

Australian Super Hornet Annual Noise Report 2023



Endorsed by:

steve.thornton
Digitally signed
by steve.thornton
Date: 2025.05.01
11:29:26 +10'00'

Steven Thornton
Group Captain
Officer Commanding
Number 82 Wing

Approved by:

tanya.evans
Digitally signed
by tanya.evans
Date: 2025.03.31
11:59:24 +10'00'

Tanya Evans
Wing Commander
Senior Australian Defence Force Officer
RAAF Base Amberley

ADDENDUM 1

Addendum to: *Australian Super Hornet Annual Noise Report 2023*, dated 1 May 2025

Effective Date: 1 December 2025

Purpose: To correct reporting of Australian Super Hornet compliance regarding the number of average daily noise events exceeding 100 dB(A). The Addendum shows that the average number of noise events at 100 dB(A) or higher per flying day is less than 0.1 noise events, which is well below the modelled less than 5 noise events per day and requirements of the Australian Super Hornet Noise Management Plan.

Background

Annual Noise Reports are required as part of the *Environment Protection and Biodiversity Conservation Act (EPBC) 1999* approval conditions.

A review in 2025 of the Australian Super Hornet Annual Noise Reports 2021-2023 identified that the reporting of average daily noise events exceeding 100 dB(A) was inconsistent with the modelling used in the *2009 Public Environment Report (PER)*, which informed the EPBC approval conditions.

Changes:

This addendum corrects statements in the executive summary and conclusion, and two data tables in Appendix H of the Australian Super Hornet Annual Noise Report to accurately report compliance with conditions relating to noise events at 100 dB(A) or higher per flying day.

- Paragraph 4 of the report (Executive Summary) is deleted and replaced with the following text:

4. Flying of the Australian Super Hornet was within the PER modelling and the requirements of the Australian Super Hornet Noise Management Plan.

- Paragraph 43, Table Four, Paragraphs 44 and 45 of the report (N100 Noise Events) are deleted and replaced with the following text and tables:

43. The 2009 Public Environment Report (PER) forecast on average less than five events exceeding 100 dB(A) per flying day at each noise terminal. The N100 noise event data per flying day is shown in Table Four.

Table Four: N100 Noise Event Data per day from 2019 to 2023

N100 annual	Estimated events per day	2019	2020	2021	2022	2023
Willowbank Cemetery	less than 5	0.00	0.00	0.01	0.00	0.02
Kholo Gardens	less than 5	nil	nil	nil	nil	Nil
Walloon PS	less than 5	0.00	0.01	0.01	0.00	0.01
Yamanto COC	less than 5	0.02	0.07	0.03	0.04	0.05

44. Table Four shows actual daily N100 noise events at the noise terminals to be well below the estimate of 'less than 5' events per day.

A review of the LMax charts in the PER show that some terminals are relatively close to the 100 dB(A) contour and therefore noise events at a level 100 dB(A) or higher may occur, and typically under conditions favourable for noise propagation.

45. The total number of events in 2023 at a noise level 100 dB(A) or higher is shown in Table

(NEW). The data shows that there were very few noise events exceeding 100 dB(A) in 2023.

Table (NEW): N100 Noise Event Data per year from 2019 to 2023

N100 annual	2019	2020	2021	2022	2023
Willowbank Cemetery	1	1	2	1	5
Kholo Gardens	0	0	0	0	0
Walloon PS	1	2	2	1	2
Yamanto COC	5	15	7	9	11

- Paragraph 47 of the report (Conclusion) is deleted and replaced with the following text:

47. The report identifies that planned periods of respite from flying operations were achieved, with no flying over the New Year period and reduced flying over the Mid-Year period. The annual movement numbers in 2023 were below the requirements of the Australian Super Hornet Noise Management Plan.

Justification

Existing text in Paragraph 43 of the *Australian Super Hornet Annual Noise Report 2023* states 'The 2009 Public Environment Report (PER) forecast zero events at all noise terminals that would exceed 100 dB(A)'. This implies there would be no events exceeding 100 dB(A) at any of the noise terminals.

However, the figure in Annex G of the *Australian Super Hornet Annual Noise Report 2023* (page 20), shows that the minimum contour is '5 events per day' above 100 dB(A). This means in areas outside/beyond the contour, there would be 'less than 5 events per day' at a noise level 100 dB(A) or higher.

Using the data from the figure in Annex G of the report, the correct interpretation and resulting statement is:

The 2009 Public Environment Report (PER) forecast less than five events exceeding 100 dB(A) per flying day at each noise terminal.

Addendum endorsed by:

Addendum approved by:

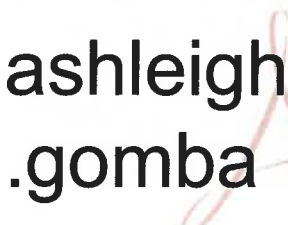
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(Steven Thornton) Group Captain Officer Commanding Number 82 Wing	(Ashleigh Gomba) Wing Commander Senior Australian Defence Force Officer RAAF Base Amberley

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DISCLAIMER

This report contains a summary of data collected over the specified period and is intended to convey the best information available from the Noise Flight Path and Monitoring System at the time. The system databases are to some extent dependent upon external sources and errors may occur. All care is taken in preparation of the report but its complete accuracy cannot be guaranteed. The Department of Defence and the Noise Flight Path and Monitoring System project contractors do not accept any legal liability for any losses arising from reliance upon data in this report which may be found to be inaccurate.

The Noise Flight Path and Monitoring System does not provide "Aircraft noise levels" as defined in Australian Standard AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction AS2021.

DEFINITIONS

Metric	Description
dB	The Sound Pressure Level (SPL) expressed on a logarithmic scale.
dB(A)	The A-weighted dB that is frequency adjusted to replicate the sound detected by the human ear.
L _{Amax}	The single event maximum A-weighted sound level reached during an aircraft movement.
L _{Amax} low value	The lowest L _{Amax} value in a range of L _{Amax} values for particular operations.
L _{Amax} high value	The highest L _{Amax} value in a range of L _{Amax} values for particular operations.
L _{Amax} average value	The arithmetical average of a range of L _{Amax} values from the L _{Amax} low value to the L _{Amax} high value for particular operations.
L _{Aeq}	The 'equivalent noise level' (L _{Aeq}) is the energy equivalent noise level measured in A-weighted decibels (dB(A)). It is a time- averaged sound level; a single-number value that expresses the time-varying sound level for the specified period as though it were a constant sound level with the same total sound energy as the time-varying level. Consequently the L _{Aeq} is the constant noise level that if continued over the sample period would have the same energy as the actual varying, measured sound level. The time period needs to be specified and can be one hour, 24 hours or the operational hours of the base.
Movement	A single take-off or a single landing carried out by an aircraft. An aircraft that conducts a single take-off followed by a single landing conducts two movements
Number Above (NA)	The NA contour for an airport represents the number of noise events occurring greater than a particular dB(A) level over a specified time period. As example, the N70 contour depicts the number of aircraft noise events above 70 dB(A) for an average day.

EXECUTIVE SUMMARY

1. The 2023 Australian Super Hornet¹ Annual Noise Report monitors Air Force's compliance with the Super Hornet Noise Management Plan, and assesses the noise measured around Royal Australian Air Force (RAAF) Base Amberley against the 2009 Public Environment Report (PER) modelling.
2. Due to changes in Defence's strategic posture, the noise and flight path monitoring system (NFPMS) has ceased receiving classified Defence radar sensor data. This has limited the ability to capture and present Australian Super Hornet (ASH) flying operations in relation to the noise generated. Defence has engaged a new contractor using spectral analysis to identify platforms by their noise signature. This mitigates part of the lost data by allowing aircraft type to be matched to detected noise but does not provide for flight path tracking.
3. Enumeration of military fast jet movements were made through the analysis of data processed by the NFPMS. In 2023, 6136 Australian Super Hornet movements were identified compared to a forecast of 7700 movements from the Australian Super Hornet Noise Management Plan version 4.0. All military fast jet movements in 2023 were conducted on Runway 15/33. There were no fast jet operations on the secondary runway 04/22.
4. Flying of the Australian Super Hornet was generally within the PER modelling and the requirements of the Australian Super Hornet Noise Management Plan. Of most significance was the recording of N100 'Noise Above' measurements at greater numbers than those modelled at the Willowbank, Walloon and Yamanto measuring sites.

¹ For the purposes of this report, 'Super Hornet' includes both the F/A-18F and EA-18G (Growler), unless otherwise specified.

BACKGROUND

5. The Australian Government announced in March 2007, the acquisition of 24 F/A-18F Super Hornets to replace the F-111 capability at RAAF Base Amberley.
6. In accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* a Public Environment Report (commonly referred to as PER) was completed in December 2009. The Public Environment Report addressed potential environmental impacts resulting from Australian Super Hornet flying operations at RAAF Base Amberley.
7. In March 2010 the Minister for Environment Protection, Heritage and the Arts (the Environment Minister) approved Australian Super Hornet flying operations at Amberley subject to ten conditions, which was later varied to nine conditions in 2014. Condition 1 required the RAAF to submit an Australian Super Hornet Noise Management Plan for approval by the Environment Minister.
8. Condition 2 required the Air Force to produce a Noise Monitoring and Complaints Handling Strategy which resulted in the installation of a NFPMS at RAAF Base Amberley. The purpose of the NFPMS at RAAF Base Amberley was to:
 - a. Identify noise emissions associated with all military aircraft operations at the Base
 - b. Assist Defence to manage aircraft noise exposure over land in the vicinity of the Base
 - c. Provide information on aircraft noise emissions to the public in a format that is easy to read and understand.
9. The Noise Monitoring and Complaints Handling Strategy required the drafting of an Annual Australian Super Hornet noise report that compared the NFPMS quarterly reports with the Australian Super Hornet Noise Management Plan. The reason for the report was to evaluate the accuracy of the noise modelling undertaken for the Public Environment Report and monitor compliance with the Australian Super Hornet Noise Management Plan. It was also to provide a tool to assist Defence in managing aircraft noise exposure in the vicinity of RAAF Base Amberley.
10. In November 2020 an updated Noise Management Plan version 4.0 was published. This plan incorporated Australian Super Hornet noise management lessons identified over the period 2010 to 2020 as reflected in previous annual noise reports. This plan forecast 7700 annual Australian Super Hornet movements and forecast up to 960 additional movements by visiting military fast jets.
11. In 2016, updated noise modelling was conducted at RAAF Base Amberley in support of the 2029 Australian Noise Exposure Forecast process. All aircraft types operating from RAAF Base Amberley were incorporated.
12. From February 2017, 12 EA-18G Growler aircraft have operated from RAAF Base Amberley, alongside the 24 F/A-18F Super Hornet aircraft. The EA-18G Growler is a derivative of the F/A-18F Super Hornet and shares the same overall airframe design and uses the same engines.

PURPOSE

13. The purpose of the Annual Australian Super Hornet Noise Report is to evaluate the impacts of Australian Super Hornet noise against the noise modelling undertaken for the 2009 Public Environment Report and the Australian Super Hornet Noise Management Plan. This report provides an opportunity to report publicly on the noise impacts of Australian Super Hornet Flying Operations at RAAF Base Amberley.

IDENTIFICATION OF AUSTRALIAN SUPER HORNET FLIGHT PATH DATA AND CALCULATION OF MOVEMENTS

14. The NFPMS consists of Noise Monitoring Terminals (NMT) located strategically around RAAF Base Amberley. In 2023, NMTs measured aircraft noise at Willowbank, Kholo Gardens and Walloon. A fourth NMT sited at Yamanto measured aircraft noise until October 2023, when it was removed due to the redevelopment of the site. Noise spectral analysis is applied to recorded noise to identify an aircraft's type by its noise signature. The NFPMS does not currently monitor flight paths.

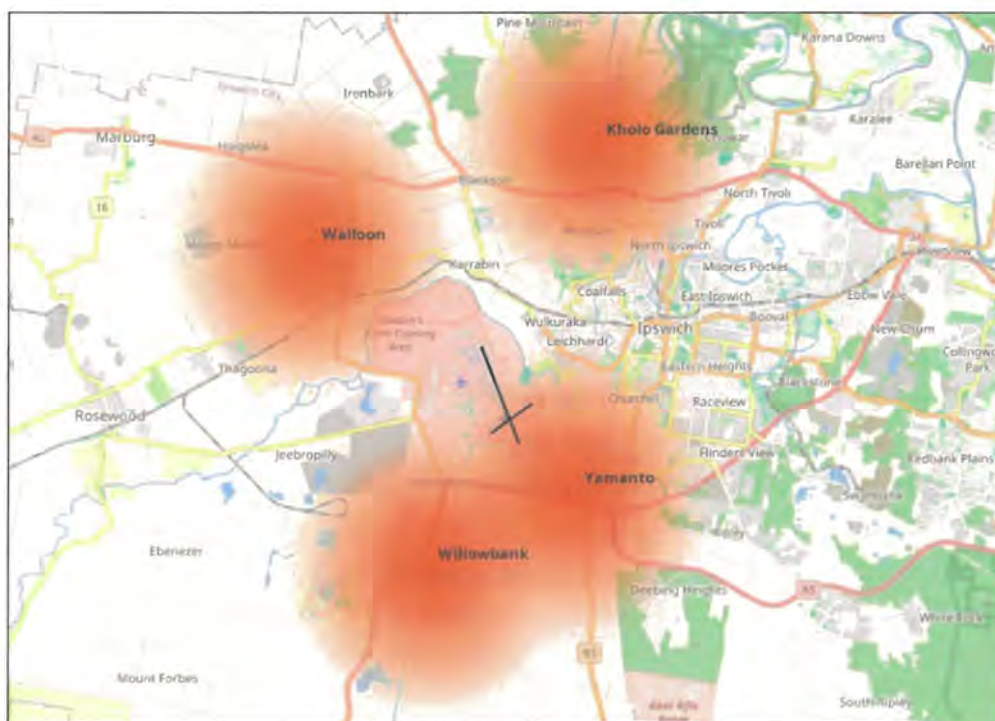


Figure One: Noise Monitoring Terminal Locations

LIMITATIONS IN FLIGHT DATA AVAILABILITY

15. Accurate determination of Australian Super Hornet movements remains limited due to the classification of Defence radar sensor data. The current NFPMS presents limited information for military flying operations and does not contain flight tracks for Australian Super Hornet aircraft.

AMBERLEY RUNWAY ORIENTATION AND USE

16. Figure Two shows the runway orientation at RAAF Base Amberley.

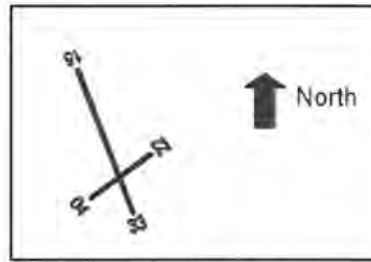


Figure Two: RAAF Base Amberley Runway Orientation

17. Australian Super Hornet operations are conducted on Runway 15/33. Runway 04/22 is only used in exceptional circumstances, such as in an emergency, or when Runway 15/33 is obstructed. Table One shows that in 2023, Australian Super Hornet operations utilised runways 15/33, with no operations detected on runways 04/22.

Table One: Total Movements per Runway in 2023

	Arrivals	Departures	Circuits	Total	Usage %
RWY 33	1406	1624	120	3150	51%
RWY 15	1560	1375	51	2986	49%
RWY 22	0	0	0	0	0%
RWY 04	0	0	0	0	0%
TOTAL	2966	2999	171	6136	100%

DEPARTURE PATHS

18. Standard Australian Super Hornet departure flight paths flown in 2023 are illustrated in Annex A. Air Traffic procedures are published in the Flight Information Handbook Australia (FIHA) AD2 Supplement Amberley.

19. **Turn to the right after take-off runway 33.** The Noise Management Plan requires that departures from runway 33 to training airspace to the west, south and south east of Amberley turn to the west (left turn) to gain altitude before departing to the training airspace. Departures to the training airspace in the north east and east can turn right for departure after reaching the 11.1 kilometre point on runway heading.

20. **Early turns after take-off runway 33.** The Noise Management Plan requires departures off runway 33 to maintain runway heading (no turn) until reaching 7.4 kilometres (4 nautical miles) to gain altitude before departing to the training airspace.

21. **Turn to the left after take-off runway 15.** The Noise Management Plan requires that departures off runway 15 turn to the west (right turn) to gain altitude before departing to the training airspace.

ARRIVAL PATHS

22. Planned Australian Super Hornet arrival flight paths are illustrated in Annexes B to D. In 2023, 86 percent of arrivals were by the Initial and Pitch procedure, which compares with an estimate of 80 percent in the 2009 Public Environment Report and a revised estimate of 70 percent in the Version 4 of the Noise Management Plan. Initial and pitch procedures are the preferred flight paths in periods of clear visibility as they provide the most efficient and safe mechanism of recovery. The alternative approach types (visual or instrument approaches) have the potential to offer some communities an increased noise impact as aircraft approaches are longer, and more time is spent flying at lower speeds.

23. The decision as to what type of approach is flown is based on a number of factors, including but not limited to weather conditions of the day, training requirements of the aircrew and/or ATC involved in the sortie, the serviceability status of the airfield's instrument approach aids and the operational requirements of the sortie. In 2022 63% of arrivals were via the initial and pitch method, and 86% is an improvement in this area.

ALTITUDE LIMITATIONS

24. The Noise Management Plan limits Australian Super Hornet aircraft to not flying below 450 metres (1,500 ft) within 18.5 kilometres (10 nautical miles) of RAAF Base Amberley, except when landing, taking off or in the circuit.

TRANSIT ROUTES

25. The transit route for Australian Super Hornet to the eastern training areas minimises the noise impact on the civilian population of Brisbane. Most transits to and from all areas are conducted above 15,000 ft above mean sea-level with transit below this level only conducted if instructed by ATC.

ENGINE RUNS

26. The Noise Management Plan limits Super Hornet routine flight-line engine runs to 80% power for a maximum of 60 minutes duration each, between 07:00am and 10:00pm. Outside of these hours routine flight-line engine runs must only occur for urgent operational outcomes. This requirement is promulgated in 82WG SI (LOG) 03-19 Aircraft Engine Ground Run Page 5, para 22 (L3361914) which refers to AMB SI (OPS) 05-04 Airfield Ground Operations (L3581575) for stipulated curfew timings.

27. The Noise Management Plan limits Australian Super Hornet high power engine runs at the Engine Test Cell 3 (ETC-3). High power engine runs involve the running of engines at an average of 95% power for up to 30 minutes. This practice is limited to:

- a. a maximum of ten events per year unless approved by Senior Australian Defence Force Officer (SADFO) Amberley as a foreseeable variation, and
- b. high power engine runs will not take place between 10:00 pm and 7:00 am.

28. During 2023, 11 high power engine test events occurred between the above hours, and nil high engine-running test events occurred outside of the above hours.

NUMBER AND TIMING OF AUSTRALIAN SUPER HORNET MOVEMENTS

29. In general, Australian Super Hornet operations occur on weekdays, with night flying when scheduled, typically occurring on Monday to Thursday nights. Flying is forecast to occur

over 46 weeks of the year with operations planned between 07:00am and 11:00pm, with no practice circuits flown after 10:00pm. Weekend flying day or night, can occur in circumstances detailed in the Variations sections of the Noise Management Plan. Normally this is associated with operational requirements or events of public significance such as ANZAC day flypasts.

30. A 'movement' is a single take-off or landing by a single aircraft, hence one aircraft departing from and then returning to the airfield will generate two movements. Circuits conducted are counted as two movements.

31. The Noise Management Plan forecasts 7700 Australian Super Hornet movements from RAAF Base Amberley in 2023. A total of 6136 Australian Super Hornet movements were identified by the NFPMS equating to flying less than the forecast total by 20 percent. A 'normal flying day' is the forecast annual movements divided across 230 flying days. (46 weeks of flying, with five flying days per week). Table Two displays the forecast flights per day compared to the actual.

Table Two: Australian Super Hornet Annual Movement Data

	2019	2020	2021	2022	2023
ASH Movement forecast	6478	6478	7700	7700	7700
ASH movements	6039	5863	6821	6551	6136
Percentage of ASH movement forecast	89%	87%	89%	85%	80%
Projected Average Day movements	28	28	33	33	33
Actual Average Day movements	26.3	25.5	29.7	28.5	26.7
Actual Average Day Standard Deviation	14.6	11.3	7.1	13.4	18.2

RESPITE FROM FLYING OPERATIONS

32. The Noise Management Plan forecasts that Australian Super Hornet operations would occur over 46 weeks of the year. Except as allowed by the approved variations specified in the plan, flying was planned to occur on weekdays with no night flying intended on Friday nights. In 2023 there were three weeks identified with no Australian Super Hornet movements over the New Year period, and a further 4 weeks with less than 50 movements over the Mid-Year period. Figure Seven shows Australian Super Hornet movements by week in 2023.

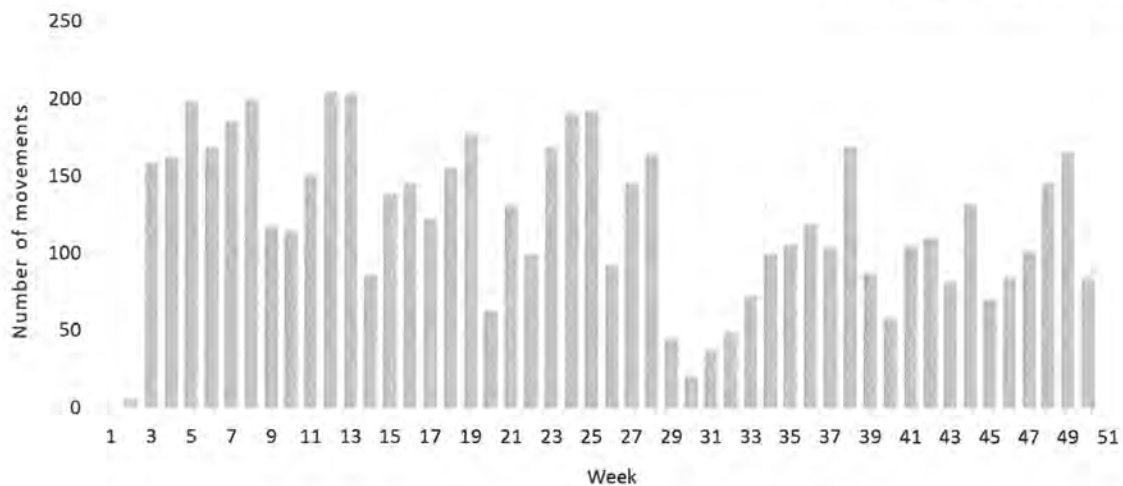


Figure Seven: Australian Super Hornet Movements by Week

33. The Noise Management Plan forecast that flying operations would occur on weekdays, except as allowed in the Variations section of the plan. In 2023 there were a total of 41 movements identified by the NFPMS on Saturdays, and 18 on Sundays. All weekend movements were approved in accordance with the Amberley Base Aircraft Noise Management Plan and promulgated on the approved base flying program. Movements by day are shown in Figure Eight.

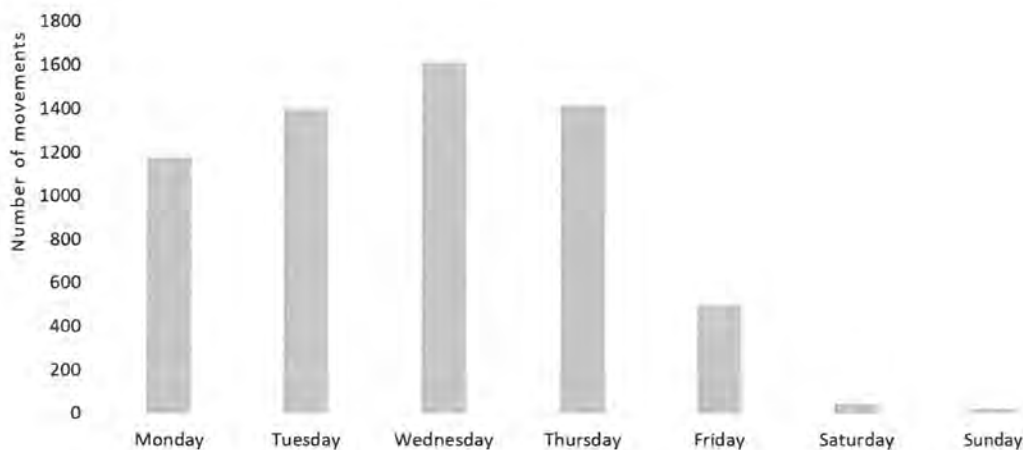


Figure Eight: Australian Super Hornet Movements by Day

34. The Noise Management Plan forecast that all operations would occur between 07:00am and 11:00pm, with no practice circuits flown after 10:00pm. Additionally it was forecast in the 2009 Public Environment Report that 20 percent of movements would occur between 7:00pm and 11:00pm. In 2023, there were no movements identified operating outside the planned flying period, and movements after 7:00pm were 4.7% compared to the 20% forecast. There were no circuits flown after 10:00pm in 2023.

35. The Noise Management Plan states that Australian Super Hornet night flying (activity between 7pm and 7am), when scheduled, will typically occur on Monday to Thursday night.

In 2023 there were 3 arrival movements of Australian Super Hornets re-deploying from an exercise on a Friday evening.

EVALUATION OF AUSTRALIAN SUPER HORNET NOISE IMPACT

36. Noise Contour Maps were produced to show geographical boundaries for the specified numbers of movements per average flying day, that are expected to exceed a nominated noise threshold in decibels (dB). The number above metric represents these impacts, though predicting the number of times aircraft noise (all platforms) may reach a nominated decibel level on an average flying day. Maps for N70, N85 and N100 are in Annexes E through G.

37. The Noise Management Plan version 4.0 increased the forecast annual Australian Super Hornet movements in 2021 from 6478 to 7700. Analysis determined that the modelling conducted in 2009 was pessimistic in relation to the actual aircraft movements required. This facilitated an increase to forecast maximum aircraft movement rate whilst remaining within the noise impact footprint modelled in 2009.

N70 AND N85 NOISE EVENTS

38. N70 and N85 noise event data per forecast flying day² for the four noise monitoring terminals from 2019 to 2023 is shown at Table Three³. Annual noise event results below the minimum forecast are shown in green font and event counts above are in red font.

39. Note one: the noise monitor at Yamanto ceased monitoring operations in October 2023, pending relocation to a new site in 2024, therefore reducing the sample size of recorded noise events in 2023.

40. Note two: the NFPMS contractor changed at the beginning of 2023. This included replacing the noise monitoring hardware at the monitoring locations.

41. Note three: The method of aligning aircraft with detected noise has changed. Direct radar input was replaced by detecting aircraft type by their noise signature.

Table Three: N70 and N85 Noise Event Data from 2019 to 2023

N70	Estimated events per day	2019	2020	2021	2022	2023
Willowbank Cemetery	15 to less than 20	10.9	10.5	12.6	12.5	5.5
Kholo Gardens	5 to less than 10	0.6	0.2	0.2	0.5	1.6
Walloon	15 to less than 20	3.9	3.9	4.4	5.1	5.8
Yamanto	15 to less than 20	15.6	18.1	20.1	19.7	11.1
N85	Estimated events per day	2019	2020	2021	2022	2023
Willowbank Cemetery	less than 5	1.6	1.6	1.7	2.1	1.5
Kholo Gardens	less than 5	0	0	0	0.01	0.0
Walloon	less than 5	0.4	0.3	0.4	0.3	0.5
Yamanto	10 to less than 15	5.7	6.3	7.6	8	5.6

² Total annual noise events divided by 230 flying days (46 weeks at 5 days a week)

³ An event that exceeds 85 dB will also be counted as a 70dB exceedance; i.e. N85 exceedances are a subset of N70 exceedances

42. Analysis of Table Three identifies the following observations:
- a. The N70 and N85 events before 2020 and after 2021 display the changes in the number of Australian Super Hornet Movements per day.
 - b. N70 and N85 events at Willowbank, Kholo Gardens and Walloon are within or below the minimum of the forecast range in every year.
 - c. The N70 events at Yamanto trend towards the maximum estimate per day.

N100 NOISE EVENTS

43. The 2009 Public Environment Report forecast zero events at all noise terminals that would exceed 100dB. Actual noise monitoring has found this forecast to be incorrect. Table Four shows annual total⁴ N100 noise events for each monitoring terminal location.

Table Four: N100 Noise Events Data from 2019 to 2023

N100	Estimate (per day)	TOTAL	2019	2020	2021	2022	2023
Willowbank Cemetery	0	Event Count / peak dB(A)	1 / 100.5	1 / 100.6	2 / 100.9	0 / 100.9	5 / 102.4
Kholo Gardens	0		0 / 84.3	0 / 83.7	0 / 84.8	0 / 84.8	0 / 88.2
Walloon	0		1 / 101.0	2 / 101.7	2 / 105.7	0 / 105.7	2 / 105.6
Yamanto	0		5 / 103.0	15 / 103.3	7 / 101.3	9 / 101.8	11 / 106.8

44. Analysis of Table Four shows;
- a. Willowbank, Walloon and Yamanto all experience more N100 events than forecast.
 - b. Kholo Gardens N100 events are within the forecasted number of events.
 - c. Walloon and Yamanto have peak sound pressure levels noticeably higher than the 100dB(A) threshold for a N100 event.
45. The PER and noise modelling underestimated the N100 noise impacts of the Australian Super Hornet. The historical data given in this report shows that N100 events at Willowbank Cemetery, Walloon and Yamanto are consistently greater than modelled.

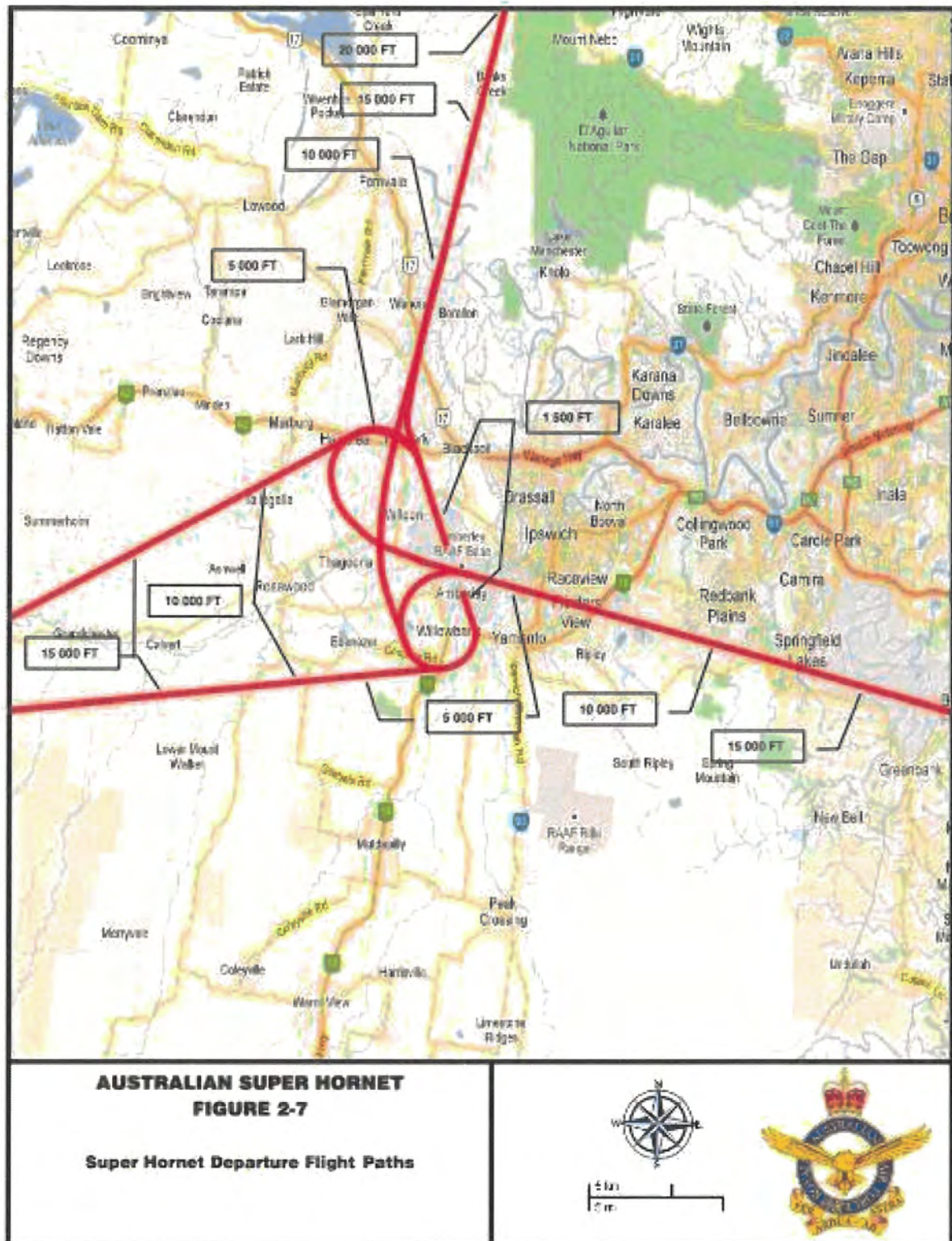
CONCLUSION

46. The 2023 Australian Super Hornet Annual Noise Report evaluated the impacts of Australian Super Hornet noise against the Australian Super Hornet Noise Management Plan and noise exposure modelling undertaken as part of the 2009 Public Environment Report process. Data was drawn from the NFPMS installed at RAAF Base Amberley. Changes in data availability to the NFPMS has limited its ability to measure flight paths, and impacted on the ability to publically display Australian Super Hornet flight paths.

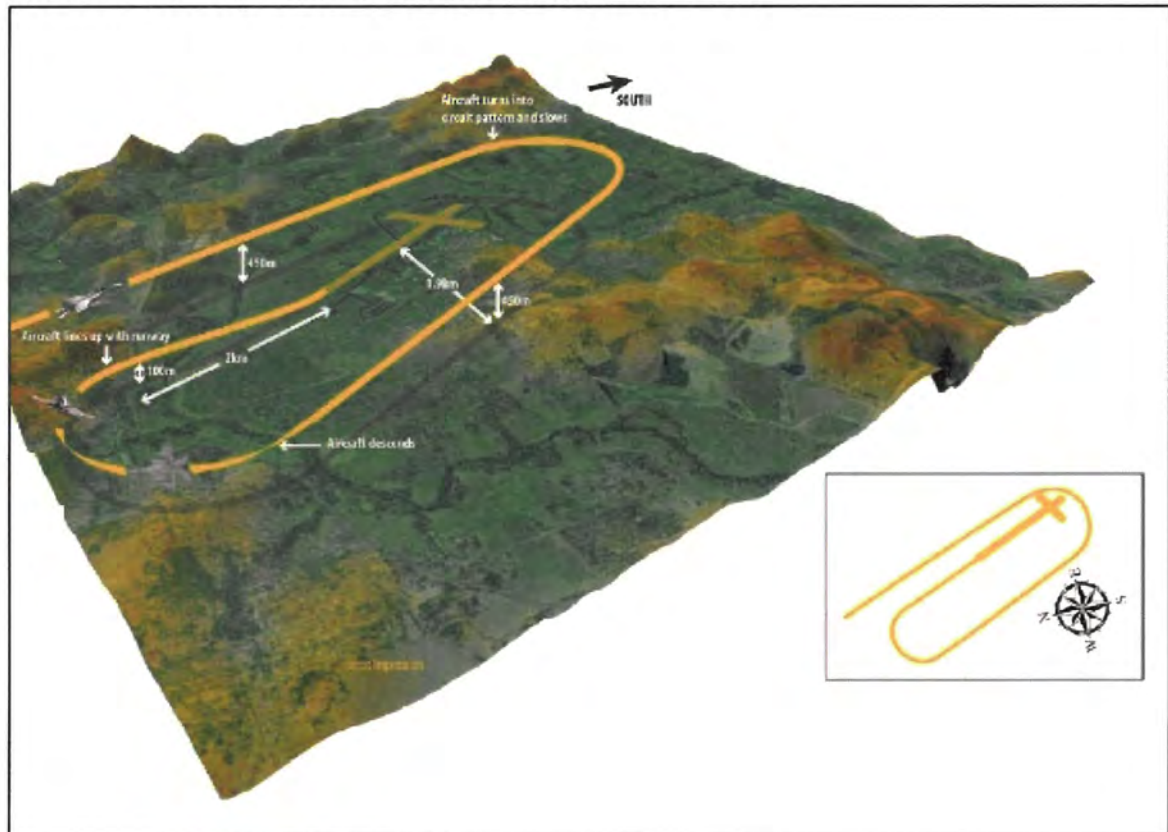
^{*} Total events for the calendar year – not average day data events as shown in Table Two

47. The report identifies that planned periods of respite from flying operations were achieved, with no flying over the New Year period and reduced flying over the Mid-Year period. The annual movement numbers in 2023 were below the requirements of the Australian Super Hornet Noise Management Plan. Most significantly, the NFPMS recorded N100 events continued to exceed the number of annual events modelled in the original 2009 Public Environment Report at the Willowbank, Walloon and Yamanto sites.

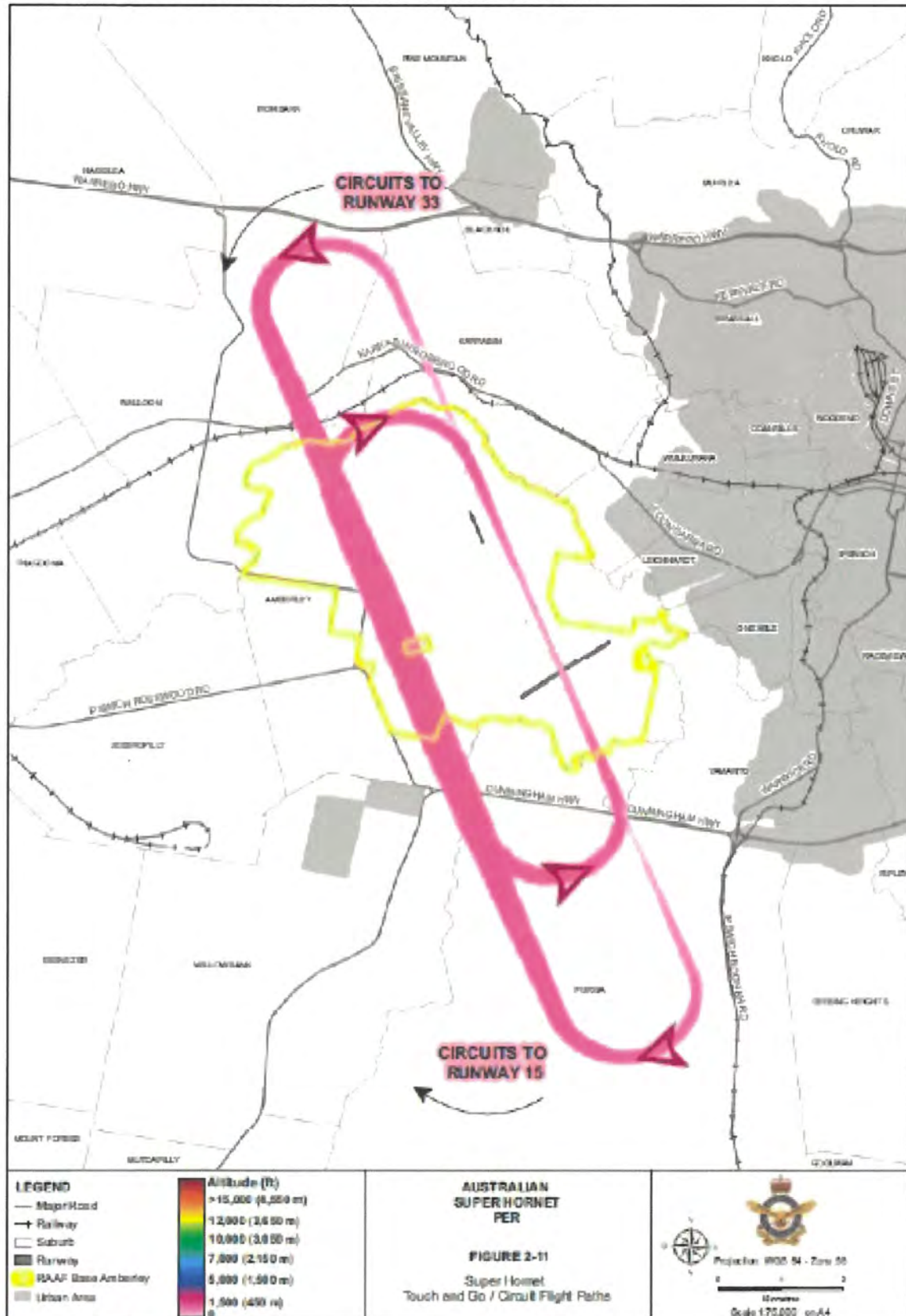
ANNEX A – AUSTRALIAN SUPER HORNET DEPARTURE FLIGHT PATHS



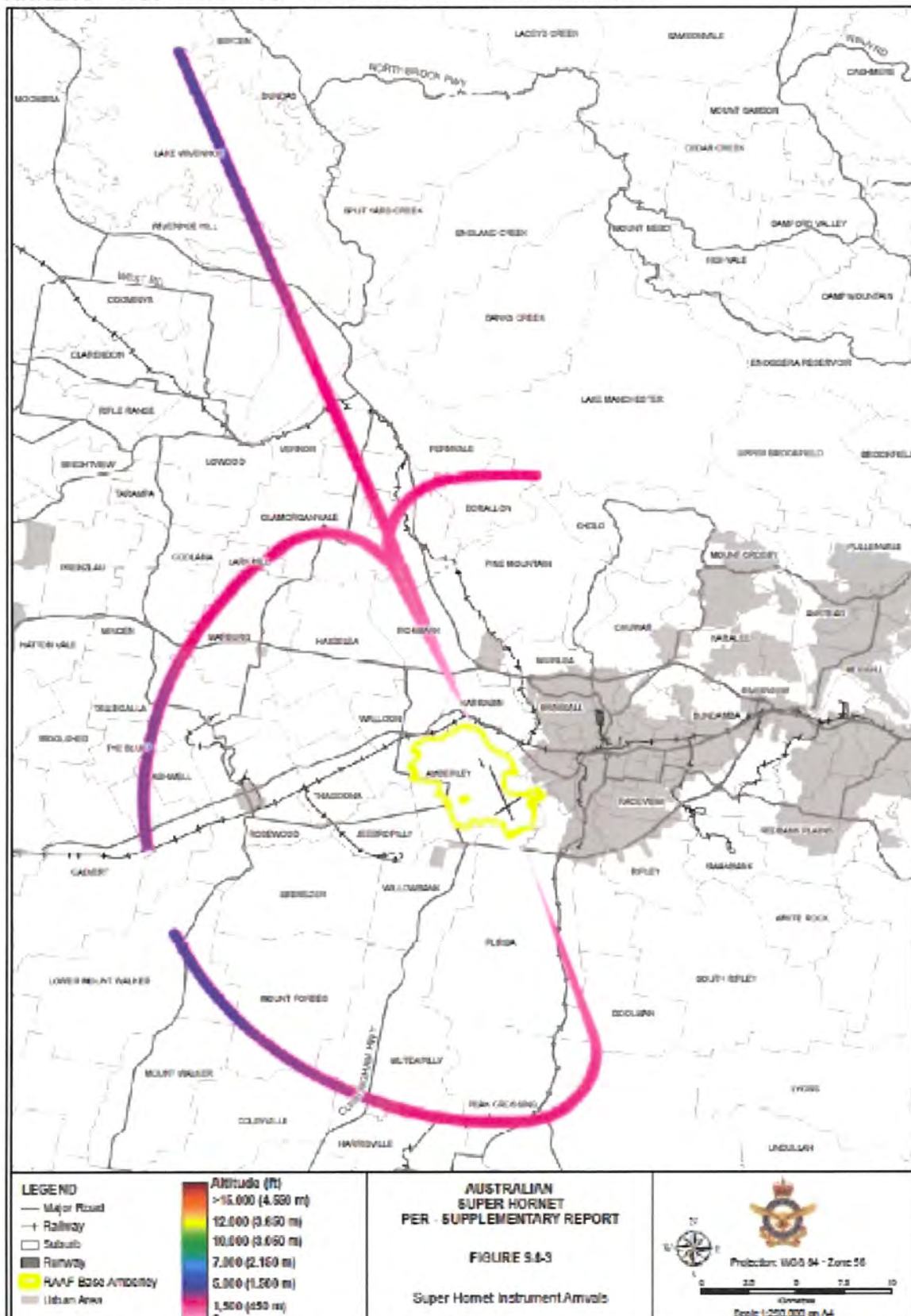
ANNEX B – AUSTRALIAN SUPER HORNET INITIAL AND PITCH

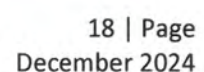


ANNEX C – AUSTRALIAN SUPER HORNET CIRCUIT PATTERN

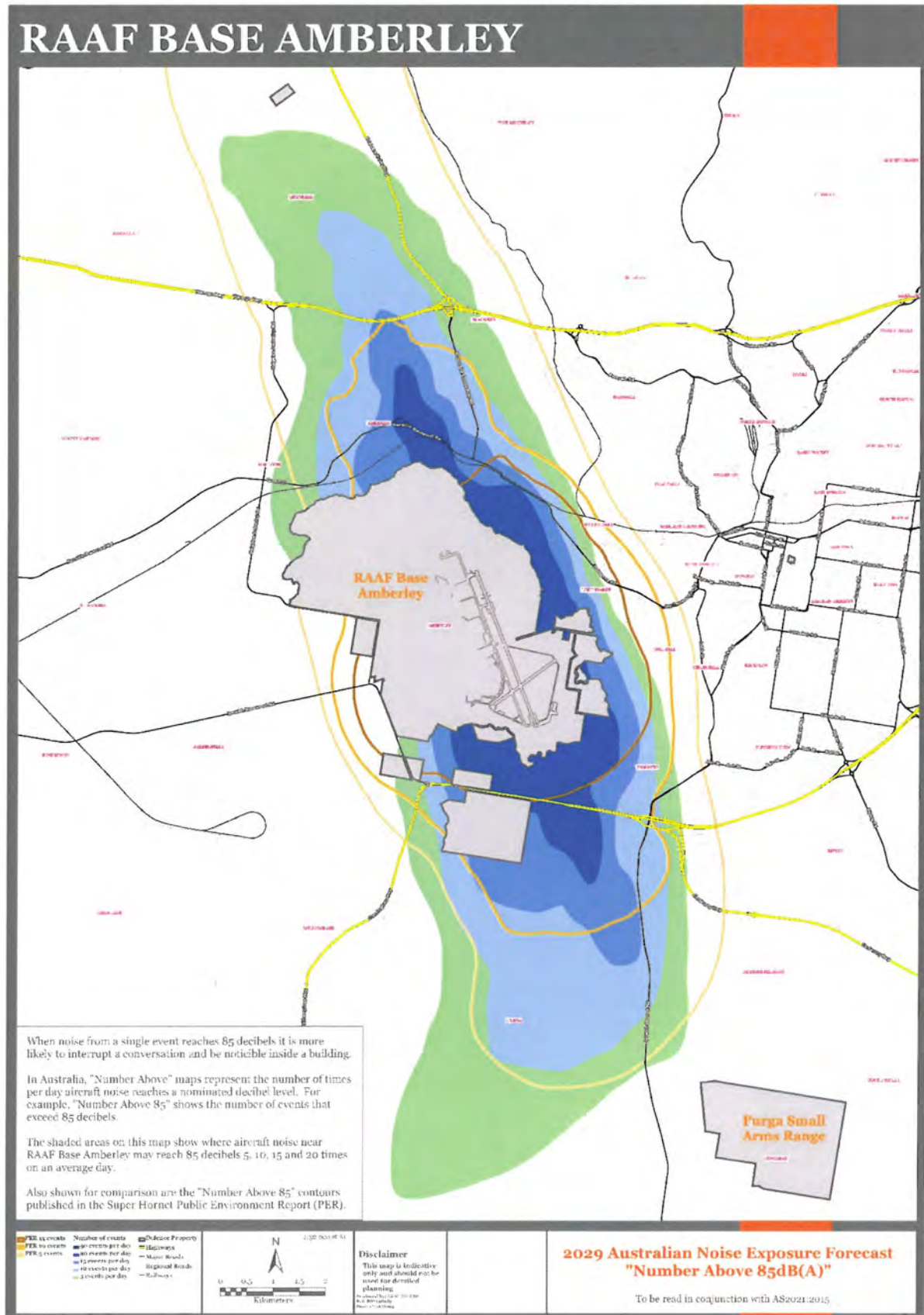


ANNEX D – AUSTRALIAN SUPER HORNET INSTRUMENT ARRIVALS





ANNEX F THREE: NUMBER ABOVE 85 dB (A) MAP, RAAF BASE AMBERLEY, 2029 ANEF



ANNEX G: NUMBER ABOVE 100 DB (A) MAP, RAAF BASE AMBERLEY, 2029 ANEF

