



**AIRSERVICES AUSTRALIA**

## **Sydney Airport**

**N461 Australian Noise Exposure Index**

**1 January to 31 December 2008**

**REPORT No: EO 09-199**

**March 2009**

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## Contents

<b>1.</b>	<b>Introduction .....</b>	<b>1</b>
1.1	Background .....	1
1.2	Airport Layout .....	1
<b>2.</b>	<b>The Integrated Noise Model (INM).....</b>	<b>2</b>
2.1	INM Terrain Data .....	2
<b>3.</b>	<b>Methodology Used in the Development of the ANEI.....</b>	<b>3</b>
3.1	Introduction .....	3
3.2	Collection and verification of the required data .....	3
3.3	Preparation of INM input file .....	4
3.4	Running of the Model .....	6
3.5	Preparation and verification of the model output.....	6
<b>4.</b>	<b>Comparison of the 2008 ANEI (N461) with the 2007 ANEI (N456) .....</b>	<b>7</b>
4.1	Comparison of ANEI N461 with ANEI N456 .....	7
	North-West of the Airport.....	8
	North of the Airport .....	8
	East of the Airport.....	8
	West of the Airport.....	8
	South of the Airport.....	9
4.2	Comparison of Runway Use.....	9
4.3	Comparison of Population Counts.....	11
<b>5.</b>	<b>Number of Aircraft Noise Events Above 70 dB(A) Noise Map .....</b>	<b>11</b>
5.1	Introduction .....	12
5.2	Methodology used in the Development of the N70 Aircraft Noise Map .....	12
5.3	Analysis of the N70 Aircraft Noise Map.....	12
	<b>Attachment A.....</b>	<b>13</b>
	ANEI N461 Average Daily Aircraft Movements by Runway .....	13
	<b>Attachment B.....</b>	<b>20</b>
	ANEI N461 Estimated Population within each ANEI Contour by Suburb.....	20
	<b>Attachment C.....</b>	<b>24</b>
	ANEI N461 Contours with INM Terrain Contours .....	24
	<b>Attachment D.....</b>	<b>26</b>
	ANEI N461 Contours .....	26
	<b>Attachment E .....</b>	<b>28</b>
	ANEI N456 Contours .....	28

**Attachment F** ..... 30  
 N461 N70 Chart..... 30

**List of Tables**

Table 1.1 Sydney Airport Runway Data ..... 1  
 Table 1.2 Sydney Airport Meteorological Data..... 1  
 Table 3.1 NFPMS Aircraft Movements ..... 3  
 Table 3.2 Factored Aircraft Movements ..... 3  
 Table 3.3 Aircraft Types Used by INM for ANEI N461 ..... 5  
 Table 3.4 Comparison of Average Daily Movements ..... 6  
 Table 4.1 Comparison of Average Daily Runway Movement..... 7  
 Table 4.2 Comparison of Average Daily Long Haul Departures from Runway 34L ..... 8  
 Table 4.3 Runway Use Comparison..... 9  
 Table 4.4 Runway End Impact Comparison ..... 11  
 Table 4.5 Comparison of Total Population Estimates within each ANEI Contour. .... 11  
 Table A1 Average Daily Movements by Runway..... 14  
 Table B1 Comparison of Estimated Population within each ANEI Contour by Suburb..... 21  
 Table B2 Comparison of Total Estimated Population within each ANEI Contour ..... 23

**List of Figures**

Figure 4.1a Runway Use Comparison - Arrivals..... 10  
 Figure 4.1b Runway Use Comparison - Departures..... 10

# Sydney Airport

## N461 Australian Noise Exposure Index

### 1 January to 31 December 2008

## 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 annual Australian Noise Exposure Index (ANEI) for the period 1 January 2008 to 31 December 2008 inclusive (Reference Number N461).

### 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	4.9	0m
Runway End 25	33 56 15.1S	151 11 23.8E	6.1	340m
Runway End 16R	33 55 45.7S	151 10 17.8E	2.4	85m
Runway End 34L	33 57 51.4S	151 10 50.4E	4.3	0m
Runway End 16L	33 56 58.6S	151 11 17.9E	4.9	230m
Runway End 34R	33 58 15.0S	151 11 38.1E	4.0	38m

The airport average temperature and humidity were obtained from Bureau of Meteorology data. The temperature and humidity are an average taken over the period of the ANEI and are shown in Table 1.2.

**Table 1.2 Sydney Airport Meteorological Data**

Airport Average Temperature	18.9 °C
Airport Average Humidity	62.0 %

## **2. The Integrated Noise Model (INM)**

The Integrated Noise Model version (INM 6.2a) 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 January 2008 to 31 December 2008 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 in feet above mean sea level. The INM interpolates this data to prepare the ground contours for presentation at the required interval. The terrain contours included in Attachment C are a graphical representation of ground contours prepared by the INM program. They indicate the areas to the north, east and west of the 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.

### 3. Methodology Used in the Development of the ANEI

#### 3.1 Introduction

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. Aircraft movement data were obtained directly from the Airservices Australia Noise and Flight Path Monitoring System (NFPMS). The total number of movement records from the unadjusted NFPMS data for the study period is shown in Table 3.1.

Flyover movements were checked using the NFPMS 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 were then excluded from the original NFPMS data.

**Table 3.1 NFPMS Aircraft Movements**

<b>Operation</b>	<b>Movements</b>
Arrivals	149,257
Departures	148,889
General (Arrival and Departure)	1,800
<b>Total</b>	<b>299,946</b>

During the analysis of the NFPMS data used to prepare this ANEI a comparison of daily movements indicated there was a reduced number of records on the 17<sup>th</sup> and 18<sup>th</sup> of January 2008 when compared to the other days during the 1 January to 31 December 2008 period. To ensure the reduced number of records on these days did not affect the daily average number of movements used to prepare this ANEI all records on these days were deleted from the NFPMS data, resulting in 287,482 records being used to prepare this ANEI. The NFPMS movements were then corrected to ensure that the total number of departures and arrivals movements were equal.

Movement data derived from Airservices Australia's Avcharges database for Sydney Airport (for the period of 1 January to 31 December 2008) and the daily average aircraft movements for this period that was derived from the data are shown in Table 3.2. The reduced number of NFPMS movements was then factored to the Avcharges recorded number of aircraft movements.

**Table 3.2 Factored Aircraft Movements**

<b>Period</b>	<b>Movements</b>
1 January to 31 December 2008	301,752
Daily Average during this period	824

The flight tracks used in the model were determined from the NFPMS. Track plots from the NFPMS were used to identify the major flight paths associated with aircraft movements to and from the airport. Representative periods were selected between 1 January and 31 December 2008

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 of the 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.

A small number of tracks that are mainly used by turbo-propeller and other propeller aircraft departing from Runway 07 for the north-west and Runway 25 for the east were not spread due to the small variations in their dispersal and the correspondingly few number of movements along these routes. In those cases a single nominal track was determined from the NFPMS.

### 3.3 Preparation of INM input file

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

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

For the purposes of modelling 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.

Terrain around the airport was also 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 6.2a. 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 36 representative aircraft types that are contained within the INM database 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.

In order to model helicopters, two helicopter profiles were developed. These profiles were based on the single engine Bell 206 LongRanger and twin engine Eurocopter AS355F Ecureuil 2. All helicopters that operate at Sydney airport were then assigned to a type depending on the number of engines. In addition, all helicopters were modelled as departing from, or arriving to the Helipad situated south of the threshold of Runway 25.

The aircraft types were assigned to representative tracks based on the type of aircraft (jet, turbo-propeller, piston engine propeller or helicopter) and the general cardinal direction from Sydney Airport of the destination or originating airport. This was further refined by determining the way-points associated with the major routes. As stated previously, the tracks were prepared as point type tracks, the location of which, and lateral spread, being



determined from the NFPMS data used to prepare each quarterly ANEI for Sydney airport during 2008.

Each operation associated with a particular runway and direction was assigned to a specific track. Where there was more than one track associated with a particular route, the percentage of operations was proportioned, based on the data obtained from the NFPMS. In the majority of cases the percentage of aircraft operations allocated to the backbone tracks and their subsidiary tracks were generally the default percentages set by the INM.

**Table 3.3 Aircraft Types Used by INM for ANEI N461**

<b>INM Type</b>	<b>Aircraft</b>
707320	Boeing B707-320
717200	Boeing B717-200
727EM1	Boeing B727-100 fitted with hushkitting
727EM2	Boeing B727-200 fitted with hushkitting
737N17	Boeing B737-200 fitted with hushkitting
737300	Boeing B737-300
737400	Boeing B737-400
737700	Boeing B737-700
737800	Boeing B737-800
74720B	Represents B747-200 and B747-300
747400	Boeing B747-400
757PW	Boeing B757-200
767300	Boeing B767-300
767JT9	Boeing B767-200
777200	Boeing B777-200
777300	Boeing B777-300
A310	Airbus Industries A310
A320	Airbus Industries A320
A330	Airbus Industries A330
A340	Airbus Industries A340
BAE300	Represents BAe146 aircraft
BEC58P	Represents GA twin piston-engine aircraft
CL601	Represents Canadair CL601 Challenger aircraft
CNA441	Represents GA twin turbine-engine aircraft
DHC6	Represents Twin Otter and similar aircraft
DHC830	Represents Dash 8, FK50 type aircraft
GASEPF	Represents GA single engine fixed pitch propeller and/or turbine aircraft
GASEPV	Represents GA single engine variable pitch propeller and/or turbine aircraft
GV	Represents Embraer 170 aircraft
JPATS	Represents Pilatus PC-12 and other single engine turbo-prop aircraft
LEAR25	Represents other small business type jets
LEAR35	Represents other small business type jets
MD11GE	Represents DC10 and MD11 type aircraft
SF340	Saab 340
AS355F	Represents Eurocopter AS355 Ecureuil 2 and all twin engine helicopters
B206L	Represents Bell 206 LongRanger and all single engine helicopters

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 Australian Noise Exposure Forecast (ANEF) metric is a modification of the US Noise Exposure Forecast (NEF) within INM 6.2a. The parameters used for the ANEF metric were:

Day multiplier	1.0
Night multiplier	4.0

The evening multiplier is included as part of the night period (7:00pm to 7:00am) and is not modelled separately as in the US NEF process.

### 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 January to 31 December 2008 ANEI (N461) 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 January to 31 December 2008 ANEI (N461) compared to the previous year - 1 January to 31 December 2007 ANEI (N456).

**Table 3.4 Comparison of Average Daily Movements**

ANEI Study	Period	Average Daily Aircraft Movements
N456	1 January to 31 December 2007	795
N461	1 January to 31 December 2008	824

#### 4. Comparison of the 2008 ANEI (N461) with the 2007 ANEI (N456)

The 1 January to 31 December 2008 ANEI (N461) contours for Sydney Airport are shown in Attachment D. In addition, a plot of the ANEI contours (N461) with terrain contours is included as Attachment C. For comparison purposes, the 1 January to 31 December 2007 ANEI (N456) for Sydney Airport has been included as Attachment E.

ANEI N461 (1 January to 31 December 2008) and ANEI N456 (1 January to 31 December 2007) were prepared with INM 6.2a. Both studies used terrain data during the calculation of their contours.

##### 4.1 Comparison of ANEI N461 with ANEI N456

The changes evident in the contours for ANEI N461, when compared with the contours for ANEI N456, are considered to be 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 N461 and ANEI N456. This comparison provides the basis for evaluation of the ANEI N461 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.

In accordance with a directive from the Civil Aviation Safety Authority (CASA) issued in 2003 Sydney Airport Corporation Limited (SACL) was to construct a Runway End Safety Area (RESA) for Runway 25 by 3 May 2008 in order to comply with the International Civil Aviation Organization (ICAO) requirements. To maintain safe operations on Runway 25 after the May 2008 and prior to the construction of the RESA, SACL obtained approval from CASA for a temporary RESA which incorporated 97 metres of the existing western end of Runway 25. Additionally, SACL restricted aircraft arrivals on Runway 07 to those times when weather conditions operationally required its use (SACL Draft Major Development Plan – Runway Safety Enhancement Runway 25 - Runway End Safety Area, Sydney Airport).

Work began on the permanent RESA on 15 October 2008, resulting in Runway 25 not being available at all and Runway 07 only being available for limited numbers of departures. The reduction in the number of movements on Runway 07/25 is reflected in the 1 January – 31 December 2008 ANEI.

**Table 4.1 Comparison of Average Daily Runway Movement**

Runway	ANEI N461			ANEI N456		
	(1 January - 31 December 2008)			(1 January - 31 December 2008)		
	Arrivals	Departures	Totals	Arrivals	Departures	Totals
<b>07</b>	12.57	0.39	<b>12.96</b>	31.07	2.51	<b>33.58</b>
<b>16L</b>	65.74	64.59	<b>130.33</b>	54.20	58.80	<b>113.00</b>
<b>16R</b>	101.71	146.32	<b>248.03</b>	87.49	140.92	<b>228.41</b>
<b>25</b>	22.87	17.52	<b>40.39</b>	25.48	24.07	<b>49.55</b>
<b>34L</b>	136.54	83.16	<b>219.70</b>	127.79	80.72	<b>208.51</b>
<b>34R</b>	64.51	91.82	<b>156.33</b>	63.27	82.21	<b>145.48</b>
<b>Helipad</b>	8.17	8.17	<b>16.34</b>	8.35	8.35	<b>16.70</b>
<b>Total</b>	<b>412.11</b>	<b>411.97</b>	<b>824.08</b>	<b>397.65</b>	<b>397.58</b>	<b>795.21</b>

### North-West of the Airport

Average daily departures from Runway 34L have increased by 2.44 movements from the ANEI N456 figures. The bump' in the 20 ANEI contour associated with departures using the Richmond SID and the Katoomba SID has increased in extent accordingly.

Long-haul jet aircraft departing from Runway 34L for destinations in the USA were split between those following the Richmond Two SID and those aircraft maintaining runway heading before turning east. The proportion of aircraft on each track was determined from analysis of NFPMS data prepared for the INM. 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 N461 (1 January - 31 December 2008)		ANEI N456 (1 January - 31 December 2007)	
	Movements	% of USA Departures	Movements	% of USA Departures
Maintain Runway Heading	2.46	68%	2.56	70%
RICHMOND TWO SID	1.14	32%	1.09	30%
<b>Total</b>	<b>3.60</b>		<b>3.65</b>	

### North of the Airport

Average daily arrivals on Runway 16R have increased by 11.54 movements from the ANEI N456 figures. Average daily arrivals on Runway 16L have increased by 14.22 movements from the ANEI N456 figures.

The ANEI contours associated with arrivals to Runway 16R have however only shown a moderate increase in their extent. This is attributed to an increase in the number of arrivals by newer and quieter aircraft, e.g. Boeing 737-800 aircraft and Embraer E170 and E190 aircraft and a reduction in number of arrivals by older and noisier aircraft, e.g. Boeing 747 aircraft and hushkitted Boeing 707 and 727 aircraft.

The ANEI contours associated with arrivals to Runway 16L have also shown only a small increase in their extent. This small increase is attributed to an increase in the number of arrivals by newer and quieter aircraft, e.g. Boeing 737-800 aircraft and Embraer E170 aircraft, all of which mainly occur during the day period, and a reduction in number of arrivals by Boeing 747 aircraft, which occurred during the night period.

### East of the Airport

Average daily arrivals on Runway 25 have decreased by 2.61 movements from the ANEI N456. Average daily departures from Runway 07 have decreased by 2.12 and departures from Runway 34R have increased by 9.61 movements from the ANEI N456.

The contours associated with arrivals to Runway 25 and departures from Runway 07 have shown a corresponding decrease in the extent of their length. The width of the contours associated with departures from Runway 34R has shown a corresponding increase in extent.

### West of the Airport

Average daily arrivals on Runway 07 have decreased by 18.50 movements from the ANEI N456 and average daily departures from Runway 25 have decreased by 6.55 movements from the ANEI N456.

The length of ANEI contours associated with arrivals on Runway 07 has shown a corresponding decrease. The spread of the contours which is associated with departures from Runway 25 has also shown a corresponding decrease in extent.

#### South of the Airport

Average daily departures from Runway 16L have increased by 5.79 movements from ANEI N456 and average daily arrivals on Runway 34R have increased by 1.24 movements from ANEI N456.

The ANEI contours associated with departures from Runway 16L have increased in their extent. The ANEI contours associated with arrivals on Runway 34R have however shown a slight decrease in their extent. This decrease is attributed to an overall reduction in number of arrivals during the night period, mainly by jet aircraft, e.g. hushkitted Boeing 727 aircraft, Boeing 767 and 737 aircraft and Airbus A320 aircraft.

Average daily departures from Runway 16R have increased by 5.40 movements from ANEI N456 and average daily arrivals on Runway 34L have increased by 8.75 movements from ANEI N456.

The ANEI contours associated with departures from Runway 16R have shown a corresponding decrease in their extent. The 20 ANEI contour associated with arrivals to Runway 34L has shown a slight increase in length, whereas the 25, 30 and 35 ANEI contours have shown a slight decrease in their extent. The decrease in the 25, 30 and 35 ANEI contours is attributed to the following;

- a reduction in number of arrivals, particularly during the night period by older and noisier aircraft, e.g. hushkitted B727 and B747-200, 300 and 400 series aircraft and B767 aircraft, and
- the increase in number of arrivals is mainly by newer and quieter aircraft types, e.g. Boeing 737-700 and 800 series aircraft, Airbus A320 aircraft and Embraer E170 aircraft.

#### **4.2 Comparison of Runway Use**

Table 4.3 shows a comparison of runway usage in the 1 January to 31 December 2008 ANEI (N461) to the 1 January to 31 December 2007 ANEI (N456).

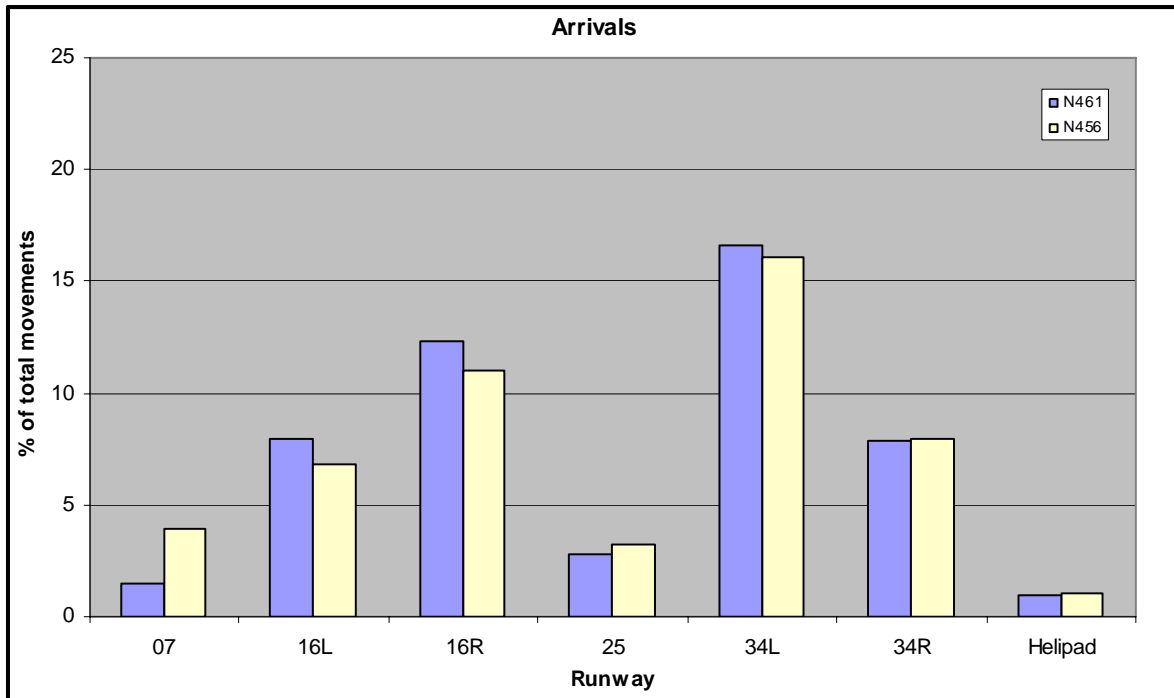
**Table 4.3 Runway Use Comparison**

Runway	ANEI N461 (1 January - 31 December 2008)		ANEI N456 (1 January - 31 December 2007)	
	N461 Arrivals	N461 Departures	N456 Arrivals	N456 Departures
	%	%	%	%
07	1.5	0.0	3.9	0.3
16L	8.0	7.8	6.8	7.4
16R	12.3	17.8	11.0	17.7
25	2.8	2.1	3.2	3.0
34L	16.6	10.1	16.1	10.2
34R	7.8	11.1	8.0	10.3
Helipad	1.0	1.0	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**

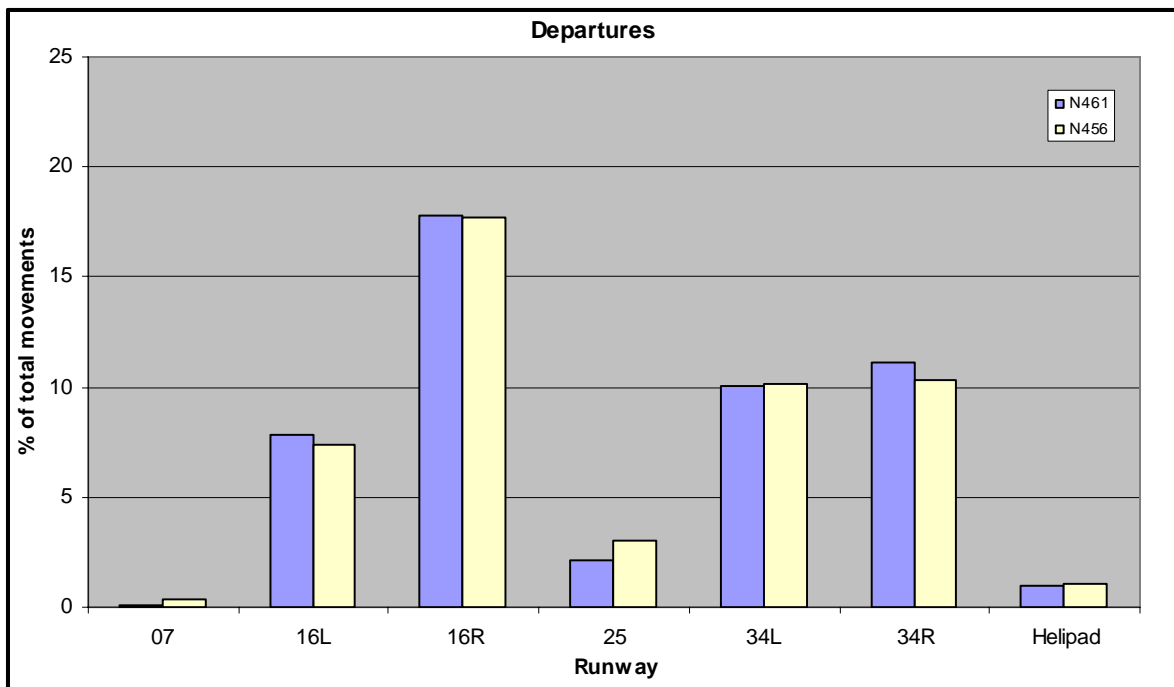


Table 4.4 details the proportion of aircraft movements to the north, south, east and west of Sydney Airport for ANEI N461 compared with ANEI N456. In calculating the proportion of aircraft movements, helicopter operations were not included.

**Table 4.4 Runway End Impact Comparison**

Direction	Operation		ANEI N461 %	ANEI N456 %
	Arrival Runway	Departure Runway		
North	16L and 16R	34L	31.0	28.6
South	34L and 34R	16L and 16R	51.0	50.2
East	25	07 and 34R	14.2	14.2
West	07	25	3.7	7.1

### 4.3 Comparison of Population Counts

The estimated population within each of the contours of the 1 January to 31 December 2008 ANEI (N461) and the 1 January to 31 December 2007 ANEI (N456) is shown in Table 4.5. These population estimates for ANEI N461 are based on the Australian Bureau of Statistics 2008 Census of Population and Housing data and the population estimates for ANEI N456 are based on the Australian Bureau of Statistics 2001 Census of Population and Housing data. Both sets of data 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
N456	1 January to 31 December 2007	88,600	21,700	2,800	300	0
N461	1 January to 31 December 2008	84,600	18,000	2,800	300	0

A more detailed listing of the number of people within the various ANEI contours is shown by suburb for ANEI N461 and ANEI N456 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 70 dB(A) Noise Map

### 5.1 Introduction

'Number Above' (Nxx) noise maps are an approach which, while technically less rigorous than the ANEI, provide 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 January to 31 December 2008 ANEI (N461).

The noise level of 70 dB(A) was selected by reference to what noise level is likely to interfere with normal conversation, telephone usage or sleep. 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 6.2a, 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 N461 N70 Aircraft Noise Map - 1 January to 31 December 2008.

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 modelled in the 1 January to 31 December 2008 ANEI (N461).

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 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 N461 Average Daily Aircraft Movements by Runway

**Table A1 Average Daily Movements by Runway**

Runway	Aircraft Type	Arrivals			Departures			Total
		Day	Night	Total	Day	Night	Total	
07	707320	0.01	0.00	0.01	0.00	0.00	0.00	0.01
07	717200	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07	727EM2	0.01	0.05	0.05	0.00	0.00	0.00	0.05
07	737300	0.01	0.10	0.10	0.00	0.00	0.00	0.10
07	737400	0.42	0.14	0.57	0.01	0.01	0.02	0.59
07	737700	0.72	0.53	1.25	0.01	0.01	0.02	1.27
07	737800	1.64	1.24	2.88	0.04	0.03	0.07	2.95
07	737N17	0.02	0.00	0.02	0.00	0.00	0.00	0.02
07	74720B	0.03	0.08	0.11	0.00	0.00	0.00	0.11
07	747400	0.23	0.19	0.42	0.01	0.00	0.01	0.43
07	757PW	0.01	0.02	0.03	0.00	0.00	0.00	0.03
07	767300	0.81	0.48	1.29	0.02	0.02	0.04	1.33
07	777300	0.06	0.03	0.09	0.00	0.00	0.01	0.10
07	A310	0.00	0.01	0.01	0.00	0.00	0.00	0.01
07	A320	0.89	0.70	1.59	0.02	0.02	0.04	1.63
07	A330	0.16	0.12	0.28	0.00	0.00	0.01	0.29
07	A340	0.02	0.02	0.04	0.01	0.00	0.01	0.05
07	BAE300	0.00	0.01	0.01	0.00	0.00	0.00	0.01
07	BEC58P	0.03	0.09	0.12	0.00	0.00	0.00	0.12
07	CL601	0.01	0.01	0.02	0.00	0.00	0.00	0.02
07	CNA441	0.00	0.02	0.02	0.00	0.00	0.00	0.02
07	DHC6	0.44	0.60	1.05	0.05	0.02	0.07	1.12
07	DHC830	1.08	0.25	1.33	0.02	0.02	0.04	1.37
07	GASEPF	0.00	0.00	0.01	0.00	0.00	0.00	0.01
07	GV	0.17	0.06	0.23	0.00	0.01	0.01	0.24
07	JPATS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07	LEAR25	0.01	0.00	0.01	0.00	0.00	0.00	0.01
07	LEAR35	0.08	0.06	0.13	0.01	0.01	0.02	0.15
07	MD11GE	0.04	0.01	0.05	0.00	0.00	0.00	0.05
07	SF340	0.77	0.08	0.85	0.02	0.02	0.04	0.89
07		7.67	4.89	12.57	0.21	0.18	0.39	12.96

Runway	Aircraft Type	Arrivals			Departures			Total
		Day	Night	Total	Day	Night	Total	
16L	707320	0.01	0.00	0.01	0.01	0.00	0.01	0.02
16L	717200	0.02	0.01	0.02	0.00	0.01	0.01	0.03
16L	727EM1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16L	727EM2	0.03	0.10	0.13	0.00	0.01	0.01	0.14
16L	737300	0.05	0.15	0.21	0.01	0.12	0.13	0.34
16L	737400	2.33	0.38	2.71	2.37	0.87	3.24	5.95
16L	737700	4.95	1.08	6.03	6.17	1.94	8.11	14.14
16L	737800	10.95	2.72	13.67	12.15	5.19	17.35	31.02
16L	737N17	0.19	0.01	0.20	0.00	0.00	0.00	0.20
16L	74720B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16L	747400	0.00	0.00	0.00	0.03	0.03	0.06	0.06
16L	757PW	0.03	0.01	0.03	0.00	0.00	0.00	0.03
16L	767300	4.76	1.32	6.08	3.96	1.25	5.21	11.29
16L	767JT9	0.12	0.00	0.12	0.01	0.00	0.01	0.13
16L	777300	0.00	0.00	0.00	0.01	0.02	0.03	0.03
16L	A310	0.00	0.01	0.01	0.00	0.00	0.00	0.01
16L	A320	8.26	1.06	9.31	7.01	2.42	9.43	18.74
16L	A330	0.13	0.00	0.13	0.02	0.04	0.06	0.19
16L	A340	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16L	BAE300	0.02	0.11	0.12	0.00	0.02	0.02	0.14
16L	BEC58P	0.86	0.12	0.98	0.14	0.02	0.16	1.14
16L	CL601	0.07	0.01	0.08	0.09	0.01	0.10	0.18
16L	CNA441	0.05	0.01	0.05	0.01	0.00	0.01	0.06
16L	DHC6	3.65	1.19	4.84	3.82	0.85	4.66	9.50
16L	DHC830	10.31	0.62	10.92	7.40	1.70	9.10	20.02
16L	GASEPF	0.01	0.00	0.01	0.00	0.00	0.00	0.01
16L	GASEPV	0.01	0.00	0.01	0.00	0.00	0.00	0.01
16L	GV	1.40	0.14	1.54	1.04	0.28	1.32	2.86
16L	JPATS	0.01	0.01	0.02	0.03	0.00	0.03	0.05
16L	LEAR25	0.00	0.00	0.00	0.01	0.00	0.01	0.01
16L	LEAR35	0.76	0.18	0.94	0.76	0.16	0.92	1.86
16L	MD11GE	0.00	0.00	0.00	0.00	0.01	0.01	0.01
16L	SF340	6.90	0.66	7.57	4.14	0.46	4.60	12.17
16L		55.86	9.88	65.74	49.20	15.39	64.59	130.33

Runway	Aircraft Type	Arrivals			Departures			Total
		Day	Night	Total	Day	Night	Total	
16R	707320	0.01	0.01	0.01	0.01	0.00	0.02	0.03
16R	717200	0.01	0.00	0.01	0.01	0.00	0.02	0.03
16R	727EM1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16R	727EM2	0.02	0.04	0.06	0.08	0.32	0.40	0.46
16R	737300	0.02	0.18	0.20	0.08	0.65	0.73	0.93
16R	737400	4.46	1.09	5.55	5.36	1.32	6.68	12.23
16R	737700	4.40	1.57	5.97	5.17	2.08	7.25	13.22
16R	737800	16.38	5.21	21.59	19.99	6.52	26.51	48.10
16R	737N17	0.05	0.00	0.05	0.29	0.02	0.31	0.36
16R	74720B	0.53	0.30	0.82	0.70	0.39	1.09	1.91
16R	747400	5.89	2.81	8.71	9.92	1.42	11.34	20.05
16R	757PW	0.01	0.02	0.03	0.08	0.00	0.08	0.11
16R	767300	8.72	2.67	11.39	12.18	3.97	16.15	27.54
16R	767JT9	0.10	0.00	0.10	0.24	0.00	0.24	0.34
16R	777200	0.15	0.01	0.15	0.17	0.00	0.18	0.33
16R	777300	2.86	1.06	3.92	3.73	1.16	4.89	8.81
16R	A310	0.00	0.00	0.00	0.01	0.00	0.01	0.01
16R	A320	4.54	1.42	5.96	8.41	1.70	10.10	16.06
16R	A330	5.99	1.59	7.58	7.28	1.90	9.18	16.76
16R	A340	1.20	1.17	2.37	2.41	0.59	3.00	5.37
16R	BAE300	0.01	0.16	0.17	0.07	2.24	2.31	2.48
16R	BEC58P	0.17	0.13	0.30	1.03	0.57	1.60	1.90
16R	CL601	0.23	0.04	0.27	0.22	0.11	0.33	0.60
16R	CNA441	0.02	0.03	0.06	0.07	0.16	0.23	0.29
16R	DHC6	2.35	1.08	3.43	3.23	4.89	8.13	11.56
16R	DHC830	7.37	0.68	8.05	10.45	2.85	13.30	21.35
16R	GASEPF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16R	GASEPV	0.02	0.01	0.03	0.02	0.02	0.04	0.07
16R	GV	3.22	0.76	3.98	3.88	1.17	5.04	9.02
16R	JPATS	0.02	0.00	0.02	0.02	0.01	0.04	0.06
16R	LEAR25	0.00	0.00	0.00	0.01	0.00	0.01	0.01
16R	LEAR35	0.91	0.18	1.09	1.23	0.53	1.76	2.85
16R	MD11GE	0.57	0.16	0.73	0.09	0.71	0.79	1.52
16R	SF340	8.19	0.91	9.10	10.62	3.96	14.57	23.67
16R		78.41	23.30	101.71	107.06	39.25	146.32	248.03

Runway	Aircraft Type	Arrivals			Departures			Total
		Day	Night	Total	Day	Night	Total	
25	707320	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	717200	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	727EM1	0.00	0.00	0.00	0.00	0.01	0.01	0.01
25	727EM2	0.00	0.07	0.07	0.00	0.02	0.02	0.09
25	737300	0.01	0.13	0.13	0.00	0.09	0.09	0.22
25	737400	0.72	0.34	1.06	0.52	0.35	0.88	1.94
25	737700	1.26	0.88	2.15	0.80	0.59	1.39	3.54
25	737800	3.33	2.10	5.43	2.43	1.97	4.40	9.83
25	737N17	0.03	0.00	0.03	0.01	0.00	0.01	0.04
25	74720B	0.04	0.11	0.16	0.05	0.01	0.07	0.23
25	747400	0.44	0.24	0.68	0.24	0.07	0.30	0.98
25	757PW	0.01	0.00	0.01	0.00	0.00	0.00	0.01
25	767300	1.39	0.85	2.25	0.92	0.85	1.77	4.02
25	767JT9	0.01	0.00	0.01	0.02	0.00	0.02	0.03
25	777200	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	777300	0.20	0.14	0.34	0.11	0.06	0.17	0.51
25	A310	0.00	0.01	0.01	0.00	0.00	0.00	0.01
25	A320	1.63	1.28	2.91	1.32	1.33	2.66	5.57
25	A330	0.43	0.17	0.60	0.20	0.12	0.32	0.92
25	A340	0.04	0.08	0.13	0.06	0.00	0.06	0.19
25	BAE300	0.00	0.15	0.16	0.00	0.03	0.03	0.19
25	BEC58P	0.09	0.07	0.16	0.09	0.02	0.10	0.26
25	CL601	0.04	0.01	0.05	0.05	0.02	0.06	0.11
25	CNA441	0.01	0.04	0.05	0.00	0.00	0.00	0.05
25	DHC6	0.78	0.66	1.44	0.76	0.49	1.25	2.69
25	DHC830	1.98	0.45	2.43	1.23	0.47	1.70	4.13
25	GASEPV	0.00	0.00	0.01	0.00	0.00	0.00	0.01
25	GV	0.45	0.15	0.60	0.33	0.29	0.63	1.23
25	JPATS	0.00	0.00	0.00	0.01	0.00	0.01	0.01
25	LEAR25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	LEAR35	0.25	0.08	0.33	0.19	0.10	0.30	0.63
25	MD11GE	0.08	0.01	0.09	0.01	0.03	0.04	0.13
25	SF340	1.51	0.08	1.59	0.92	0.31	1.23	2.82
25		14.74	8.13	22.87	10.28	7.24	17.52	40.39

Runway	Aircraft Type	Arrivals			Departures			Total
		Day	Night	Total	Day	Night	Total	
34L	707320	0.01	0.01	0.01	0.01	0.00	0.01	0.02
34L	717200	0.00	0.00	0.01	0.01	0.00	0.01	0.02
34L	727EM1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34L	727EM2	0.02	0.17	0.19	0.03	0.17	0.21	0.40
34L	737300	0.03	0.44	0.47	0.05	0.12	0.17	0.64
34L	737400	4.98	1.43	6.41	2.07	0.30	2.37	8.78
34L	737700	5.27	2.66	7.93	3.18	0.88	4.07	12.00
34L	737800	20.10	8.50	28.61	8.12	1.65	9.77	38.38
34L	737N17	0.10	0.01	0.11	0.21	0.02	0.22	0.33
34L	74720B	0.44	0.64	1.09	0.73	0.28	1.00	2.09
34L	747400	6.92	5.20	12.12	9.27	0.94	10.21	22.33
34L	757PW	0.03	0.02	0.05	0.08	0.00	0.08	0.13
34L	767300	9.77	3.85	13.62	2.84	1.02	3.87	17.49
34L	767JT9	0.14	0.00	0.14	0.21	0.01	0.21	0.35
34L	777200	0.25	0.00	0.25	0.22	0.00	0.22	0.47
34L	777300	3.40	2.11	5.51	3.63	1.13	4.76	10.27
34L	A310	0.00	0.01	0.01	0.01	0.00	0.01	0.02
34L	A320	6.09	3.07	9.16	2.44	0.22	2.66	11.82
34L	A330	6.92	2.19	9.11	6.65	1.48	8.13	17.24
34L	A340	1.40	2.06	3.46	2.37	0.55	2.92	6.38
34L	BAE300	0.03	1.90	1.93	0.07	0.02	0.09	2.02
34L	BEC58P	0.15	0.32	0.47	1.04	0.06	1.10	1.57
34L	CL601	0.22	0.05	0.27	0.03	0.00	0.03	0.30
34L	CNA441	0.03	0.07	0.10	0.07	0.02	0.09	0.19
34L	DHC6	2.80	3.92	6.72	3.30	0.69	4.00	10.72
34L	DHC830	9.00	1.56	10.56	10.00	1.96	11.96	22.52
34L	GASEPF	0.00	0.00	0.00	0.01	0.00	0.01	0.01
34L	GASEPV	0.02	0.01	0.04	0.03	0.01	0.04	0.08
34L	GV	3.64	1.11	4.75	0.82	0.01	0.83	5.58
34L	JPATS	0.02	0.01	0.03	0.02	0.00	0.02	0.05
34L	LEAR25	0.01	0.00	0.01	0.00	0.00	0.00	0.01
34L	LEAR35	1.04	0.62	1.65	0.53	0.05	0.57	2.22
34L	MD11GE	0.50	0.18	0.69	0.09	0.62	0.71	1.40
34L	SF340	9.81	1.27	11.07	9.99	2.81	12.79	23.86
34L		93.14	43.40	136.54	68.15	15.01	83.16	219.70

Runway	Aircraft Type	Arrivals			Departures			Total
		Day	Night	Total	Day	Night	Total	
34R	707320	0.00	0.00	0.00	0.01	0.00	0.01	0.01
34R	717200	0.01	0.00	0.01	0.00	0.00	0.00	0.01
34R	727EM1	0.01	0.00	0.01	0.00	0.00	0.00	0.01
34R	727EM2	0.03	0.10	0.13	0.01	0.01	0.01	0.14
34R	737300	0.06	0.14	0.20	0.03	0.16	0.19	0.39
34R	737400	2.31	0.28	2.59	4.70	0.99	5.70	8.29
34R	737700	4.78	1.01	5.79	6.77	1.51	8.28	14.07
34R	737800	11.39	2.16	13.55	22.05	5.57	27.62	41.17
34R	737N17	0.15	0.01	0.16	0.01	0.00	0.01	0.17
34R	747400	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34R	757PW	0.01	0.01	0.03	0.01	0.00	0.01	0.04
34R	767300	4.95	1.34	6.29	11.92	1.95	13.87	20.16
34R	767JT9	0.11	0.00	0.11	0.00	0.00	0.00	0.11
34R	777300	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34R	A320	8.42	0.91	9.33	11.17	2.18	13.35	22.68
34R	A330	0.14	0.01	0.15	0.13	0.02	0.15	0.30
34R	BAE300	0.02	0.07	0.10	0.01	0.02	0.02	0.12
34R	BEC58P	0.97	0.11	1.08	0.14	0.01	0.15	1.23
34R	CL601	0.06	0.02	0.08	0.20	0.05	0.25	0.33
34R	CNA441	0.04	0.02	0.06	0.01	0.00	0.01	0.07
34R	DHC6	3.62	1.20	4.82	3.70	0.50	4.20	9.02
34R	DHC830	10.00	0.50	10.50	6.27	1.41	7.68	18.18
34R	GASEPF	0.01	0.00	0.01	0.01	0.00	0.01	0.02
34R	GASEPV	0.01	0.00	0.01	0.00	0.00	0.00	0.01
34R	GV	1.35	0.09	1.44	3.77	0.95	4.72	6.16
34R	JPATS	0.02	0.01	0.03	0.02	0.00	0.02	0.05
34R	LEAR25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34R	LEAR35	0.75	0.14	0.89	1.31	0.17	1.47	2.36
34R	SF340	6.68	0.46	7.14	3.58	0.50	4.08	11.22
34R		55.92	8.59	64.51	75.82	15.99	91.82	156.33
H	AS355F	1.34	0.23	1.57	1.33	0.24	1.57	3.14
H	B206L	6.30	0.30	6.60	6.33	0.27	6.60	13.20
H		7.64	0.53	8.17	7.66	0.52	8.17	16.34
<b>Grand Total</b>		<b>313.38</b>	<b>98.72</b>	<b>412.11</b>	<b>318.38</b>	<b>93.58</b>	<b>411.97</b>	<b>824.08</b>

# Attachment B

## ANEI N461 Estimated Population within each ANEI Contour by Suburb



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

Study	Suburb		Contours (ANEF)				
	Suburb	Population	>=20	>=25	>=30	>=35	>=40
N456	Alexandria	5800	100	0	0	0	0
N461	Alexandria	5800	200	0	0	0	0
N456	Annandale	8300	700	100	0	0	0
N461	Annandale	8300	700	0	0	0	0
N456	Arncliffe	8500	1100	0	0	0	0
N461	Arncliffe	8500	800	0	0	0	0
N456	Banksia	2900	2700	1500	400	0	0
N461	Banksia	2900	2300	1000	0	0	0
N456	Banksmeadow	500	0	0	0	0	0
N461	Banksmeadow	500	0	0	0	0	0
N456	Bexley	17900	6700	1500	0	0	0
N461	Bexley	17900	3400	0	0	0	0
N456	Botany	7500	3600	700	200	0	0
N461	Botany	7500	3800	900	200	0	0
N456	Brighton-le-sands	7200	400	0	0	0	0
N461	Brighton-le-sands	7200	300	0	0	0	0
N461	Camperdown	6500	300	0	0	0	0
N456	Coogee	13200	600	0	0	0	0
N461	Coogee	13200	100	0	0	0	0
N456	Daceyville	1200	1000	0	0	0	0
N461	Daceyville	1200	900	0	0	0	0
N456	Drummoyne	10400	1500	0	0	0	0
N461	Drummoyne	10400	1700	0	0	0	0
N456	Eastlakes	6600	1600	400	0	0	0
N461	Eastlakes	6600	1800	300	0	0	0
N456	Hurstville	23300	2700	0	0	0	0
N456	Kingsford	14200	2600	0	0	0	0
N461	Kingsford	14200	2300	0	0	0	0
N456	Kurnell	2100	1200	0	0	0	0
N461	Kurnell	2100	1200	0	0	0	0
N456	Kyeemagh	800	800	300	0	0	0
N461	Kyeemagh	800	800	200	0	0	0
N456	Leichhardt	12300	8000	2200	0	0	0
N461	Leichhardt	12300	7800	2100	0	0	0
N461	Lewisham	2800	0	0	0	0	0
N456	Lilyfield	6800	3100	0	0	0	0
N461	Lilyfield	6800	3300	0	0	0	0
N456	Marrickville	23200	9200	2800	700	0	0
N461	Marrickville	23200	11900	2800	700	0	0
N456	Mascot	8500	8500	2700	300	0	0
N461	Mascot	8500	8500	3000	200	0	0
N456	Matrville	8800	0	0	0	0	0
N461	Matrville	8800	0	0	0	0	0
N456	Newtown	13500	5000	0	0	0	0
N461	Newtown	13500	5800	0	0	0	0
N456	Pagewood	3000	0	0	0	0	0
N461	Pagewood	3000	0	0	0	0	0

Study	Suburb		Contours (ANEF)				
	Suburb	Population	>=20	>=25	>=30	>=35	>=40
N456	Petersham	7400	6000	1600	0	0	0
N461	Petersham	7400	6400	1500	0	0	0
N456	Randwick	25800	2300	0	0	0	0
N461	Randwick	25800	1600	0	0	0	0
N456	Rockdale	14000	6300	2200	0	0	0
N461	Rockdale	14000	4400	400	0	0	0
N456	Rosebery	7400	1700	0	0	0	0
N461	Rosebery	7400	2600	0	0	0	0
N456	Russell Lea	5100	100	0	0	0	0
N461	Russell Lea	5100	100	0	0	0	0
N456	St Peters	2600	2600	400	100	0	0
N461	St Peters	2600	2600	400	100	0	0
N456	Stanmore	7100	4900	2700	0	0	0
N461	Stanmore	7100	5000	2600	0	0	0
N456	Sydenham	1000	1000	1000	800	200	0
N461	Sydenham	1000	1000	1000	800	300	0
N456	Tempe	3200	3100	1500	300	100	0
N461	Tempe	3200	3200	1600	300	100	0

**Table B2 Comparison of Total Estimated Population within each ANEI Contour**

Study	Total Suburb Population	Contours (ANEF)				
		>=20	>=25	>=30	>=35	>=40
N456	280000	88600	21700	2800	300	0
N461	266000	84600	18000	2800	300	0

**Notes**

1. Contour and Suburb population counts have been rounded up to the nearest 100. Contour and Suburb population Totals are calculated using the non-rounded values. The Totals are then rounded up to the nearest 100.
2. Contour and Suburb population counts and Totals with values less than fifty are rounded down to zero.
3. 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**

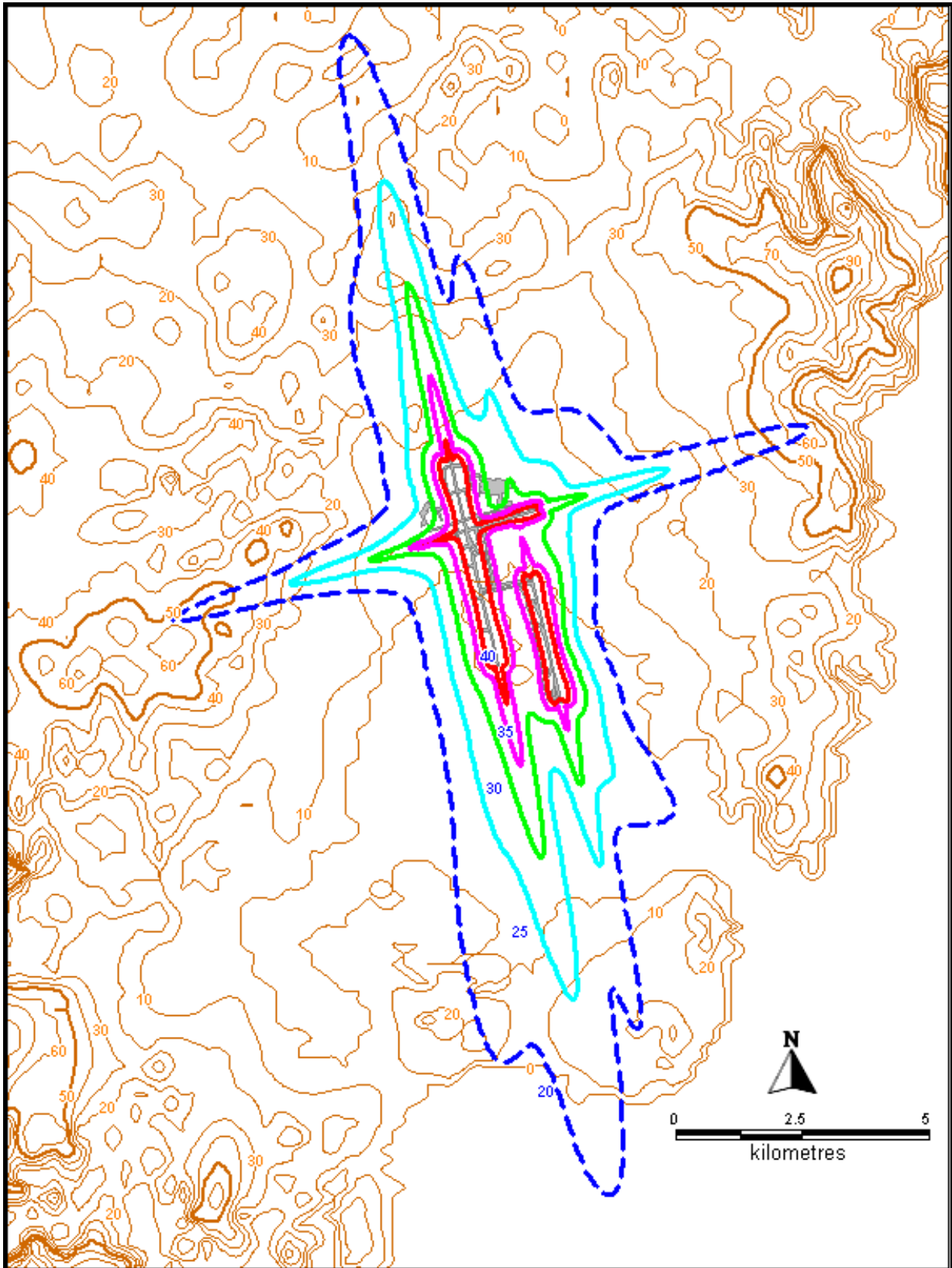
Suburb and contour population counts are approximations based on Census District (CD) populations from Census and Suburb Boundary information from the Australian Bureau of Statistics 2007 Census of Population and Housing data. Populations are calculated according to the proportion of the area of overlap 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 N461 Contours with INM Terrain Contours

Sydney Airport  
1 January to 31 December 2008

Sydney Airport N461 (1 January – 31 December 2008) ANEI Contours with Terrain Data



Terrain contour height shown in metres.

# Attachment D

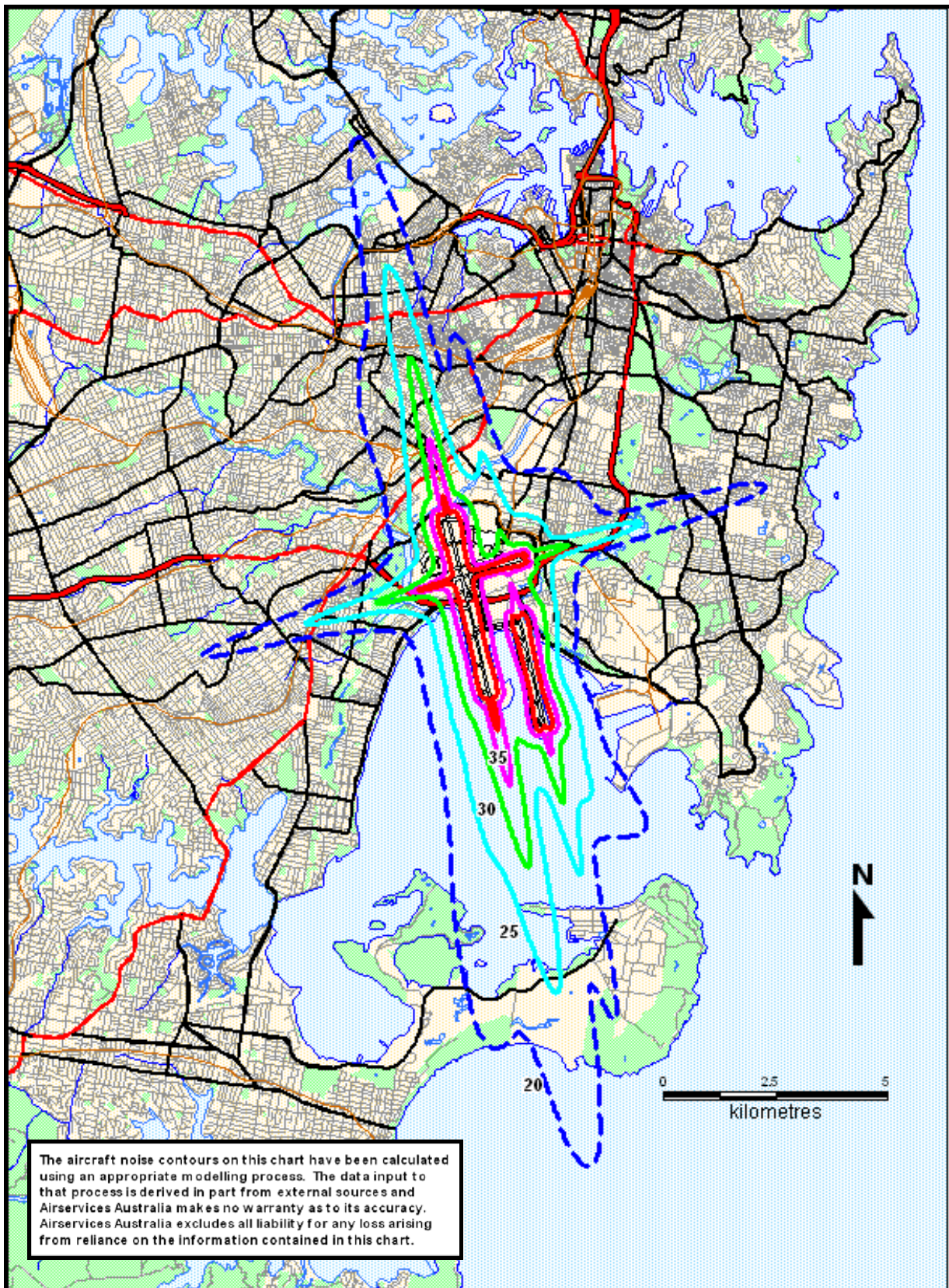
## ANEI N461 Contours

Sydney Airport

1 January to 31 December 2008

The contours for ANEI N461 have been prepared using terrain data.

### Sydney Airport N461 (1 January – 31 December 2008) ANEI Contours



ANEI contours modelled by INM 6.2a incorporating terrain data.

# Attachment E

## ANEI N456 Contours

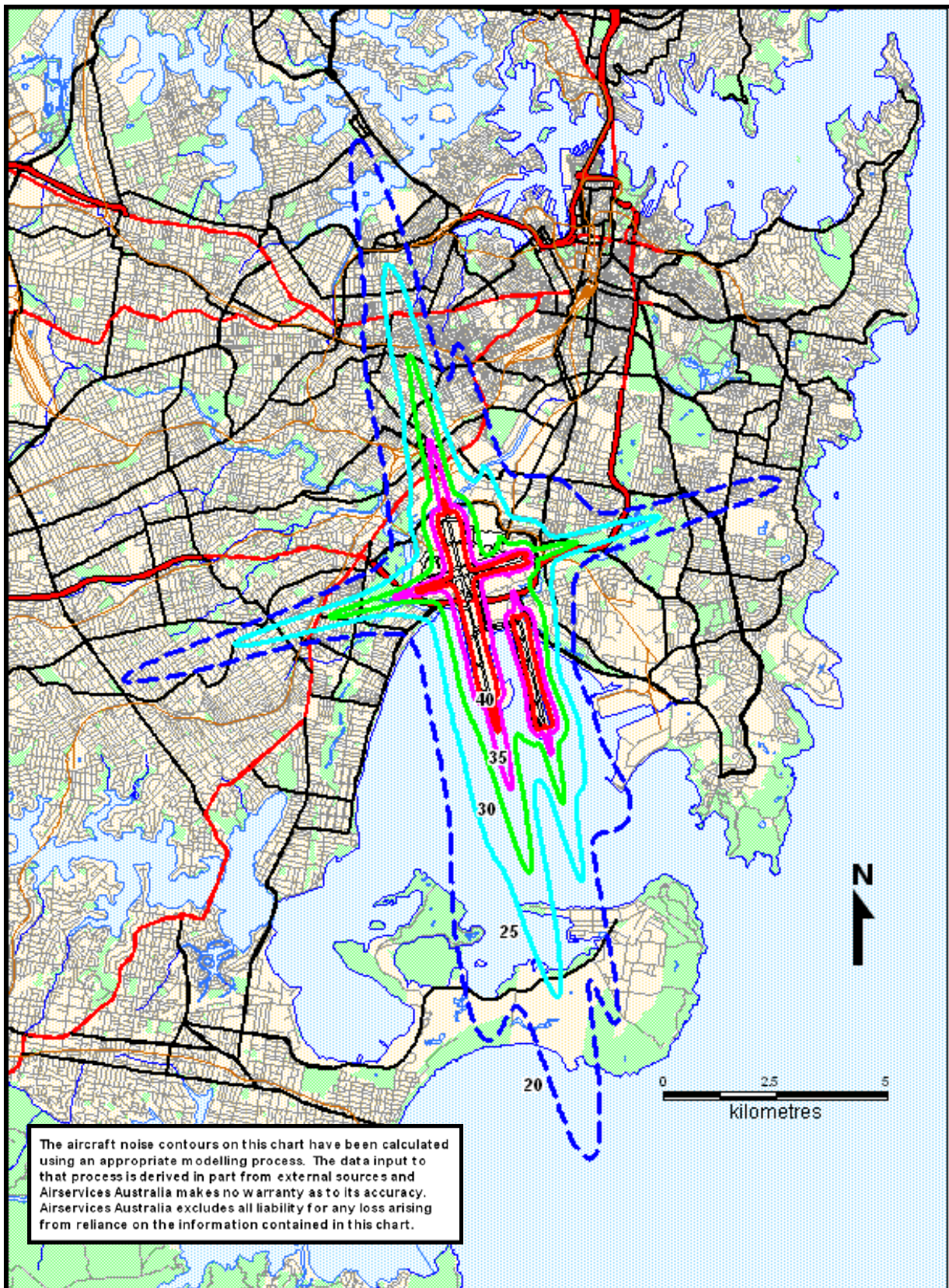
**Sydney Airport**

**1 January to 31 December 2007**

**The contours for ANEI N456 have been prepared using terrain data.**



### Sydney Airport N456 (1 January – 31 December 2007) ANEI Contours



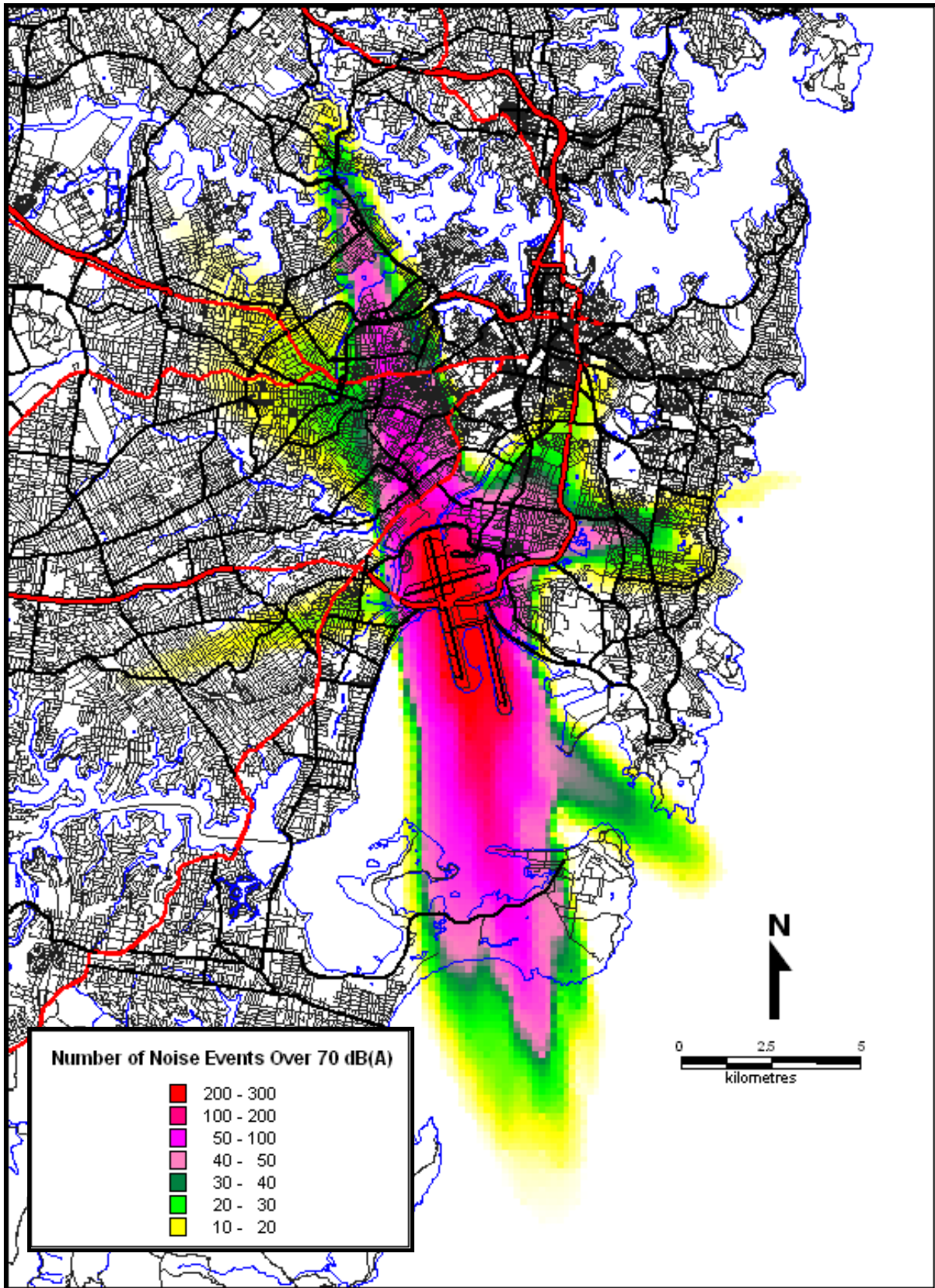
ANEI contours modelled by INM 6.2a incorporating terrain data.

# Attachment F

## N461 N70 Chart

Sydney Airport  
1 January to 31 December 2008

Sydney Airport N461 (1 January – 31 December 2008) N70 Chart



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