MARSHALL DAY Acoustics

CHRISTCHURCH AIRPORT NOISE MONITORING 2021 NOISE MONITORING REPORT

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Project: **CHRISTCHURCH AIRPORT NOISE MONITORING**

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DEFINITIONS AND ACRONYMS

Definitions

Aircraft Operations	Also referred to as 'Operational Noise' (refer Section 6.1) a) the landing and take-off of aircraft; and b) aircraft flying along any flight path associated with a landing or take-off. For the purposes of Rule 6.1.6 Activity specific noise rules, it excludes: a) aircraft operating in an emergency for medical or national/civil defence reasons; b) air shows; c) military operations; d) Antarctic operations; e) helicopter operations; f) aircraft using the airport as an alternative to a scheduled airport elsewhere; g) aircraft taxiing; and h) aircraft engine testing.
Air Noise Compliance Contour	The 65 dB L_{dn} noise contour included in the Christchurch District Plan that cannot be exceeded. The determination of compliance or otherwise with this control is demonstrated by the preparation of the AANC for the preceding year's aircraft operations and reported annually.
Air Noise Boundary (ANB)	A composite line formed by the outer extremity of the 65 dB L_{dn} noise contour and the 95 dB L_{AE} noise contour. The Air Noise Boundary defines an area in which the future daily aircraft noise exposure from aircraft operations is sufficiently high as to require land use planning controls
Decibel (dB)	The unit of sound level. Expressed as a logarithmic ratio of sound pressure relative to a reference pressure
L_{AE}	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 measure the sound energy of a particular event, such as an aircraft flyover
L_{Aeq}	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
L_{dn}	The day night noise level which is calculated from the 24-hour L_{Aeq} with a 10dB penalty applied to the night-time (2200-0700 hours) L_{Aeq}
L_{AFmax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
Noise Calculations	Noise levels calculated using computer modelling software, typically to predict current and future noise levels. Noise measurements are used to verify accuracy of calculated noise levels.
Noise Measurements	In-situ noise measurements of actual noise levels using either semi-permanent noise monitoring terminals or hand-held equipment (sound level meters).
Noise Monitoring	Monitoring of noise levels (generally with respect to assessing compliance with the District Plan), using both noise measurements and calculated noise levels.
On-Aircraft Engine Testing	The testing of engines on aircraft.

Acronyms

AANC	Annual Aircraft Noise Contour
ANB	Air Noise Boundary
ANLC	Airport Noise Liaison Committee

CIAL	Christchurch International Airport Limited
ETMS	Engine Testing Management Software
INMP	Integrated Noise Modelling Program
NMP	Noise Management Plan
NMR	Annual Noise Monitoring Report
NZS 6805	New Zealand Standard NZS 6805:1992 “Airport Noise Management and Land Use Planning”
USAP	United States Antarctic Programme

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1.0 INTRODUCTION

Christchurch International Airport Limited (CIAL) are required to prepare an Annual Noise Monitoring Report each year in accordance with the provisions of Chapter 6 of the Christchurch District Plan (CDP).

- Calculation of noise contours known as the Annual Aircraft Noise Contours (AANC) to determine compliance
- Calculation of engine testing noise level emissions at the Engine Testing Compliance Monitoring Positions (ETCMPs) to determine compliance
- Analysis of measured engine testing noise levels, to verify the compliance calculations
- Update of the Acoustic Treatment Programme (ATP) schedule of eligible dwellings

This report has been prepared by Marshall Day Acoustics (MDA) on behalf of CIAL and provides an overview of the noise monitoring programme for 2021 including:

2.0 STATUTORY REQUIREMENTS

The full list of rules relating to airport noise compliance at Christchurch is given in Appendix A.

Rule 6.1.6.2.5 iv of the Christchurch District Plan requires CIAL to prepare and submit annually an aircraft operations noise monitoring report, including the following information:

- the calculated AANC;
- the results of the verification measurements (if conducted);
- analysis of compliance with reference to Rule 6.1.6.2.5 a.i. and ii. (including the number of exceedances and the reasons for them); and
- a summary of complaints received over the previous year in relation to noise from aircraft operations, and any actions taken in response.

Rule 6.1.6.2.6 vi of the Christchurch District Plan requires CIAL to prepare and submit annually an on-aircraft engine testing noise monitoring report, including the following information:

- the results of verification measurements in accordance with activity standard v.B.; and
- analysis of compliance with reference to Rule 6.1.6.2.6 a.i.; and
- a summary of complaints received over the previous year in relation to noise from on-wing aircraft engine testing, and any actions taken in response.

Rule 6.1.6.2.7.2 of the Christchurch District Plan sets out the requirements for CIAL to implement an Acoustic Treatment Programme (ATP) and identify annually if additional dwellings become eligible for treatment within the AANC 65 dB L_{dn} contour.

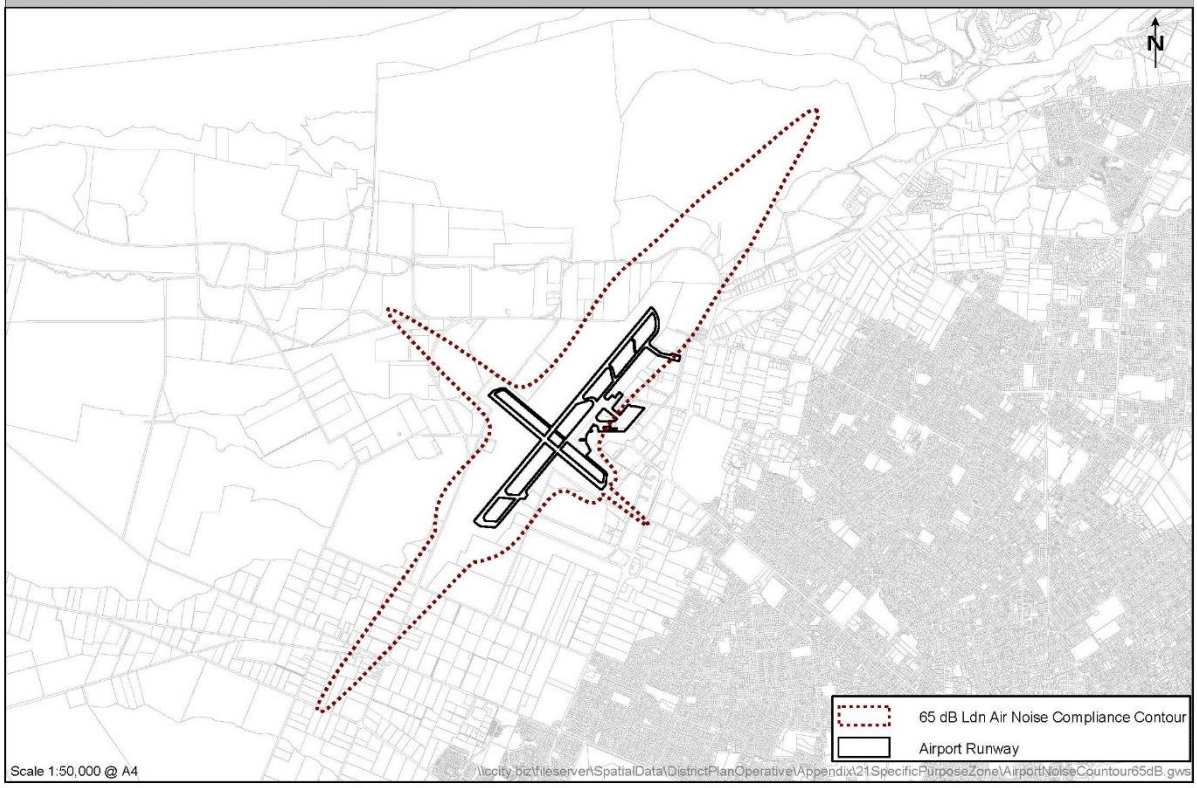
The following noise monitoring report details information required under both 6.1.6.2.5 (iv) (aircraft operations) and 6.1.6.2.6 (vi) (on aircraft engine testing) and provides an updated schedule of eligible dwellings for the ATP. The purpose of this report is to assess compliance of aircraft operations with rule 6.1.6.2.5 (a) and on-aircraft engine testing with rule 6.1.6.2.6 (a)(i) and (v) for the period of 1 January 2020 to 31 December 2020.

2.1 Noise Limits - Aircraft Operations

Aircraft operational noise limits are set in rule 6.1.6.2.5 (a) (i):

"Noise from aircraft operations shall not exceed 65 dB Ldn outside the 65 dB Ldn Air Noise Compliance Contour shown in Figure 1, other than as provided for in Rule 6.1.6.2.5 (a) (ii)."

Figure 1: Map of 65 dB Ldn Air Noise Compliance Contour



insert from rule 6.1.6.2.5 (a) (i) in the Christchurch District Plan.

Rule 6.1.6.2.5 (a) (iii) of the District Plan describes the noise monitoring required to determine compliance with rule 6.1.6.2.5 (a) (i).

2.2 Noise Limits - On Aircraft Engine Testing

Table 5 (refer to table 1 below) in rule 6.1.6.2.6 (a) of the District Plan outlines noise limits for on aircraft engine testing.

Table 1: On-aircraft engine testing noise limits

Noise Limit	Engine testing compliance monitoring positions (ETCMP) – refer Figure 2
65 dB Ldn, 7 day	8 points
55 dB Ldn, 7 day	8 points
75 dB L_{Amax} 22:00 to 07:00 only	Edge of residential zone – 3 points

Rule 6.1.6.2.6 (a) (v) of the District Plan describes the monitoring required to determine compliance with rule 6.1.6.2.6 (a).

3.0 OPERATIONAL NOISE

As defined in the Christchurch District Plan, Aircraft operational noise includes:

The landing and take-off of aircraft and aircraft flying along any flight path associated with a landing or take-off. Operational noise excludes aircraft operating in an emergency for medical or national/civil defence reasons, air shows, military operations, Antarctic operations, helicopter operations, aircraft using the airport as an alternative to a scheduled airport elsewhere, aircraft taxiing and aircraft engine testing.

3.1 Summary of Operational Aircraft Movements

Prior to COVID-19, Christchurch Airport has had a total number of aircraft movements of 80,000-110,000 aircraft movements per year. Of these around 75,000 to 80,000 were scheduled commercial movements.

Based on information provided by Airways Corporation NZ, for the year 2021 there were;

- 56,813 scheduled commercial aircraft movements, and
- 77,902 total aircraft movements.

Scheduled commercial movements over the last 8 years are as shown in Table 2 below

Table 2: Scheduled Commercial Aircraft Movements

Aircraft Movements	2021	2020	2019	2018	2017	2016	2015	2014
Scheduled Commercial Movements	56,813	49,084	75,663	75,738	76,585	74,130	74,144	75,072

The busiest three months for scheduled aircraft movements in 2021 were March, April and May. The reduced number of aircraft movements in 2021 is due to the ongoing global Covid-19 pandemic and its impacts on travel (and therefore on the aviation industry). Movement numbers dropped dramatically when the New Zealand borders were effectively closed in 2020. Total aircraft movements started climbing again as domestic travel increased during periods of the year where local 'Lockdown' restrictions had eased (refer Table 4).

A summary of the movement data input into the Integrated Noise Model (INM) used to produce the 2021 Annual Aircraft Noise Contours (AANC) is provided in section 3.2 of this report.

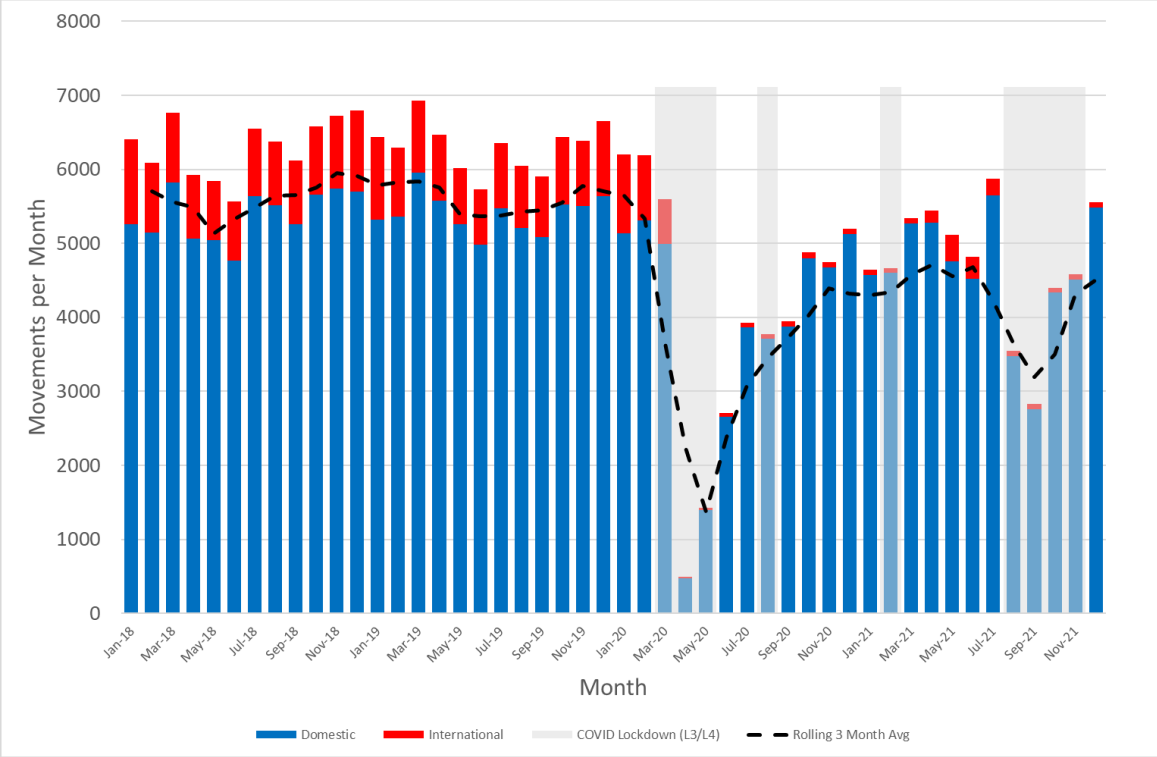
3.2 COVID-19

The Covid-19 pandemic has had a significant negative impact on the demand for air passenger transport in New Zealand and around the world.

During 2021 lockdowns continued in New Zealand, with a short nationwide lockdown in February/March 2021 and an extended lockdown (particularly for the Auckland Region) between August and December 2021. There were 55,381 scheduled domestic movements in 2021 and 1,590 scheduled international movements. International movements increased markedly in May, June and July, as can be seen on the graph below.

Figure 2 shows the monthly aircraft movements numbers since 2018. The effect of Covid-19 lockdowns on international and domestic aircraft movement numbers at Christchurch Airport is evident post March 2020.

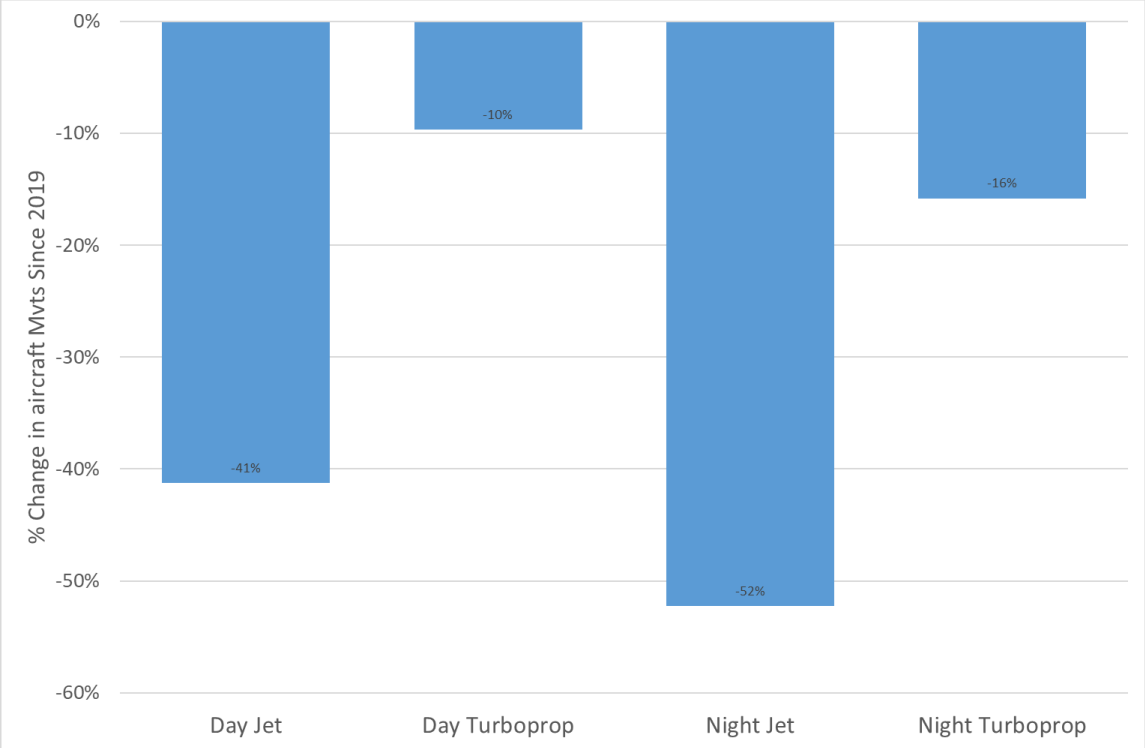
Figure 2: Monthly Aircraft Movements 2018-2021



Domestic air routes recovered at different rates between the various lockdowns in 2021 when travel restrictions were removed. Jet numbers dropped away in August/September 2021 along with turboprops. However, turboprops seemed to recover quicker in November/December.

The closure of international borders meant international traffic was reduced significantly. Freight flights still operated in 2021 along with some limited scheduled commercial flights but the numbers were significantly reduced. Due to time-zone differences and scheduling requirements, historically international passenger services have contributed heavily to the total number of night time aircraft movements, and international air traffic is almost exclusively operated by jet aircraft. The lack of international passenger flights has resulted in significantly less night-time jet flying as demonstrated in Figure 3 which shows the percentage change in 2021 compared to 2019 movements. There was also a reduction in daytime flights for jets and turboprops in 2021 compared to 2019.

Figure 3: Percentage change in aircraft Movements 2021 vs 2019



3.3 Modelling Methodology

To ensure consistency with the 65 dB L_{dn} Air Noise Compliance Contour in the Christchurch District Plan, the 2021 AANC has been calculated using version 7 of the Integrated Noise Model (INM) developed by the US Federal Aviation Authority.

The INM software (like most software), has been upgraded regularly over the last 10 years. Each update to the INM program has resulted in slightly different calculation results. As the District Plan contour and AANC are both used for noise control purposes, and as the District Plan contours are used as the basis of determining appropriate land use planning controls and the selection of mitigation treatment, it is therefore considered that the same software version should be used to prepare the AANC.

The 2021 AANC is based on aircraft movements provided by Airways Corporation NZ. The definition of aircraft operations in the Christchurch District Plan (given in Appendix A) excludes military, Antarctic and helicopter movements therefore these are not included in the AANC calculation. The busiest three months were determined by the scheduled commercial movements.

The busiest consecutive three months for scheduled commercial movements in 2021 was March, April and May in accordance with rule 6.1.6.2.5 (iii) (b).

A diagram of the Christchurch Airport runway system is included in Appendix B for reference.

The 65 dB L_{dn} Air Noise Compliance Contour in the Christchurch District Plan was developed without inclusion of GA operations. Therefore, the AANC are also prepared without inclusion of GA movements.

Based on the nature and frequency of GA flights at the time of preparing the 65 dB L_{dn} Air Noise Compliance Contour, it was considered that GA aircraft noise would not significantly affect the extent of the noise contours. It was also noted that GA aircraft are generally light aircraft.

The 2009 CIAL Noise Monitoring Report confirmed that noise from light aircraft does not contribute significantly to overall noise levels within the 65 dB L_{dn} contour, this conclusion was confirmed in all subsequent noise monitoring reports to date. A review of the annual number of GA movements

between 2008 and 2021 shows that GA activity is still at a lower relative level (compared with scheduled commercial operations) than 2009 so this conclusion remains valid, even taking into account the drop off of international movements relative to domestic flights. MDA has previously calculated the effect of GA operations on the AANC and conclude that GA operations typically contribute less than 0.1 dB to the noise contours which is a negligible difference.

The movements for the modelled scenario are shown in Table 3 as well as a breakdown of the day and night-time movements. Night-time movements are those that occur between 10pm and 7am. The number of night-time movements is relevant as night-time activity has an associated +10 decibel adjustment.

Table 3: Summary of Modelled Aircraft Movements

	Busiest 3 Months (Mar, Apr, May 2021)
Total Movements	16,433
Day Time Movements	15,119
Night Time Movements	1,314

A summary of the total aircraft movements by month is shown in Table 4, and a breakdown of the average daily aircraft movements by aircraft type and runway is included in Table C1, Appendix C.

Table 4: Summary of 2021 scheduled aircraft movements

Month (2021)	Monthly total	Consecutive 3 months total
Jan	4,832	
Feb	4,873	
Mar	5,557	15,262
Apr	5,599	16,029
May	5,277	16,433
Jun	4,932	15,808
Jul	6,006	16,215
Aug	3,691	14,629
Sep	2,989	12,686
Oct	4,630	11,310
Nov	4,761	12,380
Dec	4,832	

Data provided by Airways includes actual runway usage data which has been used in the preparation of the 2021 AANC. In 2021 the main runway was used 96% of the time compared with the crosswind runway. For the busy three months, the main runway was used 98% of the time.

3.4 Flight Tracks

The flight tracks used in the model are based on the same flight tracks that were used for the development of the 65 dB L_{dn} Air Noise Compliance Contour with additional new tracks included that have come into operation in recent years.

These new tracks are a result of a once in a generation shift to newer technology which enables aircraft to fly more accurately and precisely and generally are referred to as Required Navigation Procedures (RNP). RNP tracks encompass a shift from ground-based navigation aids emitting signals to aircraft receivers, to 'in-aircraft' systems that receive satellite signals from sources such as the Global Positioning System (GPS). These tracks generally have less dispersion and spread than conventional arrival tracks and can turn earlier and tighter than conventional arrival tracks which generally fly straight. At Christchurch Airport RNP has been implemented through two main flight track updates over the last five years, PBN arrivals (implemented in 2017/2018) and DMAPS or 15/15 Departures (implemented in 2020). Noise Monitoring Reports for the respective years include specific commentary on the updated flight paths.

Flight tracks applied in the 2021 Noise Monitoring report include, both updated flight tracks for PBN arrivals and DMAPS departures.

An email discussing any further flight track changes in 2021, (over and above the RNP and DMAPS tracks which are already included in the noise model), was sent in November 2021 by a representative of Airways NZ to CIAL and MDA. Other than the inclusion of DMAPS departures and RNP arrivals, there were no other changes to flight paths that occurred in 2021 and the flights paths remain the same as those modelled for the 2020 AANC. Airways NZ concluded the flight tracks in the noise model remain a reasonable approximation of long-term average flight tracks flown.

3.5 Verification Noise Measurements

Rule 6.1.6.2.5a iii d of the Christchurch District Plan sets out that the calculated AANC shall be verified by noise measurements carried out in accordance with the Airport Noise Management Plan (NMP).

Section 6.1.2 of the NMP states that verification measurements are to be carried out no less than every three years and the location of the NMT is be decided in consultation with the ANLC.

CIAL undertook noise measurements in 2019 and the results of these were used to verify the noise model. Information from measurements undertaken at Auckland Airport were also used. In total five measurement positions were analysed, three from Auckland and two from Christchurch.

The measurements generally showed good agreement with the modelled noise levels for most aircraft types. Slight changes were made to calibrate the noise model where improvements could be made. This included changes to the Airbus A320 aircraft where alternative aircraft substitutes and profiles were chosen to match more closely with the measured noise levels.

More detail on this calibration can be found in Section 3.5 of the 2019 NMR. We consider that the results of the noise verification process conducted as part of the work to prepare the 2019 NMR remain valid and therefore no further noise measurements were conducted in 2021.

3.6 2021 Annual Aircraft Noise Contour

The 2021 AANC is shown below as Figure 4 and in Appendix D.

Overall, the 2021 AANC demonstrates 2021 aircraft operations comply with the 65 dB L_{dn} Air Noise Compliance contour.

Towards the north-east of RW02/20, the 2021 AANC is 4-5 decibels less than the CDP Air Noise Compliance Contour.

Towards the south-west of RW02/20 the 2021 AANC is 3 decibels less than the CDP Air Noise Compliance Contour.

On the RW11/29 on centreline the 2021 AANC is 5 or more decibels less than the CDP Air Noise Compliance Contour.

When compared to the 2020 AANC, the 2021 AANC is approximately 0.5 to 1.5 decibels smaller in extent. This equates to 10% to 25% fewer movements. This is because the busiest three months used to calculate the 2020 AANC was January, February and March 2020. This was before the international travel restrictions and border closures came into place. The number of movements in this period was similar to pre pandemic levels.

CIAL's Noise Management Plan (Rev D, dated May 2019) states in section 6.1.1: "*Where the AANC are calculated to be within 2 decibels of the District Plan compliance contour, Christchurch Airport will conduct an initial summary review as to the extent and cause of this margin. The Compliance and Development Manager and Acoustic Engineer will be responsible for making the decision to conduct the initial summary review and any further analysis that may be required*."

For 2021, there is no requirement to conduct such a summary review,

Overall, the 2021 AANC is considered an accurate representation of aircraft noise exposure around the airport for the busiest three months in 2021 and have been calculated in accordance with New Zealand Standard NZS 6805:1992 *Airport Noise Management and Land Use Planning*.

In accordance with the rule contained in Appendix 6.11.4 (a)(ii).C of the CDP, the 2021 AANC showing 1 dB increments from 55 dB to 70 dB L_{dn} is shown in Figure 2, Appendix E.

Figure 4: 2021 AANC

The noise modelling, aircraft movement analysis and AANC calculation was conducted by a person suitably qualified and experienced in airport noise modelling and acoustics assessments, in accordance with rule 6.1.6.2.5 (iii) (c). The person who undertook the airport noise modelling, acoustical assessment and preparation of the technical content of this 2021 NMR is the author of this report, Laura McNeill of Marshall Day Acoustics.

4.0 ON AIRCRAFT ENGINE TESTING

As defined in the Christchurch District Plan on aircraft engine testing includes the testing of engines on aircraft.

4.1 Summary of On-Aircraft Engine Testing

Based on information obtained from the ETMS, for the year 2021 there were;

- 843 total on-wing engine tests
- 641 ATR tests
- 124 A320 tests
- 78 other tests

The total number of recorded engine testing events over the last 7 years is as follows.

Table 5: Engine Testing Events by year

Engine Testing Events	2021	2020	2019	2018	2017	2016	2015
Total number of events	843	1045	1114	1369	1384	1023	805

4.2 Verification Noise Measurements

Rule 6.1.6.2.6 (v) (B), in the CDP states that the engine testing calculations "*shall be verified by measurements undertaken with reference to at least four ETCMPs for a sample of at least two different on-aircraft engine test configurations".*

As has been agreed between CIAL and CCC, the definition of the engine test configuration simply means consideration of two different engine test events with at least one of the following being different between the tests; aircraft type, location of test, orientation or power setting.

The rule requires that this be undertaken "*at least once every two years*". Because the last engine testing measurements were conducted in 2019, there was a requirement to repeat the measurements in 2021.

4.2.1 Measurement Analysis

Four Noise Monitoring Terminals (NMTs) were deployed at four Engine Testing Compliance Monitoring Positions (ETCMPs). Terminals were deployed at ETCMP11 and ETCMP8 from 25 November to 6 December 2021. These terminals were then moved to ETCMP5 and ETCMP16 on 7 December 2021 and brought in on 15 December 2021. Each NMT consisted of a 01dB 'Cube' noise logging monitor. Data was recorded in 1 second intervals. Each NMT is equipped with audio recording capability to enable an analysis of individual engine testing events.

The following methods are applied to the data to exclude extraneous noise from the results:

- event recognition software: based on measured noise level and time thresholds, identify high noise energy events that last for a given duration. These are collated into a series of measurement events.

- frequency based recognition that include or exclude noise events with a particular frequency of sound.
- Manual review of measured noise levels and associated audio files to further exclude extraneous noise events.

The event recognition software can satisfactorily capture most discrete engine testing noise events. The measured noise events are then correlated with aircraft engine testing events provided in the Engine Testing Management Software (ETMS) by the ground run engineers. The correlation ensures that the measured noise levels represent noise from aircraft engine testing events.

4.2.2 ETMS Verification

Data from each NMT has been analysed to verify noise levels generated from the ETMS. The approach adopted was to consider two discrete engine testing events at each ETCMP where measurements occurred. A high powered ATR event was chosen as all four monitors as these occur commonly, as well as a high powered A320 run for the first week of data at ETCMP 11 and 8. For the second week a medium powered A320NEO run for ETCMP 5 and 16 was chosen.

MDA analysed the measured noise data relative to the noise levels calculated in the ETMS for discrete events at the ETCMPs and provide the following noise verification results.

Engine Testing Configurations

The engine testing configurations used for the verification are:

- Configuration 1 - ATR, Full power, 2-minute duration, ground run-up pad
- Configuration 2 - A320, High power, 3-minute duration, ground run-up pad (for ETCMP 11 and 8 only)
- Configuration 3 – A320NEO, medium power, 1 minute duration, ground run-up pad (for ETCMP5 and 16 only)

The rationale for these choices is given below:

Configuration 1 - ATR, full power, 2 minutes duration, ground run-up pad

This engine testing event was considered as it is the loudest engine testing event that occurs on a frequent basis at night. A representative measurement of one of these events was chosen. The event chosen occurred on 5 December 2021 for ETCMP 11 and 8 and 13 December 2021 for ETCMP 5 and 16.

Configuration 2 - A320, High power, 2 minutes duration, Number 1 Hangar Taxiway A11 (for ETCMP 11 and 8 only)

The last engine testing verification measurements in 2019 looked at A320s at idle power as these are permitted to occur at night. However, this time A320s at high power were chosen as they are much louder than idle measurements, and can on occasion be permitted at night. The event chosen occurred on 4 December 2021.

Configuration 3 - A320NEO, Medium Power, 1 minute duration, Number 1 Hangar Taxiway A11 (for ETCMP5 and16 only)

A320NEOs have only recently started flying into Christchurch airport. At the time of the ETMS development no data for NEO variants existed. Since they are relatively common aircraft now CIAL asked MDA to add this aircraft to the ETMS. This was completed in July 2021. These verification measurements provide a good opportunity to check the ETMS for this new aircraft type. Only one event occurred during the measurement programme so we chose this for our analysis. The event chosen was an A320NEO at medium power and this occurred on 7 December 2021.

4.2.3 ETMS Verification Results

Configuration 1 - ATR, full power, 2 minutes duration, ground run-up pad

The table below shows the measured noise levels at the ETCMPs for Configuration 1 and the predicted noise levels from the ETMS at the same ETCMPs.

Table 6: Engine testing configuration 1: ATR at full power at the run-up pad

ETCMP	Measured Noise Level (dB $L_{eq\ 5mins}$)	Predicted Noise Level (dB $L_{eq\ 5mins}$)
ETCMP 11	46.1	57.4
ETCMP 8	52.6	52.4
ETCMP 5	67.4	67.9
ETCMP 16	54.4	54.3

The predicted noise levels are within 2 dB of the measured noise levels apart from for ETCMP11 where the measured noise levels are 11 dB lower than the predicted noise levels. We observed this effect consistently at ETCMP11 for a number of other engine testing noise events. Upon further investigation we have determined that this is likely a result of shielding due to earthworks observed on deployment of the noise loggers between the run-up pad and ETCMP11. Overall, these results show good agreement between measurements and predictions.

Configuration 2 - A320, High power, 2 minutes duration, Number 1 Hangar Taxiway A11 (for ETCMP 11 and 8 only)

The table below shows the measured noise levels at the ETCMPs for Configuration 2 and the predicted noise levels from the ETMS at the same ETCMPs. Note that the ETMS does not specifically predict individual noise events so the original noise model used to develop the ETMS has been used to identify individual noise events.

Table 7: Engine testing configuration 2: A320 at high power at the Number 1 Hangar Taxiway A11

ETCMP	Measured Noise Level (dB $L_{eq\ 5mins}$)	Predicted Noise Level (dB $L_{eq\ 5mins}$)
ETCMP 11	54.5	64.4
ETCMP 8	55.7	59.2

The predicted noise levels at ETCMP8 are 3.5 dB higher than measured noise levels. The measured levels at this position show relatively good agreement with the predicted noise levels and provide a slightly conservative assessment. At ETCMP11 the measured noise levels are 10 dB lower than the predicted noise levels. As mentioned above, this is likely due to shielding from the earthworks between the run-up pad and ETCMP11.

Configuration 3 - A320NEO, Medium Power, 1 minute duration, Number 1 Hangar Taxiway A11(for ETCMP5 and16 only)

The table below shows the measured noise levels at the ETCMPs for Configuration 3 and the predicted noise levels from the ETMS at the same ETCMPs. Note that the ETMS does not specifically predict individual noise events so the original noise model used to develop the ETMS has been used to identify individual noise events.

Table 8: Engine testing configuration 3: A320NEO at medium power at the Number 1 Hangar Taxiway A11

ETCMP	Measured Noise Level (dB $L_{eq\ 5mins}$)	Predicted Noise Level (dB $L_{eq\ 5mins}$)
ETCMP 5	61.6	60.9
ETCMP 16	43.9	46.2

The measured noise levels at the ETCMPs are within 2.5 dB of the predicted noise levels. The model overpredicts at ETCMP16 while underpredicts slightly at ETCMP5. Overall these results show good agreement between measurements and predictions. We note that at ETCMP16, the measured noise levels are very low and subject to a higher degree of variation and influence from other noise sources.

4.2.4 Summary

MDA has analysed the engine testing noise verification measurements in accordance with rule 6.1.6.2.6 (v) (B). MDA conclude that there is good agreement between the ETMS and the noise measurements on site and that the ETMS is still an appropriate tool to use for engine testing noise compliance analysis at Christchurch Airport. It is noted that the discrepancy at ETCMP11 is likely due to earthworks occurring between this position and the run-up pad which provides some shielding, resulting in lower measured noise levels.

4.3 Engine Testing Management Software

The Engine Testing Management Software (ETMS) is used to calculate noise levels emitted from on aircraft engine testing and calculate the 7-day rolling average. CIAL have used the ETMS since 2010, in July 2017 this software was updated to meet new provisions in the District Plan including:

- The requirement to calculate the 7-day rolling average;
- Development of the ETMS on a web-based platform and;
- Initial 6-month period of verification of the ETMS calculated noise levels at the Engine Testing Compliance Monitoring Positions (ETCMP) locations, using in-situ noise measurements and thereafter biannual verification measurement

4.3.1 Compliance of Calculated Noise Levels

Calculated noise levels for 2021 generated from the ETMS at the ETCMPs are detailed in Table 9 (65 dB L_{dn} limit) and Table 10 (55 dB L_{dn} limit) below. The location of the ETCMPs is shown in Figure 5 below.

Figure 5: Insert from CDP On-Aircraft Engine Testing Compliance Monitoring.

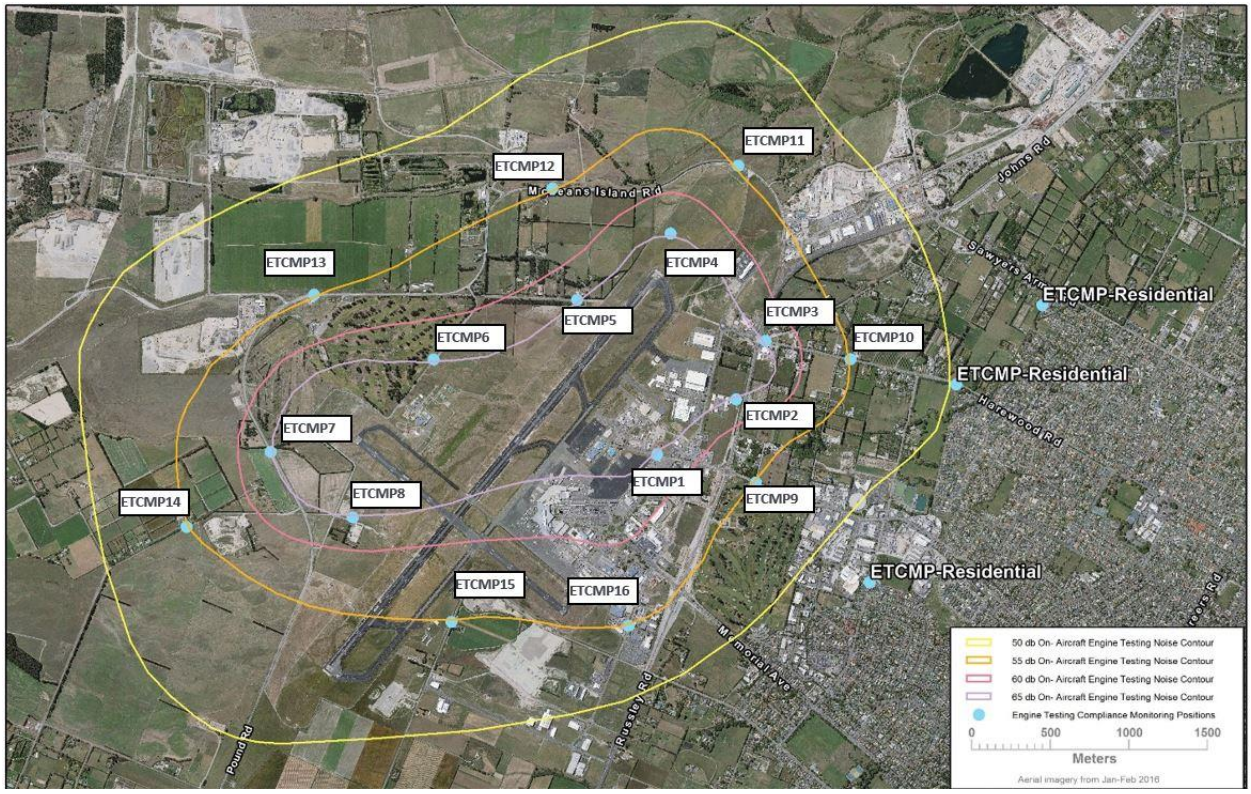


Table 9 and 10 below identify calculated noise levels generated using the ETMS are compliant with noise limits detailed in rule 6.1.6.2.5 (a) (i).

Table 9: ETMS Prediction Results - 65 dB L_{dn} limit – Highest 7 Day L_{dn} Rolling Average

ETCMP Location	Min	Max	Median	Average
1	42	60	54	54
2	37	53	48	47
3	35	58	53	52
4	38	62	53	53
5	39	59	54	53
6	33	56	44	44
7	>25	57	35	36
8	27	54	38	39

Table 10: ETMS Prediction Results - 55 dB L_{dn} limit –Highest 7 Day Rolling Average

ETCMP Location	Min	Max	Median	Average
9	37	53	48	48
10	30	50	45	44
11	31	53	45	45
12	32	49	45	45
13	26	49	36	37
14	>25	45	31	31
15	27	46	38	38
16	31	49	43	43

Maximum noise levels at ETCMP 17, ETCMP 18 and ETCMP 19 were all below the noise limit of 75 dB L_{AFmax} contained in rule 6.1.6.2.5 (a) (i). The maximum noise level for each of these was 62, 63, 59 dB L_{AFmax} respectively.

Figure 6 and 7 below display the 7-day rolling average calculated noise levels at each of the ETCMPs for 2021. As shown in the two graphs, compliance was predicted to be achieved at all ETCMPs during the engine testing events in that period.

Figure 6: ETMS predicted 2021 noise levels for ETCMP 1 to ETCMP 8, located on the 65 dB Ldn engine testing contour

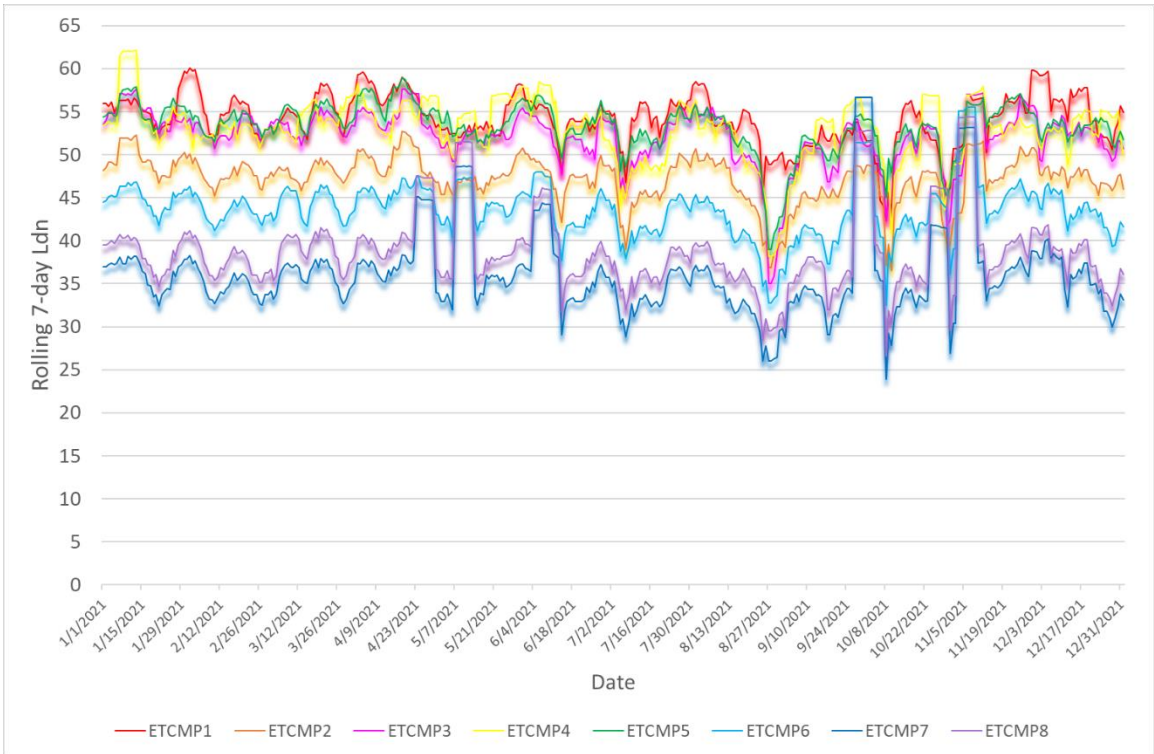
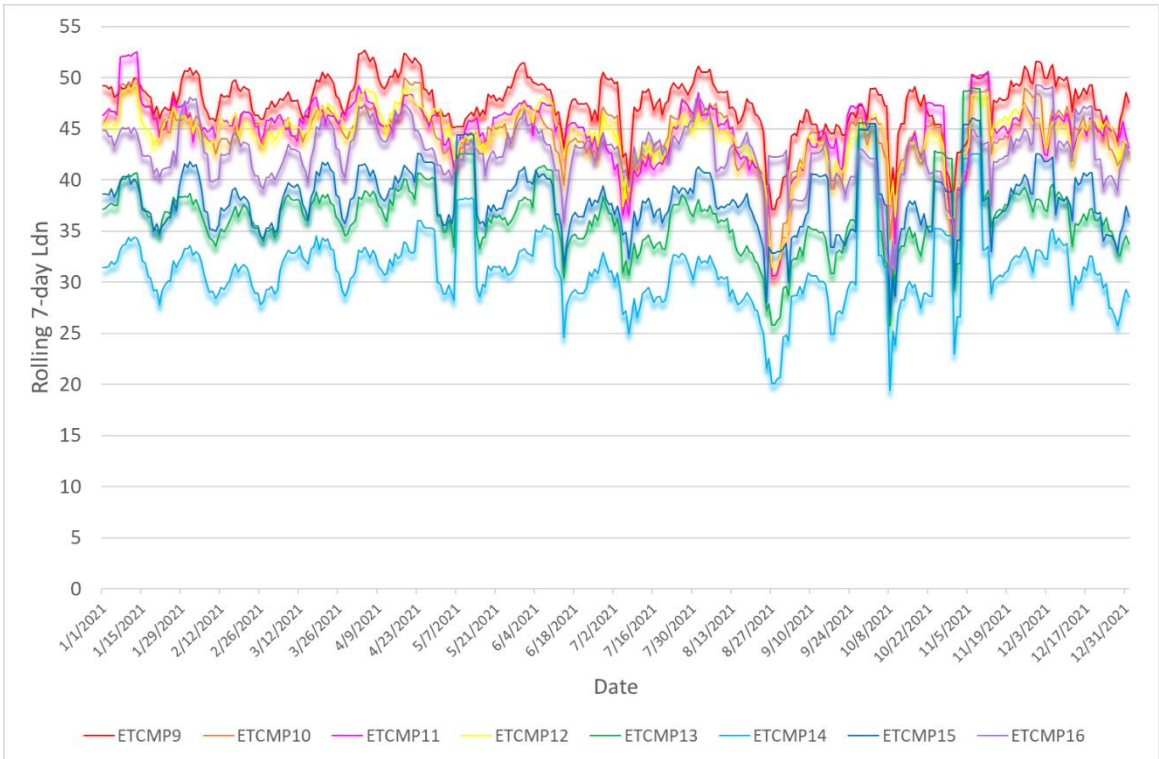


Figure 7: ETMS predicted 2021 noise levels for ETCMP 9 to ETCMP 16, located on the 55 dB Ldn engine testing contour.



The figures identify a variation in calculated noise levels with some distinct peaks for some of the ETCMPs. These peaks are a result of noise emissions from a given test; notably, high power runs in close proximity to the ETCMP.

5.0 COMPLAINTS

5.1 Complaints Summary

In accordance with Rule 6.1.6.2.5 a.iv.D and Rule 6.1.6.2.6 a.vii.C of the CDP, the noise complaints summary below details:

- Complaints received over the previous year in respect to aircraft operations and on-aircraft engine testing, and
- Any actions taken in response to these complaints

All names and addresses have been omitted for privacy purposes.

Complaints have been grouped by the type of operation and aircraft; the actions taken for each complaint are included in the table. In summary, 30 complaints were received from 28 individuals during the period 1 January to 31 December 2021.

Type of Operation	Type of Aircraft	No of Complaints	Actions Taken
Low Flying Aircraft	Jet	1	Complainant contacted CIAL about a Boeing freighter (767) that took off from Christchurch Airport on RWY 02 and flew a loop over the city before heading north-west, bound for Sydney. Airways NZ confirmed that this flight path is often flown by jets wanting to gain altitude before crossing the Southern Alps when there is turbulence forecast or reported. Normally they turn to the west for the most direct tracking. The extra miles flown on this track gives the aircraft time to climb above the turbulence.
		1	Complainant was concerned about a jet that took off from Christchurch Airport to the east which they concerned not to be a planned route. Airways was contacted and informed CIAL that RWY11 was used due the wind conditions. The complainant was told the use of RWY11 is rare but is necessary when extreme or unusual weather exists.
		1	Complainant contacted CIAL as they heard a loud humming/droning noise which they thought to be engine testing. After investigation, it was found that no engine testing occurred at this time, however a flight NZ1010, Boeing (787), bound for Los Angeles took off around the same time. This information was relayed to the complainant and there was no further correspondence.
		1	The complainant was woken by jet landing during the night. They questioned whether the airport is operational all through the night as they are often woken around 1am. CIAL responded that Christchurch Airport is a 24/7 operation, therefore night-time flights occur. Weblinks were provided to CIAL's website for more information on aircraft noise and the Airport Noise Management Plan. There was no further correspondence received.

Type of Operation	Type of Aircraft	No of Complaints	Actions Taken
Low Flying Aircraft	Turbo-prop	1	Complainant was asking why the flight paths cannot follow the new southern motorway to reduce noise over Rolleston. CIAL replied with information about how flight paths are determined. There was no further response.
	Turbo-prop and Jets	1	A complaint was made about low flying aircraft (turbo-prop and jets) over Ilam when coming into land on the cross-wind runway. The complainant asked for information on legislation and Council Bylaws that govern minimum height requirements for aircraft when they are over residential areas. CIAL informed the complainant that due to the strong north-west winds that were occurring, the cross-wind runway was being used more than usual, in addition they were provided with a link to the Noise Management Plan, and legislation from CAA regarding minimum aircraft heights. The complainant then requested evidence that flights on a particular day were meeting these regulations. Airways confirmed to CIAL that there was no evidence of any non-compliance with regulations, and this was passed on, and there was no further correspondence.
	Unknown	1	The complainant registered several aircraft departures in the early hours of 30th & 31st July; however they did not require a response from CIAL. There have been no further queries from them.
	Light aircraft	10	Ten individual complaints were received regarding a low flying aircraft on the 22-28th of January. This noise was an Landpro aircraft commissioned by Environment Canterbury (ECAN) and Christchurch City Council (CCC) to undertake two types of aerial survey: LiDAR (Light Detection and Ranging) data, and aerial photography. Information regarding the aerial survey process was provided to the complainants. CIAL has recommended to ECAN and CCC that they provide prior notice of future aerial surveys.
		1	A complaint was made about a light aircraft flying over Marshlands around 1am. This flight was a NZ Flying Doctors service from Blenheim to Christchurch arriving at 1.10am. The complainant was provided with information about the critical service that NZ Flying Doctors delivers.

Type of Operation	Type of Aircraft	No of Complaints	Actions Taken
Flight Path Change (Divergent GOMA Protection)	All Aircraft	1	Enquiry about flight path changes when aircraft take off to the south, and in particular are thought to be turning earlier over Yaldhurst. They also asked about the scope and legal framework underlying the path changes. CIAL sent correspondence outlining the changes to the 15/15 flight paths and provided more information around changes to flight tracks. There has been ongoing correspondence.
	All Aircraft	3	Three complaints were made over a week in November regarding aircraft taking off to the south on RWY20. The same complaint had been made in March 2021. The complainant suggests that the aircraft are breaching the noise contours and the noise is impacting the health and well-being of residence and animals in the area. CIAL responded with information about how noise from aircraft is modelled and compliance is measured. It was also suggested that CIAL meet with the complainant and with the Chairperson of the ANLC to discuss this complaint and the one from earlier in 2021. This occurred in December 2021, and communications are on-going with the complainant. They have been invited to attend the next meeting of the ANLC in the first quarter of 2022.
	All Aircraft	1	The complainant was concerned about an increase in aircraft noise over Hoon Hay recently. They asked whether flight paths have changed.

			CIAL responded to inform the complainant that the flight paths have not changed but outlined the two changes in aviation navigation (Performance Based Navigation) that have occurred at Christchurch Airport: the first: RNP arrivals (Required Navigation Performance) implemented in 2017/18 and the second: DMAPS (Divergent Missed Approach Protection System) in 2020. CIAL also noted that during this time the complaint was made there had been significantly more flights arriving and departing from Christchurch Airport, as Auckland moved out of Covid-19 lock down. Lastly it was explained how weather conditions influence flight paths used. No further correspondence was received.
	All Aircraft	1	A variety of different aircraft have been flying over complainant's home. They asked about flight paths and what weather conditions meant more aircraft were flying over their home. CIAL's response outlined the need to use the crosswind runway due to the north-westerly wind conditions. The complainant was appreciative for the explanation.

Type of Operation	Type of Aircraft	No of Complaints	Actions Taken
Engine Testing	Turbo-Prop	1	This compliant was related to Engine Testing that occurred at 1.30am. This was a medium power engine test of a turbo-prop AirNZ aircraft. The engines were run at medium power for 1 min and idle power for 4 mins and was conducted at the ground run-up pad adjacent to AirNZ Hangar 1. The complaint indicated the noise occurred at multiple times during that night which was likely also due to two separate flights arriving at Christchurch Airport (NZ Flying Doctors and Parceline freighter). Information about noise and engine testing was provided to the complainant.
		1	This complainant was concerned about Engine Testing noise that was occurring during the night-time and early morning, particularly over Easter. CIAL responded by outlining CIAL's engine testing procedure and the restrictions operated under.

			The complainant asked why some engine testing are carried out during the evening. There was a further correspondence explaining how planes are flying during the day, therefore some maintenance must occur at night. No further response has been received.
	Unknown	1	Complainant reported loud Engine Testing occurring when local school/daycare/kindergarten children would be outside. They suspected the noise was coming from the American Deep Freeze Aircraft and that it lasted at least 30 mins. After investigation, it was found that there was no engine testing occurring at this time. CCTV footage shows the noise was likely due to aircraft operations of the NZDF C130 and consisted of 20 mins noise between start up until take off.
			The complainant was satisfied with response from CIAL and stated that they do not have a problem with operational aircraft noise.
		1	This complaint was about engine testing during the night-time. The complainant felt like this was occurring often and wanted to know why engine testing is not done in the day instead. Investigations found that there was no engine testing at the time the complainant thought, however an AirNZ 787-9 aircraft landed around the same time so that could have been the noise source.
			In addition, CIAL provided details on the night-time engine tests that had occurred over one week in December. It was also outlined why some engine testing cannot be done during the day, as those aircraft are being flown then. There was no further correspondence.

Type of Operation	Type of Aircraft	No of Complaints	Actions Taken
Unknown	Unknown	2	Two reports were received about continuous loud base-like music or an alarm for long periods over a Saturday night of a long weekend. They were unable to locate the source but thought it to be in Airport area, and perhaps could have been an airport tenant's security alarm. Armourguard noise control were involved but could not find the source.

CIAL has responsibilities and compliance requirements of Airport operations and Engine testing. Investigations uncovered that the source of the noise was not airport or engine testing related, as such complainants were directed to talk to CCC Environmental Health Officers who are mandated to monitor and manage other noise sources or compliance issues.

CCC Environmental Health Officers were aware of the noise that evening and it was surmised that the source was a function at Riccarton Racecourse. There was no further correspondence.

6.0 SCHEDULE OF ACOUSTIC TREATMENT

In accordance with Rule 6.1.6.2.7.2 of the Christchurch District Plan, CIAL has developed an Acoustic Treatment Programme (ATP) whereby dwellings existing as at 6 March 2017 within Rural Urban Fringe and Rural Waimakariri Zones become eligible for acoustic treatment.

There are three circumstances when owners are to be offered the opportunity for acoustic treatment,

- Dwellings located within the 65 dB L_{dn} Annual Aircraft Noise Contour;
- Dwellings located within the 65 dB L_{dn} Engine Testing Contour; and
- Dwellings located within the 60 to 65 dB L_{dn} Engine Testing Contour (mechanical ventilation only).

Unlike the Annual Aircraft Noise Contour, the Engine Testing Contour has been fixed by the District Plan. Therefore, there is no change to the number of eligible dwellings inside these noise contours. For engine testing there are ten dwellings eligible for the installation of mechanical ventilation.

For operational noise, a schedule of eligible dwellings is maintained and updated annually when the AANC is prepared. The schedule contains a complete list of 'Existing Dwellings' located within the Future Aircraft Operations Contour (65 dB L_{dn}) and each year the AANC is mapped to identify which of these Existing Dwellings fall within the 65 dB L_{dn} AANC and hence become eligible for treatment.

The 2021 AANC incorporates no additional dwellings compared with the 2020 AANC. This is because the 2021 AANC is smaller than the 2020 AANC.

Therefore, no additional mitigation offers are required this year.

7.0 CONCLUSION

Marshall Day Acoustics has prepared a compliance report with regards to aircraft operations and on-aircraft engine testing at the Christchurch International Airport. The report has been prepared in accordance to Rules 6.1.2.1.5 and 6.1.2.1.6. The main conclusions are:

- The aircraft noise model has been calibrated with noise measurements reviewed and assessed as part of the 2019 NMR. The calibrated noise model was then used to prepare the 2021 AANC
- The 2021 AANC demonstrates compliance with the 65dB L_{dn} Air Noise Compliance Contour contained in the CDP, and is smaller in extent than the 2020 AANC, primarily due to the continued impact on air travel as a result of the global Covid-19 pandemic
- Verification of the ETMS occurred in 2021 using noise measurements at the ETCMPs. The ETMS is still considered an appropriate tool to use for engine testing noise compliance analysis at Christchurch Airport
- Predictions using the ETMS software shows compliance with noise limits detailed in the CDP
- Because the 2021 AANC is smaller than the 2020 AANC, no additional dwellings have become eligible for acoustic treatment

APPENDIX A REGULATORY REQUIREMENTS

6.1.2.1.5 Policy – Airport Noise

a. Require the management of aircraft operations and engine testing at Christchurch International Airport, so that:

i. noise generated is limited to levels that minimise sleep disturbance and adverse effects on the amenity values of residential and other sensitive environments so far as is practicable;

ii. where practicable, adverse noise effects are reduced over time.

b. Mitigate adverse noise effects from the operations of the Christchurch International Airport on sensitive activities, by:

i. prohibiting new sensitive activities within the Air Noise Boundary and within the 65 dB Ldn engine testing contour; and

ii. requiring noise mitigation for new sensitive activities within the 55 dB Ldn air noise contour and within the 55 dB Ldn engine testing contour; and

iii. requiring Christchurch International Airport Limited (CIAL) to offer appropriate acoustic treatment in respect of residential units existing as at 6 March 2017 within the 65 dB Ldn Annual Airport Noise Contour, and within the 60 dB Ldn engine testing contour.

Note: Policy 17.2.2.10 also mitigates noise effects from the operations of Christchurch International Airport on rural land.

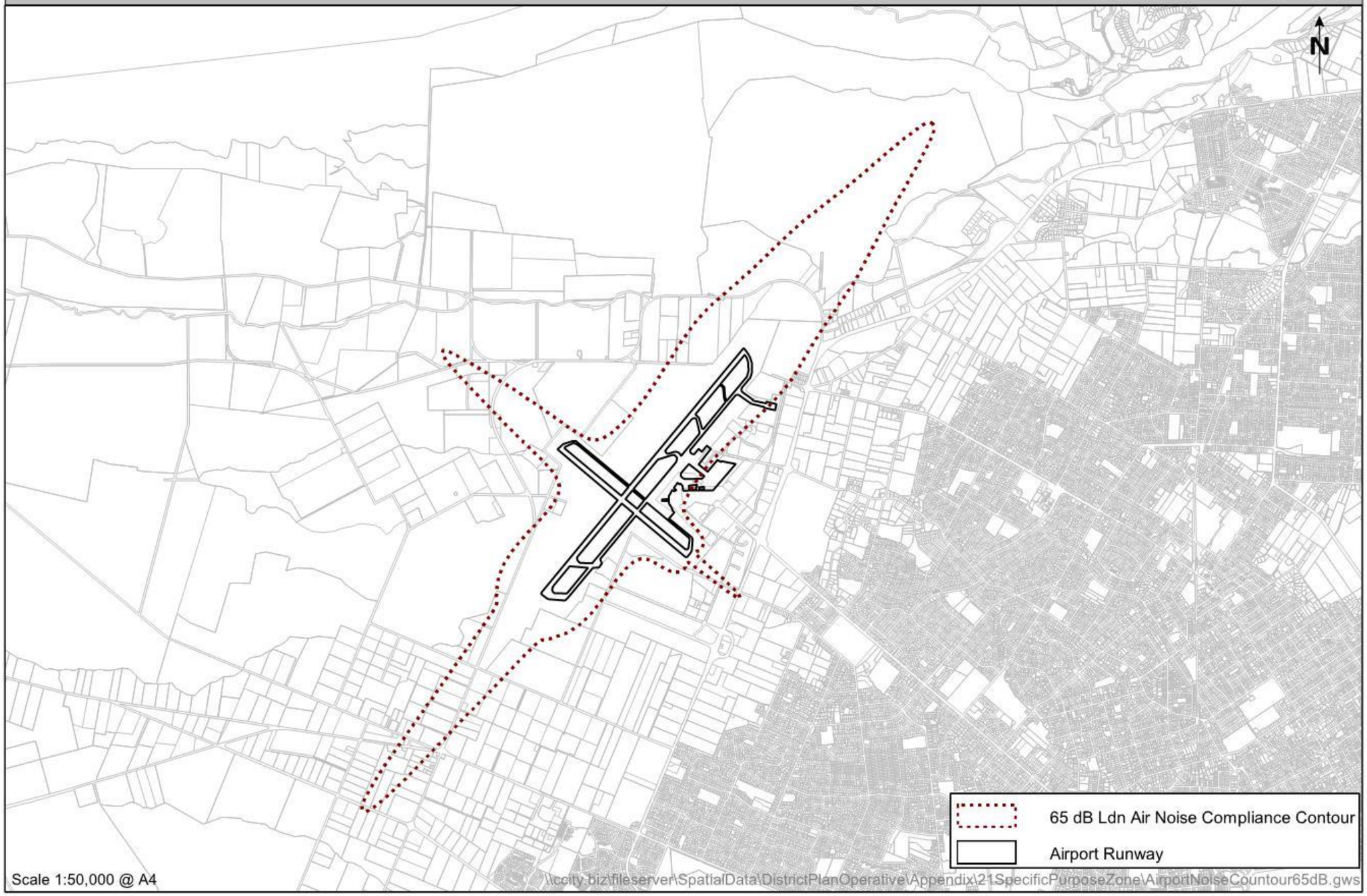
The relevant rules relating to aircraft operation and engine testing noise are given in 6.1.6.2.5 – 6.1.6.2.7.1 and Appendix 6.11.14. They state:

6.1.6.2.5 Aircraft operations at Christchurch International Airport

a. Aircraft operations at Christchurch International Airport shall meet the following activity standards:

i. Noise from aircraft operations shall not exceed 65 dB Ldn outside the 65 dB Ldn Air Noise Compliance Contour shown in Figure 1, other than as provided for in Rule 6.1.6.2.5 a.ii..

Figure 1: Map of 65 dB Ldn Air Noise Compliance Contour



ii. *Noise from aircraft operations may exceed the aircraft noise limit in Rule 6.1.6.2.5 a.i by not more than 2 dB, provided that such exceedance is due to atypical weather, national flight disruption, natural disaster or other unplanned circumstances.*

iii. *Monitoring and determining compliance with activity standards i. and ii. above shall be as follows:*

A. *Noise monitoring of aircraft operation shall be based on calculations from an operational aircraft noise model, and records of actual aircraft operations at Christchurch International Airport over the previous year's aircraft operations.*

B. *Noise from aircraft operations shall be calculated as the Annual Aircraft Noise Contour (AANC), over the busiest three month period of the previous year.*

C. *The calculations shall be performed by a person with appropriate qualifications and experience in airport noise modelling and acoustics assessments.*

D. *The calculated results shall be verified by noise measurements carried out in accordance with the Airport Noise Management Plan required under Rule 6.1.6.2.7.1.*

E. *The measurement of aircraft sound exposure levels and the derivation of the 65 dB Ldn contour shall be in accordance with NZS 6805:1992.*

iv. *An Aircraft Operations Noise Monitoring Report shall be provided annually by the airport operator to the Council, with the first required by the 6 March 2018. The report shall include:*

A. *the calculated AANC;*

B. *the results of the verification measurements;*

C. *analysis of compliance with reference to Rule 6.1.6.2.5 a.i. and ii.(including the number of exceedances and the reasons for them); and*

D. *a summary of complaints received over the previous year in relation to noise from aircraft operations, and any actions taken in response.*

v. *The additional activity standards in Rule 6.1.6.2.7 for aircraft operations at Christchurch International Airport shall be met.*

Definition: Aircraft operations

means:

a. *the landing and take-off of aircraft; and*

b. *aircraft flying along any flight path associated with a landing or take-off.*

For the purposes of Rule 6.1.6 Activity specific noise rules, it excludes:

c. *aircraft operating in an emergency for medical or national/civil defence reasons;*

d. *air shows;*

e. *military operations;*

f. *Antarctic operations;*

g. *helicopter operations;*

h. *aircraft using the airport as an alternative to a scheduled airport elsewhere;*

i. *aircraft taxiing; and*

j. *aircraft engine testing.*

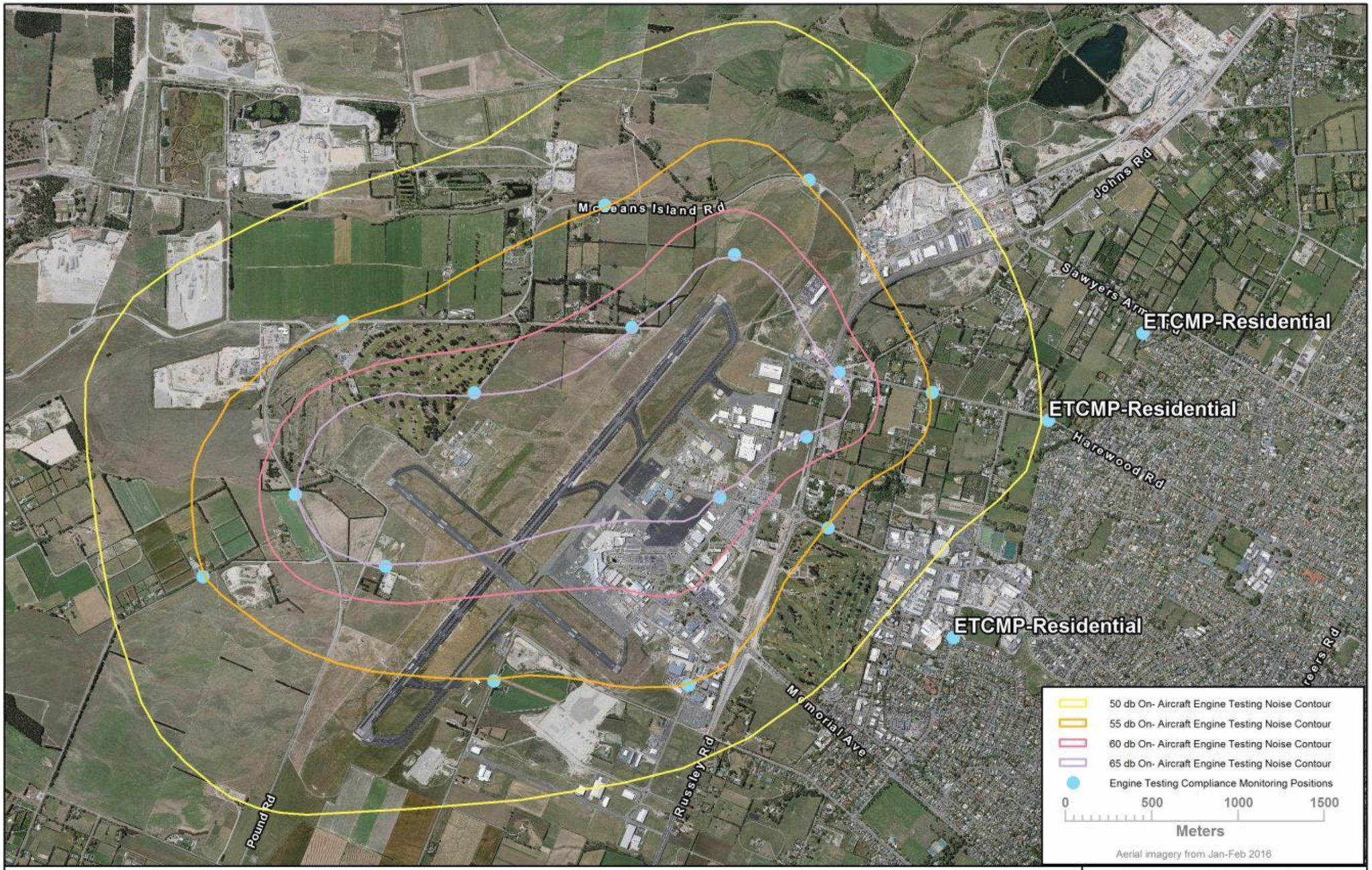
6.1.6.2.6 On-aircraft engine testing at Christchurch International Airport

a. The testing of engines on aircraft at Christchurch International Airport shall meet the following activity standards:

i. Noise from testing of engines on aircraft shall not exceed the noise limits shown in Table 5 below at the engine testing compliance monitoring positions (ETCMPs) shown in Figure 2.

Table 5: On-aircraft engine testing noise limits

Noise Limit	***Engine testing compliance monitoring positions (ETCMP) – refer Figure 2***
65 dB Ldn, 7 day	*8 points*
55 dB Ldn, 7 day	*8 points*
75 dB L_{Amax} 22:00 to 07:00 only	*Edge of residential zone – 3 points*



ii. *All high power testing of jet engines on an aircraft shall occur between the hours of 07:00h and 22:00h, except that a maximum of 5 unplanned engine testing events within any three month period, up to a maximum of 12 unplanned engine testing events per annum, may occur between the hours of 22:00h and 07:00h.*

iii. *Testing of turbo prop engines on an aircraft between the hours of 22:00h and 07:00h, when the total duration of testing at high power is five minutes or more per aircraft, shall be conducted in the vicinity of the threshold of Runway 11 (i.e. the north-western end of the cross-runway).*

iv. *The following exclusions apply:*

   A. *The testing of engines on an aircraft used for Antarctic operations, is excluded from activity standards i.-iii..*

   B. *The testing of engines on any aircraft is excluded from activity standards i.-iii., where such work is necessary to satisfy an airworthiness direction or other like safety requirement issued by the Minister of Transport, the Director of Civil Aviation or the Civil Aviation Authority, as is any other unplanned engine testing arising from an aircraft operator's identification of a safety issue relating to an aircraft fleet, or required as a result of a natural disaster including volcanic eruption.*

   C. *The testing of turbo prop engines on an aircraft is exempted from activity standard iii. When Runway 11/29 is in use.*

v. *Monitoring and determining compliance with activity standard a.i. above shall be as follows:*

   A. *Compliance or otherwise with activity standard a.i. shall be demonstrated by calculations of on-aircraft engine testing noise emissions based on the actual on-aircraft engine testing events and calculations of noise emissions for the engine testing events and configurations in question. The noise level (Ldn, 7 days) shall be calculated as a 7 day rolling average.*

   B. *The calculations in activity standard a.v.A. shall be verified by measurements undertaken with reference to at least four ETCMPs for a sample of at least two different on-aircraft engine test configurations. Verification measurements shall be carried out for an initial period of 6 months from 6 March 2017 and subsequently be undertaken at least once every two years.*

vi. *An On-aircraft Engine Testing Report shall be provided quarterly by the airport operator to the Council, with the first covering the period ending the 30 June 2017 and provided to the Council by the 15 July 2017. The report shall include:*

   A. *a summary of all on-aircraft engine testing activities undertaken in the quarter; and*

   B. *identification of all tests undertaken both in accordance with activity standard a.i. and those excluded by activity standard a.iv., including reasons for the tests excluded an any measures taken to manage noise effects during those excluded tests.*

vii. *An On-aircraft Engine Testing Noise Monitoring Report shall be provided annually by the airport operator to the Council by 6 March 2018, and annually thereafter. The report shall include:*

   A. *the results of verification measurements in accordance with activity standard v.B.; and*

   B. *analysis of compliance with reference to Rule 6.1.6.2.6 a.i.; and*

   C. *a summary of complaints received over the previous year in relation to noise from on-aircraft engine testing, an any actions taken in response.*

viii. *The additional activity standards in Rule 6.1.6.2.7 for on-aircraft engine testing at Christchurch International Airport shall be met.*

6.1.6.2.7 Additional activity standards for aircraft operations and on-aircraft engine testing at Christchurch International Airport

a. The following additional activity standards apply to aircraft operations and to the testing of engines on aircraft at Christchurch International Airport.

6.1.6.2.7.1 Airport Noise Management Plan

a. Within 12 months of 6 March 2017, noise from aircraft operations and on-aircraft engine testing at Christchurch International Airport shall be managed in accordance with an Airport Noise Management Plan prepared by a suitably qualified and experienced person on behalf of the airport operator and in consultation with the Airport Noise Liaison Committee, in accordance with the requirements set out in Appendix 6.11.14. The Airport Noise Management Plan shall be reviewed, and updated if required, at least once every two years.

b. The Airport Noise Management Plan shall:

i. demonstrate how compliance with the following noise limits will be achieved:

A. for aircraft operations – Rule 6.1.6.2.5; and

B. for on-aircraft engine testing – Rule 6.1.6.2.6.

ii. provide the details of the noise monitoring programme;

iii. incorporate a procedure for transparently and expediently responding to any compliance received in relation to noise from aircraft operations and on-aircraft engine testing; and

iv. incorporate a procedure for transparently and expediently presenting, in a publicly accessible forum, the following:

A. the Aircraft Operations Noise Monitoring Report, On-aircraft Engine Testing Report, and On-aircraft Engine Testing Noise Monitoring Report required by Rules 6.1.6.2.5 and 6.1.6.2.6;

B. a 7-day rolling report of noise from on-aircraft engine testing against the requirements of Rule 6.1.6.2.6 a.; and

C. a daily LAmax report of noise from on-aircraft engine testing against the requirements of Rule 6.1.6.2.6 a. at the edge of the residential zone.

Appendix 6.11.14 Airport Noise Management Plan

a. The Airport Noise Management Plan required by Rule 6.1.6.2.7.1 shall:

i. document noise management actions including ongoing investigations, methods, processes and resources to provide for:

A. the management of aircraft operations and on-aircraft engine testing to ensure comp liance with Rules 6.1.6.2.5 a.i. and ii. and 6.1.6.2.6 a.i.-iv.; and

B. consideration of alternative methods of noise management and mitigation to achieve the reduction of noise effects from all aspects of aircraft operations including on-aircraft engine testing; and

C. engine maintenance ground run procedures to be implemented in conjunctionwith all aircraft operators or their agents, including:

i. compliance with Rule 6.1.6.2.6 a.i.-iv., including documentation required by Rule 6.1.6.2.6 a.v.-vii.; and

ii. procedures which will encourage Antarctic and NZDF engine testing on the win g to occur between the hours of 07:00 to 19:00.

ii. provide the details of a noise monitoring programme to maintain compliance with Rules 6.1.6.2. 5 a.iii.-iv. and 6.1.6.2.6 a.v.-vii. and, in particular, the following:

A. the monitoring, recording, verification and calculation of aircraft operation and On-aircraft Engine Testing noise levels;

B. the preparation of the annual Aircraft Operations and On-aircraft Engine Testing Nois e Monitoring Reports and quarterly On-aircraft Engine Testing Report;

C. the preparation of the AANC maps, showing actual noise contours in 1 dB increments from 55 dB to 70 dB Ldn; and

D. the review of the software used for predicting aircraft operation noise and the software used for predicting engine testing noise, at least once every five years to determine whether the models and/or software require updating.

iii. establish dispute resolution procedures.

iv. establish a procedure for transparently and expediently responding to any complaints received in relation to noise from aircraft operations and on-aircraft engine testing.

v. require the maintenance of a website that provides for the transparent and accessible display of

A. the current version of the Airport Noise Management Plan as required by Rule 6.1.6.2. 7.1;

B. the Aircraft Operations Noise Monitoring Report, On-Aircraft Engine Testing Report, a nd On--Aircraft Engine Testing Noise Monitoring Report for the previous year, required by Rules 6.1.6.2.5 and 6.1.6.2.6, including a summary of noise monitoring conducted, and the AANC;

C. A 7-d-ay rolling report of noise from On-Aircraft aircraft engine testing over the previous seven days updated daily and identifying all tests undertaken both within the Ldn limits and those exempted, including reasons for the tests exempted;

D. a summary of complaints received annually and a description of actions taken to addr ess complaints.

vi. document schedules of:

A. acoustic treatment implemented over the past calendar year as required by Rule 6.1.6.2.7.2; and

B. *acoustic treatment offered, where the conditions of the offer required by section b. of Appendix 6.11.15 have not yet been met.* ETCMPs positions

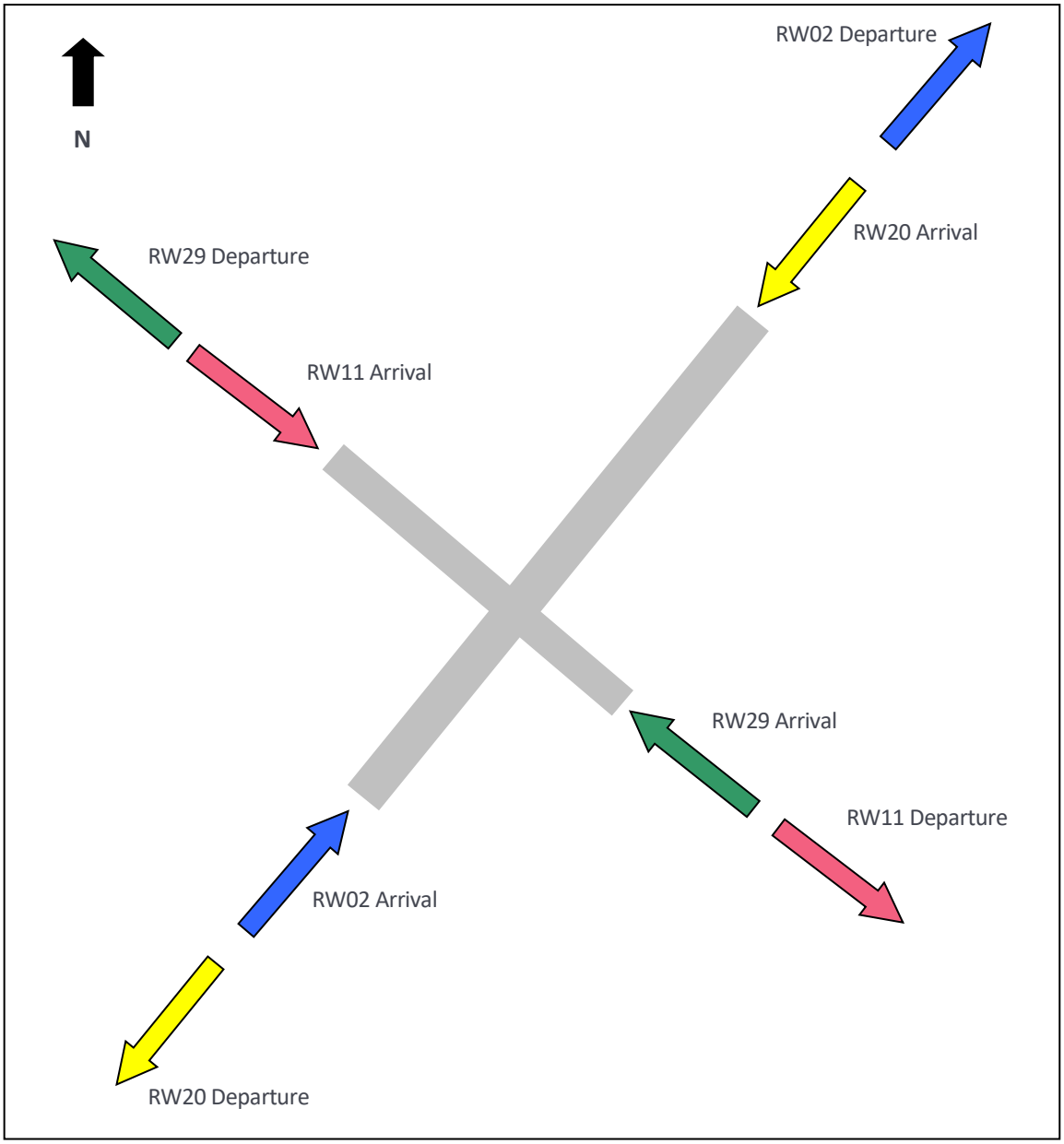
APPENDIX B CHRISTCHURCH AIRPORT RUNWAY VECTORS

Runway 02 refers to operations using the main runway with a heading of 20 degrees from true north i.e. arrivals from the south west landing in a north easterly direction and departures towards the north east.

Runway 20 refers to operations using the main runway with a heading of 200 degrees from true north i.e. arrivals from the north-east landing in a south westerly direction and departures towards the south west.

Runway 11 refers to operations using the crosswind runway with a heading of 110 degrees from true north i.e. arrivals from the north-west landing in a south easterly direction and departures towards the south east.

Runway 29 refers to operations using the crosswind runway with a heading of 290 degrees from true north i.e. arrivals from the south-east landing in a north westerly direction and departures towards the north west.



APPENDIX C MODELLED AIRCRAFT MOVEMENTS

Table C1: Modelled Aircraft Movements by Runway

Aircraft type	Aircraft	RW02		RW11	RW20		RW29	
		Day	Night	Day	Day	Night	Day	Night
Scheduled jet	A20N	1.80	0.47	0.00	0.65	0.36	0.03	0.00
	A21N	2.32	0.07	0.00	1.10	0.05	0.12	0.00
	A320	24.46	1.67	0.01	11.75	1.01	0.62	0.00
	A332	0.09	0.07	0.00	0.04	0.00	0.00	0.00
	A333	0.28	0.26	0.00	0.05	0.05	0.00	0.00
	A359	0.53	0.00	0.00	0.33	0.00	0.00	0.00
	B734	2.46	3.20	0.01	1.04	2.22	0.02	0.00
	B738	0.83	0.00	0.00	0.42	0.00	0.01	0.00
	B763	0.33	0.27	0.00	0.05	0.33	0.00	0.00
	B77W	0.23	0.09	0.00	0.09	0.00	0.00	0.00
	B789	0.79	0.03	0.00	0.42	0.00	0.00	0.00
Scheduled piston	PA31	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Scheduled turboprop	AT75	1.86	0.07	0.00	0.78	0.01	0.08	0.00
	AT76	51.75	1.71	0.04	24.18	0.96	1.85	0.02
	CVLT	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	DH8C	13.21	0.11	0.01	6.22	0.05	0.45	0.00
	PC12	5.48	0.00	0.00	2.49	0.00	0.22	0.00
	SW4B	0.07	0.00	0.00	0.04	0.00	0.00	0.00
Non-Scheduled jet	A320	0.02	0.00	0.00	0.02	0.00	0.00	0.00
	B789	0.48	0.35	0.00	0.25	0.12	0.00	0.00
	BE40	0.03	0.00	0.00	0.03	0.00	0.00	0.00
	C510	0.03	0.00	0.00	0.01	0.00	0.00	0.00
	C680	0.03	0.00	0.00	0.00	0.00	0.01	0.00
	CL60	0.55	0.04	0.00	0.26	0.01	0.01	0.00
	E55P	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Non-Scheduled piston	BE58	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	PA34	0.02	0.00	0.00	0.01	0.00	0.01	0.00
Non-Scheduled turboprop	AT75	0.02	0.00	0.00	0.00	0.00	0.00	0.00
	BE20	0.98	0.05	0.00	0.25	0.04	0.02	0.00
	BE30	0.12	0.01	0.00	0.03	0.00	0.00	0.00
	BE9L	0.32	0.02	0.01	0.15	0.00	0.00	0.00
	C441	0.30	0.01	0.00	0.16	0.02	0.00	0.00
	CVLT	0.01	0.33	0.01	0.03	0.16	0.00	0.00
	JS32	0.11	0.01	0.00	0.05	0.00	0.00	0.00
	PAY4	0.08	0.00	0.00	0.00	0.00	0.00	0.00
	SW4B	0.09	0.00	0.00	0.03	0.00	0.00	0.00

APPENDIX D 2021 NOISE COMPLIANCE CONTOURS

APPENDIX E: 2021 AANC (1 DECIBEL BANDS)