

EXTENSIONS TO GLENMORE PARK, CHAIN-O-PONDS & THE NORTHERN ROAD, MULGOA

Road traffic noise investigation

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Mirvac Homes (NSW) Pty Ltd and Vianello Holdings Pty Ltd

TK045-01F01 Road Traffic Noise Investigation (r5)

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1 Introduction

Renzo Tonin & Associates was engaged by Mirvac Homes (NSW) Pty Ltd and Vianello Holdings Pty Ltd to conduct a road traffic noise investigation for a Planning Proposal for the extension of Glenmore Park (the Study Area). The Study Area is located at the corner of Chain-O-Ponds Road and The Northern Road in Mulgoa and within the Penrith City Council's Local Government Area (LGA). The Study Area comprises the following land parcels: Lot 2 DP 224861, Lot 19/DP244610, Lot 2/DP1224642, Lot 3/DP1224642, Lot 18/DP244610, Lot 19/DP244610, Lot 25/DP244610, Lot 26/DP244610, Lot 27/DP244610, Lot 28/DP244610, Lot 29/DP244610, Lot 30/DP244610, Lot 31/DP244610, Lot 5/DP29081, Lot 3/29081, Lot 2/DP29081, Lot 1/29081, Lot 4/DP29081, Lot 6/DP29081, Lot 1/DP1088989, Lot 8/DP29081 and Lot 1/DP795841.

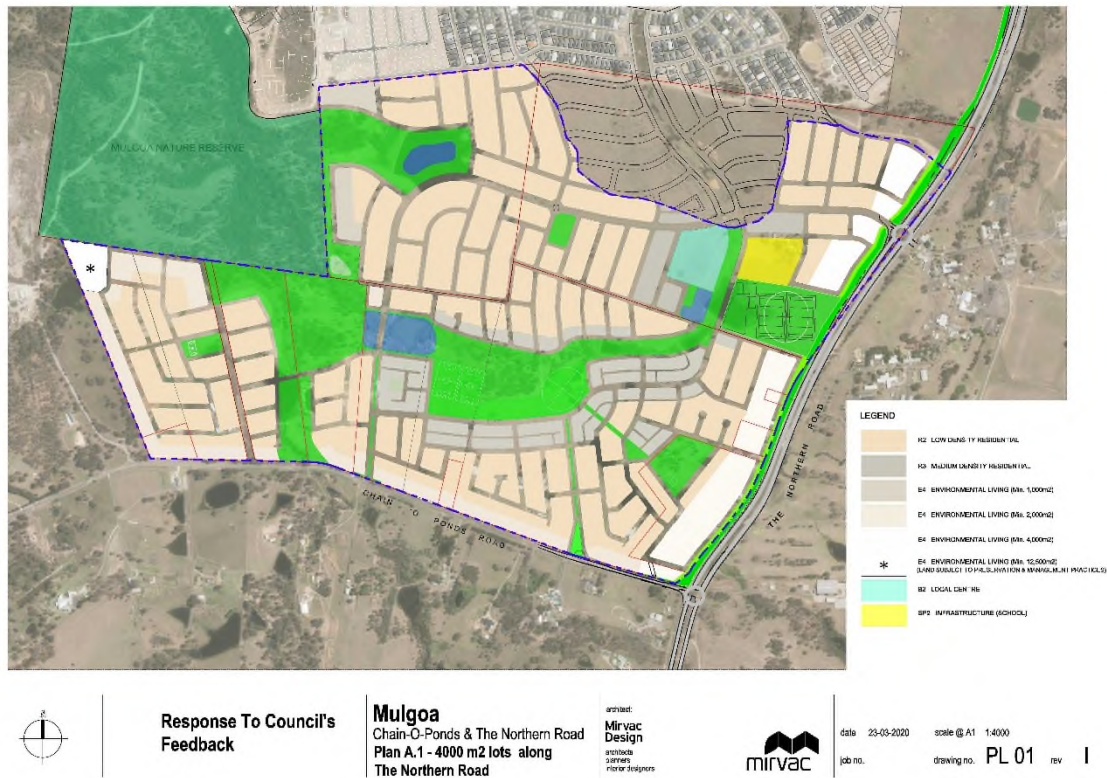
The purpose of this investigation is to determine the relevant noise criteria that apply to the proposed development, the constraints relating to noise and to provide general advice in relation to acoustics.

Due to the minor nature of the Penrith Landfill Depot and confirmation from the owners of the depot that approximately 95% of the site for the approved waste disposal activities has been capped following the completion of land fill activities, no logging was done with regard to the landfill site. It is recommended that further investigation be conducted at Development Application stage if the land fill depot is still in operation at that time.

The eastern boundary of the development site is located adjacent to the boundary of existing The Northern Road corridor. The NSW Roads and Maritime Services (RMS) is in the process of upgrading The Northern Road, which will occur adjacent to the development site.

The proposed development is shown in Figure 1 below.

Figure 1: Chain-O-Ponds & The Northern Road, Mulgoa - Concept Masterplan



Following Council's review of Renzo Tonin & Associates' report dated 7 May 2018, a set of internal referral comments is received and our responses to those comments can be found in APPENDIX F.

2 Noise criteria

2.1 Penrith City Council Development Control Plan 2014

Section C12 *Noise and Vibration* of Penrith Development Control Plan (DCP) 2014 sets out the following with respect to road traffic noise:

12.1. Road Traffic Noise

A. Background

Currently, road traffic is the most widespread source of environmental noise. The controls below seek to minimise the impact of road traffic noise.

This Section of the DCP applies to all development that generates a significant level of traffic noise (as determined by Council) that has potential to impact upon residential and other sensitive land uses.

This Section is also applicable to any residential development, subdivision or other sensitive land uses, which propose to locate near existing areas of significant road traffic noise.

B. Objectives

- a) *To ensure that the amenity of all residential development and other sensitive land uses is not significantly affected by road traffic noise;*
- b) *To ensure that the traffic associated with development does not significantly impact upon the amenity of surrounding land uses;*
- c) *To ensure that the traffic associated with development does not have a significant noise impact on the existing road network; and*
- d) *To ensure that any subdivisions are designed to minimise the impact of road traffic noise on any residential development or other sensitive land uses.*

C. Controls

1) Road traffic noise criteria including sensitive land uses

- a) *Council will not grant consent to development, particularly residential development, including subdivisions, unless the impact of traffic noise from freeway, arterial, designated or collector roads complies with the standards and guidelines for road traffic noise prepared by the relevant State Government authorities or agencies, as well as relevant Australian Standards.*

- b) *Council will not grant consent to development for sensitive land uses unless it complies with the provisions and standards for road traffic noise prepared by the relevant State Government authorities or agencies, as well as relevant Australian Standards.*
- c) *Sensitive land uses subject to road traffic noise criteria referred to in b) above include educational establishments (including schools), places of public worship, hospitals, and passive and active recreation areas.*

Noise Impact Statements - Specific Requirements

- a) *Where a site is likely to be affected by unacceptable levels of road traffic noise, the applicant is required to provide a Noise Impact Statement prepared by a qualified acoustic consultant in accordance with the requirements set out in the DA Submission Requirements Appendix of this DCP.*
- b) *The Noise Impact Statement should demonstrate acoustic protection measures necessary to achieve an indoor environment meeting residential standards, in accordance with EPA and Department of Planning Criteria, as well as relevant Australian Standards.*

NOTE: *To determine whether your site is likely to be exposed to levels of road traffic noise that exceed residential standards:*

- a) *Contact Council regarding main road frontages known to exceed residential noise standards; and*
- b) *Obtain detailed advice from a qualified acoustic consultant regarding appropriate planning and design measures.*

2.1 NSW Road Noise Policy

The NSW Road Noise Policy (RNP) was introduced in July 2011 and replaced the NSW Environmental Criteria for Road Traffic Noise (ECTRAN). Unlike the ECTRAN, the RNP no longer sets external criteria for new developments affected by existing roads. Criteria for new developments affected by existing roads are now addressed through the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) and the associated NSW Department of Planning "Development Near Rail Corridors and Busy Roads – Interim Guideline".

2.1.1 Sensitive land use developments

The RNP also sets criteria for the assessment of traffic noise on sensitive land uses such as schools, hospitals, places of worship and recreation areas. The criteria are presented in Table 1 below.

Table 1: Road traffic noise assessment criteria for non-residential land uses

Existing sensitive land use	Assessment criteria, dB(A)		Additional considerations
	Day (7am-10pm)	Night (10pm-7am)	
1. School classrooms	L _{Aeq,1hour} 40 (internal) when in use	–	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in Australian Standard 2107:2000 (Standards Australia 2000).
2. Hospital wards	L _{Aeq,1hour} 35 (internal)	L _{Aeq,1 hour} 35 (internal)	
3. Places of worship	L _{Aeq,1hour} 40 (internal)	L _{Aeq,1 hour} 40 (internal)	The criteria are internal, i.e. the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what in these areas may be affected by road traffic noise. For example, if there is a church car park between a church and the road, compliance with the internal criteria inside the church may be sufficient. If, however, there are areas between the church and the road where outdoor services may take place such as weddings and funerals, external criteria for these areas are appropriate. As issues such as speech intelligibility may be a consideration in these cases, the passive recreation criteria (see point 5) may be applied.
4. Open space (active use)	L _{Aeq,15hour} 60 (external) when in use		Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading.
5. Open space (passive use)	L _{Aeq,15hour} 55 (external) when in use		In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation, e.g. school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.
6. Childcare facilities	Sleeping rooms L _{Aeq,1hour} 35 (internal) Indoor play areas L _{Aeq,1hour} 40 (internal) Outdoor play areas L _{Aeq,1hour} 55 (external)	–	Multi-purpose spaces, e.g. shared indoor play/sleeping rooms should meet the lower of the respective criteria. Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility.
7. Aged care facilities	–	–	Residential land use noise assessment criteria should be applied to these facilities

Notes: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads.

It is generally accepted that most buildings provide a noise reduction of at least 10dB(A) when windows are left 20% open, without providing additional treatment. Therefore where the noise goals are internal, a 10dB(A) reduction from external noise levels to internal noise levels has been adopted to allow an external assessment.

2.2 State Environmental Planning Policy (Infrastructure) 2007

The ISEPP came into force in NSW on 1 January 2008 to facilitate the effective delivery of infrastructure across the State. The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure development.

Clause 102 of the ISEPP states as follows:

102 Impact of road noise or vibration on non-road development

- 1. This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:*
 - a building for residential use,*
 - a place of public worship,*
 - a hospital,*
 - an educational establishment or child care centre.*
- 2. Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.*
- 3. If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
 - in any bedroom in the building--35 dB(A) at any time between 10 pm and 7am,*
 - anywhere else in the building (other than a garage, kitchen, bathroom or hallway)-- 40 dB(A) at any time.*
- 4. In this clause, "freeway", "tollway" and "transitway" have the same meanings as they have in the Roads Act 1993.*

2.3 Department of Planning Publication “Development near Rail Corridors and Busy Roads – Interim Guideline”

To support the Infrastructure SEPP, the NSW Department of Planning released the Development in *Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. Whilst the ISEPP applies only to roads with an AADT greater than 40,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

2.3.1 Clarification of ISEPP noise limits

The Guideline clarifies the time period of measurement and assessment. As stated in the Guideline in Section 3.4 ‘*What Noise and Vibration Concepts are Relevant*’ and Table 3.1 of Section 3.6.1, noise measurements are determined over the following relevant time periods:

- Daytime 7am-10pm $L_{Aeq(15hr)}$
- Night-time 10pm-7am $L_{Aeq(9hr)}$

L_{Aeq} is the Equivalent Continuous Noise Level and accounts for both the level of fluctuating noise and also the number of noise events over the time period. The noise criteria nominated in the ISEPP are internal noise levels with windows and doors closed and the requirements are stated in the following table.

Table 2: ISEPP internal road traffic noise criteria

Internal space	Time period	Noise metric	Internal criteria [^]
Bedrooms	7am - 10pm	$L_{Aeq(15hrs)}$	40*
	10pm to 7am	$L_{Aeq(9hrs)}$	35
Other Habitable Rooms	Any Time	$L_{Aeq(15hrs)}$ and $L_{Aeq(9hrs)}$	40

Notes: [^] With windows and doors closed.

* Whilst not specified in the ISEPP, daytime criteria for bedrooms are set to 40dB(A), as per the other habitable rooms.

The Guideline in Section 3.6.1 ‘Airborne Noise’ states as follows:

“If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.”

As noise modelling is undertaken for external locations, the above criteria and guidelines have been used to establish equivalent external noise criteria. This external noise criterion is used to determine which building facades may require specific acoustic treatment to meet the requirements of the ISEPP. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2016 requirements.

Table 3: ISEPP road traffic noise criteria for new residential development

Room	Location	L _{Aeq, 15hr} Day 7am – 10pm	L _{Aeq 9hr} Night 10pm – 7am
Living rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)^	60	55

Notes: * Requisite for 40,000AADT Roads only under ISEPP 2007.

^ ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2016 requirements.

2.4 Project noise criteria

For the subject site, only The Northern Road would be considered under the ISEPP; and hence, the ISEPP noise goals should be adopted as they are considered the most current road traffic noise policy for new residential development in NSW. For the sporting fields and other recreational space along The Northern Road, reference is made to the RNP.

Chain-O-Ponds Road currently carries a negligible amount of traffic volume as evidenced in the long-term noise monitoring data and is expected to have an AADT of less than 20,000 vehicles in the Year 2031 and therefore, the projected traffic volume along the road has not been considered further.

Traffic noise modelling will be conducted for the proposed internal collector road that will traverse through the site from James Riley Drive to Chain-O-Ponds Road to support any relevant future development applications. At this stage, no traffic data has been made available for internal collector road so this cannot yet be quantified. Traffic noise shall be assessed in accordance with the objectives and controls of Council's DCP 2014 Section C12 *Noise and Vibration*. This can be fairly easily dealt with by use of upgraded facade treatments on future dwellings.

For public open spaces potentially impacted by internal collector road noise, it is not expected that use of active and passive recreation areas would coincide with the peak traffic movements along the internal collector roads, and therefore, the likelihood of intrusive noise impacts is expected to be minimal.

3 The Northern Road upgrade

RMS is upgrading around 35 kilometres of The Northern Road between The Old Northern Road, Narellan and Jamison Roads in South Penrith from a generally two to four-lane undivided road to a six to eight-lane divided road. The upgrade has been divided into various sections and REF traffic noise studies have been conducted by others. Our review of these REF studies is summarised below.

3.1 The Northern Road upgrade: Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park (Jacobs, May 2017)

A review of the REF traffic noise assessment found the following:

- 77 receivers qualified for consideration of additional noise mitigation
- As there are no groupings of four or more closely-spaced receivers of those eligible for consideration of mitigation, the use of noise barriers has not been identified as a mitigation measure for this project

3.2 The Northern Road upgrade: Glenmore Parkway to Jamison Road, South Penrith (Jacobs, September 2016)

A review of the REF traffic noise assessment found the following:

- 265 receivers qualified for consideration of additional noise mitigation
- A 5.0 metre high (460 m long) noise barrier was recommended along the western side of project between Aspen Street and Tukara Road
- A 5.0 metre high (838 m long) noise barrier was recommended on the western side of the project extending south from Tukara Road to the western end of the eastbound M4 Motorway Off Ramp

4 Opportunities and constraints

4.1 Unmitigated traffic noise levels onto the proposed development site

Based on a review of the relevant traffic noise assessments for The Northern Road upgrade, unmitigated traffic noise onto the development site would mean high exposure to road traffic noise for residences near The Northern Road.

To achieve the internal ISEPP noise criteria, a preliminary review indicates that first row residences on the lots along the eastern boundary shown on the provided Masterplan (with a setback of approximately 42m from the boundary of The Northern Road) would likely require up to Category 4 facade treatments as detailed within the ISEPP and shown in APPENDIX B of this report. This would require facade systems such as 10.38mm laminated glazing of windows, brick veneer construction facades and two layers of sound rated plasterboard applied to the ceilings of affected bedrooms and living areas.

Second row residences will typically be on standard residential lots and setback at least 100m from the eastern site boundary and would likely require acoustic facade treatment Category 3 (6.38mm laminated glazing). Indicative facade and roof constructions for these categories are also described in APPENDIX B.

Based on the current plan, it is estimated that residences within approximately 100 - 150 metres of The Northern Road would require some form of acoustic facade treatment to achieve the ISEPP internal noise goals, varying between Category 1 (standard 4mm glazing) for residences set back from the road with lower exposure to road traffic noise, up to Category 4 for residences adjacent to the road corridor.

As the ISEPP noise criteria that govern the site are internal, there is no requirement to achieve external noise amenity. Whilst there is no requirement, the external noise levels in the private open spaces for the first row of residences adjacent to The Northern Road would be considered reasonable given the private open spaces are generally located in the rear yard. Unmitigated traffic noise would likely be more than 10dB(A) above the NSW RNP external noise goals however road traffic noise will be mitigated to achieve a more acceptable external noise level through increased front setbacks for the first row of residences and the incorporation of a substantial landscape screen along the eastern boundary of the site i.e. The Northern Road.

With regard to the sporting fields along The Northern Road, the noise level along the western side of the landscape buffer of the masterplan is expected to be around 65dB(A). In the middle of the nearest sporting field (approx. 100m from the centreline of The Northern Road), this is expected to be around 61dB(A), which generally complies with the noise levels set out by the EPA. Full compliance will be achieved 125m from the centreline of The Northern Road. The level of exceedances i.e. 1-4dB(A) that can be expected in the area of the sporting fields closest to The Northern Road is considered minor, especially noting the activities on sporting fields are noise generating by nature.

4.2 Roadside noise barriers

As detailed in Section 3.2, 5 metre high noise barriers were recommended along the western corridor of The Northern Road for The Northern Road upgrade (Glenmore Parkway to Jamison Road, South Penrith) to the north of the development site. This height was determined through the noise barrier assessment process contained within the RMS' Noise Mitigation Guideline (NMG).

The design height of 5 metres was determined to be the most effective height in terms of the overall benefit to cost. Noise barriers of this height typically provide approximately 10dB reduction in road traffic noise for residences directly behind the wall. A similar reduction in traffic noise could be expected if the same height barriers were implemented on the proposed development, however the barriers will be in conflict with Council's objective of creating an attractive rural gateway along The Northern Road frontage of the development.

4.3 Alternative/additional noise mitigation measures

As an alternative to roadside noise barriers, the following noise mitigation measures have also been successfully implemented for residential subdivisions and can be considered in combination or in place of a noise wall or earth mounding:

- Internal road and landscaping buffer with front loaded building envelope plan (Figures 2 and 3 below) to provide a greater setback from The Northern Road. This option would generally result in a more satisfactory noise level on the private open space at the rear of the lot as the dwelling provides acoustic shielding.
- Landscaping buffer with rear loaded building envelope plan and acoustically rated fence along the rear to provide a degree of acoustic shielding to the private open space.

Figure 2: Typical section for The Northern Road

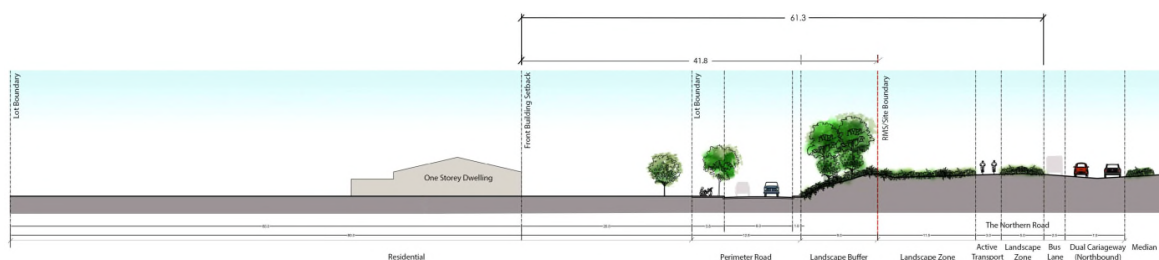
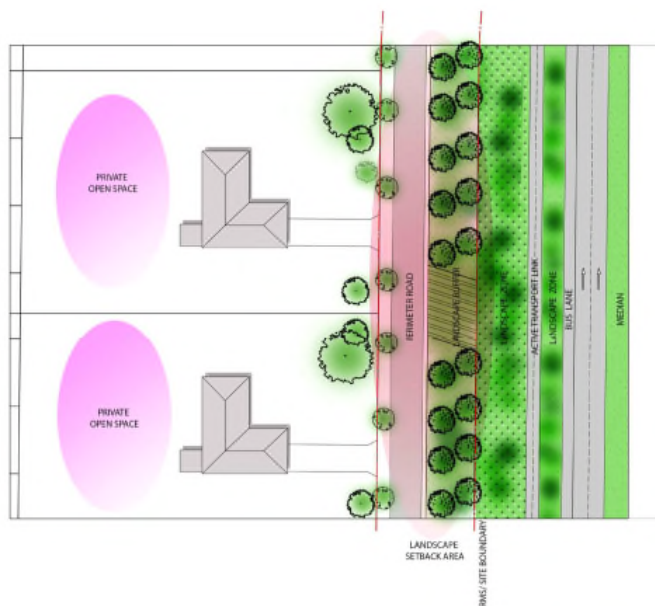


Figure 3: Plan of typical section of The Northern Road

The combination of different noise mitigation measures along The Northern Road boundary will provide a more desirable aesthetic solution instead of a long stretch of noise wall or earth mounding.

4.4 Additional traffic generated by the proposed development

Future peak period traffic flows generated by the proposed development for the Year 2031 [ref: 2021 & 2031 Traffic Volumes (for Noise Assessment) 20171116A] have been predicted by The Transport Planning Partnership (TPPP) as per their Transport Impact Assessment for this Planning Proposal.

The following assumptions were used:

- Peak hour traffic volumes are 10% of the 24hr volume;
- The 15hr daytime volume is 85% of the 24hr volume;
- Percentage of heavy vehicles in traffic mix is assumed to be 0% for the proposed residential subdivision as it is not expected that there will be any heavy good vehicle ('HGV') traffic due to the proposed development.

Based on the above assumptions, the additional daytime hourly average traffic volume is expected to increase by up to 550 vehicles in each direction of travel along The Northern Road. This would mean an increase of approx. 1 dB(A), which is considered insignificant.

4.5 Scope of acoustic recommendations

The recommended mitigation measures for road traffic noise have been developed for the purposes of the planning proposal and to provide the indicative measures required for the future lots. It is recommended that the services of an appropriately qualified acoustic consultant be sought for the Development Application process once the site has been rezoned.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.

L ₁₀	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L ₉₀	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L ₉₀ noise level expressed in units of dB(A).
L _{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L _{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B ISEPP facade treatment categories

Table 4: Treatment categories

Category no.	Building element	Required acoustic rating of building element, R_w	Indicative construction	
1	Windows / sliding doors	24+	Openable with minimum 4mm monolithic glass and standard weather seals	
	Facade	38+	Cladding construction: 9mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm timber stud, R2 insulation batts in wall cavity, 10mm standard plasterboard internally	Brick veneer construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally
	Roof	40+	Pitched concrete or terracotta tile or metal sheet roof, 10mm plasterboard ceiling fixed to ceiling joists, bulk insulation in roof cavity	
	Door	28+	35mm solid core timber door fitted with full perimeter acoustic seals	
2	Windows / sliding doors	27+	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals	
	Facade	45+	Cladding construction: 9mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm timber stud, R2 insulation batts in wall cavity, 10mm standard plasterboard internally	Brick veneer construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally
	Roof	43+	Pitched concrete or terracotta tile or metal sheet roof, 10mm plasterboard ceiling fixed to ceiling joists, bulk insulation in roof cavity	
	Door	30+	40mm solid core timber door fitted with full perimeter acoustic seals	
3	Windows / sliding doors	32+	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Facade	52+	110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally	
	Roof	48+	Pitched concrete or terracotta tile or sheet metal roof, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, bulk insulation in roof cavity	
	Door	33+	45mm solid core timber door fitted with full perimeter acoustic seals	
4	Windows / sliding doors	35+	Openable with minimum 10.38mm laminated glass and full perimeter acoustic seals	
	Facade	55+	110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally	
	Roof	52+	Pitched concrete or terracotta tile or sheet metal, 2 layers of 13mm sound-rated plasterboard fixed to ceiling joists, bulk insulation in roof cavity	

Category no.	Building element	Required acoustic rating of building element, R_w	Indicative construction
	Door	33+	45mm solid core timber door fitted with full perimeter acoustic seals
5	Windows / sliding doors	43+	Openable double glazing with separate panes: 5mm monolithic glass, 100mm air gap, 5mm monolithic glass with full perimeter acoustic seals
	Facade	55+	110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally
	Roof	52+	Pitched concrete or terracotta tile or sheet metal, 2 layers of 13mm sound-rated plasterboard fixed to ceiling joists, bulk insulation in roof cavity
	Door	40+	Special high performance acoustic door required
Notes: - Where a room has different category recommendations on two or more facades, the roof recommendation for the highest category applies. - Any wall, roof or ceiling penetrations shall be acoustically sealed so as not to reduce the acoustic performance of the element. - The acoustic performance of glazed doors should be in accordance with the window glazing requirement of the applicable category. The required acoustic rating is for the entire system. For example, for windows this includes the glass, frame and seals including the perimeter seal at the wall junction. By way of explanation, the Sound Insulation Rating R_w is a measure of the noise reduction property of the glazing assembly, a higher rating implying a higher sound reduction performance. Note that the R_w rating of systems measured as built on site (R'_w Field Test) may be up to 5 points lower than the laboratory result. The client is advised not to commence detailing or otherwise commit to systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of systems and assemblies is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved. No responsibility is taken for use of or reliance upon untested systems, estimates or opinions. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like. NOTES FOR GLAZING CONSTRUCTIONS: All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the R_w rating performance of the glazing to not be reduced. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading, etc. GENERAL: The sealing of all gaps in acoustic rated glazing assemblies and facades is critical in a sound rated construction. Use only sealer approved by the acoustic consultant. Check design of all junction details with acoustic consultant prior to construction. Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed. The information provided in this table is subject to modification and review without notice.			

APPENDIX C Existing noise environment

The following has been provided for information only.

C.1 Noise measurement locations

The long-term noise measurement locations are outlined in Table 5 and shown in Figure 4.

Table 5: Noise monitoring location

ID	Address	Description
Long-term noise monitoring		
L1	2265 The Northern Road	The noise monitor was located on the front yard, approx. 14m from the edge of existing The Northern Road, in the free-field. The noise monitoring location was exposed to existing traffic along The Northern Road as well as other natural sounds (eg. birds, insects, etc.).
L2	115-129 Chain-O-Ponds Road	The noise monitor was located on the front yard, approx. 1.5m from the southern boundary fence, in the free-field. The noise monitoring location was exposed to existing intermittent traffic along Chain-O-Ponds Road as well as other natural sounds (eg. birds, insects, etc.).

Figure 4: Noise monitoring locations



C.2 Long-term noise measurement results

Long-term noise monitoring was carried out from Friday, 3 to Friday, 11 November 2017. The long-term noise monitoring methodology is detailed in APPENDIX D, and noise level-vs-time graphs of the data are included in APPENDIX E.

Table 6 presents the overall single Rating Background Levels (RBL) and representative ambient L_{eq} noise levels for each assessment period, determined in accordance with the INP.

Table 6: Long-term noise monitoring results

Monitoring location	L _{A90} Rating Background Level (RBL)			L _{Aeq} Ambient noise levels		
	Day	Evening	Night	Day	Evening	Night
L1 - 2265 The Northern Road	50	42	30	67	63	64
L2 - 115-129 Chain-O-Ponds Road	37	36	28	53	54	48

Notes: Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
 Evening: 18:00-22:00 Monday to Sunday & Public Holidays
 Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
 As required by the INP, the external ambient noise levels presented are free-field noise levels [ie. no facade reflection].

APPENDIX D Long-term noise monitoring methodology

D.1 Noise monitoring equipment

A long-term unattended noise monitor consists of a sound level meter housed inside a weather resistant enclosure. Noise levels are monitored continuously with statistical data stored in memory for every 15-minute period.

Long term noise monitoring was conducted using the following instrumentation:

Description	Type	Octave band data	Logger location
RTA06 (NTi Audio XL2, with low noise microphone)	Type 1	1/1	L1 & L2
Note: All meters comply with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and designated either Type 1 or Type 2 as per table, and are suitable for field use.			

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4230 calibrator. No significant drift in calibration was observed.

D.2 Meteorology during monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the NSW INP. Determination of extraneous meteorological conditions was based on data provided by the Bureau of Meteorology (BOM), for a location considered representative of the noise monitoring location(s). However, the data was adjusted to account for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is typically 1.5m above ground level (and less than 3m). The correction factor applied to the data is based on Table C.1 of ISO 4354:2009 '*Wind actions on structures*'.

D.3 Noise vs time graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the L_{10} , L_{90} , and L_{eq} levels. The statistical descriptors L_{10} and L_{90} measure the noise level exceeded for 10% and 90% of the sample measurement time. The L_{eq} level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels, as presented in this report, illustrate these concepts for the broadband dB(A) results.

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inspired to achieve

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Road / Rail Noise Monitoring Results (at one metre from façade)

[illegible]

1. Day is 7:00am to 10:00pm

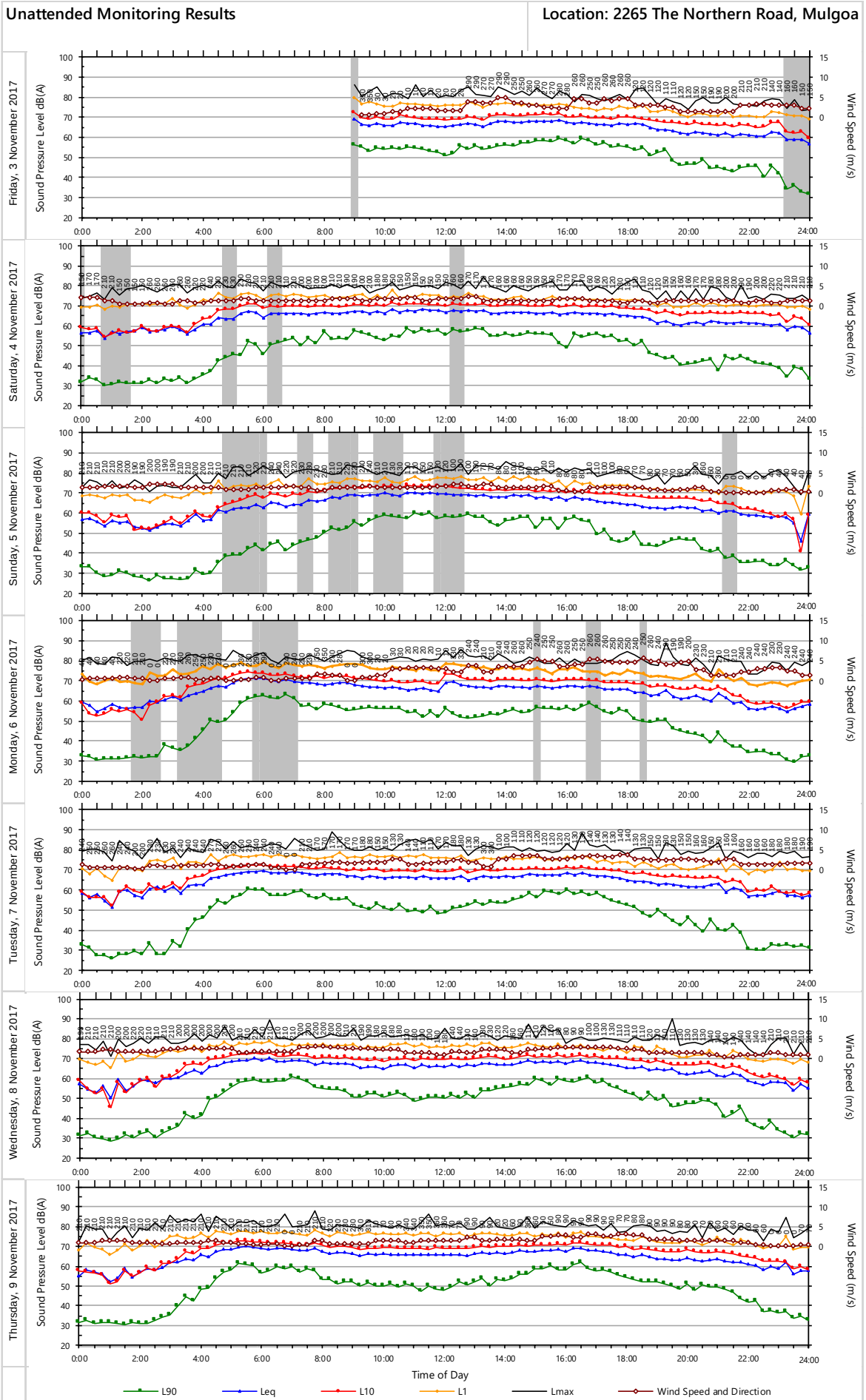
2. Night is 10:00pm to 7:00am

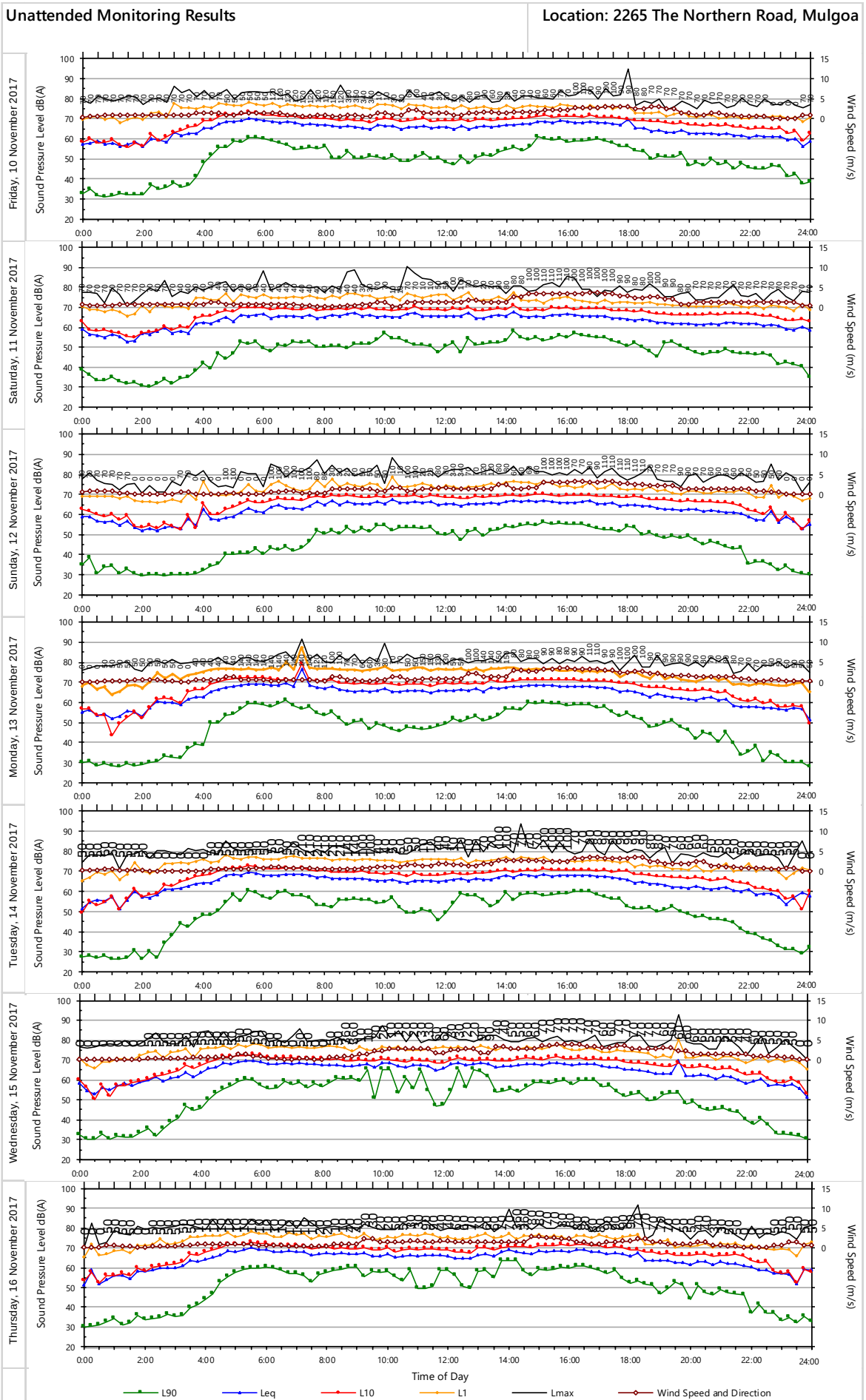
3. Logarithmic average of daily L_{Aeq}

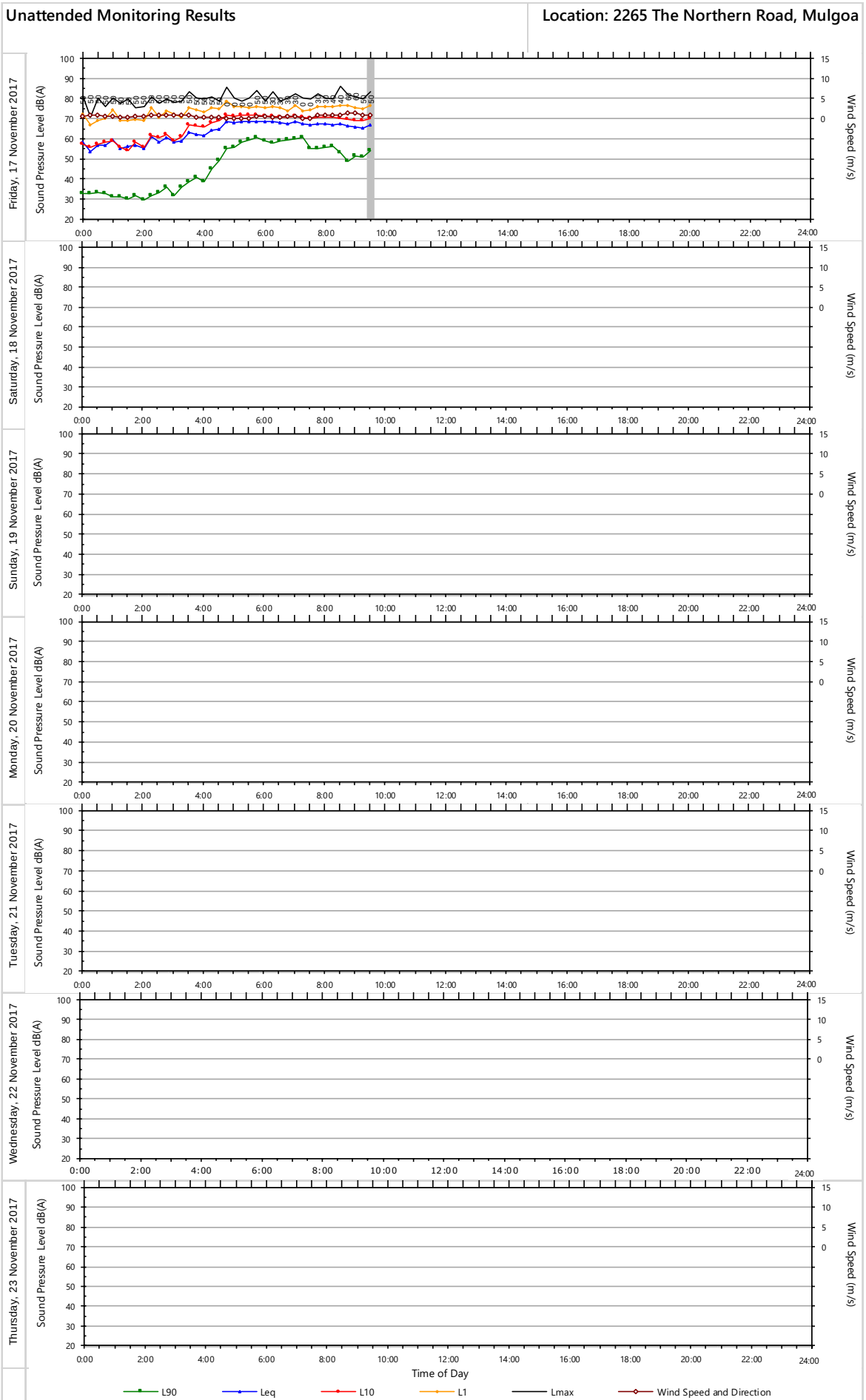
4. Upper 10th percentile $L_{Aeq, 1hr}$

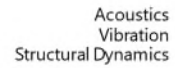
5. Lower 10th percentile $L_{Aeq,1hr}$

6. Values are calculated at the facade. 2 dB is added to results if logger is placed in the free field





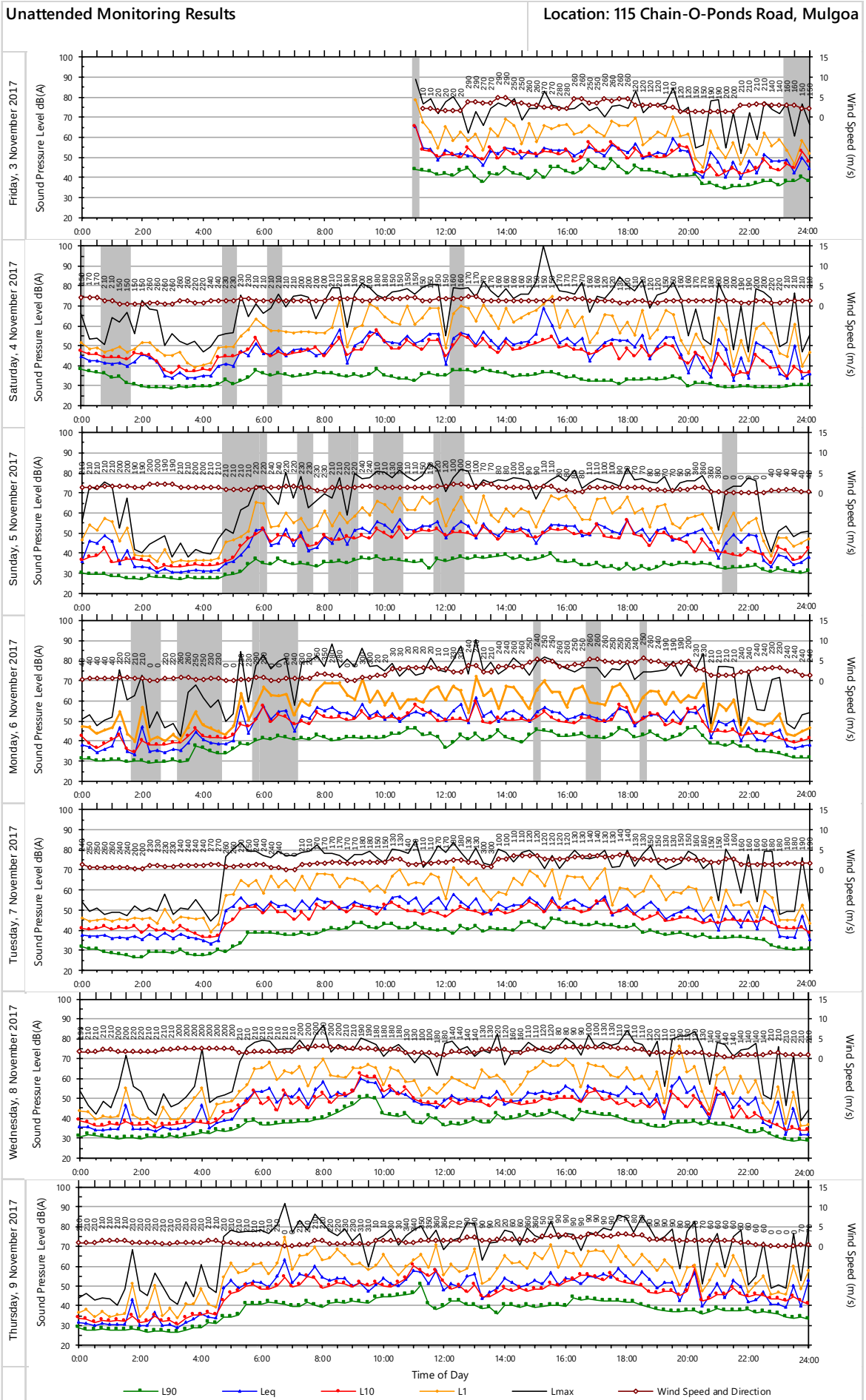


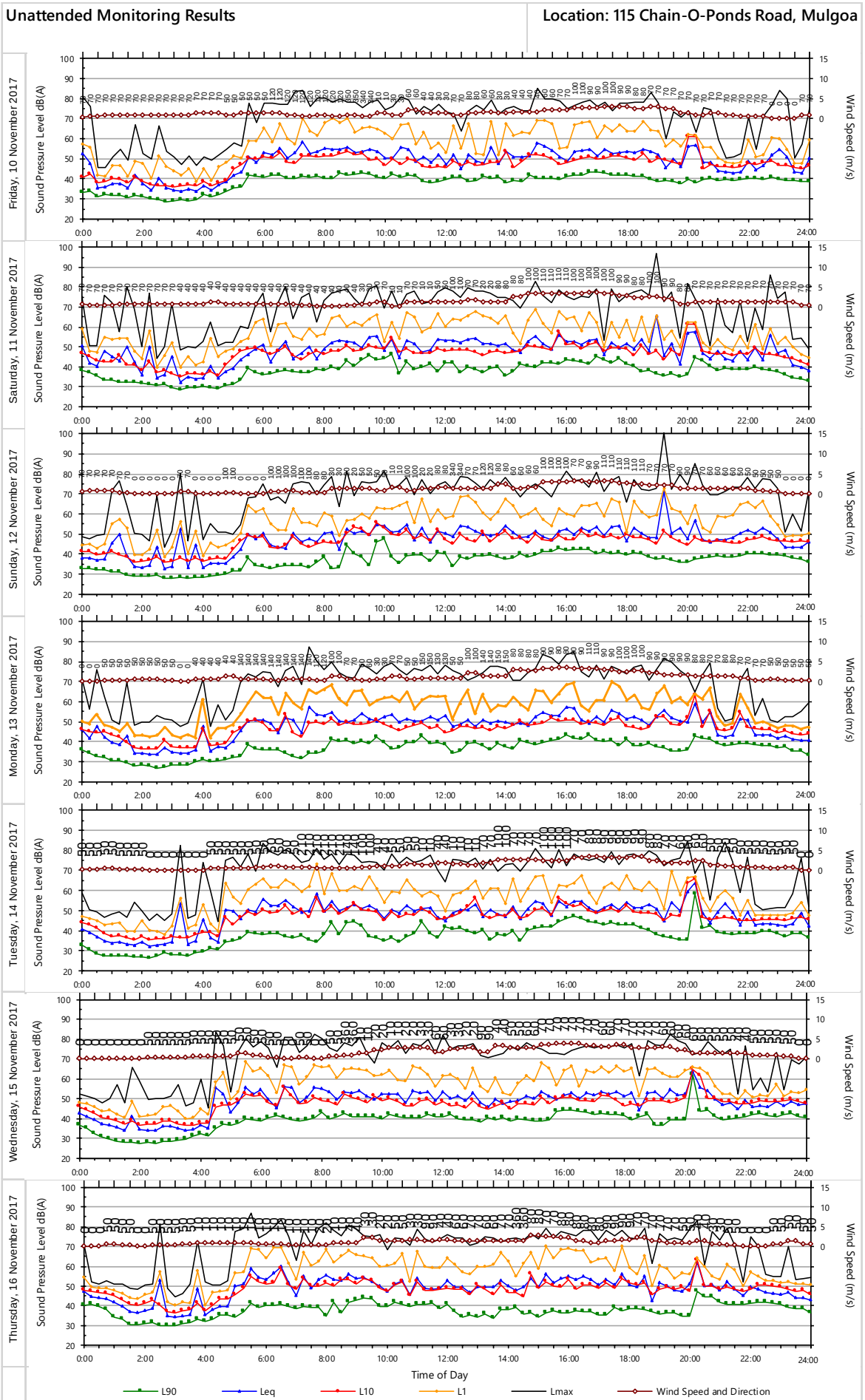


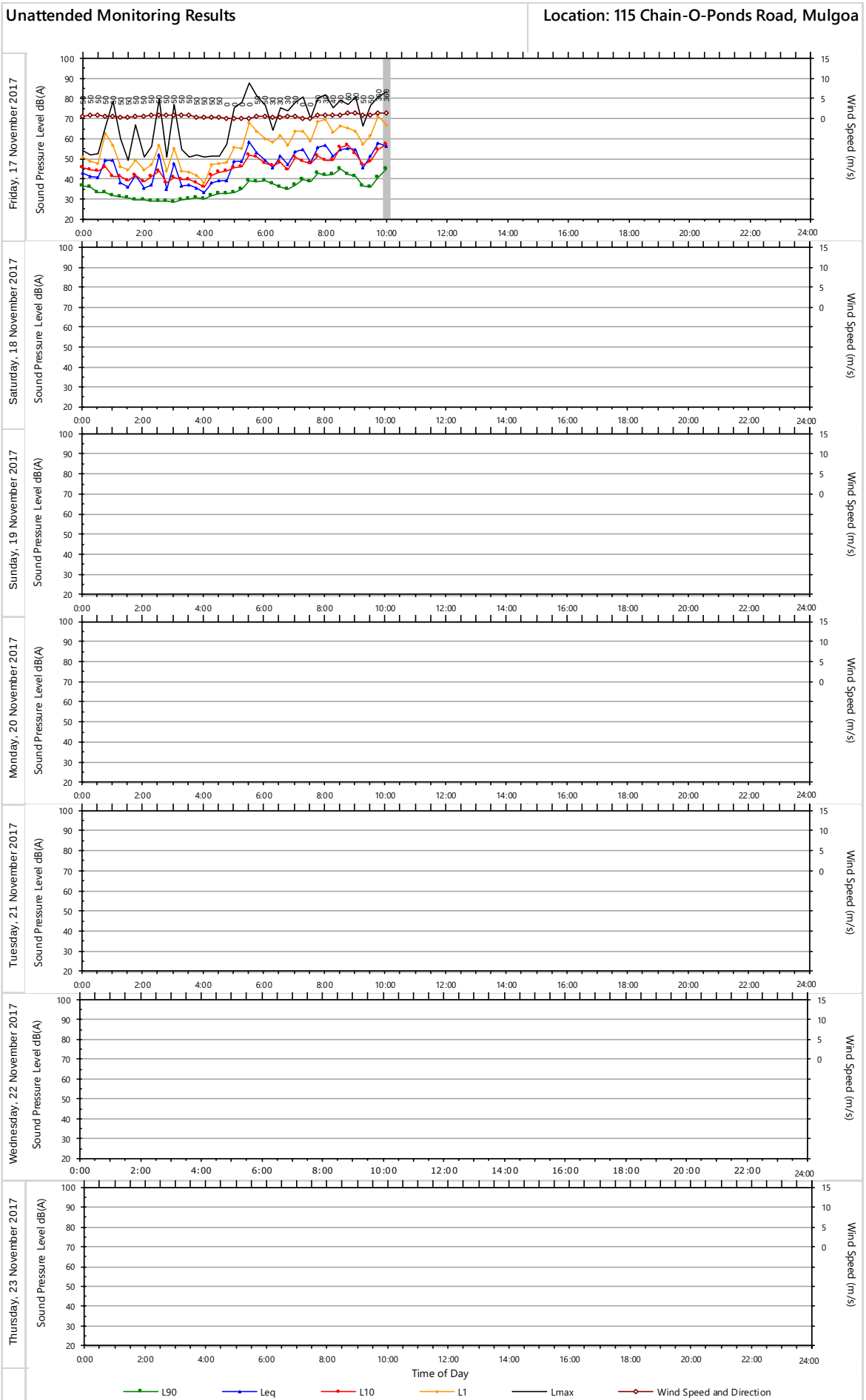
115 Chain-O-Ponds Road, Mulgoa

[illegible]

EXTENSIONS TO GLENMORE PARK, CHAIN-O-PONDS & THE
NORTHERN ROAD, MULGOA
ROAD TRAFFIC NOISE INVESTIGATION







APPENDIX F **Council's Internal Referral Comments with Renzo Tonin & Associates' responses**

Acoustics*Acoustics Assessment by Renzo Tonin*

Supporting Technical Studies to be updated to reference the updated masterplan

The following comments were received from our Environment Team. Comments refer to the original masterplan. Given the amendments to The Northern Road interface and the most recent masterplan, consideration of the following comments are required in updating the Planning Proposal and the supporting technical study.

The Northern Road noise impacts

I note that the report indicates that significant road noise impacts will occur along The Northern Road, especially in an unmitigated noise scenario where there is no noise barrier installed. The report also notes that unmitigated noise levels will be more than 10dB(A) above the noise criteria for external private open space on residential properties as outlined in the NSW EPA's Road Noise Policy. Renzo Tonin deem this to be "much higher than would be considered reasonable". Such levels are also likely to have a significant impact on the health and wellbeing of residents in these areas, and are likely to compromise the learning and skill acquisition (especially speech) of young children.

In addition, the potential noise impact on the sporting fields and other recreational space along The Northern Road needs to be understood. The NSW EPA Road Noise Policy sets a level of 60dB(A) for active recreation spaces (e.g. sports fields) and 55dB(A) for passive recreation spaces (e.g. picnic areas). Based on the Master Plan as proposed, and the road traffic noise levels indicated by Renzo Tonin, the location of sporting fields directly adjacent to The Northern Road is a concern and the noise criteria in the Road Noise Policy are likely to be exceeded by a considerable margin. This aspect needs to be considered and the acoustic assessment amended to give an idea of the level of noise the sporting field location is exposed to.

With the above in mind, it is important to set out now what noise mitigation strategies Council wants to encourage as part of the development of the area now. This will allow for easier changes to the proposed Master Plan as depicted in figure 4 of the Planning Proposal report. This would be the preferred option of the environment team, rather than waiting until the subdivision DA stage where applications are designed around the Master Plan (particularly the layout of roads and location of open space etc) and significant money spent on the plans and reports to support the application and significant delay in determining a DA occurs.

In terms of what noise mitigation might be used, Renzo Tonin state that a 5m high barrier has been recommended for sections of The Northern Road further to the north of the subject site. It is likely that a barrier of a similar height will be required in this instance. There are other solutions that can be used, such as perimeter service roads combined with a housing style fronting The Northern Road such that it will effectively act as a barrier and therefore provide suitable internal acoustic amenity (as required by the Infrastructure SEPP) and external amenity (as recommended by the Road Noise Policy).

In also note that the proposed Master Plan does not appear to have any barrier between the sporting fields and The Northern Road. This aspect needs further discussion and resolution.

Discussions regarding the above need to occur now so that appropriate changes to the Master Plan can be made and appropriate controls placed in the LEP and DCP. An amended acoustic report would be critical to these discussions.

Acoustics - Internal Collector Road impacts - Residential Land

The road noise assessment does not refer to the potential noise impacts of internal collector road development on future residential development. The level of noise from these roads is likely to be fairly easily dealt with by use of upgraded façade treatments on future dwellings and other sensitive receivers. This aspect can be dealt with at the subdivision stage with the submission of a detailed acoustic assessment, but it would be better to get an understanding of the nature of the likely impact at the rezoning stage, and will assist in the drafting of appropriate controls for the DCP.

Acoustics - Internal Collector Road noise impacts - Public Open Space

There has been no assessment of noise impacts from internal collector roads on public open space. Depending on the forecast level of traffic, these impacts could require attenuation measures to be included. Whilst road traffic noise impacts for residential premises can be fairly easily mitigated through façade treatments, providing suitable acoustic amenity for recreational areas can be much more difficult. The attenuation of road traffic noise in recreational spaces, may require the proposed Master Plan to be amended, or the identification of affected areas so that the design of the recreational spaces can account for the noise impacts and ensure that sensitive areas are located away from the noise source. Given this, the acoustic assessment needs to be amended to include an assessment of road traffic noise impacts on the proposed public open spaces areas throughout the rezoning area. The criteria recreational areas outlined in point a) above need to be addressed. Depending on the results of this assessment, changes may be required to the Master Plan.

Figure 1 of the Acoustic Report has been updated with the latest masterplan

We advise that there is no strict criterion for external principal private open space (PPOS) under the RNP or the Guideline. It is just a general comment. The latest masterplan indicated that there will be internal perimeter roads and landscape buffer zones separating the residential lots from The Northern Road.

With reference to the Jacobs' report dated September 2016 and assuming the operational noise contours in Appendix H represented facade-corrected noise levels as required under the NSW RNP, the noise level along the western side of the landscape buffer is expected to be around 65dB(A). In the middle of the nearest sporting field (approx. 100m from the centreline of The Northern Road), this is expected to be around 61dB(A), which generally complies with the noise levels set by the EPA. Full compliance will be achieved 125m from the centreline of The Northern Road.

It is our understanding that noise mounds or barriers are not actively supported by Council as a source noise mitigation measure. The latest masterplan already includes a large separation of ~ 42m between The Northern Road boundary and the future residential dwellings (pathway noise mitigation measure) with any exceedance to be resolved through acoustic facade treatment (receiver noise mitigation measure). This is an acceptable strategy that has been replicated in many masterplanned subdivisions.

The latest masterplan has implemented the recommended solution of having perimeter service roads combined with executive housing fronting The Northern Road. In addition and according to the RNP, land use developers (such as Mirvac) must meet internal noise goals in the ISEPP and its Guideline with no external criteria applicable to 'new' residences along existing roads.

As discussed above, the level of exceedances i.e. 1-4dB(A) that can be expected in the area of the sporting fields closest to The Northern Road is minor. To include a noise mound/noise barrier in the design is unnecessary and we understand that the installation of such measures will obstruct important viewlines to the Blue Mountains from The Northern Road.

The amended report has been updated to address the points raised by Council, where applicable.

Noise impacts of internal collector road are not required to be assessed or considered under any current government policy. Renzo Tonin & Associates agreed that this can be fairly easily dealt with by use of upgraded facade treatments on future dwellings and therefore, it is not deemed critical to be discussed/highlighted in the Road Traffic Noise Investigation report. At this stage, no traffic data has been made available for internal collector road so this cannot yet be quantified.

At this stage, no traffic data has been made available for internal collector road so this cannot yet be quantified. Furthermore, it is not expected that use of active and passive recreation areas would coincide with the peak traffic movements along the internal collector roads, and therefore, the likelihood of intrusive noise impacts is expected to be minimal.