AVERAGE DAILY AIRCRAFT MOVEMENTS

Runway 14

Aircraft	Arrival Day	Arrival Night	Arrival Total	Departure Day	Departure Night	Departure Total	Touch & Go Day	Touch & Go Night	Touch & Go Total	All Movements Total
737300	5.87	7.18	13.05	5.87	7.18	13.05				26.10
737400	13.30	0.02	13.32	13.32		13.32				26.64
767300	8.53	1.51	10.04	8.74	1.30	10.04				20.08
767200	4.35		4.35	4.35		4.35				8.70
777200	0.54	0.14	0.68	0.68		0.68				1.36
A320	5.22		5.22	5.22		5.22				10.44
BAE146	0.78	0.09	0.87	0.78	0.09	0.87				1.74
BEC190	6.10	0.83	6.93	6.10	0.83	6.93				13.86
SD360	1.46	0.20	1.66	1.46	0.20	1.66				3.32
DHC830	0.10	0.01	0.11	0.10	0.01	0.11				0.22
SF340	0.54		0.54	0.54		0.54				1.08
C130	0.33		0.33	0.25		0.25				0.58
BEC58P	18.88	2.82	21.70	18.88	2.82	21.70				43.40
LEAR35	2.05	0.30	2.35	2.05	0.30	2.35				4.70
CONSEP	13.46	2.01	15.47	13.46	2.01	15.47	62.32	9.88	72.20	103.14
Total	81.21	15.41	96.62	81.79	14.74	96.54	62.32	9.88	72.20	265.36

Runway 32

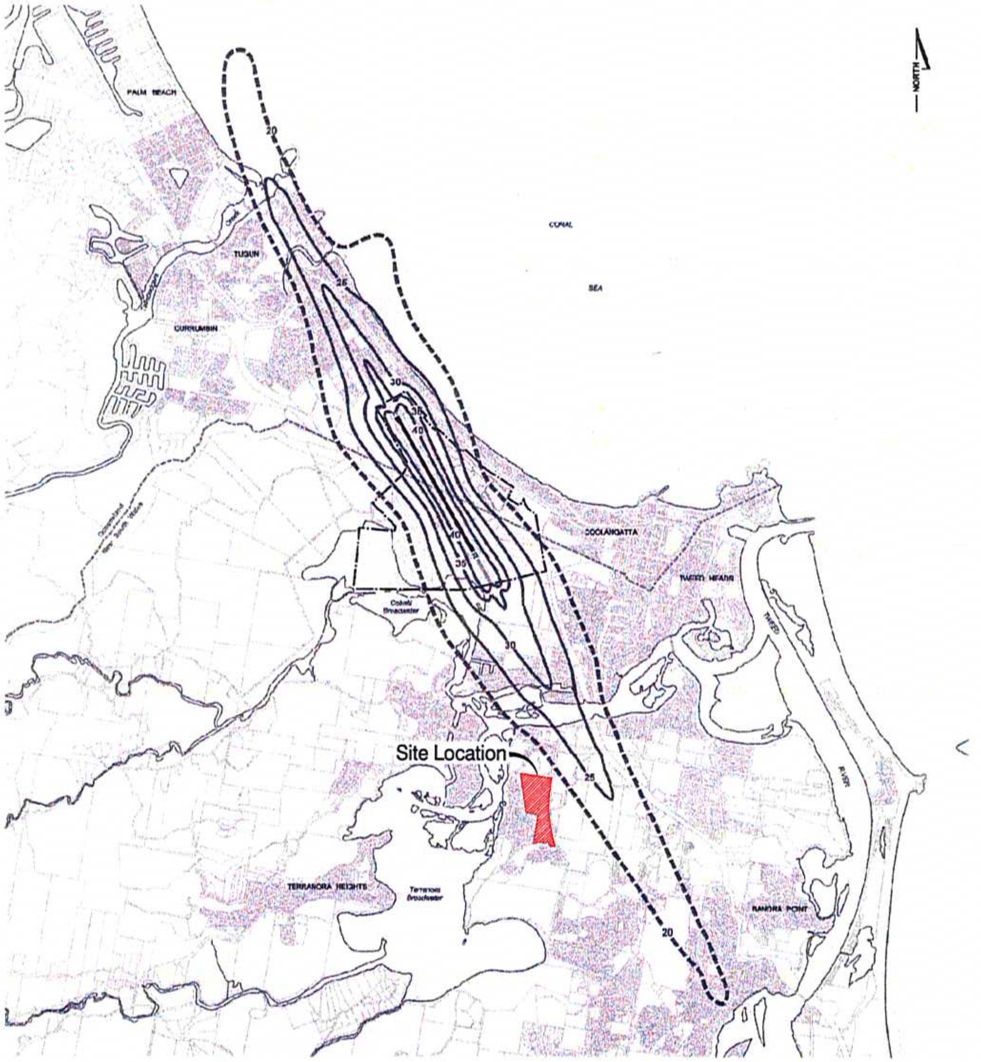
Aircraft	Arrival Day	Arrival Night	Arrival Total	Departure Day	Departure Night	Departure Total	Touch & Go Day	Touch & Go Night	Touch & Go Total	All Movements Total
737300	3.52	4.31	7.83	3.52	4.31	7.83				15.66
737400	7.95	0.04	7.99	7.99		7.99				15.98
767300	5.12	0.90	6.02	4.35	1.67	6.02				12.04
767200	2.61		2.61	2.61		2.61				5.22
777200	0.32	0.08	0.40	0.41		0.41				0.81
A320	3.13		3.13	3.13		3.13				6.26
BAE146	0.47	0.05	0.52	0.47	0.05	0.52				1.04
BEC190	3.66	0.50	4.16	3.66	0.50	4.16				8.32
SD360	0.88	0.12	1.00	0.88	0.12	1.00				2.00
DHC830	0.06	0.01	0.07	0.07	0.00	0.07				0.14
SF340	0.32		0.32	0.32		0.32				0.64
C130	0.08		0.08	0.16		0.16				0.24
BEC58P	12.59	1.88	14.47	12.59	1.88	14.47				28.94
LEAR35	1.36	0.20	1.56	1.36	0.20	1.56				3.12
CONSEP	8.97	1.34	10.31	8.97	1.34	10.31	41.88	6.26	48.14	68.76
Total	51.04	9.43	60.47	50.48	10.07	60.55	41.88	6.26	48.14	169.17

TOTAL	132.25	24.84	157.09	132.27	24.82	157.09	104.70	15.64	120.34	434.52

* Touch & Go movements were composed of 93% touch-go landings and 17% circuit flights (5 to 1 ratio). The number of touch-go/circuit operations used in the Integrated Noise Model was half the number of movements shown in this table as each operation was counted as two movements: a take-off and a landing.

Where figures have been rounded, discrepancies may occur between totals and the sum of the component parts.

ANEF CONTOURS	-	SINGLE ANEF MODEL
HEADWIND	-	8 KNOTS
TERRAIN MODELLED	-	YES



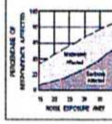
LAND USE COMPATIBILITY ADVICE FOR AREAS IN THE VICINITY OF AUSTRALIAN AIRPORTS

Shall be read in conjunction with AS 2021 - 2000
Acoustics - Aircraft noise intrusion - Building siting and construction

Building Type	ANEF zone of site: Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (note 1)	20 to 25 ANEF (note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (note 1)	20 to 25 ANEF (note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF Zones		

NOTES:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]



PERCENTAGE OF PEOPLE SERIOUSLY & MODERATELY AFFECTED BY AIRCRAFT NOISE

[illegible]

THIS ANEF CHART IS INTENDED TO BE USED SOLELY FOR LAND USE PLANNING PURPOSES. INFORMATION ON AIRCRAFT FLIGHT PATTERNS AND NOISE SHOULD BE SOUGHT SEPARATELY FROM THE AIRPORT.

AIRSERVICES AUSTRALIA ENDORSEMENT

This plan was endorsed for technical accuracy by Leigh Kenna, Manager, Environment Monitoring, Environment Branch of Airservices Australia

Original signed copies are held on file by Airservices Australia and Coolangatta Airport

Signed: L Kenna

Date: 10 / 1 / 03 AIRSERVICES AUSTRALIA

THE AIRCRAFT NOISE CONTOURS ON THIS CHART HAVE BEEN CALCULATED USING THE BEST AVAILABLE MODELLING PROCESS. THE DATA INPUT TO THAT PROCESS ARE FORECASTS, AND AIRSERVICES CANNOT WARRANT THEIR ULTIMATE CORRECTNESS. AIRSERVICES ACCEPTS NO LIABILITIES FOR ANY RELIANCE PLACED ON ANY DATA ON THIS CHART BY ANY THIRD PARTY. AIRSERVICES ACCEPTS NO RESPONSIBILITY FOR ANY INTERPRETATION OF THIS DATA BY THIRD PARTIES.

Gold Coast Airport LTD
COOLANGATTA

2020 ANEF Contour Plan as per " 2020 ANEF Terrain Modelled",
Drg.No. AOS 02 235, Issue 1, Gold Coast Airport Coolangatta, July 2002

N.T.S

FIGURE 6
2020 ANEF CONTOUR PLAN

Rev: Orig. Date: 20 Decemeber 2006

Project No.: 7214/29

Villa World Ltd
CAD FILE: I:\7214-29\Acad\Acoustic Assessment\Figure 6 - 2020 ANEF Contour Plan.dwg
XREF's:

PRINT DATE: 22 December, 2006 - 9:31am

APPENDIX A

Sample Calculation of Building Component Sound Reduction Indexes

Ground Floor Units - 2017

Assuming a bedroom located adjacent to Fraser Drive has the following dimensions:

Wall Height: 3m
Room Length: 3.1m
Room Width: 4.2m
Window Dimensions: 2 * (2m * 1.2m)

As there are 2 external walls, a ceiling and 2 windows exposed to road traffic noise, there are 3 components where noise can enter the room (the walls, ceiling and windows).

Therefore C = 3

Area of the ceiling = 3.1 * 4.2 = 13m^2
Area of the exposed walls is = 3.1 * 4.2 * 2 = 26m^2
Area of windows = 1.2 * 2 * 2 = 4.8m^2

Sc/Sf of the ceiling is therefore = 13/26 = 0.5
Sc/Sf of the walls are therefore = 26/26 = 1
Sc/Sf of the window is therefore =4.8/24 = 0.2

To determine the TNAc of the components, use the equation provided in section 3.4.2.6 of AS 3671.

$$TNAc = TNR + 10\log10 [(Sc/Sf) * (3/h) * 2 * T_{60} * C]$$

Where:

TNAc = the traffic noise attenuation required for each component
TNR = overall traffic noise reduction required
Sc/Sf = ratio of area of ceiling and area of component
h = height of walls
T_{60} = reverberation time of room
C = number of components

The maximum façade corrected ground floor LAeq SPL has been determined to be 60 dB(A). Therefore TNR = 60 - 40 = 20.

For the ceiling, assuming TNR = 20 dB(A) and T_{60} = 0.5 sec.

TNAc = 20 + 10log10[0.5 * 1 * 2 * 0.5 * 3]
TNAc = 28dB(A)
Rw = 34

For the walls, assuming TNR = 20 dB(A) and T_{60} = 0.5 sec.

TNAc = 20 + 10log10[1 * 1 * 2 * 0.5 * 3]
TNAc = 25dB(A)
Rw = 31

For the windows, assuming TNR = 20 dB(A) and T_{60} = 0.5 sec.

TNAc = 20 + 10log10[0.2* 1 * 2 * 0.5 * 3]
TNAc = 18dB(A)
Rw = 24

Therefore, in Appendix B of AS3671, the ceiling should be constructed as detailed in item 1 or 2 of Table B1. The walls should be constructed as detailed in item 1 of Table B2. The windows should be constructed as detailed in item 1 of Table B3.

First Floor Units - 2017

Assuming a bedroom located adjacent to Fraser Drive has the following dimensions:

Wall Height: 3m
Room Length: 3.1m
Room Width: 4.2m
Window Dimensions: 2 * (2m * 1.2m)

As there are 2 external walls, a ceiling and 2 window exposed to road traffic noise, there are 3 components where noise can enter the room (the walls, ceiling and windows).

Therefore C = 3

Area of the ceiling = 3.1 * 4.2 = 13m^2
Area of the exposed walls is = 3.1 * 4.2 * 2 = 26m^2
Area of windows = 1.2 * 2 * 2 = 4.8m^2

Sc/Sf of the ceiling is therefore = 13/26 = 0.5
Sc/Sf of the walls are therefore = 26/26 = 1
Sc/Sf of the window is therefore =4.8/24 = 0.2

To determine the TNAc of the components, use the equation provided in section 3.4.2.6 of AS 3671.

$$TNAc = TNR + 10\log10 [(Sc/Sf) * (3/h) * 2 * T_{60} * C]$$

Where:

TNAc = the traffic noise attenuation required for each component
TNR = overall traffic noise reduction required
Sc/Sf = ratio of area of ceiling and area of component
h = height of walls
T_{60} = reverberation time of room
C = number of components

The maximum façade corrected ground floor LAeq SPL has been determined to be 67 dB(A). Therefore TNR = 67-40 = 27.

For the ceiling, assuming TNR = 27dB(A) and T_{60} = 0.5 sec.

TNAc = 27 + 10log10 [0.5 * 1 * 2 * 0.5 * 3]
TNAc = 29dB(A)
Rw = 35

For the walls, assuming TNR = 27 dB(A) and T_{60} = 0.5 sec.

TNAc = 27 + 10log10 [1 * 1 * 2 * 0.5 * 3]
TNAc = 32dB(A)
Rw = 38

For the windows, assuming TNR = 25 dB(A) and T_{60} = 0.5 sec.

TNAc = 27 + 10log10 [0.2 * 1 * 2 * 0.5 * 3]
TNAc = 25dB(A)
Rw = 31

Therefore, using appendix B of AS3671, the ceiling should be constructed as detailed in item 1 or 2 of Table B1. The walls should be constructed as detailed in item 2 of Table B2. The windows should be constructed as detailed in item 3 of Table B3.

APPENDIX B

Noise Monitoring Data

Logger Serial Number	15-299-424
Measurement Title	cardno39
Measurement started at	12/04/2006 9:27
Measurement stopped at	12/06/2006 12:40

Date	Time	Lmax	L10	L90	Leq
12/04/2006	13:00	82	71.1	53.2	66.2
12/04/2006	13:15	80.8	71.4	52.8	66.6
12/04/2006	13:30	80.9	71.5	52.9	66.7
12/04/2006	13:45	80.2	72.3	52.4	67.3
12/04/2006	14:00	81.8	72.5	53.9	67.8
12/04/2006	14:15	80.7	73.5	54.4	68.8
12/04/2006	14:30	80.7	73.1	53.2	68.2
12/04/2006	14:45	79.7	72.8	52.9	67.9
12/04/2006	15:00	82.4	71.8	53.5	67.2
12/04/2006	15:15	83.4	72.9	53.6	68.1
12/04/2006	15:30	82.8	73	52.7	68.2
12/04/2006	15:45	81.6	72.3	53.9	67.4
12/04/2006	16:00	82.2	72.9	53.2	68.4
12/04/2006	16:15	79.5	72.9	52.9	68
12/04/2006	16:30	86.8	72.5	52.4	68
12/04/2006	16:45	81.4	73.1	50.7	68
12/04/2006	17:00	80.9	73.2	51.8	68
12/04/2006	17:15	80.8	71.6	48.5	66.6
12/04/2006	17:30	89.7	73.3	52.5	68.9
12/04/2006	17:45	81.8	72.1	51.3	67.3
12/04/2006	18:00	96.3	72.2	50.2	71
12/04/2006	18:15	94	71.7	50	68.5
12/04/2006	18:30	81.8	70.7	52.3	66.2
12/04/2006	18:45	80	69.3	50.2	64.6
12/04/2006	19:00	80.8	68.8	53.2	64.8
12/04/2006	19:15	79.9	65.5	54	62.8
12/04/2006	19:30	80.7	70.2	52.7	65.9
12/04/2006	19:45	83	66.8	51.3	63.6
12/04/2006	20:00	84.9	69.5	51.3	65.3
12/04/2006	20:15	82.6	68.6	51.8	64.7
12/04/2006	20:30	81.1	67.6	52.5	64.2
12/04/2006	20:45	85.8	67.6	53.7	64.8
12/04/2006	21:00	77.5	64	54.1	61.9
12/04/2006	21:15	78.4	66.6	54.2	63.2
12/04/2006	21:30	77.6	63	54.1	61.1
12/04/2006	21:45	80.3	62.4	54.2	61.6
12/04/2006	22:00	80.4	57.3	53.7	58.3
12/04/2006	22:15	78.7	59.2	53.6	59.6
12/04/2006	22:30	81.1	56.4	53.3	58.1
12/04/2006	22:45	79.8	56.6	52.7	58.8
12/04/2006	23:00	76.2	55	51.4	56.7
12/04/2006	23:15	78.5	56.7	50	58.2
12/04/2006	23:30	79.5	51.7	46.2	55.5
12/04/2006	23:45	78.7	57	42.7	57.2
12/05/2006	0:00	75.9	49	41.8	50.7
12/05/2006	0:15	73.2	49.6	40.5	50.3
12/05/2006	0:30	75.3	49.9	40.1	52.3
12/05/2006	0:45	78.9	45.2	39.3	51.8
12/05/2006	1:00	80.3	44.9	38.9	56
12/05/2006	1:15	77.6	45.3	38.6	52.9

12/05/2006	1:30	76.9	45	37.9	49.9
12/05/2006	1:45	52.7	46	38.2	42.6
12/05/2006	2:00	74.7	48.6	38.6	49.9
12/05/2006	2:15	73.3	50.5	39.2	50.3
12/05/2006	2:30	81.4	51.9	39.2	56.5
12/05/2006	2:45	78.3	50.2	39.7	54
12/05/2006	3:00	76.8	51.2	40.2	50.4
12/05/2006	3:15	52.4	49.5	39.6	46.1
12/05/2006	3:30	72.7	51.9	39.7	50.3
12/05/2006	3:45	72	52.3	39.8	49.7
12/05/2006	4:00	80.6	54.1	40.9	57.3
12/05/2006	4:15	80.6	54	40.1	56.4
12/05/2006	4:30	80.8	59.8	42.3	58.9
12/05/2006	4:45	80.2	65.3	44.7	63.3
12/05/2006	5:00	82.6	65.8	43.1	63.2
12/05/2006	5:15	82.3	64.9	42.8	63.2
12/05/2006	5:30	81.2	66.2	44	63.8
12/05/2006	5:45	82.6	69.6	44.8	66.2
12/05/2006	6:00	84	70.2	45.9	66
12/05/2006	6:15	98.3	71.4	46.7	70.7
12/05/2006	6:30	87.7	71.9	47.4	67.6
12/05/2006	6:45	82.6	72	49.4	67.2
12/05/2006	7:00	84.8	73.1	53.1	68.4
12/05/2006	7:15	81.7	74.6	57.7	70
12/05/2006	7:30	81.4	75.2	57.8	70.8
12/05/2006	7:45	92.8	75.4	58	72.3
12/05/2006	8:00	84.2	74.3	54.5	69.4
12/05/2006	8:15	80.9	73.1	51.3	68.2
12/05/2006	8:30	83.9	73.1	52.7	68.3
12/05/2006	8:45	82.6	72.3	51.3	67.5
12/05/2006	9:00	86.2	72.2	51.3	67.6
12/05/2006	9:15	81.6	72.6	50.4	67.6
12/05/2006	9:30	83.5	72.7	48	67.7
12/05/2006	9:45	88.5	71.8	49.9	66.9
12/05/2006	10:00	81.3	71.5	48.9	66.8
12/05/2006	10:15	80.8	72.3	48.1	67.3
12/05/2006	10:30	81.4	71.4	51.6	66.6
12/05/2006	10:45	82.7	72.1	51.9	67.3
12/05/2006	11:00	81	72.4	50	67.2
12/05/2006	11:15	80.8	72.3	51.4	67.1
12/05/2006	11:30	84.2	72.1	51.8	67.5
12/05/2006	11:45	85.8	71.7	51.9	67.1
12/05/2006	12:00	81.4	71.8	51.6	67
12/05/2006	12:15	81.8	71.2	52.4	66.4
12/05/2006	12:30	81.5	70.9	52.5	66.2
12/05/2006	12:45	79.8	70.5	51.5	65.8
12/05/2006	13:00	79.3	70.8	51.4	65.9
12/05/2006	13:15	82.2	71.1	53.1	66.5
12/05/2006	13:30	81.4	72.2	52.2	67.3
12/05/2006	13:45	81.1	72.4	52.8	67.4
12/05/2006	14:00	84.7	73.8	54.7	69.2
12/05/2006	14:15	80	73.4	53.5	68.9
12/05/2006	14:30	82.7	73	52.7	68.4
12/05/2006	14:45	84.3	73.3	52.7	68.6
12/05/2006	15:00	85.1	73.1	53.9	68.3
12/05/2006	15:15	84.4	73.1	55.6	68.7

12/05/2006	15:30	84.7	73.3	52.6	68.4
12/05/2006	15:45	86.1	73.4	53.4	68.5
12/05/2006	16:00	83.6	73.2	53.1	68.3
12/05/2006	16:15	81.2	73.2	53.7	68.3
12/05/2006	16:30	87.3	72.7	51.3	67.8
12/05/2006	16:45	81	73.9	56.1	69.3
12/05/2006	17:00	81.3	73.6	53	69
12/05/2006	17:15	81.7	73.4	54.5	68.6
12/05/2006	17:30	81.4	73.5	53.7	68.7
12/05/2006	17:45	87.2	73.1	52.7	68.4
12/05/2006	18:00	79.8	72.4	50.2	67.2
12/05/2006	18:15	80.8	71.6	49.7	66.7
12/05/2006	18:30	81.4	72.1	49.1	67.2
12/05/2006	18:45	84.1	71	52.1	66.5
12/05/2006	19:00	83.7	69.9	48.3	65.7
12/05/2006	19:15	83.5	70	55.2	66.1
12/05/2006	19:30	82.1	68.6	50.4	65.1
12/05/2006	19:45	87.4	69.9	48.1	65.9
12/05/2006	20:00	79.9	69.6	47.1	65
12/05/2006	20:15	78.9	67	46.9	62.7
12/05/2006	20:30	84.3	68.3	46.9	64.6
12/05/2006	20:45	84.4	69.2	47.1	65.4
12/05/2006	21:00	79.4	66.5	48.2	63.1
12/05/2006	21:15	85.6	66	48.4	64.2
12/05/2006	21:30	79.7	65	48.8	62.5
12/05/2006	21:45	77.7	62	48.8	60.1
12/05/2006	22:00	97.4	64.3	49.4	66.5
12/05/2006	22:15	92.2	59.1	46.2	63.3
12/05/2006	22:30	94	63.3	49	67.2
12/05/2006	22:45	79	62	48.2	60.9
12/05/2006	23:00	77.6	53.8	47.1	56.1
12/05/2006	23:15	78.8	56.9	50.7	57.7
12/05/2006	23:30	80.1	54	49	57.2
12/05/2006	23:45	79.3	52.6	46.8	55.8
12/06/2006	0:00	83	49.7	43.5	55.5
12/06/2006	0:15	78.3	47.7	42.1	52.3
12/06/2006	0:30	80.7	48.8	39.3	53.8
12/06/2006	0:45	83.9	51.6	38.1	58.6
12/06/2006	1:00	79.7	48.1	37.2	54.1
12/06/2006	1:15	79.1	56.8	37.5	57
12/06/2006	1:30	79.4	48.2	36.9	54.8
12/06/2006	1:45	77.1	44.4	37.3	51.3
12/06/2006	2:00	74.3	44	36.5	47.9
12/06/2006	2:15	77.8	45.3	37.4	55.1
12/06/2006	2:30	80.7	46.2	37.9	57.3
12/06/2006	2:45	52.8	42.6	37.9	40.4
12/06/2006	3:00	76.6	45	38.6	51.2
12/06/2006	3:15	78.1	44.9	38.7	50.3
12/06/2006	3:30	77	45.3	39	52.4
12/06/2006	3:45	75.4	44.7	38.3	50.9
12/06/2006	4:00	77.5	49.9	38.5	54.5
12/06/2006	4:15	79	52	39.1	54.9
12/06/2006	4:30	82.7	60.1	42.1	59.8
12/06/2006	4:45	81.7	64.8	42.8	62.9
12/06/2006	5:00	83.5	66.5	41.2	63.8
12/06/2006	5:15	80.5	65.9	41.2	63.3

12/06/2006	5:30	80.2	67.2	41.5	64.3
12/06/2006	5:45	82.4	68.4	41.3	65.2
12/06/2006	6:00	83	71.3	43.5	67
12/06/2006	6:15	80.2	71	47.5	66.5
12/06/2006	6:30	83.4	70.7	44.8	66.8
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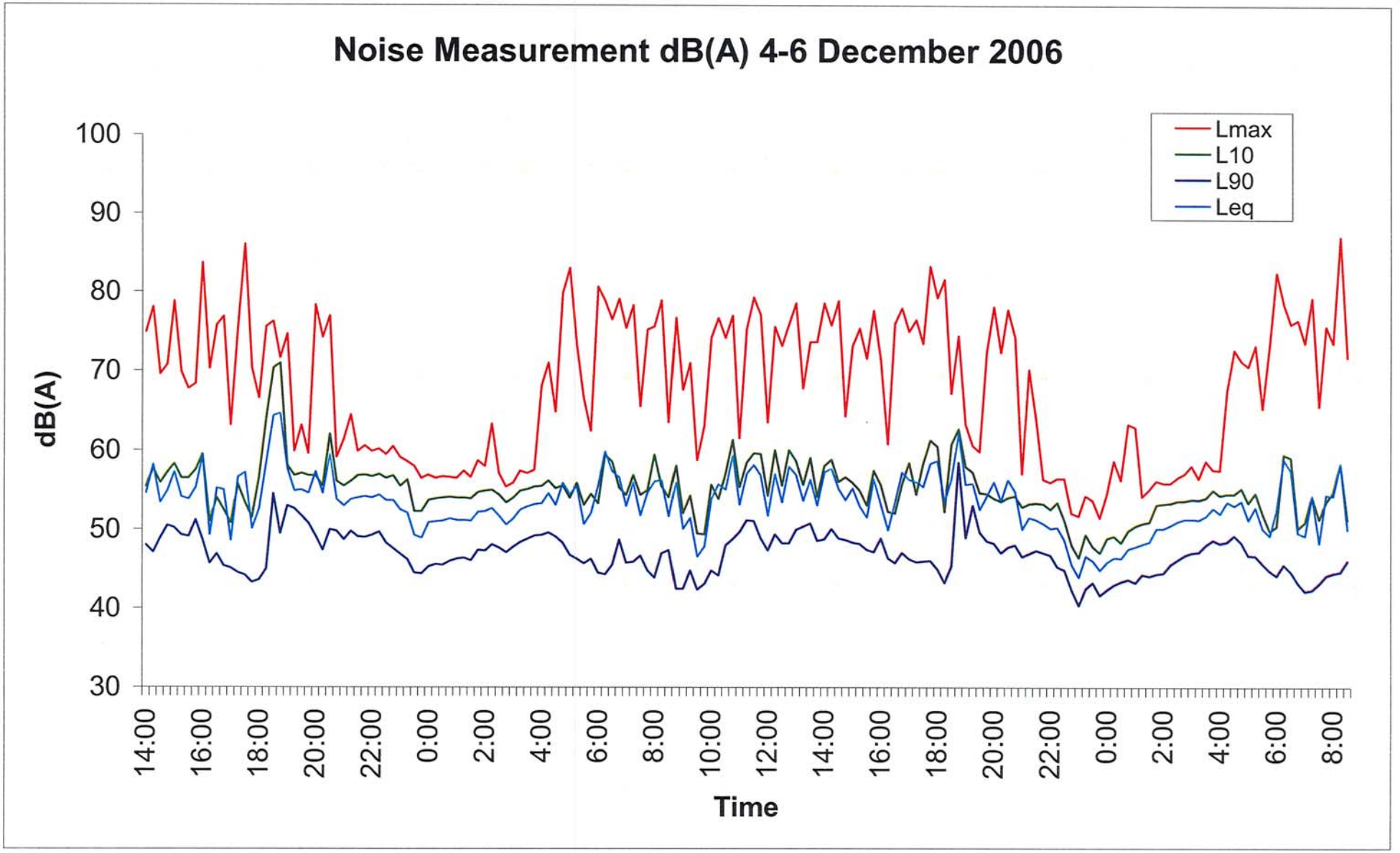
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L10
L90
Leq
100
90
80
70
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50
40
30
dB(A)
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22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
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6:00
8:00
Time

Appendix 08

Geotechnical Report

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consulting
geotechnical +
environmental
services

06282/1-G ps:ps
8 March 2007

Cardno (Qld) Pty Ltd

Commercial Centre

ISLE OF CAPRI QLD 4217

Attention: Mr Alaister Macrae

RE: RESIDENTIAL SUBDIVISION AT FRASER DRIVE

REQUEST FOR SUPPLEMENTARY INFORMATION DATED 22 FEBRUARY 2007

1. INTRODUCTION

Thank you for your correspondence of 6 March 2007 attaching a copy of the NSW Department of Planning request for supplementary information dated 22 February 2007.

The request for supplementary information states in reference to the Shaw:Urquhart report, "*although the report details geotechnical investigations to establish certainty in terms of site stability and suitability for the development of the site, the field assessments undertaken were not carried out specifically for the current proposed allotment layout. As a result, further issues such as slope instability, development of individual allotment building areas and those matters listed in Section 4.1 of the report, require further investigation.*"

Schedule 1 – Inadequacy of Draft Environmental Assessment – MP06_0243 states: "*The geotechnical report provided in Appendix 8 of Volume 2 does not provide an adequate assessment of geotechnical issues. The report details geotechnical investigations to establish certainty in terms of site stability and suitability for the proposal. However, the field assessments undertaken were not carried out specifically for the current proposed allotment layout and there are numerous issues that require further investigation. These should be addressed in the EA and not at the construction certificate stage. In particular, those matters identified in Section 4.1 of the Geotechnical Report should be addressed. Furthermore, the report does not provide details of building platforms/envelopes in all potential slip areas*".

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2. RESPONSE

The previous geotechnical investigations by Coffey (Coffey Geosciences Pty Ltd report Ref B17439/1-B dated 4 April 2002) as presented in Appendix C of the Shaw:Urquhart report were not based on any particular allotment layout and were directed specifically at understanding the site geology. This can be shown from Drawing 1 of the report which does not impose an allotment layout and clearly shows the test pits locations as providing a broad coverage to the site. As such, the geotechnical information is suitable for general use and is not allotment layout specific.

As described in Section 1 of the Shaw:Urquhart report, the process adopted for the current proposal was to take the broad understanding of the site geology as presented in the Coffey report and, by an iterative process involving the developer (Villa World), the civil consultants (Cardno) and the geotechnical consultants (Shaw:Urquhart), develop an allotment layout which was sympathetic to the geotechnical constraints of the site.

The geotechnical constraints imposed on the allotment layout were based on the surface and subsurface conditions as described in the Coffey report. The constraints are described in Section 3.2.3 of the Shaw:Urquhart report.

The constraints are extensive and detailed and are specifically imposed to exclude all areas of the site assessed as having a high likelihood of instability and to carefully manage the risks associated with the proposed development of the remainder of the site.

The main geological feature on this site, which has the potential to adversely affect stability, is the presence of the basalt/metamorphic interface zone. This is described in detail in the Shaw:Urquhart report.

During the process of formulating the current proposed layout, a large number of slope stability analyses were carried out using the computer programme SLOPE/W. The stability of a range of slope angles was assessed for various groundwater conditions and for a range of adverse interface conditions based on the information in the Coffey report. As a result of this extensive analyses it was found that slopes of 3H:1V (18°) or flatter generally achieved acceptable factors of safety for the range of conditions considered.

The geotechnical constraint of limiting building areas within allotments to land with slopes not steeper than 3H:1V (18°) along with the imposition of limitations on cut and fill dimensions is designed, for the current understanding of site conditions, to provide an acceptable factor of safety against instability.

Section 4 of the Shaw:Urquhart report describes in detail future geotechnical investigations that are required to verify the design assumptions adopted to date. These include further test pits to more precisely delineate the location and dip of the basalt/metamorphic interface and laboratory testing to confirm the shear strength of the interface materials.

shaw:urquhart

If you have any questions or if you wish to discuss or clarify any of the issues raised in this report, please contact Philip Shaw or Keith Urquhart at our Brisbane office.

For and on behalf of

SHAW URQUHART PTY LTD

PHILIP SHAW

Principal Geotechnical Engineer

shaw:urquhart
consulting
geotechnical +
environmental
services

CARDNO (QLD) PTY LTD

PROPOSED RESIDENTIAL DEVELOPMENT (PART B) FRASER DRIVE, TWEED HEADS SOUTH

06282/1-C Rev.4
12 January 2007

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06282/1-C Rev.4 KU:
12 January 2007

Cardno (Qld) Pty Ltd
Commercial Centre
ISLE OF CAPRI QLD 4217

Attention: Mr Alaister MacRae

RE: PROPOSED RESIDENTIAL DEVELOPMENT (PART B), FRASER DRIVE, TWEED HEADS SOUTH

Please find attached our report regarding our geotechnical review of the allotment layout master-plan for the above development. This report presents the geotechnical considerations and constraints relating to the design allotment layout.

By a process of review of information provided, application of geotechnical constraints on the proposed development and requirement for future geotechnical studies, a feasible allotment layout was created for the development.

If you have any questions or wish to discuss or clarify any of the issues raised in this report, please contact Keith Urquhart or Philip Shaw in our Brisbane office.

For and on behalf of

SHAW URQUHART PTY LTD

KEITH URQUHART

Principal Engineering Geologist, BSc (Hons), M.Eng.Sc.

Distribution: Original held by Shaw Urquhart Pty Ltd
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TABLE OF CONTENTS

APPENDICES

A Copy of Appendix G from "Landslide Risk Management Guidelines" published by The Australian Geomechanics Society (March 2000).

B Copy of Appendix J from "Landslide Risk Management Guidelines" published by The Australian Geomechanics Society (March 2000).

C Copy of Coffey Geosciences Pty Ltd Report Ref. B17439/1-B dated 4 April 2002

D Copy of Coffey Geosciences Pty Ltd Report Ref. B17439/1-F Revision 1 dated 30 September 2002.

1. INTRODUCTION

Shaw Urquhart Pty Ltd (Shaw:Urquhart) was commissioned by Cardno (Qld) Pty Ltd (Cardno) to assist with the formulation of an allotment layout for the proposed residential development(Part B) at Fraser Drive, Tweed Heads South.

Geotechnical investigations on the site had previously been carried out by Coffey Geosciences Pty Ltd (Coffey) and copies of their reports were provided to Shaw:Urquhart. During the commission, particular reference was made to Coffey reports ref. B17439/1-B dated 4 April 2002 and B17439/1-F Revision 1 dated 30 September 2002. Copies of these report reports are presented in Appendices C and D of this report for completeness.

The Fraser Drive development involves two parts. Part A of the proposed development lies on flat-lying ground adjacent to Fraser Drive and allotment layouts on this area are not influenced by slope stability considerations. During the construction of Part A it will be necessary to remediate existing landslip areas that are located within Part B directly above some of the Part A allotments.

This report deals specifically with slope stability issues relating to the Part B development.

The commission from Cardno did not involve further site investigations and any considerations of geotechnical issues were based on the information presented in the Coffey reports. During the commission the following work was carried out:-

- Shaw:Urquhart personnel attended project team planning meetings to assist Cardno and Villa World Limited (Villa World) personnel in interpreting the geotechnical report prepared by Coffey. The interpretation was specifically with regard to the influence of the local geology, geomorphology and localised areas of existing slope instability on the layout of the proposed allotments and associated infrastructure.
- A brief familiarisation visit to the Fraser Drive site was carried out on 26 October 2006 accompanied by personnel from Cardno and Villa World. The purpose of the visit was to view the site and to assess any changes in surface conditions which may have occurred since the Coffey geotechnical investigations were carried out and to familiarise Cardno and Villa World personnel with the site conditions.
- Assistance was provided to Cardno and Villa World personnel in achieving a feasible allotment layout which was sensitive to and managed the potential risks associated with hillside development on this site. During this process a number of alternative layouts were considered.

The resulting proposed allotment layout is attached to this report as the Allotment Layout Plan (Reference 20934-5a) by PMM Brisbane Pty Ltd (PMM). Copies of cross-