Walker Beak Mason Limited
01604 771101 | hq@wbm.co.uk | www.wbm.co.uk

ACOUSTIC CONSULTANTS

Technical Note

Prepared by:	**Rachel Canham**	Date:	**06 November 2024**
Project:	**NRS Lea Castle Farm**	Ref:	**5342**
		Page:	**1 of 9**
Subject:	**Response to Inspector's request for further details about noise predictions**		

This document provides a response to Inspector's request for further details about noise predictions for Lea Castle Farm.

1. A comparison between the predicted sound level from Phase 1 at the Bungalow with Bund 7 at a height of 6m and 4m. This should include noise calculation sheets in the form set out for Broom Cottage in Appendix H of CD 1.07 Appendix D Noise. The details about barrier attenuation should set out how frequency has been taken into account.

The calculation summary sheets are presented at the end of this document and show a calculated level of 45 dB $L_{Aeq,T}$ at The Bungalow for the original and revised schemes Note that the calculations for the revised scheme have been undertaken using a slightly different calculation spreadsheet.

A comparison of the barrier attenuations for different sources is tabulated below:

Table 1: Comparison of Barrier attenuation at The Bungalow

Source	Original Scheme	Revised Scheme
Excavator for sand and gravel extraction	17.8 dB (6m bund)	12.8 dB (4m bund)
Excavator loading dump truck	16.8 dB (6m bund)	11.9 dB (4m bund)
Loading shovel at processing plant	17.6 dB (6m bund)	15.1 dB (3m bund)
Duo processing plant - crusher & sand plant*	16.5 dB (6m bund)	14.3 dB (3m bund)
Duo processing plant - screen & conveyors*	16.1 dB (6m bund)	13.6 dB (3m bund)
Dump trucks to and from processing plant	15.8 dB (6m bund)	8.6 (4m bund)
Lorries for imported inert material	17.5 dB (6m bund)	9.3 dB (4m bund)
Dozer to profile imported inert material	17.7 dB (6m bund)	13.0 dB (4m bund)
Lorries on site access road	11.8 dB (4m bund)	0.0 dB (assumed unscreened)

* Note also the reduced height of the processing plant with the revised scheme, which will also affect barrier attenuation calculations

The Phase 1 calculations for the original scheme included simultaneous extraction and infilling, whereas for the revised scheme extraction and infilling will not occur simultaneously in Phase 1.

Although the summary sheets present the barrier attenuation and soft ground attenuation, only the highest value of these are used in the calculations (not both).

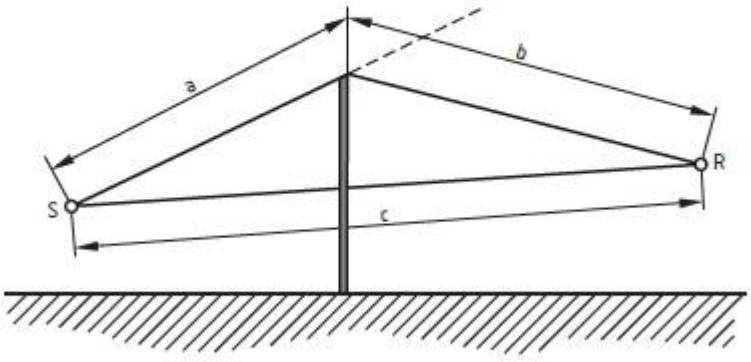
With regard to the barrier attenuation, the calculation spreadsheet include allowance for the consideration of frequency in the assessment of barrier attenuation. Spectrum shapes (octave bands from 125 Hz to 2 kHz) for the noise sources are included. The path length difference is calculated, using distances and height information for the source, receiver and barrier. The path length difference is used to calculate the barrier attenuation in specific octave bands following standard equations and the guidance in Annex F of BS 5228 (see Figure 1 below), which also provides an upper limit for barrier attenuation. The octave band barrier attenuation is used against the spectrum shape used for a particular source to evaluate the overall, A-weighted reduction.

Figure 1: Extract from BS 5228-1:2009+A1:2024, Annex F

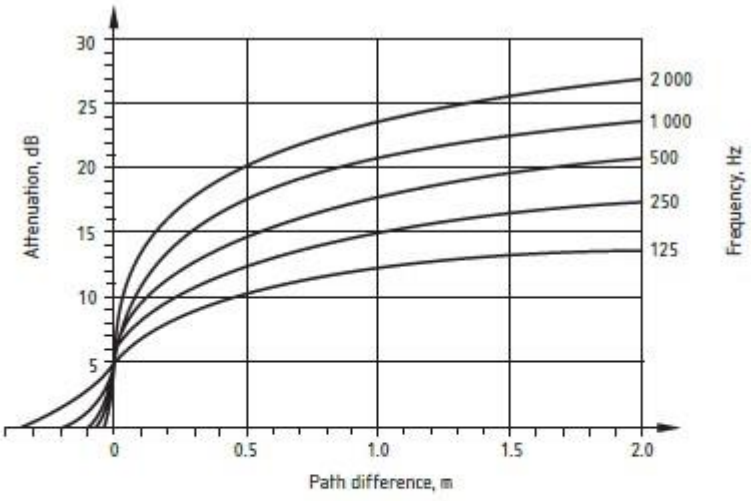
BRITISH STANDARD BS 5228-1:2009+A1:2014

Figure F.3 **Screening effect of barriers**

Unless otherwise stated, dimensions are in metres



a) Illustration of path difference (a + b – c) introduced by a barrier



b) Barrier attenuation at different frequencies of sound

Key

S Source

R Receiver

Note that the terms in the calculation spreadsheet "Duo processing plant – crusher & sand plant" and "Duo processing plant – screen & conveyors" have been used in both calculations, however the processing plant noise sources for the revised scheme calculations use the lower noise levels and reduced source heights.

2. How conveyor noise was assessed in the original scheme given that para 6.2 CD1.07 Appendix D refers to plant item 'due processing plant – screen & conveyors'. ES addendum 5.3.21 refers to 'Field Conveyor 2m 100% 74 dB per meter'. How has the proposed conveyor been assessed as a line source in both the original and proposed amended schemes.

For the processing plant, the cumulative noise level output has been considered for both the original and proposed scheme. As such, any integral conveyors on the processing plant have not been considered separately and are included in the overall noise level from the processing plant. Data from which the sound power levels for the processing plant were derived included operation of those conveyors as an integral part of the plant. Conveyors are usually considered to be relatively minor noise sources compared to the processing plant and other mobile plant. The relatively low sound power level of conveyors relative to the processing plant means that they will contribute minimally to the noise emitted from this aspect of the site.

The field conveyor (that transfers material from the field hopper to the processing plant) was not included in the calculations for the original scheme. However, the field conveyor has been considered as part of the revised scheme calculations, as a line source. The equation used for the conveyors assumes hemi-cylindrical propagation as from a line source of the stated power level per unit length, as indicated below:

$L_{Aeq,T} = L_{wA}$ / m – 5 – 10log(distance) + 10log(angle of view/180) – (any screening or ground absorption)

Where:

- $L_{Aeq,T}$ is the calculated noise level at the receiver from this noise source
- L_{wA} / m is the sound power level of the conveyor (per meter)
- Distance is the perpendicular distance to the extended line of the conveyor
- Angle of view is that of the conveyor line as seen from the receiver

3. Appellant's noise rebuttal PoE refers at para 5.22 to a 20 dB reduction in sound level on the Bridleway at 200 m distance from where the Bridleway crosses over the conveyor. The inspector requests a comparison between the predicted sound level at this conveyor cross-over point in the Bridleway with Bund 3 at a height of 6m and 3m, and whether these predictions, and the 20 dB reduction over 200 m, include the conveyor as a line source. Also whether the barrier attenuation takes account of frequency given that ES Addendum 5.3.21 refers to A weighted Sound Power Levels, dB LWA 'Updated processing plan – crusher & sand plant 3.5m 100% 100 dB' and 'Updated processing plant – screen & conveyors** 4.5m 100% 100 dB' *** combined sound power level of 103 dB LWA for the processing plant.**

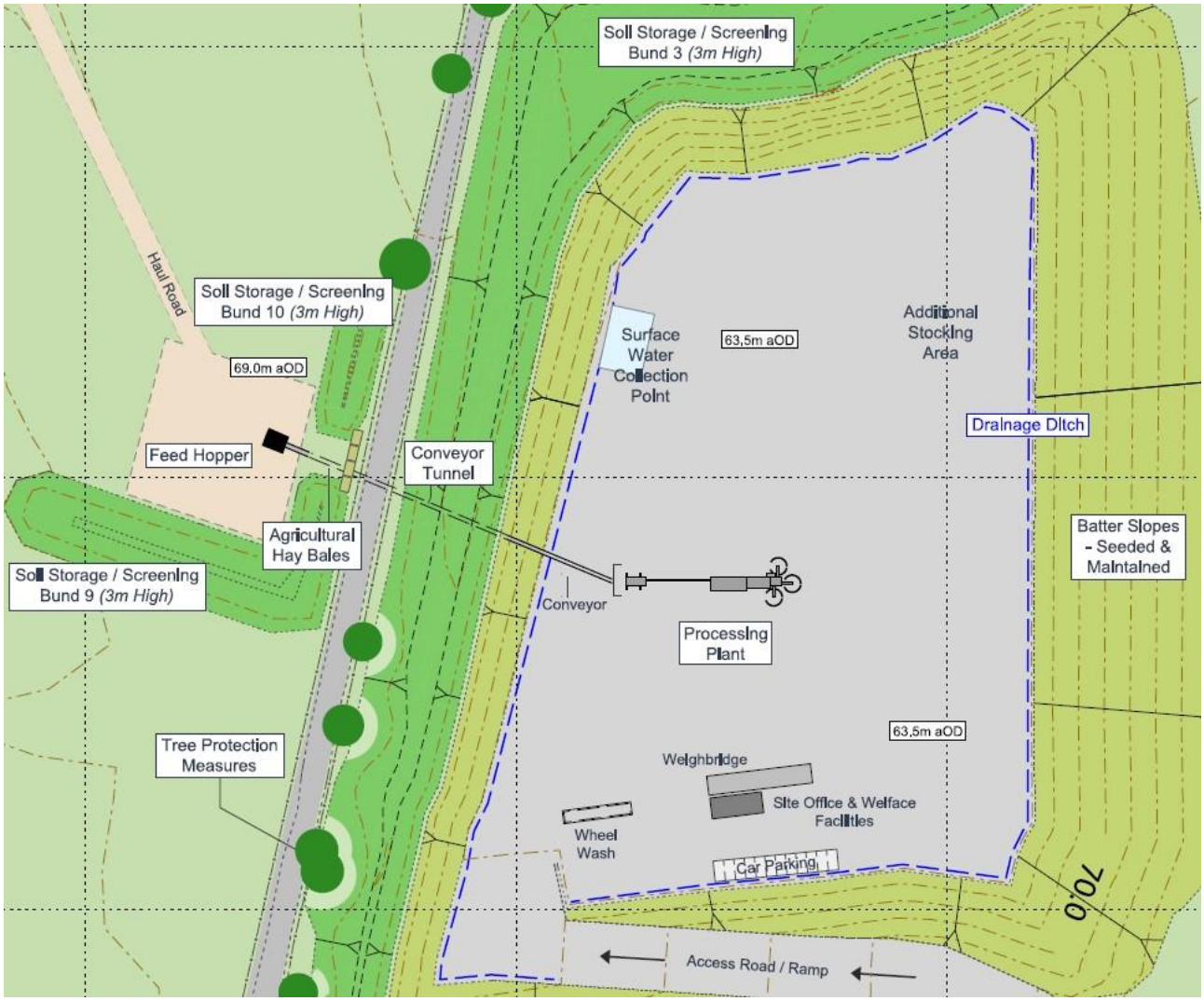
With regard to the simple reduction in sound from a conveyor (as referred to in paragraph 5.2 of the noise rebuttal), as a line source the sound level reduces at a rate of 3 dB per doubled perpendicular distance from the conveyor. In terms of a reduction at 200m, this equates to a reduction of 23 dB compared to the noise level at 1m just due to distance attenuation only, and assuming all other parameters were constant. I indicated in the noise rebuttal that the reduction due to distance at 200m would be at least 20 dB.

With regard to the predicted sound level at the cross-over point, I have separately considered contributions from the processing plant and integral conveyors, and the field conveyor between the plant and the hopper.

With regard to the query regarding barrier attenuation taking account of frequency, the same procedure is followed as set out in the response to question 1.

The field conveyor is shown in Figure 2 below, and shows the section of the conveyor in the tunnel under the bridleway and bund 3.

Figure 2: Extract from Plant Site drawing showing field conveyor and conveyor tunnel



Field conveyor

The field conveyor connects the feed hopper and the processing plant. The conveyor is to be in a tunnel under the bridleway and bund 3, as shown on Figure 2 above. The only part of this field conveyor that will be 'visible' to the bridleway would be the small section to the west of the bridleway between bunds 9 and 10 (both 3m tall), assuming negligible screening from the hay bales. The section of field conveyor outside the tunnel to the east of the bridleway will be screened by bund 3.

For the calculation of noise levels arising from a conveyor, you need to consider the perpendicular distance to the line of the conveyor, and also the angle of view of the conveyor to the receptor. The calculation assumptions for the field conveyor to the west are as follows:

- The sound power level of the conveyor is assumed to be 74 dB L_{wA} per metre.
- Calculations have been undertaken at various perpendicular distances along the bridleway from the crossover point with the conveyor: at 1m, 2m, 4m, 6m, 8m and 10m.
- The corresponding unscreened angles of view of the conveyor in the gap between bunds 9 and 10 are respectively 35º, 50º, 55º, 50º, 30º and 15 º.

The calculated unscreened noise levels due to the conveyor are as follows:

Table 2: Calculated unscreened level from field conveyor

Distance	Angle of view	Calculated Level dB $L_{Aeq,T}$
1m	35º	62
2m	50º	60
4m	55º	58
6m	50º	56
8m*	30º	52
10m*	15º	48

* reduced angle of view due to the screening provided by bunds 9 and 10

The table above demonstrates that the noise level from the conveyor will rapidly diminish as a receptor moves along the bridleway. Note that the calculations have not taken any temporary screening into account from the hay bales that are proposed to be located by this section of conveyor.

With regard to the section of the field conveyor on the eastern side of the bridleway, this will be fully screened from a receiver on the bridleway by bund 3. It is estimated that the noise from the eastern section of field conveyor would be at or below 48 dB at the crossover point with a 3m bund, and assuming minimal screening from this bund. The noise level would be lower with a 6m tall bund, but it is not possible to provide an accurate estimate of the difference as the bund attenuation offered to the conveyor will depend on the relative height of the field conveyor to the bund apex and receptors (which may vary).

Suggested condition 14 in the schedule of conditions for both the original and proposed scheme requires a scheme to be prepared for this conveyor, including the measures needed to minimise noise.

Processing plant and integral conveyors

In terms of the processing plant and integral conveyors, as noise from other elements of the processing plant (e.g. engine) would be dominant, this is considered as a point source. The calculation assumptions for the revised scheme are as follows:

- The total sound power level of processing plant is assumed to be 103 dB L_{wA}. For noise modelling purposes, this is split into two sources of 100 dB L_{wA}, one at 3.5m above local ground (to represent the crusher and sand plant) and the other at 4.5m above local ground (to represent the screen and conveyors, although the screen will be the dominant noise source)
- The ground level of the processing plant is 63.5m AoD; the ground levels of the bridleway and adjacent bund 3 are assumed to be 69m AoD.
- The bridleway is 35m horizontally from the centre of the processing plant and 8m horizontally from the apex of bund 3.

- For the bridleway, the receptor heights above local ground are taken to be 1.5m for a pedestrian, 1.8m for a horse and 3m to represent a rider on horseback.

The calculated noise levels on the bridleway from the processing plant for both the revised scheme with 3m bund and original scheme with 6m bund are as follows:

Table 3: Calculated noise level from processing plant including conveyors dB $L_{Aeq,T}$		
Receptor Heights	Revised Scheme	Original Scheme
1.5m (pedestrian)	49 dB	48 dB
1.8m (horse)	49 dB	49 dB
3m (rider on horseback)	54 dB	50 dB

For the revised scheme with updated plant, for a rider on horseback receptor on the bridleway adjacent to the processing plant, the calculated noise level with a 3m tall bund would be 54 dB $L_{Aeq,T}$. For a pedestrian or horse receptor the calculated noise level with a 3m tall bund would be 49 dB L_{Aeq}.

Repeating the calculation with a 6m tall bund and with the original plant (which is taller and with higher noise levels) would result in a calculated noise level of 50 dB $L_{Aeq,T}$ for a rider on horseback, 49 dB $L_{Aeq,T}$ for a horse and 48 dB $L_{Aeq,T}$ for a pedestrian.

These results show that for a rider on horseback receptor, the difference between a 3m tall bund for the revised scheme and 6m tall bund for the original scheme would be around 4 dB, with the revised scheme having the greater noise level.

The difference for a horse or pedestrian receptors is smaller (0 to 1 dB) – this is because the screening attenuation provided by the bunds are approaching the maximum values for these scenarios.

Combined Noise Level

The total noise from both the western and eastern sides of the bridleway, for a rider on horseback, horse and pedestrian, would be as follows:

Table 3a: Total Conveyor and Processing Plant Noise Level (Revised Scheme)					
	Western Side	**Eastern Side**	**Combined Level dB $L_{Aeq,T}$**		
Distance from conveyor crossover point	**Calculated unscreened level from conveyor dB $L_{Aeq,T}$**	**Calculated level from processing plant & integral conveyors 3m bund dB $L_{Aeq,T}$**	**Rider on horseback**	**Horse**	**Pedestrian**
1m	62	Rider on horseback: 54 dB Horse: 49 dB Pedestrian:49 dB	63	62	62
2m	60		61	61	61
4m	58		59	58	58
6m	56		58	57	56
8m	52		56	54	54
10m	48		55	52	51

Table 3b: Total Conveyor and Processing Plant Noise Level (Original Scheme)					
	Western Side	**Eastern Side**	**Combined Level dB $L_{Aeq,T}$**		
Distance from conveyor crossover point	**Calculated unscreened level from conveyor dB $L_{Aeq,T}$**	**Calculated level from processing plant & integral conveyors 6m bund dB $L_{Aeq,T}$**	**Rider on horseback**	**Horse**	**Pedestrian**
1m	62	Rider on horseback: 50 dB Horse: 49 dB Pedestrian:48 dB	62	62	62
2m	60		61	61	61
4m	58		59	58	58
6m	56		57	56	56
8m	52		54	54	54
10m	48		52	51	51

Comparison of the combined levels between the revised scheme with 3m bund and original scheme with 6m bund, on the bridleway in the vicinity of the field conveyor show a difference of up to 3 dB between the schemes for a rider on horseback, up to 1 dB between the schemes for a horse and no difference for a pedestrian.

Rachel Canham
Director

(This document has been generated electronically and therefore bears no signature)

Response to Query 1: Calculation summary sheet for the Bungalow, Phase 1, original scheme

	NRS Aggregates Limited	**4826**	**11-Sep-19**	**PWC**			Receiver Height :		1.5	m	Infill Working Depth :		0.5	m	
							Plant Site Ground Height :		63.5	m AOD	Mineral Working Depth :		0.5	m	
	Land at Lea Castle Farm near Wolverley														
				Activity	Power LWA	1 hour	Capacity	Source		2 way flow	Speed	10		BS5228	
Ref	Plant Item	Comments on Plant		LAeq @ 10 m	or LWA / m	On-time %	Tonnes	Height		Q per hour	V kph	Plant Set back(m)		method	
1	Excavator for sand and gravel extraction			76	104	50		2				10	m back	1	Activity
2	Excavator loading dump truck			76	104	50		2				20	m back	1	Activity
3	Loading shovel at processing plant			78	106	100		2				0	m back	1	Activity
4	Duo processing plant - crusher & sand plant			78	106	100		5				0	m back	1	Activity
5	Duo processing plant - screen & conveyors			78	106	100		6				0	m back	1	Activity
6	Dump trucks to and from processing plant			78	106	100		2		6	15	0	m back	4	Haul Road
7	Lorries for imported inert material			76	104	100		2		8	15	0	m back	4	Haul Road
8	Dozer to profile imported inert material			80	108	75		2				10	m back	1	Activity
9	Lorries on site access road			76	104	100		2		16	25	0	m back	4	Haul Road
10															
11															
12	**Temporary Works**														
13	Excavator for temporary works			76	104	100		2				5	m back	1	Activity
14	Dump trucks for temporary works			78	106	100		2				10	m back	1	Activity
15	Dozer for temporary works			80	108	100		2				15	m back	1	Activity

	Location No.	**5**	**McDonalds Bungalow**												
	Receiver Height	71.5	m AOD												
								Suggested Site Noise Limit							
	Site Noise Level for Items 1 to 6 and 9	42	dB LAeq, 1 hour, free field		Extraction & processing			45	dB LAeq, 1 hour, free field						
	Site Noise Level for Items 3 to 5 and 7 to 9	44	dB LAeq, 1 hour, free field		Infill & processing			45	dB LAeq, 1 hour, free field						
	Site Noise Level for Items 1 to 9	**45**	**dB LAeq, 1 hour, free field**		**Extraction, infill & processing**			**45**	**dB LAeq, 1 hour, free field**						
	Site Noise Level for Items 13 to 15	66	dB LAeq, 1 hour, free field		Temporary works			70	dB LAeq, 1 hour, free field						

Ref	Plant Item	Plan	Working	Ground	Working	Source	Angle	Range	Barrier	Barrier	Path	Barrier	Soft	Ground	Resultant
		Distance	Distance	Height	Height/depth	Height	Degrees	Metres	-Receiver	Height	Diff.	Atten.	Ground %	Atten.	LAeq
	Normal Operations														
1	Excavator for sand and gravel extraction	80	90	69.0	-0.5	70.5	0	0	65	76.0	0.748	17.8	90.0	2.5	36.1
2	Excavator loading dump truck	80	100	69.0	-0.5	70.5	0	0	65	76.0	0.580	16.8	90.0	2.7	36.2
3	Loading shovel at processing plant	250	250	63.5	0.0	65.5	0	0	110	78.0	0.677	17.6	90.0	4.5	32.4
4	Duo processing plant - crusher & sand plant	250	250	63.5	0.0	68.5	0	0	110	78.0	0.496	16.5	90.0	3.5	33.5
5	Duo processing plant - screen & conveyors	250	250	63.5	0.0	69.5	0	0	110	78.0	0.442	16.1	90.0	3.1	33.9
6	Dump trucks to and from processing plant	100	100	69.0	0.0	71.0	90	0	65	76.0	0.510	15.8	90.0	2.7	30.2
7	Lorries for imported inert material	100	100	69.0	-0.5	70.5	90	0	65	76.0	0.580	17.5	90.0	2.7	27.8
8	Dozer to profile imported inert material	80	90	69.0	-0.5	70.5	0	0	65	76.0	0.748	17.7	90.0	2.5	42.0
9	Lorries on site access road	370	370	70.0	0.0	72.0	50	0	110	76.0	0.122	11.8	90.0	5.3	26.0
10															
11															
12	**Temporary Works**														
13	Excavator for temporary works	50	55	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	1.5	59.7
14	Dump trucks for temporary works	50	60	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	1.7	60.7
15	Dozer for temporary works	50	65	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	1.9	61.9

ACOUSTIC CONSULTANTS

Response to Query 1: Calculation summary sheet for the Bungalow, Phase 1, revised scheme, reduced bund heights

	NRS Lea Castle - Phase 1, The Bungalow	**5342**	**04/11/2024**	**RHC**											
	Extraction noise sources						Receiver Height :		1.5	m					
	Infill noise sources														
	Plant site noise source														
				Activity	Power LWA	1 hour	Capacity	Source		2 way flow	Speed			BS5228	
Ref	Plant Item	Comments on Plant		LAeq @ 10 m	or LWA / m	On-time %	Tonnes	Height		Q per hour	V kph	Plant Set back(m)		method	
1	Excavator for sand and gravel extraction	Excavation		76	104.0	50		2				0	m back	1	Activity
2	Excavator loading dump truck	Excavation		76	104	50		2				0	m back	1	Activity
3	Dump trucks to and from field hopper/plant	Mineral transport		78	106	100		2		6	15	0	m back	4	Haul Road
4	Lorries for imported inert material	infilling		76	104	100		2		8	15	0	m back	4	Haul Road
5	Dozer to profile imported inert material	infilling		78	106	75		2				0	m back	1	Activity
6	Field Hopper	Mineral transport		65	93	100		1				0	m back	1	Activity
7	Field Conveyor	Mineral transport		46	74	100		2				0	m back	5	Conveyor
8	*not used*														
9	*not used*														
10	*not used*														
11	Loading shovel at processing plant	plant site		76	104	100		2				0	m back	1	Activity
12	Duo processing plant - crusher & sand plant	plant site		72	100	100		3.5				0	m back	1	Activity
13	Duo processing plant - screen & conveyors	plant site		72	100	100		4.5				0	m back	1	Activity
14	Lorries on site access road	access road		76	104	100		2		16	25	0	m back	4	Haul Road
15	*not used*														
	Location No.	**1**	**The Bungalow**												
	Receiver Height	71.5	m AOD												
	Site Noise Level for Items 1 to 3, 6 to 7, 11 to 14	**45**	**dB LAeq, 1 hour, free field**	**Noise from mineral extraction and plant site**											
	Site Noise Level for Items 4 to 5, 11 to 14	**45**	**dB LAeq, 1 hour, free field**	**Noise from infilling and plant site**											
Ref	Plant Item	Plan	Working	Ground	Working	Source	Angle	Range	Barrier	Barrier	Path	Barrier	Soft	Ground	Resultant
		Distance	Distance	Height	Height/depth	Height	Degrees	Metres	-Receiver	Height	Diff.	Atten.	Ground %	Atten.	LAeq
1	Excavator for sand and gravel extraction	100	100	68.0	-0.5	69.5	0	0	70	73.0	0.200	12.8	90.0	2.7	40.2
2	Excavator loading dump truck	100	110	68.0	-0.5	69.5	0	0	70	73.0	0.151	11.9	90.0	2.9	40.3
3	Dump trucks to and from field hopper/plant	180	180	68.0	0.0	70.0	56	0	70	73.0	0.051	8.6	90.0	3.8	32.8
4	Lorries for imported inert material	180	180	68.0	0.0	70.0	56	0	70	73.0	0.051	9.3	90.0	3.8	31.3
5	Dozer to profile imported inert material	100	100	68.0	-0.5	69.5	0	0	70	73.0	0.200	13.0	90.0	2.7	43.8
6	Field Hopper	240	240	68.0	0.0	69.0	0	0	150	72.0	0.038	8.7	90.0	4.4	28.7
7	Field Conveyor	250	250	68.0	0.0	70.0	25	0	0	0.0	-1.000	0.0	90.0	4.5	32.0
8	*not used*														
9	*not used*														
10	*not used*														
11	Loading shovel at processing plant	250	250	63.5	0.0	65.5	0	0	130	75.0	0.351	15.1	90.0	4.5	32.9
12	Duo processing plant - crusher & sand plant	250	250	63.5	0.0	67.0	0	0	130	75.0	0.273	14.3	90.0	4.1	29.7
13	Duo processing plant - screen & conveyors	250	250	63.5	0.0	68.0	0	0	130	75.0	0.227	13.6	90.0	3.8	30.4
14	Lorries on site access road	340	340	70.0	0.0	72.0	35	0	0	0.0	-1.000	0.0	90.0	5.1	31.5