Sydney Airport

N505 Australian Noise Exposure Index

1 October to 31 December 2017

July 2018

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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 has prepared an Australian Noise Exposure Index (ANEI) for the period 1 October 2017 to 31 December 2017 inclusive (Reference Number N505).

Moreover, the ANEI contour reports were previously prepared by Airservices for the Sydney Noise Insulation Programmes (https://infrastructure.gov.au/aviation/environmental/insulation/index.aspx). The Sydney initiative commenced in 1994 and was completed in 2016 with all eligible residential properties having had the opportunity to be insulated.

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 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 20.4S	151 11 27.2E	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	21.8°C
Airport Average Humidity	62.5%

2. The Integrated Noise Model (INM)

The Integrated Noise Model version 7.0d (INM 7.0d) 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. Further information regarding INM can be found at:

http://www.faa.gov/about/office_org/headquarters_offices/apl/research/models/inm_model/

INM Version 7.0d is the most recent release of INM. It includes database updates and correction of minor software issues, but no new functionality added relative to INM Version 7.0c. Details of the database updates and changes can be found in the link above.

2.1 Development of INM Model

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.

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. 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.

3. Methodology Used in the Development of the ANEI

3.1 Introduction

The ANEI contour is based on the data collected by Airservices Noise and Flight Path Monitoring System (NFPMS).

The development of the ANEI consisted of the following stages:

i) collection and verification of the required NFPMS 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 NFPMS data

Aircraft movement data was obtained from Airservices NFPMS. The total number of movement records from the NFPMS data for the study period is shown in Table 3.1.

Table 3.1 NFPMS Aircraft Movements

Operation	Movements
Arrivals – Fixed Wing	42194
Departures – Fixed Wing	42175
Touch and Go - Fixed Wing	33
Arrivals – Helicopter	388
Departures – Helicopter	391
Touch and Go - Helicopter	1770
Total	**88754 (# see note)**

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

Other sources of data exist within Airservices, (Avcharges data for example) however NFPMS data has been used for this ANEI. NFPMS data at Sydney airport is groomed daily for a high level of data integrity.

There were 2 unknown aircraft movements within the study period. The NFPMS movement numbers were adjusted to account for these. This was achieved by increasing either the arrival or departure number to ensure arrivals equals departures by aircraft type. Touch and Go operations were split into arrivals and departures evenly.

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 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.

The types of aircraft that operated at Sydney Airport were assigned to 43 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.

To allocate aircraft operations to flight tracks within the INM study, the geographical track location from the NFPMS was used.

In this study, helicopters were modelled using actual helicopter profiles within INM. Representative helicopter types from INM7.0d were used to assign helicopter movements where possible. Not all helicopter types that operated at Sydney Airport are available for use in INM7.0d. Where it was not possible to use actual helicopter types, representatives were used based on aircraft size. Helicopter types that were unknown were assigned to the representative helicopter type that contained the highest percentage of operations, namely the R44. All helicopters were modelled as arriving to or departing from the Helipad that is located south of the threshold of Runway 25.

Table 3.3 Aircraft Types Used by INM for ANEI N505

INM Type	Aircraft
717200	Boeing B717-200 aircraft
737300	Boeing B737-300 aircraft
737400	Boeing B737-400 aircraft
737700	Boeing B737-700 aircraft
737800	Boeing B737-800 aircraft
747400	Represents B747-400 aircraft
7478	Represents B747-800 aircraft
757PW	Boeing B757-200 aircraft
757RR	Represents T204 (twin engine medium jet) aircraft
767300	Boeing B767-300 aircraft
777200	Boeing B777-200 aircraft, A359 - Airbus A350-900 aircraft
777300	Boeing B777-300 aircraft
7878R	Boeing B787-800 aircraft, B789 - Boeing B787-900 aircraft
A319-131	Airbus Industries A319 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
CL601	Represents Canadair CL601 Challenger aircraft
CNA208	Represents Pilatus PC-12 and other single engine turbo-prop aircraft
CNA441	Represents GA twin turbine-engine aircraft
DHC6	Represents Twin Otter and similar aircraft
DHC830	Represents Dash 8, FK50 type aircraft
EMB145	Represents Embraer 135 and 145 type aircraft
EMB170	Represents Embraer 170 type aircraft
EMB190	Represents Embraer 190 type aircraft
GASEPF	Represents GA single engine fixed pitch propeller aircraft
GASEPV	Represents GA single engine variable pitch propeller and/or turbine aircraft
F10062	Represents F100 and F70 aircraft
HS748A	Represent AT75, AT76 and ATR 72-212 A aircraft
LEAR35	Represents other small business type jet aircraft, including the G280 – Gulfstream G280 aircraft
MD11GE	Represents DC10 and MD11 type aircraft
SF340	Saab 340 aircraft
B206B3	Bell 206 helicopter aircraft
B407	Bell 407 helicopter
B430	Bell 430 helicopter
EC130	Euro copter EC130 helicopter representing large-medium helicopter types
R22	Robinson R22 helicopter representing small helicopter types
R44	Robinson R44 helicopter, also representing unknown 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 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 modelled.

3.5 Preparation and verification of the model output

The ANEI contours produced by INM were plotted using a GIS software package onto a base map. The contours produced for the 1 Oct - 31 Dec 2017 ANEI (N505) 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 ANEI N505 is 3.5 movements less than for the same period for the previous year.

Table 3.4 Comparison of Average Daily Movements

ANEI Study	Period	Average Daily Aircraft Movements
N505	1 Oct – 31 Dec 2017	965.3
N500	1 Oct – 31 Dec 2016	968.8

4. Comparison of the 2017 ANEI (N505) with the 2016 ANEI (N500)

The 1 October 2017 to 31 December 2017 ANEI (N505) contours for Sydney Airport are shown in Attachment D. For comparison purposes, the 1 October to 31 December 2016 ANEI (N500) for Sydney Airport has been included as Attachment E. Both contours were produced using INM 7.0d software.

4.1 Comparison of Movement Numbers

The changes evident in the contours for ANEI N505, when compared with the contours for ANEI N500, are consistent with the changes in aircraft types, movement numbers, runway usage, night movements and aircraft flight path use during the two periods.

Table 4.2 shows a comparison of average daily arrival and departure movements by runway for ANEI N505 and ANEI N500. Note that this comparison provides the basis for evaluation of the ANEI N505 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 N505 (1 October 2017 to 31 December 2017)			ANEI N500 (1 October 2016 to 31 December 2016)		
	Arrivals	Departures	Totals	Arrivals	Departures	Totals
07	6.8	0.3	7.1	5.3	0.7	6.0
16L	77.5	79.0	156.5	71.3	74.0	145.3
16R	116.7	138.2	254.9	99.9	120.5	220.4
25	2.8	1.2	4.0	13.8	11.3	25.1
34L	171.2	111.3	282.5	172.4	118.7	291.1
34R	84.0	129.2	213.2	96.3	134.1	230.3
Helipad	23.5	23.5	47.1	25.3	25.3	50.5
Total	482.6	482.6	965.3	484.4	484.4	968.8

Table 4.2 Difference of Average Daily Runway Movement

	Difference N505 - N500		
Runway	**Arrivals**	**Departures**	**Totals**
7	1.5	-0.4	1.1
16L	6.2	5.0	11.2
16R	16.7	17.7	34.4
25	-11.0	-10.1	-21.1
34L	-1.2	-7.4	-8.6
34R	-12.3	-4.9	-17.2
Helipad	-1.7	-1.7	-3.4
Total	-1.8	-1.7	-3.5

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 4.3 shows a comparison of departures that maintained runway heading and those that tracked via the Richmond Two SID and South West Jet SID.

Table 4.3 Comparison of Average Daily Long Haul Departures from Runway 34L

Runway 34L US Departures	ANEI N505 (1 October 2017 to 31 December 2017)		ANEI N500 (1 October 2016 to 31 December 2016)	
	Movements	% of USA Departures	Movements	% of USA Departures
Maintain Runway Heading	3.7	68%	4.1	70%
RICHMOND TWO SID / Rwy 34L SOUTH WEST SID	1.7	32%	1.7	30%
Total	**5.4**		**5.8**	

4.2 Comparison of Runway Use

Table 4.4 shows a comparison of runway usage in the 1 October 2017 to 31 December 2017 ANEI (N505) to the 1 October 2016 to 31 December 2016 ANEI (N500).

Table 4.4 Runway Use Comparison

Runway	ANEI N505		ANEI N500	
	1 October 2017 to 31 December 2017		1 October 2016 to 31 December 2016	
	N505 Arrivals %	N505 Departures %	N500 Arrivals %	N500 Departures %
07	0.7	0.0	0.6	0.1
16L	8.0	8.2	7.4	7.6
16R	12.1	14.3	10.3	12.4
25	0.3	0.1	1.4	1.2
34L	17.7	11.5	17.8	12.3
34R	8.7	13.4	9.9	13.8
Helipad	2.4	2.4	2.6	2.6

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.

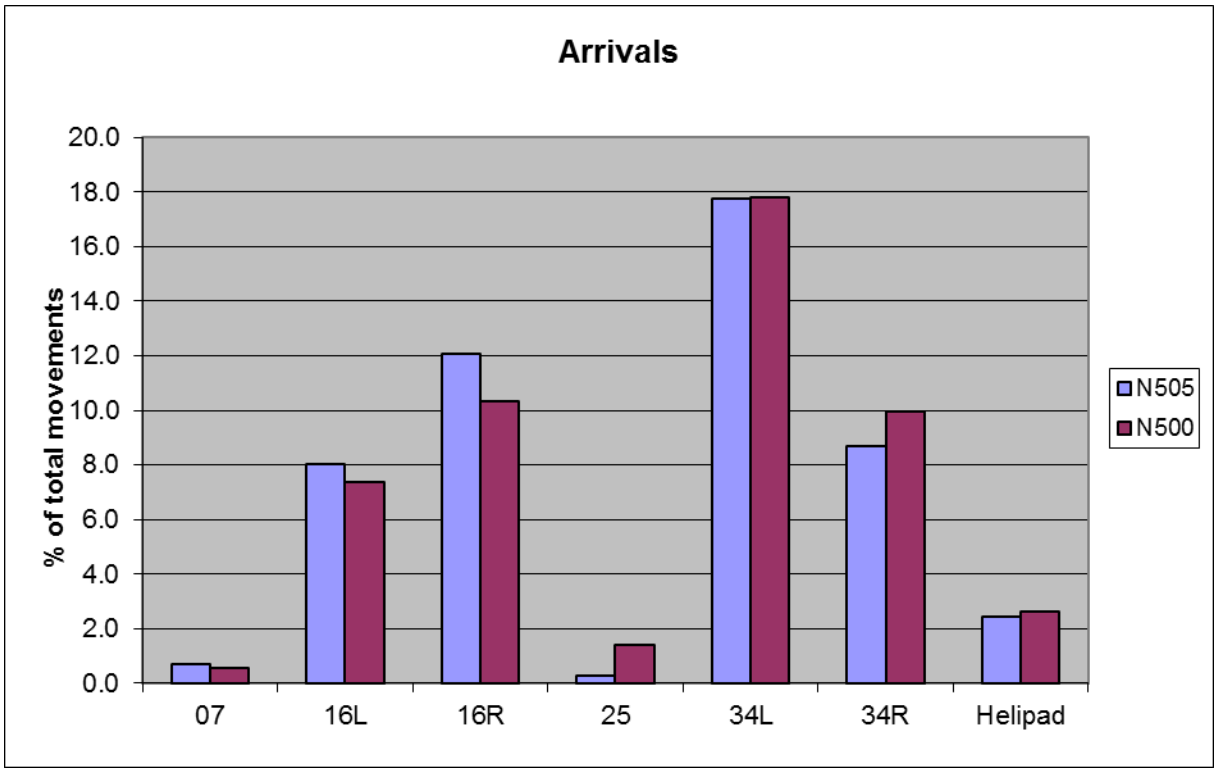


Figure 4.1a Runway Use Comparison – Arrivals

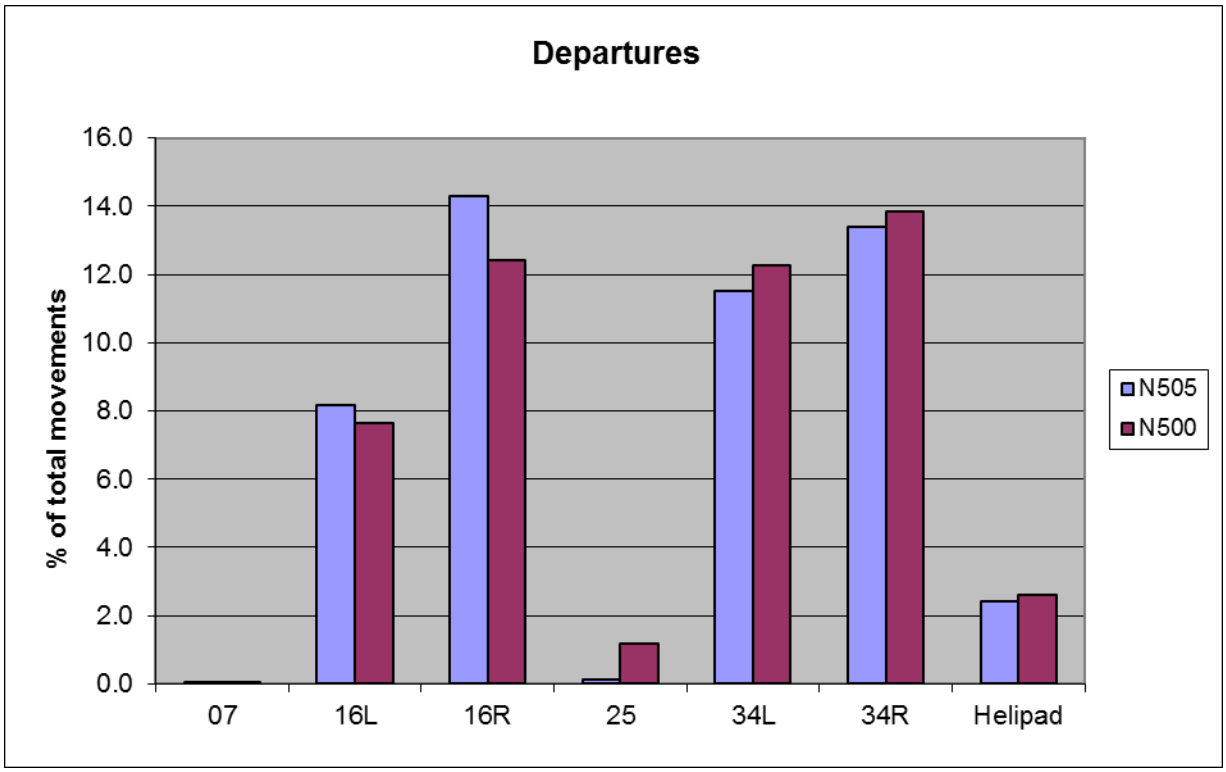


Figure 4.1b Runway Use Comparison - Departures

Table 4.5 details the proportion of aircraft movements to the north, south, east and west of Sydney Airport for ANEI N505 compared with ANEI N500. In calculating the proportion of aircraft movements, helicopter operations were not included. Further information regarding runway end usage should be obtained from the Sydney Operational Statistics Report, http://www.airservicesaustralia.com/publications/reports-and-statistics/sydney-airport-operational-statistics.

Table 4.5 Runway End Impact Comparison

Direction	Operation		ANEI N505	ANEI N500
	Arrival Runway	Departure Runway	%	%
North	16L and 16R	34L	31.6	29.9
South	34L and 34R	16L and 16R	48.9	47.8
East	25	07 and 34R	13.7	15.3
West	07	25	0.8	1.7

4.3 Comparison of Population Counts

To estimate the population beneath the current ANEI contours, the latest available Census 2011 Mesh Block data and Suburb Boundary information has been used. Mesh Blocks are the smallest geographic region in the Australian Statistical Geography Standard (ASGS), and the smallest geographical unit for which Census data are available. Details of Mesh Block data can be found here:

http://www.abs.gov.au/websitedbs/censushome.nsf/home/meshblockcounts

Previous contour population counts were generated using 2006 Census District information. These included much larger blocks which required some editing of CD boundaries and populations to accurately reflect population distribution in critical areas (close to the airport or flight paths). This editing was not required for the current count due to the improved accuracy of the much smaller Mesh Block data.

The section below compares total population within ANEI contours for the Q4 2017 (N505), Q4 2016 (N500) and the previous annual contour for 2016 (N501).

Table 4.6 Comparison of Total Population Estimates within each ANEI Contour

ANEI	Period	>=20	>=25	>=30	>=35	>=40
N500	1 October 2016 to 31 December 2016	97150	20400	2000	150	0
N501	1 January 2016 to 31 December 2016	97200	20650	2000	150	0
N505	1 October 2017 to 31 December 2017	98700	21400	2400	150	0

Notes:

- 2011 Mesh Block information and has been rounded to the nearest 50. The size of a Mesh Block is much smaller than the size of a suburb.

A more detailed listing of the number of people within the current ANEI contour is shown by suburb in Attachment B. The Census Mesh Block data captured indicates suburb information. In the latest Census data, various suburbs have been grouped together. This grouping can be seen within the tables of 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 2017 to 31 December 2017.

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 INM 7.0d, 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 N505 N70 Aircraft Noise Map - 1 October 2017 to 31 December 2017.

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 ANEI (N505).

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 the limitations with the N70 aircraft noise maps.

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 N505 Average Daily Aircraft Movements by Runway

Table A1 Average Daily Movements by Runway

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
07	717200	0.04	0.07	0.11	0.00	0.00	0.00	0.11
07	737300	0.00	0.02	0.02	0.00	0.00	0.00	0.02
07	737400	0.00	0.04	0.04	0.00	0.00	0.00	0.04
07	737700	0.03	0.04	0.08	0.00	0.00	0.00	0.08
07	737800	1.24	1.23	2.47	0.11	0.00	0.11	2.58
07	747400	0.01	0.07	0.08	0.00	0.00	0.00	0.08
07	757PW	0.00	0.01	0.01	0.00	0.00	0.00	0.01
07	767300	0.00	0.02	0.02	0.00	0.00	0.00	0.02
07	777200	0.03	0.00	0.03	0.00	0.00	0.00	0.03
07	777300	0.00	0.02	0.02	0.00	0.00	0.00	0.02
07	7878R	0.09	0.05	0.14	0.00	0.00	0.00	0.14
07	A320-232	0.65	1.20	1.85	0.05	0.00	0.05	1.90
07	A330-301	0.20	0.30	0.50	0.02	0.00	0.02	0.52
07	A380-841	0.01	0.03	0.04	0.00	0.00	0.00	0.04
07	A380-861	0.00	0.02	0.02	0.00	0.00	0.00	0.02
07	BAE300	0.00	0.03	0.03	0.00	0.00	0.00	0.03
07	CL601	0.01	0.01	0.02	0.01	0.00	0.01	0.03
07	CNA441	0.01	0.00	0.01	0.00	0.00	0.00	0.01
07	DHC6	0.15	0.16	0.32	0.01	0.00	0.01	0.33
07	DHC830	0.49	0.04	0.53	0.01	0.00	0.01	0.54
07	EMB145	0.01	0.00	0.01	0.00	0.00	0.00	0.01
07	HS748A	0.07	0.02	0.09	0.02	0.00	0.02	0.11
07	LEAR35	0.05	0.04	0.10	0.01	0.00	0.01	0.11
07	MD11GE	0.01	0.01	0.02	0.00	0.00	0.00	0.02
07	SF340	0.23	0.04	0.27	0.05	0.00	0.05	0.33
07		**3.34**	**3.50**	**6.84**	**0.30**	**0.00**	**0.30**	**7.14**

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
16L	717200	1.01	0.09	1.10	1.23	0.30	1.53	2.63
16L	737300	0.02	0.03	0.05	0.02	0.07	0.09	0.14
16L	737400	0.00	0.14	0.14	0.00	0.07	0.07	0.21
16L	737700	0.83	0.11	0.93	0.92	0.11	1.03	1.97
16L	737800	22.12	5.80	27.92	27.37	6.33	33.70	61.62
16L	747400	0.00	0.00	0.00	0.01	0.01	0.02	0.02
16L	757PW	0.04	0.16	0.21	0.03	0.01	0.04	0.25
16L	767300	0.23	0.07	0.29	0.01	0.04	0.05	0.35
16L	777200	0.47	0.05	0.52	0.45	0.07	0.51	1.03
16L	7878R	0.90	0.10	1.00	0.74	0.11	0.85	1.85
16L	A319-131	0.01	0.00	0.01	0.01	0.00	0.01	0.02
16L	A320-232	13.36	3.73	17.09	15.97	4.52	20.49	37.58
16L	A330-301	1.50	0.25	1.75	1.77	0.41	2.18	3.93
16L	BAE300	0.01	0.05	0.07	0.00	0.00	0.00	0.07
16L	BEC58P	0.01	0.00	0.01	0.04	0.00	0.04	0.05
16L	CL601	0.10	0.03	0.13	0.15	0.02	0.17	0.30
16L	CNA441	0.04	0.00	0.04	0.05	0.01	0.07	0.11
16L	DHC6	1.86	0.78	2.64	1.80	0.47	2.27	4.91
16L	DHC830	11.12	1.14	12.26	8.15	1.27	9.42	21.68
16L	EMB145	0.00	0.03	0.03	0.07	0.00	0.07	0.10
16L	EMB190	0.20	0.01	0.21	0.22	0.03	0.25	0.46
16L	F10062	0.10	0.01	0.11	0.02	0.03	0.05	0.16
16L	GASEPF	0.17	0.00	0.17	0.17	0.00	0.17	0.35
16L	GASEPV	0.00	0.00	0.00	0.00	0.01	0.01	0.01
16L	HS748A	2.50	0.27	2.77	1.34	0.20	1.53	4.30
16L	LEAR25	0.03	0.00	0.03	0.00	0.00	0.00	0.03
16L	LEAR35	0.82	0.10	0.91	0.88	0.12	1.00	1.91
16L	SF340	6.27	0.79	7.07	2.97	0.41	3.38	10.45
16L		**63.72**	**13.76**	**77.48**	**64.40**	**14.62**	**79.02**	**156.50**

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
16R	717200	1.73	0.26	1.99	1.27	0.64	1.91	3.90
16R	737300	0.01	0.13	0.14	0.01	0.38	0.39	0.53
16R	737400	0.00	0.24	0.24	0.00	0.77	0.77	1.01
16R	737700	0.67	0.16	0.84	0.74	0.15	0.89	1.73
16R	737800	27.49	8.30	35.79	27.49	8.30	35.79	71.59
16R	747400	2.22	1.10	3.32	2.55	1.22	3.77	7.09
16R	7478	0.26	0.02	0.28	0.29	0.01	0.30	0.59
16R	757PW	0.02	0.04	0.07	0.05	0.49	0.54	0.61
16R	767300	0.10	0.10	0.20	0.17	0.45	0.62	0.82
16R	777200	1.83	0.14	1.97	1.88	0.28	2.16	4.13
16R	777300	2.29	1.18	3.48	2.38	1.50	3.88	7.36
16R	7878R	4.52	0.65	5.17	4.82	1.20	6.01	11.18
16R	A319-131	0.02	0.01	0.03	0.01	0.02	0.03	0.07
16R	A320-232	13.67	4.52	18.20	14.49	5.27	19.76	37.96
16R	A330-301	12.38	4.30	16.68	13.12	5.14	18.26	34.95
16R	A340-211	0.30	0.02	0.33	0.20	0.12	0.32	0.64
16R	A380-841	2.41	1.52	3.93	3.39	0.95	4.34	8.27
16R	A380-861	0.76	0.98	1.74	0.46	1.28	1.74	3.48
16R	BAE300	0.00	0.22	0.22	0.01	3.85	3.86	4.08
16R	BEC58P	0.01	0.01	0.02	0.01	0.01	0.02	0.04
16R	C130	0.00	0.00	0.00	0.01	0.00	0.01	0.01
16R	CL601	0.16	0.07	0.23	0.20	0.03	0.23	0.46
16R	CNA208	0.02	0.00	0.02	0.02	0.00	0.02	0.04
16R	CNA441	0.03	0.01	0.04	0.01	0.00	0.01	0.05
16R	DHC6	1.33	0.73	2.05	2.48	1.11	3.59	5.64
16R	DHC830	6.29	0.66	6.96	8.86	1.27	10.13	17.09
16R	EMB145	0.04	0.01	0.05	0.03	0.02	0.05	0.11
16R	EMB190	0.12	0.01	0.13	0.07	0.05	0.12	0.25
16R	F10062	0.01	0.00	0.01	0.02	0.04	0.07	0.08
16R	GASEPF	0.01	0.00	0.01	0.00	0.00	0.00	0.01
16R	HS748A	2.11	0.40	2.51	3.30	0.67	3.98	6.49
16R	LEAR25	0.00	0.00	0.00	0.03	0.00	0.03	0.03
16R	LEAR35	0.73	0.29	1.02	0.93	0.41	1.35	2.37
16R	MD11GE	0.46	0.10	0.55	0.18	0.41	0.60	1.15
16R	SF340	7.61	0.86	8.47	9.40	3.20	12.60	21.07
16R		**89.63**	**27.07**	**116.70**	**98.90**	**39.26**	**138.16**	**254.86**

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
25	717200	0.01	0.00	0.01	0.03	0.02	0.05	0.07
25	737300	0.00	0.02	0.02	0.00	0.00	0.00	0.02
25	737400	0.00	0.08	0.08	0.00	0.00	0.00	0.08
25	737700	0.00	0.03	0.03	0.00	0.00	0.00	0.03
25	737800	0.32	0.49	0.80	0.23	0.15	0.38	1.18
25	747400	0.01	0.01	0.02	0.00	0.00	0.00	0.02
25	757PW	0.01	0.01	0.02	0.00	0.00	0.00	0.02
25	767300	0.01	0.02	0.03	0.00	0.02	0.02	0.05
25	777300	0.02	0.04	0.07	0.00	0.00	0.00	0.07
25	7878R	0.04	0.04	0.09	0.00	0.01	0.01	0.10
25	A320-232	0.17	0.49	0.66	0.16	0.26	0.42	1.09
25	A330-301	0.07	0.42	0.49	0.01	0.03	0.04	0.53
25	A340-211	0.00	0.01	0.01	0.00	0.00	0.00	0.01
25	A380-841	0.01	0.04	0.05	0.00	0.00	0.00	0.05
25	A380-861	0.00	0.01	0.01	0.00	0.00	0.00	0.01
25	BAE300	0.00	0.03	0.03	0.00	0.00	0.00	0.03
25	BEC58P	0.01	0.00	0.01	0.00	0.00	0.00	0.01
25	CNA441	0.00	0.00	0.00	0.00	0.01	0.01	0.01
25	DHC6	0.03	0.09	0.12	0.04	0.01	0.05	0.17
25	DHC830	0.09	0.01	0.10	0.09	0.00	0.09	0.18
25	EMB145	0.00	0.01	0.01	0.00	0.00	0.00	0.01
25	EMB190	0.00	0.02	0.02	0.00	0.01	0.01	0.03
25	HS748A	0.02	0.02	0.04	0.02	0.00	0.02	0.07
25	LEAR35	0.00	0.02	0.02	0.00	0.00	0.00	0.02
25	MD11GE	0.01	0.01	0.02	0.00	0.00	0.00	0.02
25	SF340	0.03	0.03	0.07	0.04	0.00	0.04	0.11
25		**0.87**	**1.98**	**2.85**	**0.63**	**0.53**	**1.16**	**4.01**

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
34L	717200	2.32	0.39	2.71	0.62	0.00	0.62	3.33
34L	737300	0.02	0.28	0.30	0.02	0.00	0.02	0.33
34L	737400	0.00	0.47	0.47	0.00	0.12	0.12	0.59
34L	737700	0.96	0.32	1.27	0.27	0.03	0.30	1.58
34L	737800	37.92	15.52	53.45	15.20	3.77	18.97	72.41
34L	747400	2.68	1.86	4.54	2.72	1.46	4.17	8.72
34L	7478	0.27	0.07	0.34	0.29	0.02	0.32	0.65
34L	757PW	0.04	0.12	0.16	0.04	0.00	0.04	0.21
34L	767300	0.29	0.23	0.52	0.10	0.28	0.38	0.90
34L	777200	2.34	0.30	2.64	1.92	0.38	2.30	4.95
34L	777300	2.87	1.86	4.73	2.86	1.55	4.41	9.14
34L	7878R	5.22	1.33	6.54	4.95	1.28	6.23	12.77
34L	A319-131	0.01	0.00	0.01	0.01	0.00	0.01	0.02
34L	A320-232	18.20	9.02	27.22	7.35	2.35	9.70	36.91
34L	A330-301	14.58	6.89	21.47	12.89	5.02	17.91	39.38
34L	A340-211	0.38	0.02	0.40	0.25	0.17	0.42	0.83
34L	A380-841	3.32	2.20	5.51	4.04	1.16	5.21	10.72
34L	A380-861	0.90	1.33	2.23	0.54	1.72	2.26	4.49
34L	BAE300	0.00	3.51	3.51	0.01	0.00	0.01	3.52
34L	BEC58P	0.03	0.01	0.04	0.04	0.02	0.07	0.11
34L	C130	0.01	0.00	0.01	0.00	0.00	0.00	0.01
34L	CL601	0.36	0.09	0.45	0.09	0.01	0.10	0.54
34L	CNA208	0.02	0.00	0.02	0.01	0.00	0.01	0.03
34L	CNA441	0.01	0.01	0.02	0.03	0.01	0.04	0.07
34L	DHC6	1.58	2.08	3.65	3.09	0.38	3.47	7.12
34L	DHC830	8.72	1.04	9.76	10.62	1.71	12.33	22.09
34L	EMB145	0.04	0.05	0.10	0.02	0.00	0.02	0.12
34L	EMB190	0.25	0.08	0.33	0.02	0.01	0.03	0.36
34L	F10062	0.03	0.00	0.03	0.00	0.00	0.00	0.03
34L	GASEPF	0.01	0.00	0.01	0.01	0.00	0.01	0.02
34L	HS748A	3.43	0.75	4.18	3.91	0.92	4.84	9.02
34L	LEAR35	1.32	0.75	2.07	0.75	0.22	0.97	3.03
34L	MD11GE	0.55	0.17	0.73	0.08	0.65	0.73	1.46
34L	SF340	10.49	1.33	11.82	11.73	3.54	15.27	27.09
34L		**119.17**	**52.07**	**171.24**	**84.49**	**26.80**	**111.29**	**282.53**

Runway	Aircraft Type	Arrivals			Departure			Total
		Day	Night	Total	Day	Night	Total	
34R	717200	1.11	0.12	1.23	2.15	0.87	3.02	4.25
34R	737300	0.01	0.07	0.08	0.01	0.11	0.12	0.20
34R	737400	0.00	0.20	0.20	0.00	0.21	0.21	0.40
34R	737700	0.97	0.16	1.13	1.85	0.21	2.05	3.18
34R	737800	23.72	5.64	29.36	49.11	11.74	60.85	90.21
34R	747400	0.01	0.00	0.01	0.00	0.00	0.00	0.01
34R	757PW	0.08	0.20	0.27	0.07	0.04	0.11	0.38
34R	767300	0.17	0.04	0.22	0.01	0.20	0.21	0.42
34R	777200	0.65	0.03	0.68	0.73	0.14	0.87	1.55
34R	7878R	1.12	0.02	1.14	0.83	0.16	0.99	2.13
34R	A320-232	14.60	4.09	18.68	27.46	5.82	33.27	51.96
34R	A330-301	1.88	0.23	2.11	3.91	0.66	4.58	6.68
34R	BAE300	0.00	0.02	0.02	0.01	0.00	0.01	0.03
34R	BEC58P	0.07	0.03	0.10	0.04	0.01	0.05	0.15
34R	C130	0.01	0.00	0.01	0.01	0.00	0.01	0.02
34R	CL601	0.11	0.02	0.13	0.41	0.03	0.45	0.58
34R	CNA208	0.00	0.00	0.00	0.01	0.00	0.01	0.01
34R	CNA441	0.10	0.00	0.10	0.05	0.03	0.09	0.18
34R	DHC6	2.23	0.89	3.12	2.11	0.40	2.51	5.63
34R	DHC830	12.38	1.17	13.55	9.46	1.73	11.18	24.74
34R	EMB145	0.02	0.00	0.02	0.07	0.02	0.09	0.11
34R	EMB190	0.20	0.08	0.27	0.41	0.13	0.54	0.82
34R	F10062	0.11	0.00	0.11	0.04	0.10	0.14	0.25
34R	GASEPF	0.08	0.00	0.08	0.09	0.00	0.09	0.16
34R	GASEPV	0.00	0.01	0.01	0.00	0.00	0.00	0.01
34R	HS748A	2.29	0.29	2.59	1.60	0.20	1.79	4.38
34R	LEAR35	0.96	0.14	1.10	1.73	0.16	1.89	2.99
34R	SF340	7.26	0.42	7.68	3.61	0.41	4.02	11.71
34R		**70.12**	**13.88**	**84.00**	**105.77**	**23.38**	**129.15**	**213.15**
H	B206B3	5.73	0.09	5.82	5.73	0.09	5.82	11.63
H	B407	0.23	0.00	0.23	0.23	0.00	0.23	0.46
H	B430	0.12	0.04	0.16	0.14	0.02	0.16	0.33
H	EC130	6.32	0.35	6.66	6.34	0.33	6.66	13.33
H	R22	0.04	0.00	0.04	0.04	0.00	0.04	0.09
H	R44	10.16	0.47	10.63	10.18	0.45	10.63	21.26
H		**22.60**	**0.95**	**23.54**	**22.66**	**0.88**	**23.54**	**47.09**
Grand Total		**369.45**	**113.20**	**482.64**	**377.16**	**105.48**	**482.64**	**965.28**

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

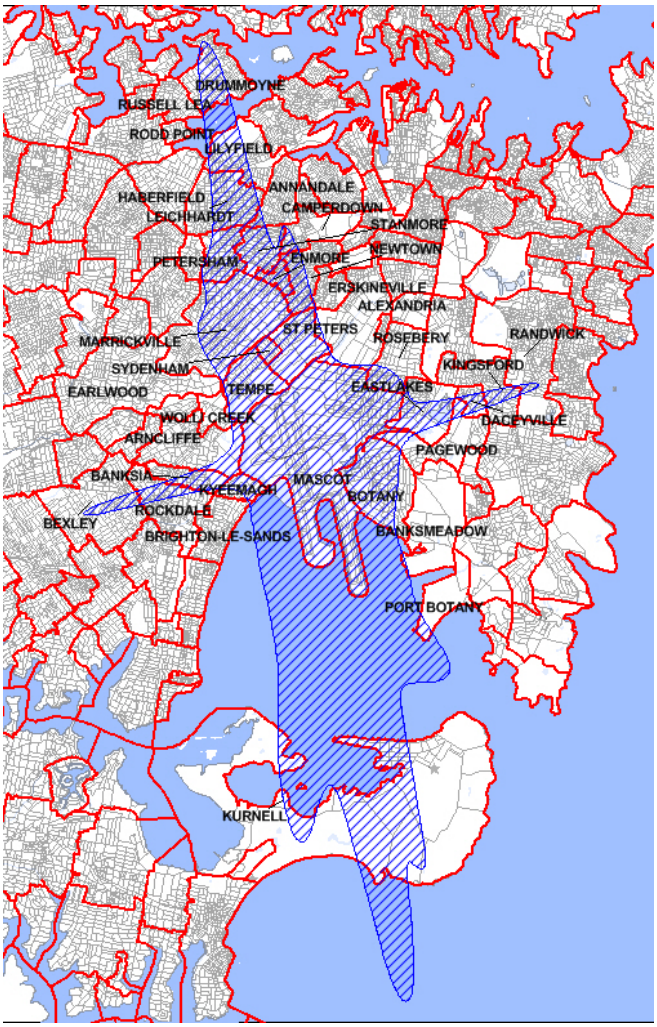
ANEI N505 Estimated Population within each ANEI Contour by Suburb

Table B1 Estimated Population within each ANEI Contour by Suburb

Suburb information is derived directly from the latest Census Mesh Block data. As a result certain suburbs have been grouped together. The Census data has not been altered. The above chart displays the Annual Contour for 2016 (N501) for display purposes. The table shows how the population within the current contour (N505) compares to the counts from the Annual Contour.

ANEI 20 Contour

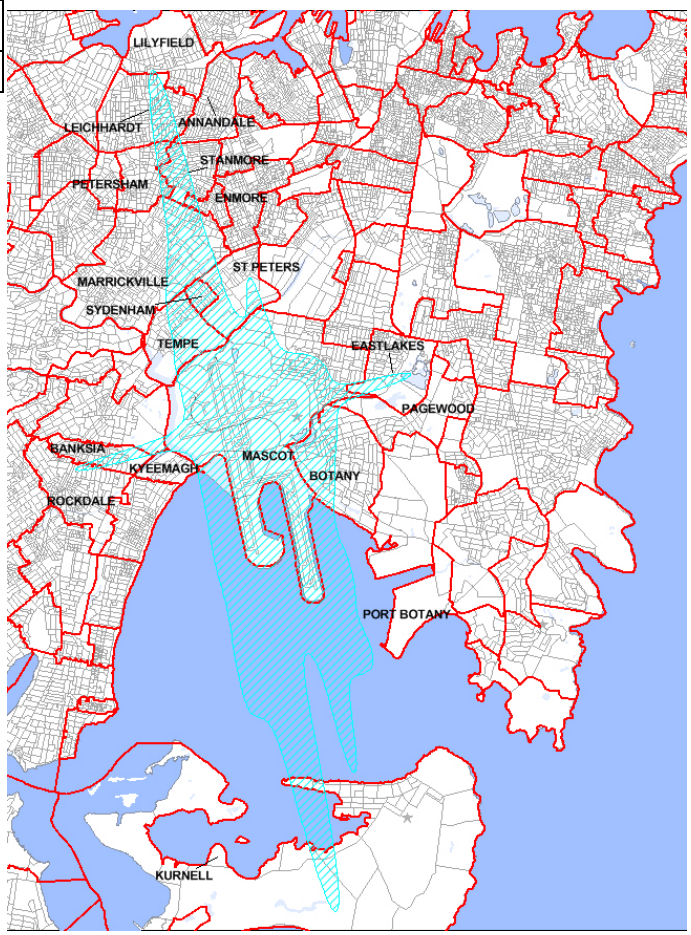
Suburb	2016 Annual Sum of Residents (N501)	2017 Q4 Sum of Residents (N505)
Arncliffe - Bardwell Valley	3	0
Bexley	1616	419
Botany	5939	5844
Cronulla - Kurnell - Bundeena	1309	1309
Drummoyne - Rodd Point	3167	5774
Dulwich Hill - Lewisham	857	425
Erskineville - Alexandria	172	201
Kensington - Kingsford	516	0
Leichhardt - Annandale	10086	11540
Lilyfield - Rozelle	2584	2786
Marrickville	18028	18277
Mascot - Eastlakes	15668	15006
Monterey - Brighton-le-Sands - Kyeemagh	445	297
Newtown - Camperdown - Darlington	7718	8869
Pagewood - Hillsdale - Daceyville	482	
Petersham - Stanmore	17233	18431
Rockdale - Banksia	3828	2097
Sydenham - Tempe - St Peters	7204	7204
Sydney Airport	3	3
Waterloo - Beaconsfield	364	240
Grand Total	**97222**	**98722**



ANEI 25 Contour

Suburb information is derived directly from the latest Census Mesh Block data. As a result certain suburbs have been grouped together. The Census data has not been altered. The above chart displays the Annual Contour for 2016 (N501) for display purposes. The table shows how the population within the current contour (N505) compares to the counts from the Annual Contour.

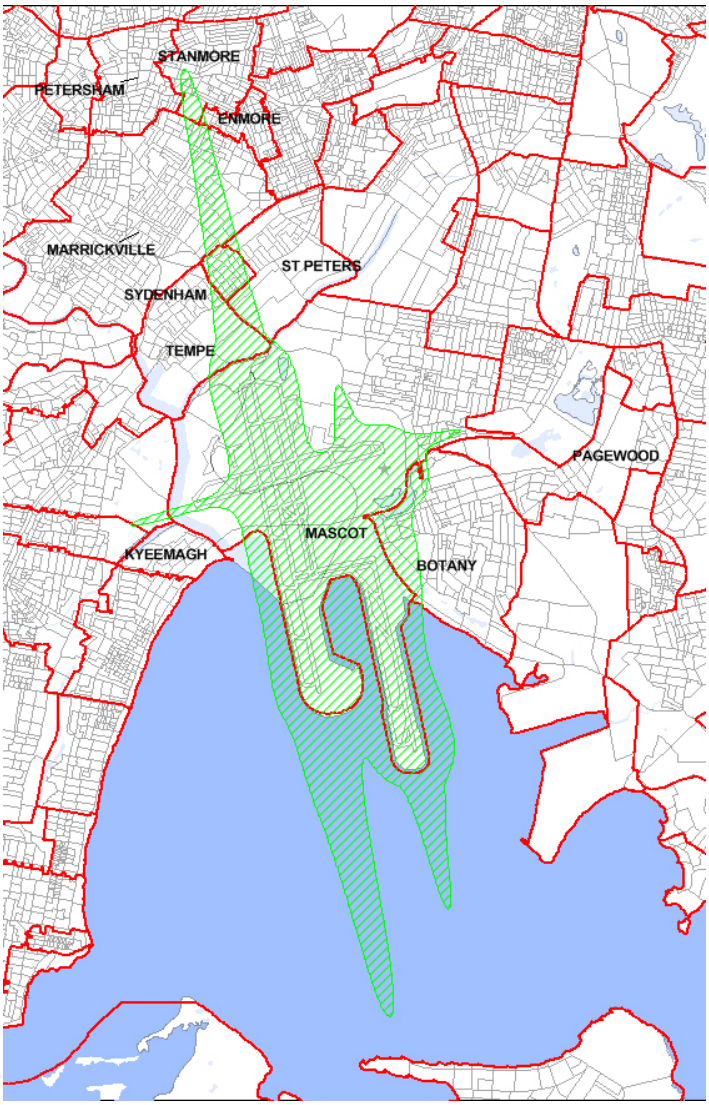
Suburb Names	2016 Annual Sum of Residents (N501)	2017 Q4 Sum of Residents (N505)
Botany	2353	2055
Cronulla - Kurnell - Bundeena	101	0
Leichhardt - Annandale	2326	2973
Lilyfield - Rozelle	0	108
Marrickville	3570	3858
Mascot - Eastlakes	3733	3404
Petersham - Stanmore	4231	4923
Rockdale - Banksia	584	62
Sydenham - Tempe - St Peters	3768	4023
Grand Total	**20669**	**21409**



ANEI 30 Contour

Suburb information is derived directly from the latest Census Mesh Block data. As a result certain suburbs have been grouped together. The Census data has not been altered. The above chart displays the Annual Contour for 2016 (N501) for display purposes. The table shows how the population within the current contour (N505) compares to the counts from the Annual Contour.

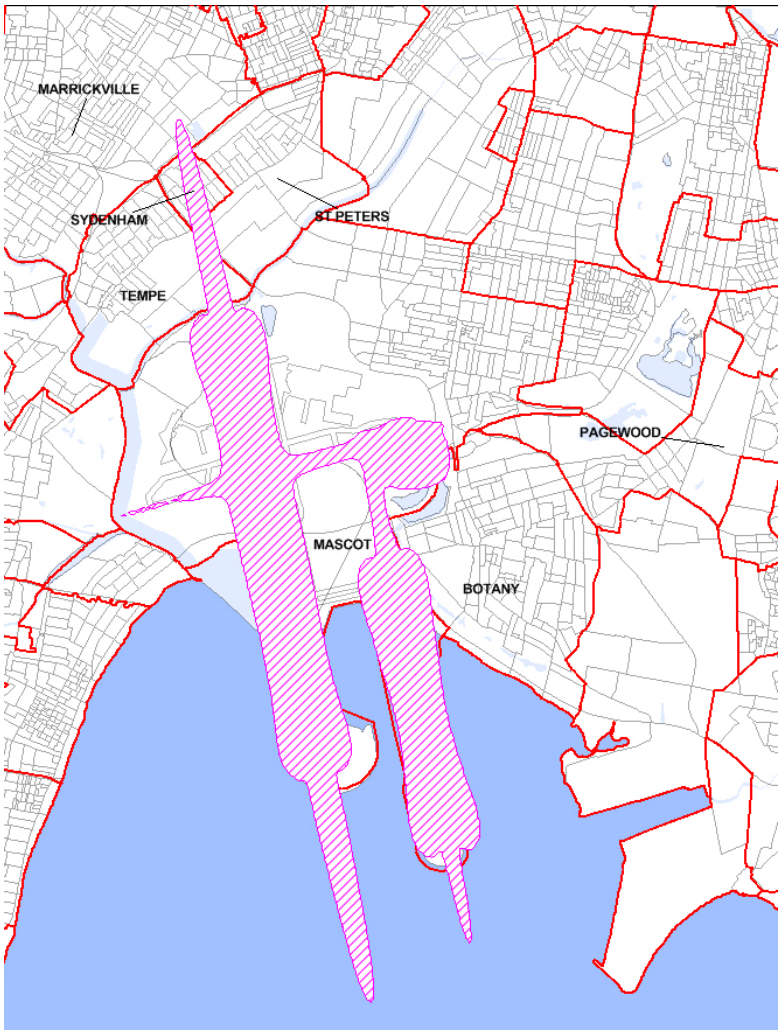
Suburb Names	2016 Annual Sum of Residents (N501)	2017 Q4 Sum of Residents (N505)
Botany	196	196
Marrickville	528	803
Mascot - Eastlakes	123	0
Petersham - Stanmore	6	281
Sydenham - Tempe - St Peters	1134	1134
Sydney Airport	0	0
Grand Total	**1987**	**2414**



ANEI 35 Contour

Suburb information is derived directly from the latest Census Mesh Block data. As a result certain suburbs have been grouped together. The Census data has not been altered. The above chart displays the Annual Contour for 2016 (N501) for display purposes. The table shows how the population within the current contour (N505) compares to the counts from the Annual Contour.

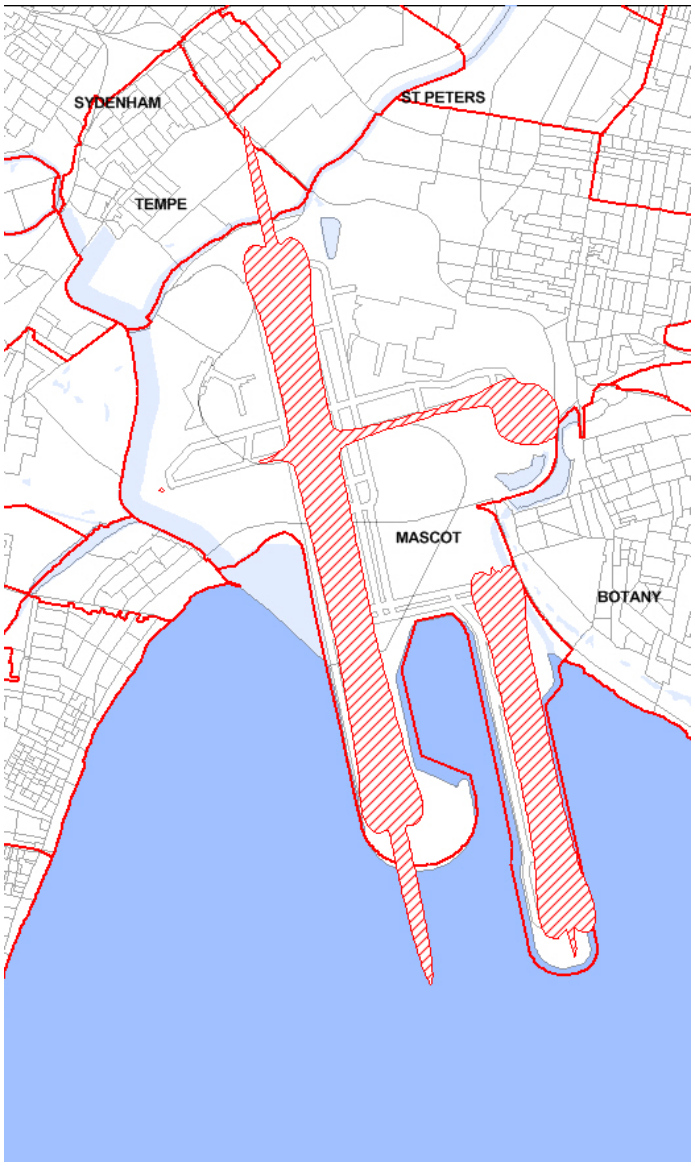
Suburb Names	2016 Annual Sum of Residents (N501)	2017 Q4 Sum of Residents (N505)
Botany	0	0
Marrickville	0	8
Sydenham - Tempe - St Peters	136	136
Sydney Airport	0	0
Grand Total	**136**	**144**



ANEI 40 Contour

Suburb information is derived directly from the latest Census Mesh Block data. As a result certain suburbs have been grouped together. The Census data has not been altered. The above chart displays the Annual Contour for 2016 (N501) for display purposes. The table shows how the population within the current contour (N505) compares to the counts from the Annual Contour.

Suburb Name	2016 Annual Sum of Residents (N501)	2017 Q4 Sum of Residents (N505)
Sydenham - Tempe - St Peters	0	0
Sydney Airport	0	0
Grand Total	**0**	**0**



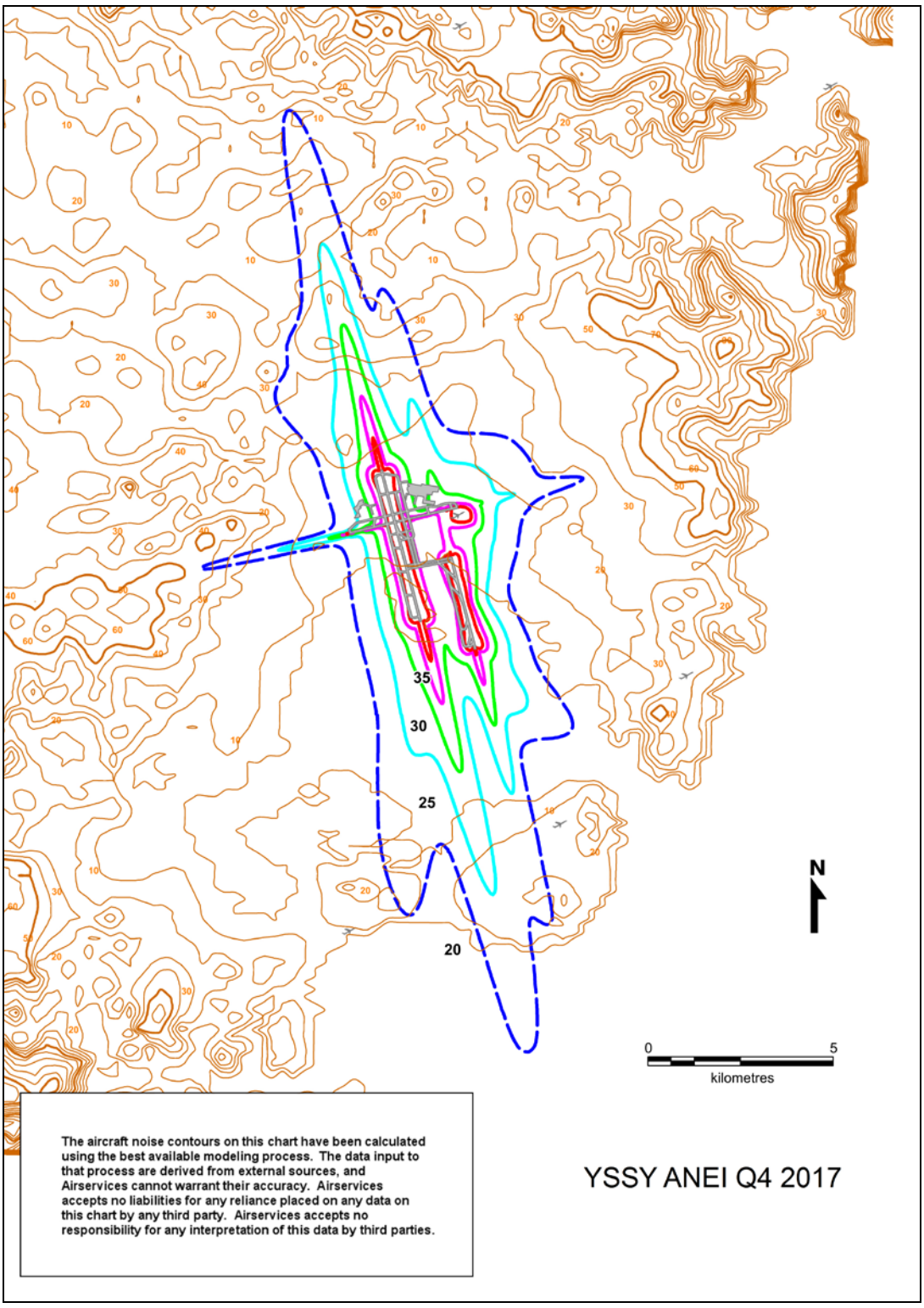
Attachment C

ANEI N505 Contours with INM Terrain Contours

Sydney Airport

1 October 2017 to 31 December 2017

Sydney Airport N505 (1 October 2017 to 31 December 2017) ANEI Contours with Terrain Data



Terrain contour height shown in metres.

Attachment D

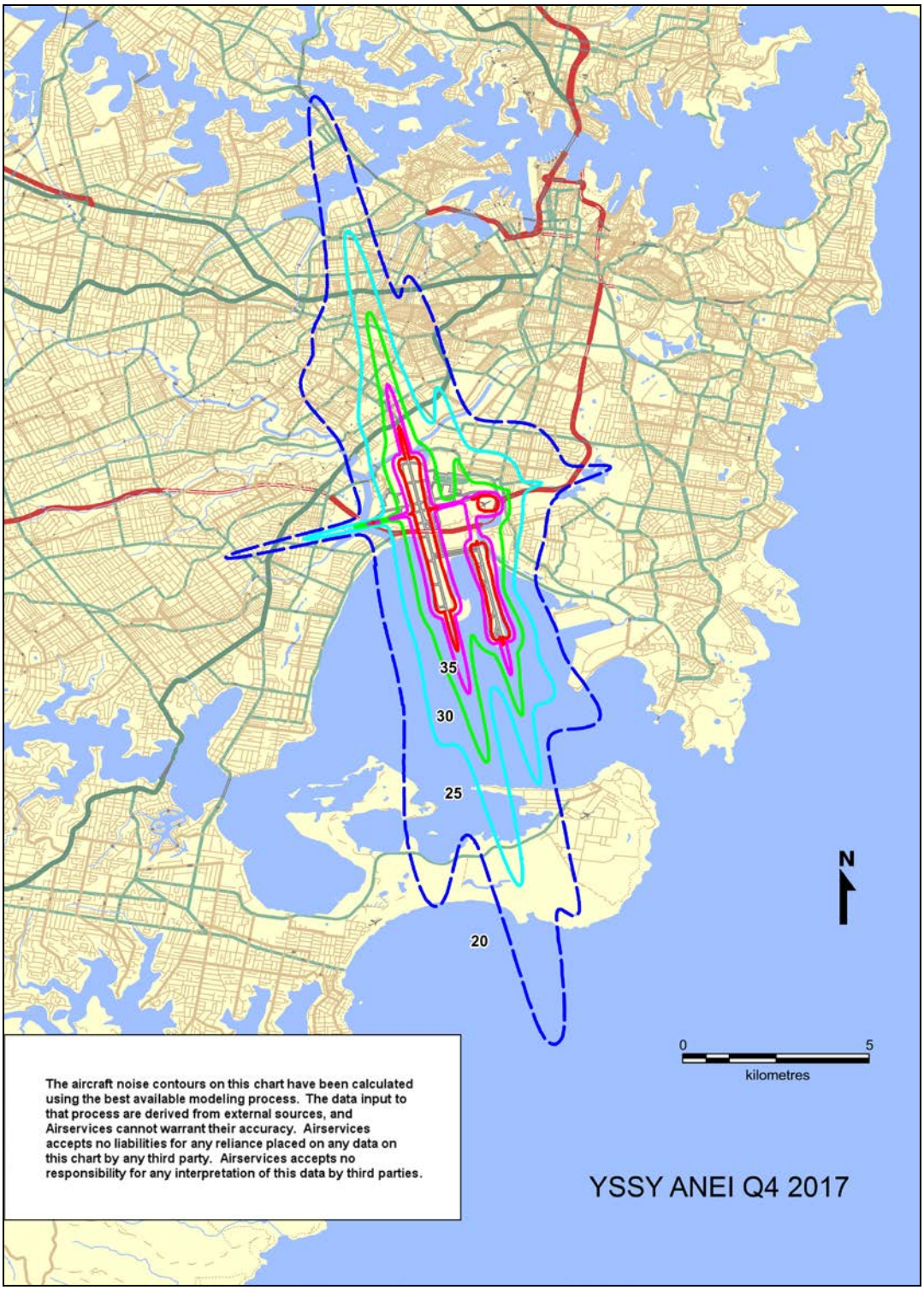
ANEI N505 Contours

Sydney Airport

1 October 2016 to 31 December 2016

The contours for ANEI N505 have been prepared using terrain data.

Sydney Airport N505 (1 October 2017 to 31 December 2017) ANEI Contours



ANEI contours modelled by INM 7.0d incorporating terrain data.

Attachment E

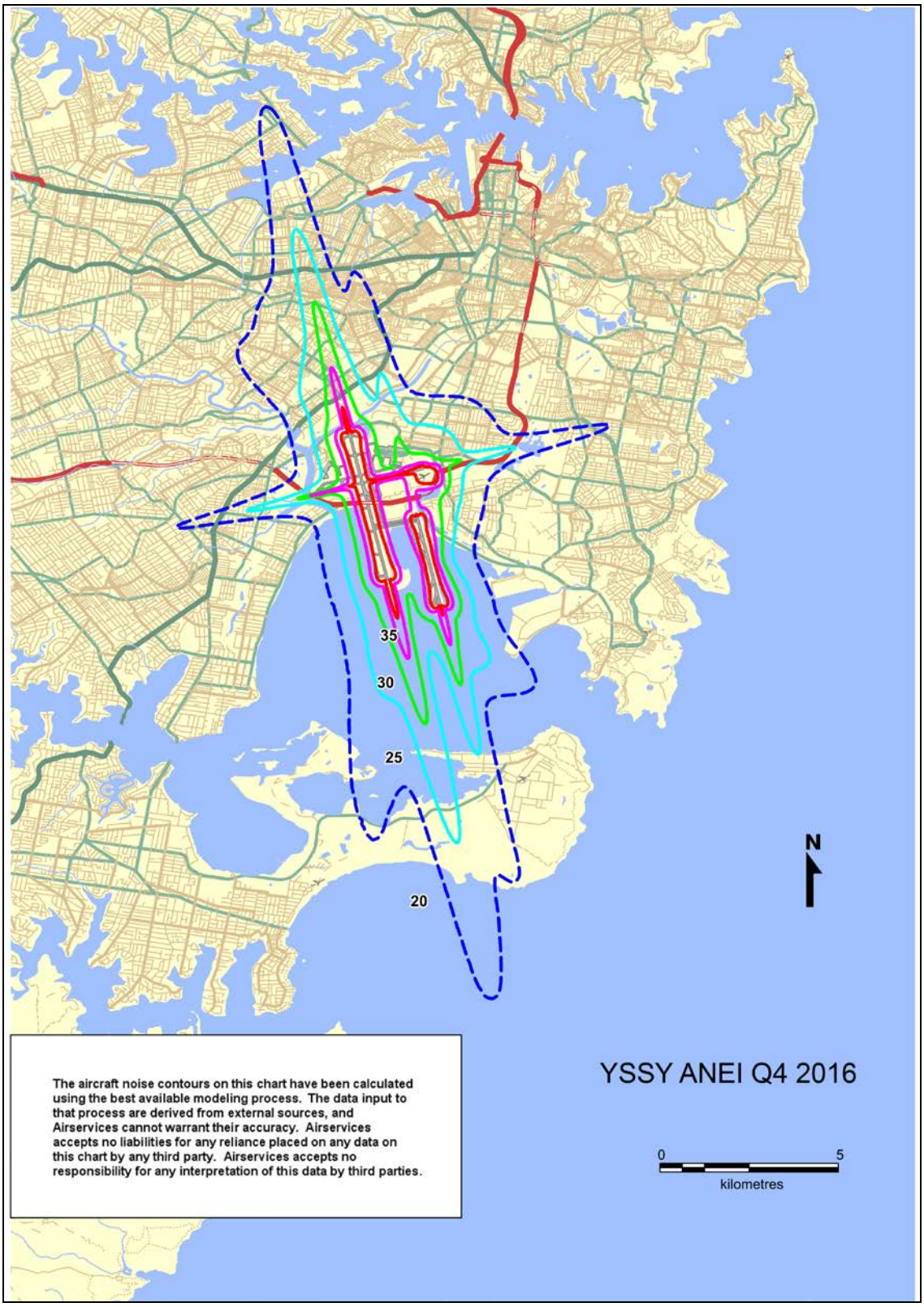
ANEI N500 Contours

Sydney Airport

1 October 2016 to 31 December 2016

The contours for ANEI N500 have been prepared using terrain data.

Sydney Airport N505 (1 October 2016 to 31 December 2016) ANEI Contours



ANEI contours modelled by INM 7.0d incorporating terrain data.

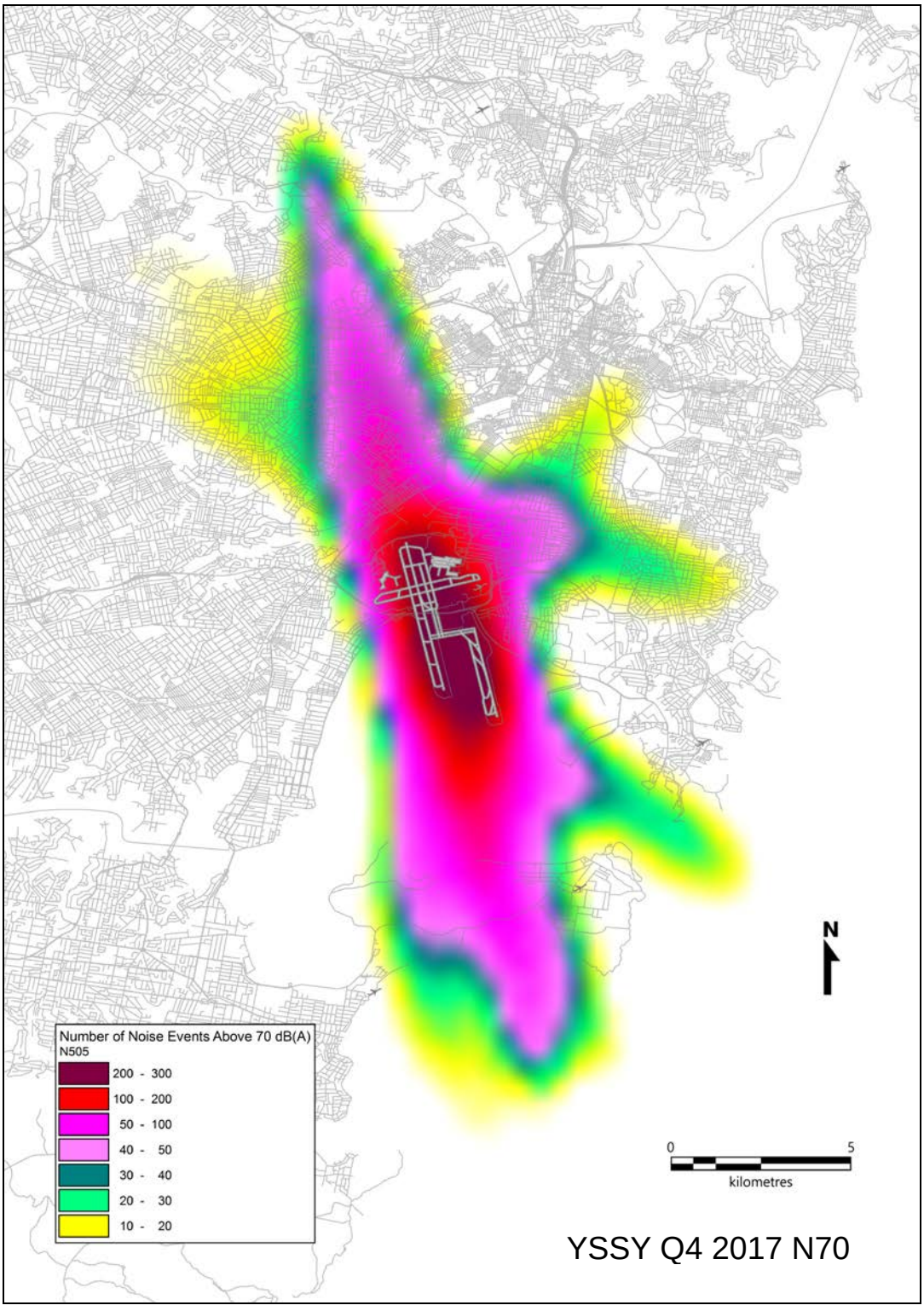
Attachment F

N505 N70 Chart

Sydney Airport

1 October 2017 to 31 December 2017

Sydney Airport N505 (1 October 2017 to 31 December 2017) N70 Chart



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