

The weather during the survey was dry with light winds, which made the conditions suitable for the measurement of environmental noise.

Measurements were made generally in accordance with ISO 1996-2:2007 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels*.

Please refer to Appendix A for details of the acoustic terminology used throughout this report.

4.0 RESULTS

Figures AS7839/TH1-TH3 show the L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels as time histories at monitoring position 'A' (Norway Lane) and figures AS7839/TH4-TH6 show the same at monitoring position 'B' (Worthing Road).

The northern area of the site, in the vicinity of Measurement Position A is affected by building services plant noise from the light industrial unit opposite and road noise from the dual carriageway A259 further east, with maximum events attributed to passing heavy goods vehicles on Norway Lane. It is noted from the time histories that average noise levels decrease over the weekend at this measurement position. For this reason, the higher weekday average noise levels have been used to specify all following mitigation measures at receptors in the locality of this measurement position.

The southern area of the site, in the vicinity of Measurement Position B is primarily affected by road traffic noise from the single carriageway Worthing Road. Note that Monitoring Position B was located at a distance of 6m from the existing carriageway. The southern proposed dwelling facades are approximately 21m from the proposed re-aligned carriageway.

The average noise levels for the 'Daytime' and 'Night-time' periods at the monitoring locations are shown in Table 4.1.

Measurement Position	Daytime $L_{Aeq, 16 \text{ hour}}$	Night-time, $L_{Aeq, 8 \text{ hour}}$
A	55 dB	50 dB
A (weekday only)	59 dB	n/a
B	71 dB	65 dB

Table 4.1 - Daytime and night-time average noise level at survey measurement positions [dB ref. 20µPa]

Typical maximum night time noise events at measurement position A were 70dB $L_{Amax, fast}$.

Typical maximum night time noise events at measurement position B were 81dB $L_{Amax, fast}$.

5.0 DESIGN REVIEW

The following design review is based on the LHC Architecture drawings for the proposed development available at the time of writing.

5.1 Calculated Façade Levels

The measured sound pressure levels at the two monitoring positions have been corrected for distance losses in order to predict façade-incident levels at the nearest proposed building lines and garden areas to the Worthing Road and Norway Lane.

5.2 Architectural Arrangements

It has been assumed that all non-glazed elements, i.e. masonry walls/facings and the roof systems, will provide the following minimum sound insulation performances, when tested in accordance with ISO 10140-2:2010.

Frequency (Hz)	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Masonry	41	43	48	50	55	55

Table 5.1 - Assumed minimum sound reduction indices of solid constructions

6.0 REQUIRED GLAZING PERFORMANCE

The minimum sound insulation specifications for the glazed elements of the building façades closest to the Norway Lane and Worthing Road are given in the table below. These have been calculated using the monitoring data and appropriate corrections based on the distance of the proposed building façades from the relative noise sources.

Glazing Type	Single Figure Weighted Sound Reduction Figure (dB)	Ventilator Performance (dB)
Type A	R_w 30	$D_{n,e,w}$ 30
Type B	R_w 32	$D_{n,e,w}$ 34

Table 6.1 - Minimum required sound reduction indices for glazing and ventilators

The Type A glazing requirement is expected to be achieved by standard thermal double glazing units. In order that windows may remain closed to maintain the internal noise levels, it is expected that an alternative means of providing background ventilation will be required. If trickle vents or wall ventilators are used, the acoustic performance shown in Table 6.1 will be required.

The figures stated are for a single ventilator per room. If multiple vents are required, then the performance requirement shown in Table 6.1 will increase by a value equal to $+10\log(N)$, with N being the total number of vents serving the room. (*e.g., two vents in a room will require each vent to 3dB higher performance than indicated*).

The sound reduction specified for the windows must be met with any proposed trickle vents installed and open. However, there is no reason why windows cannot be opened for personal preference or purge ventilation, provided the required performance is reliably achieved when they are closed.

7.0 DISCUSSION

7.1 Glazing Specification

Table 7.1, below, identifies where the performance requirements shown in Table 6.1 apply. For clarity, see also attached mitigation strategy plan, AS7839/MSP1.

Elevation	Floor	Glazing type required
Green (north-eastern) aspects	All	Type A
Red (southern and south-eastern) aspects	All	Type B
Other	All	Standard Thermal Glazing / Standard Trickle Vents

Table 7.1 - Locations for glazing types

Standard thermal double glazing and standard (non-acoustic) trickle ventilators at all other plot façades within the development would be expected to result in satisfactory internal noise levels in line with Table 2.2.

Where specified, it is important that the quoted minimum sound reduction specifications are met by the entire glazing unit in each case, including frames, seals, etc. Glass performance alone is not an acceptable means of demonstrating compliance with the specification for window performance.

Windows to bathrooms, corridors or other non-habitable areas are not required to achieve the indicated specification.

7.2 Areas of External Amenity

The most exposed gardens located along the north-east extent of the development are expected to be subject to levels in the region of L_{Aeq} 50-55dB during weekday daytime hours. These levels are within the range of WHO levels recommended for outdoor living areas. It is assumed that all plot gardens throughout the development will be surrounded by standard 1.8m high close boarded timber fencing (other than those specified as 2.0m high fencing: see below). This will provide additional screening losses and average daytime levels in the most exposed areas are therefore anticipated to be below the L_{Aeq} 50dB WHO guideline level.

Balconies are proposed on the western façade of the proposed block of flats located at the north east of the site. These are orientated away from Norway Lane and will be heavily screened by the intermediate building. Levels on these balconies are also expected to be below the L_{Aeq} 50dB WHO level recommended for outdoor living areas.

Most gardens belonging to the southern-most plots of the development are expected to experience average daytime levels in the region of L_{Aeq} 60dB, due to variable screening from the road due to the intermediate houses. There are two properties with gardens closer to and with a clear view of the road. Levels in these gardens are expected to be in the region of 65-66dB.

Installation of 2.0m high close-boarded timber fencing along the garden boundaries, at the locations indicated in blue in the attached Mitigation Strategy Plan, AS7839/MSP1, is expected to control noise levels to below the higher L_{Aeq} 55dB WHO level recommended for outdoor living areas.

Fencing should be continuous and imperforate. Standard close boarding construction would provide adequate mass to achieve the required reductions, however, a good quality fence is recommended such that gaps do not form and the integrity is maintained over time.

8.0 CONCLUSIONS

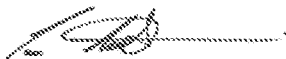
Measurements have been made of the prevailing noise climate at the proposed site for residential development at Windroos Nursery, Littlehampton.

The measured levels have been assessed against currently available standards and guidance documents, including the World Health Organisation Guidelines for Community Noise (1999) and BS8233:2014, to address Condition 18 of Arun District Council Planning Decision Notice LU/229/10/.

The survey has allowed the minimum sound reduction requirements of the external building fabric to be established as a performance specification, for those proposed housing façades bordering the southern and eastern extents of the site.

Boundary attenuation measures for the southern boundary of the site have also been specified.

All noise impact assessments and accompanying recommendations have been made in the context of currently available details pertaining to the A259 local road widening works proposed by the Highway Authority.



Ian MacArthur MIOA

CLARKE SAUNDERS ASSOCIATES

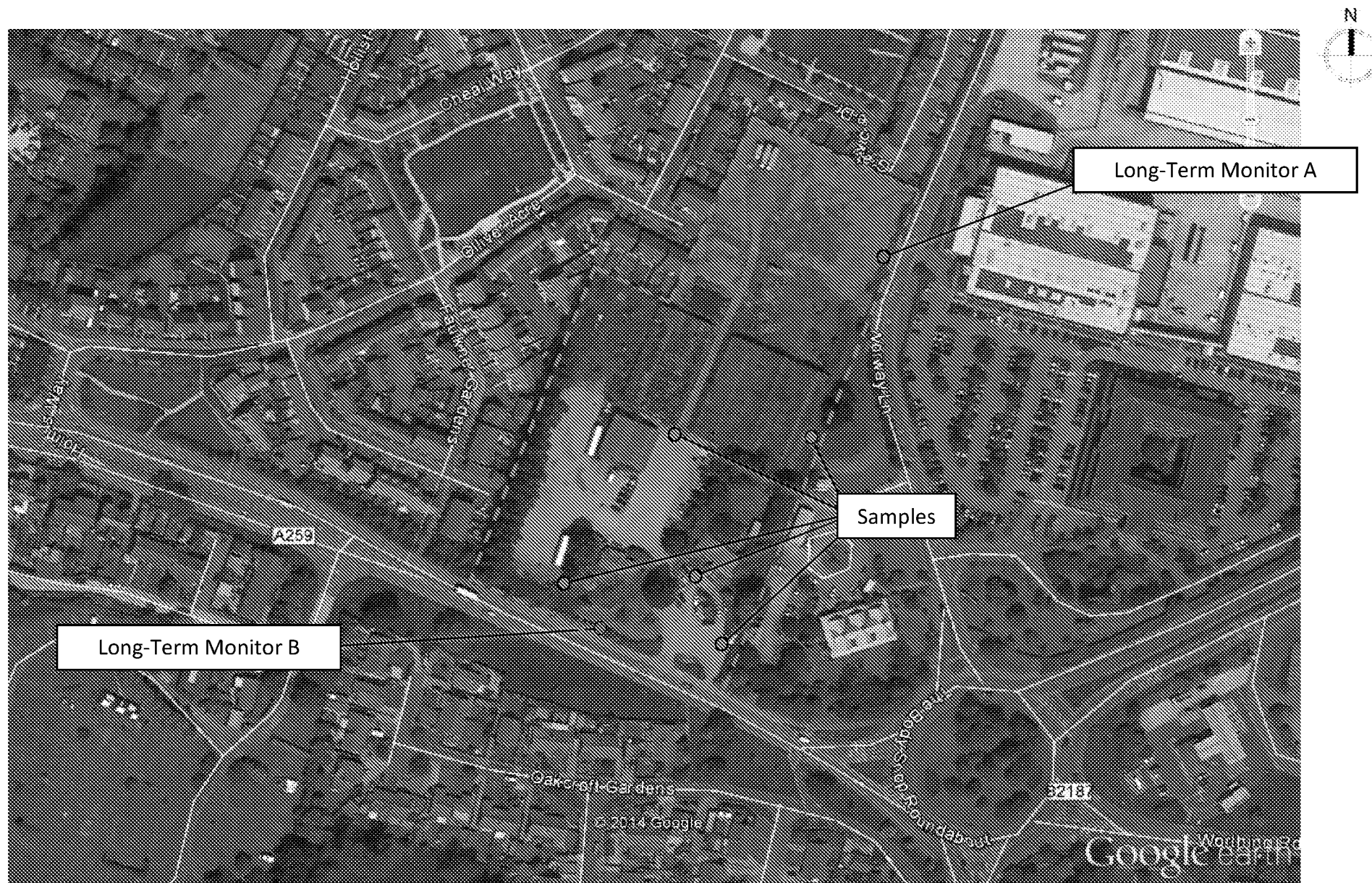


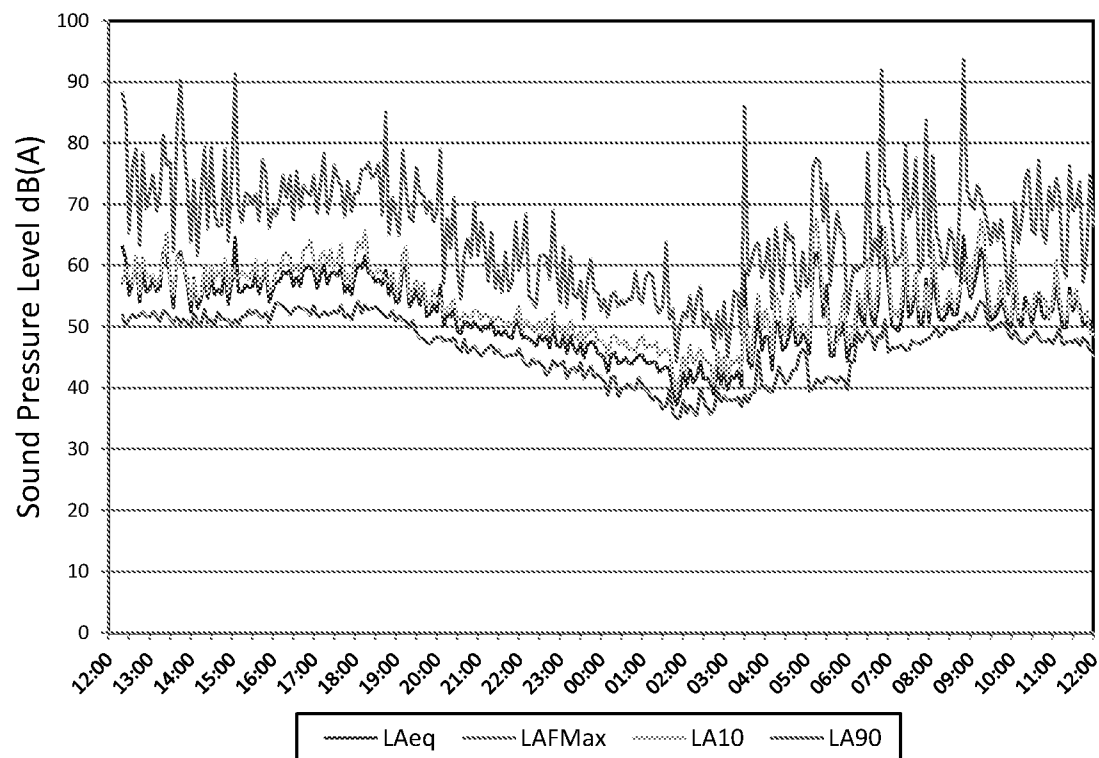
Figure AS7839/SP1



Figure AS7839/MSP1

Windroos Nursery, Littlehampton

Environmental Noise Time History: Monitoring Location A

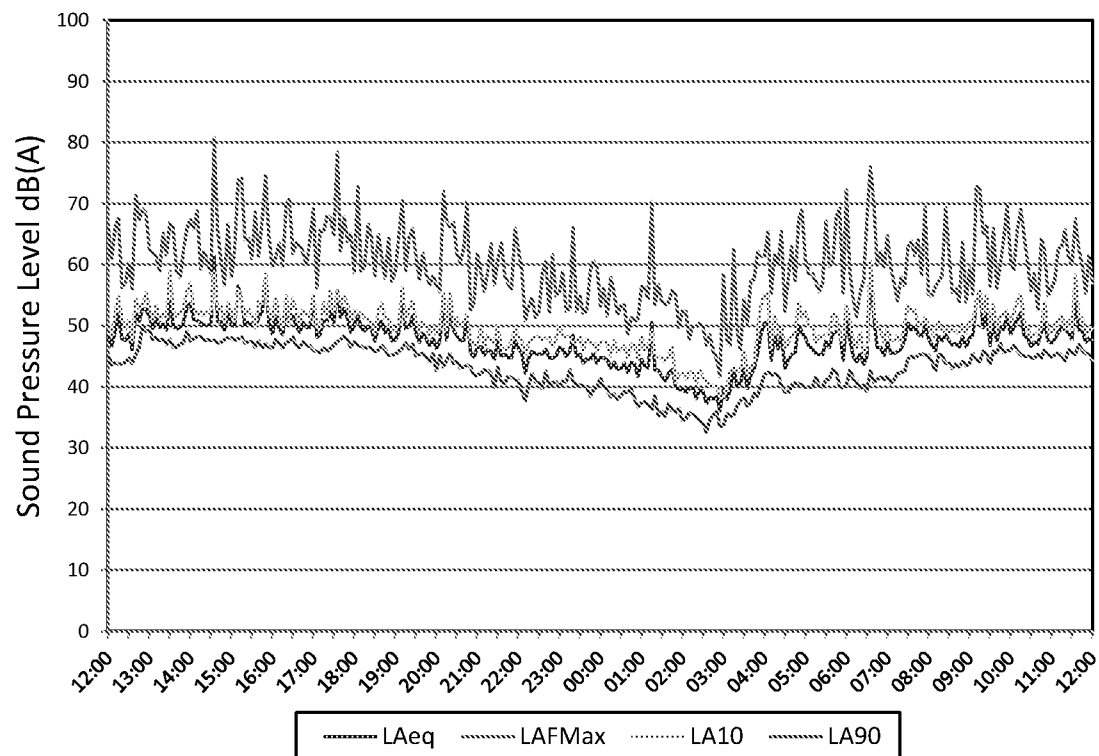


Friday 06 June to Saturday 07 June 2014

Figure AS7839/TH1

Windroos Nursery, Littlehampton

Environmental Noise Time History: Monitoring Location A

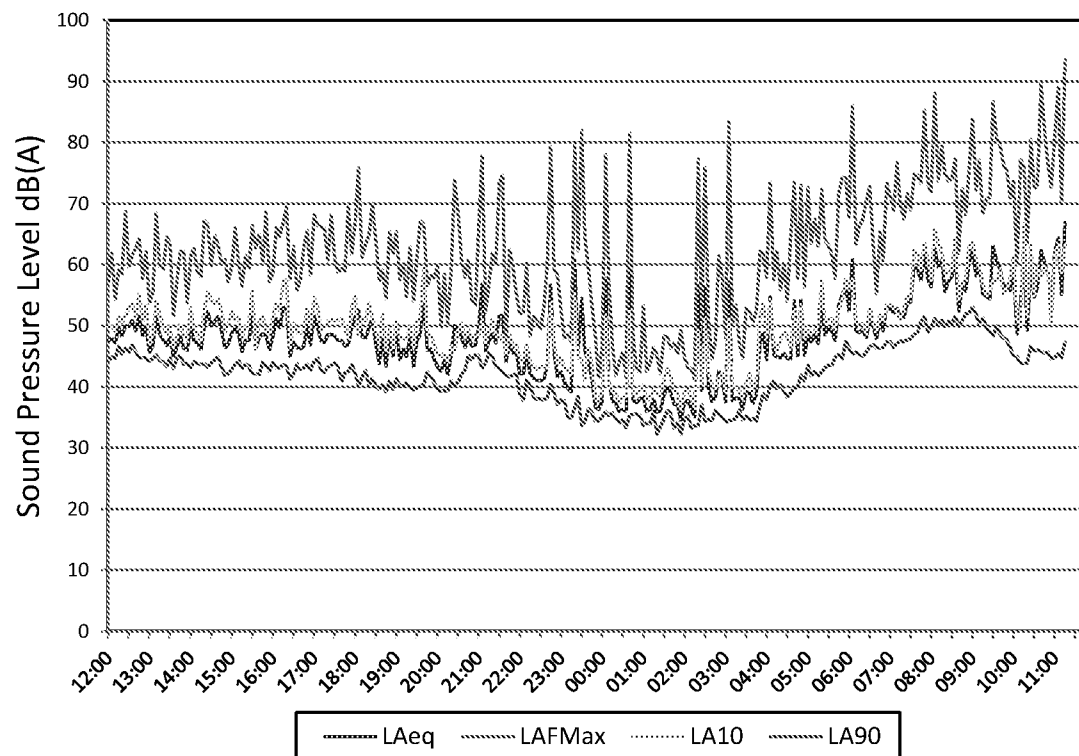


Saturday 07 June to Sunday 08 June 2014

Figure AS7839/TH2

Windroos Nursery, Littlehampton

Environmental Noise Time History: Monitoring Location A

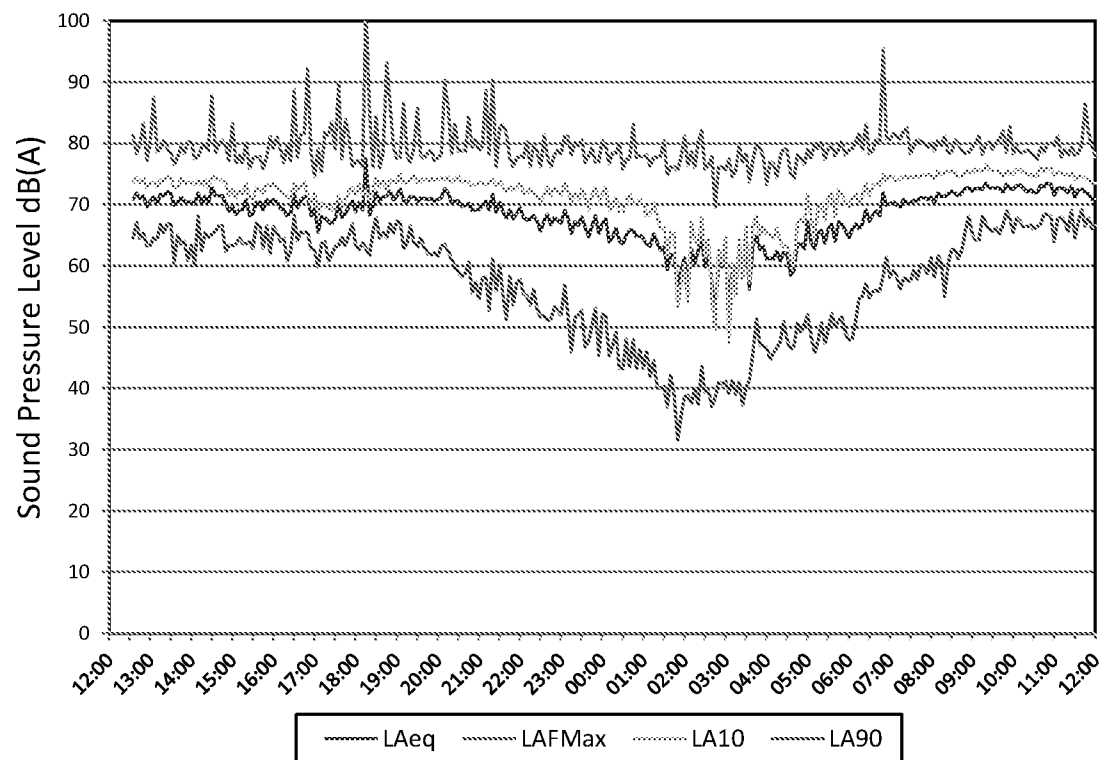


Sunday 08 June to Monday 09 June 2014

Figure AS7839/TH3

Windroos Nursery, Littlehampton

Environmental Noise Time History - Monitoring Location B

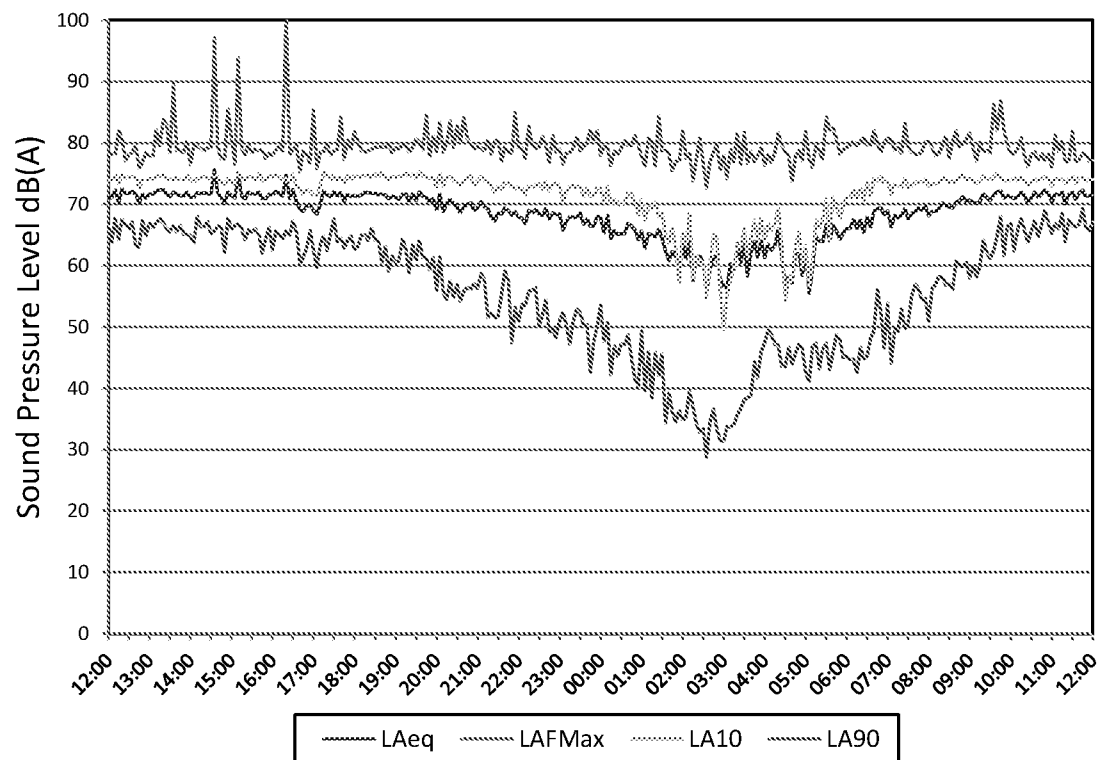


Friday 06 June to Saturday 07 June 2014

Figure AS7839/TH4

Windroos Nursery, Littlehampton

Environmental Noise Time History - Monitoring Location B

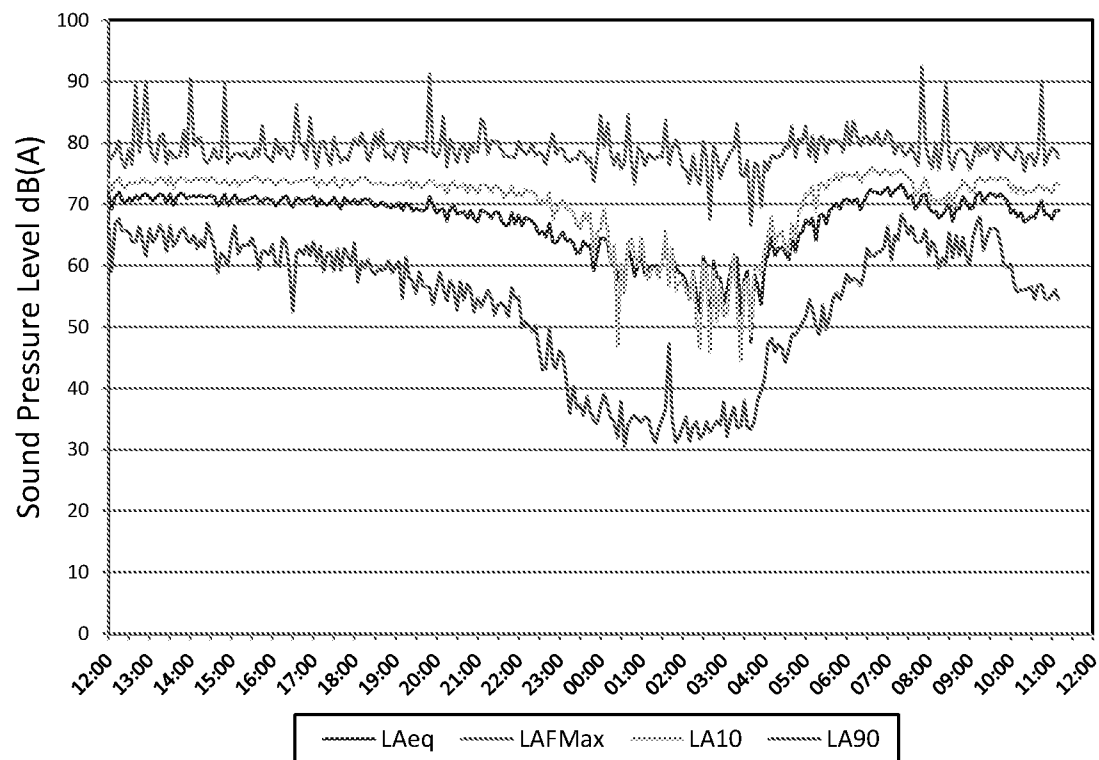


Saturday 07 June to Sunday 08 June 2014

Figure AS7839/TH5

Windroos Nursery, Littlehampton

Environmental Noise Time History - Monitoring Location B



Sunday 08 June to Monday 09 June 2014

Figure AS7839/TH6

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND NOISE

1.0 ACOUSTIC TERMINOLOGY

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

dB (A):	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level.
L₁₀ & L₉₀ :	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L₁₀ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L₉₀ is the average minimum level and is often used to describe the background noise. It is common practice to use the L₁₀ index to describe traffic noise, as being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic noise.
L_{eq} :	The concept of L_{eq} (equivalent continuous sound level) has up to recently been primarily used in assessing noise in industry but seems now to be finding use in defining many other types of noise, such as aircraft noise, environmental noise and construction noise. L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward. Because L_{eq} is effectively a summation of a number of noise events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute noise limit.
L_{max} :	L _{max} is the maximum sound pressure level recorded over the period stated. L _{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L _{eq} noise level.
D	The sound insulation performance of a construction is a function of the difference in noise level either side of the construction in the presence of a loud noise source in one of the pair of rooms under test. D, is therefore simply the <i>level difference</i> in decibels between the two rooms in different frequency bands.
D_w	D _w is the <i>Weighted Level Difference</i> The level difference is determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1.
D_{nT,w}	D _{nT,w} is the <i>Weighted Standardised Level Difference</i> as defined in BS EN ISO 717-1 and represents the <i>weighted level difference</i> , as described above, corrected for room reverberant characteristics.
C_{tr}	C _{tr} is a spectrum adaptation term to be added to a single number quantity such as D _{nT,w} , to take account of characteristics of a particular sound.
L'_{nT,w}	L' _{nT,w} is the <i>Weighted Standardised Impact Sound Pressure Level</i> as defined in BS EN ISO 717-2 and represents the level of sound pressure when measured within room where the floor above is under excitation from a calibrated tapping machine, corrected for the receive room reverberant characteristics.

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND NOISE

2.0 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 have 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, eg. 250 Hz octave band runs from 176 Hz to 353 Hz. The most commonly used bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000
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3.0 HUMAN PERCEPTION OF BROADBAND NOISE

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

INTERPRETATION

Change in Sound Level dB(A)	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 loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

4.0 EARTH BUNDS AND BARRIERS - EFFECTIVE SCREEN HEIGHT

When considering the reduction in noise level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a 3 metre high barrier exists between a noise source and a listener, with the barrier close to the listener, the listener will perceive the noise source is 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 noise source would seem quieter than it was if he were standing. This may be explained by the fact that the "effective screen height" is changing with the three cases above, the greater the effective screen height, in general, the greater the reduction in noise level.

Where the noise sources are various roads, the attenuation provided by a fixed barrier at a specific property will be greater for roads close to the barrier than for roads further away.