REPORT REFERENCE:

SA – 3631 – 3

REVISED LAYOUT

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

British Standard 8233: 2014

.

CLIENT:

Persimmon Homes & Sompting Estate Trustees

Persimmon House

Knoll Road

Camberley

Hampshire

GU15 3TQ

SITE:

Land West of Sompting

Sompting

West Sussex

SURVEY DATES:

20th – 24th February 2015

Report By [redacted]

Mr. B. J. Scrivener MIOA.

Sound Advice Acoustics Ltd

2 West Links, Tollgate, Chandlers Ford, Hampshire, SO53 3TG

Tel: 02380 641357

soundadviceacoustics.co.uk

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1 EXECUTIVE SUMMARY

1.1 Instruction

Sound Advice Acoustics Ltd have been instructed by Persimmon Homes & Sompting Estate Trustees to undertake a background noise survey to British Standard 8233: 2014 to determine the impact of existing noise sources on the proposed development scheme at the land West of Sompting, Sompting, West Sussex.

1.2 Scope of Report

The measurements will be undertaken in accordance with ISO 1996 – Part 2: 2007 to determine the existing background noise levels and British Standard 8233: 2014 will be used to determine the impact of existing traffic on the internal noise environment within the proposed residential dwellings. This report aims to establish the following:

- Existing background noise levels within the area;
- Assess the potential internal noise levels on the proposed rooms;
- Provide specifications for the ventilation and window glazing with the proposed rooms.

1.3 Summary of Results

1.3.1 Background Noise Levels

A 96 hour background noise survey was undertaken from 20th – 24th February 2015 at two positions (front of site and rear of site) in order to establish the underlying background noise levels. The maximum day time levels were found to be $L_{Aeq,\ 16\ hour}$ 72.3 dB and the maximum night time levels were found to be $L_{Aeq,\ 8\ hours}$ 65.9 dB at position 1. The maximum day time levels were found to be $L_{Aeq,\ 16\ hour}$ 59.5 dB and the maximum night time levels were found to be $L_{Aeq,\ 8\ hours}$ 54.8 dB at position 2.

Assessment Position	Date Start	Date Finish	Daytime LAeq	Night Time LAeq
Position 1 Front	20/02/2015	24/02/2015	72.3	65.9
Position 2 Rear	20/02/2015	24/02/2015	59.5	54.8

1.4 Conclusions

The development should be designed with a 4mm glass / 14mm air gap / 6mm glass double glazed windows and a Greenwood Acoustic Humidity Controlled Energy Saver Window Vent or similarly approved to all rooms to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014.

It has been agreed with Michael Lavender, Senior Environmental Health Officer from Adur & Worthing Councils that the plots at the top of the site closest to the dual carriageway will require a mechanical ventilation heat recovery unit in order to protect future occupiers with regards to noise. Additionally further mitigation measures will be required to some of the garden areas closest to the industrial park. Both these points are to be calculated when further drawings are made available. This does not affect any part of phase 1.

Levels have been recorded and assessments made in accordance with the relevant standards. Internal criteria's have been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

2 INTRODUCTION

Sound Advice Acoustics Ltd has been instructed by Persimmon Homes & Sompting Estate Trustees to carry out the relevant noise assessments and calculations at the land West of Sompting, Sompting, West Sussex. It is proposed that the existing land is to be developed into new build housing.

Ambient noise levels were measured from 20th – 24th February 2015. This report by Sound Advice Acoustics Ltd gives the results of these measurements and an assessment in accordance with government planning guidelines and relevant standards together with mitigation measures as required.

With regards to external ambient noise, environmental noise levels are to be monitored at the site in accordance with British Standard 7445: 2003 'Description and measurement of environmental noise assessments and calculation made in accordance with BS 8233: 2014 Sound Insulation and Noise Reduction for Buildings Code of Practice.

BS 8233: 2014 set the following parameters as target levels that should be designed to within rooms such as Living Rooms and Bedrooms.

Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important		
Objective	**Typical situations**	**Design Range $L_{Aeq,t}$ dB**
Typical noise levels for acoustic privacy in shared spaces	Living room	35 – 40
NOTE: See Noise control in building services [28] and BS EN ISO 3382.		

Indoor ambient noise levels for dwellings			
Activity	**Location**	**07:00 – 23:00**	**23:00 – 07:00**
Resting	Living Room	35 dB $L_{Aeq\ 16\ HOUR}$	--
Dining	Dining Room / Area	40 dB $L_{Aeq\ 16\ HOUR}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq\ 16\ HOUR}$	30 dB $L_{Aeq\ 8\ HOUR}$

Calculations and assessments are therefore to be carried out in order to satisfy the above requirements of BS8233: 2014.

References and evaluations are to be made to the National Planning Policy Framework 2018 (NPPF) and the Noise Policy Statement for England 2010 (NPSE). The purpose of this document is to include all aspects of environmental noise within assessments i.e. environmental noise, neighbour noise and neighbourhood noise. Noise is to be considered alongside other relevant issues relating to the site and should not be considered in isolation, according to the NPSE.

There are several key phrases within the NPSE aims and these are discussed below.

2.1 "Significant adverse" and "adverse"

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

2.2 NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

2.3 LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.
Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

2.4 SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

In addition, calculations are to be made for the predicted daytime noise levels within the outdoor living area and assessments made against the recommended levels within the World Health Organisation's 'Guidelines for Community Noise'. In order to evaluate these levels accurately, the 3D modelling software CADNA A is to be adopted for the purpose of this assessment.

Finally, assessments and references are to be made to the World Health Organisation Night Time Noise Guidance 2009.

3 SITE LOCATION

Position of Site in Wider Area

The site is located in Sompting. The dominant noise source is road traffic noise.





Position 1 – North of the site
Position 2 – South of the site

3.1 Proposed Development

The proposed illustrative masterplan is shown below.



4 PROCEDURE

External noise levels were recorded over a typical period and analysis date extrapolated between 07:00 hrs 20th – and 07:00 hrs on 24th February 2015 at positions 1 and 2 as detailed on the attached plan sketch layout.

Position 1 was located at the front façade of the site in order to capture the noise levels associated with the nearby roads, position 2 was located to the rear of the site in order to capture any noise associated with the lower noise levels in order to aid in the 3D model. Sample measurements were recorded over continuous 15 minute samples and from this data the hourly LAeq daytime values have been evaluated. Sound Pressure Levels were recorded on the following setting along with a full octave band frequency analysis measured simultaneously and between 31.5 Hz and 16.0 kHz.

Daytime 07:00 – 23:00		Night Time 23:00 – 07:00	
$L_{Aeq\ 1\ HOUR}$ dB	$L_{A10\ 1\ HOUR}$ dB	$L_{Aeq\ 15\ MINUTES}$ dB	$L_{A10\ 15\ MINUTES}$ dB
$L_{AMAX\ 1\ HOUR}$ dB	$L_{A50\ 1\ HOUR}$ dB	$L_{AMAX\ 15\ MINUTES}$ dB	$L_{A50\ 15\ MINUTES}$ dB
$L_{AMIN\ 1\ HOUR}$ dB	$L_{A90\ 1\ HOUR}$ dB	$L_{AMIN\ 15\ MINUTES}$ dB	$L_{A90\ 15\ MINUTES}$ dB

Calculations have been made in accordance with BS 8233: 2014 'Sound Insulation and Reduction of Buildings - Code of Practice'. Recommendations were made for any additional acoustics measures to conform to these standards.

From the downloaded recorded results, the daytime and night time periods were assessed and used within the above calculations as $L_{Aeq\ 16\ HOUR}$ dB levels for daytime and $L_{Aeq\ 8\ HOUR}$ dB levels for night time. These are detailed within this report. All data averaged throughout the day has been done so on a logarithmic basis to give accurate $L_{Aeq\ 16\ Hour}$ dB daytime and $L_{Aeq\ 8\ Hour}$ dB night time noise levels.

Finally, it should be noted that calculations are carried out with façade levels corrected from the recorded noise levels to the calculated façade levels.

5 APPARATUS

The equipment was calibrated using a sound pressure level of 114.0 dB at an octave band centre frequency of 1000Hz with reference to 2 x 10^{-5} Nm^{-2} before and after the tests and the equipment set to have no inaccuracy greater than 0.2dB.

All the following equipment was calibrated in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service (UKAS) on the following dates. Calibration schedules are implemented within Sound Advice Acoustics Ltd in accordance with UKAS directive LAB 23.

5.1 Noise meter s/n 1402941 environmental testing

Description	Make	Type	Serial No.	Calibration Intervals	Last Calibrated	Next Due Calibration
Integrated Sound Level Meter	Norsonic	140	1402941	2 YEARS	14.05.2014	14.05.2016
12.5mm Microphone (with windshield)	Norsonic	1220	91720	2 YEARS	14.05.2014	14.05.2016
Microphone Pre – Amplifier	Norsonic	1201	30479	2 YEARS	14.05.2014	14.05.2016

5.2 Noise meter s/n 1403140 environmental testing

Description	Make	Type	Serial No.	Calibration Intervals	Last Calibrated	Next Due Calibration
Integrated Sound Level Meter	Norsonic	140	1403140	2 YEARS	27.05.2014	27.05.2016
12.5mm Microphone (with windshield)	Norsonic	1220	52260	2 YEARS	27.05.2014	27.05.2016
Microphone Pre – Amplifier	Norsonic	1201	30233	2 YEARS	27.05.2014	27.05.2016

Full calibration certificates are available upon request.

6 RESULTS

$L_{Aeq,t}$ -	The equivalent A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.
$L_{A90,t}$ -	The A weighted sound pressure level that is exceeded for 90% of the time period 5 minutes night time and 1 hourly daytime.
$L_{A50,t}$	The A weighted sound pressure level that is exceeded for 50% of the time period 5 minutes night time and 1 hourly daytime
$L_{A10,t}$ -	The A weighted sound pressure level that is exceeded for 10% of the time period 5 minutes night time and 1 hourly daytime
L_{Amax} -	The maximum A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.
L_{Amin} -	The minimum A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.

6.1 Downloaded results, and averages.

20th – 21st February 2015 – POSITION 1

Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	72.3	79.9	55.6	61.8	58.6	56.9	59.8	68.2	67.2	63.3	50.1	35.1
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	65.0	78.4	46.6	54.6	52.4	51.2	53.2	61.6	60.0	52.5	37.2	22.8

21st – 22nd February 2015 – POSITION 1

Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	71.5	79.8	52.0	60.3	59.5	57.0	59.6	68.3	66.4	59.0	43.7	27.9
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	64.2	77.6	45.8	52.5	51.5	50.4	52.6	61.0	59.1	51.3	35.8	20.4

22nd – 23rd February 2015 – POSITION 1												
Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	71.6	80.2	69.4	63.4	59.7	57.5	59.8	67.3	66.2	63.7	51.1	36.4
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	66.3	78.3	48.3	56.4	53.7	51.4	54.2	62.4	61.4	55.9	42.1	28.0

23rd – 24th February 2015 – POSITION 1												
Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	72.2	79.5	57.8	62.2	59.3	57.5	60.4	68.6	67.1	61.5	47.5	32.6
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	65.9	77.7	51.7	55.9	53.8	51.4	54.1	61.7	60.8	57.1	43.8	29.3

20th – 21st February 2015 – POSITION 2												
Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	54.3	59.6	56.9	56.0	51.6	47.2	48.9	52.5	44.6	30.3	24.0	18.9
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	48.9	55.1	51.1	50.2	46.6	42.8	44.7	46.9	38.8	21.1	13.9	9.4

21th – 22nd February 2015 – POSITION 2												
Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	54.6	60.7	56.9	55.5	54.2	50.2	49.9	52.9	43.4	25.7	16.4	11.9
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	48.2	53.9	51.8	48.6	45.7	41.1	44.3	46.4	37.3	18.3	10.6	8.8

22nd – 23rd February 2015 – POSITION 2												
Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	67.1	77.4	88.9	84.4	79.0	71.4	60.9	54.7	52.0	50.2	47.1	40.9
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	48.7	55.3	63.3	56.9	51.5	47.1	44.9	45.7	38.9	27.6	24.9	20.3

23rd – 24th February 2015 – POSITION 2												
Date / Time	LAeq	Lmax	Octave Band Centre Frequency (Hz)									
			31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00												
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	59.5	70.2	78.7	71.8	66.2	62.1	56.1	53.2	48.9	45.8	44.0	38.8
23:00 - 07:00												
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	54.8	66.4	74.3	66.6	60.9	58.1	52.0	48.6	43.0	38.4	34.5	26.7

* The data from the 22nd – 23rd February has been disregarded due to poor weather conditions.

7 DISCUSSION OF RESULTS

It can be seen from the attached graph and downloaded results that the external noise levels have followed the expected path and remained fairly constant throughout the day. The levels then gradually dropped off as the evening progressed and began to rise when morning traffic levels increased.



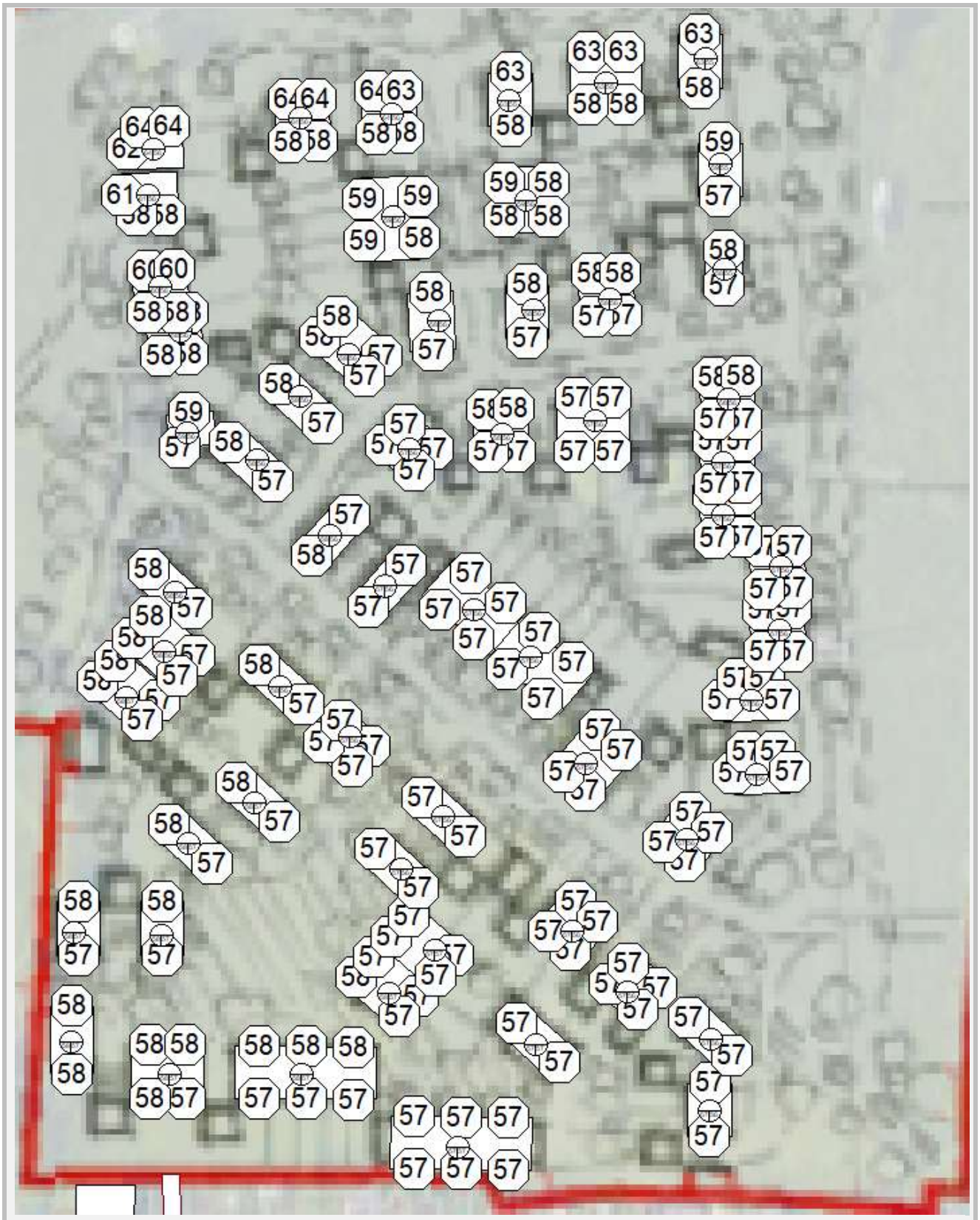
Daytime prior to recommendations

The layout shown is indicative for purposes of pre application for the noise assessment



Night time prior to recommendations

The layout shown is indicative for purposes of pre application for the noise assessment



Daytime post recommendations – Upper Section

The layout shown is indicative for purposes of pre application for the noise assessment



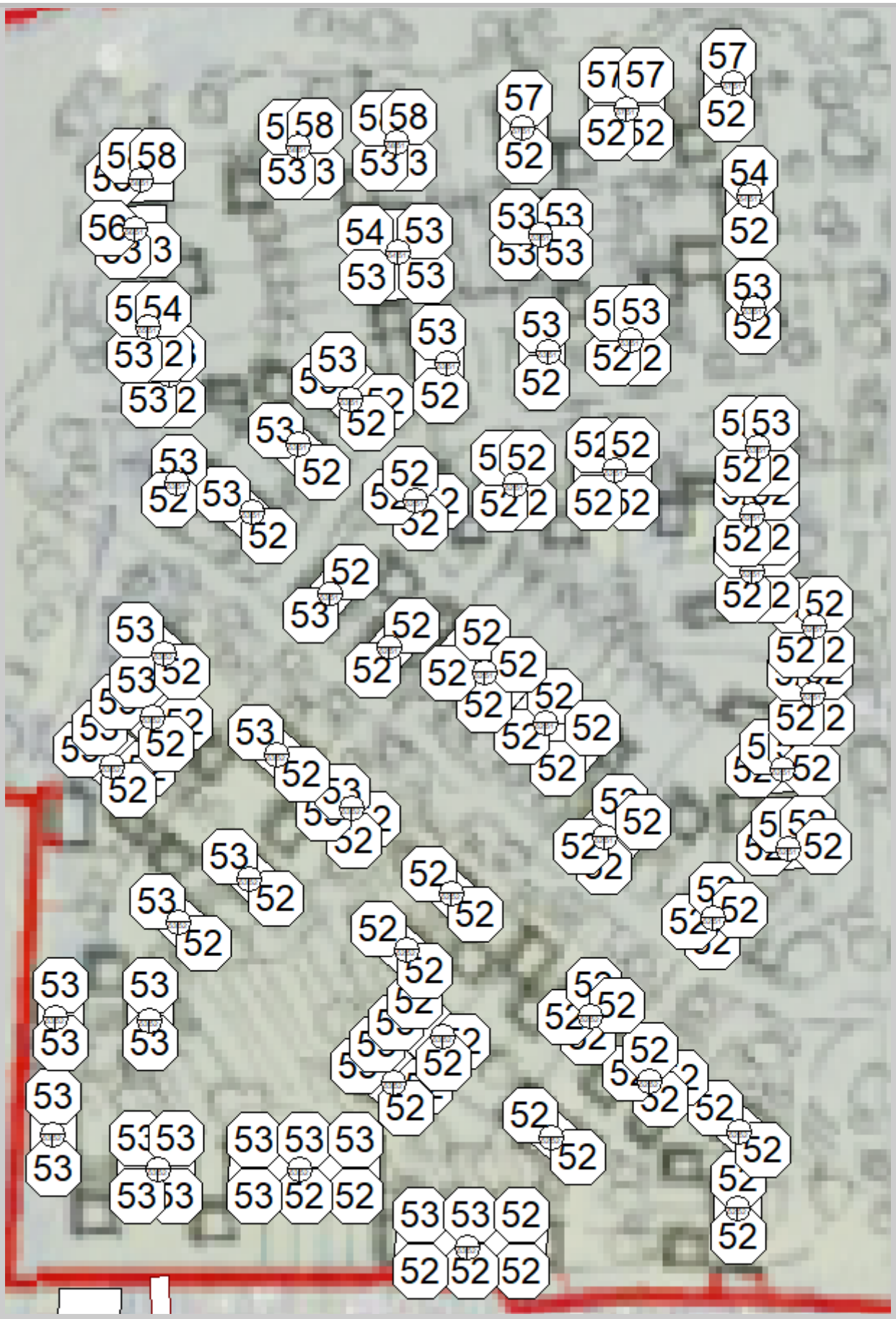
Daytime post recommendations – Mid Section

The layout shown is indicative for purposes of pre application for the noise assessment



Daytime post recommendations – Lower Section

The layout shown is indicative for purposes of pre application for the noise assessment



Night Time post recommendations – Upper Section

The layout shown is indicative for purposes of pre application for the noise assessment



Night Time post recommendations – Mid Section

The layout shown is indicative for purposes of pre application for the noise assessment



Night Time post recommendations – Lower Section

The layout shown is indicative for purposes of pre application for the noise assessment

8 RECOMMENDATIONS

For the purpose of this assessment, the corresponding façade levels will be used within the BS 8233: 2014 calculations in order evaluate the worst case scenario and select the correct window specification.

Therefore, in order to achieve the required noise levels of $L_{Aeq\ 16\ HOUR}$ 35 dB for habitable rooms daytime and $L_{Aeq\ 8\ HOUR}$ 30 dB for Bedroom at night within the proposed, the following additional acoustic measures have been calculated.

It should be noted that the calculations have been made with the proposed windows closed. Additional calculations were made for the top floor due to the influence of sound transmission into the various rooms via the roof / ceiling i.e. an increased impeding façade. Inputted levels into the calculation sheets have been corrected for distance attenuation and free field in accordance with the aforementioned British Standard.

8.1 Calculation Procedure to BS 8233: 2014

The following calculations have been carried out in order to determine the required window and ventilation specification in order to meet the requirements of BS 8233: 2014.

8.2 Front of site - Ground Floor Living Room

Proposed Window Configuration	**4 / 14 / 6 with Greenwood Acoustic Humidity Controlled Energy Saver Window Vent**
Façade corrected to daytime 64 dB and Night time 58 dB	
Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*
Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	10	10	10	10	10	10
Sr	0	0	0	0	0	0
Swi	5.4	5.4	5.4	5.4	5.4	5.4
Sew	4.6	4.6	4.6	4.6	4.6	4.6
Srr	0	0	0	0	0	0
S	10	10	10	10	10	10
A0	10	10	10	10	10	10
V	57	57	57	57	57	57
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	18.2	18.2	18.2	18.2	18.2	18.2
Daytime Leqff	50.3	48.6	51.5	59.9	58.9	55.0
Night time Leqff	45.5	43.1	45.8	53.4	52.5	48.8
Dne	42.2	39.9	33.8	41.2	40.2	36.8
Rwi	24.4	26.5	36.2	41.7	40.3	42.6
Rew	40.0	44.0	45.0	51.0	56.0	56.0
Rrr	28.0	34.0	40.0	45.0	49.0	49.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**26.5**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**20.3**	**dB(A)**

8.3 Front of site – First Floor Bedroom

Proposed Window Configuration	**4 / 14 / 6 with Greenwood Acoustic Humidity Controlled Energy Saver Window Vent**
Façade corrected to daytime 64 dB and Night time 58 dB	
Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*
Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	9	9	9	9	9	9
Sr	18	18	18	18	18	18
Swi	2.5	2.5	2.5	2.5	2.5	2.5
Sew	6.5	6.5	6.5	6.5	6.5	6.5
Srr	18	18	18	18	18	18
S	27	27	27	27	27	27
A0	10	10	10	10	10	10
V	44	44	44	44	44	44
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	14.1	14.1	14.1	14.1	14.1	14.1
Daytime Leqff	50.3	48.6	51.5	59.9	58.9	55.0
Night time Leqff	45.4	43.1	45.9	54.1	53.1	47.6
Dne	40.0	36.0	34.0	33.0	35.0	37.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	56.0
Rrr	28.0	34.0	40.0	45.0	49.0	49.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**31.7**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**21.9**	**dB(A)**

8.4 Rear of site – Ground Floor Living Room

Proposed Window Configuration	**4 / 14 / 6 with Greenwood Acoustic Humidity Controlled Energy Saver Window Vent**

Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*

Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	10	10	10	10	10	10
Sr	0	0	0	0	0	0
Swi	5.4	5.4	5.4	5.4	5.4	5.4
Sew	4.6	4.6	4.6	4.6	4.6	4.6
Srr	0	0	0	0	0	0
S	10	10	10	10	10	10
A0	10	10	10	10	10	10
V	57	57	57	57	57	57
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	18.2	18.2	18.2	18.2	18.2	18.2
Daytime Leqff	66.2	62.1	56.1	53.2	48.9	45.8
Night time Leqff	60.9	58.1	52.0	48.6	43.0	38.4
Dne	42.2	39.9	33.8	41.2	40.2	36.8
Rwi	25.8	29.7	36.1	39.0	41.3	44.7
Rew	40.0	44.0	45.0	51.0	56.0	56.0
Rrr	28.0	34.0	40.0	45.0	49.0	49.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**26.5**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**22.6**	**dB(A)**

8.5 Rear of site – First Floor Bedroom

Proposed Window Configuration	**4 / 14 / 6 with Greenwood Acoustic Humidity Controlled Energy Saver Window Vent**
Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*
Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	9	9	9	9	9	9
Sr	18	18	18	18	18	18
Swi	2.5	2.5	2.5	2.5	2.5	2.5
Sew	6.5	6.5	6.5	6.5	6.5	6.5
Srr	18	18	18	18	18	18
S	27	27	27	27	27	27
A0	10	10	10	10	10	10
V	44	44	44	44	44	44
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	14.1	14.1	14.1	14.1	14.1	14.1
Daytime Leqff	66.2	62.1	56.1	53.2	48.9	45.8
Night time Leqff	60.9	58.1	52.0	48.6	43.0	38.4
Dne	42.2	39.9	33.8	41.2	40.2	36.8
Rwi	25.8	29.7	36.1	39.0	41.3	44.7
Rew	40.0	44.0	45.0	51.0	56.0	56.0
Rrr	28.0	34.0	40.0	45.0	49.0	49.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**34.8**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**25.9**	**dB(A)**

8.6 Ventilation (D_{ne})

Octave Band Frequency	125	250	500	1000	2000	4000
Greenwood Acoustic Humidity Controlled Energy Saver Window Vent	42.2	39.9	33.8	41.2	40.2	36.8

8.7 Glazing (R_{wi})

Octave Band Frequency	125	250	500	1000	2000	4000
4mm / 14mm / 6mm	24.4	26.5	36.2	41.7	40.3	42.6

8.8 Walls (R_{ew})

Octave Band Frequency	125	250	500	1000	2000	4000
Brick and Concrete Block	40.0	44.0	45.0	51.0	56.0	56.0

8.9 Roof (R_{rr})

Octave Band Frequency	125	250	500	1000	2000	4000
Minimum Value	28.0	34.0	40.0	45.0	49.0	49.0

The above are minimum construction attenuation values and should alternative methods be selected; these should be equal to or greater than the above corresponding values. Calculations carried out have indicated the following specifications should be installed for this site.

9 ASSESSMENT

The development should be designed with a 4mm glass / 14mm air gap / 6mm glass double glazed windows and a Greenwood Acoustic Humidity Controlled Energy Saver Window Vent or similarly approved to all rooms to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014.

10 NIGHT NOISE GUIDELINES EUROPE 2009

The Night Noise Guidelines 2009 make direct reference to the World Health Organisations Guidelines for Community Noise 1999 with recommended guideline criteria of L_{Aeq} 30 dB indoors for continuous noise. The document goes on to explain that sleep disturbance correlates best with L_{Amax} and effects have been observed at 42 dB or less. This is particularly true if the background noise level is low. Noise events exceeding 42 dB(A) should therefore be limited.

It should be noted that BS 8233: 2014 makes no reference to a criteria under this British Standard to L_{Amax} dB limits within bedrooms at night. The aforementioned documents are Guidelines and therefore should be used for reference purposes only.

Section 8.5 calculates an internal bedroom level at night of $L_{Aeq\ 8\ HOUR}$ 25.9 dB. The corresponding night time external level of $L_{Aeq\ 8\ HOUR}$ 54.8 dB was calculated as detailed within this report thus giving an overall façade attenuation of 28.9 dB. Applying this to the L_{Amax} 42 dB level above results in an L_{Amax} target level of L_{Amax} 70.9 dB.

There have been a few periods where this value has been exceeded within the measurement periods and therefore recommendations have been made for upgraded acoustic glazing specification in order to improve the overall acoustic environment within these rooms at night.

11 OUTDOOR LIVING AREAS

The World Health Organisation 'Guidelines for Community Noise gives guidance as to desirable noise levels that should be achieved within outdoor living areas such as gardens, patios and verandas etc.

Table 1: Guideline values for community noise in specific environments, details the desirable target noise levels within various areas.

Outdoor Living Area	
Serious Annoyance, daytime and evening	$L_{Aeq\ 16\ HOUR}$ 55 dB
Moderate Annoyance, daytime and evening	$L_{Aeq\ 16\ HOUR}$ 50 dB

In order to evaluate the external noise levels within the proposed development, and to correctly and accurately select the precise required minimum screen heights, the 3D modelling software CADNA A is to be used. Initially, the site plan is to be overlaid onto Google Earth and then imported directly into CADNA A using the geometric co-ordinates.

From this, the monitoring positions and noise sources such as roads are added. The output noise levels from the roads are then increased until the monitored noise levels are achieved at the monitoring position. This model is then saved and used as a working 3D acoustic model of the site.

The proposed buildings are then constructed on a 3D bases and receptors placed within the garden areas.

The calculation software is then run to evaluate the garden levels within sample plots across the development.

The following CADNA A screen shots demonstrate the existing sites working 3D model. The levels at the measurement position correlate with the measured daytime average levels detailed on pages 10- 13 of this report.



3D View

The development has external living areas on the development and therefore this criteria / guideline would be appropriately considered within the proposed rear residential garden areas.



Upper Section

The layout shown is indicative for purposes of pre application for the noise assessment



Middle Section

The layout shown is indicative for purposes of pre application for the noise assessment



Lower Section

The layout shown is indicative for purposes of pre application for the noise assessment

12 NPPF & NPSE

The National Planning Policy Framework 2018 (NPPF) and assessments to the Noise Policy Statement for England 2010 (NPSE) should be made in conjunction with each other. Paragraphs 180 - 183 of the National Planning Policy Framework 2018 (NPPF) states the following:

Paragraph 180 Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life.
b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Paragraph 181 Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications.

Paragraph 182 Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

Paragraph 183 The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

The Noise Policy Statement for England gives various levels of effect as detailed within this report.
With the glazing / ventilation specifications achieved within this report, the development can be implemented within the guidelines of the aforementioned documents and ensure a conclusion of **NOEL – No Observed Effect Level.** This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

13 CONCLUSION

Levels have been recorded and assessments made in accordance with the relevant standards. Internal criteria's have been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

The development should be designed with a 4mm glass / 14mm air gap / 6mm glass double glazed windows and a Greenwood Acoustic Humidity Controlled Energy Saver Window Vent or similarly approved to all rooms to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014.

The development proposes external living areas and therefore an assessment to the World Health Organisation's 'Guidelines for Community Noise' has been carried out and demonstrates that the external garden areas of the proposed dwellings fall under the upper guideline criteria of 55 dB for external noise.

It has been agreed with Michael Lavender, Senior Environmental Health Officer from Adur & Worthing Councils that the plots at the top of the site closest to the dual carriageway will require a mechanical ventilation heat recovery unit in order to protect future occupiers with regards to noise. Additionally further mitigation measures will be required to some of the garden areas closest to the industrial park. Both these points are to be calculated when further drawings are made available. This does not affect any part of phase 1.

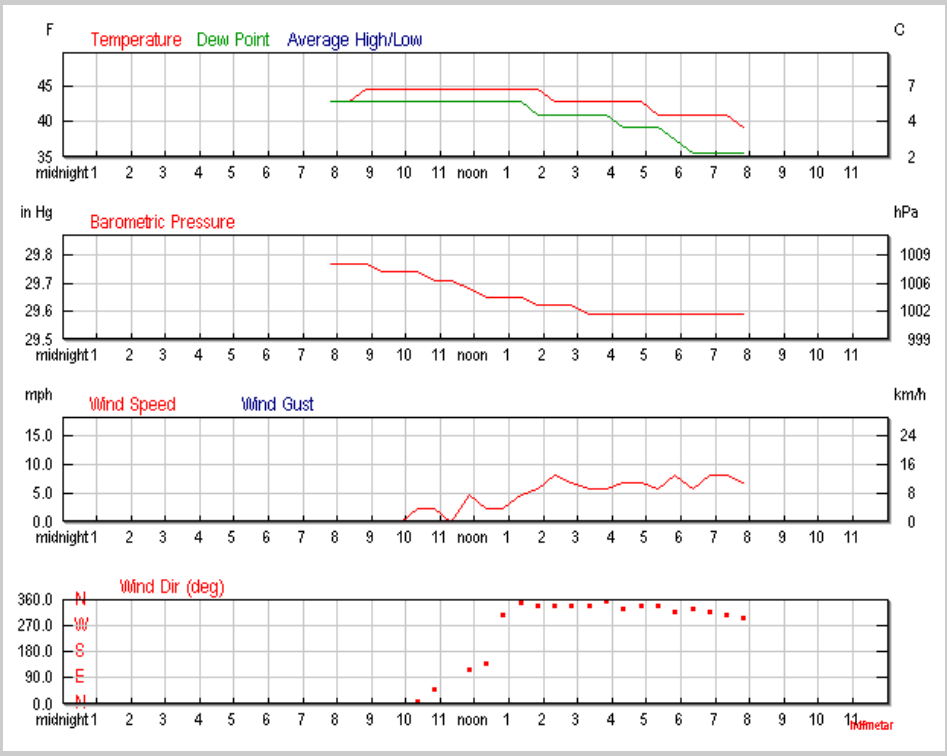
This report and subsequent calculations and assessments have demonstrated that mitigation measures can be introduced to the site in order to ensure compliance with BS 8233: 2014 for predicted internal noise levels within dwellings and the WHO guidelines for community noise for external living areas.

Section 14 of the National Planning Policy Framework 2012 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate the application should be restricted.

Based on the calculations and assessments made within this report it is the professional opinion of Sound Advice Acoustics Ltd that the proposed development can demonstrate compliance with the National Planning Policy Framework 2018, NPPF & NPSE and that, with regards to sound, planning permission can be granted.

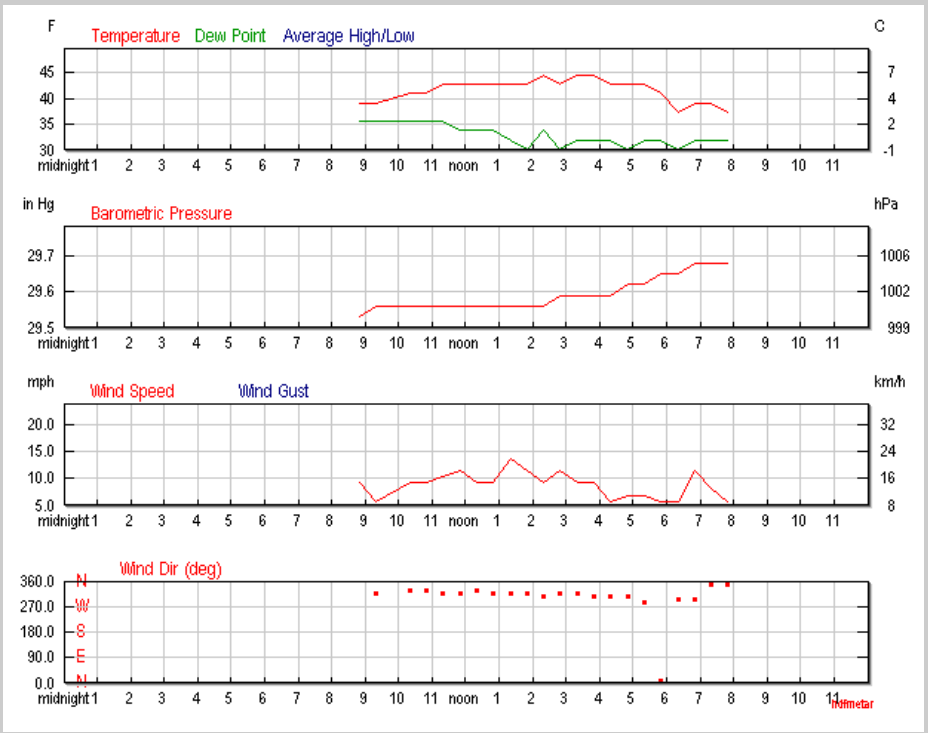
14 ENVIRONMENTAL CONDITIONS

14.1 20th February 2015



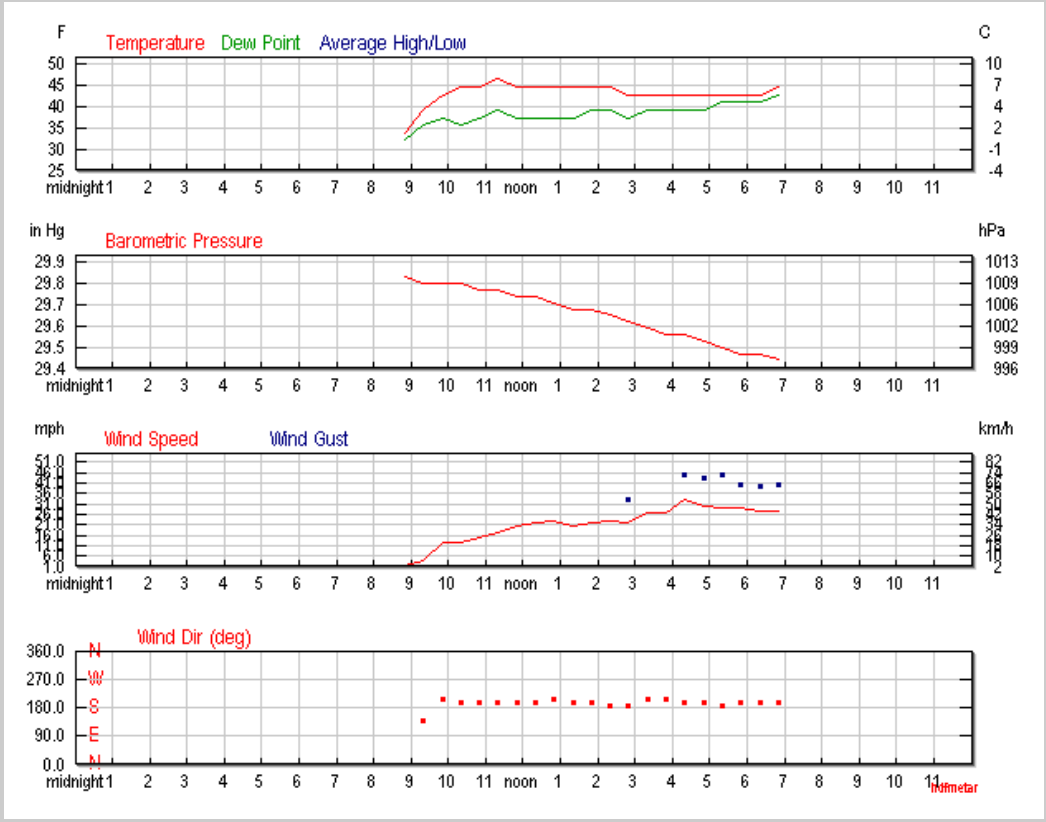
20th February 2015

14.2 21st February 2015



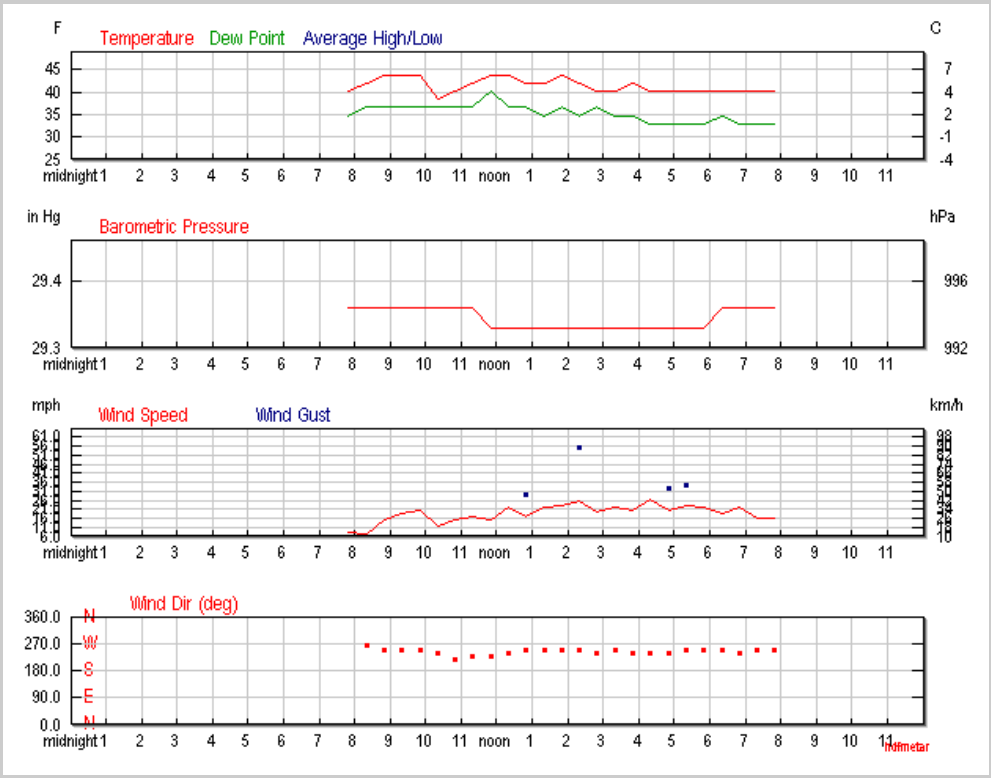
21st February 2015

14.3 22nd February 2015



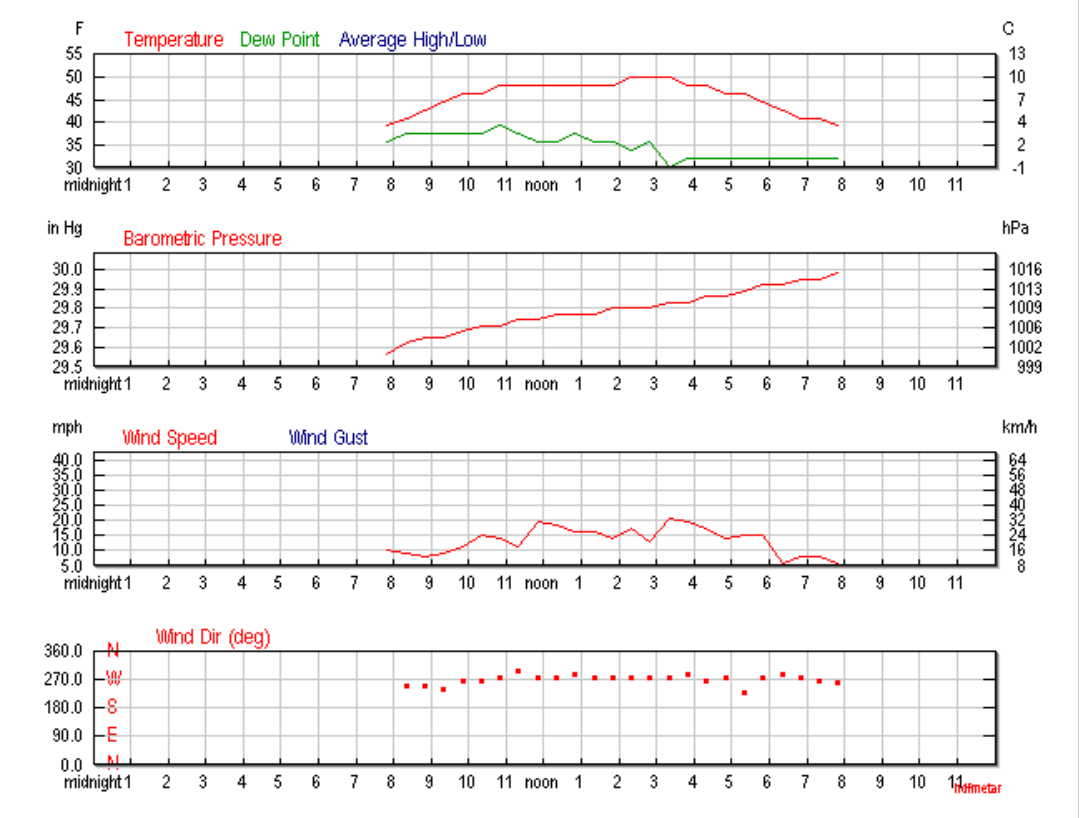
22nd February 2015

14.4 23rd February 2015



23rd February 2015

14.5 24th February 2015



24th February 2015

#END OF REPORT#