Sydney Airport

N475 Australian Noise Exposure Index

1 October to 31 December 2011

March 2012

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1. Introduction

1.1 Background

In accordance with recommendation 21 of the Proponent's Statement for the Long Term Operating Plan (LTOP) at Sydney Airport, Airservices Australia has prepared an Australian Noise Exposure Index (ANEI) for the period 1 October 2011 to 31 December 2011 inclusive (Reference Number N475).

1.2 Airport Layout

Sydney Airport has three runways. Runway 07/25 (2529m long and 45m wide), Runway 16R/34L (3962m long and 45m wide) and Runway 16L/34R (2438m long and 45m wide). The runway end coordinates and elevations, Aerodrome Reference Point coordinates, elevation data and displaced threshold information for Sydney Airport were obtained from airport data held by Airservices Australia and are shown in Table 1.1.

Table 1.1 Sydney Airport Runway Data

Location	Latitude (WGS84)	Longitude (WGS84)	Elevation AHD (m)	Displaced Landing Threshold (m)
Aerodrome Reference Point	33 56 45.6S	151 10 37.6E	6.4	
Runway End 07	33 56 37.5S	151 09 49.1E	5.3	0m
Runway End 25	33 56 15.1S	151 11 23.8E	6.0	340m
Runway End 16R	33 55 45.7S	151 10 17.8E	2.1	85m
Runway End 34L	33 57 51.4S	151 10 50.4E	4.1	0m
Runway End 16L	33 56 58.6S	151 11 17.9E	4.5	230m
Runway End 34R	33 58 19.0S	151 11 38.1E	3.1	38m
Helipad	33 56 1.60S	151 11 56.4E	6.0	

The airport average temperature and humidity were obtained from Bureau of Meteorology (BOM) data. The temperature and humidity shown in Table 1.2 are taken from the BOM data over the study period.

Table 1.2 Sydney Airport Meteorological Data

Airport Average Temperature	20.6°C
Airport Average Humidity	64.8%

2. The Integrated Noise Model (INM)

The Integrated Noise Model version 7.0b (INM 7.0b) developed by the US Federal Aviation Administration (FAA) as a means of evaluating the impact of aircraft noise was used to model the noise contours for the period 1 October 2011 to 31 December 2011 for Sydney Airport.

2.1 INM Terrain Data

The INM program can import and use terrain elevation data for use in calculating noise metrics. The terrain data is set out in a grid format and includes elevation above mean sea level. The INM interpolates this data to prepare the ground contours for presentation at the required interval. Terrain data has been used within this ANEI study. Areas to the north, east and west of Sydney airport are higher than that of the airport, which has had the effect of increasing the extent of the length and width of the ANEI contours in these areas.

2.2 Changes Incorporated in INM Version 7.0b

At the time of preparing this report, INM7.0b was the most recent release of INM including database updates and correction of minor software issues. INM version 7.0b includes the following enhancements:

- Performance data updates for many existing Airbus aircraft types, replacing existing fixed point standard arrival flight profiles with new procedural profiles.
- Two Airbus A380 aircraft types.
- Five new propeller driven aircraft types.
- Three new helicopter types.
- Updated substitutions to take account of the inclusion of new aircraft types.

A change has also been made to the way helicopters have been incorporated into the current study. Helicopters have been modelled with their own profiles and helipad, details of which are given in Section 3.3.

Because of enhancements made to INM7.0b, care should be exercised when comparing this ANEI with studies that were prepared using earlier versions of the INM program.

3. Methodology Used in the Development of the ANEI

3.1 Introduction

The ANEI contour is based on the data collected by Airservices Australia's Noise and Flight Path Monitoring System (NFPMS). The NFPMS went through a major enhancement during the latter part of 2009. These enhancements have enabled an improved process for generating the ANEI contour for Sydney Airport. The main improvement has been made in the way aircraft movements have been allocated to modelled tracks. This change is detailed below in Section 3.2.

The development of the ANEI consisted of the following stages:

i) collection and verification of the required data;

ii) preparation of the data as INM input files;

iii) running of the model; and,

iv) preparation and verification of model's output.

3.2 Collection and verification of the required data

Runway and associated airport data were obtained from airport data held by Airservices Australia's NFPMS. The total number of movement records from the NFPMS data for the study period is shown in Table 3.1.

As part of the routine data verification of the NFPMS records, flyover movements are checked to determine whether any of these aircraft had made an arrival or departure at Sydney Airport. The records that could not be described as a movement at Sydney Airport are excluded from the study.

Table 3.1 NFPMS Aircraft Movements

Operation	Movements
Arrivals	38875
Departures	38816
# General (Touch and Go not including Helicopters)	16
# General (Touch and Go Helicopters)	884
Total	**79,491**

Note that the touch and go movements above have been doubled in the total movement count.

There were 38 unknown aircraft types within the study period. The NFPMS movement numbers were adjusted to account for unknown aircraft types for input into the INM study. This was achieved by increasing either the arrival or departure number to ensure arrivals equals departures by aircraft type. This process did not exclude aircraft types or movements from the data set. Touch and Go operations were split into arrivals and departures evenly.

Movement data derived from Airservices Australia's published 'Movements at Australian Airports' for Sydney Airport for the period of 1 October 2011 to 31 December 2011 and the daily average aircraft movements for this period are shown in Table 3.2. Note there are more movements captured by the NFPMS then by the Avcharges data. In previous ANEI models, the NFPMS movements were then factored to the Avcharges recorded number of aircraft movements and the daily average number of movements was calculated. This

factoring calculation has not been performed since Q1 2010 due to improvements in the data integrity in the NFPMS.

Table 3.2 Avcharges Recorded Movements

Period	Movements
1 October 2011 to 31 December 2011	79,470
Daily Average during this period	863.80

The flight tracks used in the model were determined from the NFPMS. Flight track plots from the NFPMS were used to identify the major flight paths associated with aircraft movements to and from the airport.

A nominal backbone track for all the major flight paths was identified by means of geographic coordinates along the length of the track and from NFPMS track plots. The corresponding spread for each track was also determined from the NFPMS plots. These tracks were entered into the INM as 'point type' tracks. Each 'nominal backbone track' was prepared with subsidiary tracks that provided a realistic lateral spread of traffic along the nominal tracks.

3.3 Preparation of INM input file

The aircraft movement data extracted from the NFPMS were organised into:

- track flown;
- aircraft types and the associated operation (departure or arrival);
- the runway used; and,
- the time of day or night.

For the purposes of modeling and using the Australian Noise Exposure Forecast (ANEF) metric, night is considered to be between the hours of 7:00pm and 7:00am and carries a weighting of 4.

Including terrain information around the airport improves the accuracy of the contour and was taken into account. Terrain data for the Sydney region was compiled in accordance with the INM User's Guide into a format suitable to be read by INM 7.0b. The terrain data was aligned to the Aerodrome Reference Point (ARP) and incorporated by INM when calculating the ANEI contours.

The use of terrain data changes the shape of the ANEI contours when compared to a flat ground model. Variances in ground elevation change the distance between the aircraft and the ground, hence the calculated aircraft noise levels at each grid point on the ground.

The types of aircraft that operated at Sydney Airport were assigned to 39 representative aircraft types that are contained within the INM database and are shown in Table 3.3. Where possible, the actual aircraft type was matched to its INM counterpart. However, in cases where a particular aircraft type had a small number of movements, it was grouped with a major INM type or INM substitute. Additional aircraft types in operation during quarter 4, 2011 include the:

- ATR 72-212A. Data for this specific aircraft type was not in the standard INM suite of aircraft. Therefore a substitution was made using the HS748A aircraft. This was a standard substitution approved by the FAA.

- B787-800. This new aircraft operated once during the study period and was included into B767-300 movements.
- B747–800. No specific noise data for this aircraft was in INM. Operations for this aircraft were included into the B747-400 movements. This is considered a worst case.

In this study, helicopters were modeled using actual helicopter profiles within INM. Three representative helicopter types were used to assign helicopter movements (B407, EC130, R22). These helicopters were chosen because they contain the appropriate Noise Power Distance (NPD) curves data relevant for the ANEI noise metric and they represent helicopter movements at Sydney Airport. All helicopters that operate at Sydney airport were then assigned to the representative type based on size. Helicopter types that were unknown were assigned to the representative helicopter type that contained the highest percentage of operations, namely the R22. All helicopters were modelled as arriving to or departing from the Helipad that is located south of the threshold of Runway 25.

The aircraft types were assigned to representative back bone tracks based on their track location within the NFPMS. As stated previously, the INM tracks were prepared as point type tracks, the location of which, and lateral spread, being determined from the NFPMS data for each ANEI prepared for Sydney airport.

Table 3.3 Aircraft Types Used by INM for ANEI N475

INM Type	Aircraft
707320	Represents B707, C135 and DC8 type aircraft
727EM2	Boeing B727-200 aircraft fitted with hushkitting
737300	Boeing B737-300 aircraft
737400	Boeing B737-400 aircraft
737700	Boeing B737-700 aircraft
737800	Boeing B737-800 aircraft
74720B	Represents B747-200 and B747-300 aircraft
747400	Boeing B747-400 aircraft
757PW	Boeing B757-200 aircraft
767300	Boeing B767-300 aircraft
767JT9	Represents B767-200 aircraft
777200	Boeing B777-200 aircraft
777300	Boeing B777-300 aircraft
A310-304	Airbus Industries A310 aircraft
A320-232	Airbus Industries A320 aircraft
A330-301	Airbus Industries A330 aircraft
A340-211	Airbus Industries A340-200 and A340-400 aircraft
A340-642	Airbus Industries A340-500 and 600 aircraft
A380-841	Airbus Industries A380 aircraft fitted with RR Trent engines
A380-861	Airbus Industries A380 aircraft fitted with Engine Alliance engines
BAE300	Represents BAe146 aircraft
BEC58P	Represents GA twin piston-engine aircraft
C130	Represents C130, P3 and other 4 engine turbo-prop aircraft
CL601	Represents Canadair CL601 Challenger aircraft
CNA441	Represents GA twin turbine-engine aircraft
CNA208	Represents Pilatus PC-12 and other single engine turbo-prop aircraft
DHC6	Represents Twin Otter and similar aircraft
DHC830	Represents Dash 8, FK50 type aircraft
GASEPF	Represents GA single engine fixed pitch propeller aircraft.
GASEPV	Represents GA single engine variable pitch propeller and/or turbine aircraft
GV	Represents Embraer 170 aircraft
HS748A	Represent AT75, (ATR 72-212 A aircraft)
LEAR35	Represents other small business type jet aircraft
MD11GE	Represents DC10 and MD11 type aircraft
SF340	Saab 340 aircraft
B407	Bell 407 helicopter representing large helicopter types
EC130	Eurocopter EC130 helicopter representing medium helicopter types
R22	Robinson R22 helicopter representing small helicopter types

The average daily movements for each aircraft type by runway, time of day and type of operation are shown in Attachment A.

3.4 Running of the Model

The INM was run using standard noise profile data for each of the aircraft types. The parameters used for the ANEF metric were:

Day multiplier	1.0
Night multiplier	4.0

A derivation for the ANEF metric can be found in Attachment A of Australian Standard 2021:2000 *Acoustics, Aircraft Noise Intrusion – Building Siting and Construction.* In accordance with the standard, the evening multiplier is included as part of the night period (7:00pm to 7:00am) and is not modeled.

3.5 Preparation and verification of the model output

The ANEI contours produced by the INM were plotted using a GIS software package onto a base map. The contours produced for the 1 October 2011 to 31 December 2011 ANEI (N475) are consistent with flight tracks and the aircraft operations for the period and the use of terrain data.

Table 3.4 shows the average daily aircraft movements for the 1 October 2011 to 31 December 2011 ANEI (N475) is 3.78 movements higher than for the same period for the previous year - the 1 October 2010 to 31 December 2010 ANEI (N470).

Table 3.4 Comparison of Average Daily Movements

ANEI Study	Period	Average Daily Aircraft Movements
N470	1 October 2010 to 31 December 2010	860.90
N475	1 October 2011 to 31 December 2011	864.68

4. Comparison of the 2011 ANEI (N475) with the 2010 ANEI (N470)

The 1 October 2011 to 31 December 2011 ANEI (N475) contours for Sydney Airport are shown in Attachment D. For comparison purposes, the 1 October 2010 to 31 December 2010 ANEI (N470) for Sydney Airport has been included as Attachment E.

Both studies have been performed using INM7.0b and have used terrain data during the calculation of their contours.

4.1 Comparison of ANEI N475 with ANEI N470

The changes evident in the contours for ANEI N475, when compared with the contours for ANEI N470, are consistent with the changes in aircraft types, movement numbers, runway usage, night movements and aircraft flight path use during the two periods.

Table 4.1 shows a comparison of average daily arrival and departure movements by runway for ANEI N475 and ANEI N470. Note that this comparison provides the basis for evaluation of the ANEI N475 contours. When INM disperses the movements assigned for each aircraft type from the nominated ‘nominal backbone track’ to its subsidiary tracks, there are sometimes slight differences between the reported number of arrivals and departures for that aircraft type, runway or INM study due to rounding.

Table 4.1 Comparison of Average Daily Runway Movement

Runway	ANEI N475 (1 October 2011 to 31 December 2011)			ANEI N470 (1 October 2010 to 31 December 2010)		
	Arrivals	Departures	Totals	Arrivals	Departures	Totals
07	33.18	1.27	34.46	18.55	0.38	18.93
16L	78.55	77.65	156.21	58.55	60.72	119.27
16R	115.91	176.22	292.13	82.56	120.33	202.90
25	15.67	4.56	20.24	14.52	13.65	28.17
34L	120.99	76.51	197.50	168.68	105.07	273.75
34R	53.76	81.86	135.62	77.92	120.64	198.56
Helipad	14.27	14.27	28.54	9.65	9.65	19.30
Total	432.34	432.34	864.68	430.45	430.45	860.90

North-West of the Airport

Average daily departures from Runway 34L decreased by 28.6 movements per day from the ANEI N470 figures. Departures using the Richmond SID and the Katoomba SID are shown to cause the "north-west bumps' in the 20 ANEI contour.

Long-haul jet aircraft departing from Runway 34L for destinations in the USA were allocated to a backbone track based on their actual departure track. Table 4.2 shows a comparison of departures that maintained runway heading and those that tracked via the Richmond Two SID.

Table 4.2 Comparison of Average Daily Long Haul Departures from Runway 34L

Runway 34L US Departures	ANEI N475 (1 October 2011 to 31 December 2011)		ANEI N470 (1 October 2010 to 31 December 2010)	
	Movements	% of USA Departures	Movements	% of USA Departures
Maintain Runway Heading	2.15	61%	3.10	62%
RICHMOND TWO SID	1.36	39%	1.90	38%
Total	**3.51**		**5.00**	

North of the Airport

Average daily arrivals on Runway 16R increased by 33.4 movements compared to the ANEI N470 figures. Average daily arrivals on Runway 16L increased by 20.0 movements from the ANEI N470 figures. The extent of the contours increased in these areas accordingly.

East of the Airport

Average daily arrivals on Runway 25 have increased by 1.2 movements from the ANEI N470. Average daily departures from Runway 07 were minimal for both studies and increased by 0.9 from N470. The additional cross runway arrival movements in the N475 study have changed the shape of the contours accordingly.

Average daily departures from 34R have decreased 38.8 movements from N470, and the contours have reduced in this area accordingly.

West of the Airport

Average daily arrivals on Runway 07 increased by 14.6 movements from ANEI N470. The average daily departures from Runway 25 decreased by 9.1 movements from the ANEI N470.

The ANEI contours associated with arrivals on Runway 07 and departures from Runway 25 have changed as expected.

South of the Airport

The contours south of the airport have changed due to an increase of departures and a decrease in arrivals from the south.

Average daily departures from Runway 16L increased by 16.9 movements from ANEI N470.
Average daily departures from Runway 16R increased by 55.9 movements from ANEI N470.
Average daily arrivals on Runway 34R decreased by 24.2 movements from ANEI N470.
Average daily arrivals on Runway 34L decreased by 47.7 movements from ANEI N470.

4.2 Comparison of Runway Use

Table 4.3 shows a comparison of runway usage in the 1 October 2011 to 31 December 2011 ANEI (N475) to the 1 October 2010 to 31 December 2010 ANEI (N470).

Table 4.3 Runway Use Comparison

Runway	ANEI N475		ANEI N475	
	(1 October 2011 to 31 December 2011)		(1 October 2010 to 31 December 2010)	
	N475 Arrivals %	N475 Departures %	N470 Arrivals %	N470 Departures %
07	3.8	0.1	2.2	0.0
16L	9.1	9.0	6.8	7.1
16R	13.4	20.4	9.6	14.0
25	1.8	0.5	1.7	1.6
34L	14.0	8.8	19.6	12.2
34R	6.2	9.5	9.1	14.0
Helipad	1.7	1.7	1.1	1.1

Note: Numbers represent percentage of total movements for the respective period of the ANEI and have been rounded to one decimal place.

Figures 4.1a and 4.1b depict this comparison for arrivals and departures respectively.

Figure 4.1a Runway Use Comparison - Arrivals

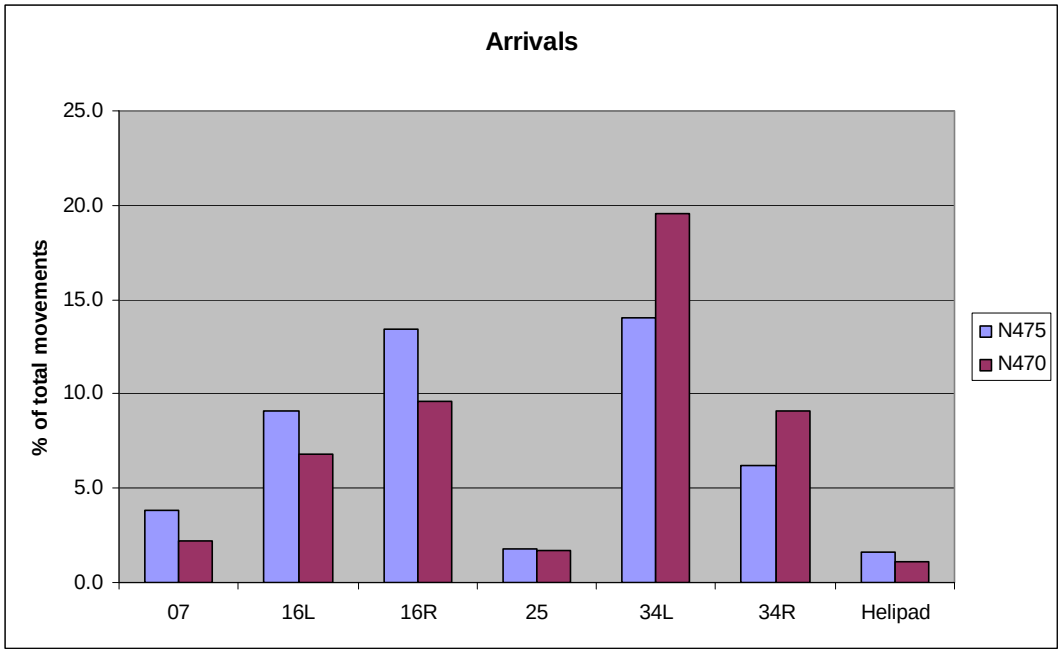


Figure 4.1b Runway Use Comparison - Departures

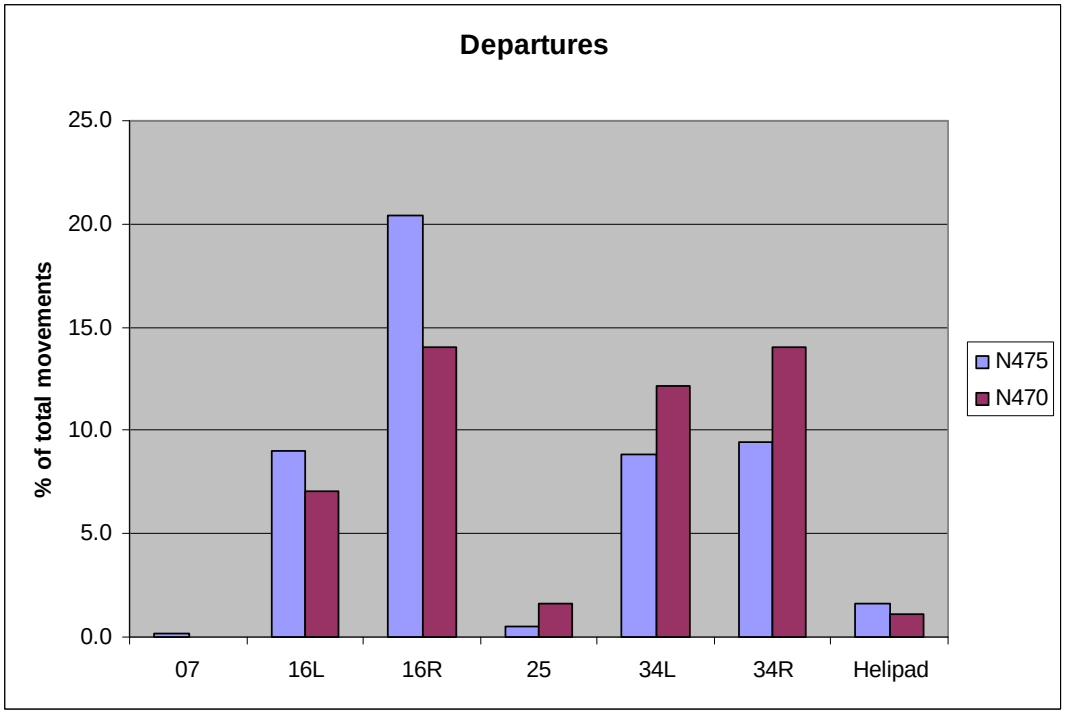


Table 4.4 details the proportion of aircraft movements to the north, south, east and west of Sydney Airport for ANEI N475 compared with ANEI N470. In calculating the proportion of aircraft movements, helicopter operations were not included.

Table 4.4 Runway End Impact Comparison

Direction	Operation		ANEI N475	ANEI N470
	Arrival Runway	Departure Runway	%	%
North	16L and 16R	34L	31.3	28.6
South	34L and 34R	16L and 16R	49.6	49.7
East	25	07 and 34R	11.4	15.7
West	07	25	4.4	1.9

4.3 Comparison of Population Counts

The estimated population within each of the contours of the 1 October 2011 to 31 December 2011 ANEI (N475) and the 1 October 2010 to 31 December 2010 ANEI (N470) is shown in Table 4.5. These population estimates are based on the Australian Bureau of Statistics 2006 Census of Population and Housing data and have been rounded to the nearest 100.

Table 4.5 Comparison of Total Population Estimates within each ANEI Contour

ANEI	Period	>=20	>=25	>=30	>=35	>=40
N470	1 October 2010 to 31 December 2010	89600	20000	2500	400	0
N475	1 October 2011 to 31 December 2011	88100	21100	3500	400	0

A more detailed listing of the number of people within the various ANEI contours is shown by suburb for ANEI N475 and ANEI N470 in Attachment B. Notes and methodology specific to the suburbs and contour population counts are also included in Attachment B.

5. Number of Aircraft Noise Events Above 70dB(A) Noise Map

5.1 Introduction

'Number Above' (Nxx) noise maps are an approach which provides additional information on aircraft noise in a form that is more easily understood by the community. The contours provide a visual depiction that shows the number of noise events during a given period that are louder than a selected threshold level. The N70 Aircraft Noise Map for Sydney Airport shows for all areas around the airport how many aircraft noise events louder than 70 dB(A) there were, on a daily average, during the period from 1 October 2011 to 31 December 2011 ANEI (N475).

70 dB(A) is generally considered to be the external sound level below which no difficulty with reliable communication from radio, television or conversational speech in a typical room with windows open is expected. (Reference - Department of Transport and Regional Services, 2000, *Expanding Ways to Describe and Assess Aircraft Noise,* pp23-35).

5.2 Methodology used in the Development of the N70 Aircraft Noise Map

The N70 aircraft noise map was prepared using the same input files as those for the ANEI contours and was prepared by running the Time-Above (TA) metric, which is a standard metric within the INM 7.0b, to produce a detailed grid output file. It is important to note that the TA metric, unlike the ANEF metric, does not use any night weighting in the calculations.

The detailed grid output file was then modified using propriety software and then imported into a GIS software package for plotting onto a base map.

5.3 Analysis of the N70 Aircraft Noise Map

The N70 map prepared for Sydney Airport is shown in Attachment F – Sydney Airport N475 N70 Aircraft Noise Map - 1 October 2011 to 31 December 2011.

The map output is consistent with the patterns that would be expected given the position of the flight paths and the number and types of aircraft using the flight paths modeled in the 1 October 2011 to 31 December 2011 ANEI (N475).

The N70 aircraft noise map provides information on the total number of aircraft noise events that exceeded 70 dB(A) in a grid area that were likely to have interfered with conversation, sleeping and listening to the radio or television inside a house with the windows open. However, it is important to note several limitations with the N70 aircraft noise maps. These include:

- Unlike the ANEI computations, 'Number Above' metrics are based on a large INM grid format and have so far had limited use in formal noise assessment documents in Australia and they are therefore not tested or verified. The figures that may be derived from the N70 aircraft noise maps are therefore purely indicative.
- The INM does not provide users with a direct way of computing a 'Number Above' chart, unlike the ANEI and TA contours. It is only possible to derive 'Number Above' values on a rectangular grid, which is then processed for importing into the GIS software package. The accuracy of the N70 contours shown in Attachment F is therefore at best plus or minus 500 metres, the distance between grid points used by INM in the calculations. In addition, the superimposed contours may have incurred errors in the transformation from INM coordinates to the map coordinates that were used in the preparation of the N70 chart.

Attachment A

ANEI N475 Average Daily Aircraft Movements by Runway

Attachment A

Table A1 Average Daily Movements by Runway

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
07	737300	0.07	0.40	0.47	0.00	0.00	0.00	0.47
07	737400	0.51	0.25	0.76	0.02	0.01	0.03	0.79
07	737700	1.29	1.00	2.29	0.01	0.03	0.04	2.34
07	737800	4.51	3.52	8.03	0.15	0.13	0.28	8.32
07	74720B	0.00	0.01	0.01	0.00	0.00	0.00	0.01
07	747400	0.58	0.26	0.84	0.00	0.01	0.01	0.85
07	757PW	0.00	0.16	0.16	0.00	0.00	0.00	0.16
07	767300	1.90	0.96	2.86	0.05	0.03	0.09	2.95
07	777200	0.12	0.13	0.25	0.00	0.01	0.01	0.26
07	777300	0.07	0.16	0.23	0.00	0.00	0.00	0.23
07	A319-131	0.00	0.01	0.01	0.00	0.00	0.00	0.01
07	A320-232	2.97	2.16	5.13	0.09	0.09	0.17	5.30
07	A330-301	0.67	0.53	1.21	0.02	0.00	0.02	1.23
07	A340-211	0.10	0.01	0.11	0.01	0.00	0.01	0.12
07	A340-642	0.02	0.14	0.16	0.00	0.00	0.00	0.16
07	A380-841	0.03	0.02	0.05	0.00	0.00	0.00	0.05
07	A380-861	0.00	0.03	0.03	0.01	0.00	0.01	0.04
07	BAE300	0.00	0.17	0.17	0.00	0.00	0.00	0.17
07	BEC58P	0.01	0.15	0.16	0.00	0.00	0.00	0.16
07	CL601	0.00	0.02	0.02	0.00	0.00	0.00	0.02
07	CNA208	0.01	0.00	0.01	0.01	0.00	0.01	0.02
07	CNA441	0.01	0.01	0.02	0.00	0.00	0.00	0.02
07	DHC6	1.22	0.93	2.15	0.16	0.04	0.21	2.36
07	DHC830	3.30	0.50	3.80	0.05	0.08	0.13	3.93
07	GV	0.97	0.30	1.27	0.03	0.03	0.07	1.34
07	HS748A	0.16	0.07	0.23	0.01	0.00	0.01	0.24
07	LEAR35	0.51	0.17	0.68	0.02	0.00	0.02	0.71
07	MD11GE	0.11	0.00	0.11	0.00	0.01	0.01	0.12
07	SF340	1.76	0.17	1.93	0.07	0.07	0.13	2.07
07		20.90	12.28	33.18	0.73	0.54	1.27	34.46

Attachment A

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
16L	707320	0.02	0.00	0.02	0.01	0.01	0.02	0.04
16L	737300	0.10	0.08	0.17	0.10	0.10	0.20	0.37
16L	737400	1.24	0.10	1.34	1.30	0.51	1.82	3.15
16L	737700	3.25	0.48	3.73	3.86	0.89	4.75	8.48
16L	737800	17.50	3.45	20.95	18.00	5.85	23.85	44.79
16L	747400	0.00	0.00	0.00	0.03	0.02	0.05	0.05
16L	757PW	0.01	0.01	0.02	0.03	0.08	0.11	0.13
16L	767300	4.32	0.79	5.11	4.20	1.32	5.51	10.62
16L	777200	0.00	0.00	0.00	0.01	0.00	0.01	0.01
16L	A319-131	0.03	0.01	0.04	0.00	0.00	0.00	0.04
16L	A320-232	10.03	1.97	12.00	10.49	2.89	13.38	25.38
16L	A330-301	0.16	0.01	0.17	0.13	0.15	0.28	0.46
16L	BAE300	0.01	0.01	0.02	0.00	0.00	0.00	0.02
16L	BEC58P	0.03	0.02	0.05	0.03	0.02	0.05	0.11
16L	CL601	0.04	0.00	0.04	0.03	0.01	0.04	0.09
16L	CNA208	0.03	0.00	0.03	0.04	0.01	0.05	0.09
16L	CNA441	0.05	0.01	0.07	0.02	0.00	0.02	0.09
16L	DHC6	3.89	1.34	5.23	3.60	0.66	4.26	9.49
16L	DHC830	13.41	0.43	13.85	11.17	1.51	12.68	26.53
16L	GASEPF	0.00	0.01	0.01	0.00	0.01	0.01	0.02
16L	GV	2.80	0.24	3.04	2.36	0.57	2.92	5.97
16L	HS748A	1.00	0.10	1.10	0.67	0.00	0.67	1.77
16L	LEAR25	0.01	0.00	0.01	0.00	0.00	0.00	0.01
16L	LEAR35	1.02	0.14	1.16	0.92	0.16	1.09	2.25
16L	MD11GE	0.00	0.00	0.00	0.00	0.01	0.01	0.01
16L	SF340	9.76	0.62	10.38	5.30	0.54	5.85	16.23
16L		68.74	9.81	78.55	62.33	15.33	77.65	156.21

Attachment A

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
16R	707320	0.04	0.00	0.04	0.05	0.00	0.05	0.10
16R	737300	0.09	0.14	0.23	0.16	1.10	1.26	1.49
16R	737400	3.37	0.78	4.15	4.04	0.91	4.96	9.11
16R	737700	3.51	1.07	4.58	5.74	1.34	7.08	11.65
16R	737800	17.95	3.70	21.64	25.74	7.30	33.04	54.68
16R	74720B	0.04	0.01	0.05	0.01	0.04	0.05	0.11
16R	747400	6.60	1.82	8.41	9.12	1.27	10.39	18.80
16R	757PW	0.05	0.04	0.10	0.04	0.40	0.45	0.54
16R	767300	7.47	2.22	9.68	10.07	3.77	13.84	23.52
16R	777200	3.23	1.27	4.50	3.43	1.82	5.25	9.75
16R	777300	1.66	1.29	2.96	2.38	1.11	3.49	6.45
16R	A319-131	0.04	0.00	0.04	0.08	0.02	0.10	0.14
16R	A320-232	9.15	1.84	10.99	13.96	4.38	18.34	29.33
16R	A330-301	9.77	1.76	11.53	10.79	3.39	14.18	25.72
16R	A340-211	1.25	0.24	1.49	1.45	0.24	1.68	3.17
16R	A340-642	1.11	1.00	2.11	1.96	0.58	2.53	4.64
16R	A380-841	1.42	0.64	2.07	2.22	0.04	2.26	4.33
16R	A380-861	0.38	0.72	1.10	0.53	0.58	1.11	2.21
16R	BAE300	0.01	0.12	0.13	0.03	2.59	2.62	2.75
16R	BEC58P	0.03	0.09	0.12	0.08	0.55	0.63	0.75
16R	C130	0.01	0.00	0.01	0.01	0.00	0.01	0.02
16R	CL601	0.21	0.02	0.23	0.21	0.09	0.29	0.52
16R	CNA208	0.02	0.00	0.02	0.01	0.00	0.01	0.03
16R	CNA441	0.05	0.01	0.07	0.14	0.07	0.21	0.27
16R	DHC6	1.95	1.12	3.07	4.22	2.89	7.11	10.17
16R	DHC830	7.84	0.35	8.18	12.67	2.32	14.99	23.17
16R	GASEPV	0.00	0.00	0.00	0.01	0.00	0.01	0.01
16R	GV	4.27	0.73	5.00	6.28	1.13	7.41	12.41
16R	HS748A	0.80	0.22	1.02	1.21	0.61	1.82	2.84
16R	LEAR25	0.00	0.00	0.00	0.01	0.00	0.01	0.01
16R	LEAR35	1.26	0.26	1.52	2.17	0.70	2.87	4.39
16R	MD11GE	0.67	0.26	0.93	0.28	0.87	1.15	2.09
16R	SF340	9.14	0.79	9.93	13.01	4.00	17.01	26.95
16R		93.41	22.50	115.91	132.12	44.10	176.22	292.13

Attachment A

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
25	737300	0.01	0.24	0.25	0.00	0.00	0.00	0.25
25	737400	0.20	0.18	0.38	0.03	0.09	0.12	0.50
25	737700	0.36	0.51	0.87	0.08	0.21	0.28	1.15
25	737800	1.53	2.43	3.97	0.53	0.68	1.22	5.18
25	747400	0.26	0.39	0.65	0.03	0.00	0.03	0.68
25	757PW	0.00	0.08	0.08	0.00	0.00	0.00	0.08
25	767300	0.41	0.68	1.10	0.12	0.17	0.29	1.39
25	777200	0.07	0.25	0.32	0.00	0.02	0.02	0.34
25	777300	0.01	0.20	0.21	0.00	0.00	0.00	0.21
25	A320-232	1.14	1.41	2.55	0.24	0.48	0.72	3.27
25	A330-301	0.29	0.66	0.96	0.05	0.11	0.16	1.12
25	A340-211	0.07	0.02	0.09	0.02	0.01	0.03	0.12
25	A340-642	0.02	0.09	0.11	0.00	0.00	0.00	0.11
25	A380-841	0.01	0.03	0.04	0.01	0.00	0.01	0.05
25	BAE300	0.00	0.09	0.09	0.00	0.00	0.00	0.09
25	BEC58P	0.00	0.09	0.09	0.01	0.00	0.01	0.10
25	CL601	0.02	0.01	0.03	0.00	0.00	0.00	0.03
25	CNA208	0.00	0.01	0.01	0.00	0.00	0.00	0.01
25	DHC6	0.35	0.55	0.90	0.26	0.41	0.67	1.58
25	DHC830	0.95	0.36	1.30	0.26	0.08	0.34	1.64
25	GV	0.36	0.27	0.63	0.05	0.03	0.09	0.72
25	HS748A	0.07	0.02	0.09	0.01	0.00	0.01	0.10
25	LEAR35	0.16	0.17	0.34	0.12	0.07	0.18	0.52
25	MD11GE	0.02	0.03	0.05	0.00	0.00	0.00	0.05
25	SF340	0.48	0.10	0.58	0.26	0.11	0.37	0.95
25		6.78	8.89	15.67	2.10	2.47	4.56	20.24

Attachment A

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
34L	707320	0.03	0.01	0.04	0.01	0.00	0.01	0.05
34L	717200	0.00	0.00	0.00	0.02	0.00	0.02	0.02
34L	737300	0.15	0.42	0.58	0.17	0.04	0.22	0.79
34L	737400	2.67	0.66	3.34	0.86	0.13	0.99	4.33
34L	737700	3.52	1.55	5.08	1.30	0.02	1.33	6.40
34L	737800	17.61	7.60	25.21	8.20	2.14	10.34	35.54
34L	74720B	0.02	0.00	0.02	0.02	0.01	0.03	0.05
34L	747400	5.55	2.39	7.95	6.52	0.84	7.36	15.30
34L	757PW	0.05	0.16	0.22	0.02	0.01	0.03	0.25
34L	767300	6.93	2.99	9.92	2.00	0.91	2.91	12.84
34L	777200	2.50	1.41	3.91	2.45	1.24	3.68	7.60
34L	777300	1.17	1.48	2.65	1.66	0.89	2.55	5.21
34L	A319-131	0.04	0.02	0.07	0.03	0.00	0.03	0.10
34L	A320-232	9.39	3.64	13.03	3.00	0.86	3.86	16.89
34L	A330-301	8.20	2.29	10.49	6.86	1.91	8.77	19.26
34L	A340-211	0.76	0.18	0.95	0.80	0.10	0.90	1.85
34L	A340-642	0.96	0.96	1.91	1.35	0.41	1.76	3.67
34L	A380-841	1.07	0.62	1.68	1.52	0.05	1.58	3.26
34L	A380-861	0.24	0.63	0.87	0.46	0.42	0.88	1.75
34L	BAE300	0.01	2.20	2.21	0.01	0.00	0.01	2.22
34L	BEC58P	0.01	0.18	0.20	0.00	0.00	0.00	0.20
34L	CL601	0.24	0.03	0.27	0.04	0.01	0.05	0.33
34L	CNA208	0.02	0.00	0.02	0.01	0.00	0.01	0.03
34L	CNA441	0.04	0.07	0.11	0.04	0.02	0.07	0.17
34L	DHC6	1.65	2.11	3.76	2.76	0.89	3.65	7.41
34L	DHC830	8.11	0.74	8.85	8.38	1.64	10.02	18.87
34L	GV	3.92	0.74	4.66	0.83	0.43	1.26	5.92
34L	HS748A	0.63	0.21	0.84	0.66	0.24	0.90	1.74
34L	LEAR35	0.95	0.86	1.80	0.65	0.12	0.77	2.58
34L	MD11GE	0.67	0.25	0.92	0.18	0.66	0.85	1.77
34L	SF340	8.39	1.04	9.43	8.76	2.89	11.65	21.09
34L		85.53	35.46	120.99	59.60	16.91	76.51	197.50

Attachment A

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
34R	707320	0.00	0.01	0.01	0.02	0.01	0.03	0.04
34R	717200	0.02	0.00	0.02	0.00	0.00	0.00	0.02
34R	737300	0.05	0.13	0.18	0.02	0.18	0.21	0.39
34R	737400	0.49	0.09	0.58	2.22	0.41	2.63	3.21
34R	737700	2.35	0.63	2.98	5.08	0.97	6.04	9.02
34R	737800	12.00	2.46	14.46	20.42	5.10	25.52	39.98
34R	757PW	0.01	0.05	0.07	0.03	0.02	0.05	0.12
34R	767300	2.58	0.51	3.09	7.47	1.65	9.12	12.21
34R	A319-131	0.01	0.00	0.01	0.02	0.02	0.04	0.05
34R	A320-232	7.27	1.36	8.63	12.61	3.26	15.87	24.50
34R	A330-301	0.10	0.03	0.13	0.73	0.34	1.07	1.20
34R	BAE300	0.00	0.01	0.01	0.00	0.00	0.00	0.01
34R	BEC58P	0.02	0.08	0.10	0.02	0.00	0.02	0.12
34R	CL601	0.08	0.01	0.09	0.24	0.05	0.29	0.38
34R	CNA208	0.03	0.00	0.03	0.04	0.00	0.04	0.08
34R	CNA441	0.02	0.02	0.04	0.01	0.00	0.01	0.05
34R	DHC6	2.58	0.82	3.39	2.22	0.38	2.60	5.99
34R	DHC830	9.48	0.61	10.09	6.95	0.97	7.91	18.00
34R	GASEPV	0.01	0.00	0.01	0.00	0.00	0.00	0.01
34R	GV	1.87	0.27	2.14	4.42	0.58	5.00	7.14
34R	HS748A	0.41	0.04	0.46	0.32	0.00	0.32	0.77
34R	LEAR35	0.75	0.18	0.93	1.34	0.17	1.51	2.45
34R	SF340	5.90	0.41	6.32	3.20	0.37	3.57	9.88
34R		46.03	7.73	53.76	67.37	14.49	81.86	135.62
H	B407	0.90	0.09	0.99	0.88	0.11	0.99	1.98
H	EC130	3.59	0.20	3.78	3.54	0.24	3.78	7.57
H	R22	9.02	0.48	9.50	9.08	0.42	9.50	19.00
H		13.51	0.76	14.27	13.50	0.77	14.27	28.54
		334.91	97.43	432.34	337.74	94.61	432.34	864.68

Note

1. Movement numbers in the above table are daily, averaged over the quarter.

2. The above movement numbers have been rounded to two significant figures, as a result minor discrepancies may occur between totals and the sums of component items.

Attachment B

ANEI N475 Estimated Population within each ANEI Contour by Suburb

Attachment B

Table B1 Comparison of Estimated Population within each ANEI Contour by Suburb

Study	Suburb		Contours (ANEF)				
	Name	Population	>=20	>=25	>=30	>=35	>=40
N470	Alexandria	5800	200	0	0	0	0
N475	Alexandria	5800	100	0	0	0	0
N470	Annandale	8300	400	0	0	0	0
N475	Annandale	8300	600	100	0	0	0
N470	Arncliffe	8500	300	0	0	0	0
N475	Arncliffe	8500	100	0	0	0	0
N470	Banksia	2900	2000	1000	100	0	0
N475	Banksia	2900	1800	1100	400	0	0
N470	Banksmeadow	500	0	0	0	0	0
N475	Banksmeadow	500	0	0	0	0	0
N470	Bexley	17900	4900	200	0	0	0
N475	Bexley	17900	5700	1400	0	0	0
N470	Botany	7500	4600	1600	200	0	0
N475	Botany	7500	4000	900	200	0	0
N470	Brighton-le-sands	7200	0	0	0	0	0
N475	Brighton-le-sands	7200	0	0	0	0	0
N470	Camperdown	6500	300	0	0	0	0
N475	Camperdown	6500	1200	0	0	0	0
N470	Daceyville	1200	700	0	0	0	0
N475	Daceyville	1200	800	0	0	0	0
N470	Drummoyne	10400	1800	0	0	0	0
N475	Drummoyne	10400	4500	0	0	0	0
N470	Eastlakes	6600	2700	200	0	0	0
N475	Eastlakes	6600	1300	300	0	0	0
N470	Hurstville	23300	500	0	0	0	0
N475	Hurstville	23300	2500	0	0	0	0
N470	Kingsford	14200	1500	0	0	0	0
N475	Kingsford	14200	2000	0	0	0	0
N470	Kurnell	2100	1200	0	0	0	0
N475	Kurnell	2100	1100	0	0	0	0
N470	Kyeemagh	800	700	0	0	0	0
N475	Kyeemagh	800	600	0	0	0	0
N470	Leichhardt	12300	6900	1800	0	0	0
N475	Leichhardt	12300	7200	2700	0	0	0
N470	Lilyfield	6800	2700	0	0	0	0
N475	Lilyfield	6800	3100	200	0	0	0
N470	Marrickville	23200	15200	3000	700	0	0
N475	Marrickville	23200	11200	2700	900	0	0
N470	Mascot	8500	8500	3900	100	0	0
N475	Mascot	8500	8400	2800	200	0	0
N470	Matraville	8800	0	0	0	0	0
N475	Matraville	8800	0	0	0	0	0
N470	Newtown	13500	5600	0	0	0	0
N475	Newtown	13500	6400	0	0	0	0
N470	Pagewood	3000	0	0	0	0	0
N475	Pagewood	3000	0	0	0	0	0

Attachment B

Study	Suburb		Contours (ANEF)				
	Name	Population	>=20	>=25	>=30	>=35	>=40
N470	Petersham	7400	7100	1200	0	0	0
N475	Petersham	7400	5800	1400	0	0	0
N470	Randwick	25800	500	0	0	0	0
N475	Randwick	25800	1500	0	0	0	0
N470	Rockdale	14000	4300	1400	0	0	0
N475	Rockdale	14000	4200	1900	0	0	0
N470	Rosebery	7400	3200	0	0	0	0
N475	Rosebery	7400	1600	0	0	0	0
N470	Russell Lea	5100	100	0	0	0	0
N475	Russell Lea	5100	100	0	0	0	0
N470	St Peters	2600	2600	500	100	0	0
N475	St Peters	2600	2600	500	100	0	0
N470	Stanmore	7100	4600	2300	100	0	0
N475	Stanmore	7100	5400	2500	600	0	0
N470	Sydenham	1000	1000	1000	800	300	0
N475	Sydenham	1000	1000	1000	800	300	0
N470	Tempe	3200	3200	1900	400	100	0
N475	Tempe	3200	3200	1600	300	100	0
N470	Wolli Creek	2700	0	0	0	0	0
N475	Wolli Creek	2700	0	0	0	0	0
N470	Dulwich Hill	12200	1000	0	0	0	0
N475	Coogee	13200	100	0	0	0	0
N470	Lewisham	2800	1300	0	0	0	0
N475	Erskineville	6500	0	0	0	0	0
N470	Alexandria	5800	200	0	0	0	0

Table B2 Comparison of Total Estimated Population within each ANEI Contour

Study	Total Suburb Population	Contours (ANEF)				
		>=20	>=25	>=30	>=35	>=40
N470	291100	89600	20000	2500	400	0
N475	295800	88100	21100	3500	400	0

Notes

1. Contour and Suburb population totals are calculated using the non-rounded values. The totals are then rounded to the nearest 100.

2. A Contour may overlap a Suburb but have no population under the contour. This can occur because the population distribution within a Suburb is modelled to ensure that there is no significant population in parks, reserves and industrial areas.

Data and Methodology

Suburb and contour population counts are approximations based on Census District (CD) populations from Census and Suburb Boundary information from MapInfo Australia. Populations are calculated according to the proportion of the area of overlap of a suburb/contour on a CD to the CD total area. Some editing of CD boundaries and populations was performed to accurately reflect population distribution in critical areas (close to the airport or flight paths).

Attachment C

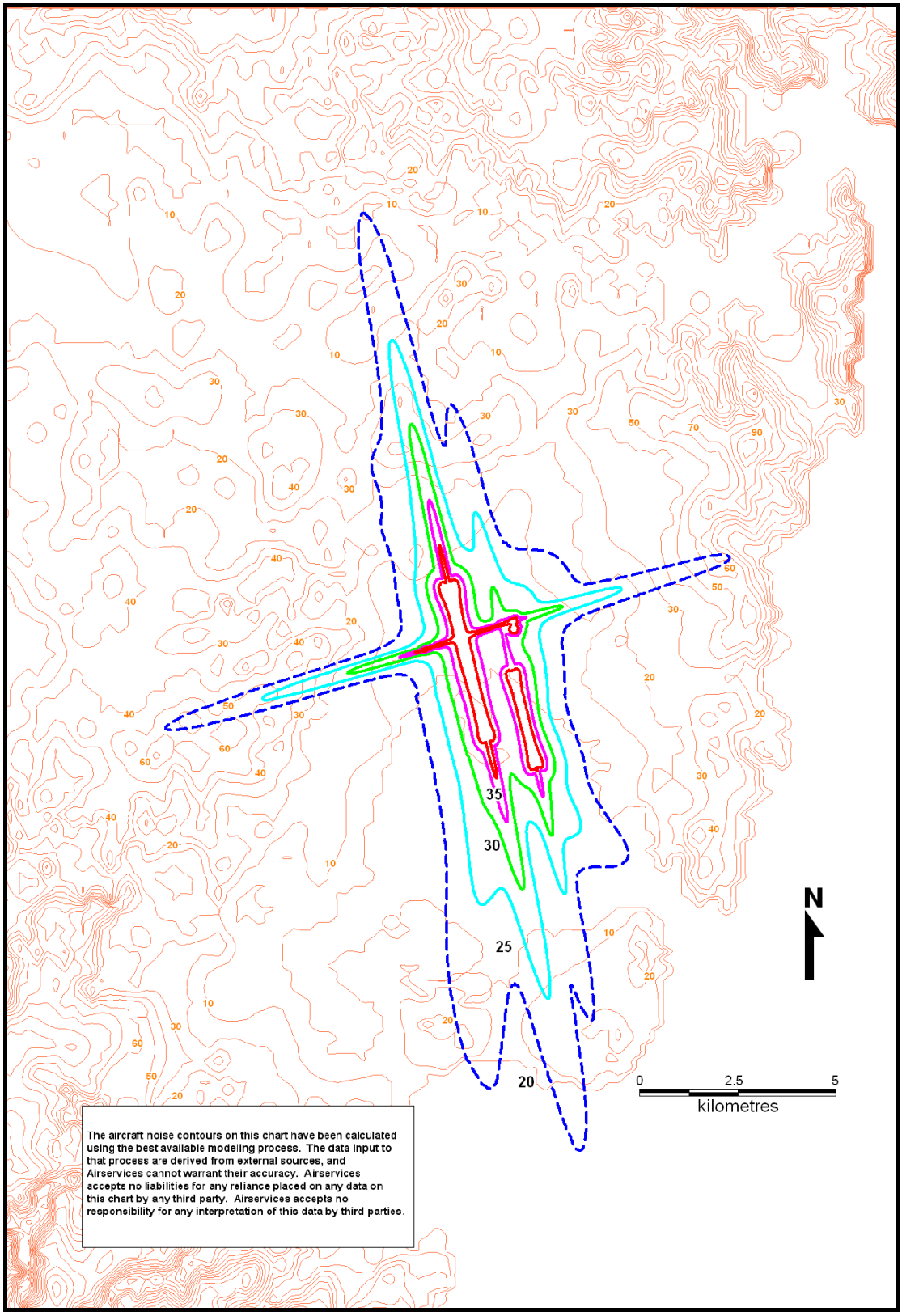
ANEI N475 Contours with INM Terrain Contours

Sydney Airport

1 October to 31 December 2011

Attachment C

Sydney Airport N475 (1 October to 31 December 2011) ANEI Contours with Terrain Data



Terrain contour height shown in metres.

Attachment D

ANEI N475 Contours

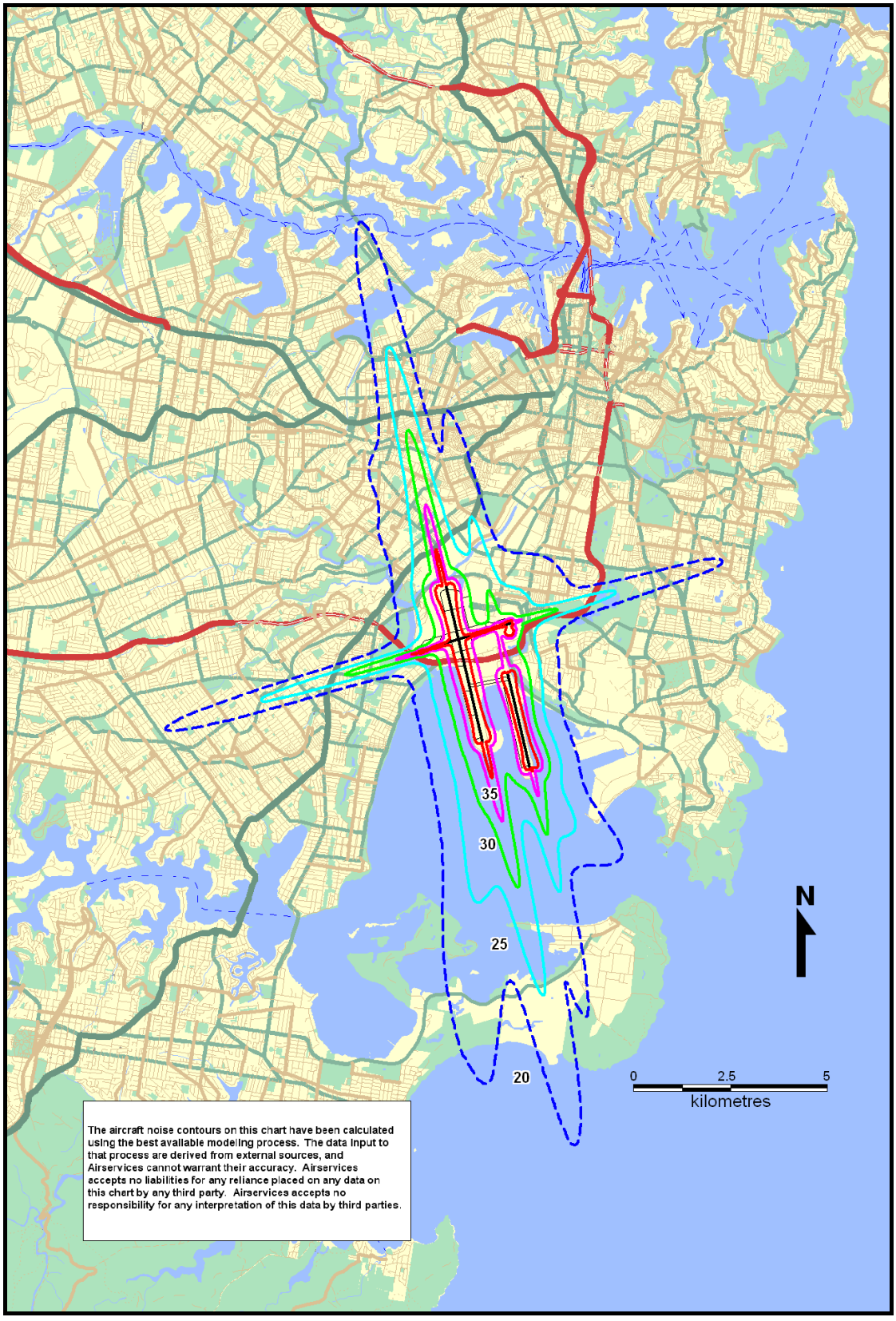
Sydney Airport

1 October to 31 December 2011

The contours for ANEI N475 have been prepared using terrain data.

Attachment D

Sydney Airport N475 (1 October to 31 December 2011) ANEI Contours



ANEI contours modeled by INM 7.0b incorporating terrain data.

Attachment E

ANEI N470 Contours

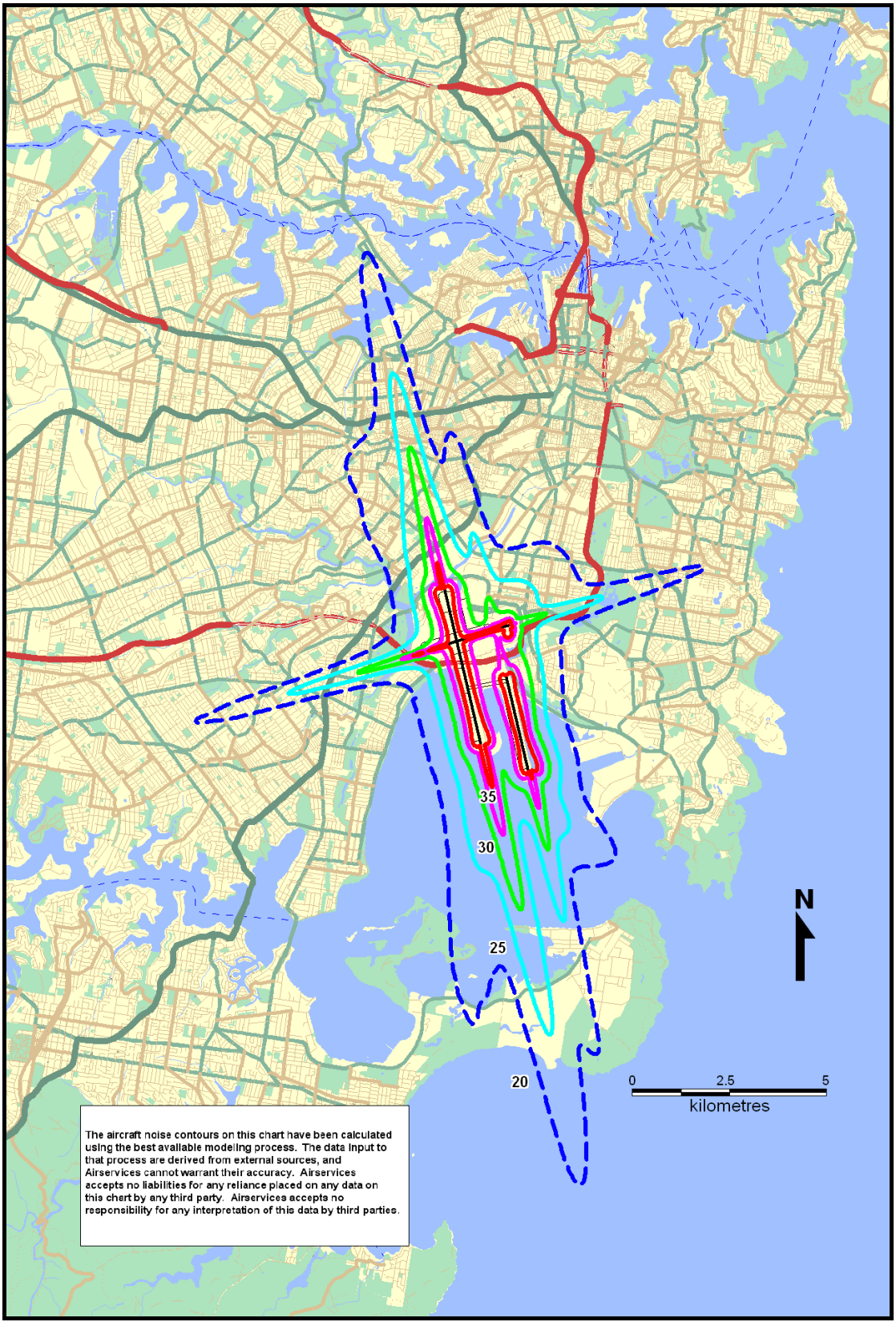
Sydney Airport

1 October to 31 December 2010

The contours for ANEI N470 have been prepared using terrain data.

Attachment E

Sydney Airport N470 (1 October to 31 December 2010) ANEI Contours



ANEI contours modeled by INM 7.0b incorporating terrain data.

Attachment F

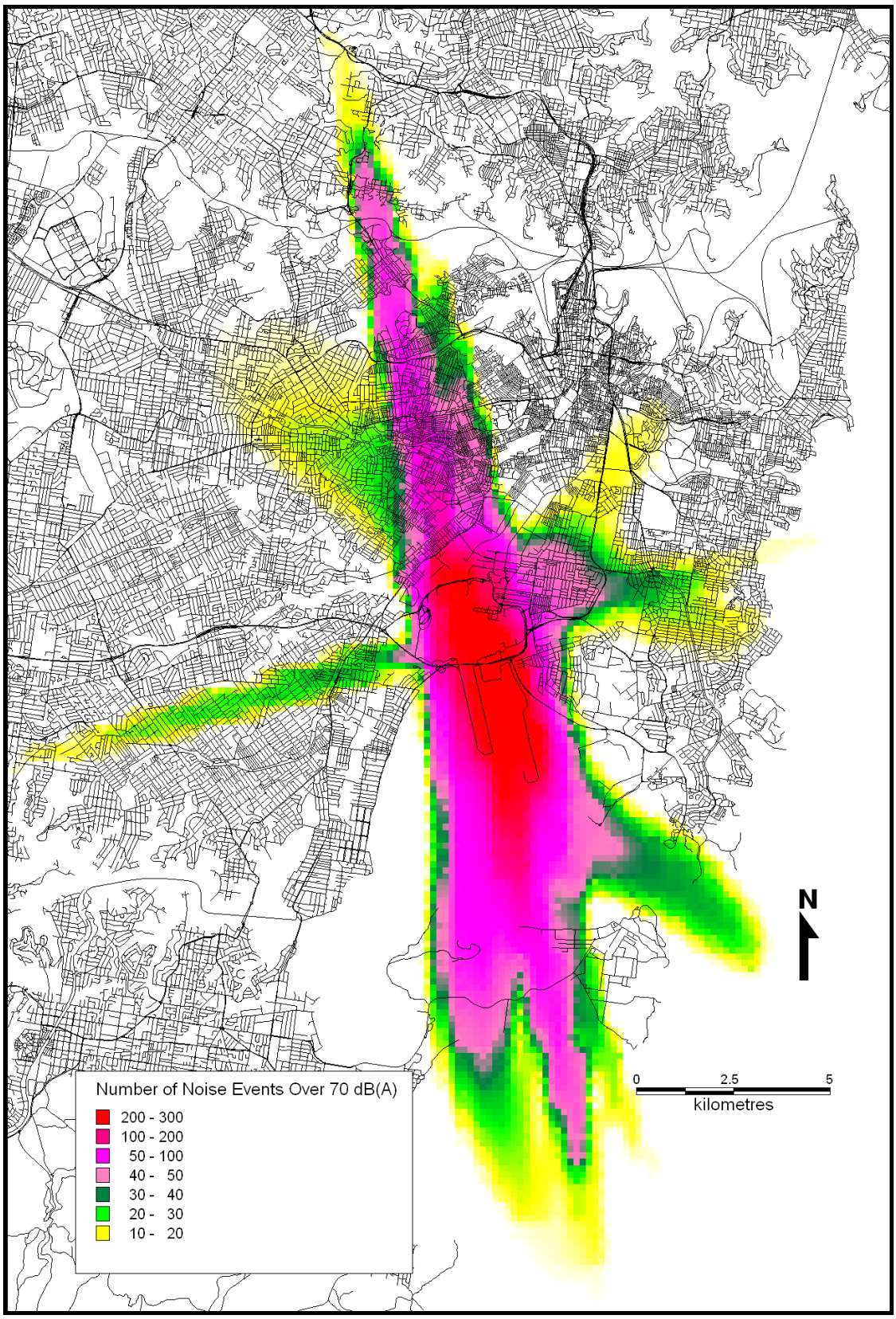
N475 N70 Chart

Sydney Airport

1 October to 31 December 2011

Attachment F

Sydney Airport N475 (1 October to 31 December 2011) N70 Chart



Daily average number of aircraft noise events louder than 70 db(A).