



PROPOSED NEW SHOOTING CLUB  
AT TERREY HILLS  
PENINSULAR FIREARM ACADEMY INC.

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PENINSULAR FIREARM ACADEMY INC.

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PREPARED FOR

BOSTON BLYTH FLEMING  
SUITE 1, 9 NARABANG WAY  
BELROSE NSW 2085

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## GLOSSARY OF TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

**Maximum Noise Level ( $L_{Amax}$ )** – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

**$L_{A1}$**  – The  $L_{A1}$  level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the  $L_{A1}$  level for 99% of the time.

**$L_{A10}$**  – The  $L_{A10}$  level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the  $L_{A10}$  level for 90% of the time. The  $L_{A10}$  is a common noise descriptor for environmental noise and road traffic noise.

**$L_{Aeq}$**  – The equivalent continuous sound level ( $L_{Aeq}$ ) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

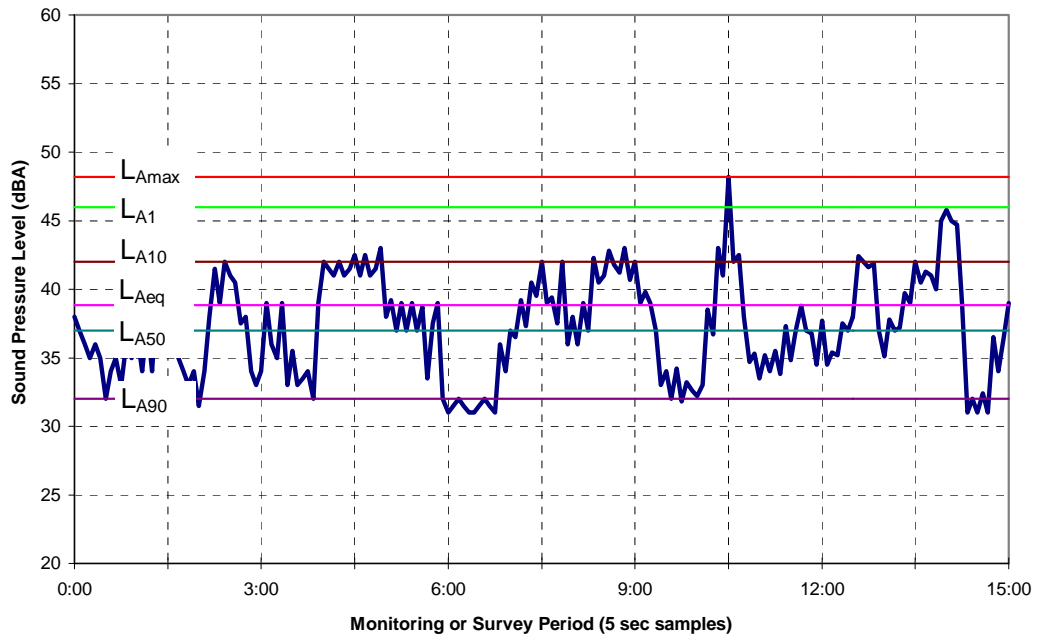
**$L_{A50}$**  – The  $L_{A50}$  level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the  $L_{A50}$  level for 50% of the time.

**$L_{A90}$**  – The  $L_{A90}$  level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the  $L_{A90}$  level for 10% of the time. This measure is commonly referred to as the background noise level.

**ABL** – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10<sup>th</sup> percentile (lowest 10<sup>th</sup> percent) background level ( $L_{A90}$ ) for each period.

**RBL** – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

### Typical Graph of Sound Pressure Level vs Time



## 1 INTRODUCTION

The Peninsula Firearm Academy Incorporated proposes to construct a new shooting club at Mona Vale Road, Terrey Hills. The range will be 100m long and built to a “no exit” standard, meaning that the full length of the bullets’ trajectory will be surrounded by walls and earth mounds to prevent bullets escaping from the range. This report presents a noise assessment of the proposed range.

This report addresses only noise from shooting at the club. The club is at 450m from the nearest residence and any other noise source from the club would be insignificant.

Noise from extra traffic generated by the proposal is also assessed.

## 2 DESCRIPTION OF THE PROPOSAL

### 2.1 Site Description

The location of the proposed range is shown on Figure 2-1. The nearest residences to the club are listed in Table 2-1. The nearest residence is 450m to the south-west of the club and located across Mona Vale Road. The buildings to the east of the club are industrial or commercial. To the west of the club is the St Ives Showground. The club is also surrounded by crown land and parts of Ku-ring-gai Chase National Park.

**Table 2-1 Nearest Residences to Site**

Receiver Number	Address	Distance to Range (m)
1	Mona Vale Road (south)	450
2	Mona Vale Road (east)	650
3	Myoora Road (Terrey Hills)	1580
4	Bundaleer Street (Belrose)	1500

### 2.2 Hours of Operation

One meeting per month is proposed. The meeting would be on Sunday between 12.30pm and 4.30pm.

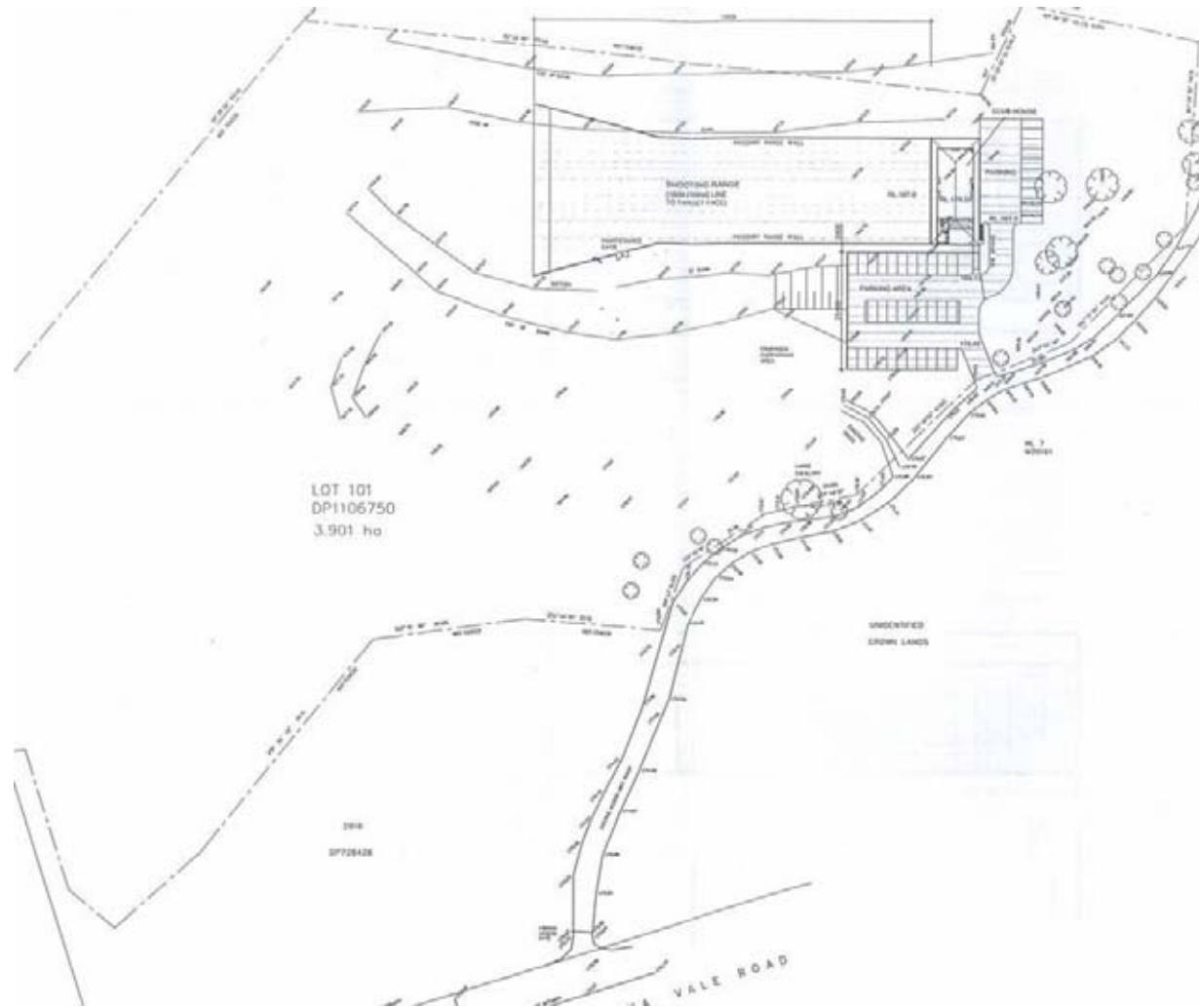
### 2.3 Site Plan and Range Description

Figure 2-2 shows the site plan. The figure shows that the club is located off Mona Vale Road. The range is oriented from east to west. The range is surrounded by a 3m high masonry wall. To the west of the range is an earth mound 14.5m high intended to capture any bullets which ricochet out of the range. Also worth noting for acoustic reasons is that all shooting takes place from within the club house behind an “eyebrow” baffle. Whilst its purpose is for safety, the eyebrow baffle would serve to reduce noise from rifle shots as they exit the building.

Figure 2-1 Site Location and Sensitive Receivers



Figure 2-2 Site Plan and Relation to Mona Vale Road



### 3 NOISE CRITERIA

The Environment Protection Authority, now part of the DECCW, published the *Environmental Noise Control Manual (ENCM)*. Chapter 164 of the *ENCM* gave noise limits for target shooting ranges based on the frequency of the use of the range. These are shown in Table 3-1. The *ENCM* states that “Criteria may be used for guideline and less stringent figures could be used if site details and topography are very favourable.”

**Table 3-1 Residential Noise Level Limits for Target Shooting Ranges**

Shooting Range	Residential Level – dB(Lin) L <sub>peak</sub>										
	60	65	70	75	80	85	90	95	100	105	Over 105
Maximum Usage – Days (Nights) Per Week											
Existing Range Daytime Use	7	7	7	7	7	7	5	4	3	2	1
Existing Range Night Time Use	3	3	2	2	2	1	-	-	-	-	-
Future Range Daytime Use	7	5	5	4	3	2	1	-	-	-	-
Future Range Night Time Use	3	2	1	-	-	-	-	-	-	-	-

While the *ENCM* is now generally superseded, no alternative guidelines for rifle range noise or similar sources have been put forward in subsequent documents. The DECCW *Noise Guide for Local Government, Part 3, Noise management Principles*, says

*Outdoor shooting ranges – As this noise comprises a set of very short duration, high intensity events, noise measurements may need to be made using a specialised noise descriptor to adequately describe the noise impact. Sound level meters used to measure noise from shooting ranges should be set at ‘peak hold’ with a linear weighting, that is, no weighting at all. Councils could develop a policy that limits the number of days and nights that the range is used according to a measured typical maximum peak hold value so that when noise levels are high, fewer days are available for events than for venues where noise levels are lower. The policies from other states may provide guidance such as Audible Bird Scaring Devices – Environmental Noise Guidelines (EPA SA 2007)*

The guidelines in Table 3-1 are not inconsistent with this principle, and will be adopted in this report for assessment of shooting noise from the range.

## 4 PREDICTED NOISE LEVELS

### 4.1 Description of the Noise Source

Because the criteria are expressed in terms of unweighted or Linear, peak noise, accurate prediction is not possible using standard prediction procedures, which are designed to predict average or r.m.s. noise levels. However, it is possible to obtain a conservatively high prediction the peak levels and this leads to a conservative assessment.

The National Acoustics Laboratory Report No. 84 (February 1981) *Community Reaction to Noise from Hornsby Rifle Range* by AJ Hede & RB Bullen, discusses noise levels for the firearms expected to be used at this range.

For firearms such as pistols and shotguns, whose bullets travel at velocities below the speed of sound, the most significant noise is from the explosion at the gun. Peak noise levels from this source are attenuated by shielding and distance to the residences. At the proposed range, this noise will be further attenuated by the building and the eyebrow baffle.

For high power weapons, which in this report means those whose bullets travel at supersonic speeds, the noise has two components:

- noise from the explosion within the rifle; and
- noise from shockwave shedding from the bullet as it travels along its trajectory at supersonic speeds.

Although the second component is generally found to be lower in peak level than noise from the rifle, this component will not be attenuated by the building and eyebrow baffle.

### 4.2 Noise Source Levels

A range of weapons would be used at the range. In general there are two classes of weapon that would be used - rim fire and centre fire.

Rim fire weapons are the least powerful and generally fire bullets at speeds below the speed of sound.

Centre fire weapons are the most powerful and can fire bullets whose velocity is supersonic for the length of the range.

It is proposed to fire firearms of calibre up to 375 H&H at the range. Noise levels of several firearms were measured by Bassett Acoustics for their Report No. SA0026-GG-A1 of October 2003. That report was a noise assessment of a previous proposal for a shooting range at the same site. The results of those measurements are shown in Table 4-1. Note that all of these weapons are centre fire and in general would fire bullets at supersonic speeds. Noise from rim fire weapons is assumed to be at the lower end of the range. A level of  $L_{\text{peak}}$  143 dB is assumed for rim fire weapons.

**Table 4-1 Noise Levels Measured by Bassett Acoustics at 10m, 45 Degrees to Line of Firing**

Type of Firearm	L <sub>peak</sub>	ASEL
Winchester 308 (7.62 Nato)	148	125
Remington 223 (5.56 Nato)	143	119
45/70 (Ported)	144	125
243	142	121
444	149	127
Long Barrel 22/250	145	123

### 4.3 Prediction of Noise Levels

The NAL Report 84 gives a predictive equation for calculating noise at a distance from the range, but this does not allow for shielding provided by range walls, earth mounds or natural topography. The equation is:

$$L_{\text{peak}} = 94.0 + 5.49 (1 + \cos\theta)^{2.7} + 0.11 V - 20 \log (D/100)$$

where

- $\theta$  is the angle between the trajectory of the bullet and the line from gun to receiver;
- D is the distance from gun to receiver in metres; and
- V is a vector wind component in m/sec.

The wind is not known at the Terrey Hills site; however, this term is small and likely wind speed variations would not result in significant differences in predicted levels.

### 4.4 Testing of Live Fire Noise Levels at the Range Location

To validate the formula proposed in Section 4.3 permission was obtained to test noise levels at the site of the proposed range.

A rifle using .308 Winchester (7.62 Nato) calibre bullets was fired along a 100m trajectory as close as possible to the location of the proposed range. Noise levels were measured at 83m and at the residence at Location 2.

The noise was analysed using the Samurai sound analysis system. The analysis showed that close to the firing location the rifle noise and bullet noise are both of significant level. However, analysis of the noise at the residence showed that the rifle noise had been significantly attenuated, but the bullet noise was similar to the predicted level. Three shots were measured at the residence and the L<sub>peak</sub> levels were 105, 105 and 111dB.

The predicted level at the measurement location is L<sub>peak</sub> 111dB.

It is noted that even with the same rifle firing three shots at 15 second intervals, there is a spread of 6dB in L<sub>peak</sub> noise levels, due presumably to short-term meteorological fluctuations. While the predictive equation predicts the highest measured noise level, many shots would be expected to have lower levels.

#### 4.5 Noise to Residences

Noise from weapons that do not fire supersonic bullets will be reduced by the shielding provided by the building. This noise is shielded significantly more to the east than to the west. All rim fire weapons fall into this category.

Prediction of noise from high power centre fire rifles is complicated by noise from shockwave shed by the bullet along its supersonic trajectory. Peak levels from this source are typically lower than from the gun, but in the direction of the bullet trajectory they may be higher. This noise is not attenuated by the building.

The predictive equation of Bullen and Hede refers to unshielded noise, and the measurements reported above indicate it gives a conservatively high estimate of unshielded peak noise levels at this site. To provide a conservative estimate of final noise levels, this equation was used as the starting point for calculation of noise from both the gun (shielded by the building) and the bullet (shielded by external mounding). In both cases, the calculation included:

- the predictive equation by Hede and Bullen;
- shielding by local topography, range walls and safety bund, and the building in the case of the gun; and
- atmospheric absorption.

Predicted noise levels are given in **Table 4-2**. The predicted noise level of the rifle within the building would apply to the rifle noise component of noise from centre fire weapons, and to all noise from rim fire weapons.

**Table 4-2 Noise,  $L_{peak}$ , to Residences**

Receiver Number	Address	Distance to Range (m)	Predicted Noise Level – Rim Fire Rifle Noise from Within building	Predicted Noise Level, Supersonic Bullet of Centre fire rifle
1	Mona Vale Road (south)	450	68	81
2	Mona Vale Road (east)	650	64	91
3	Myoora Road (Terrey Hills)	1580	30	46
4	Bundaleer Street (Belrose)	1500	38	41

For noise from within the building, the maximum predicted level is at Location 1 as it is closest to the firing position. The maximum predicted level is 68dB at Location 1. The levels are shown in **Table 4-2** for other residential locations. With reference to Table 2-1, the range would be considered suitable for use for 5 days or nights per week for levels less than 70dB.

For noise from supersonic bullets, the maximum predicted level in **Table 4-2** is 91dB. With reference to Table 2-1, the range would be considered suitable for use for 1 day or night per week for levels less than 90dB. Given the conservative assumptions made for the calculation, this minor exceedance is considered negligible. Also, it is noted that it is proposed to use the

range only once per month, not once per week.

#### 4.6 Noise to Parks and St Ives Showground

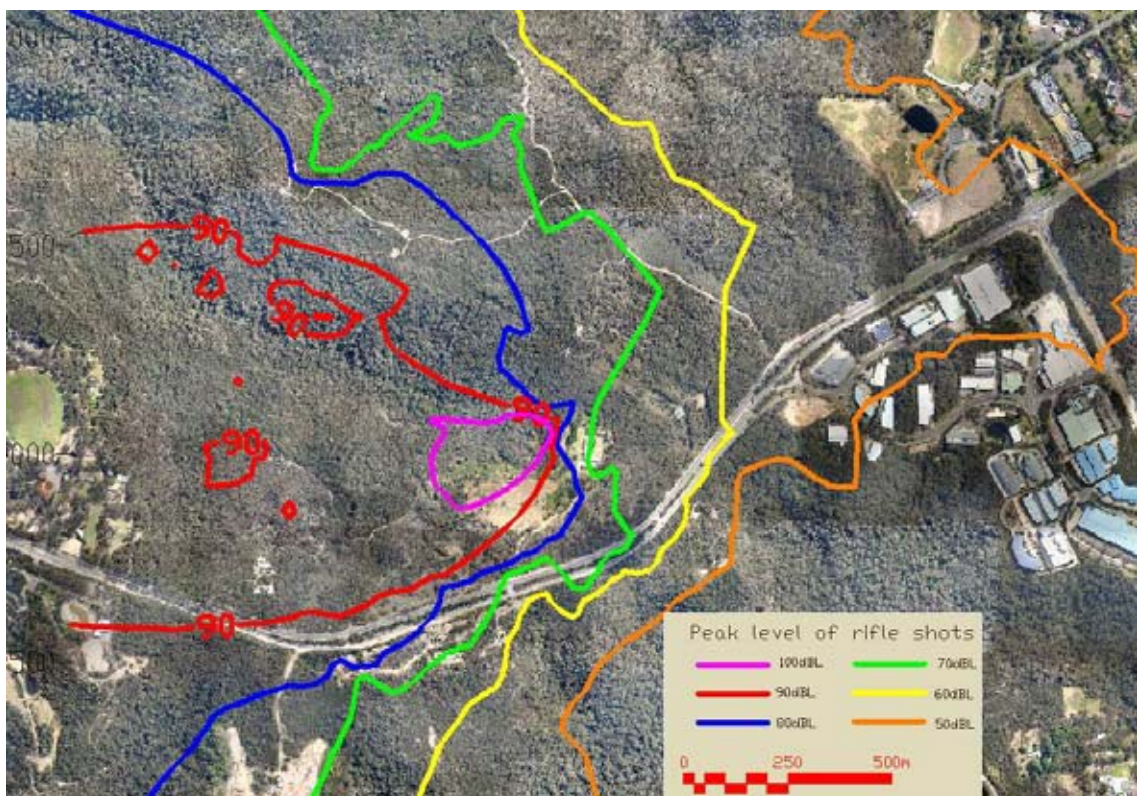
Ku-ring-gai Chase National Park is located to the north of the shooting range. Approximately 1km west is St Ives showground.

There are no target shooting noise criteria for recreational areas. Typically, for other types of noise, the criteria for recreation areas are higher than those for residential locations.

Figure 4-1 shows an aerial view of the area. The figure shows a noise contours for noise from supersonic bullets, predicted using the NAL Report 48 technique, and allowing for shielding provided by topography. These predictions should be considered approximate as the location of the showground area is outside the limits where the predictive equation has been tested, and the topographic shielding of  $L_{\text{peak}}$  levels is not well understood. The predicted levels at the showground are less than 90dB  $L_{\text{peak}}$ . The 90dB contour extends north and south of the showground, corresponding to areas less protected acoustically by the earth bund at the western end of the firing range.

Trails can be seen north and east of the range location, and most of the large trails appear to be outside the 90dB contour. As this level would be considered suitable for residential locations for 1 meeting per week, it is reasonable to consider that there would be minimal noise impact at recreational areas outside this contour. Noise levels would be suitable for active recreation except very near the range. There appear to be no dedicated areas for passive recreation, for example picnic grounds, within the 90dB contour.

Figure 4-1  $L_{\text{peak}}$  Noise Contours



## 5 TRAFFIC NOISE

### 5.1 Road Traffic Noise Goals

The DECCW's *Environmental Criteria for Road Traffic Noise (ECRTN)* sets out criteria for assessment of noise from vehicles on public roads.

The *ECRTN* sets out noise criteria for 'arterial', 'sub-arterial', 'local roads' and 'collector roads'.

Mona Vale Road would be considered an arterial road. Criteria for "land use developments with potential to create additional traffic" are as follows:

- Arterial Roads
  - Daytime (7.00am-10.00pm)  $L_{Aeq,15hr} = 60dBA$
  - Night Time (10.00pm-7.00am)  $L_{Aeq,9hr} = 55dBA$

In cases where the criteria are already exceeded, consideration should be given to reasonable and feasible means of reducing traffic noise to the criteria. In all cases, traffic from the development should not lead to an increase in existing levels of more than 2dBA.

### 5.2 Traffic Flows

A traffic report *Proposed Shooting Range Facility, Lot 101, DP 1106750 Mona Vale Road, Terrey Hills, Traffic and Parking Impact Assessment, 3 February 2011* was prepared by Ray Dowsett Traffic and Transport Planning Pty Ltd. According to that report the peak traffic generation expected would be 31 two way vehicle movements between 2.45pm and 3.45pm. Further, *as the Academy would be transferring its events from the St Ives Pistol Club's facility the proposal will not result in any substantial change to the number of vehicle movements to and from the site.*

The total movements over the day would be approximately twice the maximum hourly flow, or 62 vehicles per day. These movements would take place during the daytime assessment period.

The traffic report discusses to RTA traffic counts. The Annual Average Daily Traffic (AADT) on Mona Vale Road at Forest Way was 48,819 in 2005. The traffic flow details for the Sunday daytime periods are not available, however it is reasonable to assume that it would be at least 30,000 vehicles per day.

### 5.3 Assessment of Traffic Noise Levels

The addition of 84 movements to the existing traffic flow during the Sunday daytime period would not increase existing noise significantly. The increase would be less than 0.1dBA and is considered negligible.

## 6 CONCLUSION

A noise assessment of the proposed target shooting range at Terrey Hills was conducted.

The noise was assessed using criteria published in the *Environmental Noise Control Manual*. The criteria determine the number of times the range could be used per week based on the  $L_{\text{peak}}$  noise level at residences.

The prediction of noise from high powered rifles is described in the body of the report. The uncertainty of predicting propagation of noise for  $L_{\text{peak}}$  levels is described. To allow for this uncertainty, measurements of live fire at the range were performed, and conservative assumptions were made in predicting worst case noise levels at residences.

The noise from rim fire weapons is predicted to be less than  $L_{\text{peak}}$  80dB at all residences. Under the adopted criteria, the range would be suitable for up to 5 meetings per week for rim fire weapons.

At residences west of the range, the noise from the supersonic bullets is predicted to be at most 91dB.

Under the adopted criteria, levels of 90dB would be suitable for a proposed range that operates one day or night per week. While the predicted maximum level is 91dB, the 1dB exceedance is not considered significant for two reasons:

- the range will only operate one afternoon per month; and
- due to the conservative assumptions made, the noise levels of most rifle shots is likely to be less than 90dB.

The impact of increased traffic noise due to the proposal was assessed. The proposal could increase the number of movements on Mona Vale Road by 80 vehicles per day. As Mona Vale Road is a busy arterial road, the traffic noise increase would be insignificant and no noise impact is predicted.

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Version	Status	Date	Prepared by	Checked by
C	Final	8 February 2011	George Jenner	Rob Bullen