Proposed Turkey Units Bromtrees Hall Stoke Lacy Bromyard HR7 4HZ

## NOISE IMPACT ASSESSMENT

Acoustics Report M1415/R01b 14<sup>th</sup> July 2014

To: Ian Pick Associates Llewellyn House Middle Street Kilham Driffield YO25 4RL

By: Paul Smith BSc MIOA

# 1. Introduction

This acoustic report documents a noise impact assessment for the three proposed turkey units and a plant noise assessment for the new extract fans on the existing poultry sheds at Bromtrees Hall, Stoke Lacy, Bromyard; Figure 1.

The report is divided into the following sections:

- Section 2: Overview of the Development
- Section 3: Background Noise survey
- Section 4: Plant Noise Assessment
- Section 5: Transport Noise Assessment
- Section 6: Conclusion
- Appendix A: Noise monitor data
- Appendix B: Calculations

### 2. Overview of the Development

The proposal is for:

- Three new turkey units; Figures 1 & 2
- Replacement extract fans on the four existing poultry sheds; Figure 1.

The closest dwellings to the proposed turkey units and existing poultry sheds, labelled A - C in Figure 1, are between approximately 360m and 800m from the centre of the development.

The line of sight between the proposed turkey sheds and the new extract fan duct terminations on the existing poultry sheds and the nearest dwellings will be fully blocked by:

- Dwelling A: Local topography
- Dwellings B & C: 40m 120m deep dense woodland

For the noise impact assessment for the proposed turkey units the noise sources generated by the proposed scheme have been split into two categories, namely:

- Plant noise (section 4): Each of the proposed sheds will have 14 extract fans located within the units, with roof mounted duct terminations at 6.2m above local ground; Figure 2. The fans will all be by the same manufacturer and of the same type.
- Transport noise (section 5): Transport noise includes vehicles arriving/departing on the access road, manoeuvring and loading/unloading. The HGVs/tankers will use the existing poultry unit's access road, which will be extended to the north of the poultry sheds to access the turkey sheds. The line of sight between the nearest dwellings and the access route and manoeuvering area will be fully blocked by local topography (Dwelling A) and dense woodland (Dwelling B & C).

The side mounted extract fans on the existing poultry sheds are to be replaced by new units, which will be located on the east gable end with an atmosphere duct termination at 6.3m above local ground. Figure 3 shows a photo of this configuration on livestock sheds elsewhere. Each shed will have eight fans; they will be by the same manufacturer and of the same type as those proposed for the roof mounted units in the turkey sheds. The assessment of the aggregate of the proposed poultry and turkey shed extract fan noise is documented in section 4.



Figure 1. Aerial view (source: www.google.com) showing footprint of existing poultry units, proposed turkey sheds, nearest dwellings and noise monitor position



Figure 2. North and west elevations of turkey poultry units



Figure 3. Photo showing gable end mounted extract fans and atmosphere duct terminations on livestock sheds

## 3. Background Noise Survey

A noise survey has been conducted to establish the lowest pre-development background noise levels at the nearest dwellings to the proposed turkey units. Tabulated noise survey data is provided in Table A1, Appendix A.

- Survey dates: 8<sup>th</sup> 9<sup>th</sup> April 2014
- Weather: Dry with wind speeds less than 10mph
- Monitor locations: Microphone, attached to a tripod, located approximately 600m east of Dwelling B; Figure 1
- Equipment: Brüel & Kjær Type 2238
- Monitor configuration: The noise monitor was configured to record consecutive 15minute samples of noise. Measurements are free-field. Tabulated results are given in Table A1, Appendix A
- **Calibration**: The noise monitor was calibrated before and after the survey using a Brüel & Kjær Type 4231 calibrator with no deviations found

### 3.1 Lowest background noise level, LA90, at nearest dwellings

Figure 3 show the variation of the measured background ( $L_{A90}$ ) noise levels. The overall lowest measured background noise levels obtained were:

- 07:00 18:00hrs: L<sub>A90</sub> 32dB
- 18:00 20:00hrs: L<sub>A90</sub> 31dB
- 20:00 07:00hrs: L<sub>A90</sub> 23dB

The above lowest background noise levels are expected to represent those that will occur at the nearest dwellings to the proposed turkey and existing poultry units.



Figure 4. Noise monitor data (free-field)

It should be noted that the noise data obtained shows no indication of unusual noise events that will have affected the lowest background noise levels at the two measurement positions; the fluctuation in noise level is typical of a rural area over a 24hr period. From experience we have found that there is very good repeatability in the lowest background noise levels on a day-to-day basis during dry and relatively still conditions (both rain and wind will increase the background noise level).

#### 4. Plant Noise Assessment

4.1 Calculation of aggregate plant noise at nearest dwellings

The full calculation is provided in Table B1, Appendix B with the resultant aggregate noise level at each Dwelling A – C given in Table 2.

#### 4.2 Fan noise data

- Fan type: Ziehl-Abegg FC063-6E
- Duct termination:
  - Proposed turkey sheds: Roof mounted duct, terminating 6.3m above ground
  - Existing poultry sheds: East gable end mounted ducts, terminating 6.3m above ground
- Sound pressure level: 63dB(A), measured at 90° from the centre of the fan at 2m. The measurements of the Ziehl-Abegg FC063-6E were conducted by Matrix Acoustics at Dungeon Farm, Wells, Somerset, with the in-situ extract fan operating at full capacity. The fan's duct termination was 1m above the roof of the broiler shed; the measurements therefore include reflections off the roof.

### 4.3 Extract fan operation

The number of thermostatically controlled extract fans operating at any one time depends on the stage in the flock cycle and ambient temperature. In the early stages of the flock cycle typically one to two fans per shed would operate during the day, with only 100% fans operating when high ambient temperatures coincide with the end of the flock cycle. During the evening and night the external temperature will fall, which will result in a substantial drop in demand for the operation of the extract fans to regulate the internal temperature of the broiler units; typically no more than 30% of the extract fans would be expected to be operating at one time per shed.

The calculation has been based on the 'worst case' assumption of all extract fans operating between 07:00 - 20:00 hrs, and 50% operating at any one time between 20:00 - 07:00 hrs.

#### 4.4 Atmosphere attenuators

Table 1 provides the 63Hz – 500Hz minimum insertion loss requirements for attenuators fitted to the atmosphere side of each of the extract fans.

Table 1. Atmosphere side attenuators insertion losses												
Octave Band Centre Frequency												
63Hz	125Hz	250Hz	500Hz									
3	3 5 13 18											

### 4.5 Derivation of aggregate Plant Noise at Dwellings A - C

The individual noise level of each proposed extract fan has been calculated at the three nearest Dwellings, A - C; Figure 1. The following corrections have been applied to the measured extract fan noise data (see section 4.2):

- Attenuator: Insertion loss atmosphere side attenuator (see Table 1)
- **Distance correction:** 20 x log  $(d_1/d_0)$ , where  $d_1$  = distance between receptor and the proposed extract fan and  $d_0$  = distance between reference extract fan and noise monitor (2m). Note the receptor height has been taken to be 4.5m above ground, which represents 1<sup>st</sup> floor level
- **Ground absorption correction:** ISO 9613-2: Attenuation of sound during propagation outdoors, Formula 10:

$$A_{gr} = 4.8 - (2h_m/d)[17 + (300/d)]$$

Where,

 $h_m$  = mean height of the propagation path above ground

d = distance from source to receptor

- Shielding correction: Where the line of sight between the dwelling and extract duct termination is fully blocked by a solid barrier, as with the local topography for Dwelling A, 10dB shielding correction has been applied in accordance with BS5228-1 2009.
- Foliage correction: Attenuation values given in ISO 9613-2: Attenuation of sound during propagation outdoors, Table A1, to account for dense foliage of trees and shrubs that are greater than 20m deep as will occur between the proposed extract fan duct terminations and Dwellings B & C

Table B1, Appendix B provides the full calculation with the resultant aggregate extract fan noise at the three Dwellings A - C given in Table 2.

### 4.6 Assessment Level

We define Assessment Level =  $L_p - \min L_{A90} dB$ , where:

L<sub>p</sub> = Aggregate extract fan sound pressure level, dB(A)

Min  $L_{A90}$  dB = the lowest background noise level,  $L_{A90}$ , derived from the noise survey data

Table 2 provides the resultant Assessment Level at Dwellings A - C.

With attenuators fitted that achieve the minimum insertion losses given in Table 1, the highest calculated Assessment Level is -10dB at the nearest dwellings. This will result in a negligible noise impact.

Table 2. Lowest measured background, calculated extract fan sound pressure level and Assessment Level at the nearest dwellings A - C												
ure 1)	07 All extr	:00 - 20:00h act fans op	nrs: erating	20:00 - 07:00hrs: 50% fans of fans operating								
Dwelling (Figu	[A] Lowest L <sub>A90</sub> dB	[B] Extract fan L <sub>p</sub> , dB	[B] - [A] Assessment Level, dB	[C] Lowest L <sub>A90</sub> dB	[D] Extract fan L <sub>p</sub> , dB	[D] - [C] Assessment Level, dB						
A	31	12	-19	23	9	-14						
В	B 31 17 -15 23 14 -10											
C	D         O1         H         10         20         H         10           C         31         9         -22         23         6         -17											

## 5. Transport Noise Assessment

Transport related noise already occurs at Bromtrees Hall as a result of the existing poultry units. With the addition of the proposed units there will be an overall increase in traffic movements. This will not change the transport Rating Levels already experienced at the nearest dwellings, but will increase the frequency of these events. The purpose of the assessment is therefore to determine the acceptability of the noise emissions from transport related activities be it from the existing or proposed poultry units.

Transport noise for the proposed turkey sheds will occur between 07:00 - 18:00 hrs with the exception of bird removal, which will be undertaken at night (reduces stress on the birds). It should be noted that bird removal for the proposed units will only be three times a year.

5.1 Calculation of Transport Noise

The full calculation is provided in Table B2, Appendix B with the resultant BS4142 Assessment Levels at Dwellings A, B & C given in Table 4.

#### 5.2 Transport vehicles

Table 3 provides the number of transport vehicles per flock cycle for the existing poultry units and proposed turkey sheds.

Table 3. Transport vehicle details									
	Traffic generation								
Activity	Existing poultry sheds	Proposed turkey sheds							
Bird Delivery	4	3							
Feed Delivery	38	29							
Bird Removal	27	20							
Total per cycle	69	52							
Total per annum (3 flocks)	207	156							

#### 5.3 Transport source noise levels

Measurements of transport related activity noise levels were obtained during poultry catching at Parton Poultry Farm, Herefordshire on 9/1/14. The measurements were made at 5m from the noise source with the noise monitor mounted on a tripod. Table 4 provides the recorded noise levels.

For our assessment we have used the recorded noise levels of an HGV loading/unloading, manoeuvring and travelling at 10mph.

Table 4. Measured transport noise source levels at 5m (free-field)	
Event	L <sub>Aeq</sub> dB
HGV engine idling	68
HGV manoeuvring	72
HGV passing the noise monitor at approximately 10mph	71
HGV loading/unloading using a diesel forklift over a 5min period	72

# 5.4 Deviation of BS4142 Specific Level

To establish the Specific Level (SL) of transport related noise at the nearest dwellings the following corrections have been applied to the source noise levels given in Table 4:

- On-time correction: 10 log (r/r<sub>ref</sub>), where r is the on-time of the noise event over the reference time, r<sub>ref</sub>. In accordance with BS4142 r<sub>ref</sub> = 60 minutes during the day and 5 minutes during the night. Access to the turkey sheds will be via a track to the north of the existing poultry units; Figure 1. The greatest distance that a HGV will have to travel between the road and the turkey sheds is 300m; this will take an HGV travelling at 15mph under 1 minute to complete. For the calculation 1 minute has been allowed for manoeuvring in the unloading/loading area. Two transport movements (HGV travelling along the access road + manoeuvring) per hour have been assumed during the day and one transport movement during the night. For loading/unloading an on-time r of 45minutes during the day and 5minutes during the day and 5minutes during the night has been used.
- **Distance correction:** 20 x log (d<sub>1</sub>/d<sub>0</sub>), where d<sub>1</sub> = distance between receptor and the noise source and d<sub>0</sub> = measurement distance from the noises source (5m)
- Shielding correction: Where the line of sight between the dwelling and noise source is fully blocked by a solid barrier, as will occur between Dwelling A due to local topography, 10dB shielding attenuation has been applied in accordance with BS5228-1 2009.
- **Ground absorption correction:** ISO 9613-2: Attenuation of sound during propagation outdoors, Formula 10:

$$A_{gr} = 4.8 - (2h_m/d)[17 + (300/d)]$$

Where,

 $h_m$  = mean height of the propagation path above ground

d = distance from source to receptor

• Foliage correction: Attenuation values given in ISO 9613-2: Attenuation of sound during propagation outdoors, Table A1, to account for dense foliage of trees and shrubs that are greater than 20m deep as will occur between the access road and unloading/loading areas and Dwellings B & C

The calculation and resultant SLs are given in Tables B2 & B3, Appendix B.

# 5.5 Deviation of BS4142 Rating Level

To account for the potential intermittent/impulsive nature of the transport related noise, a BS4142 +5dB character correction has been added to the calculated Specific Level values to determine the Rating Level. Table 5 provides the resultant Rating Levels at Dwellings A – C as calculated in Tables B2 and B3, Appendix B.

### 5.6 BS4142 Assessment Level

We define BS4142 Assessment Level =  $RL - min L_{A90} dB$ , where:

RL = Rating Level

Min  $L_{A90}$  dB = the lowest background noise level,  $L_{A90}$ , between 07:00 – 18:00hrs and 'typical' lowest background between 18:00 – 07:00hrs derived from the survey data.

The resultant Assessment Level (AL) is given in Table 5. The highest AL of the transport related activities (transport movements and loading/unloading) is -3dB (3dB below background) during the day and +5dB during the night.

It should be noted that BS4142 considers a Rating Level of 35dB to be very low; the highest predicted Rating Level in this case is 30dB. We therefore consider that the transportation noise will result in a negligible noise impact at the nearest dwellings.

Table	Table 5. Calculated transport BS4142 Assessment Level at Dwellings A, B & C											
	Day	(07:00 - 18:00	)hrs)	Night (18:00 - 07:00hrs)								
Dwelling (Figure 1)	[A] Lowest Laso dB	<ul> <li>[B] Aggregate HGV movements &amp; loading/unloading Rating Level</li> </ul>	[B] - [A] Assessment Level	[C] Typical lowest LA90 dB	[D] Aggregate HGV movements	[D] - [C] Assessment Level	[E] HGV loading/unloading	[E] - [C] Assessment Level				
Α	32	24	-8	25	23	-2	25	0				
В	32	29	-3	25	26	1	30	5				
C	32	21	-11	25	17	-8	22	-3				

### 6. Conclusion

A noise survey has been conducted to determine the lowest background noise levels at the nearest dwellings to the proposed turkey units.

Via calculation (Appendix B) it has been demonstrated that the aggregate:

- Extract fan noise level at the nearest Dwellings (A C, Figure 1) can be controlled so that at its greatest it is 10dB below the lowest measured background noise level (Assessment Level -10dB). This can be achieved provided that attenuators are fitted to the atmosphere side of the extract fans that meet the insertion loss values given in Table 1.
- Rating Level of HGV movements and loading/unloading will be no more than 3dB below the lowest measured background between 07:00 – 18:00hrs and 5dB above the typical lowest background during the night. Note that the highest predicted RL is 30dB, which is considered by BS4142 to be very low.

The resultant plant and transport noise is therefore considered to have a negligible noise impact at the nearest dwellings.

Table A1	. Noise	monitor	data (fr	ee-field)							
Start	$L_{Amax,F}$	$L_{Aeq}$	L <sub>A90</sub>	Start	L <sub>Amax,F</sub>	$L_{Aeq}$	L <sub>A90</sub>	Start	$L_{Amax,F}$	$L_{Aeq}$	L <sub>A90</sub>
Time	dB	dB	dB	Time	dB	dB	dB	Time	dB	dB	dB
16:00	76.6	48.8	38.0	01:30	56.6	37.3	24.5	11:00	65.3	47.7	34.5
16:15	55.7	42.6	37.5	01:45	38.2	32.7	30.0	11:15	62.6	45.6	34.5
16:30	62.8	46.9	40.0	02:00	37.6	31.3	29.5	11:30	67.2	48.2	36.0
16:45	74.8	53.2	37.5	02:15	41.9	31.2	29.0	11:45	53.6	39.6	34.0
17:00	60.5	44.1	36.0	02:30	35.8	31.5	28.0	12:00	55.9	41.0	35.0
17:15	65.9	42.9	36.5	02:45	40.9	30.1	27.5	12:15	67.8	46.5	33.5
17:30	54.2	40.0	33.0	03:00	35.0	30.5	28.5	12:30	71.8	48.2	33.0
17:45	76.0	52.7	34.0	03:15	44.3	32.6	30.0	12:45	54.6	40.3	35.5
18:00	66.6	45.3	33.0	03:30	36.0	30.2	28.0	13:00	59.3	39.1	32.0
18:15	63.5	46.4	33.0	03:45	37.6	31.5	28.5	13:15	71.9	46.5	32.5
18:30	66.8	43.0	31.5	04:00	38.1	33.2	30.5	13:30	56.2	39.6	33.5
18:45	67.1	43.6	32.0	04:15	55.1	37.9	30.5	13:45	62.5	41.5	33.5
19:00	57.9	40.2	31.5	04:30	48.5	36.1	33.5	14:00	70.3	46.5	34.5
19:15	55.3	40.0	32.0	04:45	47.2	37.2	35.0	14:15	81.8	51.5	35.0
19:30	59.5	42.6	31.5	05:00	48.4	36.8	34.5	14:30	62.2	44.1	38.5
19:45	63.9	47.4	33.0	05:15	52.1	37.8	35.5	14:45	69.0	43.8	37.0
20:00	59.3	40.5	30.5	05:30	71.3	50.9	39.0	15:00	54.8	42.3	37.5
20:15	65.0	42.4	30.0	05:45	72.2	56.5	43.5	15:15	66.0	49.2	37.0
20:30	57.5	38.0	27.0	06:00	72.0	52.8	41.0	15:30	57.8	44.0	37.5
20:45	56.2	36.9	25.0	06:15	71.3	52.5	41.5	15:45	68.0	48.8	37.5
21:00	58.2	39.7	26.0	06:30	71.0	50.8	41.0	16:00	78.4	50.5	37.0
21:15	55.5	37.4	25.0	06:45	68.0	44.3	37.0	16:15	77.7	48.8	37.0
21:30	54.8	36.7	25.5	07:00	58.9	44.5	37.0	16:30	78.9	51.2	37.0
21:45	56.1	37.6	25.5	07:15	80.4	56.1	38.5	16:45	78.5	50.3	35.5
22:00	55.5	38.0	26.5	07:30	53.0	44.5	39.5	17:00	78.2	49.6	33.5
22:15	67.2	49.0	26.5	07:45	66.0	44.9	39.5	17:15	77.6	48.6	35.0
22:30	43.7	30.1	26.0	08:00	58.6	44.8	40.0	17:30	77.0	50.4	36.5
22:45	46.3	27.9	25.0	08:15	70.3	46.9	38.5	17:45	77.5	48.2	36.5
23:00	43.2	28.8	25.0	08:30	66.6	47.3	38.5	18:00	68.4	52.2	37.0
23:15	37.1	27.5	25.0	08:45	62.5	45.7	39.0	18:15	76.5	46.6	35.0
23:30	46.5	30.7	26.0	09:00	64.5	46.2	39.0	18:30	62.2	43.5	32.5
23:45	36.7	28.3	25.5	09:15	74.0	51.9	38.0	18:45	59.7	43.9	33.5
00:00	45.5	27.6	24.5	09:30	63.7	47.0	36.0	19:00	67.7	46.8	35.5
00:15	38.6	28.9	24.5	09:45	69.7	45.1	35.0	19:15	69.0	51.2	37.5
00:30	45.1	29.7	24.0	10:00	65.6	47.1	33.5	19:30	60.8	47.7	32.5
00:45	39.7	26.5	23.5	10:15	57.6	41.4	33.0	19:45	56.5	40.0	31.0
01:00	38.1	26.1	23.0	10:30	66.5	49.8	38.5	20:00	66.1	44.4	33.0
01:15	39.4	26.4	23.0	10:45	68.6	49.7	34.5				

# Appendix B: Calculations

Table B1. Proposed extract fan noise at Dwelling A with attenuators fitted																
Extract f	an: Zie	hl-Abeg	g FC063	3-6E						0.1	. David	0	-			
									63	125	250 e Band	S00	Frequer 1000	2000	4000	dB(A)
	I at Q	<u>n° sidev</u>	vavs fror	m the ce	ontre of	fan at a	distanc	e of 2m	81	68	66	60	55	52	42	63
	Lp ut o	o olaci	ayo nor	aon			40% fr		2	5	12	10	20	22	16	00
1 -4	000 -:-!			yen			40 % 11		3	5	15	10	20	22	10	
L <sub>p</sub> at	90° sidi	eways fr	om the	centre d	of fan wi	ith atten	distanc	ted at a e of 2m	78	63	53	42	35	30	26	54
Proposed sheds Existing sheds									Pror	oosed s	heds		Fxistin	sheds		
	]	2	20	ကိ	<u></u>	<u> </u>	ពួ	4		2	2	ကိ	2	<u></u>	ព	4
Fan		ed F	ed F	ed F	edE	ed E	ed E	ed E		ed F	ed F	ed F	edE	ed E	ed E	ed E
		Ŝ	Ŝ	ů.	ů.	ů.	Š	ů.		Ŝ	Š	ů.	ů.	ů.	Š	ů.
1		401.6	409.9	421.8 427.4	328.7 328.5	336.3 336.0	355.7	366.5		46.1	46.2 46.4	46.5 46.6	44.3 44.3	44.5 44.5	45.0 45.0	45.3 45.3
3		413.3	421.4	433.0	328.3	335.7	354.9	365.7	m	46.3	46.5	46.7	44.3	44.5	45.0	45.2
4	ε	419.1	427.1	438.5	328.0	335.4	354.6	365.2	), df	46.4	46.6	46.8	44.3	44.5	45.0	45.2
5	é.	425.0	432.8	444.1 449.8	329.2 329.4	336.9	356.4	367.4	ction	46.5	46.7 46.8	46.9 47 0	44.3 44.3	44.5 44.5	45.0 45.0	45.3 45.3
7	stan	436.7	444.3	455.4	329.7	337.5	357.2	368.3	rrec	46.8	46.9	47.1	44.3	44.5	45.0	45.3
8	t dis	442.6	450.0	461.0	329.9	337.8	357.6	368.7	00	46.9	47.0	47.3	44.3	44.6	45.0	45.3
10	irec	440.4	400.0	400.7					ance	47.0	47.2 47.3	47.4 47.5				
11	ā	460.2	467.4	478.0					Dista	47.2	47.4	47.6				
12		466.1	473.2	483.7						47.3	47.5	47.7				
13		472.0	479.0	409.3 495.0						47.5	47.0 47.7	47.0 47.9				
1		4.3	4.3	4.4	4.2	4.2	4.3	4.3		10	10	10	10	10	10	10
2		4.3	4.3	4.4 4 4	4.2	4.2	4.3 ⊿ 3	4.3 ⊿ 3		10	10 10	10 10	10 10	10 10	10 10	10 10
4	Вb	4.3	4.4	4.4	4.2	4.2	4.3	4.3	dB	10	10	10	10	10	10	10
5	ou,	4.4	4.4	4.4	4.2	4.2	4.3	4.3	ion,	10	10	10	10	10	10	10
6	orpti	4.4 4.4	4.4 4.4	4.4 4.4	4.2 4.2	4.2 4.2	4.3 4.3	4.3 4.3	rect	10	10 10	10 10	10 10	10 10	10 10	10 10
8	absc	4.4	4.4	4.4	4.2	4.2	4.3	4.3	cor	10	10	10	10	10	10	10
9	ud 0	4.4	4.4	4.4					ling	10	10	10				
10	rou	4.4	4.4 4.4	4.4 4.4					Jeilo	10	10	10				
12	U U	4.4	4.4	4.4					Ś	10	10	10				
13		4.4	4.4	4.4						10	10	10				
14		<u>4.4</u> 0	<u>4.4</u> 0	<u>4.4</u> 0	0	0	0	0	ۍ م	-7	-7	-7	-5	-5	-6	-6
2		0	0	0	0	0	0	0	ellin	-7	-7	-7	-5	-5	-6	-6
4	B	0	0	0	0	0	0	0	dv	-7	-7	-7 -8	-5	-5	-0 -6	-0 -6
5	ion,	0	0	0	0	0	0	0	el at	-7	-7	-8	-5	-5	-6	-6
7	rect	0	0	0	0	0	0	0	eve (A)	-7 -8	-8 -8	-8 -8	-ə -5	-5 -5	-0 -6	-0 -6
8	cor	0	0	0	0	0	0	0	dB(	-8	-8	-8	-5	-5	-6	-6
10	age	0 0	0	0	0	0	0	0	ISSe	-8 -8	-8 -8	-8 -8				
11	olia	0	0	0	0	0	0	0	pre	-8	-8	-8				
							0	ouno	-8 -8	-8 -8	-8 -9					
								0	So	-8	-9	-9				
Aggregate L <sub>p</sub> Day (07:00 - 20:00hrs):						, ar(a)							12 31			
100	100% extract fans operating Lowest day background						essmer	Level							-19	
	Aggregate L							egate L,	, dB(A)							9
50°	light (2)	0:00 - 07	(:00hrs)	: 10	Lov	west nig	ht back	ground,	L <sub>A90</sub> dB							23
	50% extract fans operating Lowest night back							sessmer	nt Level							-14

# Appendix B: Calculations

Table B2	2. Propo	osed ext	ract fan	noise a	at Dwelli	ng B wi	th atten	uators fi	tted							
Extract f	an: Zie	hl-Abeg	g FC06	3-6E						<b>0</b> /	- ·	<b>•</b> •	-			
									63	Octave 125	e Band	Centre	Frequer	1CY, HZ	4000	dB(A)
	I at 90	0° sidew	avs from	n the ce	entre of	fan at a	distanc	e of 2m	81	68	66	60	55	52	42	63
	L <sub>p</sub> at 50	0 31000	ays no	den	eric atte	enuator	40% fr	ee area	3	5	13	18	20	22	16	00
L <sub>p</sub> at	90° side	eways fr	om the	centre d	of fan wi	ith atten	autor fit	ted at a	70	60	50	40			26	54
							distanc	e of 2m	78	03	53	42	35	30	20	54
Proposed sheds Existing sheds									Prop	bosed s	heds		Existin	g sheds		
_		Р	P2	Р3	Ē	E2	E3	Ε4		5	P2	Р3	Ē	E2	E3	E4
Fan		hed	hed	hed	hed	hed	hed	hed		hed	hed	hed	hed	hed	hed	hed
1		<u>の</u> 555.2	<u>の</u> 532.9	<u>の</u> 512.0	<u>の</u> 523.1	の 498 3	の 4763	の 4533		の 48 9	<u>の</u> 48.5	の 48.2	<u> </u>	の 47 9	<u>の</u> 47.5	ഗ 47 1
2		558.8	536.7	515.9	524.1	499.3	477.2	454.1		48.9	48.6	48.2	48.4	47.9	47.6	47.1
3		562.5	540.5	519.9	525.0	500.2	478.1	455.0	В	49.0	48.6	48.3	48.4	48.0	47.6	47.1
4	Ε	566.2	544.3	523.9	525.9	501.1	479.0	455.9	р, С	49.0	48.7	48.4	48.4	48.0	47.6	47.2
6	Ġ.	570.0	552.1	526.0 532.1	521.5	490.5	474.5	451.5	ction	49.1	40.0 48.8	40.4 48.5	40.3	47.9	47.5	47.1
7	tan	577.6	556.1	536.2	519.5	494.7	472.8	449.8	rrec	49.2	48.9	48.6	48.3	47.9	47.5	47.0
8	dis	581.5	560.1	540.4	518.6	493.8	471.9	448.9	8	49.3	48.9	48.6	48.3	47.9	47.5	47.0
9	ect	585.4	564.2	544.6					nce	49.3	49.0	48.7				
10	Ē	593.3	572.4	540.0 553.1					sta	49.4	49.1	40.0 48.8				
12		597.3	576.5	557.4					ā	49.5	49.2	48.9				
13		601.4	580.7	561.7						49.6	49.3	49.0				
14		605.4	584.9	566.1	11	11	11	1.1		49.6	49.3	49.0	0	0		0
2		4.5	4.4	4.4	4.4	4.4	4.4	4.4		0	0	0	0	0	0	0
3		4.5	4.5	4.4	4.4	4.4	4.4	4.4	В	0	0	0	0	0	0	0
4	, d	4.5	4.5	4.4	4.4	4.4	4.4	4.4	р ú	0	0	0	0	0	0	0
5	tior	4.5	4.5 4.5	4.4 4.4	4.4 4.4	4.4 4.4	4.4 4.4	4.4 4.4	ctio	0	0	0	0	0	0	0
7	orp	4.5	4.5	4.4	4.4	4.4	4.4	4.4	rrec	Ő	Ő	õ	õ	Ő	õ	õ
8	sde	4.5	4.5	4.5	4.4	4.4	4.4	4.4	8	0	0	0	0	0	0	0
9	pu	4.5	4.5	4.5					ling	0	0	0				
10	D D	4.5	4.5 15	4.5 4.5					eilc		0	0				
12	Ū	4.5	4.5	4.5					Sh	0	0	0				
13		4.5	4.5	4.5						0	0	0				
14		4.5	4.5	4.5	2	2	2	2	_	0	0	0	2	2	1	1
2		3	3	3	3	3	3	3	lling	-3	-2	-2 -2	-2 -2	-2	- 1 -1	-1 -1
3	щ	3	3	3	3	3	3	3	we	-3	-2	-2	-2	-2	-1	-1
4	Ľ,	3	3	3	3	3	3	3	atd	-3	-3 -3	-2 -2	-2 -2	-2 -2	-1 -1	-1 -1
6	ctio	3	3	3	3	3	3	3	) (el	-3	-3	-2	-2	-2	-1	-1
7	orre	3	3	3	3	3	3	3	a le	-3	-3	-2	-2	-2	-1	-1
9	00	3	3	3	3	3	3	3	dE	-3	-3 -3	-2 -3	-2	-2	-1	-1
10	age	3	3	3					esc	-3	-3	-3				
								d pr	-3	-3	-3					
								Duno	-3	-3	-3 -3					
							oncte !	З С С	-4	-3	-3				47	
Aggregate L Day (07:00 - 20:00hrs):						, ar(a)							17 24			
100% extract fans operating Assessme					tlevel							-15				
Aggregate L					, dB(A)							14				
N 500	Night (20:00 - 07:00hrs): 50% extract fame expension						ground,	L <sub>A90</sub> dB							23	
50	50% extract fans operating Lowest hight background Assessme						sessmer	nt Level							-10	

# Appendix B: Calculations

Table B3	8. Propo	osed ext	ract fan	noise a	it Dwelli	ng C wi	th atten	uators fi	tted							
Extract f	an: Zie	hl-Abeg	g FC063	3-6E						Osta	David	0	<b>-</b>			
									63	125	250 250	Centre	Frequer	2000	4000	dB(A)
	L <sub>0</sub> at 90	)° sidew	ays fror	n the ce	entre of	fan at a	distanc	e of 2m	81	68	66	60	55	52	42	63
				gen	eric atte	enuator,	40% fr	ee area	3	5	13	18	20	22	16	
L <sub>p</sub> at	90° side	eways fr	om the	centre o	of fan wi	ith atten	autor fit distanc	ted at a e of 2m	78	63	53	42	35	30	26	54
		Pror	osed s	heds		Existin	g sheds			Proposed sheds				Existing	g sheds	
								4					-			
Fan		р Д Д	р Д	р Д	Ш	Б	Б	Б		D D D	р Д	р Д	Ш Ю	Б	ы В	Ш р
		She	She	She	She	She	She	She		She	She	She	She	She	She	She
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Direct distance, m	791.8 788.0 784.2 780.4 776.7 773.0 769.3 765.6 762.0 758.4 754.8 754.8 751.3 747.8 744.3	771.2 767.3 763.4 759.5 755.6 751.8 748.0 744.2 740.5 736.8 733.1 729.5 725.9 722.3	749.5 745.4 741.4 737.4 729.5 725.6 721.7 717.9 714.0 710.3 706.5 702.8 699.1	847.2 847.8 848.5 849.2 845.9 845.2 844.5 843.9	829.4 830.0 830.7 831.3 828.1 827.4 826.8 826.2	803.1 803.7 804.4 805.0 801.9 801.2 800.6 800.0	786.8 787.4 788.0 788.6 785.6 785.0 784.3 783.7	Distance correction, dB	52.0 51.9 51.8 51.8 51.7 51.7 51.7 51.7 51.6 51.6 51.5 51.5 51.5 51.4	51.7 51.7 51.6 51.6 51.5 51.5 51.5 51.4 51.4 51.4 51.3 51.3 51.2 51.2 51.2	51.5 51.4 51.4 51.3 51.2 51.2 51.2 51.2 51.1 51.1 51.1 51.0 51.0 50.9 50.9	52.5 52.6 52.6 52.5 52.5 52.5 52.5 52.5	52.4 52.4 52.4 52.3 52.3 52.3 52.3 52.3	52.1 52.1 52.1 52.1 52.1 52.1 52.0 52.0	51.9 51.9 51.9 51.9 51.9 51.9 51.9 51.9
1		4.6	4.6	4.6	4.6	4.6	4.6	4.6		0	0	0	0	0	0	0
2 3 4 5 6 7 8 9 10 11 12 13 14	Ground absorption, dB	4.6 4.6 4.6 4.6 4.6 4.6 4.6 4.6 4.6 4.6	4.6 4.6 4.6 4.6 4.6 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.5	4.6 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.5	4.6 4.6 4.6 4.6 4.6 4.6 4.6	4.6 4.6 4.6 4.6 4.6 4.6 4.6	4.6 4.6 4.6 4.6 4.6 4.6 4.6	4.6 4.6 4.6 4.6 4.6 4.6 4.6	Sheilding correction, dB				0 0 0 0 0 0		0 0 0 0 0 0	0 0 0 0 0 0
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Foliage correction, dB	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	7 7 7 7 7 7 7 7	7 7 7 7 7 7 7	7 7 7 7 7 7 7 7	7 7 7 7 7 7 7 7	Sound pressure level at dwelling, dB(A)	-10 -10 -10 -10 -10 -10 -10 -10 -10 -10	-10 -10 -10 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9	-9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -	-11 -11 -11 -11 -11 -10 -10 -10	-10 -10 -10 -10 -10 -10 -10 -10	-10 -10 -10 -10 -10 -10 -10	-10 -10 -10 -10 -10 -10 -10
Aggregate L <sub>p</sub> ,							, dB(A)	-	-	-				9		
Day (07:00 - 20:00005):         Lowest day background,           100% extract fans operating         August and August a					L <sub>A90</sub> dB							31				
Assessmen					t Level							-22				
N	Aggregate I Night (20:00 - 07:00hrs): Lowest night background						egate L <sub>p</sub> around	, aB(A) L <sub>100</sub> dR							6 23	
509	50% extract fans operating Lowest night background Assessm						sessmer	nt Level							-17	

Table B4. Calculation of transport BS4142 Assessment Level at Dwellings A, B & C between 07:00 - 18:00hrs											
					L <sub>Aeq,5min</sub> dB						
Source	HGV arriving/departing at 5m				71						
noise levels	HGV manoeuvring at 5m				72						
	HGV loading/unloading using a diese	l forklift at	5m		72						
Dwelling		Α	В	С	А	В	С	Α	В	С	
BS4142 Spe	cific Level										
		HGV a	HGV arriving/departing HGV				ring	HGV lo	ading/unl	oading	
(A)	Distance, m	230	413	750	380	490	760	380	490	760	
suo	Distance correction, dB	33	38	44	38	40	44	38	40	44	
ecti	Ground absorption correction, dB	4.4	4.6	4.7	4.6	4.6	4.7	4.6	4.6	4.7	
Sorr	Foliage correction, dB	0.0	3.0	7.0	0.0	3.0	7.0	0.0	3.0	7.0	
	Shielding correction, dB	10	0	0	10	0	0	10	0	0	
el fic	On time, mins	2	2	2	2	2	2	45	45	45	
eve	On time correction, dB (r <sub>ref</sub> = 60mins)	-15	-15	-15	-15	-15	-15	-1	-1	-1	
С Sp	Specific Level, dB	9	10	1	5	10	2	19	23	15	
BS4142 Rat	ing & Assessment Level										
		Aggregat	te HGV mo	ovements							
a lei		& loa	ading/unloa	ading							
ing ssm svel	BS4142 character correction	5	5	5							
Rati Ses Le	Rating Level, dB	24	29	21							
As	Lowest working day L <sub>A90</sub> , dB	32	32	32							
	Assessment Level	-8	-3	-11							

Table B5. C	alculation of transport BS4142 Assess	ment Leve	l at Dwell	ings A, B 8	C betwee	en 18:00 -	07:00hrs				
					$L_{Aeq,5min}$						
					dB						
Source	HGV arriving/departing at 5m				71						
noise levels	HGV manoeuvring at 5m				72						
	HGV loading/unloading using a diesel	forklift at 5	Sm		72						
Dwelling		Α	В	С	А	В	С	Α	В	С	
BS4142 Spe	ecific Level										
		HGV a	rriving/de	oarting	HG\	/ manoeu	/ring	HGV lo	ading/unl	oading	
	Distance, m	230	413	750	380	490	760	380	490	760	
suo	Distance correction, dB	33	38	44	38	40	44	38	40	44	
ectic	Ground absorption correction, dB	4.4	4.6	4.7	4.6	4.6	4.7	4.6	4.6	4.7	
ore	Foliage correction, dB	0.0	3.0	7.0	0.0	3.0	7.0	0.0	3.0	7.0	
0	Shielding correction, dB	10	0	0	10	0	0	10	0	0	
il ic	On time, mins	1	1	1	1	1	1	5	5	5	
eci	On time correction, dB (r <sub>ref</sub> = 5mins)	-7	-7	-7	-7	-7	-7	0	0	0	
Ľ Š	Specific Level, dB	16	18	9	13	18	10	20	25	17	
BS4142 Rat	ing & Assessment Level	•	•			•					
& ent	Aggregate HGV movements HGV loading/unloading										
ng sm vel	BS4142 character correction	5	5	5	5	5	5				
tati ses Le	Rating Level, dB	23	26	17	25	30	22				
AS:	Typical lowest night L <sub>A90</sub> , dB	25	25	25	25	25	25				
	Assessment Level	-2	1	-8	0	5	-3				