ACOUSTICS AND AIR

FERNHILL PRECINCT, MULGOA

NOISE ASSESSMENT FOR DA

REPORT NO. 13101-A
VERSION B

DECEMBER 2013

PREPARED FOR

CUBELIC HOLDINGS PTY LIMITED

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Final	26 June 2013	George Jenner	Neil Gross
B	Final	18 December 2013	George Jenner	-

Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose. The information contained in this document produced by Wilkinson Murray is solely for the use of the client identified on the front page of this report. Our client becomes the owner of this document upon full payment of our **Tax Invoice** for its provision. This document must not be used for any purposes other than those of the document's owner. Wilkinson Murray undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Celebrating 50 Years in 2012

Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. 2010 saw the introduction of our Queensland office and 2011 the introduction of our Orange office to service a growing client base in these regions. From these offices, Wilkinson Murray services the entire Asia-Pacific region.

TABLE OF CONTENTS

Page

GLOSSARY OF ACOUSTIC TERMS

1 INTRODUCTION 1

2 PROJECT DESCRIPTION 1

3 NOISE CRITERIA – EMISSION FROM CENTRAL PRECINCT 4

3.1 *INP* Guidelines 4

3.2 Noise Criteria 4

3.3 Noise Monitoring of 2013 Events 6

4 NOISE ASSESSMENT OF CENTRAL PRECINCT 7

4.1 Monitoring of Events 7

4.2 Recommendations 7

4.3 Regular Events 7

4.4 Medium Sized Events 8

4.5 Signature / Large Events 8

5 TRAFFIC NOISE 9

5.1 Goals for Traffic Generated by the Development 9

5.2 Traffic Noise Assessment 9

6 NOISE ASSESSMENT OF HOUSING PRECINCTS 11

6.1 Traffic Noise into New Housing Developments 11

6.2 Noise from the Central Precinct 12

6.3 Other Noise Sources 12

6.4 Traffic Noise Generated by the Housing Precincts 12

7 NOISE MANAGEMENT PLAN 13

7.1 Central Precinct Noise Management Plan 13

8 CONCLUSION 13

8.1 Housing Precincts 13

8.2 Function Precinct 13

GLOSSARY OF ACOUSTIC 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 below, 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.

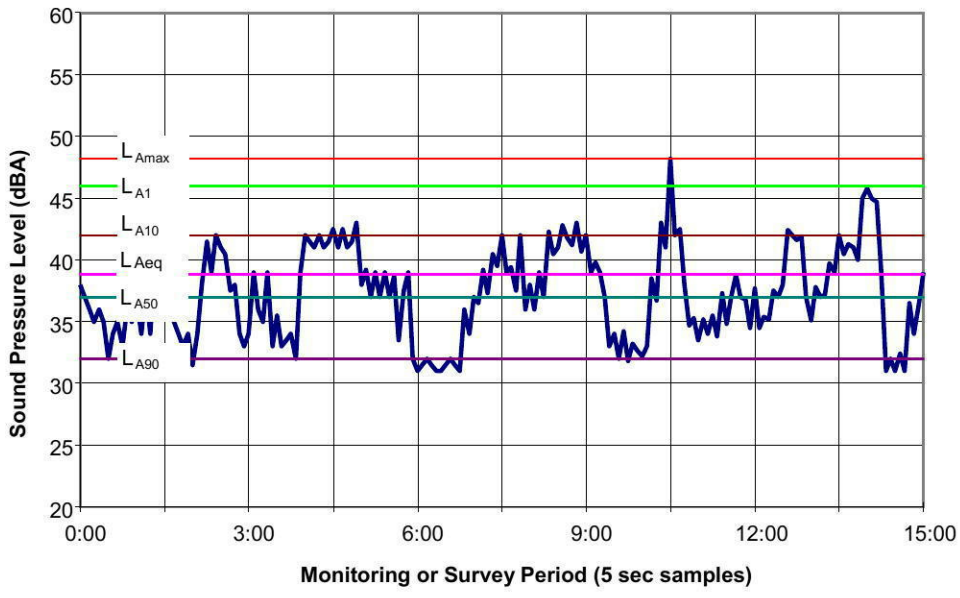
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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.

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^{th} percentile (lowest 10^{th} 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

It is proposed to develop an area of approximately 700 hectares at the Fernhill Estate, Mulgoa Road, Mulgoa. The development would include four precincts. The Eastern and Western Precincts would be for residential development The Central Precinct would be redeveloped for a variety of functions. No development is proposed for the Northern Precinct. This report presents a preliminary noise assessment in support of the application to rezone the land prior to development.

The assessment is based in part on noise monitoring of two functions at the Estate in 2013.

The report considers the potential impacts of noise from the central precinct to both existing residences and the proposed new housing precincts. The report also considers impacts associated with the new housing precinct at existing residences as well as potential impacts on the proposed new housing from existing transportation or industrial noise sources.

There are two main parts to this assessment.

The assessment in Sections 1 relates to emission from functions and not to the new housing developments. Section 4 relates only to housing developments.

2 PROJECT DESCRIPTION

The proposed development comprises three precincts. The land is located at Mulgoa Road, Mulgoa, and outlined on Figure 2-1.

The four development precincts are:

The Eastern Precinct; comprises a 54 lot Torrens Title residential subdivision accessed from Mulgoa Road that incorporates the construction of road and infrastructure services associated in accordance with relevant standards associated to service the allotments.

The proposed residential lots range in size between 900m^2 to 2,600m^2 , averaging over 1,000sqm and are shaped suitable for detached dwelling houses.

The Western Precinct; comprises a 38 lot Torrens Title rural residential subdivision, with access from Nepean George Drive and Fairlight Road. The proposal will incorporate construction of road and infrastructure services associated in accordance with relevant standards associated to service the allotments.

The proposed lots range in size and shape between 2-3ha with on-site sewer disposal and storm water management.

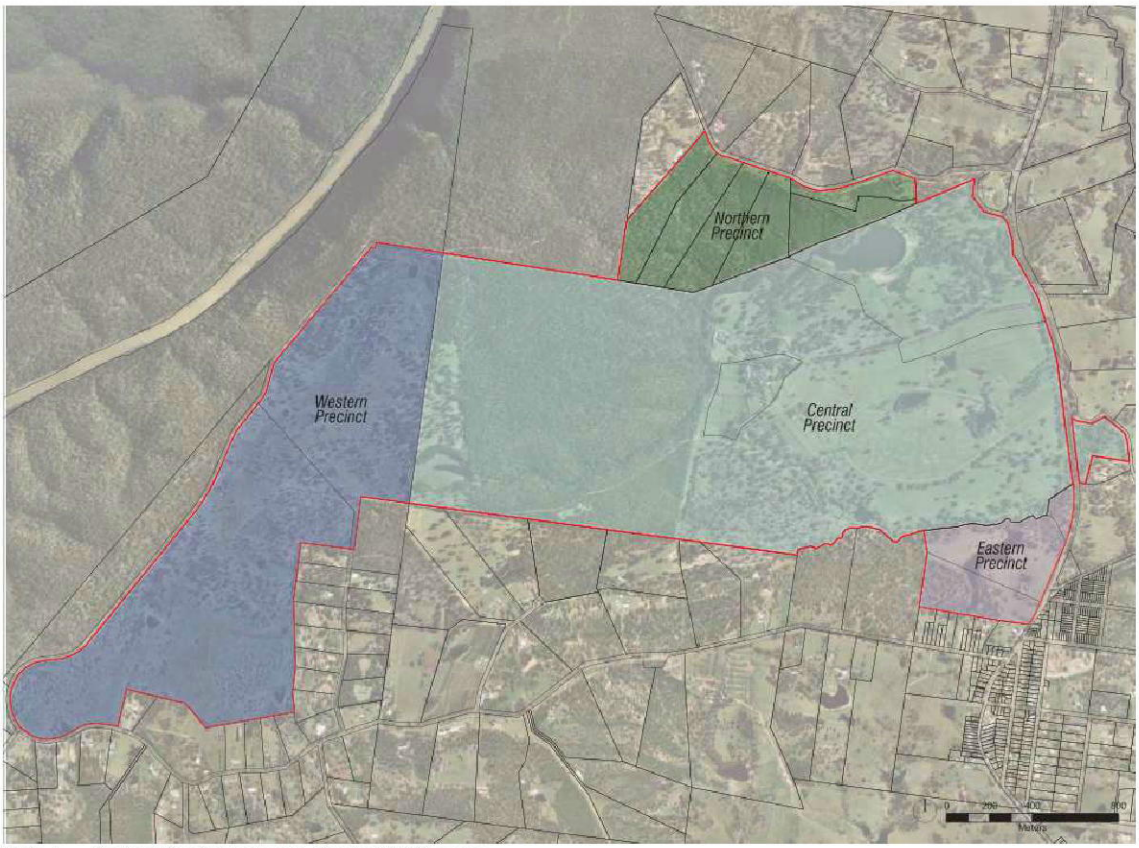
The Central Precinct; comprises the following development:

- Use of land, existing structures and temporary structures for the use of Events, Functions, (Function Centre land use under Penrith LEP 2010).

- Use of land, existing structures and temporary structures for the use as an Equestrian Centre comprising adgistment, riding training and riding events (an equestrian Centre forms part of Recreation Centre (outdoor) under Penrith LEP 2010).
- Use of land and temporary structures for sporting activities, (permanent use of land for this activity forms part of Recreation Centre (outdoor) under Penrith LEP 2010).
- Temporary use of land, existing structures for the purpose of outdoor entertainment.
- Use of land, existing structures and temporary structures for the purpose of a camping ground ancillary to the above uses.
- Use of land, existing structure and temporary structures for the purpose of a market ancillary to the above uses.

The Northern Precinct; no development is proposed at this precinct.

Figure 2-1 Site Outline[1]



Note 1 – Central Precinct shown shaded light green.

Typical events to be held in the Central Precinct are described below.

Regular Events:

- up to 300 people confirmed 1-2 times per week
- several of these will be charity/community events such as:
    - fund raising dinners where the venue is provided as a donation

Medium Sized Events:

- Up to 2500 people
- 2,500-10,000 – these may require conditional approval
- Suited to local community events such as:
    - Carols by Candlelight (1 evening)
    - Easter Egg Hunt (1 day)
    - Smaller concerts like Penrith Symphony orchestra
    - Melbourne Cup display (1 day plus 5 days of school visits in lead up)
    - Moonlight cinema (4-6 evenings)

Signature / Large Events:

- More than 10,000-15,000 people
- 6 time per year, some may be multi day events such as physical endurance events
- Physical endurance events x2 (4 days)
- Race picnic days 1-2 (2 days)
- Music concerts (3 days); typical artists would be symphonic or jazz.

3 NOISE CRITERIA – EMISSION FROM CENTRAL PRECINCT

3.1 *INP* Guidelines

Noise emission from the Central Precinct should be assessed according to the guidelines of the EPA's *NSW Industrial Noise Policy (INP)*.

The guidelines recommend limits for:

- Intrusiveness – so that the noise should not exceed that background level by more than 5dBA; and
- Amenity – so that the total industrial noise is limited to a maximum level.

Preliminary noise goals are provided by monitoring of a Tough Mudder event in 2013. Permanent noise goals should be based on long term monitoring at the nearest residential receivers.

If alcohol is to be served then the noise should also comply with the guidelines of the Office of Liquor and Gaming (OLGR). These are similar to the INP though require the background to be measured in octave bands, and operation after midnight should not exceed the background in any octave band.

The goals thus established should be included in the Precinct's Noise Management Plan.

3.2 Noise Criteria

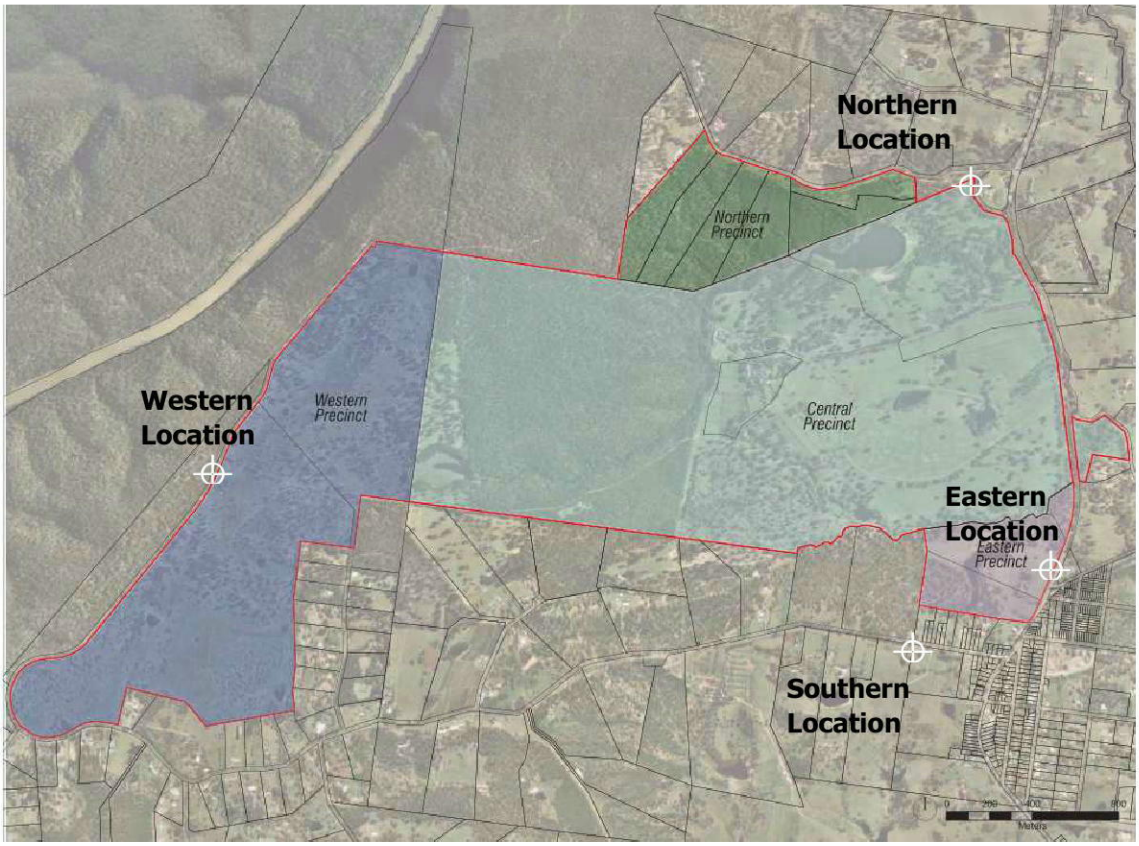
Noise monitoring was conducted in the afternoon (2.00pm to 6.00pm) and evening (6.00pm to 10.00pm) on Saturday, 13 April 2013 during the Tough Mudder event. The short term background levels measured will be used to establish preliminary noise goals for the permanent site.

The monitoring locations are described as:

- Northern Location: at the gates of access road to property located at 10, Mayfair Road;
- Eastern Location: at the gates of access road to property located at 1119 Mulgoa Road;
- Southern Location: at the gates of access road to property located at 35 Fairlight Road;
- Western Location: along dirt road running alongside western boundary of Site.

Figure 3-1 shows the monitoring locations around the Fern Hill Estate.

Figure 3-1 Monitoring Locations



The L_{A90} noise levels were used to determine the appropriate noise limit at each location. The results, and noise limits, are shown in Table 3-1.

Table 3-1 Noise Limits

Period	Location	Lowest Measured $L_{A90,15min}$ without Event Noise (dBA)	$L_{Aeq,15min}$ Noise Limit (dBA)
Day	Eastern Location	45	50
	Northern Location	44	49
	Southern Location	40	45
	Western Location	40	45
Evening	Eastern Location	39	44
	Northern Location	43	48
	Southern Location	41	46
	Western Location	36	41

3.3 Noise Monitoring of 2013 Events

Noise monitoring has been done for two large scale events in 2013: a Tough Mudder event, and a Country Race Day. Noise emission complied with noise limits on both occasions. A summary of the measured levels is given below.

Table 3-2 presents a summary of monitoring done for the Tough Mudder event. The proposed noise limit is based on the lowest L_{A90} measurement on the day. It is recommended that final noise limits be based on long term monitoring at the same locations. This would also provide data to set night time limits.

Noise levels from the Tough Mudder event included the music from the stage, big band and public address system.

Table 3-2 Noise Levels of Tough Mudder Event

Period	Location	Typical $L_{Aeq,15min}$ due to Tough Mudder Event (dBA)	$L_{Aeq,15min}$ Noise Limit (dBA)
Day	Eastern Location	44	50
	Northern Location	39	49
	Southern Location	40	45
	Western Location	44	45
Evening	Eastern Location	31	44
	Northern Location	41	48
	Southern Location	Inaudible	46
	Western Location	Inaudible	41

Table 3-3 presents a summary of monitoring done for the Country Race Day Event. Noise levels from the Tough Mudder event included live music and the public address system.

Table 3-3 Noise Levels of Race Day Event

Period	Location	Typical $L_{Aeq,15min}$ due to Race Day Event (dBA)	$L_{Aeq,15min}$ Noise Limit (dBA)
Day	Eastern Location	39	50
	Northern Location	Not measurable	49
	Southern Location	Not measureable	45
	Western Location	Inaudible	45
Evening	Eastern Location	Inaudible	44
	Northern Location	45	48
	Southern Location	Inaudible	46
	Western Location	Inaudible	41

4 NOISE ASSESSMENT OF CENTRAL PRECINCT

4.1 Monitoring of Events

Noise monitoring of the Tough Mudder and Country Race Day events demonstrated that noise levels associated with PA announcements and amplified music complied with background levels plus 5dBA.

Event noise was found to be inaudible after 10.00pm.

The results confirmed that events such as Tough Mudder and Race Days could be held with noise emission within appropriate guidelines.

Both events included live music with sound levels audible over much of the Central Precinct.

4.2 Recommendations

As the site is generally more than 500m from any existing residence, there is no acoustic reason that the site cannot be developed as a Function Centre. Noise emission from the site would be dependent on the type and size of function; however, noise mitigation could be designed so that the amenity of the surrounding area is not adversely affected.

Recommendations that would assist in controlling noise from the site:

- Maximise the distance from function areas to residential areas;
- Site function areas so that existing natural topography provides acoustic shielding to residential areas;
- Where possible, orient loud speakers so that noise projection is away from residential areas;
- Any permanent structure intended to house functions should be designed to minimise noise egress to suitable levels;
- Develop noise management strategies that limit the total sound power level of outdoor loud speakers; and
- Develop a Noise Management Plan that includes the noise emission limits from loud speakers at outdoor functions.

4.3 Regular Events

Typical regular events would be up to 300 people.

Noise impact from regular events would normally be negligible. Operators of the events should be aware of the Noise Management Plan for the venue and if amplified music takes place as part of the event, the noise emission should be appropriately limited.

4.4 Medium Sized Events

Medium sized events are for up to 10,000 people.

For events up to 2,500 people no extra traffic controls are required for the site.

For events with 2,500 to 10,000 people, extra traffic management will be required.

Noise emission from medium sized events would typically be low impact. Any events that include amplified music outdoors; e.g. the Moonlight Cinema, should be aware of the Noise Management Plan and apply appropriate limits to noise levels of external speakers.

The larger scale of the medium events could be up to 10,000 attendees. The noise emission from 10,000 people cheering or singing would generally be audible at the residential premises. Based on the noise monitoring of the Tough Mudder event it is considered probable that noise levels can be controlled within appropriate limits.

4.5 Signature / Large Events

These will be subject to future Development Applications and would be for 10,000 to 15,000 attendees would be held up to 8 times per year over 9 days, for example:

- Tough Mudder x2 (4 days)
- Picnic Race days 1-2 (2 days)
- 3 music concerts (3 days); typical artists would be symphonic or jazz.

The noise monitoring of the Tough Mudder and Country Raced Day events in 2013 showed that noise levels from such events would be within appropriate limits.

5 TRAFFIC NOISE

5.1 Goals for Traffic Generated by the Development

The EPA's *Road Noise Policy* (RNP) sets out criteria for assessment of noise from vehicles on public roads.

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

Mulgoa Road would be considered an arterial road for assessment purposed. Other roads around the estate would be local roads.

Criteria for existing residences affected by **additional traffic** are shown in Table 5-1. It is considered these relate to developments where the traffic is likely to be generated 5 days per week, rather than a number of days per month.

Table 5-1 *RNP* Criteria for Traffic Noise due to Land Use Development

Road Category	Assessment Criteria – dB(A)	
	Day (7am-10pm)	Night (10pm-7am)
Freeway / arterial / sub-arterial roads	$L_{Aeq15hr}$, 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Local Roads	L_{Aeq1hr}, 55 (external)	$L_{Aeq,1hr}$ 50 (external)

Where predicted noise levels exceed the project-specific noise criteria, an assessment of all feasible and reasonable mitigation options should be considered. The *RNP* states that *an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person*.

5.2 Traffic Noise Assessment

Traffic noise due to extra vehicles on the road network generated by the proposal should be assessed according to the guidelines of the *RNP*. A letter from GTA Consultants dated 26 June 2013 gives existing and estimated traffic flows on Mulgoa Road.

The existing peak hour flow is 700 vehicles per hour. Medium functions could generate 1,000 extra vehicles per hour at the beginning of the function and at the end of the function.

The letter estimates that 80% of vehicles would travel north on Mulgoa Road. This would increase traffic noise in two hours of the day by up to 4dBA for the largest of the regular functions. As Mulgoa Road is an arterial road the noise assessment is carried out over the entire 15hour day from 7.00am to 10.00pm. The increase in $L_{Aeq,15hr}$ would be at most 2dBA. This constitutes a minor impact considered barely perceptible.

For the larger events such as concerts, traffic flow would be increased considerably. The $L_{Aeq,15hr}$ traffic noise could be increased by up to 5 or 6dBA.

Using the *Calculation of Road Traffic Noise (CoRTN)* algorithms, it is estimated that this would mean that the guideline of $L_{Aeq,15hr}$ 60dBA could be exceeded at residences within approximately 30m from Mulgoa Road. North of the site there are few houses closer than 30m to Mulgoa Road, so impact would be limited to few residences.

The Noise Management Plan should discuss means of mitigation of road traffic noise caused by the functions. Such mitigations could include notification of residences where traffic noise goals are predicted to be exceeded for specific sizes of functions.

6 NOISE ASSESSMENT OF HOUSING PRECINCTS

6.1 Traffic Noise into New Housing Developments

In the context of the overall development, self-generated traffic noise should also be considered, particularly noise from function traffic. Such traffic noise is covered by the *RNP* in Section 5.2.

Considering both housing developments are south of the Mulgoa Road entrance to the Central Precinct, traffic generated by functions is predicted to be low impact at the new housing precincts.

Planning of the development should take into account potential and existing traffic noise from Mulgoa Road. As the Eastern Precinct is on Mulgoa Road, development of the subdivision should be in accordance with the recommendation the *RNP*. Mulgoa Road does not have high volume of traffic, however if houses are sited too close to the road then consideration of reasonable and feasible mitigation of traffic noise may be required.

The Eastern Precinct Landscape Plan, shown on Figure 6-1, shows outlines of houses with facades typically more than 20m from Mulgoa Road. At this setback, it is unlikely that noise mitigation will be required.

Figure 6-1 Eastern Precinct Landscape Plan

6.2 Noise from the Central Precinct

Noise levels measured at the "Western Location" for the Tough Mudder and Country Raced Day events represent the noise impact at the Western Precinct housing lots. Potential impact at this precinct is similar to existing residences west of the function site, and is covered by assessment to those existing residences.

The proposed Eastern Precinct housing estate is closer to the function site than the existing residences, and noise levels could be higher than those measured during the monitoring of the events. As the precinct is several hundred metres from function areas, there is ample opportunity for design of the Central Precinct and Eastern Precinct to minimise noise impact at the houses. Small and medium events could be designed to have negligible impact. Large scale events such as Tough Mudder, where noise is distributed over a large area, would also have minimal impact. Large concert events that may have 15,000 people cheering would be audible and therefore have some impact.

Siting of residential blocks should take into account location of noise sources from the central precinct, including Function Centres, car parks and access roads.

The houses on these lots should be designed so that noise intrusion from the large concert events complies with the recommendations of Australian Standard 2107 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors.* This may require provision of laminated glass and ventilation to some rooms.

6.3 Other Noise Sources

Based on a survey of aerial photography of the region, and notes taken during the site surveys of the Tough Mudder event, there are no other significant sources of industrial or transportation noise impinging on the proposed housing precincts.

6.4 Traffic Noise Generated by the Housing Precincts

The housing precincts themselves will also generate extra traffic on the road network. However, the size of the residential precincts, 38 and 54 lots, is not sufficient to generate significant traffic and noise impact is predicted to be insignificant given the existing peak hour traffic flow on Mulgoa Road is 700 vehicles per hour.

7 NOISE MANAGEMENT PLAN

7.1 Central Precinct Noise Management Plan

It is recommended that the Central Precinct should have a Noise Management Plan similar to the Noise Management Plan prepared for the County Race Day in August 2013 (Wilkinson Murray Report 13101-B).

The Plan should include:

- Noise goals at surrounding areas based on long term monitoring;
- Noise limits for all functions;
- Guidelines for small and medium functions to ensure noise limits are met, including placement and noise level of external loudspeakers;
- Guidelines for large events to minimise noise emission;
- Contact details for noise complaints; and
- Procedures for notification of large events.

8 CONCLUSION

The Fern Hill Estate proposal includes two housing precincts and a function precinct.

8.1 Housing Precincts

The Western Precinct and Eastern Precinct were found to be suitable for residential subdivisions. Noise emission due to extra traffic generated by the housing proposals is predicted to be negligible.

Construction of residences in the Eastern Precinct should take into account the potential noise emission from occasional large scale concerts.

8.2 Function Precinct

The function precinct will cater for a large variety of different functions. For the majority of functions, the attendance would be at most 2500 people and there would be negligible noise impact.

Potential noise impact from large scale events depends largely on the type of event. Noise monitoring of a large scale events 2013, the Tough Mudder and Country Raced Day events, showed that large scale events could occur with minimal noise emission from the site.

Other events proposed include concerts for up to 15,000 people. For such large scale events, it is recommended that a Noise Management Plant for the site should be prepared.