Olympic Park Grandstand

Noise Impact Assessment

Muswellbrook Shire Council (NSW)

7 July 2022

The Power of Commitment

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Glossary

Term	Definition
AS	Australian Standard
Ambient Noise Level	The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' ($L_{Aeq, T}$).
Background Noise Level	The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc.. It is quantified by the noise level that is exceeded for 90% of the measurement period 'T' ($L_{A90,T}$). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days).
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
DCP	Development Control Plan
DECC	Department of Environment and Climate Change (NSW Government), later known as the Department of Environment Climate Change and Water, and now known as the Office of Environment and Heritage (OEH).
EPA	Environment Protection Authority
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
LAeq (15 hr)	The L_{Aeq} noise level for the period 7:00 to 22:00 hours.
LAeq (9 hr)	The L_{Aeq} noise level for the period 22:00 to 7:00 hours.
$L_{A1(period)}$	The sound pressure level that is exceeded for 1% of the measurement period.
$L_{A10(period)}$	The sound pressure level that is exceeded for 10% of the measurement period.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
$L_{n,w}$	Weighted normalised impact sound pressure level. A measure of the noise impact performance of a floor/ceiling, measured in controlled laboratory conditions. Characterises extent of impact sound reaching receiving room via the ceiling / floor from a standard tapping machine test. The lower the number the better the performance.
LEP	Local Environmental Plan
LGA	Local Government Area
Mitigation	Reduction in severity.
Noise Sensitive Receptor	Noise sensitive land use that may be impacts by noise from the development.
NPI	Noise Policy for Industry
PSNG	Project Specific Noise Goals
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.

Term	Definition
R_W	Weighted sound reduction index. A single number descriptor facilitating comparison of the performance of different partitions, derived from a curve fitting technique to measured data of calculated 1/3 octave band centre frequency transmission loss (TL) data for the partition between 100 Hz and 3150 Hz. The higher the number the better the insulation performance.
Satisfactory Design Sound Level	The level of noise that has been found to be acceptable by most people occupying the environmental space in question and considered to be non-intrusive.
Sound Pressure Level (SPL or L_p)	The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_P = 10 \log_{10} (P_a/P_o)^2$ dB (or $20 \log_{10} (P_a/ P_o)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is 20 µPa (20×10^{-6} Pa) for airborne sound. SPL varies with distance from a noise source.
Sound Power Level, (SWL or L_W)	The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment.
Sound transmission loss	The amount in decibels by which a random sound is reduced as it passes through a sound barrier.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.

1. Introduction

1.1 Overview

Muswellbrook Shire Council (MSC) has engaged GHD Pty Ltd (GHD) to prepare a Noise Impact Assessment (NIA) to support a Development Application (DA) for the new Olympic Park Grandstand and Amenity Design (referred to as 'The Proposal').

1.2 Purpose of this report

The purpose of this report is to present the results, findings and recommendations of the NIA for The Proposal.

1.3 Scope of work

The scope of work undertaken by GHD for this assessment is summarised below:

– Conduct a review of the following documentation, to ensure requirements of the development are in line with the relevant regulations:
  - Proposed architectural design documentation
  - Council's Local Environment Plan and Development Control Plan
  - Environment Protection Authority (EPA) NSW Noise Policy for Industry (NPI)
  - EPA NSW Road Noise Policy (RNP)
  - World Health Organisation's (WHO) Guideline for Community Noise
  - EPA Noise Guide for Local Government (NGLG)
  - State Environmental Planning Policy (Infrastructure) 2021
– Desktop review to identify key environmental noise catchment areas and sensitive receivers applicable to the proposed site from aerial photography and planning maps.
– Existing acoustic environment baseline noise measurements have not been undertaken as part of this assessment. In the absence of background noise monitoring, GHD has assumed the Rating Background Levels (RBLs) as previously stated in the Review of Environmental Factors Olympic Park Development NE30034 (Cardno), dated 4 January 2021.
– Determine Project Specific Noise Goals (PSNG) at the nearest noise sensitive receptors with consideration to relevant legislation and guidelines.

  Determine noise emissions sound power levels for various external noise sources. Noise emissions levels for crowd will be predicted based on the expected number of people. Noise sound emission data for any other noise sources such as mechanical plant or the public address system was obtained from the manufacturer data. Where information could not be obtained, GHD made conservative assumptions using past project experience.
– Develop a computational noise model (3D acoustic model in SoundPLAN version 8.2) for the grandstand and the crowd to predict noise emissions from the development to the nearest affected noise sensitive receivers.
– A desktop review of operation road traffic noise to verify that noise levels are not anticipated to increase by 2 dB or more at the most affected sensitive receiver near to the Project in accordance with the RNP.
– Assess the predicted noise levels against relevant established noise limits and comment on potential noise impact.
– Based on noise modelling results, provide recommendations for noise attenuation measures if predicted noise levels indicate specified noise goals would be exceeded at the respective nearest sensitive receivers.

1.3.1 Assumptions and exclusions

The following assumptions and exclusions were made in preparation of this report:

– Construction noise and vibration assessment is not included as part of this assessment.
– Internal room acoustic assessment is not included as part of this assessment.
– Internal mechanical HVAC noise is not included as part of this assessment.
– Entertainment noise from sources such as licenced venues and concerts are not included as part of this assessment.
– The improved grandstand facility aims to attract regional sporting events to the locality, during such events it is anticipated that there will be elevated levels of noise received at adjacent sensitive receptors resulting from traffic, crowds, public address systems and whistles. However, it is not anticipated that this will be any change against the existing noise environment during events as there is no alteration to the capacity of the sporting fields, just an upgrade to the available facilities. As a result, only noise impacts from the increased grandstand capacity, associated carpark movements from the main building have been assessed.

1.4 Limitations

This report: has been prepared by GHD for Muswellbrook Shire Council (NSW) and may only be used and relied on by Muswellbrook Shire Council (NSW) for the purpose agreed between GHD and Muswellbrook Shire Council (NSW) as set out in section 1.2 and section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Muswellbrook Shire Council (NSW) arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.3 and 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

2. Proposal description

2.1 Site description

The site is located within the Muswellbrook Olympic Park precinct on part Lot 7010 DP 93327, located at 3 Wilkinson Avenue, Muswellbrook, NSW. The site is zoned RE1 Public Recreation under *Muswellbrook Local Environmental Plan* (LEP) *2009*. The subject site is bound by Haydon Street to the west, the New England Highway to the south, Bell Street to the east, and Australian Rail Track Corporation (ARTC) railway corridor to the north. Lot 7010 DP 93327 is Crown parcel that is currently managed by Council.

Along with the Muswellbrook golf course, the Olympic Park precinct forms the northern end of an almost 3.2 km long green space corridor running primarily east of the New England Highway from Wilkinson Avenue in the north and along the length of Bimbadeen Drive in the south The site is located directly adjacent to areas zoned B2 Local Centre to the north along Market Street and Victoria Street, and to the west along New England Highway and Sydney Street, within the existing Muswellbrook sports and recreation precinct.

The site is strategically located between Singleton and Scone, approximately a 40-minute drive from Singleton and 25-minute drive from Scone. The regional locality of the site is shown in Figure 2.1.

2.2 Development overview

The proposal comprises the construction of a new Olympic Park Grandstand and Amenity Design (proposed facility). Muswellbrook Shire Council's aspiration is to embrace the recently adopted Olympic Park's Precinct Master Plan and show its commitment to the community through the redevelopment of the grandstand and amenity project, with an aim to reinvigorate the park and establish it as the main leisure facility for Muswellbrook.

The project involves a NRL Regional Level Standard grandstand and associated facilities. These facilities will be distributed over three (3) levels. Provided below is a summary of all the facilities located on each level of the proposed facility and The Proposal footprint is shown Figure 2.2.

Table 2.1 Facility design details

Level	Detail
Ground level	– Male and female change room with WC and showers x 2 – Male and female change room with WC and showers x 2 – WC x 2 – Massage rooms x 4 – Bar & canteen/kiosk – Lobby – Admin room – First aid room – Changing places room Acc – Strength & conditioning room – Referee room – Storeroom x 3 – Dry servery – Time keeper room – Referee toilets

Level	Detail
Level 1	– Terrace – Function room – Club/social/community space – Kitchen – Bar – Male and female WC – Store rooms x 2 – Comms room
Level 2	– Coaches box x 2 – Media room
Other	**Detail**
Capacity	– The current grandstand has a capacity of 444 seats, while the proposed grandstand will provide (approximately) 870 seats, an increase of 426 seats.

2.3 Hours of operation

The existing and proposed hours of operation associated with the football fields and grandstand are set out in Table 2.2.

Table 2.2 Hours of operation

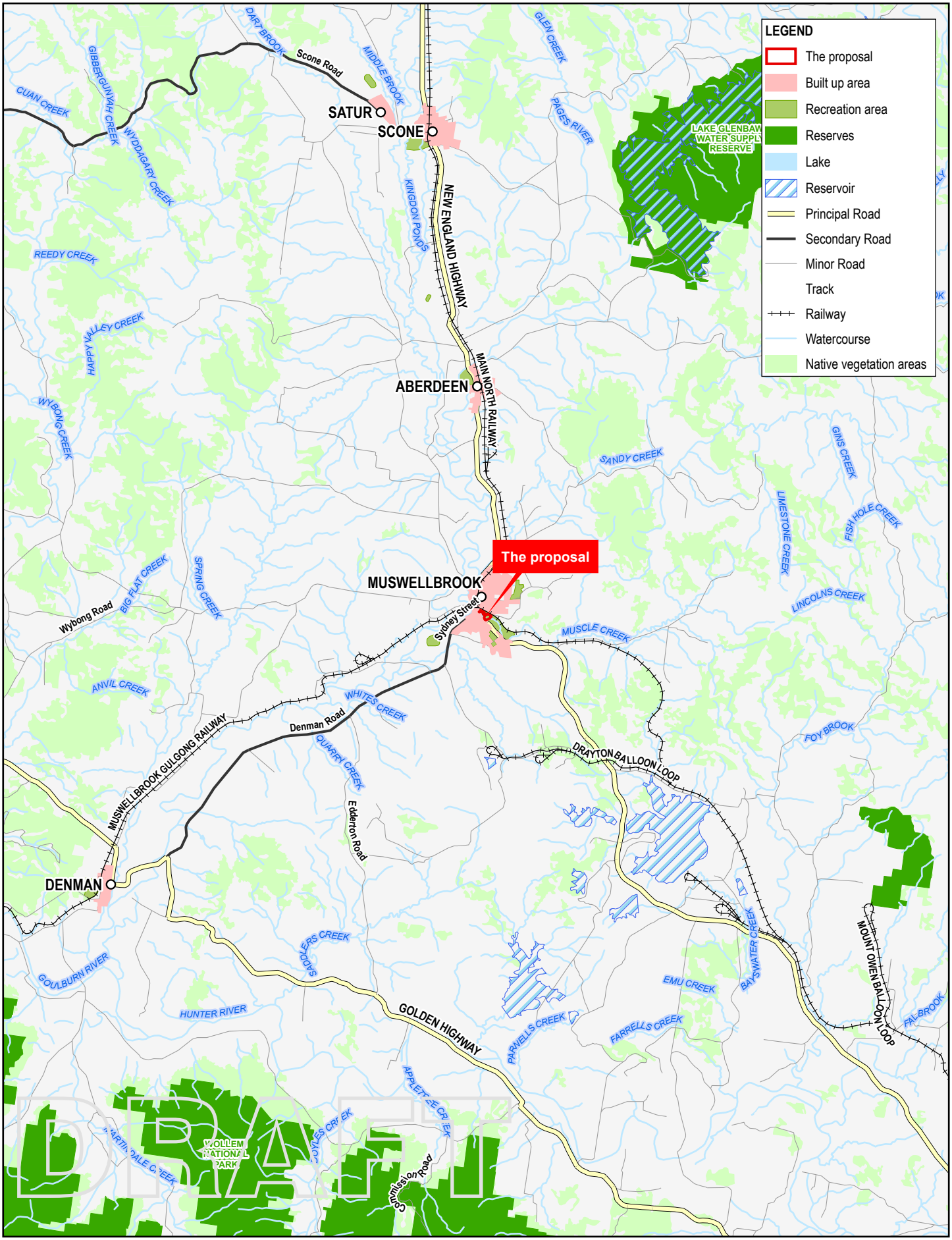
Facility	Time of use	Description of use
Football fields 1,2 and 3. Grandstand	7 am to 10 pm	Major regional events and competitions
		Typical local events
		Training and small events
Main building Carpark	7 am to 12 pm	Use of main building and carpark for Entertainment events

2.4 Access and parking

Vehicle access to the site will continue to be via Wilkinson Avenue. Wilkinson Ave connects persons using sports and recreational services within the precinct accessible through Haydon Street to the west. Olympic Park currently contains a total of 172 formalised car parking spaces, with additional overflow parking available. These spaces are located within walking distance to the proposed facility, two of which are located approximately 60 metres from the western boundary of the site. The car parking facilities are associated with the sports fields and leisure facilities currently located in the precinct, including Muswellbrook Aquatic and Fitness Centre.

Vehicle access to the proposed facility would continue to be via Wilkinson Avenue. During event times, visitor access and parking will be managed and controlled by on-site parking.

Car parking would be located in the existing car parking areas servicing the precinct as well as available space for street parking along Haydon Street and Lorne Street.



Paper Size ISO A4

0 1.5 3 4.5 6

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Muswellbrook Shire Council (NSW)
Olympic Park Grandstand
Noise Impact Assessment

Project No. **12529663**
Revision No. **A**
Date **10/06/2022**

Regional locality

FIGURE 2-1

G:\22\12529663\GIS\Maps\Noise_ImpactAssess_A.aprx
Print date: 10 Jun 2022 - 16:09

Data source: Commonwealth of Australia (Geoscience Australia): 250K Topographic Data Series 3, 2006. Metromap Tile Service: .
Created by: tmorton

ID	Type
1	Car park B1
2	Fields 1 and 2
3	Field 3
4	Velodrome
5	Proposed grandstand
6	Proposed club house
7	Proposed bridge
8	Wilkinson Avenue road upgrade

DRAFT

Paper Size ISO A4

0 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Muswellbrook Shire Council (NSW)
Olympic Park Grandstand
Noise Impact Assessment

The proposal

Project No. **12529663**
Revision No. **A**
Date **10/06/2022**

FIGURE 2-2

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Print date: 10 Jun 2022 - 16:08

Data source: LPI: DTDB/DCDB, 2019. Metromap Tile Service: . Created by: tmorton

3. Sensitive receptors

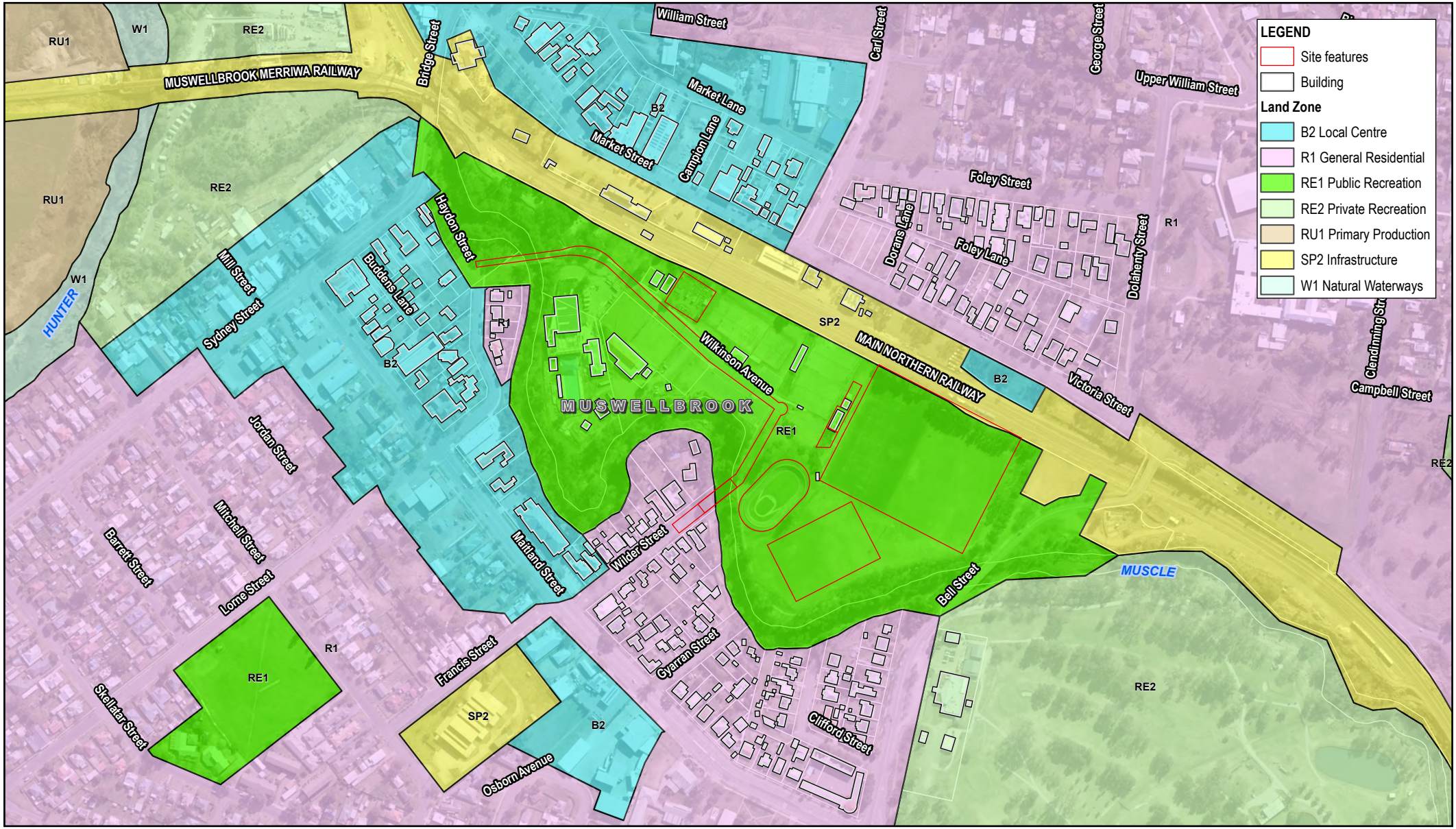
Noise sensitive receptors are defined in the NPI based on the type of occupancy and the activities performed in the surrounding land uses. Sensitive noise and vibration receptors could include:

– Residences
– Educational facilities
– Hospitals and medical facilities
– Places of worship
– Passive and active recreational areas such as parks, sporting fields, golf courses (note that these recreational areas are only considered sensitive when they are in use or occupied)
– Commercial or industrial premises

Table 3.1 provides the identified nearest potential affected sensitive receptors and land uses to The Proposal. Furthermore, the sensitive receptor locations are displayed in Figure 3.1.

Table 3.1 Sensitive receptor locations used in this assessment

Direction	Sensitive land use
North	SP2 Infrastructure – Main Northern Rail line R1 General Residential B2 Local Centre
East	SP2 Infrastructure – Main Northern Rail line R1 General Residential RE2 Private Recreation
South	SP2 Infrastructure R1 General Residential B2 Local Centre RE1 Public Recreation
West	SP2 Infrastructure – Main Northern Rail line R1 General Residential RE2 Private Recreation B2 Local Centre



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Paper Size ISO A4

0 40 80 120 160

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

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Muswellbrook Shire Council (NSW)
Olympic Park Grandstand
Noise Impact Assessment

Muswellbrook Shire Council Local Environment Plan Land Zoning

Project No. **12529663**
Revision No. **A**
Date **10/06/2022**

FIGURE 3-1

G:\22\12529663\GIS\Maps\Noise_ImpactAssess_A.aprx
Print date: 10 Jun 2022 - 16:09

Data source: LPI: DTDB/DCDB, 2019. MSC: LEP Land Zones, 2019. Metromap Tile Service: . Created by: tmorton

4. Existing acoustic environment

4.1 Background noise monitoring

In the absence of background noise monitoring, GHD has assumed the Rating Background Levels (RBLs) as previously stated in the *Review of Environmental Factors Olympic Park Development NE30034* (Cardno), dated 4 January 2021 (refer to Table 4.1).

It is relevant to note no background monitoring was undertaken in Cardno report. The assumed background noise levels in the Cardno report have been taken from the Transport for NSW (TfNSW) construction noise estimator tool.

Table 4.1 Assumed rating background noise levels (source: RMS, 2017)

Time of Day	Minimum assumed rating background noise level (dBA)
Day	45
Evening	40
Night	35

Note 1: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am.
Morning shoulder period 6:00 am to 7:00 am.

4.2 Effects of Meteorology on Noise Levels

Meteorological conditions may increase noise levels by focusing soundwave propagation paths at a single point. Such refraction of sound waves will occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level), and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receiver.

The NPI provides two options for a proponent to consider meteorological effects on noise levels:

1. *Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night.*
2. *Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.*

This NIA has used the option 1 approach and assumed a source to receiver wind and temperature inversion conditions to represent a conservative assessment of noise impacts.

5. Noise guidelines

5.1 External noise goalsgoals

Currently, there is no document in NSW or Australia which specifically outlines suitable goalsgoals or noise limits for the assessment of the noise impact from a sporting facility on a residential developments. To develop suitable noise goals, a review of documentation that provides guidance on external noise levels has been undertaken.

5.1.1 World Health Organisation Guidelines for Community Noise (1999)

The World Health Organisation's (WHO) *Guideline for Community Noise* (1999) provides acceptable noise levels for specific environments.

Table 1 of the WHO guideline provides guideline values for community noise in specific environments, including outdoor living areas and internal areas of residential dwellings. The guideline values are reproduced below in Table 5.1.

Table 5.1 Extract from Guideline values for community noise in specific environments (Table 1 of WHO guideline)

Specific environment	Critical health effects	L_{Aeq} [dB(A)]	Time base (hours)
Outdoor living area	Serious annoyance, daytime and evening	55	16
	Moderate annoyance, daytime and evening	50	16

5.1.2 NSW Environment Protection Authority's Noise Policy for Industry 2017

The amenity levels provided in the Noise Policy for Industry (EPA, 2017) are designed to "protect against noise impact such as speech interference, community annoyance and some sleep disturbance". It is noted that this document is not intended for noise from sporting facilities. However, the amenity noise levels can provide for guidance for external levels. These noise levels are provided in Table 5.2.

The NPI also provides amenity levels for passive recreation areas, which could be considered applicable for outdoor areas.

Table 5.2 Amenity noise levels (Table 2.2 from EPA's NPI)

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A) – external
Residential	Suburban	Day	55
		Evening	45
		Night	40
Area specifically reserved for passive recreation	All	When in use	50

5.1.3 Noise Guide of Local Government

Case Study 2 within the EPA's Noise Guide for Local Government (NGLG 2013) provides a framework for assess the impact of noise from a proposed motor sports facility. The guideline does not provide specific details on how to apply this approach for an existing facility, which proposes to expand its operations in the future, and would typically be used by the sporting facility operator. This case study is not intended to be applied to residential developments near existing or future sporting facilities and as such cannot be directly applied to this assessment.

However the Case Study does suggests that the event frequency does affect the impact on residential receivers. For example:

– Events which occur regularly could exceed the background noise level by up to 5 dB and would not impact surrounding residences
– Events which occur several times a year could exceed the background noise level by up to 20 dB

5.1.4 Summary (External)

Based on the above review of guideline values, Table 5.3 provides the external noise goals are considered appropriate to protect the amenity of occupants within habitable outdoor spaces of a residential property.

Note that the background plus 5 dB(A) intrusive goals is generally adopted in noise assessments as a screening tool for assessing impacts on existing residential receivers from intrusive noise. For this assessment a background plus 10 dB(A) noise goal has been adopted for assessing habitable outdoor spaces for typical weekend events and background plus 20 dB(A) for the occasional event which is likely to occur only a few times a year. This is equivalent to 45 dB(A) and 55 dB(A) respectively for the habitable outdoor space. When compared to the WHO guideline values (and the NPI passive recreational goals) these adopted noise goals are consistent or lower and will provide a satisfactory amenity for residences using their outdoor habitable area during the time periods when these events occur. From an intrusive perspective background plus 20 dBA is also consistent with the EPA's Noise Guide for Local Government (NGLG 2013) Case Study 2 for occasional events.

Table 5.3 Adopted project external noise goals

Area of property	Event	External L_{Aeq} noise level, dB(A)		
		Day 7 am – 6 pm Monday to Saturday, 8 am to 6 pm Sunday and Public Holidays	**Evening 6 pm – 10 pm**	**Night 10 pm – 7 am Monday to Saturday and 10 pm to 8 am Sunday and Public Holidays**
Habitable outdoor space	Large regional or state significant events	65 (RBL + 20 dB)	60 (RBL + 20 dB)	55 (RBL + 20 dB)
	Typical local events	55 (RBL + 10 dB)	50 (RBL + 10 dB)	45 (RBL + 10 dB)
	Training and typical small events	50 (RBL + 5 dB)	45 (RBL + 5 dB)	40 (RBL + 5 dB)

5.2 Internal noise goals

To determine an internal noise goal, a review of documentation has been undertaken that provides guidance on internal noise levels. While not all of these documents are directly related to noise from sporting fields, they can be used as guidance to determine an appropriate internal noise level that is unlikely to impact the occupants of these areas.

5.2.1 World Health Organisation Guidelines for Community Noise

World Health Organisation's (WHO) Guideline for Community Noise provides L_{Aeq} and L_{Amax} fast noise levels for internal areas of dwellings. These are provided in Table 5.4.

Table 5.4 Extract from Guideline values for community noise in specific environments (Table 1 of WHO guideline)

Specific environment	Critical health effects	L_{Aeq} [dB(A)]	Time base (hours)	$L_{Amax\ fast}$ [dB]
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

5.2.2 State Environmental Planning Policy (Transport and Infrastructure) 2021

The SEPP (Transport and Infrastructure) Clause 2.99 *Impact of rail noise or vibration on non-rail development* and Clause 2.119 *Impact of road noise or vibration on non-road development* provides guidance on internal noise levels for residential developments impacted by rail and road traffic noise. It is noted that this standard is not intended for sporting events. However, the internal design sound levels are provided for guidance. The noise goals within the SEPP (Transport and Infrastructure) 2021 are also consistent with *Development near Rail Corridors and Busy Roads Interim Guideline* (Department of Planning, 2008) which also provides measures to implement in the design process to avoid airborne noise by good design.

Table 5.5 State Environment Planning Policy (Infrastructure) 2021 – Internal noise goals for residential buildings

Type of occupancy	Noise level	Time period
Sleeping area (bedrooms)	35 dBA	10 pm to 7 am
Other habitable rooms	40 dBA	7 am to 10 pm

5.2.3 Australian Standard AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors

AS2107:2017 provides design goals for building interiors to ensure a healthy, comfortable and productive environment for the occupants. It is noted that this standard is not intended for transient or variable noise sources such as crowd noise and sporting events. However, the internal design sound level range is provided for guidance.

Table 5.6 Design sound levels for different areas of occupancy in buildings (Table 1 from AS2107:2017)

Type of occupancy/activity	Noise sound level ($L_{Aeq,t}$) range
Houses and apartments in suburban areas or near minor roads	
Sleeping areas (night-time)	30 to 35 dBA
Other habitable rooms	30 to 40 dBA

5.2.4 NSW Environment Protection Authority's Noise Policy for Industry 2017

The amenity levels provided in the Noise Policy for Industry (EPA, 2017) are designed to "protect against noise impact such as speech interference, community annoyance and some sleep disturbance". It is noted that this document is not intended for noise from sporting facilities. However, the amenity noise levels can provide for guidance for internal levels. The amenity levels presented in Table 2.2 of the NPI are external requirements. A 10 dB reduction can be applied to determine suitable internal noise levels based on partially open windows. These adjusted internal noise levels are provided in Table 5.7.

Table 5.7 Amenity noise levels (Table 2.2 from EPA's NPI)

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A) – internal[1]
Residential	Suburban	Day (7 am to 6 pm)	45
		Evening (6 pm to 10 pm)	35
		Night (10 pm to 7 am)	30

Note 1: Based on external amenity noise levels minus 10 dB

5.2.5 Summary (Internal)

Based on the above guidance, the following internal noise goals are considered appropriate to protect the amenity of occupants within internal areas of a residential property.

The bedrooms have conservatively been assessed to a noise goal of 30 dBA to protect the amenity of the occupants at all times of the day.

Table 5.8 Adopted project internal noise goals

Area of dwelling	Time period	Internal L_{Aeq} noise level, dB(A)
Living areas and bedrooms	At all times	35
Bedrooms	10 pm to 7 am	30

5.3 Sleep disturbance

In lieu of any specific guidance on sleep disturbance issues related to sporting facilities, the Noise Policy for Industry (NPI) (EPA, 2017) has been adopted to assess the sleep disturbance impact on The Proposal.

The football fields are not proposed to be used after 10 pm on any night of the week. However, spectators leaving the football fields following a major event may occur. Based on the proposed times of use of the facility, there is the possibility that spectators will be exiting the car park after 10 pm.

In addition, the main building could be used for entertainment events during night-time hours. As specified previously entertainment noise from the proposal has not been included as part of this assessment.

The NPI provides $L_{Aeq,\ 15\ min}$ and L_{Amax} noise levels for external areas. The internal levels should be set to 10 dB lower than these external limits (based on a 10 dB reduction through an open window).

These levels are:

– $L_{Aeq,\ 15\ min}$ 40 dBA (external) and 30 dBA (internal)
– L_{Amax} 52 dBA (external) and 42 dBA (internal)

As our assessment for internal noise levels already takes into account an $L_{Aeq,\ 15\ min}$ 30 dBA, the likelihood of sleep disturbance from The Proposal will be assessed against an internal noise goals of L_{Amax} 42 dBA.

The NPI establishes sleep disturbance noise goals for residential receivers in close proximity to industrial noise sources during the night-time period. The noise goals for protecting the amenity of surrounding receptors in regards to sleep disturbance is:

– $L_{Aeq\ (15minute)}$ 40 dBA or prevailing RBL plus 5 dB, whichever is greater, and/or
– L_{AFmax} 52 dBA or prevailing RBL plus 15dB, whichever is greater.

Table 5.9 Sleep disturbance noise goals

Sensitive Receptors	Period	Sleep disturbance goals	
		L_{AFmax} dBA	$L_{Aeq\ (15minute)}$ dBA
All residential	Night	52	40

Note 1: Night is defined as 10:00 pm to 7:00 am.

5.4 Road traffic noise goals

The NSW EPA Road Noise Policy (RNP) provides traffic noise target levels for sensitive receptors in the vicinity of existing roads and traffic generating developments. Table 5.10 provides the relevant goals for residential land uses affected by a traffic generating developments to identify potential traffic noise impacts and the subsequent need for reasonable and feasible mitigation measures.

Table 5.10 Road traffic noise assessment goals for residential land uses

Road Category	Type of development	Day 7.00 am to 10.00 pm	Night 10.00 pm to 7.00 am
Freeway/arterial/sub-arterial roads	Existing residence affected by additional traffic on arterial roads generated by land use developments	$L_{Aeq(15\ hour)}$ 60 (external)	$L_{Aeq(9\ hour)}$ 55 (external)
Local roads	Existing residence affected by additional traffic on local roads generated by land use developments	$L_{Aeq(1\ hour)}$ 55 (external)	$L_{Aeq(1\ hour)}$ 50 (external)

Note: 1: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2021) for sensitive developments near busy roads (see **Appendix C10** of the RNP for details).

Note 2: Sub-arterial roads previously designated as 'collector roads' in the Environmental goals for road traffic noise.

Section 2.4 of the RNP states that in addition to the assessment goals presented in Table 5.10, any increase in the traffic noise level at a location due to a proposed development or traffic generating development must be considered. Residences experiencing increases in total traffic noise level above the relative increase goals should also be considered for mitigation. Table 5.11 shows relative increase goals for residential land uses. It is relevant to note for projects where the main subject road is a local road, the relative increase criterion does not apply.

Table 5.11 Relative Increase Goals for Residential Land Uses

Road category	Type of Project/development	Total traffic noise level increase – dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/ sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{Aeq,\ (15\ hour)}$ + 12 dB (external)	Existing traffic $L_{Aeq,\ (9\ hour)}$ + 12 dB (external)

In Table 5.11 above, the 'existing' traffic noise level refers to the level from all road categories which would occur for the relevant 'no build' option. Where the existing $L_{Aeq(period)}$ road traffic noise level is found to be less than 30 dBA, it is deemed to be 30 dBA.

Section 3.4 of the RNP also states:

Where existing traffic noise levels are above the noise assessment goals, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment goals. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase goals.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

If road traffic noise from The Proposal for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion

5.5 Liquor and Gaming New South Wales (LGNSW)

The main building could be used for entertainment events. As specified previously entertainment noise from the proposal has not been included as part of this assessment. However, any noise emission from the any licenced venue will need to be assessed against the standard conditions imposed on licensed venues by Liquor and Gaming New South Wales (LGNSW).

The standard conditions imposed on licensed venues by LGNSW are presented below:

The LA10 noise emitted from the licensed premises shall not exceed the background noise level in any octave band frequency (31.5 Hz to 8 kHz inclusive) by more than 5 dB(A) between 7.00am and midnight at the boundary at any affected residence.

The LA10 noise level emitted from the licensed premises shall not exceed the background noise in any octave band centre frequency (31.5 Hz to 8 kHz inclusive) between midnight and 7.00am at the boundary of any affected residence.

Notwithstanding compliance of the above, noise from the licensed premises shall not be audible in any habitable room in any residential premises between the hours of midnight and 7.00am.

It should be noted that no operations are proposed between midnight and 7:00 am.

6. Operational noise impact assessment

6.1 Acoustically significant sources

As previously stated in the *Review of Environmental Factors Olympic Park Development NE30034* (Cardno), dated 4 January 2021:

6.2.2.2 Operational Phase

The operation of the proposed works is not anticipated to result in a significant impact to the existing noise environment. There is anticipated to be a minor increase in traffic noise on residential receivers in Wilder Street due to the redistribution of traffic, the severity of this impact is dependent on the selected option for the final bridge configuration but is expected to be minor. The improved facilities aim to attract regional sporting events to the locality, during such events it is anticipated that there will be elevated levels of noise received that adjacent residences resulting from traffic, crowds, public address systems and whistles. It is not anticipated that this will be any change against the existing noise environment during events as there is no alteration to the capacity of the sporting fields, just an upgrade to the available facilities.

As a result, only noise impacts during major regional events and competitions from the increased grandstand capacity and associated carpark movements from the main building have been assessed in this report.

Sections 6.1.1 present a detailed list of all sources modelled for each size of event in relation to fields and facilities associated with The Proposal.

6.1.1 Scenario 1 - Major regional events and competitions

Table 6.1 presents all noise sources and associated sound power level for each sports field and facility. Crowd levels are assumed to be the worst case 15 minute period during the operation and use of the facilities and fields for major regional events.

Table 6.1 Assumptions and sound power levels for major events, dBA

Facility/field	Activity / noise source	Source type in noise model	Sound power level L_{Aeq}, dBA
Scenario 1 – Major regional event and competition. Existing oval sporting field 1 and Grandstand	40 sporting participants	Area source	107[1]
	870 spectators	Area source	115[2]
	PA system making announcements mounted on the grandstand roof (4 x 150W tap OneSystem SP8)	Point source	114[3] per speaker
	Use of Acme 58.5 referee whistle (including tonal correction)	Area source	104[4]
	Use of car park Carpark A – 76 spaces Carpark B – 25 spaces Carpark B1 – 44 spaces Carpark C – 31 spaces Carpark D – 72 spaces Carpark bowling facility - 27 spots	Car park area source	63[5] per carpark movement

Note 1: Sporting participants noise levels are based on the following breakdown:

- 100% of the sporting participants shouting (male) for five (5) minutes in any fifteen (15) minute period .
- Noise source level: Handbook of Acoustical Measurements and Noise Control, Third Edition Cyril M. Harris.

Note 2: Crowd noise levels are based on the following breakdown:

- 100% of the participants shouting for two (2) minutes in any fifteen (15) minute period.
- 50% Female spectators shouting.
- 50% Male spectators shouting.
- Noise source level: Handbook of Acoustical Measurements and Noise Control, Third Edition Cyril M. Harris.

Note 3: PA system noise levels are based on the following breakdown:

- PA system noise sources are time corrected for the assumption that in a worst-case 15 minute period the PA system is operating for two (2) minutes in any fifteen (15) minute period.
- Four (4) PA mounted on the grandstand roof (4 x 150W tap OneSystem SP8).
- Noise source and directivity: OneSystem

Note 4: Whistle noise levels are based on the following breakdown:

- All whistle noise sources are time corrected for the assumption that in a worst-case 15 minute a whistle is blown for two (2) seconds fifteen (15) times.
- Noise source and directivity: Acme.

Note 5: Carpark noise levels are based on the following breakdown:

- Carpark noise sources one parking movement per hour per car parking space.
- Noise source: Parking lot Study 2007, Bavarian Landesamt fur Umwelt.

6.2 Operational noise modelling

6.3 Operational noise modelling parameters

Based on information provided by Council, the scenario detailed in Section 5.1, above, have been assessed to determine the noise impact of the sporting complex on the surrounding residential receptors. These assumptions are a worst case 15 minute period during the operation of the facilities and are considered conservative.

Noise modelling was undertaken using SoundPLAN 3D modelling software (Version 8.2). SoundPLAN is a computer program for the calculation, assessment and prognosis of noise exposure. Noise modelling was undertaken using SoundPLAN which calculates environmental noise propagation according to *ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors.* The following tasks were undertaken as part of the operational noise impact assessment:

- Noise goals was determined based on the sensitive receiver type and time of day
- Appropriate site specific conditions for the noise model were developed
- The sound power levels of each activity was established
- The impacts on sensitive receivers surrounding the site were assessed

The following noise modelling assumptions were made to establish site specific conditions:

- Surrounding land was modelled assuming a mixture of hard and soft ground with a ground absorption coefficient of 0.5. The sporting field 1 was modelled at soft 1.0.
- Terrain topography with a 2 metre resolution (NSW Government Spatial Services Elvis) of the study area was used to generate the site used to predict noise levels.
- A moderate temperature inversion during the day period according to ISO 9613-2 algorithm for noise propagation.
- Atmospheric air absorption was based on an average temperature of 10ºC and an average humidity of 70%.
- Nearest sensitive receptors assumed 1.5 m above ground level.
- Car park modelled according to ISO 9613-2 study (2007) noise emissions.

6.4 Meteorological conditions

Noise propagation was calculated according to ISO 9613-2 *Acoustics – Attenuation of sound during propagation outdoors* which includes the following downwind propagation conditions:

– *wind direction within an angle of ± 45º of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver, and*

– *wind speed between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above the ground.*

The ISO 9613-2 algorithm also includes average propagation under a well-developed moderate temperature inversion, such as commonly occurs on, clear clam nights. GHD believes that the assessment is a conservative represent of the local wind conditions and considers a worst-case scenario.

6.5 Predicted noise levels

The following section provides details of the resultant noise contour plots at surround residential dwellings from The Proposal.

Predicted noise levels have then been assessed against the goals for internal and external areas. The relevant goals can be found in the following sections:

– External - Table 5.3

– Internal - Table 5.8

The external and internal predicted noise levels in Figure 6.1 and Figure 6.2 have been assessed against the day-time and evening noise goals.

The predicted noise levels in Figure 6.2 assumes a 15 dB reduction from outside to inside with partially open windows (WHO 1999).

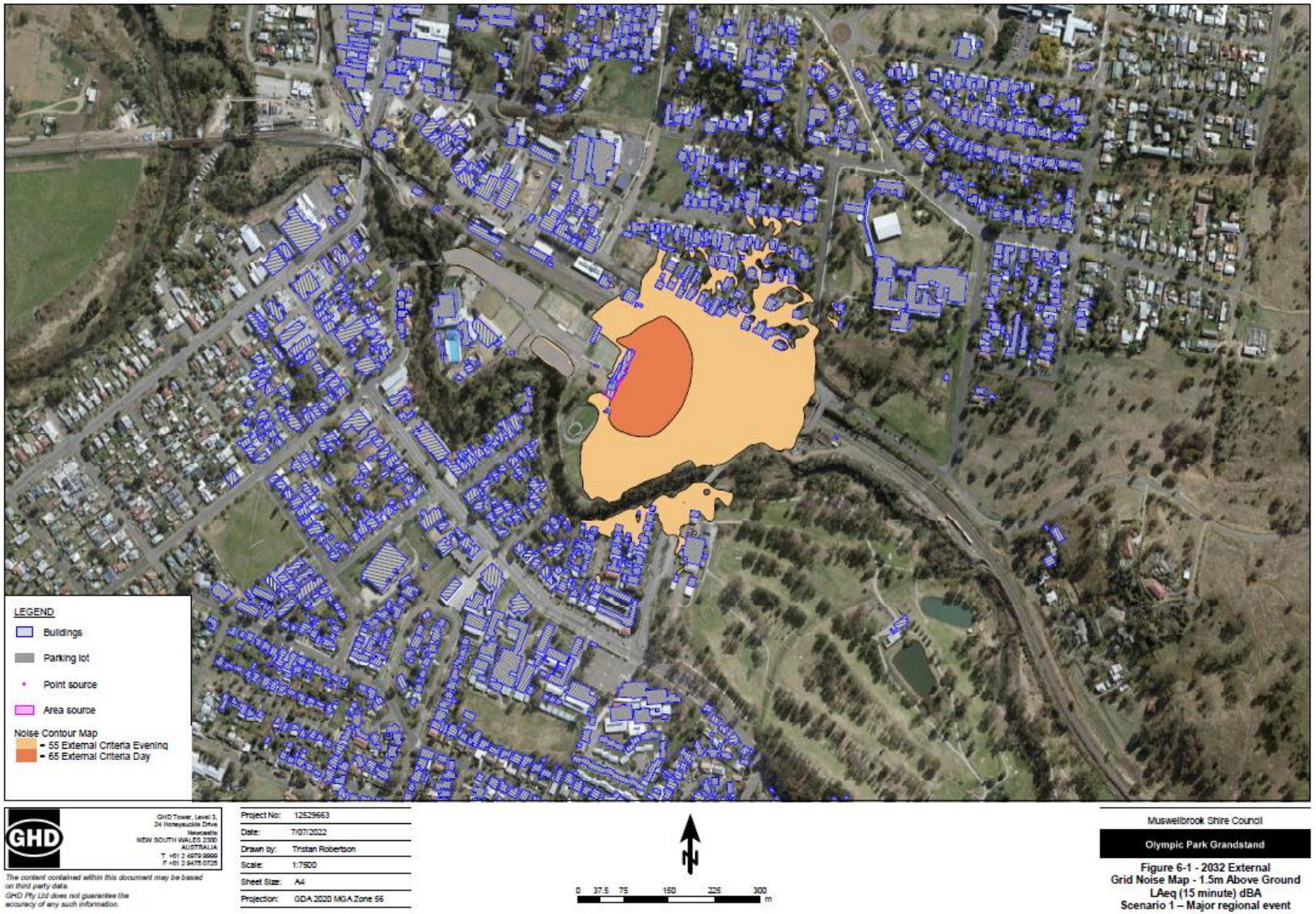

Figure 6.1 Day and Evening External Predicted L_{Aeq} levels, dBA – major regional event

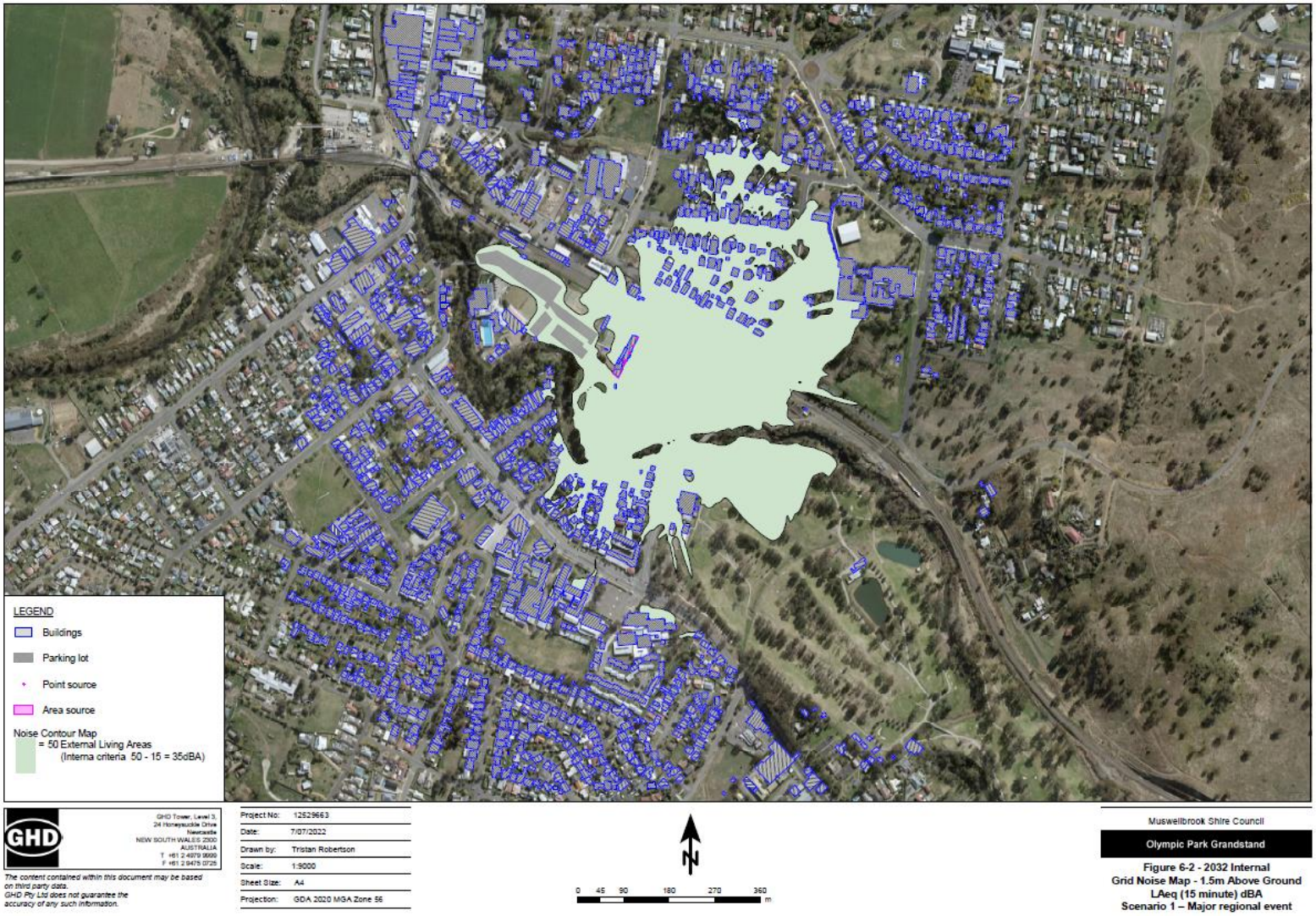

Figure 6.2 Internal Living Area Predicted L_{Aeq} levels, dBA – major regional event.

6.6 Sleep disturbance assessment

GHD has undertaken an assessment of sleep disturbance to determine the impact of maximum level events from The Proposal.

Based on the proposed times of use of the facility, there is the possibility that spectators will be exiting the car park after 10 pm.

As such, GHD has undertaken an assessment of sleep disturbance based on a maximum, being a car door slam with a SWL of 99.5 dBA (Bavarian parking lot study) within the car parks. The noise contour plots are provided in Figure 6.3.

The predicted noise levels in each zone from a car door slam in proposed parking is predicted to exceed the sleep disturbance screening goals for a surrounding residential properties to the north and south of the proposal presented in Figure 6.3 and Figure 6.4.

Figure 6.3 Predicted L_{AFmax} levels from use of parking throughout the sporting precinct (car door slam), dBA

Figure 6.4 Predicted L_{Aeq} levels from use of parking throughout the sporting precinct (car door slam), dBA

6.7 Operational road traffic noise

6.7.1 Methodology and Assumptions

Road traffic noise levels from the Proposal have been predicted using with the Federal Highway Administration traffic noise screening tool 1.0 – the FHWA. The modelling allows for traffic volume and mix, vehicle speed, ground absorption type, pavement type, road grade.

The calculation algorithms are generally considered to be mathematically more rigorous than those of the Calculation of Road Traffic Noise (CoRTN) method, leading to greater accuracy and a wider range of validity at low traffic flows.

The predicted levels are for receiver points 1.5 m above the external ground level.

Two (2) scenarios were modelled for the purposes of this traffic noise impact assessment:

– Scenario 1 Future (No build) – 2032 assumes future traffic volumes without the proposed development.
– Scenario 2 Future (Build) – 2032 assumes future traffic volumes with the proposed development in operation.

The predicted road traffic noise levels due to the proposal are provided in Table 6.3. Please note peak traffic volumes have been assumed as a conversative approach and actual average $L_{Aeq\ (1\ hour)}$ noise levels from the surrounding local roads would be lower than the noise levels provided.

6.7.2 Trip generation

SIDRA analysis provided in GHD Traffic report provided the ten-year 2032 peak hourly traffic volumes for the following two scenarios:

– A “no-build” scenario, accounting for background traffic growth in Muswellbrook
– A “build” scenario, accounting for background traffic growth plus the trips associated with the grandstand

The 2032 “no-build: peak hourly traffic volumes are displayed in Figure 6.5 and the 2032 “build” peak hourly traffic volumes are displayed in Figure 6.6.

In addition, the peak hourly traffic on Wilder Street 61 (no build 2019) and 224 (Future 2031) has been taken from the *Review of Environmental Factors Olympic Park Development NE30034* (Cardno), dated 4 January 2021.

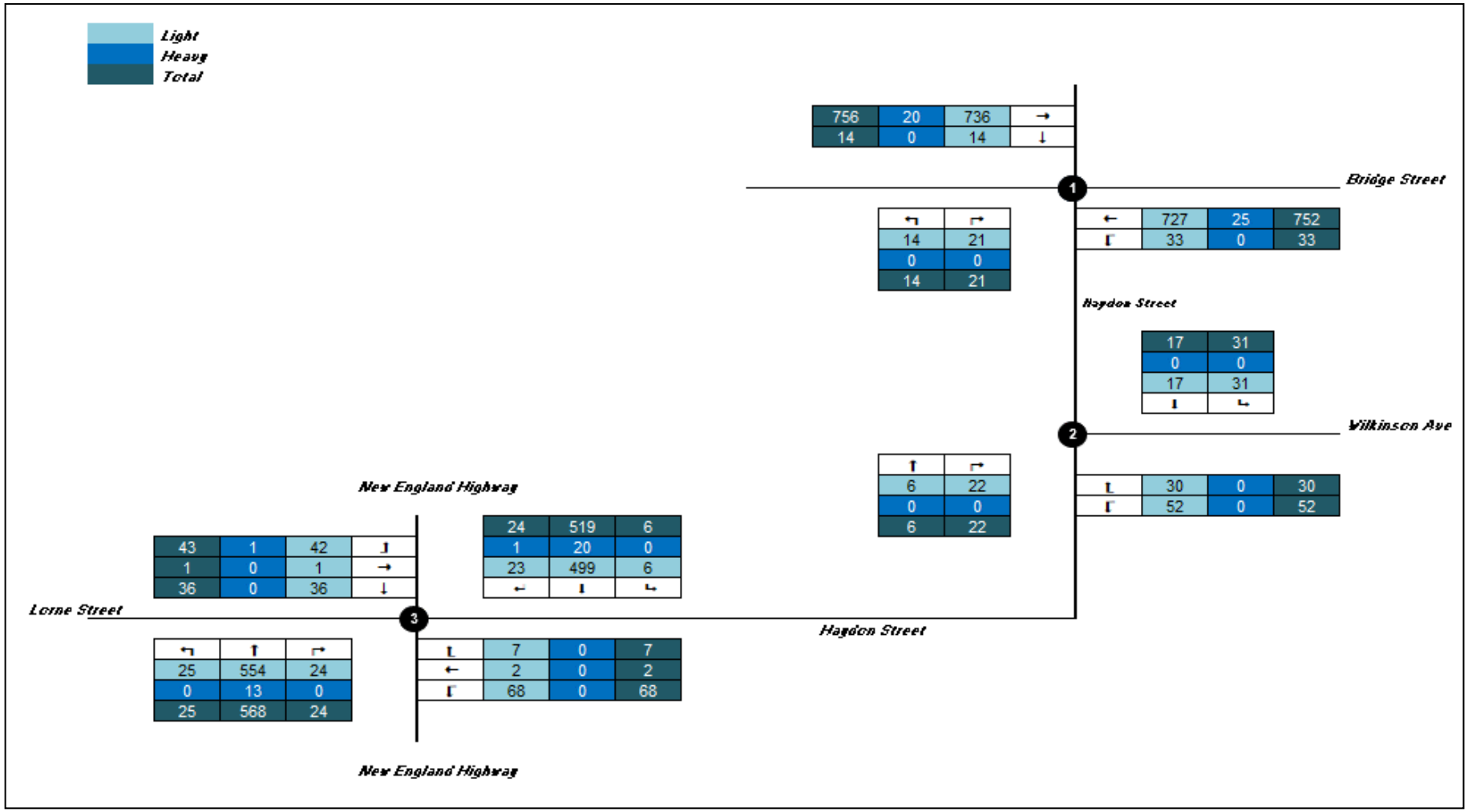

Figure 6.5 2032 No Build traffic volumes

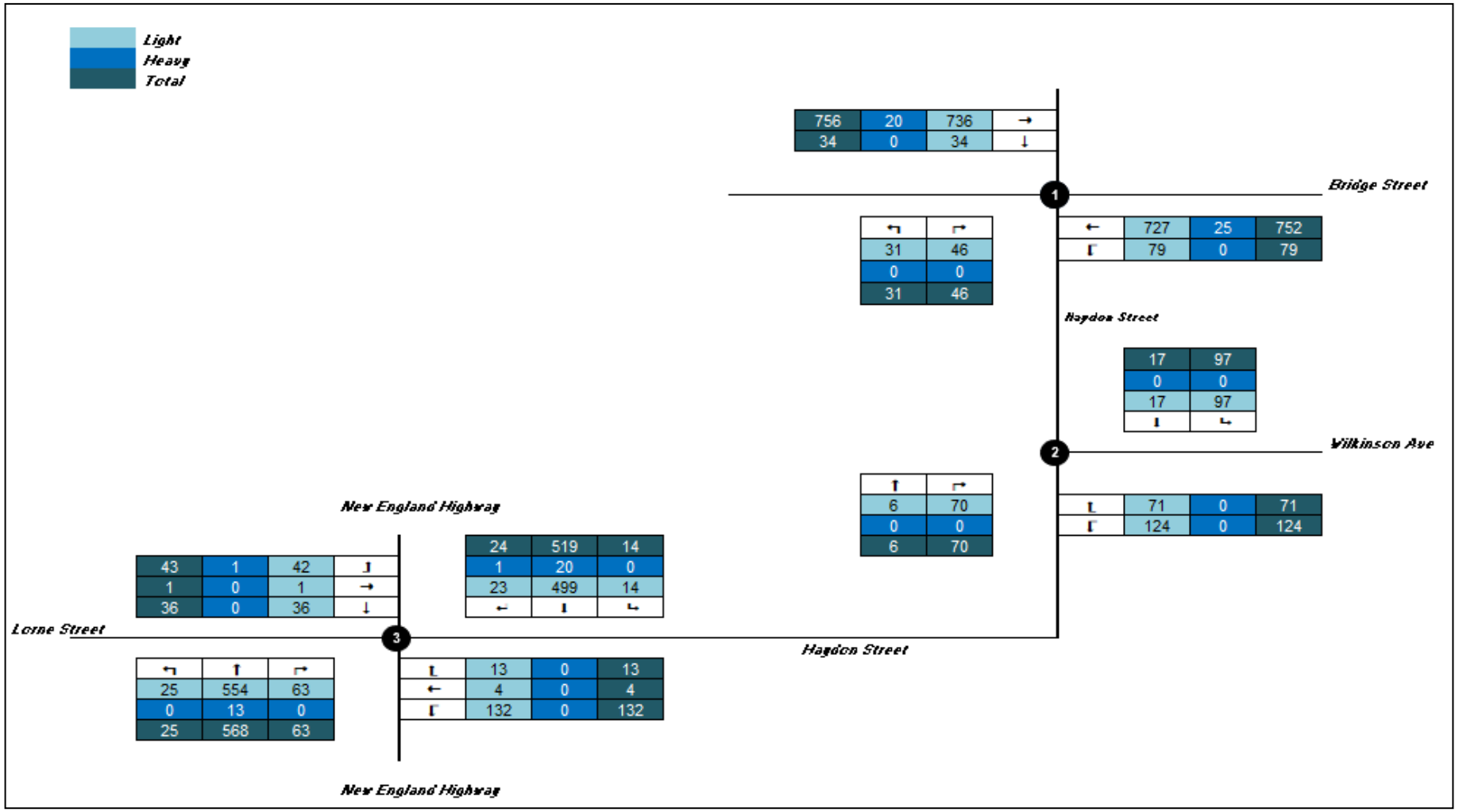

Figure 6.6 2032 Build traffic volumes

Table 6.2 Operational traffic volumes

Scenario	Local road description	Road Traffic Speed km/h	Peak hourly traffic volumes	
			Light	Heavy
Scenario 1 (2032) – No Build	Haydon Street (between Bridge Street and Wilkinson Avenue)	50	135	0
	Wilkinson Avenue		135	0
	Haydon Street (between New England Hwy and Wilkinson Avenue)		205	0
	Lone Street		129	2
	Wilder Street		61	0
Scenario 2 (2032) – Build	Haydon Street (between Bridge Street and Wilkinson Avenue)	50	213	0
	Wilkinson Avenue		362	0
	Haydon Street (between New England Hwy and Wilkinson Avenue)		372	0
	Lone Street		131	2
	Wilder Street		224	0

Table 6.3 Operational road traffic noise predictions

Scenario	Road Description	Closest residential receptor & Offset Distance	Prediction Results LAeq (dBA)	Goals
			Day (1 hour) 7am to 10pm	Day (1 hour) 7am to 10pm
Scenario 1 (2032) – No Build	Haydon Street (between Bridge Street and Wilkinson Avenue)	10	54.0	55
	Wilkinson Avenue	25	50.5	55
	Haydon Street (between New England Hwy and Wilkinson Avenue)	10	**55.5**	55
	Lone Street	10	**55.2**	55
	Wilder Street	10	51.0	55
Scenario 2 (2032) – Build	Haydon Street (between Bridge Street and Wilkinson Avenue)	10	**55.8**	55
	Wilkinson Avenue	25	54.8	55
	Haydon Street (between New England Hwy and Wilkinson Avenue)	10	**58.2**	55
	Lone Street	10	**55.3**	55
	Wilder Street	10	**56.2**	55

6.8 Assessment of impacts

6.8.1 Major regional events and competitions

During major regional events some exceedances have the potential to occur at the most exposed façades for surrounding sensitive receptors. All acoustically significant sources such as crowd noise (shouting) has been assumed to operate continuously during any 15-minute assessment period. This is considered very conservative worst-case as, in reality, this is unlikely to occur. Consequently, the actual operational noise levels from the Proposal are likely to be lower than the predicted results.

6.8.2 Sleep disturbance

During major regional events some minor exceedances have the potential to occur.

6.8.3 Operational road traffic

During major regional events some minor exceedances have the potential to occur. It is relevant to note that the predictions presented in Table 6.3 has assumed the peak hourly traffic volumes as a worst-case scenario. Consequently, the actual road traffic noise levels from the Proposal are likely to be lower than the predicted results.

7. Mitigation recommendations

7.1 Major regional events

Noise modelling demonstrates that major regional events noise levels are predicted to exceed the noise goals detailed in Table 5.3 (external noise) and Table 5.8 (internal noise goals) within the most exposed areas of surround residential properties, including internal and external areas.

It is recommended that a Noise Management Plan be adopted for The Proposal. This should include, but not be limited to noise management measured detailed in the following sections below.

7.1.1 Site supervision

7.1.1.1 Prior to event

Security staff should be deployed to locations (ingress routes and entry points) around the site to ensure that all patrons are entering the site in a quiet and orderly manner and are not loitering in areas that may impact the nearby sensitive receivers.

7.1.1.2 During event

Security staff should continue to monitor areas in the vicinity of the site to ensure all patrons have entered and are not loitering in areas that may impact the nearby sensitive receivers.

7.1.1.3 Completion of event

At the completion of the event, security staff should ensure that all patrons are directed towards either the car park, or the exit gates.

Patrons exiting on foot should be directed towards the taxi rank or public transport. Should the patrons leave the area on foot, security or staff should be directing them to be doing so in a quiet and orderly manner. Should the patrons ignore the requests of security, and there is a high likelihood that residents will be impacted by the noise from the patrons, the police should be called to attend to the issue if security deem the noise from the patrons is significant.

Security and staff shall also monitor the exit points and car park to ensure that all vehicles are leaving in an orderly manner.

7.1.2 Signage

Signage should be erected at all exits informing patrons to leave the site in a quiet and orderly manner and to consider the residential receivers in the vicinity of the Proposal.

Signage should be erected throughout the car parks and the exits advising patrons to exit in a quiet and orderly manner and to consider the residential receivers in the vicinity of the Proposal.

7.1.3 Staff training

All staff and security staff should undergo training prior to working at their first event and at 12 monthly intervals following this. The training must educate staff regarding the following:

– Requirements of the Noise Management Plan, including noise limits
– Location of the sensitive receivers
– Mitigation measures
– Dealing with noise complaints from residents and management of noise related complaints during the event
– Details of exit routes from the site following completion of the event
– Any changes to procedures since last briefing

A training program should be established to assist with the education of all staff in consultation with a qualified acoustic consultant.

A copy of the noise management plan should be provided to all staff.

7.1.4 Community consultation

7.1.4.1 Major events

Prior to each major regional event, the Proposal should locally advertise. The advertising should detail the following:

– A contact number for noise complaints on the evening of the event
– An email address for complaints following the event
– The name and date of the event
– The start and finish time of the event
– The expected spectator size
– Hours of operation for the complaints line

7.1.4.2 Complaints

Complaints arising from the noise emission from the site during events should be documented and responded to in a sensitive, timely and consistent manner. The following process should be established to ensure all complaints are dealt with in an appropriate manner:

– A staff member will be nominated to deal with complaints from the community. Contact details of this member of staff will be displayed at each entry point of the site
– All complaints will be logged within a complaint register (see example table below). An archive of complaints will be maintained, documenting the nature of the complaint and the actions implemented for resolving the complaint
– The operations manager will endeavour to attend to these complaints within 48 hours of receiving
– Following each event, the complaint log is to be reviewed and actions should be put in place to resolve the complaint. Depending on the nature of the complaint, this may involve follow up discussions with the complainant, or consultation with the regulatory authority, police of acoustic engineer.
– The complaints log will be made available to relevant regulatory authority on request

Table 7.1 Complaints log template

Item	Comments
Date and time of call	
Name and location of the caller	
Contact details of caller	
Nature of complaint	
Action taken	
Staff member handling complaint	

The complaint log should be reviewed at regular intervals to identify common complaints and recurring issues. The review can be used to adjust operations to reduce the number of complaints at future events.

7.2 Other events

7.2.1 Outdoor concerts

It is recommended that outdoor concerts venue management consider and implement into the site Noise Management Plan where practicable and relevant to the venue the noise management measures outlined Noise Guide for Local Government.

7.2.2 Licenced venue

It is also recommended that the licensees and venue management review, consider and implement into the site Noise Management Plan where practicable and relevant to the venue the noise management measures outlined within the Liquor & Gaming NSW (LGNSW) publication, Sound Advice (October 2009, OLGR).

8. Conclusion

GHD has undertaken an assessment of noise impact from the proposed new Olympic Park Grandstand and Amenity Design.

Various scenarios of maximum and typical usage of the complex were modelled to determine the noise levels at the proposed development. Noise mitigation has been recommended, as discussed in Section 7.

Noise levels from The Proposal are predicted to be exceed the adopted noise goals during major regional events. Noise mitigation measures recommended in this report should be adopted wherever feasible and reasonable.

9. References

Australian Standard AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors

AS IEC 61672.1-2019 Electroacoustics - Sound Level Meters – Specifications, Standards Australia, 2019

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The Power of Commitment