

15 May 2023

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**Attention: Corné Roelofse**

Dear Corné

## **NZ SHOOTING SPORTS CENTRE – ENVIRONMENTAL NOISE ASSESSMENT**

### **Introduction**

Marshall Day Acoustics has been engaged by Terra Consultants, on behalf of the Auckland Shooting Club Incorporated, to carry out acoustic modelling of the already constructed shooting range at 287 Tuhirangi Road, Kakanui. The shooting club has five shooting bays and would cater for shooting using pistols, rifles, and shotguns. We note, however, that pistols would likely be used most often.

This letter shows our recommended noise performance criteria, details our modelling process, and presents our noise prediction results.

In summary, we predict the already established gun ranges can comply with our recommended noise limits.

### **Noise Performance Standard**

We consider the below noise limits to be acceptable for this project. We have based it on those adopted for the Waiuku Pistol Club (refer Appendix A).

- 0700 – 2200 Monday to Saturday 45 dB  $L_{Aeq}$  55 dB  $L_{Amax}$   
0900 – 1800 Sunday
- For 18 special event days 50 dB  $L_{Aeq}$  60 dB  $L_{Amax}$
- To be measured and assessed in accordance with NZS 6801:2008 “Acoustics – Measurement of Environmental Sound” and NZS6802:2008 “Acoustics – Environmental Noise” except Section 6.3 shall not apply.
- To be measured within the notional boundary of a dwelling on an adjoining property in existence at the time of granting consent
- Note that a penalty for special audible character shall not be applied

Note that under the Auckland Unitary Plan (AUP) the noise rules applicable for the site (zoned *Rural – Rural Production* as are all surrounding sites) is Rule E25.6.3. It states that the noise level measured within the notional boundary of any site in any rural zone shall not exceed:

- 55 dB  $L_{Aeq}$  Monday – Saturday 0700 – 2200
- 55 dB  $L_{Aeq}$  Sundays 0900 – 1800
- 45 dB  $L_{Aeq}$  All other times  
75 dB  $L_{AFmax}$

Our experience from other gun clubs is that a Rating Level of 55 decibels is too lenient and that, due to the nature of gun fire noise, an overall noise limit of 45 dB  $L_{Aeq}$  provides acceptable acoustic amenity at the nearest affected properties.

## Noise Management Measures for Ranges

The following management measures have been recommended and incorporated into the design.

### Operational Hours

The proposed hours of operation would be:

- Monday to Saturday 0700 – 2000 hrs
- Sunday 0900 – 1800 hrs
- Special Event days limited to 18 per calendar year

### Control of Gun Noise

- Gun noise between 55 dB  $L_{Amax}$  and 60 dB  $L_{Amax}$  at the nearest notional boundary shall be limited to 18 events per year
- Gun noise that exceeds 60 dB  $L_{Amax}$  at the nearest notional boundary shall be prohibited from use at this range

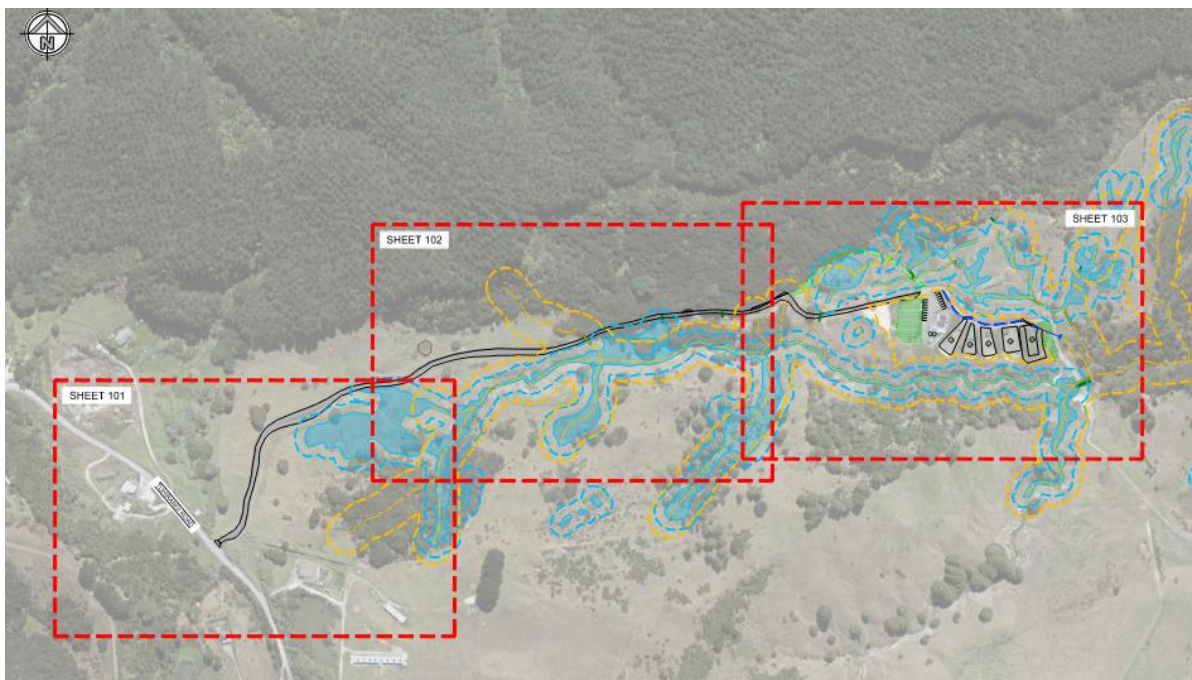
## Acoustic Modelling

A SoundPlan computer-based model, which uses International Standard ISO 9613-2:1996 "Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation", was developed to determine the noise received at the notional boundary of the nearest existing receivers. The program assumes meteorological conditions favourable for sound propagation from the source (i.e. receiver is downwind from source in all directions).

### Topographical Inputs

Terrain data used in the model was obtained from Terra Consultants. Figure 1 below shows the layout of the proposed range. The ranges have been designed to follow the existing terrain.

**Figure 1: Proposed Shooting Range Configuration**



### Model Calibration

The SoundPLAN model was calibrated to match measurements we carried out on 6 March 2018. The meteorological conditions at the time were fine with a light breeze from the west and overcast skies and were generally in accordance with the provisions of NZS6801:2008 Acoustics – Measurement of environmental sound”.

Table 1 shows the measurement results with our measurement positions given in Figure 2:

**Table 1: Measured noise levels**

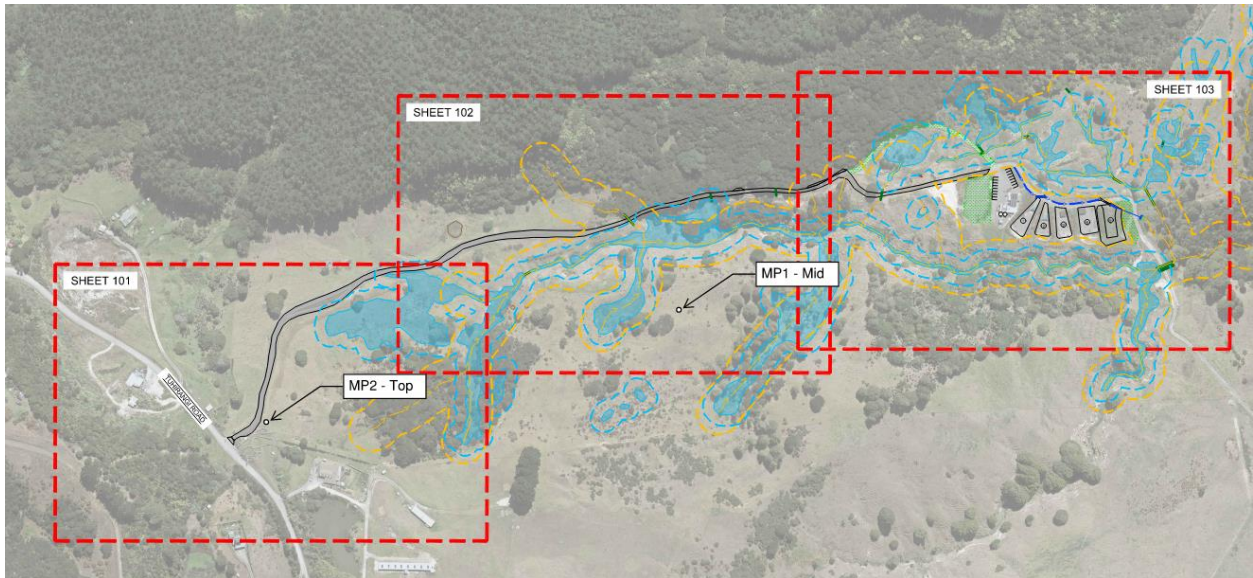
| Measurement Position   | Measured Noise Level (dBA) |                            | Predicted Noise Levels |                    |
|--|----------------------------|----------------------------|------------------------|--------------------|
|  | L <sub>Aeq</sub>           | Average L <sub>AFmax</sub> | L <sub>Aeq</sub>       | L <sub>AFmax</sub> |
| <b>AR15 – Single Shots (average of 12 shots – for L<sub>max</sub> calibration)</b> |                            |                            |                        |                    |
| MP1 – Mid  | 54                         | 57                         | 51                     | 54                 |
| MP2 – Top  | 42                         | 44                         | 45                     | 48                 |
| <b>634 rounds in four minutes (for L<sub>Aeq</sub> calibration)</b>                |                            |                            |                        |                    |
| MP1 – Mid  | 54                         | 55                         | 55                     | 56                 |
| MP2 – Top  | 43                         | 44                         | 48                     | 50                 |

For the second set of measurements, the following firearms and number of rounds were used:

- Range 2
  - o 64 rounds .45 ACP
  - o 160 rounds .38 Super
  - o 85 rounds 9mm Tanfoglio
- Range 3
  - o 90 rounds AR15
  - o 80 rounds .38 Super
  - o 155 rounds 9mm Tanfoglio

Whilst the correlation was considered to be good for position MP1 (halfway between the shooting range and nearest affected property), the predicted levels at the notional boundary of the nearest affected dwelling exceeded the measured values by 3 to 5 decibels. We consider, therefore, that the acoustic model has a reasonable safety margin for the noise predictions.

Figure 2: Measurement Positions



### Scenarios

Two general scenarios have been modelled and are summarised below:

| Scenario          | Average number of rounds   | Comments   |
|-------------------|--|--|
| Typical daily use | Monday to Saturday:<br>2,520 pistol rounds or<br>720 AR15 rounds<br><br>Sunday:<br>2,485 pistol rounds or<br>700 AR15 rounds | <ul style="list-style-type: none"> <li>Based on existing usage rate of 11 people (approximately 450 membership size) per day.</li> <li>Extrapolated to a projected membership size of 5,000. Therefore, a daily usage rate of 110 people per day is anticipated.</li> <li>Calculation includes all 5 ranges in use.</li> </ul>   |
| Special Events    | 7,700 pistol rounds or<br>2,205 AR15 rounds  | <ul style="list-style-type: none"> <li>Special events are typically for competition use (pistols only) or training days for police where AR15s are used.</li> <li>The average rounds per range is understood to be the typical amount fired during a competition. We understand that this would be a reasonable amount fired during training days as well.</li> <li>Calculation includes all 5 ranges in use.</li> </ul> |

### Predicted Sound Levels

Figure 3 shows the nearest sensitive dwellings. Table 1 shows the predicted sound levels.

Figure 3: Nearest Sensitive Receivers

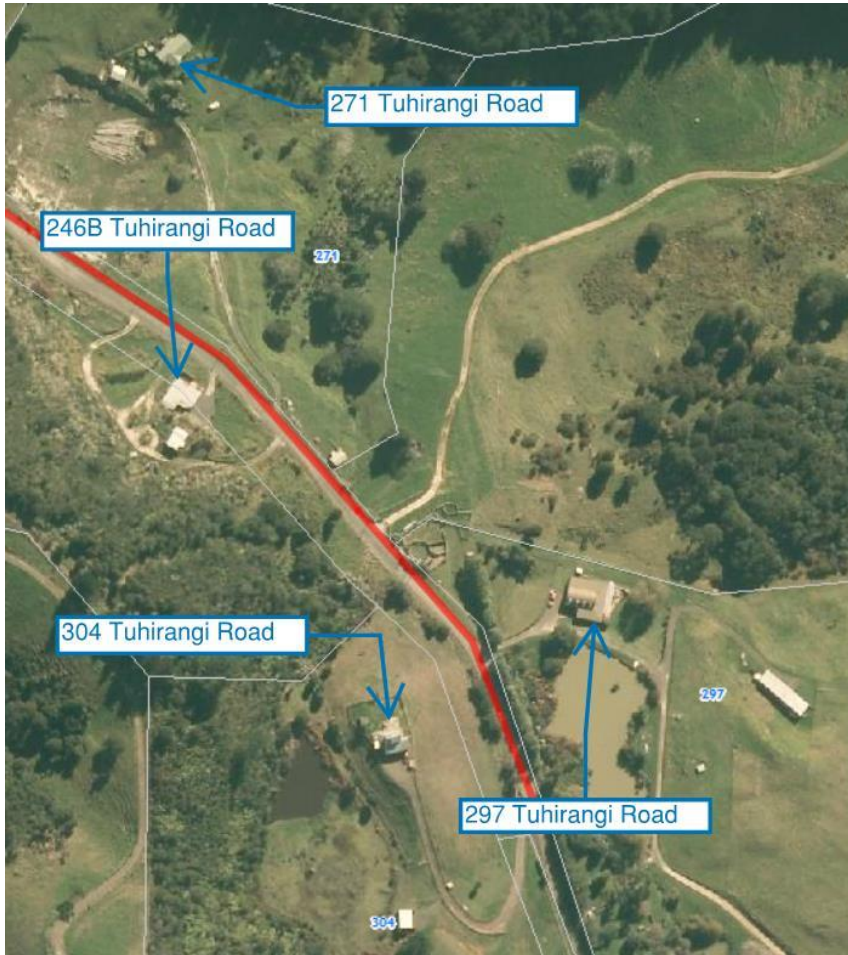


Table 2: Predicted Noise Levels – Pistol Only

| Receiver's Notional Boundary | Predicted Sound Level             |                   |                  |                   |
|------------------------------|-----------------------------------|-------------------|------------------|-------------------|
|                              | Typical daily use (Mon – Sat/Sun) |                   | Special Events   |                   |
|                              | L <sub>Aeq</sub>                  | L <sub>Amax</sub> | L <sub>Aeq</sub> | L <sub>Amax</sub> |
| 246B Tuhirangi Road          | <40                               | 43                | <40              | 43                |
| 271 Tuhirangi Road           | <40                               | <40               | <40              | <40               |
| 297 Tuhirangi Road           | <40                               | 47                | <40              | 47                |
| 304 Tuhirangi Road           | <40                               | 45                | <40              | 45                |
| Vispassana Centre            | <30                               | <30               | <30              | <30               |

**Table 3: Predicted Noise Levels - Pistols and AR15s**

| Receiver's Notional Boundary | Predicted Sound Level             |                   |                  |                   |
|------------------------------|-----------------------------------|-------------------|------------------|-------------------|
|                              | Typical daily use (Mon – Sat/Sun) |                   | Special Events   |                   |
|                              | L <sub>Aeq</sub>                  | L <sub>Amax</sub> | L <sub>Aeq</sub> | L <sub>Amax</sub> |
| 246B Tuhirangi Road          | <40                               | 50                | <40              | 50                |
| 271 Tuhirangi Road           | <40                               | 42                | <40              | 42                |
| 297 Tuhirangi Road           | <40                               | 54                | <40              | 54                |
| 304 Tuhirangi Road           | <40                               | 52                | <40              | 52                |
| Vispassana Centre            | <30                               | <30               | <30              | <30               |

We predict ready compliance at all nearby receivers with our recommended noise performance standard. As shown in Table 2 and Table 3, the most sensitive receiver location, in terms of compliance, is 297 Tuhirangi Road.

We consider that the daily number of rounds fired may increase by as much as 3 times and still comply with the typical daily use noise limit of 45 dB L<sub>Aeq</sub>. For special event days, the number of rounds fired may increase by as much as 8 times and still comply with 50 dB L<sub>Aeq</sub>.

### Conclusion and Recommendation

We recommend a noise performance criterion for the proposed activity of 45 dB L<sub>Aeq</sub> and 55 dB L<sub>Amax</sub> between 0700 – 2200 Monday to Saturday and 0900 – 1800 Sunday. For up to 18 special event days per year, we recommend a noise performance criterion of 50 dB L<sub>Aeq</sub> and 60 dB L<sub>Amax</sub>. All measurements are to be taken within the notional boundary of a dwelling on an adjoining property in existence at the time of granting consent.

We have set up a computer acoustic model for the site which has been calibrated to measured levels with a safety margin of at least 3 decibels.

As shown, we predict ready compliance with our recommended noise performance standard at the notional boundary of all receivers. We also predict compliance during special events where the limits are 50 dB L<sub>Aeq</sub> and 60 dB L<sub>Amax</sub>.

We recommend that noise surveys be undertaken at regular intervals to confirm compliance.

We trust this information is satisfactory. If you have any further questions, please do not hesitate to contact us.

Yours faithfully

**MARSHALL DAY ACOUSTICS LTD**

**Micky Yang**

**Acoustician**

**APPENDIX A WAIUKU PISTOL CLUB NOISE LIMITS**

c. General Noise

- i. The consent holder shall ensure that the noise generated by all firearm discharge activity on the site is measured in accordance with the provisions of NZS 6801:2008 Acoustics – Measurement of Environmental Sound and assessed in accordance with the provisions of NZS 6802:2008 Acoustics – Environmental Noise and shall not exceed the following noise limits at any point within the notional boundary of a dwelling in existence at the time of granting consent on an adjoining property during the following times:

Wednesday to Sunday, except public holidays:

1000 hrs to 1600 hrs      55 dBA  $L_{max}$  and 45 dBA  $L_{eq}$  (15 mins)

- ii. On no more than 18 days per year in accordance with condition (k) of this consent the following noise levels shall apply.

Wednesday to Sunday, except public holidays:

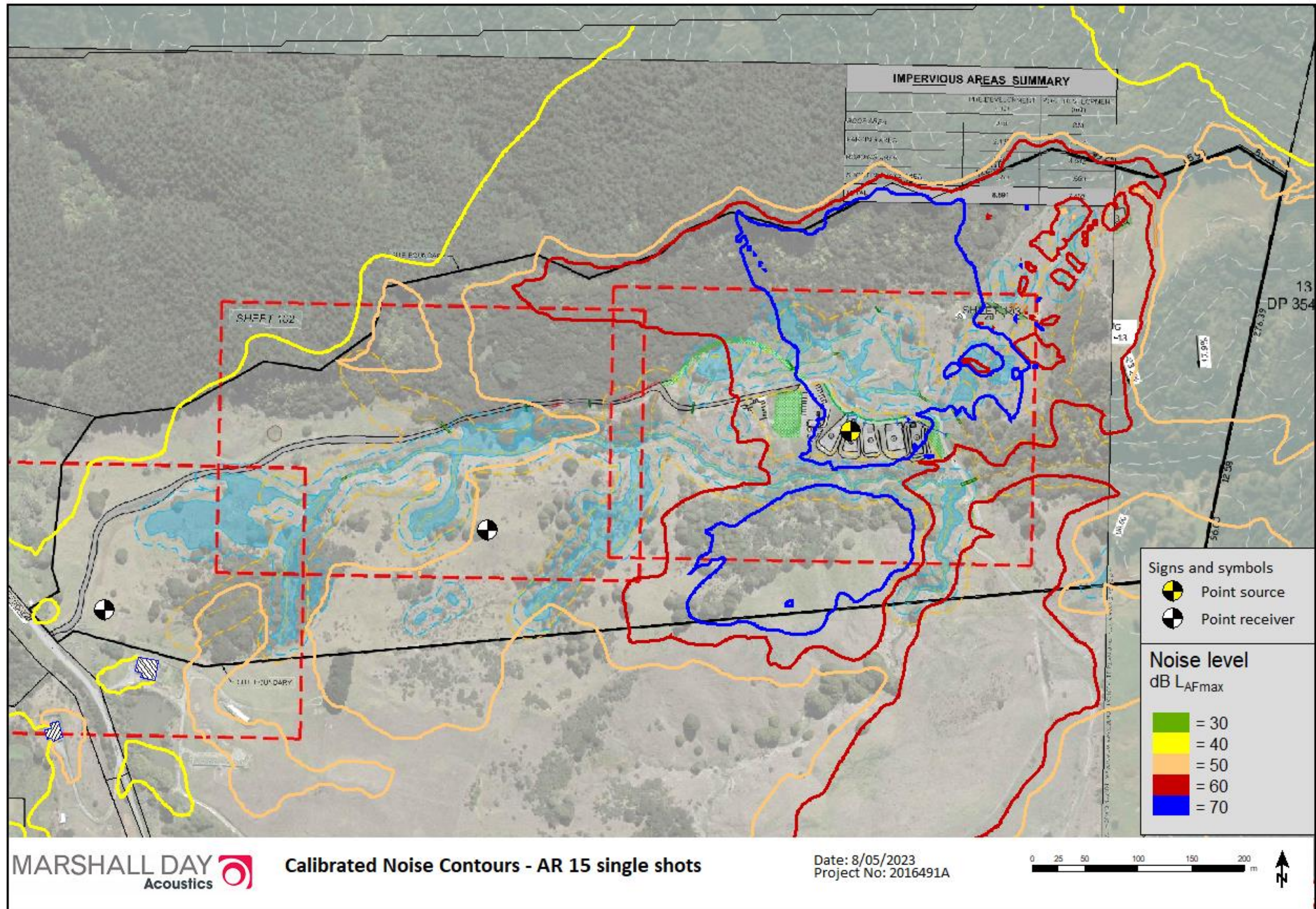
1000 hrs to 1600 hrs      60 dBA  $L_{max}$  and 50 dBA  $L_{eq}$  (15 mins)

These days shall be designated as 'special event days'.

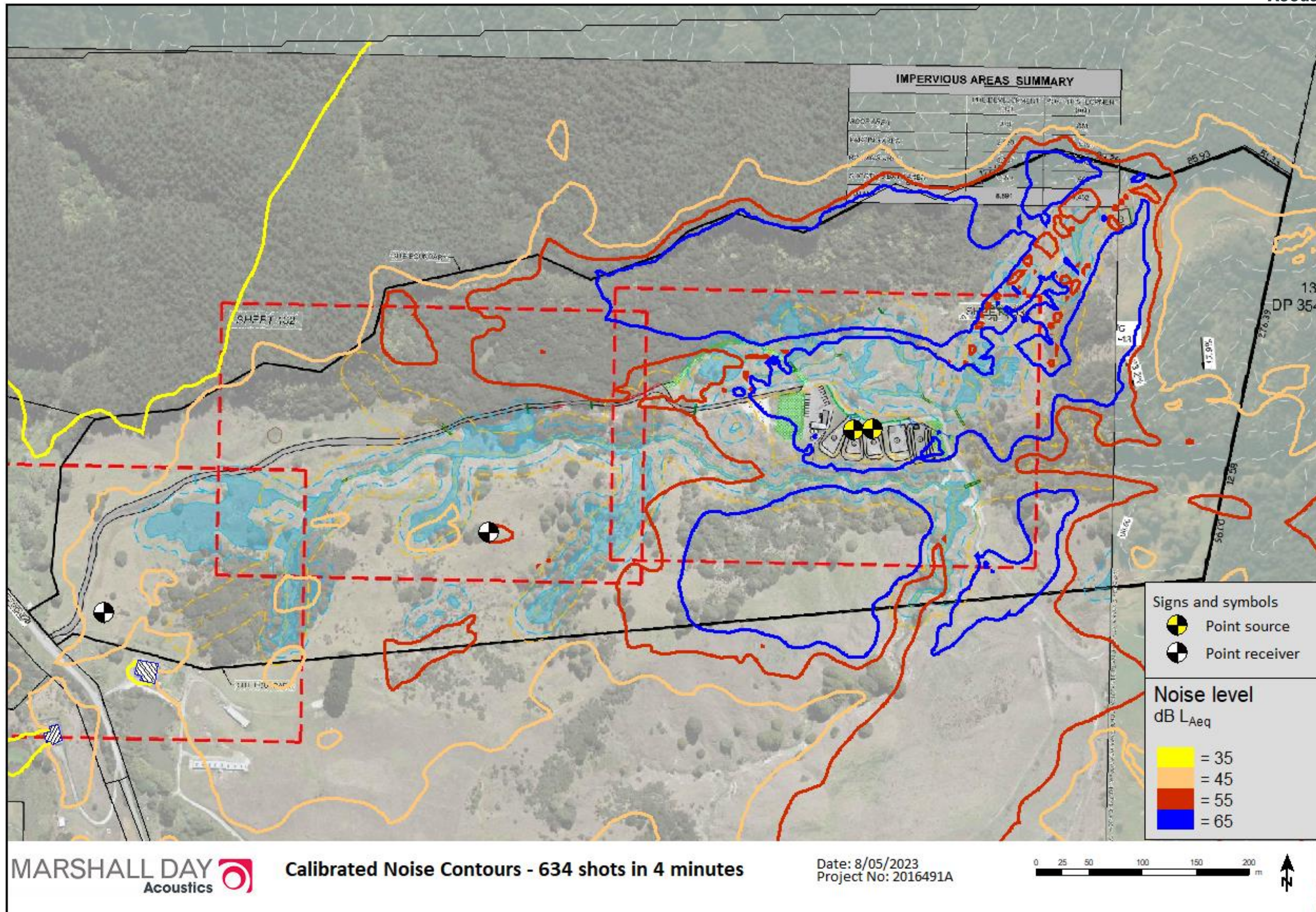
The rule excludes special audible character, so therefore noise generated by activities occurring for less than 3 hours per day could reach 50 dB  $L_{Aeq}$  and 55 dB  $L_{Aeq}$  for special events. Individual gun noise is controlled by the  $L_{max}$  noise limit.

It is understood that of all the noise rules associated with gun clubs around the city and afar, the Waiuku gun club noise limit has had the best outcome for both the club and the adjacent community. MDA would recommend applying those noise limits to this application.

APPENDIX B CALIBRATION CONTOUR MAPS







## APPENDIX C MANAGEMENT OF GUN NOISE

### Gun Noise Standards

There is no New Zealand standard for the assessment and control of gunshot noise in New Zealand. There is no real consistency in NZ regarding the assessment of noise from organised gun club / rifle range / shooting activities. Criteria that has been used for gunshot noise assessment in New Zealand together with a discussion on the relevance of each are summarised below:

**CNR:** The composite noise rating was developed by the Australian NAL laboratories (report number 67) in 1977 and is an attempt to correlate the  $L_{peak}$  noise level with the number of annual gunshots, number of days use, and extent of neighbour tolerance, etc. This criterion is often used by Hegley Acoustic Consultants and can be found in several court and resource consent decisions. CNR is an old criterion which is based on abstracted  $L_{peak}$  levels making it harder to measure and assess than a directly measurable level. The CNR rating was originally intended for use predicting annoyance from aircraft and has since been superseded (for aircraft noise).

The NAL report does not provide clear direction for what ratings should be applied to new shooting ranges. However, the NAL report 67 contains the following graphs that relate annoyance to the CNR rating.

Figure 4:NAL Report 67 Figure 1

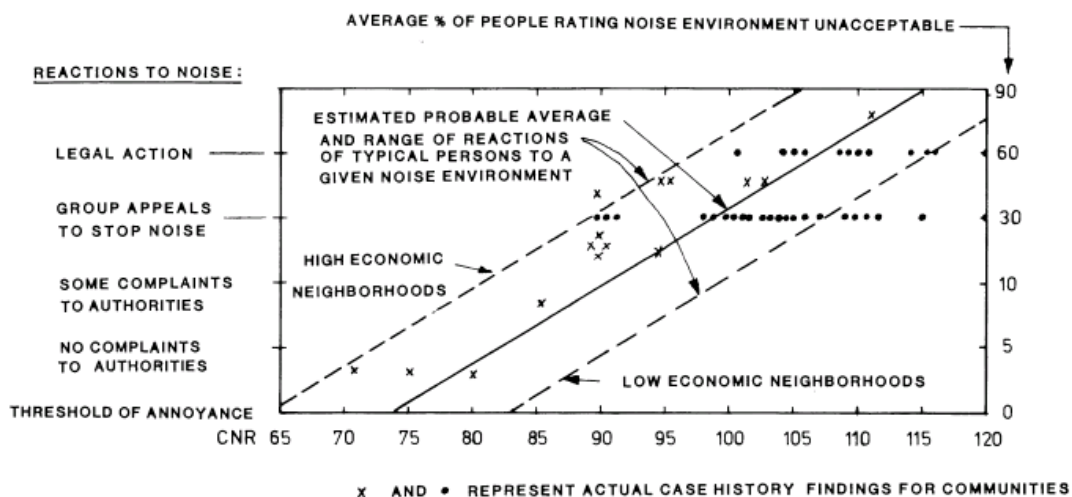


FIGURE 1. Relation between CNR and (a) community reactions to noise (left hand ordinate); (b) the percentage of people finding the noise unacceptable (right hand ordinate). The range of CNR for given community reactions is less than shown if the high and low socioeconomic groups are plotted separately (after Kryter, 1970).

Figure 1 shows that at a CNR of 90, between 5 to 30% of people are expected to find the noise environment unacceptable (the “probable average” is 10%). The expected reaction to noise varies between “no complaints to authorities” to “group appeals to stop noise”.

It can be seen that at a CNR of 80, the risk of annoyance is reduced, notwithstanding that in “high socio-economic neighbourhoods” perhaps 10% of people may still be annoyed and there may be some complaints.

Figure 5:NAL Report 67 Figure 2

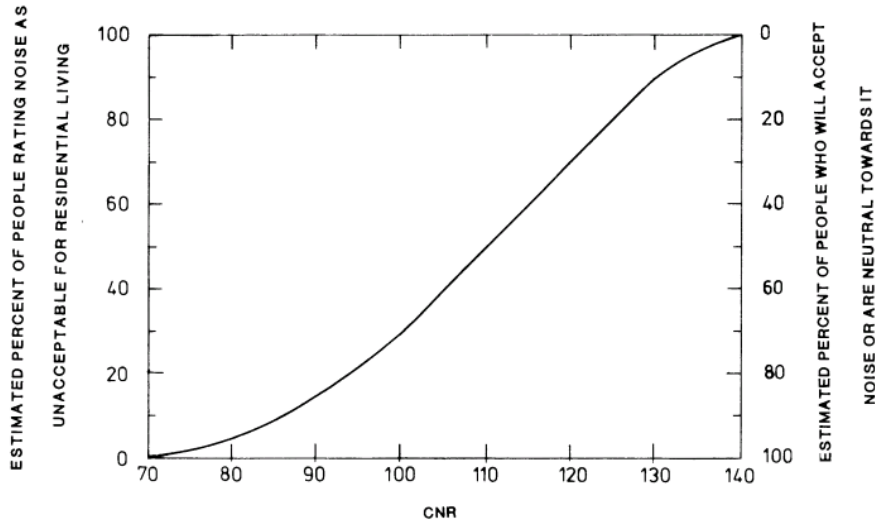


FIGURE 2. Estimates of attitudes to be expected from non-fear provoking noise in residential areas, by CNR (after Kryter, 1970).

**L<sub>peak</sub>:** Several papers correlate  $L_{zpeak}$  noise levels with annoyance. *S. Sorensen and J. Magnusson*<sup>1</sup> suggest that approx 80 dB  $L_{Cpeak}$  is where the threshold of annoyance lies, (but suggest that  $L_{AFmax}$  is a better metric). The paper *A. J Hede and R. B Bulle*<sup>2</sup> found a similar correlation with  $L_{Cpeak}$  levels of 80 dB indicating 5% of people would be seriously affected and 20% moderately affected

**L<sub>AFmax</sub>:**  $L_{AFmax}$  levels appear to correlate reasonably well with annoyance (Refer *A. J Hede and R. B Bulle, S. Sorensen and J. Magnusson*). An  $L_{AFmax}$  noise level provides no correlation on number of shots and annoyance and so an  $L_{AFmax}$  criterion is probably only relevant for a rifle range shooting 10,000+ shots per annum. Literature suggests that  $L_{AFmax}$  levels of 55 dBA and below are likely to be acceptable from rifle ranges, however these shots may be clearly audible. Literature suggests that between 55 and 65 dB  $L_{AFmax}$  serious annoyance will start to arise at some point (i.e. that the onset of serious annoyance is somewhere in this range). The paper *V. Desamaulds*<sup>3</sup> showed that  $L_{AFmax}$  noise limits for small firearms are typically between 50 to 60 dB  $L_{AFmax}$ . A few regulations allow noise levels above 60 dB  $L_{AFmax}$ . However, it is noted that data in this paper is difficult to interpret with confidence.

The Victorian EPA (AUS) has issued a publication entitled “*Noise from Outdoor Shooting Ranges*”. This document recommends noise levels in terms of the “ $L_{AIMax}$ ” parameter. This is a similar parameter to the  $L_{AFmax}$  level<sup>4</sup>. The guideline suggests 45 dB  $L_{AIMax}$  (or the background plus 10 dB, whichever is higher) for between 3 to 7 days of shooting per week on a planned range.

<sup>1</sup> *S. Sorensen and J. Magnusson, Annoyance Caused by Shooting Ranges, Journal of Sound and Vibration (1979) 62(3), 437 – 442*

<sup>2</sup> *A. J Hede and R. B Bulle, Community Reaction to Noise from a Suburban Rifle Range, JASA (1882) 82(1), 39-49*

<sup>3</sup> *V. Desamaulds, Shooting Noise Regulation Review of Various National Practices, Proceedings of Internoise 98, Christchurch*

<sup>4</sup> For a typical gunshot shot, the  $L_{AIMax}$  noise level would be higher than the  $L_{AFmax}$  level, perhaps by around 2 to 5 dB (although greater differences may occur).

Environment Court decisions are worth reviewing on this matter - specifically the Ashburton Rifle Range and the Nelson Rifle Range (Harvey).

**L<sub>Aeq</sub>:** L<sub>Aeq</sub> levels and the correlation with annoyance does not appear to be well studied (although LAE/SEL has been studied - refer to *A. J Hede and R. B Bulle*). However, some consultants suggest they are a good way of controlling noise as they consider number of shots, level and duration all in one metric. L<sub>Aeq</sub> controls have been suggested in a number of applications (Waiuku Pistol Club, Nelson Rifle Range and Ashburton Rifle Range). There is a lack of guidelines in the literature on what is a reasonable L<sub>Aeq</sub> noise level. A noise limit of 45 dB L<sub>Aeq (15 min)</sub> (special audible character correction not to be excluded) at a specified boundary was set for Waiuku pistol club with a relaxation to 50 dB L<sub>Aeq (8 hour)</sub> for 18 special events per year (a noise limit of 50 dB L<sub>Aeq</sub> would be equivalent to the AUP:OiP noise limit where special audible character would apply).

**L<sub>AE</sub>:** The LAE / SEL level is another way of including allowances for level and number of shots in the metric / limit. However, LAE / SEL levels do not appear to have found their way into many decisions. These metrics are used in the ISO suite of standards with regard to shooting noise.

**SNL:** The Shooting Noise Level (SNL) is suggested by the UK Chartered Institute of Environmental Health as a way of controlling noise from clay pigeon shooting. It is essentially the logarithmic average L<sub>AFmax</sub> noise level of the loudest 25 shots. The document states the following:

*“...The BRE research suggests that there is no fixed shooting noise level at which annoyance starts to occur. Annoyance is less likely to occur at a mean shooting noise level (mean SNL) below 55 dB(A), and highly likely to occur at a mean shooting noise level (mean SNL) above 65dB(A). The likelihood of annoyance at levels within this range will depend upon local circumstances.”*

If enough shots are fired it is considered by MDA that the L<sub>AFmax</sub> noise level and the SNL will be somewhat similar. On this basis the criterion of 63 dB L<sub>AFmax</sub> is in the region of where “annoyance is likely to occur” and is marginally below than the region where “annoyance is highly likely to occur”.