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Proposed Residential Subdivision, Walmsleys Road, Bilambil Heights

ENVIRONMENTAL NOISE IMPACT REPORT

Prepared for

Jim & Les Dickinson & Peter Walmsley,
C/o Darryl Anderson Consulting Pty Ltd

30 October 2007

crgref: 07348a report

1.0 INTRODUCTION

This report is submitted in response to a request by Jim and Les Dickinson, and Peter Walmsley, for a road traffic noise and construction noise assessment of a proposed residential subdivision of land currently used for rural pursuits.

Through modelling, predictions of potential noise from the change in numbers of vehicular movements on the two streets accessing the subject site impacting the nearest potentially affected premises were produced. Further, a management plan for control of noise from the construction phase has been provided.

Due to extraneous noise from wind in vegetation, and bird activity (which often dominates the local acoustic environment), it was not possible to record meaningful road traffic noise level measurements. For this reason, the road traffic noise assessment is based upon calculated levels only. Spot measurements of background noise was conducted to assist in assessing impacts associated with the construction phase of the project.

The proposed subdivision plan consists of 83 detached housing allotments with access to the subdivision proposed via both Stott Street and Walmsleys Road.

The Department of Environment and Conservation have requested the following in relation to the proposal (re: letter dated July 23, 2007):

Noise

The environmental outcomes should include the following:

- The proposal must be designed, constructed, operated and maintained so that there are no adverse impacts from noise (including traffic noise).

Stott Street and Walmsleys Road are both dead end, and are classified as Access Streets, with Stott Street (the northern access point to the subject site) connected to Piggabeen Road via Skyline Drive. Walmsleys Road (the southern access point to the subject site) connects through to Scenic Drive, via Nabilla Street and Warringa Drive.

Land to the eastern side of Stott Street is occupied by an Aged Care complex ("Bangalor Retreat"), with residential premises (a mixture of single and two storey dwellings) fronting both access streets.

Bulk earthworks are proposed to grade out local irregularities, and to ensure the Lots are at grade with the proposed internal street network. It is anticipated that this process will last for approximately 6 to 12 months, and according to preliminary calculations from the Civil Engineer (blueLAND Engineers), no fill will be exported or imported to site – all earth fill balance will be achieved through onsite materials movement.

Refer to Figures No. 1 and 2 for site location and surrounds, and Sketch No. 1 for subdivision layout.

3.0 NOISE ASSESSMENT CRITERIA

Road Traffic Noise Impacts

Assessment of potential noise impacts resulting from the increase in road traffic volumes are required to be conducted as per the New South Wales EPA "*Environmental Criteria for Road traffic Noise*". As both Walmsleys Road and Stott Street are deemed local roads (in terms of the road hierarchy provided in the "Environmental criteria for road traffic noise" document), the following criteria applies to the proposed development:

TYPE OF DEVELOPMENT	CRITERIA		
	DAY (7 am – 10 pm) dB(A)	NIGHT (10 pm – 7 am) dB(A)	WHERE CRITERIA ARE ALREADY EXCEEDED
13. Land use developments with potential to create additional traffic on local roads	L_{Aeq}[1] $_{(1hr)}$ 55	$L_{Aeq\,(1hr)}$ 50	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

Table 1: Extract from the New South Wales EPA document "*Environmental Criteria for Road traffic Noise*".

Construction Noise Criteria

Tweed Shire Council have no specific local law regulating construction noise, therefore, the Industrial Noise Policy applies. The Policy is intended for large, permanent industrial activities, whilst the construction activities for the site are a (relatively) short term activity. We believe it is unreasonable to set a strict noise limit to construction activities, due to the non-permanent nature of the activity - we note that most Councils do not set noise limit criteria, but set acceptable times that construction activities are allowed.

As a guide, typically accepted time restrictions are as follows (it is noted that Council have accepted this approach in the past for other more intensive development, including a shopping centre in Flametree Park):

- Monday – Friday: 7 am – 6pm
- Saturday: 7 am – 4 pm
- Sundays & Public Holidays: not allowable

Further to the above time restrictions, we recommend applying the recommended management procedures listed in the appendix to minimise noise impacts at the neighbouring residential premises.

[1] The L_{eq} level is the "energy level equivalent" – a conversion of a noise level that fluctuates over a time period into the equivalent continuous level over the time period.

4.0 PREDICTED NOISE IMPACTS

4.1 Road Traffic Noise From Extra Traffic Generation

As both streets proposed for access to the subject site are dead ended, the dwellings at the current end of both streets are only exposed to vehicular bypass noise stemming from vehicles entering or exiting their own Lots, or from vehicles turning around at the end of the streets. Clearly, it is not possible to comply with the allowable 2 decibel rise in existing traffic noise levels, and for this reason, we have assessed impacts at the open end of both streets rather than at the access points to the subject site (e.g. at the dead ends).

Volumes are as follows (sourced from the blueLAND Engineers Infrastructure Impact Assessment):

Existing Traffic Scenario (excludes proposed development traffic)

Walmsleys Road	477 vpd, 48 vehicles in peak hour;
Stott Street	531 vpd, 53 per peak hour.

Proposed Development Traffic Generation

Total predicted volume due to proposed 82 Lots	738 vpd, 74 vehicles in peak hour;
Walmsleys Road	369 vpd, 38 per peak hour;
Stott Street	369 vpd, 38 per peak hour.

Proposed Plus Existing Traffic Scenario

Walmsleys Road	846 vpd, 85 vehicles in peak hour;
Stott Street	900 vpd, 90 per peak hour.

The traffic generated by the proposed development is expected to be evenly split between trips along Walmsleys Road and Stott Street.

Net noise impact effects resulting from the increase in road traffic volumes were produced using the CoRTN model (the modelling methodology deemed acceptable under appendix C5 of the New South Wales EPA's document "*Environmental Criteria for Road traffic Noise*"). The predicted peak hour $L_{Aeq,1hr}$ noise levels at the top floor level assessment locations are as follows:

	Predicted Noise Impact Level, SPL dB
Assessment Scenario	**Peak Hour $L_{Aeq,1hr}$**
CURRENT Walmsleys Rd	52.1
PROPOSED Walmsleys Rd	55.6
Rise in noise level Walmsleys Rd	**3.5**
CURRENT Stott Street	52.5
PROPOSED Stott Street	55.9
Rise in noise level Stott Street	**3.4**

Table 2: Predicted road traffic noise levels with and without the proposed development

It is concluded from the modelling results that the daytime $L_{eq\ (1hr)}$ level will be within 1 decibel of the 55 dB(A) criteria, and the net increase in road traffic noise levels in peak hour will be approximately 3.5 dB, due to the increase in traffic volumes, resulting from the 82 residential Lot development.

For road noise modelling details, refer to the calculation sheets in the Appendix to this report.

4.2 Construction Phase

Sources of noise typically associated with such a development are as follows:

- Trade vehicle movements along the local street network;
- Earthmoving vehicle movements (e.g. graders, excavators);
- Trade tool use during dwelling construction phase (e.g. hammering, power tools);
- Cement delivery trucks visiting the site.

Noise source levels for typically utilized plant and equipment were referenced from Australian Standard AS 2436 – 1981 "*Guide to noise control on construction, maintenance and demolition sites*". Based upon typical noise decay rates, and location of plant at various distance from the northern residential premises, we predict that the typically occurring noise (assessed at the nearest and furthest location from the receivers), will impact at the following levels:

	Noise Level, SPL dB(A)	
Noise Source	**Walmsleys Rd Dwellings, L_{AMax}**	**Stott St dwellings, L_{AMax}**
Truck movement on Walmsleys Road and Stott Street	66 – 69	66 - 69
Hammering on Lots	55 – 92	89 – 59
Excavator on Lots	60 – 97	94 – 64
Grader on Lots	99 – 62	96 – 66
Vibratory roller Lots	90 - 53	57 – 87
Dump truck movements on Lots	56 - 93	60 - 90

Refer to the attached calculation sheet for prediction methodology.

Background noise levels in the area were recorded as being approximately 36 dB(A) L_{90}, with the acoustical environment comprised of birds, and wind in vegetation, and the occasional vehicle movement. This background noise level is typical of a quiet suburban area.

5.0 DISCUSSION & CONCLUSIONS

5.1 Road Traffic Noise Impacts From Use of the Site

This assessment has taken into account the effect of the increase in road traffic resulting from the proposed development, which is predicted to exceed the allowable 2 dB rise in existing noise levels by between 1.4 to 1.5 dB. Such an exceedance is not deemed significant, when it is considered that the average person cannot detect less than a 3 dB shift in sound pressure level. It is noted that we have assessed for these impacts towards the ends of Stott Street and Walmsleys Road, as the existing traffic proximate to the entry points into the subject site is non-existent, given that both streets are dead ended at present. Clearly, if noise was assessed at the existing dead end of these streets, exceedances much greater than those quoted in this report would result.

The site has two access points, thereby dispersing the traffic generated by the proposed use, which is a valid acoustical treatment cited in the NSW EPA's "*Environmental Criteria for Road traffic Noise*".

5.2 Noise Impacts From Construction Phase

We have assessed potential impacts from both the earthworks phase of the development, and from the building construction phase. As there is no set noise limit criteria in Tweed Shire Council for construction noise, Council have accepted in the past relying upon restriction of hours that works can be undertaken, generally restricting works to the following times:

- Monday – Friday: 7 am – 6pm
- Saturday: 7 am – 4 pm
- Sundays & Public Holidays: not allowable

Further to the above time restrictions, we have provided a system to manage noise impacts as much as is possible (attached in the Appendix to this report).

We note that there is no fixed plant needed for dewatering of the site, therefore, all plant will be mobile. There will be periods when plant (and building construction) is being undertaken adjacent to the neighbouring residential property boundaries – there is little opportunity to control such impacts, apart from ensuring that all equipment is in good working order, and that mobile plant commence work as far from the dwellings as possible in the mornings.

Report Compiled by:

JAY CARTER BSc
Director

APPENDIX

Figure No. 1: Subject Site & Locale

Figure No. 2: Subject Site & Locale

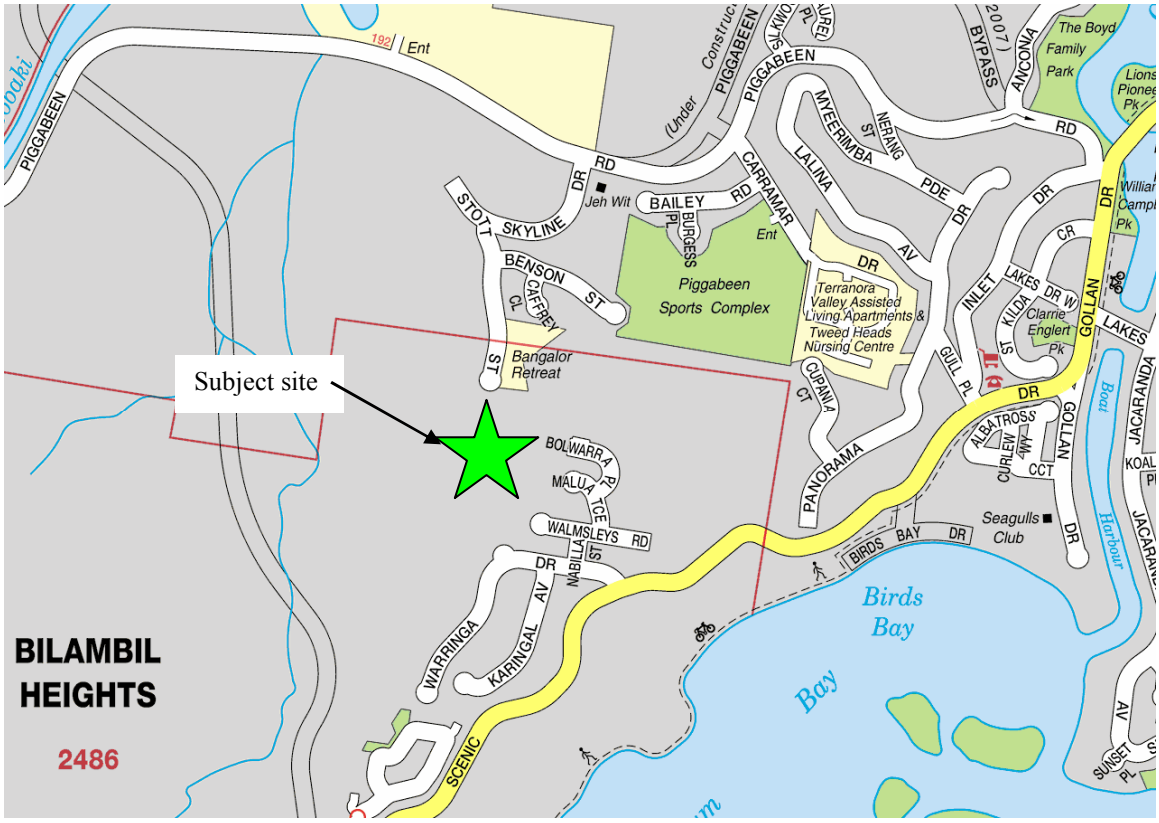
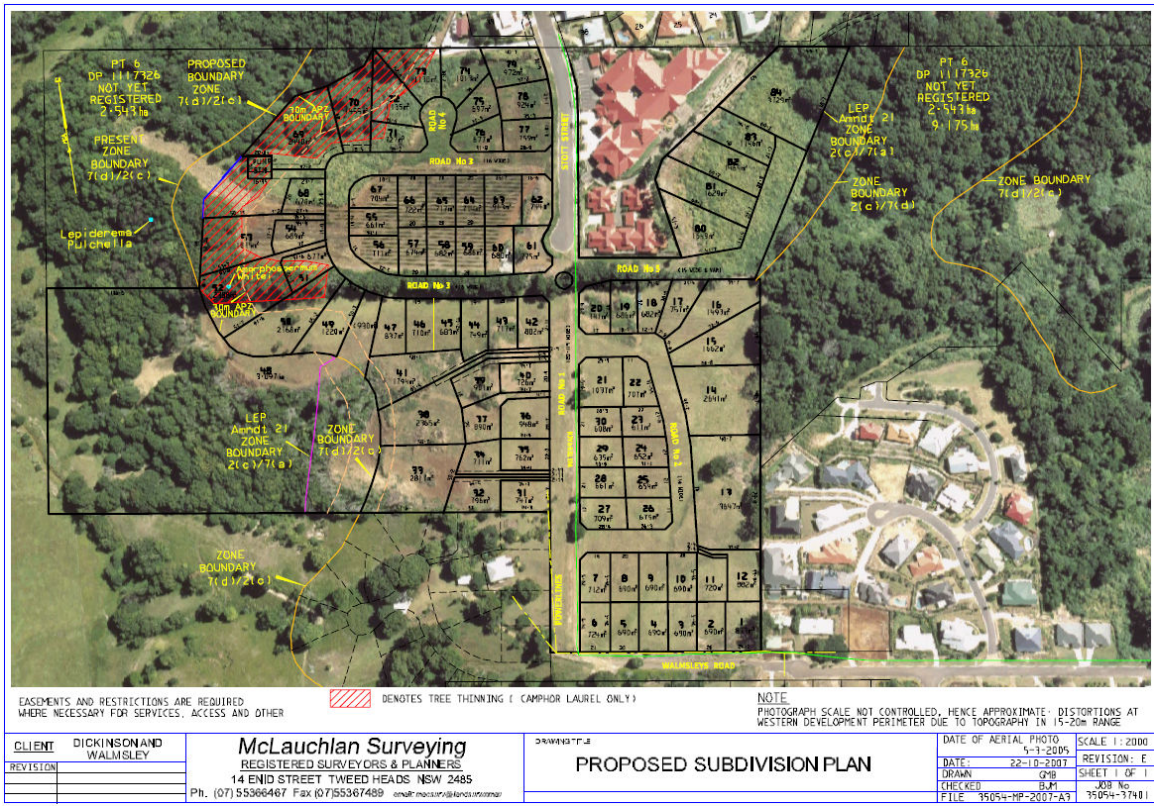


Figure 3: Subject Site Lot Layout



CONSTRUCTION NOISE MANAGEMENT PLAN

CONTROL STRATEGY

Australian Standard AS 2436 – 1981 "Guide to noise control on construction, maintenance and demolition sites", states that control of noise emissions from construction sites can be broken down into 2 broad strategies as follows:

- Control of noise at source;
- Controlling the spread of noise (control in noise path).

By employing both aspects of the above, emissions can be minimised as much as is practical.

Strategies
The construction firm shall observe the following treatments and principles to manage potential noise impacts:

a) No works are conducted outdoors before 7 a.m. or after 6. p.m. Monday to Saturday, or any time on a Sunday or public holiday should be avoided. In special cases, if the time restrictions cannot be met, the construction manager should contact Council for a temporary relaxation of the time restriction. In such cases, it would be necessary to notify all potentially affected residents that out of hours work will be conducted, and the times for such works.

b) Commence earthworks in the mornings as far from the residential premises as is possible.

c) Maintenance of equipment. Regular maintenance of stationary and mobile equipment, including off-site vehicles. By maintaining equipment, noise emissions from older equipment will be similar to that of new equipment.

d) Install residential mufflers on earthmoving equipment.

e) Use and siting of equipment. By locating noisy equipment as far away from noise sensitive premises as is practical, distance separation will reduce potential noise impacts. Unloading building materials should be conducted as far away from noise sensitive premises as possible.

f) Assign the task of managing noise emissions to a person (the 'responsible person') that is likely to be present on-site most of the time that activity is occurring. This person would be responsible for handling noise complaints sensitively, and ensuring that work does not commence before the times specified in Section 6 above. The name and contact details of the 'responsible person' shall be displayed outside the principal construction office.

g) Encouraging workers to not congregate outside the site before 6.45 a.m.

h) If complaints arise regarding noise, the complaint will be directed to the 'responsible person', who will determine the source of the noise, and take immediate steps to mitigate the noise. This may involve moving the noise source further away from affected premises, replacing the equipment, or in some cases, engaging a qualified acoustic consultant to provide specialist control advice.

Performance Indicators

The performance indicator adopted is that the site is not the subject of noise complaints.

Road Traffic Noise Prediction Model Detail

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Bilambil Heights Residential Subdivision Walmsleys Rd

Segment		Abbrev	Leq	Seg Group	Group Total
1	Walmsleys Rd Existing Scenario	walexi	52.1		
2	Walmsleys Rd With Proposed Development Traffic	walult	55.6		
3	Stott St Existing Scenario	stotex	52.5		
4	Stott St With Proposed Development Traffic	stotul	55.9		

INPUT DATA	Seg 1 walexi	Seg 2 walult	Seg 3 stotex	Seg 4 stotul
Total Flow (veh/18h)				
Heavy Vehicles (%)				
SPEED:				
Average (km/h)				
Origin (Zone or Est)				
Road RL (m)	0	0	0	0
Road Gradient (%)	1	1	1	1
ROAD SURFACE:				
Surface Type (B,C,P)	b	b	b	b
Texture Depth (mm)	1	1	1	1
Dist Road-Rec (m)	10	10	10	10
Absorbing Ground (%)	90	90	90	90
Av Prop Ht (m)	2.6	2.6	2.6	2.6
Angle View (deg)	180	180	180	180
SPECIAL ADJUSTMENT?				
Value (±dBA)				
Comment				
BARRIERS ?				
1:Dist Road-Barr (m)				
Barrier RL (m)				
Description				
2:Dist Road-Barr (m)				
Barrier RL (m)				
Description				
3:Dist Road-Barr (m)				
Barrier RL (m)				
Description				
REFLECTORS ONLY ?				
Refl Angle View (deg)				
COMBINED REFL/BARR?				
Reflector RL (m)				
Reflector Tilt (deg)				
DistanceBetween (m)				
Either on Embankment?				

Ground RL at Receiver:	0.0
Height of Receiver above ground:	4.2
Road Surface Corrections supplied by:	CRTN
Building Facade at Receiver:	Yes
User's overall adjustment to CRTN:	0.0
Leq factor: 1hr:	-3.0

INPUT DATA (TRAFFIC)

HOUR	SegNo	Flow veh/h	%HV	SpAv km/h	Speed Orig	SegNo	Flow veh/h	%HV	SpAv km/h	Speed Orig
00 - 01	1	50	0.5	40	E	2	50	0.5	40	E
01 - 02	1	50	0.5	40	E	2	50	0.5	40	E
02 - 03	1	50	0.5	40	E	2	50	0.5	40	E
03 - 04	1	50	0.5	40	E	2	50	0.5	40	E
04 - 05	1	50	0.5	40	E	2	50	0.5	40	E
05 - 06	1	50	0.5	40	E	2	50	0.5	40	E
06 - 07	1	50	0.5	40	E	2	50	0.5	40	E
07 - 08	1	50	0.5	40	E	2	50	0.5	40	E
08 - 09	1	50	0.5	40	E	2	50	0.5	40	E
09 - 10	1	50	0.5	40	E	2	50	0.5	40	E
10 - 11	1	50	0.5	40	E	2	50	0.5	40	E
11 - 12	1	50	0.5	40	E	2	50	0.5	40	E
12 - 13	1	50	0.5	40	E	2	50	0.5	40	E
13 - 14	1	50	0.5	40	E	2	50	0.5	40	E
14 - 15	1	50	0.5	40	E	2	50	0.5	40	E
15 - 16	1	50	0.5	40	E	2	50	0.5	40	E
16 - 17	1	50	0.5	40	E	2	50	0.5	40	E
17 - 18	1	50	0.5	40	E	2	50	0.5	40	E
18 - 19	1	50	0.5	40	E	2	85	0.5	40	E
19 - 20	1	50	0.5	40	E	2	50	0.5	40	E
20 - 21	1	50	0.5	40	E	2	50	0.5	40	E
21 - 22	1	50	0.5	40	E	2	50	0.5	40	E
22 - 23	1	50	0.5	40	E	2	50	0.5	40	E
23 - 24	1	50	0.5	40	E	2	50	0.5	40	E

HOUR	SegNo	Flow veh/h	%HV	SpAv km/h	Speed Orig	SegNo	Flow veh/h	%HV	SpAv km/h	Speed Orig
00 - 01	3	53	0.5	40	E	4	50	0.5	40	E
01 - 02	3	53	0.5	40	E	4	50	0.5	40	E
02 - 03	3	53	0.5	40	E	4	50	0.5	40	E
03 - 04	3	53	0.5	40	E	4	50	0.5	40	E
04 - 05	3	53	0.5	40	E	4	50	0.5	40	E
05 - 06	3	53	0.5	40	E	4	50	0.5	40	E
06 - 07	3	53	0.5	40	E	4	50	0.5	40	E
07 - 08	3	53	0.5	40	E	4	50	0.5	40	E
08 - 09	3	53	0.5	40	E	4	50	0.5	40	E
09 - 10	3	53	0.5	40	E	4	50	0.5	40	E
10 - 11	3	53	0.5	40	E	4	50	0.5	40	E
11 - 12	3	53	0.5	40	E	4	50	0.5	40	E
12 - 13	3	53	0.5	40	E	4	50	0.5	40	E
13 - 14	3	53	0.5	40	E	4	50	0.5	40	E
14 - 15	3	53	0.5	40	E	4	50	0.5	40	E
15 - 16	3	53	0.5	40	E	4	50	0.5	40	E
16 - 17	3	53	0.5	40	E	4	50	0.5	40	E
17 - 18	3	53	0.5	40	E	4	50	0.5	40	E
18 - 19	3	53	0.5	40	E	4	90	0.5	40	E
19 - 20	3	53	0.5	40	E	4	50	0.5	40	E
20 - 21	3	53	0.5	40	E	4	50	0.5	40	E
21 - 22	3	53	0.5	40	E	4	50	0.5	40	E
22 - 23	3	53	0.5	40	E	4	50	0.5	40	E
23 - 24	3	53	0.5	40	E	4	50	0.5	40	E

NOTE: The Model does not accept less than 50 vehicles in one hour. For this reason, the minimum traffic volume used is 50 vph.

CORRECTIONS	Seg 1 walexi	Seg 2 walult	Seg 3 stotex	Seg 4 stotul
Total Flow 18h (Ch3)				
Low Flow 18h (Ch12)				
Heavy Vehicles (Ch4)				
{SpChange,km/h} (Ch5)				
Road Gradient (Ch6)	0.3	0.3	0.3	0.3
Road Surface (CRTN)				
Dist Road-Rec (Ch7)	-0.2	-0.2	-0.2	-0.2
{h,metres} (Ch7)	3.7	3.7	3.7	3.7
Av Prop Ht (Ch8)	0.0	0.0	0.0	0.0
Angle View (Ch10)	0.0	0.0	0.0	0.0
Special (User)	0.0	0.0	0.0	0.0
BARRIERS				
Barrier Absent (Ch8)				
1:Pot Barr Corr (Ch9)				
{PathDiff,metres} (P21)				
Description				
2:Pot Barr Corr (Ch9)				
{PathDiff,metres} (P21)				
Description				
3:Pot Barr Corr (Ch9)				
{PathDiff,metres} (P21)				
Description				
Barr Multiple Effect:				
Barr Numbers				
Pot Barr Corr (P35)				
REFLECTORS				
Refl Angle of View (P26)				
COMBINED REFL/BARR				
Correction (P36)				
{Y} (P36)				
{W} (P36)				
{Alpha} (P36)				
{Delta1} (P36)				
{Delta2} (Ch13)				
{Delta3} (Ch13)				
{Delta4} (Ch14)				
{Delta5} (Ch15)				

Building facade at receiver: +2.5
User's overall adjust to CRTN: 0
Leq factor: 1hr = -3.0

Stott St Retirement village					
NEAREST POINT TO RECEIVER			**FURTHEST POINT TO RECEIVER**		
Cement Truck on Street			**Cement Truck on Street**		
Sound Level	86	dB(A) at 1m	Sound Level	86	dB(A) at 1m
Distance separation	10	m	Distance separation	14	m
Distance attenuation	-20	dB(A)	Distance attenuation	-23	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	69	dB(A)	Impact at façade	66	dB(A)
Hammering on Lots			**Hammering on Lots**		
Sound Level	105	dB(A) at 1m	Sound Level	105	dB(A) at 1m
Distance separation	8	m	Distance separation	277	m
Distance attenuation	-18	dB(A)	Distance attenuation	-49	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	89	dB(A)	Impact at façade	59	dB(A)
Excavator, 200 to 300 kW on Lots			**Excavator, 200 to 300 kW on Lots**		
SWL	118	dB	SWL	118	dB
SWL to SPL	90	dB(A) at 10m	SWL to SPL	90	dB(A) at 10m
Distance separation	8	m	Distance separation	277	m
Distance attenuation	2	dB(A)	Distance attenuation	-29	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	94	dB(A)	Impact at façade	64	dB(A)
Grader, > 100kW on Lots			**Grader, > 100kW on Lots**		
SWL	120	dB	SWL	120	dB
SWL to SPL	92	dB(A) at 10m	SWL to SPL	92	dB(A) at 10m
Distance separation	8	m	Distance separation	277	m
Distance attenuation	2	dB(A)	Distance attenuation	-29	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	96	dB(A)	Impact at façade	66	dB(A)
Vibratory Roller single drum 2kW on Lots			**Vibratory Roller single drum 2kW on Lots**		
SWL	111	dB	SWL	111	dB
SWL to SPL	83	dB(A) at 10m	SWL to SPL	83	dB(A) at 10m
Distance separation	8	m	Distance separation	277	m
Distance attenuation	2	dB(A)	Distance attenuation	-29	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	87	dB(A)	Impact at façade	57	dB(A)
Dump truck, 25t on Lots			**Dump truck, 25t on Lots**		
SWL	114	dB	SWL	114	dB
SWL to SPL	86	dB(A) at 10m	SWL to SPL	86	dB(A) at 10m
Distance separation	8	m	Distance separation	277	m
Distance attenuation	2	dB(A)	Distance attenuation	-29	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	90	dB(A)	Impact at façade	60	dB(A)

Walmsleys Rd Dwellings					
NEAREST POINT TO RECEIVER			FURTHEST POINT TO RECEIVER		
Cement Truck on Street			**Cement Truck on Street**		
Sound Level	86	dB(A) at 1m	Sound Level	86	dB(A) at 1m
Distance separation	9	m	Distance separation	13	m
Distance attenuation	-19	dB(A)	Distance attenuation	-22	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	69	dB(A)	Impact at façade	66	dB(A)
Hammering on Lots			**Hammering on Lots**		
Sound Level	105	dB(A) at 1m	Sound Level	105	dB(A) at 1m
Distance separation	6	m	Distance separation	440	m
Distance attenuation	-16	dB(A)	Distance attenuation	-53	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	92	dB(A)	Impact at façade	55	dB(A)
Excavator, 200 to 300 kW on Lots			**Excavator, 200 to 300 kW on Lots**		
SWL	118	dB	SWL	118	dB
SWL to SPL	90	dB(A) at 10m	SWL to SPL	90	dB(A) at 10m
Distance separation	6	m	Distance separation	440	m
Distance attenuation	4	dB(A)	Distance attenuation	-33	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	97	dB(A)	Impact at façade	60	dB(A)
Grader, > 100kW on Lots			**Grader, > 100kW on Lots**		
SWL	120	dB	SWL	120	dB
SWL to SPL	92	dB(A) at 10m	SWL to SPL	92	dB(A) at 10m
Distance separation	6	m	Distance separation	440	m
Distance attenuation	4	dB(A)	Distance attenuation	-33	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	99	dB(A)	Impact at façade	62	dB(A)
Vibratory Roller single drum 2kW on Lots			**Vibratory Roller single drum 2kW on Lots**		
SWL	111	dB	SWL	111	dB
SWL to SPL	83	dB(A) at 10m	SWL to SPL	83	dB(A) at 10m
Distance separation	6	m	Distance separation	440	m
Distance attenuation	4	dB(A)	Distance attenuation	-33	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	90	dB(A)	Impact at façade	53	dB(A)
Dump truck, 25t on Lots			**Dump truck, 25t on Lots**		
SWL	114	dB	SWL	114	dB
SWL to SPL	86	dB(A) at 10m	SWL to SPL	86	dB(A) at 10m
Distance separation	6	m	Distance separation	440	m
Distance attenuation	4	dB(A)	Distance attenuation	-33	dB(A)
Façade reflection	3	dB(A)	Façade reflection	3	dB(A)
Impact at façade	93	dB(A)	Impact at façade	56	dB(A)