Short Term Noise Monitoring Program, *Northgate*

16 March 2022 – 15 May 2024

Version Control

Version	Date	Comments	Sections
1.0	11 July 2024	Initial Version	All

Summary

Deployment Purpose

This deployment aims to capture noise levels of turboprop aircraft departing off runway 19R during a trial to perform full length runway departures off the NPR.

Deployment monitoring Period

16 March 2022 – 15 May 2024

Monitoring Details

Capture zone: 2.5km radius x 8,202ft (2,500m) altitude.

Noise threshold settings by time of day: 00:00-05:59 = Threshold 53dB(A), 06:00-18:59 = Threshold 59dB(A), 19:00-23:59 = Threshold 53dB(A)

Key Findings

- Noise Correlation

  80.5% of the aircraft from Brisbane Airport, as per the focus group, generated noise events that correlated to the aircraft.

- Noise Daily Distribution

  The distribution of the maximum noise levels generated by aircraft falls within the following ranges:

  - 87.9% within the range of 60dB(A) to 70dB(A)
  - 8.6% within 70dB(A) to 75dB(A)
  - 1.1% exceeds 75dB(A).
  - 3.5% below 60dB(A).

- Most Common aircraft

  The most prevalent aircraft type during the deployment period was the DH8D aircraft.

- Top loudest noise events

  The top 10 noise events for this deployment originated from aircraft and community sources. Additionally, the top 10 correlated noise events were associated with community sources in addition to aircraft noise.

- Busiest Day

  The purpose was to analyze the day that had the most significant impact on the community. All aircraft busiest day during the deployment period occurred on 1 January 2024. Focus group busiest day during the deployment period occurred on 18 October 2023

Glossary of Terms

A	Arrivals
Background noise Level (L90)	The noise level in dB(A) that is exceeded 90% of the time. It is considered the background noise level of an environment.
Capture Zone	The region relative to the noise monitor that an aircraft can be within and be able to be correlated to a noise event.
Correlated Noise Event (CNE)	A noise event matched to an aircraft movement that flew through the capture zone.
D	Departures
Data Availability	The degree of data completeness achieved during the deployment period. The data availability percentage factors in any monitor outages that occur.
Day	6:00am-10:00pm
dB(A)	A-weighted decibel. It is an expression of the relative loudness of sounds as perceived by the human ear.
General Aviation	Movements other than scheduled commercial airline operations. This includes private, sports, charter and training operations.
LaMax	Each noise event will have a peak noise level which is referred to as the maximum sound level in dB(A) or LaMax
Movement	An aircraft operation, such as an arrival or departure
Night	10:00 pm to 6:00 am
NMT	Noise Monitoring Terminal also referred to as the noise monitor.
Noise Event	A noise event is created when the noise level exceeds the threshold settings for a specified period.
O	Overflight i.e. an aircraft movement that flew over the area but did not arrive or depart from the airport of concern.
Overall Correlation Percentage	The total number of correlated noise events (CNE) is divided by the total number of aircraft movements through the capture zone to calculate the overall correlation percentage.
RWY	Runway
T	An operation by an aircraft that arrives and departs on a runway without stopping or exiting the runway. It is also known as Touch and Go.
Threshold	The threshold represents the value that the noise level must surpass for a specified period to create a noise event.
YBBN	Brisbane Airport, Queensland

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1 Purpose

The short-term noise monitoring program targets locations in suburbs chosen by Airservices Australia with consideration for community feedback. This deployment aimed to capture noise levels of turboprop aircraft departing from runway 19R during a trial to perform full length runway departures off the NPR. Furthermore, we conducted an extensive analysis on a selected day, specifically the busiest day of the deployment period. This day was chosen for its potential to provide significant statistical data and insight into a day that had the greatest impact on the community during the deployment. The analysis provided details of the loudest noise events experienced and the most prevalent aircraft operations observed.

To adequately depict the variation in flight paths, weather conditions, and operational patterns from Brisbane Airport movements during the trial, a monitoring period from 16 March 2022 to 24 February 2023 was deemed sufficient. However, the monitor remained in place until 15 May 2024 as part of the ongoing short term monitoring program.

This short-term monitor was deployed in Northgate, QLD. The noise monitoring terminal (NMT) was positioned to capture aircraft within a three-dimensional cylinder capture zone. The zone spans a radius of 2.5km and extends to 8,202ft (2,500m) above the NMT site level as depicted in Figure 1. Considering that the focus group of aircraft operate below 5,000ft (1,524m), a ceiling of 8,202 (2,500m) was adopted to accommodate potential variations.

The Focus Group for this deployment consists of aircraft departing from southern runway ends of Brisbane Airport, specifically:

- Fixed-wing turboprop aircraft departing from runway 19R of YBBN.

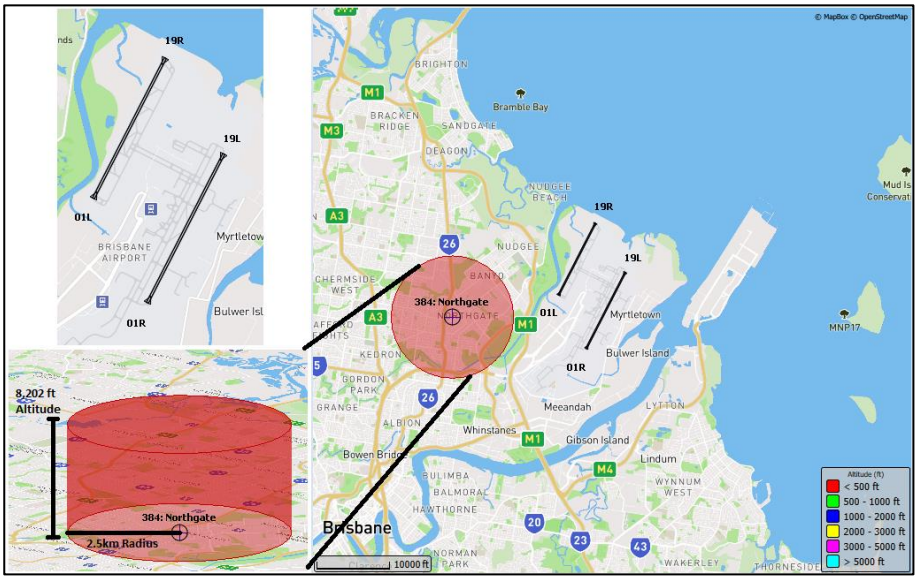

Figure 1: NMT Correlation Zone

2 Deployment Details

The Northgate monitor was installed on 15 March 2022 and removed on 16 May 2024. Complete data is available from 16 March 2022 to 15 May 2024.

NMT ID	384
Deployment Period	16/03/2022 – 15/05/2024
Location	Flower St Northgate, QLD 4013
NMT Altitude	66ft (20m)
Capture Zone	2.5km radius x 8,202ft (2,500m) altitude
Data Availability	99.9%
Threshold Settings[1]	The noise detection thresholds which have been selected: • 00:00-05:59 = Threshold 53dB(A) • 06:00-18:59 = Threshold 59dB(A) • 19:00-23:59 = Threshold 53dB(A)

Table 1: NMT Details

3 Findings

3.1. Noise Correlation Summary

The total number of aircraft correlated noise events (CNEs) that were captured by the noise monitor during the 26-month deployment period is shown in Table 2 below.

	All Movements[2]	**Brisbane Airport Movements**	**Brisbane Airport Focus Group**
Number of Movements through capture zone	21,439	20,734	17,613
Number of CNE	16,268	16,132	14,190
Correlation Summary	75.8%	77.8%	80.5%

Table 2: Aircraft correlation rate

96.7% of all operations that passed through the capture zone were Brisbane Airport movements. A one-week sample of these movements is shown in Figure 2, below. Other operations included traffic from other airports, such as Amberley, Archerfield, and Wellcamp Airports. A correlation of 80.5% was achieved for the focus group of Brisbane Airport movements.

[1] Threshold setting procedures are explained in section 6.1.1.
[2] All-movement tab accounts for operations to and from other airports (E.g. Amberley, Archerfield and Wellcamp) as well as YBBN operations.

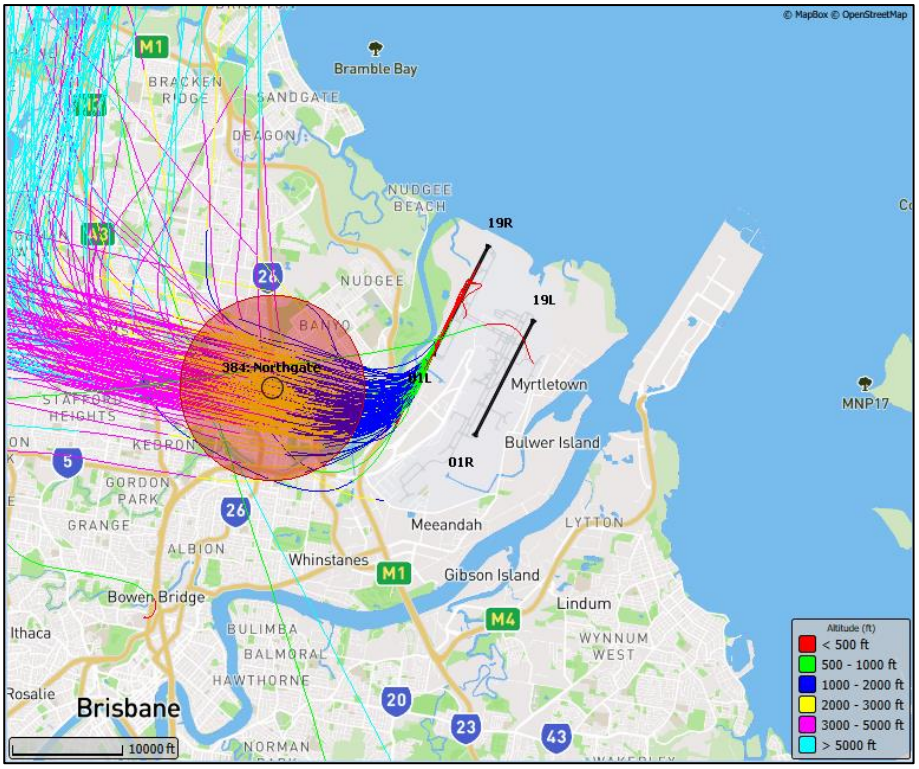

Figure 2: One week of Brisbane Airport flight tracks passing through the correlation zone

The findings obtained during the short-term deployment at Northgate are as follows:

- Departure runway 19R and 19L accounted for 92% and 4% of the operations respectively from Brisbane Airport over the noise monitor.
- Arrival runway 01L and 01R account for 0.8% and 0.1% of the operations respectively from Brisbane Airport over the noise monitor.
- The average LaMax and highest LaMax for arrival and departure runways are detailed in Table 3, below.

Operation Type	Runway	Average LaMax noise dB(A)	Highest LaMax dB(A)
Brisbane Airport Departure	19R	67.5	87.0
Brisbane Airport Arrival	01L	69.2	76.8
Brisbane Airport Departure	19L	63.1	74.9
Brisbane Airport Arrival	01R	68.4	73.0

Table 3: Average LaMax and highest LaMax noise levels corresponding to each runway.

3.2. Daily Distribution of Correlated Noise Events

A summary of the total number of correlated noise events by time of day, and the minimum to maximum number of CNE on any day, are summarized below in Table 4.

Correlated Noise Event (CNE)	Day Time Count (6:00am-10:00pm)	Night-time Count (10:00pm-6:00am)	Min number of CNE per day	Max number of CNE per day
N- Above[3] 50 dB(A) (N50+[4])	15,505	803	1	82
N- Above 60 dB(A) (N60+[4])	15,396	521	0	82
N- Above 70 dB(A) (N70+[4])	1,578	49	0	45

Table 4: Total correlated noise events during deployment period by time

Examination of the N-above distribution values in Figure 3 and Figure 4 (below) show that the highest daytime noise levels (N70+) were recorded on 1 January 2024, and nighttime distribution peaks were observed on 3 July 2022 and 12 March 2024. 87.9% of the maximum noise level generated by aircraft falls within a range of 60dB(A) to 70dB(A), with only 1.1% exceeding 75dB(A).

[3] N-above (or Number-above) is defined as the number of noise event with a LaMax above the specified (eg.N50+) value.
[4] N50+, N60+, N70+ are expressed as number of noise events with a LaMax above 50dB(A), 60 dB(A) and 70 dB(A), respectively.

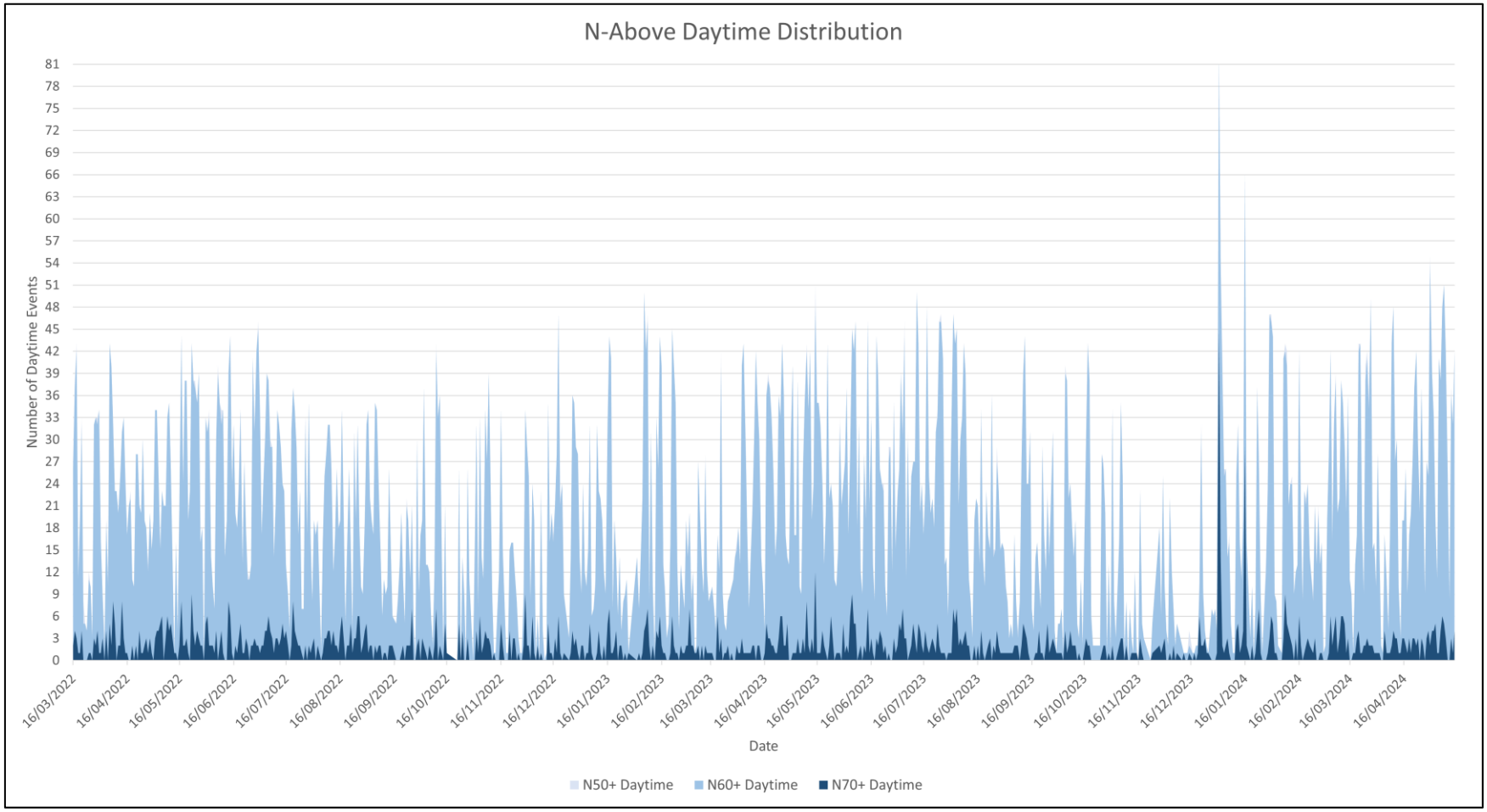

Figure 3: Daytime Daily N-Above Distribution Graph

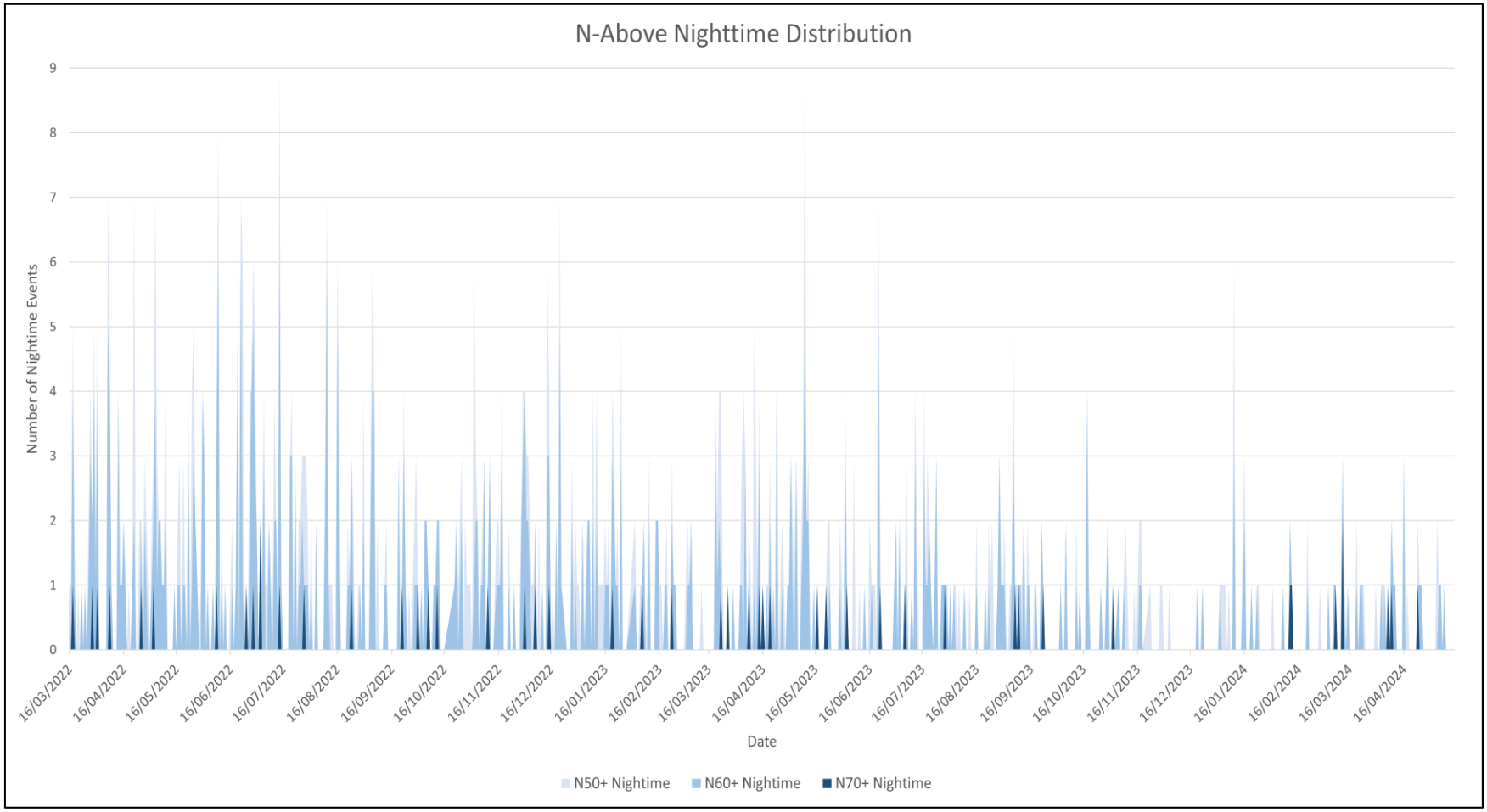

Figure 4: Nighttime Daily N-Above Distribution Graph

3.3. Most Common Aircraft

The most common aircraft type that flew through the zone during the deployment period is a DH8D aircraft as shown in Table 5, below.

Brisbane Airport Operation Type	Operations	Correlated %
Arrival	24	4%
Departure	10,425	86%
Touch and Go	40	82%
Overflight	0	0%

Table 5: DH8D correlation percentage across the deployment period

3.4. Top 10 Correlated Aircraft

The following table shows the top 10 average and maximum noise levels of correlated noise events (CNEs) for the deployment period from 16 March 2022 to 15 May 2024. The highest average LaMax of 70.5 dB(A) is attributed to A139 helicopter departing from the Heli Pad, shown in Table 6.

Aircraft Type	Aircraft Category	Airport Code	Operation Type	Runway	Total CNE	Average LaMax dB(A)	Max dB(A)
DH8D	T	YBBN	D	19R	8,924	66.7	87.0
SF34	T	YBBN	D	19R	2,098	68.2	81.4
BE20	T	YBBN	D	19R	1,567	67.5	80.7
B350	T	YBBN	D	19R	481	65.6	75.9
AC50	P	YBBN	D	19R	383	69.4	78.1
SW4	T	YBBN	D	19R	349	67.5	80.2
A139	H	YBBN	A	Heli Pad	235	70.5	78.7
DH8A	T	YBBN	D	19R	222	65.5	74.8
AT75	T	YBBN	D	19R	196	68.5	73.9
BE20	T	YBBN	D	19L	161	62.7	71.5

Table 6: Top 10 aircraft in the deployment period by total CNE

Aircraft Type: *J = Jets, T = Turboprop, P = Piston engine, H = Helicopter.*

Operation Type: *D = Departure, A = Arrival*

3.5. Noise Event Analysis

The audio verification process involved listening to and confirming the accuracy of the top 100 loudest (LaMax) noise events.

Table 7 outlines the top 10 noise events from all sources. The maximum noise levels (LaMax) of the noise events for this deployment originated from community sources such as rain and thunder, and from aircraft noise. Please note that some aircraft details may not be available for movements associated with military, emergency services or public safety actions.

Table 8 outlines the top 10 correlated noise events (that is, correlated with aircraft noise). The maximum noise levels (LaMax) of correlated noise events for this deployment originated from other nearby local airport movements (Overflights) as well as Brisbane Airport movements.

Some correlated noise events were associated with community sources in addition to aircraft. This can be seen in the 'noise source' details in Table 8 and Figure 5. Consequently, there may be a benefit in conducting further noise monitoring in this location to explore and confirm the spectrum of noise levels attributed to aircraft, with the exclusion of any impact from community noise contamination.

Future aircraft noise monitoring in the Northgate area can achieve greater precision by:

- Choosing a location further away from the main road and school ovals to minimise contamination of the aircraft noise events from the community.

Start Date/Time	Correlated to Aircraft?	LaMax dB(A)	Noise Source	Aircraft Type[5]	Operation Type[6]	Runway
26/12/2023 17:18	No	101.7	Thunder	-	-	-
15/12/2023 19:08	No	101.2	Thunder	-	-	-
18/03/2022 10:54	No	97.5	Rain and thunder	-	-	-
25/04/2024 07:59	Yes	96.5	Aircraft	-	O	-
24/06/2022 17:14	No	95.2	Rain and thunder	-	-	-
06/09/2023 01:32	No	94.9	Thunder	-	-	-
14/02/2023 15:24	No	92.3	Rain and thunder	-	-	-
26/12/2023 14:10	No	92.1	Rain and thunder	-	-	-
20/11/2022 16:55	No	91.9	Rain and thunder	-	-	-
26/12/2023 06:34	No	91.1	Rain and thunder	-	-	-

Table 7: Top 10 loudest noise events during the deployment period by LaMax

[5] Dash (-) indicates the details are not publicly available.
[6] Operation type O = Overflight from Amberley Airport, Archerfield Airport, Toowoomba Airport, etc

Start Date/Time	Movement Airport[7]	LaMax dB(A)	Noise Source	Aircraft Type[8]	Operation Type[9]	Runway
25/04/2024 07:59	Overflight	96.5	Aircraft	-	O	-
02/04/2022 09:19	Brisbane	87.0	Aircraft	DH8D	D	19R
25/04/2024 10:13	Overflight	86.9	Aircraft	-	O	-
24/01/2024 13:13	Brisbane	85.6	Aircraft	C130	D	19R
30/09/2022 10:38	Brisbane	85.1	Aircraft and community	DH8D	D	19R
01/06/2022 09:53	Brisbane	84.2	Aircraft and community	DH8D	D	19R
19/08/2023 13:23	Brisbane	83.4	Aircraft	C130	D	19R
10/02/2024 12:59	Brisbane	83.4	Aircraft and machinery	C130	D	19R
24/01/2023 10:36	Overflight	83.1	Helicopter	H	O	Heli Pad
01/01/2024 07:24	Brisbane	82.6	Aircraft	B738	D	19R

Table 8: Top 10 loudest aircraft correlated noise events during the deployment period by LaMax

[7] Overflights refer to movements from Amberley Airport, Archerfield Airport, Toowoomba Airport, etc. [8] Dash (-) indicates the details are not publicly available.
[9] Operation types A = Arrival, D = Departure, O = Overflight, T = Touch and Go

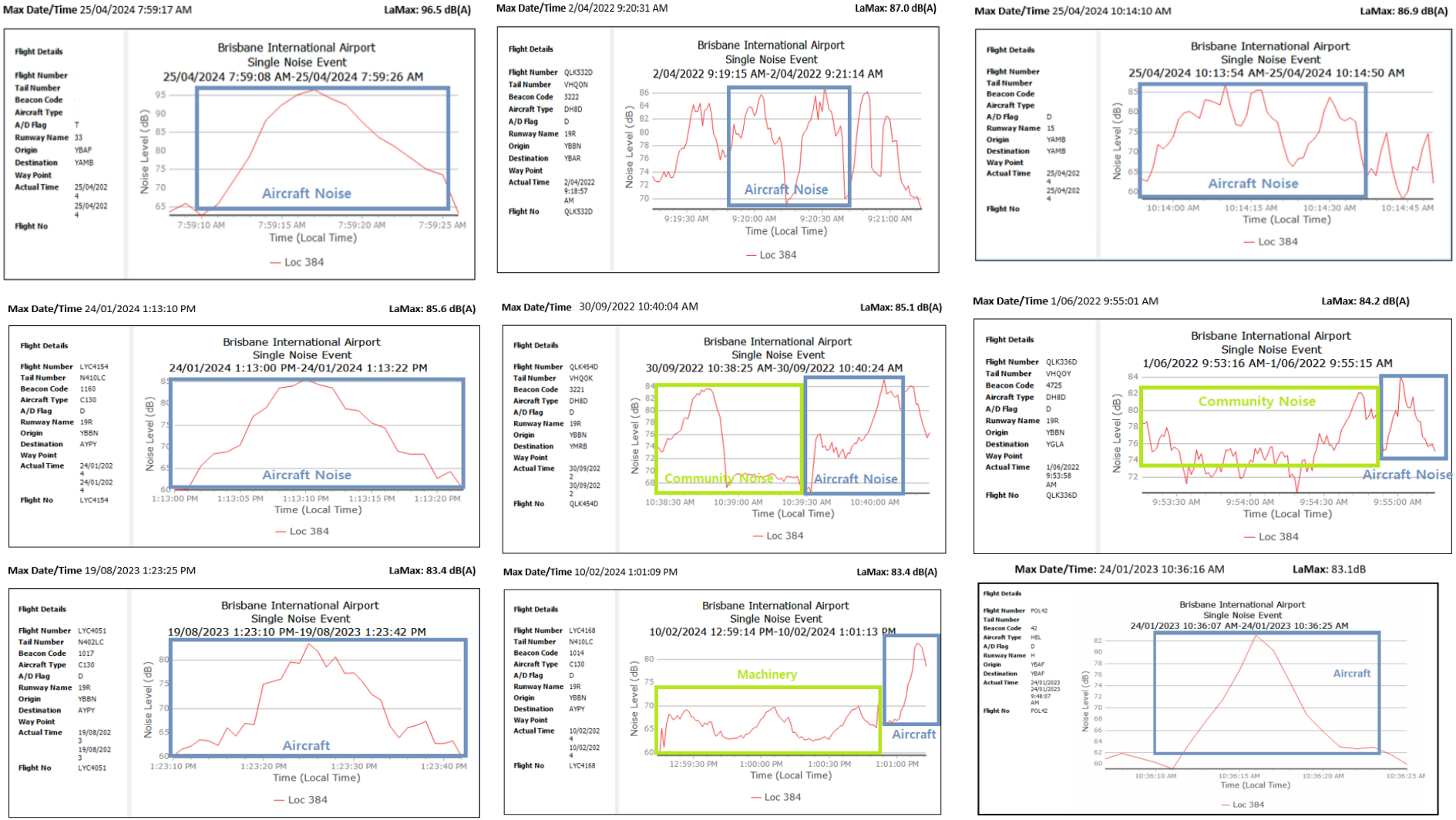

Figure 5: Top 9 correlated noise events from Table 8 graphed and analysed.

4 Busiest Day Analysis

4.1 Busiest Day Discussion:

4.1.1 All Aircraft Busiest Day Discussion

All aircraft busiest day during the deployment period occurred on 1 January 2024, with a total of 226 noise events. The noise events consisted of jet, helicopter, turboprop, bird, machinery, and vehicle noise. There were 121 aircraft captured passing through the zone from Brisbane Airport movements, of which 22% were from the focus group. The predominant movement over the capture zone was from jet operations (77%). This is unusual for this site and was due to severe weather disruptions to normal air traffic patterns.

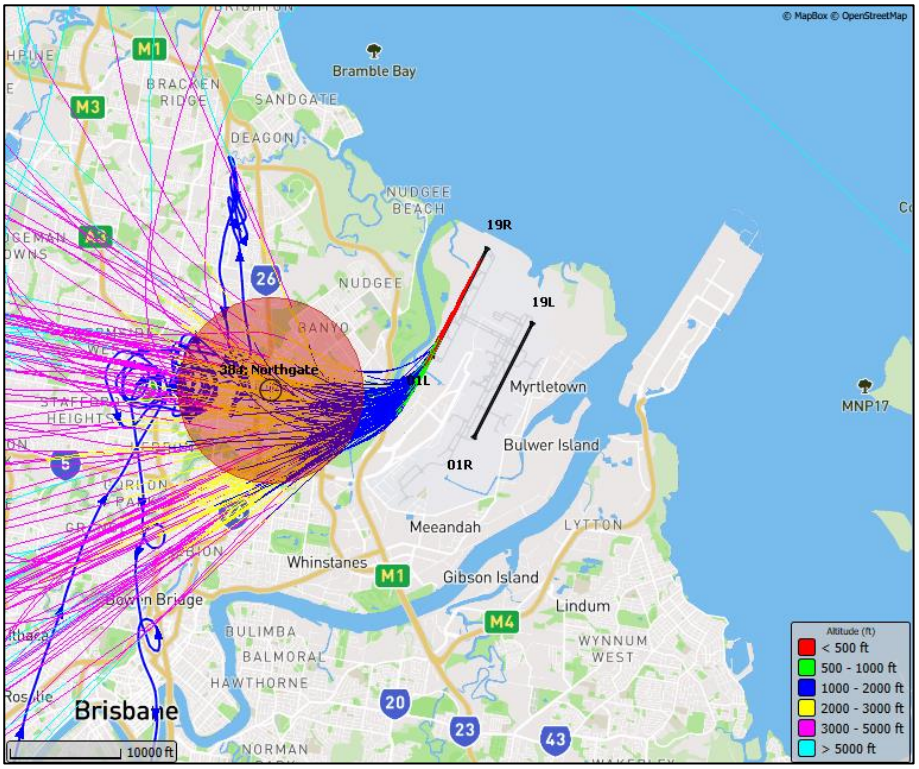

Figure 6: All aircraft busiest day flight tracks 1 January 2024

4.1.2 Focus Group Busiest Day Discussion

The focus group busiest day (turboprop aircraft departing from runway 19R of YBBN) occurred on 18 October 2023, with a total of 89 noise events. The noise events consisted of helicopter, turboprop, bird, machinery, and vehicle noise. There were 66 aircraft captured passing through the zone from Brisbane Airport movements, of which 59 aircraft were from the focus group.

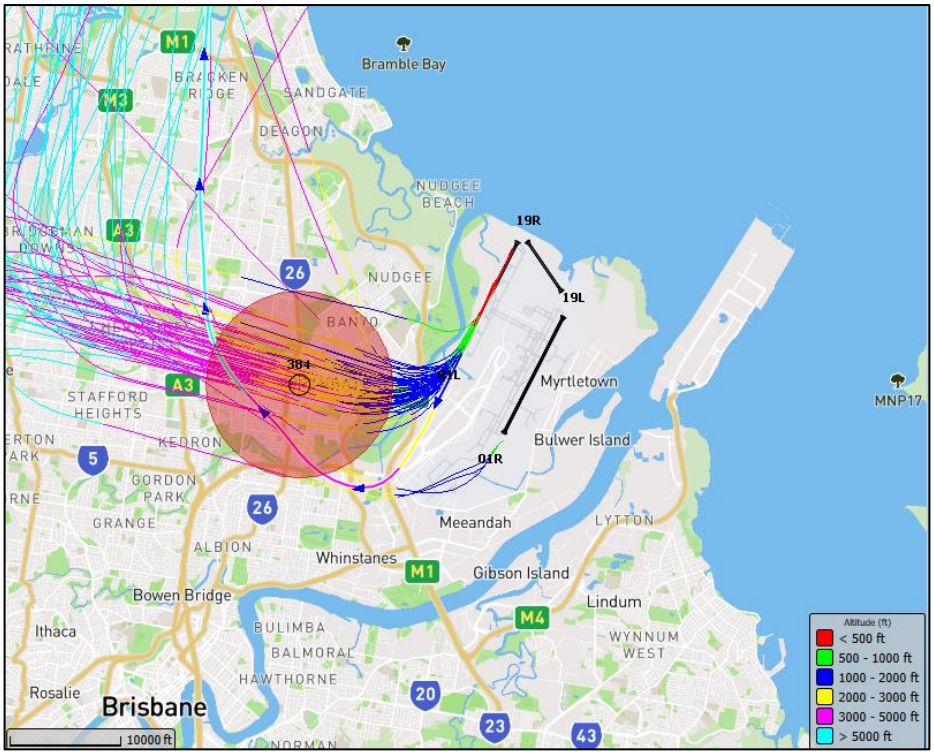

Figure 7: Focus group busiest day flight tracks 18 October 2023

4.2 Busiest Day Graph:

4.2.1 All Aircraft Busiest Day Graph

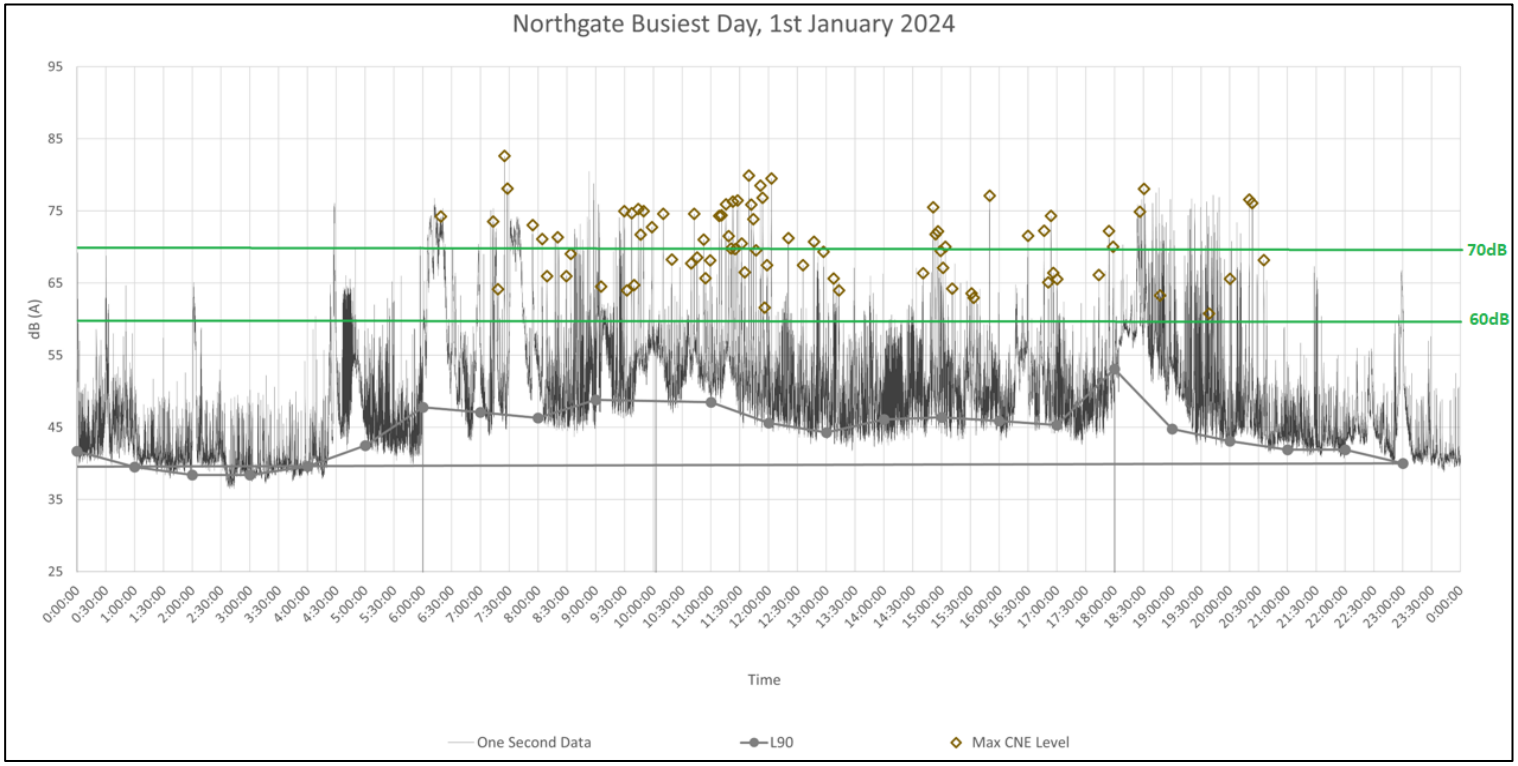

Figure 8: Distributions of hourly L90, max CNE level and one-second noise data on the busiest day. Hourly L90 refers to background noise levels; see Section 6.1.1 for more information. Max CNE level refers to the maximum noise level of the noise event, known as LaMax, which occurs when the aircraft is within the capture zone of the noise monitor; see Section 6.1.2 for more information. One-second noise data refers to the sound levels that are recorded every second by the noise monitor.

4.2.2 Focus Group Busiest Day Graph

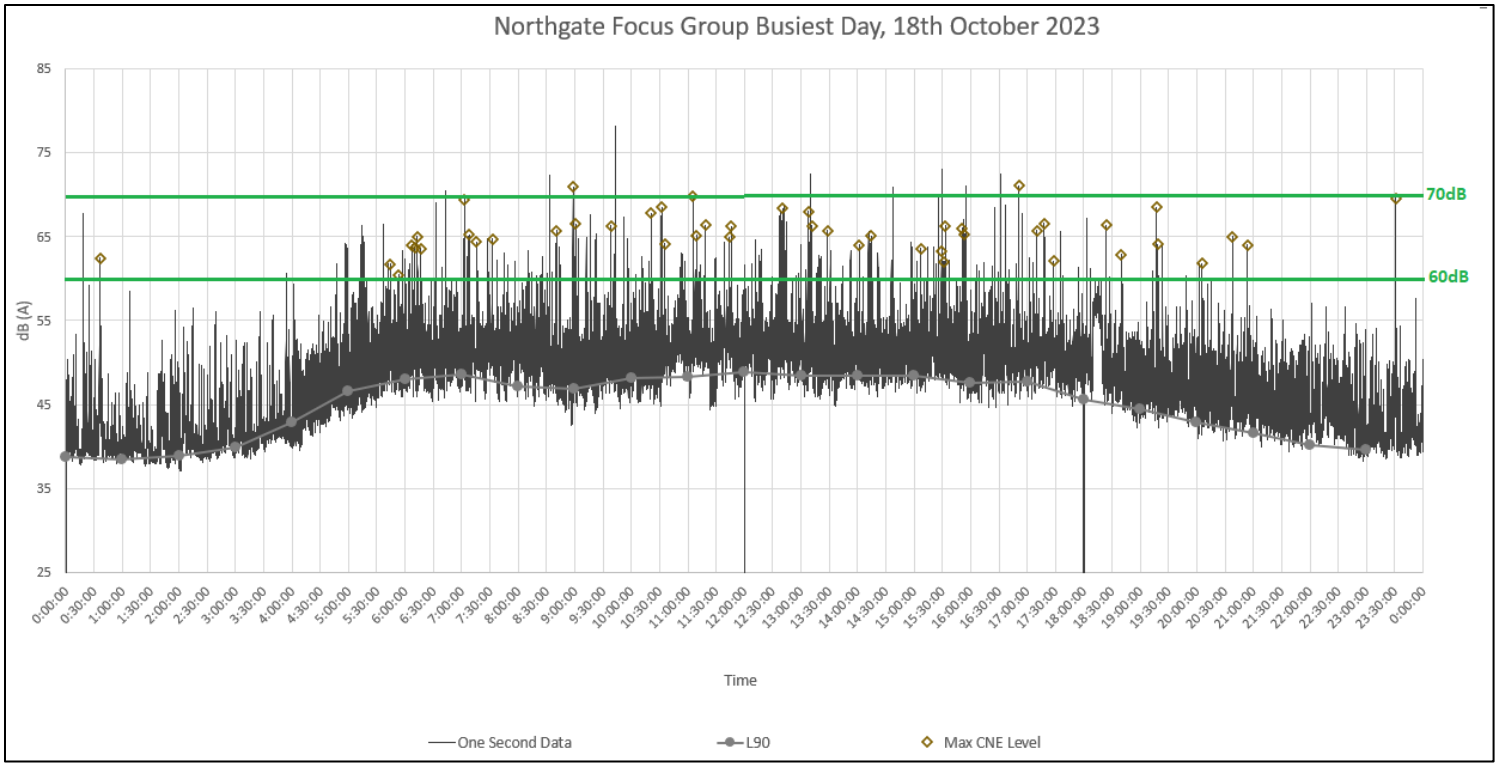

Figure 9: Distributions of hourly L90, max CNE level and one-second noise data on the busiest day. Hourly L90 refers to background noise levels; see Section 6.1.1 for more information. Max CNE level refers to the maximum noise level of the noise event, known as LaMax, which occurs when the aircraft is within the capture zone of the noise monitor; see Section 6.1.2 for more information. One-second noise data refers to the sound levels that are recorded every second by the noise monitor.

4.3 Busiest Day Noise Levels:

4.3.1 All Aircraft Busiest Day Noise Levels

The loudest event on the 1 January 2024 was created by an aircraft, reaching a maximum noise level of 82.64 dB(A) at 07:25:01 in the morning, lasting for 26 seconds.

4.3.2 Focus Group Busiest Day Noise Levels

The loudest event on the 18 October 2023 was created by a vehicle, reaching a maximum noise level of 78.2dB(A) at 09:42:39 in the morning, lasting for 12 seconds. The loudest Brisbane Airport movement on 18 October 2023 was created during the departure of a BE20 turboprop from runway 19R at 16:50:55, registering a maximum noise level of 71.1 dB(A).

5 Further Information

The following platforms provide further information on Brisbane aircraft noise monitoring.

5.1 Airservices Australia

Information on the noise and flight path monitoring system including approach to noise monitoring and frequently asked questions:
https://www.airservicesaustralia.com/community/environment/aircraft-noise/monitoring-aircraft-noise/

5.2 Aircraft in Your Neighbourhood

Brisbane Noise Monitoring Report (interactive tool to explore monthly noise monitoring data):
https://aircraftnoise.airservicesaustralia.com/2020/10/29/brisbane-noise-monitoring-report/

The Brisbane Noise and Flight Path Monitoring System (long term noise monitor terminal locations):https://aircraftnoise.airservicesaustralia.com/2020/06/03/the-brisbane-noise-and-flight-path-monitoring-system-nfpms/

5.3 WebTrak

Aircraft noise data is displayed from live noise monitors across Brisbane, along with historical data: https://webtrak.emsbk.com/bne3

5.4 Brisbane Airport

Dashboard for live noise monitor and PDF reports from past monitor locations provided by Brisbane Airport Corporation (all short term monitor placements):
https://www.bne.com.au/corporate/community-and-environment/flight-paths-aircraft-noise/noise-management

6 Appendix

6.1 Noise Event Detection Details:

ISO 20906 provided technical guidance in this short-term noise monitoring. The NMT (i.e., sound level monitor) used for testing passed the Class 1 periodic calibration tests outlined in clauses of IEC 61672-3:2013 and IEC 61260-3:2016. The placement of NMT considered the vicinity of reflective surfaces and the height of the NMT relative to the target aircraft operations to minimise potential unintended anomalies. The NMT height is fixed on a supporting pole and the captured noise events were observed acceptable throughout the deployment. The background noise levels were taken into account in the monitoring area, to appropriately capture aircraft noise levels.

6.1.1 Threshold Settings

Noise monitor threshold settings are established by collecting hourly average L90 data over a period of two to five days following installation of the noise monitor. L90 represents noise level which are exceeded 90% of the time. It is considered the background noise level of an environment. For instance, if the L90 hourly noise level reads 50dB(A), it means that for 90% of that hour, the noise level is above 50dB(A). The threshold is set close to the average L90+10dB(A). The addition of 10dB(A) effectively filters out most community noise, such as birds and animal sounds, machinery, and vehicle noises. As a result, the created noise event will predominantly contain aircraft noise with minimal community noise.

6.1.2 Aircraft and Noise Event Correlation

The correlation of a noise event with an aircraft requires meeting the following conditions:

- The aircraft passes through the defined capture zone set by the monitor as shown in Figure 1.
- The rise and fall time of the measured event matches a sound pattern representative of an aircraft flyover.
- Noise levels are greater than the specified threshold for a specified period when aircraft flies over, this creates a noise event.
- Maximum noise level of the noise event known as LaMax must occur while the aircraft is within the capture zone of the noise monitor.

Aircraft that flew within the vicinity of the monitor but did not trigger a correlated noise event may have failed to meet some of the parameters above. In other instances, this could be attributed to the lack of air traffic control data (ATC). This occurs when aircraft do not have an operating transponder or when there are radar outages. Despite a noise event being created by the aircraft, without available ATC data, there will be no aircraft to correlate with the noise event.

6.2 Calibration Check

The integrity of the noise monitor relies on regularly verifying the accuracy of the microphone recording levels and time synchronisation of samples with radar data. The microphones are replaced with laboratory certified microphones every 12 months and electrostatic calibration tests are automatically performed daily to ensure data quality.