Appendix 3: AES Peer Review of Acoustic Report

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13 March 2020

Vicki Barker
Selwyn District Council
PO Box 90
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Email: Vicki.Barker@selwyn.govt.nz

Dear Vicki

Re: Peer Review of Assessment of Noise for West Melton Rifle Range

As requested, we have undertaken a peer review of the Assessment of Noise prepared for the New Zealand Defence Force (NZDF) by Tonkin & Taylor (T+T) for the West Melton Rifle Range (WMRR). This assessment is being used to inform draft Selwyn District Plan provisions relating to land use planning near this activity.

Our review is based on a desktop assessment of the following material:

- Report titled *West Melton Rifle Range – Assessment of Noise* as prepared by Tonkin & Taylor and dated 18 December 2019 (the T+T report).
- West Melton Rifle Range – Draft Provisions received by email from Vicki Barker on 16 January 2020.
- Report titled *New Zealand Defence Force, Re-assessing Noise from Temporary Military Training in New Zealand, District Plan Recommendations* as prepared by Malcolm Hunt Associates (MHA) and dated January 2013 (the MHA report).
- Letter titled West Melton Rifle Range – Response to Acoustics Peer Review as prepared by Tonkin + Taylor and dated 28 February 2020 (the RFI response).
- Revised map titled *Noise Control Boundary for Consultation* as prepared by T+T and dated 5 March 2020.

1.0 NOISE GENERATING ACTIVITY

The T+T report describes the main sources of noise associated with WMRR which include weapons firing on the Wooster A & B ranges near Range Road, grenade training on the grenade range, 40 mm mortar firing and controlled detonations of high explosives which occur to the north west of the Wooster Ranges.

Taking into account the level of activity at WMRR over a year, and the sound generated by each of these sources, a 55 dB L_{dn} 'outer control boundary' and 65 dB L_{dn} 'inner control boundary' have been presented in the T+T report.

In the remainder of this section we discuss aspects which may affect the extent of these boundaries. In section 2.0 we discuss the justification for the selected criteria in relation to noise associated with military ranges.

1.1 Modelling

We agree that the modelling software used (SoundPLAN) and assumptions stated in section 4.2 of the T+T report are reasonable. Calculation based on ISO:9613-2 is typical best practice as this assumes conditions favourable to sound propagation.

A table showing peak and sound exposure levels for each of the sources used at WMRR has been provided the RFI response. The peak sound pressure levels presented appear to be consistent with published data for similar small arms, and for hand grenades. It is unclear why the peak sound pressure levels provided in the MHA report for grenades and 40 mm mortars are significantly lower than the values provided by T+T, although given the consistency with published data we consider the T+T values to be a reasonable basis for the modelling.

Based on this information and the number of events provided, we have been able to calculate the relative contribution of each of these sources at the extent of the 55 L_{dn} contour. It appears that grenade use primarily determines the extent of the contour, particularly to the west.

Directivity is described as a characteristic of weapon noise in section 2.2 of the T+T report. The RFI response notes that that the highest sound levels occur in front of the muzzle and to the side (not at the operator's ear) and clarifies that no specific provisions for directivity have been included in the model. Since the base data for rifle type is measured at the operator's ear, and firing only occurs in a northerly direction, T+T consider that this is likely to result in worst case sound levels for small arms. We note that by using this base data, the noise levels for small arms to the east and west of the range could potentially be underestimated, although this is unlikely to result in any significant changes to the contour in this direction because of other more dominant sources. Based on the commentary in the RFI response, we also note that the T+T measurements appear to be consistent with the sound levels in the model for this activity. In the absence of more comprehensive source data we agree that this is a reasonable approach and additional source data is not required.

1.2 Proposed activity

Activity levels for future use of the range have been retained from earlier MHA modelling, and the yearly level of activity for each of these sources has been provided. We agree that it is a robust approach to base control boundaries on an anticipated level of future activity, although the material we have reviewed provides no indication about how this future level of activity relates to the current use of the range. The RFI response does note that the projections are for a "busy point in the next 10 years" which is a reasonable forecast period. Since the underlying forecasts will determine how large the contours are, we recommend that the basis for this information is confirmed by NZDF.

1.3 Annual distribution

Based on comment in section 4.2 of the T+T report, it appears that WMRR will be used over 42 weeks of the year, and the predicted noise levels have been determined based on a yearly average. In section 2.1, the T+T report states that *"L_{dn} is usually averaged over a year to reflect the varying periods of light and heavy training loads, as well as periods with no activity".*

T+T have provided further comment on this in their RFI response, noting that the range has been assumed to be open for a period of 250 days per year. Given the number of events provided by NZDF represents a busy point in the next 10 years, T+T state that averaging Range activity over this timeframe is representative of a busy period, but not an absolute worst case. Further comment on the seasonal distribution of activities at the range has not been provided.

This is a significantly longer averaging period than the other New Zealand Standards referenced by T+T which use the L_{dn} in a similar manner. For aircraft noise NZS 6805:1991 refers to the busiest 3 months, for port noise NZS 6809:1999 refers to the busiest 5 day period, and for helicopter noise NZS 6807:1994 refers to averaging over no longer than 7 consecutive days.

If there is significant seasonal distribution in the activities at WMRR, for example there is typically more activity during the summer months when daylight hours are longer, or there are more incidences of louder events in a given week (grenades for example) then the monthly/weekly L_{dn} would be higher in these months than the values predicted using the 250 day average.

However, given the underlying forecasts from NZDF are based on a "busy point" 10 years in the future, and considering the maximum noise levels expected at nearby dwellings (discussed in section 2.0 below), the level of usage embodied in the contour appears to represent a reasonable basis for future land use planning.

1.4 Night-time use of WMRR

The T+T report describes some night-time use of the range, predominantly on the Wooster Ranges. Further information on the night-time use of the range has been provided in the RFI response. We understand that the forecasted night-time activity (between 10 pm and 7 am) is for less than 18 rounds fired on approximately 20 occasions per year. There will be no use of grenades, 40 mm mortar or detonations between these hours, although there may be occasional grenade use during the evening up to 2200 hours.

We agree with T+T that District Plans often establish reduced night-time noise limits from 10 pm and this is the period when sleep disturbance is typically considered to be relevant noise effect. For types of noise which are not continuous, the World Health Organisation (WHO) Community Health Guidelines state that there is the potential for noise induced awakenings within bedrooms at external levels of 60 dB L_{AFmax} (allowing for a dwelling with windows open).

Based on the peak levels provided, and a typical -25 dB adjustment to adjust from peak to maximum noise levels (which is also consistent with the T+T measurements), we expect that noise from these firing events on the Wooster ranges will generate noise levels below 55 dB L_{AFmax} at the extent of the 55 dB L_{dn} contour which is not expected to cause sleep disturbance at this distance.

2.0 APPROPRIATE CRITERIA

We agree with T+T that a 55 dB L_{dn} 'outer control boundary' inside which noise sensitive buildings are required to include acoustic insulation measures, and a 65 dB L_{dn} 'inner control boundary' inside which new dwellings are not permitted is an approach that is commonly used for aircraft and port noise in New Zealand.

Based on the information provided in Appendix B of the T+T report, a similar approach to land use management also appears to be adopted in the United States for military noise involving large calibre weapons (with a different parameter used for small arms weapons). This provides useful context, although because these guidelines apply to large calibre weapons and use the C-weighted L_{dn} the threshold values cannot be directly compared to what is proposed in this case.

The percentage of populations that are shown to be annoyed or highly annoyed when exposed to the same L_{dn} level of noise is different depending on the source. Section 2.1 of the T+T report discusses how noise associated with military training activities can be perceived differently to other types of environmental noise due to the impulsive nature and the increased perception of low frequency sound at distance. While we agree that a L_{dn} control boundary approach is likely to be able to be used to provide reasonable land use controls in this case, there is limited supporting information provided about the suitability of the proposed 55 / 65 L_{dn} (annual average) thresholds for this type of noise.

To provide another point of reference for the acceptability of this noise, based on the data provided we have estimated expected maximum noise levels at the extent of the 55 dB L_{dn} contour.

The most frequent noise event will be rounds fired on the Wooster Ranges. Noise levels received at the extent of the 55 dB L_{dn} contour to the south from this activity are expected to be in the order of 55 dB L_{AFmax} which is consistent with international guidance for the upper limit of noise received from rifle ranges in residential environments (typically 50 – 55 dB L_{AFmax}). This indicates that the 55 dB L_{dn} contour is in a reasonable location for this type of noise, and that provisions to require mitigation for any activity establishing inside the 55 dB L_{dn} contour would be reasonable.

There will be louder noise events from grenades, mortars and detonations, although these events occur much less frequently than activity on the Wooster Ranges. The future annual activity level equates to 80 events per day for grenades, 5 mortar firing events per day, and <1 detonation per day.

From the base data provided, grenades could generate noise levels in the order of 85 dB L_{AFmax} at the extent of the 55 dB L_{dn} contour, with higher levels from detonations and mortars. Data we have reviewed from previous MHA measurements of WMRR activity received to the south of the range, within the extent of the 55 dB L_{dn} contour (attached as Appendix A) appears to show that levels from these sources are variable and may typically be lower than this. Given the relative infrequency of these sounds, the 55 dB L_{dn} contour produced by T+T may again be a reasonable threshold for the onset of effects requiring mitigation associated with these sources – however as above we are not aware of any directly relevant research or precedent for this, and so consider the exact location of the outer control boundary where it is driven by these infrequent, higher noise level sources to be relatively arbitrary.

3.0 PROPOSED DISTRICT PLAN RULE

We have reviewed the draft District Plan rule NOISE-7.1. The current proposal is to require buildings containing noise sensitive activities establishing between the 55 dB L_{dn} and 65 dB L_{dn} overlays to demonstrate that a suitable internal noise level will be met. Where windows need to remain closed, an alternative ventilation system should be provided. New noise sensitive activity within the 65 dB L_{dn} overlay would be a non-complying activity.

We agree that this is a common generic approach although we recommend the following amendments to the proposed rule:

- We recommend that internal noise level requirements in b. of the draft rule reference appropriate L_{dn} criteria (instead of L_{Aeq}) so that they are consistent with the L_{dn} metric used for the overlay. This is similar to the proposed aircraft rule.

- We recommend that point d. relating to the 'design noise level' is replaced with an interpolation condition similar to the aircraft requirement. For example: *"For the purpose of sound insulation calculations, the external noise levels for a site shall be determined by application of the L_{dn} overlays. Where a site falls within the contours the calculations shall be determined by linear interpolation between the contours."*

We note that this rule provides no protection for outdoor amenity in a residential setting, which will often influence people's response to this kind of noise. For context we note that the US land use planning guidelines referenced by T+T also only provide provisions relating to upgrades for dwellings inside the "noise zone" where residential activity requires mitigation.

As above there appears to be no directly relevant research or precedent for the methodology that has been used to establish the proposed exact location of the control boundaries – and similarly there is no specific research for this particular noise source which confirms that requiring dwelling upgrades but no control over noise received in outdoor areas where levels are 55 to 65 dB L_{dn} and prohibition of new buildings containing noise sensitive activities above 65 dB L_{dn} is an appropriate mitigation response. However we agree that what is proposed is similar to the controls commonly applied to other sources, and the overall outcome in terms of land use planning is likely to be reasonable.

4.0 SUMMARY

The modelling methods and source data provided by T+T appears reasonable and is consistent with typical best practice and available data.

We agree that an 'outer control boundary' inside which noise sensitive buildings are required to include acoustic insulation measures, and an 'inner control boundary' inside which new dwellings are not permitted would be a reasonable approach to managing noise in the vicinity of WMRR. It appears a similar approach has been used in the U.S to manage military noise from large calibre weapons.

While a 55 dB L_{dn} threshold for the outer control boundary, and a 65 dB L_{dn} threshold for the inner control boundary is used for aircraft and port noise in New Zealand, there does not appear to be any specific research for how this relates to military noise. This type of noise has a distinct character and will be perceived differently than these other sources.

Based on the source level data provided for each of the activities occurring at WMRR, we consider that maximum noise levels received at the extent of the 55 dB L_{dn} overlay will be consistent with international guidance for the protection of residential amenity for firing events on the Wooster ranges. Maximum noise levels associated with grenades, mortars and detonations will be higher, although these events occur much less frequently. Where the outer control boundary is driven by these infrequent, higher noise level sources there is no specific research which confirms that the 55 dB L_{dn} contour is the exact threshold for the onset of effects requiring mitigation, or that new buildings containing noise sensitive activities should be prohibited above 65 dB L_{dn}.

However, we agree that what is proposed is similar to the controls commonly applied to other sources, and the overall outcome in terms of land use planning is likely to be reasonable.

Please do not hesitate to contact me to discuss further as required.

Kind Regards,

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Senior Acoustic Engineer
Acoustic Engineering Services

Measurements Of Live Firing Bells Road, West Melton.
Range approx 1,500 metres to source(s) All values dB.

		LCpeak	LAFmax	difference
11:34:00	40mm	99.8	76.1	23.7
11:35:00	40mm	69.6	46.1	23.5
11:36:00	40mm	95.8	71	24.8
11:37:00	40mm	97.2	74.4	22.8
11:38:00	40mm	80.6	58.2	22.4
11:39:00	40mm	78.1	46.7	31.4
11:40:00	40mm	63.9	38.4	25.5
12:10:00	Claymore	66.9	44	22.9
10:57:00	Detonation	68.7	41.3	27.4
11:01:00	Detonation	66.1	40.3	25.8
11:08:00	Grenade	64.3	38.7	25.6
11:09:00	Grenade	65.3	39.8	25.5
11:10:00	Grenade	64.6	39	25.6
11:11:00	Grenade	65	39.7	25.3
11:12:00	Grenade	65.1	41.9	23.2
11:13:00	Grenade	74.9	48.4	26.5
11:14:00	Grenade	84.5	58.2	26.3
11:15:00	Grenade	97.3	73.8	23.5
11:16:00	Grenade	76.6	64.9	11.7
11:17:00	Grenade	99.6	76	23.6
11:18:00	Grenade	100.5	77.3	23.2
11:24:00	Grenade	100.5	75.1	25.4
11:25:00	Grenade	75.1	48.2	26.9
11:26:00	Grenade	68.7	44.6	24.1
11:27:00	Grenade	98.1	74	24.1
11:28:00	Grenade	97.2	73.8	23.4
11:29:00	Grenade	63.8	39	24.8
11:31:00	Grenade	74.4	47.3	27.1
11:32:00	Grenade	62.7	39.5	23.2
11:33:00	Grenade	72.1	47.3	24.8
11:43:00	Grenade	87.4	62.1	25.3
11:44:00	Grenade	68.7	45.9	22.8
11:45:00	Grenade	69	46.6	22.4
11:57:00	Grenade	93.5	68.6	24.9
11:58:00	Grenade	102.8	77.2	25.6
11:59:00	Grenade	68.4	36	32.4
12:00:00	Grenade	71.9	48.6	23.3
12:01:00	Grenade	98.3	73.7	24.6

Average difference = 24.6 dB