MARSHALL DAY Acoustics

# AUCKLAND AIRPORT DMAPS STUDY

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Project: **AUCKLAND AIRPORT DMAPS**

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## 1.0 SUMMARY

Auckland International Airport Limited (AIAL) has asked Marshall Day Acoustics (MDA) to assess the potential noise effects resulting from flight path changes proposed by Airways under the Divergent Missed Approach Protection System (DMAPS) project.

We understand that the proposed DMAPS has minimal airspace changes except for a 30° track divergence for turboprop aircraft departing on Runway 05R. This would change the published flightpath to the missed approach procedure flightpath.

There is also a similar DMAPS proposal for Runway 23L departures. This has a more limited potential for adverse noise effects because of the more sparsely populated areas that could be affected. Therefore, the focus of this report is on the Runway 05R departure changes.

Note, this assessment did not include the new missed approach tracks (which are also shifted 30°), as missed approach procedures are very rare at Auckland Airport. In the last five years, 0.08% of arrival aircraft have undertaken a missed approach. Also, the new missed approach track is currently in use for non-jet standard departures and jet departures that are turned early to the North.

Currently 12 turboprop aircraft depart daily to domestic northern airports and aerodromes (Great Barrier Island, Kaitaia, Kerikeri and Whangarei). This increases during summer with peak traffic increasing to 38 turboprop aircraft.

MDA has undertaken measurements and calculations to assess the change in noise exposure for the affected communities and the predicted change in the annual noise compliance contours.

We have found that with the proposed tracks, the affected communities would experience a significant change in noise level of ±10 dB for an aircraft passing directly overhead (see Table 3). However, the noise level received for an individual aircraft flyover is still relatively low and therefore overall acceptable. For comparison, the larger turboprop aircraft measured maximum noise levels of 75 dB $L_{AFmax}$, which is similar to a truck passing by at 40m (a common occurrence in these areas).

Because the tracks are replacing existing turboprop departure tracks elsewhere, there is also an equivalent noise reduction benefit for those communities no longer subject to the overflight tracks.

In terms of overall compliance with the Auckland Unitary Plan (AUP), there is no change to the annual noise contours (ANC) when the proposed track is modelled. This is because there are only a few aircraft movements the DMAPS applies to, and the aircraft are smaller (and quieter) than the other aircraft in use at the airport.

Overall, people under the new DMAPS flightpath may perceive a significant increase in noise levels for an individual aircraft flying overhead but as the aircraft are small and relatively infrequent, the actual noise level is not dissimilar to other environmental noise sources in the area.

Therefore, there is no impact of any significance on the overall community noise exposure or AUP compliance.

## 2.0 METHOD

The initial stage involved undertaking attended noise measurements under the existing turboprop flight paths. This was to quantify the existing noise environment in the relevant neighbourhoods and verify the noise levels calculated in our noise modelling. These neighbourhoods were chosen as they represent communities that would be most affected by the change in flightpath.

Figure 1 shows the two measurement locations and an average flightpath (based on actual flight tracks flown) headed to Great Barrier Island, Kaitaia, Kerikeri or Whangarei. Due to the larger proportion of flights to Great Barrier Island (see Table 1), this average flightpath represents a flight to Great Barrier Island.

**Table 1: Current daily domestic northbound flights**

| Destination | Aircraft type | Aircraft Category | Average daily flights | Daily summer flights (peak) |
|---|---|---|---|---|
| Great Barrier Island | Cessna 208b | Turboprop | 6 | 27 |
| Kaitaia | Cessna 208b | Turboprop | 2 | 3 |
| Kerikeri | Dash 8 | Turboprop | 2 | 4 |
| Whangarei | Dash 8 | Turboprop | 2 | 4 |

**Figure 1: Map showing average domestic northbound flightpath and measurement locations**


Table 2 below shows the results from the on-site measurements. These were mainly Cessna 208b flights leaving Runway 05R to Great Barrier Island (as per the flight track shown in Figure 1).

**Table 2: On-site measurement summary**

| Measurement location | Distance from Runway 23L | Destination | Aircraft | Average $L_{AE}$[1] | Average $L_{AFmax}$[2] |
|---|---|---|---|---|---|
| Papatoetoe | 5.0 km | Great Barrier Island | Cessna 208b | 80.3 dB | 73.4 dB |
| | | Kerikeri | Dash 8 | 79.4 dB | 76.2 dB |
| Pakuranga | 13.6 km | Great Barrier Island | Cessna 208b | 76.0 dB | 67.8 dB |

[1] $L_{AE}$ is the sound exposure level (in this case for one aircraft flyover event)

[2] $L_{AFmax}$ is the loudest noise level measured during the event

In the second stage, modelling was conducted in INM 7.0d, the software used to calculate the AIAL ANC. The base model used was FY23 ANC but also included either the current or proposed DMAPS flightpaths and four calculation point locations. These tracks and locations can be seen in Figure 2.

These point locations include the two measured locations (Papatoetoe and Pakuranga), and two equivalent locations along the proposed track (Māngere East and Mt Wellington/Stonefields). These equivalent locations are the same distance from Runway 23L as the measurement locations.

**Figure 2: Proposed flightpath (in red), with current flightpath (in blue) and the calculation locations**


To compare the current and proposed flightpaths, four calculations were undertaken:

Comparison of noise levels from a single flight event:

- A Cessna 208b departing on the current flightpath
- A Cessna 208b departing on the proposed DMAPS flightpath

Comparison for overall compliance in the Annual Noise Contours (ANC):

- Latest FY23 ANC with the current flightpath
- Latest FY23 ANC with the flight movements from the current flightpath transferred to the proposed DMAPS flightpath

# 3.0 RESULTS

## 3.1 Results for single flight event comparison

Table 3 overleaf shows the noise levels at the different locations when a Cessna 208B Grand Caravan flies overhead on the current or proposed flight track.

**Table 3: INM results for point locations for a single Cessna 208b flight**

| | Distance from RW23L | Measured $L_{AE}$ (dBA) | Calculated $L_{AE}$ | | Change in noise level (dB) |
|---|---|---|---|---|---|
| | | | Current track (dBA) | Proposed track (dBA) | |
| **Under the current flightpath** | | | | | |
| Papatoetoe | 5.0km | 80 | 78 | 71 | -7 |
| Pakuranga | 13.6km | 76 | 74 | 62 | -12 |
| **Under the proposed flight path** | | | | | |
| Mangere East | 5.0km | 72[1] | 70 | 78 | +8 |
| Mt Wellington (Stonefields) | 13.6km | 64[1] | 62 | 74 | +12 |
| | | | | **Log average:** | **±10 dB** |

[1] These noise levels were not measured but have been back calculated based on the calculated noise levels

Between the current and proposed track, the change in noise levels is calculated to be ±7.5 dB at the closer neighbours (5km) and ±12 dB at the further neighbours (13.6km). This is an energy average of ±10 dB. A change of 9 to 11 dB would be perceived by the human ear as a doubling of loudness and be considered a significant change (as per Table 4 and replicated in Appendix B).

**Table 4: Change in noise level and its effect**

| Change in Sound Level (dBA) | Subjective Reaction | Impact / RMA Adverse Effect |
|---|---|---|
| 1 - 2 | Imperceptible change | Negligible/less than minor |
| 3 - 4 | Just perceptible change | Slight/Minor |
| 5 - 8 | Appreciable change | Noticeable |
| 9 - 11 | Doubling of loudness | Significant/Substantial |
| > 12 | More than a doubling of loudness | Severe |

Note, there is also a difference of 2 dB between the measured and calculated $L_{AE}$. This is likely due to the large distances away from the airport, and the lower signal to noise ratio experienced at this distance. There may also be some uncertainty associated with the environmental conditions at the time, compared with the underlying prediction assumptions. However, this is still within the standard 2 dB tolerance for a noise model so is acceptable.

## 3.2 Results for FY23 ANC comparison

The FY23 ANC represents the actual aircraft movements that occurred in financial year 2023 (1 July 2022 to 30 June 2023). This is done by calculating a representative average day by averaging the total noise exposure from all annual movements over one day.

To calculate the change in noise levels with the proposed track, the aircraft movements from the current track were transferred to the proposed track. These results can be seen in Table 5 and the contours can be seen in Figure 3.

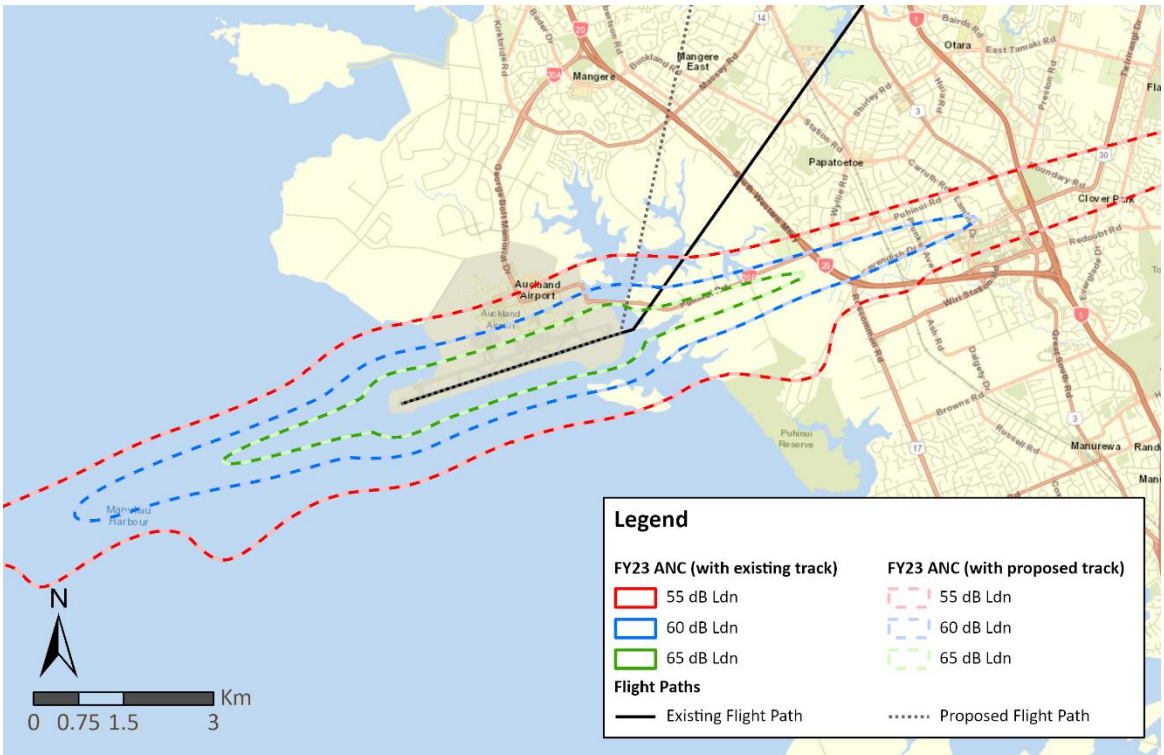
**Table 5: FY23 ANC comparison at the chosen point locations**

| | | Calculated $L_{dn}$ | | |
|---|---|---|---|---|
| | Distance from RW23L (km) | Current track (dB) | Proposed track (dB) | Change in noise level (dB) |
| **Under the current flightpath** | | | | |
| Papatoetoe | 5.0 | 42 | 41 | -1 |
| Pakuranga | 13.6 | 39 | 38 | -1 |
| **Under the proposed flight path** | | | | |
| Mangere East | 5.0 | 38 | 39 | 1 |
| Mt Wellington (Stonefields) | 13.6 | 37 | 38 | 1 |
| | | | **Log average:** | ±1 dB |

Using the same point locations as before, the change in noise levels were calculated to be ±1 dB. This is considered an imperceptible change in noise level to the human ear and of negligible effect (as per Table 4). As well as this, we note the total noise exposure received at any location considered is well below where airport noise management controls are implemented.

Similarly, the ANC contours below show no change. The existing contours (solid lines) and the contours that use the proposed track (dotted lines) overlap entirely. For further reference, see Appendix C for these contours overlaid on the AUP contours.

**Figure 3: FY23 ANC Ldn Comparison**



# 4.0 DISCUSSION

## 4.1 Single flight event comparison

For a departure heading to Great Barrier Island, there would be a significant change of ±10 dB in the affected communities with the proposed DMAPS track change.

When on-site, we measured an $L_{AFmax}$ noise level of up to 75 dB. This is equivalent to a truck driving past at 40m. As the affected neighbourhoods are urban and near industrial areas, truck passings are common. This means the flyovers of the small aircraft (Cessna 208 or Dash 8) would not make a significant change to the current overall noise environment. We consider an aircraft on the proposed DMAPS track would overall not be disruptive.

Additionally, there is a small number of aircraft flying along this proposed track (12 turboprops daily), and the track is only used when Runway 05R is in operation (when easterly winds prevail – an average of 30% of the year). These factors combine so that overall, there is no discernible noise effect.

## 4.2 FY23 ANC comparison

For compliance with the AUP, there is very negligible/no change to the Annual Noise Contours. This is due to the proposed track change involving small aircraft and the low number of flights per day. With these factors there is no change in the overall noise exposure represented by the ANC contour, and therefore no issues with compliance.

## 4.3 Overall

Whilst some people under the new DMAPS flightpath may get a significant increase in noise levels for those specific flights, the actual noise level received is relatively low (e.g. a single large turboprop had a similar maximum noise level to a truck passing by at 40m), so the overall noise level is acceptable. These flights are also relatively infrequent.

There is also a small benefit to other communities under the current flight track where aircraft noise levels would decrease.

For Runway 23L departures, we expect a similar insignificant change in overall noise exposure noise level as the aircraft are small and infrequent. Also, the affected West Auckland suburbs are more sparsely populated areas.

Overall, we consider that with the implementation of DMAPS, there would be no impact or effect of any significance on the overall community noise exposure or AUP compliance.

## APPENDIX A GLOSSARY OF TERMINOLOGY

| | |
|---|---|
| dBA | A measurement of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear. |
| $L_{eq}$ | The time averaged sound level (on a logarithmic/energy basis) over the measurement period (normally A-weighted). |
| $L_{dn}$ | The day-night sound level which is calculated from the 24-hour $L_{eq}$ with a 10 dBA penalty applied to the night-time (2200-0700 hours) $L_{eq}$ (normally A-weighted). |
| $L_{AFmax}$ | The maximum sound level recorded during the measurement period (A-weighted). |
| $L_{AE}$ (SEL) | The sound exposure level. The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to quantify short duration noise events such as aircraft flyovers |
| Noise | A sound that is unwanted by, or distracting to, the receiver. |
| Ambient Noise | Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far. |
| NZS 6805:1992 | New Zealand Standard NZS 6805:1992 "Airport Noise Management and Land Use Planning" |
| ANC | The Actual Noise Contour represents the actual activity that occurred in the relevant financial year. |
| DMAPS | Divergent Missed Approach Protection System |

## APPENDIX B CHANGE IN NOISE LEVEL AND ITS EFFECT

| Change in Sound Level (dBA) | Subjective Reaction | Impact / RMA Adverse Effect |
|---|---|---|
| 1 - 2 | Imperceptible change | Negligible/less than minor |
| 3 - 4 | Just perceptible change | Slight/Minor |
| 5 - 8 | Appreciable change | Noticeable |
| 9 - 11 | Doubling of loudness | Significant/Substantial |
| > 12 | More than a doubling of loudness | Severe |

## APPENDIX C FY23 ANC COMPARISON WITH AUP CONTOURS (EXCLUDING 55 DB $L_{DN}$ CONTOURS)