Henry Lawson Drive Stage 1A

Noise and Vibration Impact Assessment

Transport for NSW

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Executive Summary

Aurecon Australasia has undertaken an assessment of potential noise and vibration impacts associated with the proposed Henry Lawson Drive Stage 1A Upgrade project (the overall proposal). The overall proposal consists of upgrading a 1.3 kilometre (km) section of Henry Lawson Drive, including intersection upgrades, and an additional 480 metres (m) of carriageway along Milperra Road (refer Figure 1-1).

The overall proposal comprises of an REF proposal and an EIS proposal. This Noise and Vibration Impact Assessment has been prepared to assess the potential noise and vibration impacts of the proposal. It will support:

- A Review of Environmental Factors (REF) being prepared by Transport under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) for the REF proposal and
- An Environmental Impact Statement (EIS) being prepared under Division 4.1 of the EP&A Act for the EIS proposal areas, where activities are proposed on land mapped as Coastal Wetlands and deemed designated development.

The assessment considers both proposal areas (refer Figure 1-1), however, considers them as a whole as works would be undertaken concurrently for both proposals.

Construction noise and vibration

Construction noise impacts associated with the overall proposal are predicted to exceed the proposal noise management levels (NMLs) for all noise catchment areas (NCAs), during both the construction standard hours and out-of-hours work (OOHW) periods, for all proposed construction scenarios.

Exceedance of the highly noise affected management level of 75 dBA was predicted for the following receivers/NCAs:

- Six receivers within NCA 1 during the Bridge and Drainage works construction scenario, and
- Most receivers along Henry Lawson Drive and Auld Avenue in NCA 2 during all construction scenarios

As some construction works will be required to occur outside the recommended standard hours of work, a sleep disturbance assessment was undertaken to determine the level of construction noise impact to surrounding residences. Activities associated with the widening and pavement works construction scenario are expected to generate the highest levels of noise on site, and hence to forecast worst-case noise impacts, this scenario was assumed to occur during the OOHW period, with noise levels of >65dBL_{Amax} predicted for all residential receivers in NCA 1 and 2. Construction scheduling would be revised during the detailed design stage and if necessary, further assessment of construction noise impacts would be undertaken. undertaken

Given the potential for exceedance of the proposal NMLs (noise affected and highly noise affected) and sleep disturbance awakening limits, noise mitigation measures will be implemented in accordance with the RMS *Construction Noise and Vibration Guideline 2016* (CNVG).

Construction traffic noise impacts associated with temporary additional traffic generation on the surrounding public road network was also assessed, by comparing the daily predicted construction induced traffic volumes with the existing traffic volumes (traffic counts provided by Matrix Traffic). The additional construction traffic on the surrounding road network would not increase existing noise levels by more than 2 dB, which represents a minor impact that is barely perceptible.

There is potential for structural damage and human discomfort caused by construction vibration on surrounding residential receivers when vibratory roller operations are conducted within 100 metres of structures. Given the proximity of the proposal footprint to receivers in NCA 2 and 4, vibration mitigation measures have been recommended, including identifying minimum working distances provided with respect to the contractors Construction Noise and Vibration Management Plan (CNVMP)

It should be noted that there are no construction noise impacts for the EIS proposal alone, as there are no sensitive receivers in the EIS proposal areas.

Operational noise

Operational road traffic noise during the day and night-time periods were predicted for the future Build and No Build assessment scenarios for the opening year (2026) as well as 10 years after opening (2036). The assessment considered future traffic growth from surrounding developments.

Operational noise levels were considered across the study area, but particularly in NCA 1 and NCA 2, due to the presence of residential receivers. Both groups of receivers are already in proximity to Henry Lawson Drive and Newbridge Road and experience high levels of existing road traffic noise.

NCA 1 would be predicted to have a slight increase in noise levels in the No Build and Build Scenarios for both day and night periods in 2026 and 2036 scenarios. These increases are up to 1.0 dBA, which is not perceptible to the human ear.

NCA 2 would experience a slight improvement in the predicted noise levels, with most sensitive receivers experiencing a slight decrease in noise levels between the No Build and Build scenarios in both 2026 and 2036 scenarios for both day and night periods. The general improvement in predicted noise levels for NCA 2 is most likely due to the shift of the southbound lane on Henry Lawson Drive further east. However, for the sole residential property to the east of Henry Lawson Drive, there is an increase of up to 1 dBA between the No Build and Build Scenarios for both day and night periods, due to the traffic lanes shifting closer to this receiver.

In summary, the maximum changes in noise levels between the No Build and Build scenarios is between a reduction of 2dBA up to an increase in 1 dBA for all assessed receivers. This is not a noticeable change in road traffic noise levels and is below the relative increase criterion of 2 dB between the No Build and Build scenarios.

However, receivers do exceed the acute Noise Mitigation Guideline (NMG) criteria which instigate eligibility for mitigation measures. As receivers in NCA 2 exceed the NMG criteria due to proposal roads, these properties are eligible for noise mitigation. Noise mitigation measured were considered and at-property mitigation was preferred as locality, space and access to properties for the residents deemed quiet pavement surfaces and noise mounds/barriers in adequate to mitigation road traffic noise.

It should be noted that there are no operational noise impacts for the EIS proposal alone, as there are no sensitive receivers in the EIS proposal areas.

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Glossary

Term	Meaning
A-weighted decibels [dB(A)]	The A-weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1 kHz and 4 kHz) which the human ear is most sensitive to and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Airborne sound	Airborne sound is sound transmitted through the air/atmosphere, eg conversation between people.
Ambient noise	The prevailing noise level at a location due to all noise sources but excluding the noise from the specific noise source under consideration. Generally measured as a dB(A) noise level.
Background noise	The noise level exceeded for 90% of the measurement period ($L_{A90)}$ ie the underlying level of noise present and does not include transient noise such as intermittent traffic or dogs barking.
Construction	Includes all physical work required to construct the proposal and includes construction planning such as the development of construction management plans.
Day	The period from 7:00 am to 6:00 pm Monday to Saturday and 8:00 am to 6:00 pm Sundays and public holidays.
Decibel [dB]	The measurement unit of sound.
Decibel scale	The decibel scale is logarithmic. Sound pressure levels are expressed in decibels as a ratio between the measured sound pressure level and the reference pressure. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy.
Equivalent continuous sound pressure level [L_{eq}] and A-weighted equivalent continuous sound pressure level [$L_{Aeq(15min)}$]	The equivalent continuous A-weighted sound pressure level is the value of the A-weighted sound pressure level of a continuous steady sound that has the same acoustic energy as a time-varying A-weighted sound pressure level when determined over the same measurement period, T. The INCG defines $L_{Aeq(15min)}$ as 'the A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as industry, road, rail and the community.
Evening	The period from 6:00 pm to 10:00 pm Monday to Sunday and public holidays.
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low pitched sound.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
L_{10}	The sound pressure level exceeded for 10 per cent of the measurement period. For 10 per cent of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90 per cent of the measurement period. For 90 per cent of the measurement period it was louder than the L_{90}.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
Methodology	The method for analysis and evaluation of the relevant subject matter.
NCA	A Noise Catchment Area is a logical grouping of receivers affected by the same works to assist with assessment, consultation or notification.
Night	The period from 10:00 pm to 7:00 am Monday to Saturday and 10:00 pm to 8:00 am Sundays and public holidays.
Noise intensive works	Works which include the use of power saws for the cutting of timber, masonry and steel; grinding of metal, concrete or masonry; rock/line drilling; bitumen milling and profiling; jack hammering, rock hammering and rock breaking; or impact piling.
Out-of-hours works	Defined as works outside standard construction hours (ie outside of 7:00 am to 6:00 pm Monday to Friday, 8:00 am to 1:00 pm Saturday and no work on Sundays/public holidays).

Term	Meaning
Proposal	The first stage of the progressive upgrade to 7.5 kilometres of Henry Lawson Drive between the intersections of Hume Highway, Villawood, and the M5 South Western Motorway, Milperra.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.
Sensitive receiver/ receptor	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises).
Sound power level	The total sound power emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Study area	The area over which the noise assessment is conducted, extending 600 metres from the centre line of the outermost traffic lane on each side of the subject road
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Vibration intensive works	Works which use vibration intensive equipment such as jack hammers, piling rigs and rock breakers.
Vibration Dose Vale (VDV)	Vibration dose value is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration (British Standard 6472 – 2008).

1 Introduction

Transport for NSW (Transport) is proposing to upgrade Henry Lawson Drive Upgrade between Keys Parade, Milperra, to Tower Road, Bankstown Aerodrome (known as the Henry Lawson Drive Upgrade Stage 1A) (the overall proposal). The proposal consists of upgrading a 1.3 kilometre (km) length of Henry Lawson Drive including intersection upgrades and an additional 480 metres (m) along Milperra Road to the Newbridge Road Georges River Bridge tie in (the site).

This Noise and Vibration Impact Assessment has been prepared to assess the potential noise and vibration impacts of the proposal. It will support a Review of Environmental Factors (REF) being prepared by Transport under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and an Environmental Impact Statement (EIS) being prepared under Division 4.1 of the EP&A Act. Figure 1-1 highlights the REF proposal area and the EIS proposal areas.

The REF has been prepared for the majority of the proposal area, where Transport can approve works under the State Environmental Planning Policy (Infrastructure) 2008 (referred to as the 'REF proposal'). However, as part of the proposal is located within areas mapped as coastal wetlands under the State Environmental Planning Policy (Coastal Management) 2018, this part of the proposal is deemed designated development and is subject to an EIS. The work within mapped coastal wetlands is referred to as the 'EIS proposal'.

1.1 Proposal background

The overall proposal forms the first stage of the progressive upgrade to 7.5 km of Henry Lawson Drive between the intersections of Hume Highway, Villawood, and the M5 South Western Motorway, Milperra.

The upgrade would help ease existing traffic issues and increase traffic capacity at key intersections to help meet growing demand, with residential, commercial and industrial development in the surrounding area expected to increase in the coming years. The upgrade would be delivered in three stages.

Subject to approval, construction of the Stage 1A proposal may commence in early 2023 and would take about two years to complete. Other stages of upgrading Henry Lawson Drive would be developed and assessed separately in the future.

1.2 Proposal location and setting

The overall proposal is located around 20 km south west of the Sydney CBD in the City of Canterbury-Bankstown local government area. The overall proposal is mainly along Henry Lawson Drive and includes intersection upgrades at Tower Road, Newbridge/Milperra Road and Auld Avenue.

Henry Lawson Drive is a key connection for traffic moving between the Hume Highway, Milperra Road/ Newbridge Road and the M5 Motorway. It is also used for local travel trips between residences and services. In terms of heavy vehicle access, Henry Lawson Drive is designated as a B-Double access route that connects surrounding large industrial areas of Milperra, Revesby, Chipping Norton and Moorebank.

The overall proposal is located to the east of the Georges River and surrounding recreational areas. There are a number of Coastal Wetlands within and surrounding the proposal associated with the Georges River.

Located to the south west of the proposal, is a residential area with detached housing and sporting fields and passive recreation areas. To the south east, is the Bankstown Golf Course and urban bushland areas. North of Milperra Road comprises retail and commercial development that backs onto the Bankstown Airport and land currently being redeveloped, all of which access Henry Lawson Drive via Tower Road. Located north of Tower Road is the Georges River Golf Course.

1.3 Proposal overview

The key features of the REF proposal and the EIS proposal are discussed in the following section. Relevant construction information is contained within Chapter 3.

1.3.1 Key features of the REF proposal

Key features of the REF proposal include:

- Widening Henry Lawson Drive from two to four lanes
- Upgrading the signalised intersection of Henry Lawson Drive and Tower Road including:
  - An additional right turn lane from Tower Road onto Henry Lawson Drive
  - A new channelised short left-turn lane from Henry Lawson Drive (southbound) onto Tower Road
  - An additional right turn lane from Henry Lawson Drive (northbound) onto Tower Road
  - Retaining the pedestrian crossing across Henry Lawson Drive on the southern side of the intersection
- Upgrading the signalised intersection of Henry Lawson Drive and Milperra Road /Newbridge Road including:
  - An additional right turn lane on the Milperra Road and Newbridge Road approaches to Henry Lawson Drive
  - An additional through lane on the Henry Lawson Drive southbound approach
  - The removal of the bus only lane on Milperra Road to provide an additional right turn lane on the Henry Lawson Drive northbound approach
- Removing the dedicated left turn slip lane into the ALDI and fast-food area with access being retained via a standard property driveway
- Retaining the existing bus stop on Milperra Road (eastbound) and moving the westbound bus stop 20 m to the west
- Altering access to Auld Avenue to a “left in/left out” only configuration
- Installing a new Henry Lawson Drive road bridge (over Milperra Drain) to the south of Auld Avenue (referred to as the Auld Avenue bridge) to carry northbound traffic and retaining the existing bridge for southbound traffic
- Constructing new footpaths on the eastern side of Henry Lawson Drive to connect Tower Road to the existing bus stop on the eastbound lanes of Milperra Road and a new footpath on the southern side between Henry Lawson Drive to the bus stop on the westbound lanes of Milperra Road
- Widening the shared user pathway between Flower Power (Keys Parade) and Newbridge Road to 3 m and reconstructing footpaths along the western side of Henry Lawson Drive, where required
- Adjusting existing drainage, including lengthening culverts, installing new drainage infrastructure and water quality controls
- Relocating utilities (including electrical, gas, water and telecommunications)
- Final roadworks including pavement, kerb and gutters, signs, lighting and line marking
- Ancillary work for the proposal including, but not limited to road furniture, tie-in works, landscaping, earthworks and the like
- Temporary ancillary compounds, stockpile sites and associated facilities

1.3.2 Key features of the EIS proposal

Key features of the EIS proposal are identified below for each EIS Proposal Area.

EIS proposal area 1 – Henry Lawson Drive opposite Tower Road

The key features of EIS proposal area 1 are:

- Widening of Henry Lawson Drive northbound lanes
- Installing of fill embankments along the edge of the new carriageway to meet existing ground levels
- Extending existing stormwater culvert and installing outlet scour protection measures
- Installing additional stormwater drainage infrastructure and water quality treatments
- Installing a vegetated swale along the toe of the new fill embankment
- Adjusting the existing shared path to suit the new re-alignment and to connect it back to the existing path
- Installing road furniture, including road safety barriers.

EIS proposal area 2 – Milperra Road opposite Bankstown Airport

The key features of the EIS proposal area 2 are:

- Installing a new bus stop relocated from its existing position on Milperra Road
- Installing a section of a new footpath to the bus stop (connecting to the remainder of the new path to Henry Lawson Drive – REF proposal)
- Installing fill embankments along the edge of the new carriageway to meet existing ground levels
- Extending existing stormwater culvert and installing outlet scour protection measures
- Installing additional stormwater drainage infrastructure connecting to the outlet of the extended culvert
- Installing road furniture, including road safety barriers.

EIS proposal area 3 – Henry Lawson Drive opposite Auld Avenue

The key features of the EIS proposal area 3 are:

- Removing of existing ancillary structures
- Installing temporary fencing, flagging of exclusion boundaries & temporary erosion and sediment controls for use as an ancillary facility and construction area
- Installing fill embankments along the edge of the new carriageway to meet existing ground levels
- Stabilising the ground surface following the completion of construction to minimise erosion.

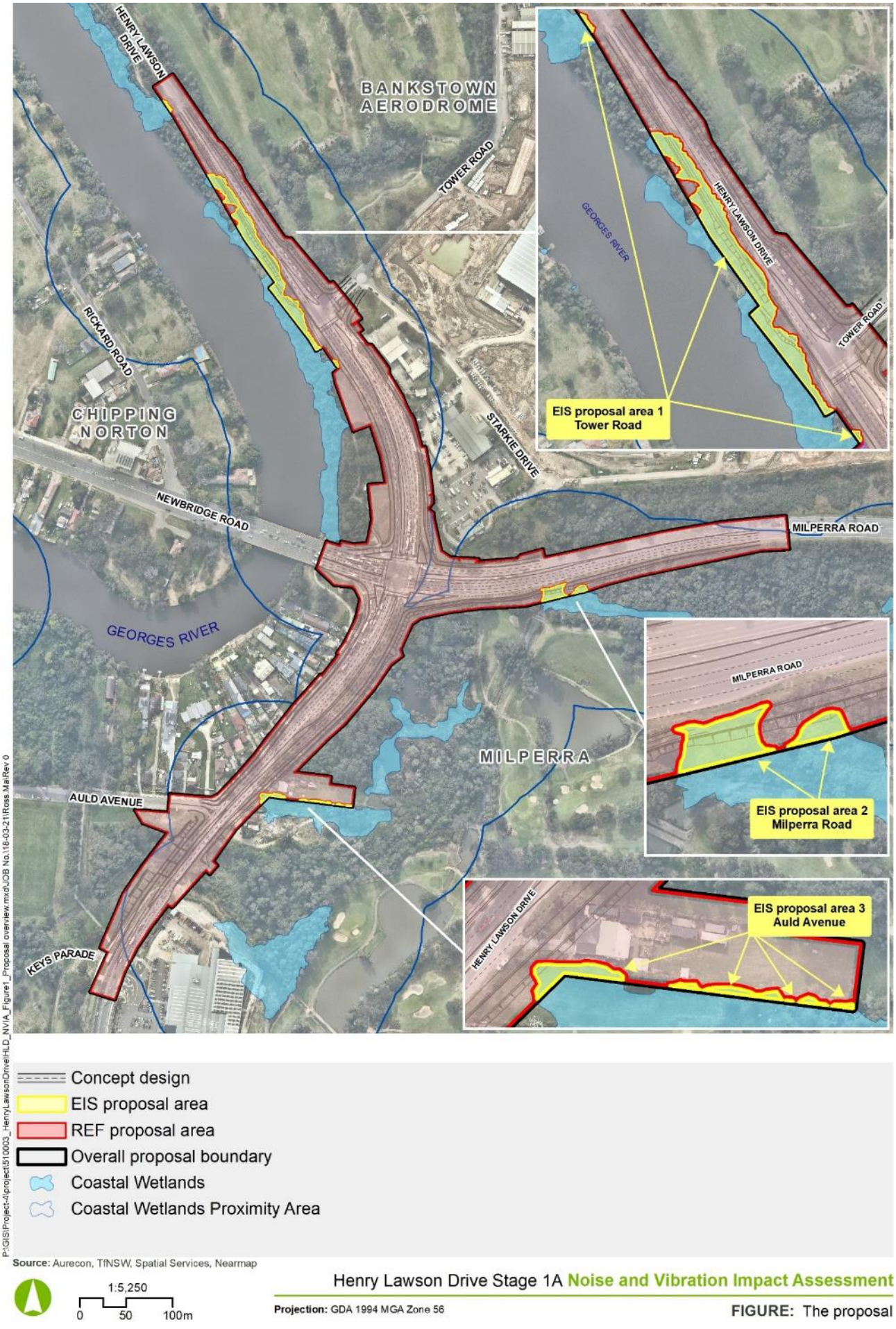

Figure 1-1 Proposal overview

2 Existing environment

2.1 Noise catchment areas

The area surrounding the proposal has been divided up into noise catchment areas (NCAs) as shown in Figure 2-1. These NCAs are based on similar land use and similar location. Each of the NCAs has been described in Table 2-1.

Table 2-1 Noise catchment area descriptions

NCA	Description
NCA 1	The noise catchment area contains residential receivers. The NCA is not directly adjacent the construction footprint or Henry Lawson Drive, however the sensitive receivers are directly adjacent to Newbridge Road. Receivers are also exposed to noise from Henry Lawson Drive, particularly due to the presence of the Georges River. Traffic along Newbridge Road would be affected by the proposal and is required to be assessed relative to the receivers within the NCA.
NCA 2	The noise catchment area contains residential receivers directly adjacent to the construction footprint as well as adjacent to the widening of the Henry Lawson Drive. Sensitive receivers within the NCA would be affected by the change in operational road traffic noise and the construction noise and vibration of the proposal.
NCA 3	The noise catchment area contains recreational open space, which would be affected by construction and operational noise and vibration induced by the proposal.
NCA 4	The noise catchment area contains commercial receivers.
NCA 5	The noise catchment area contains recreational open space, which would be affected by construction and operational noise and vibration induced by the proposal.
NCA 6	The noise catchment area contains recreational open space, which would be affected by construction and operational noise and vibration induced by the proposal
NCA 7	The noise catchment area contains recreational open space, which would be affected by construction and operational noise and vibration induced by the proposal

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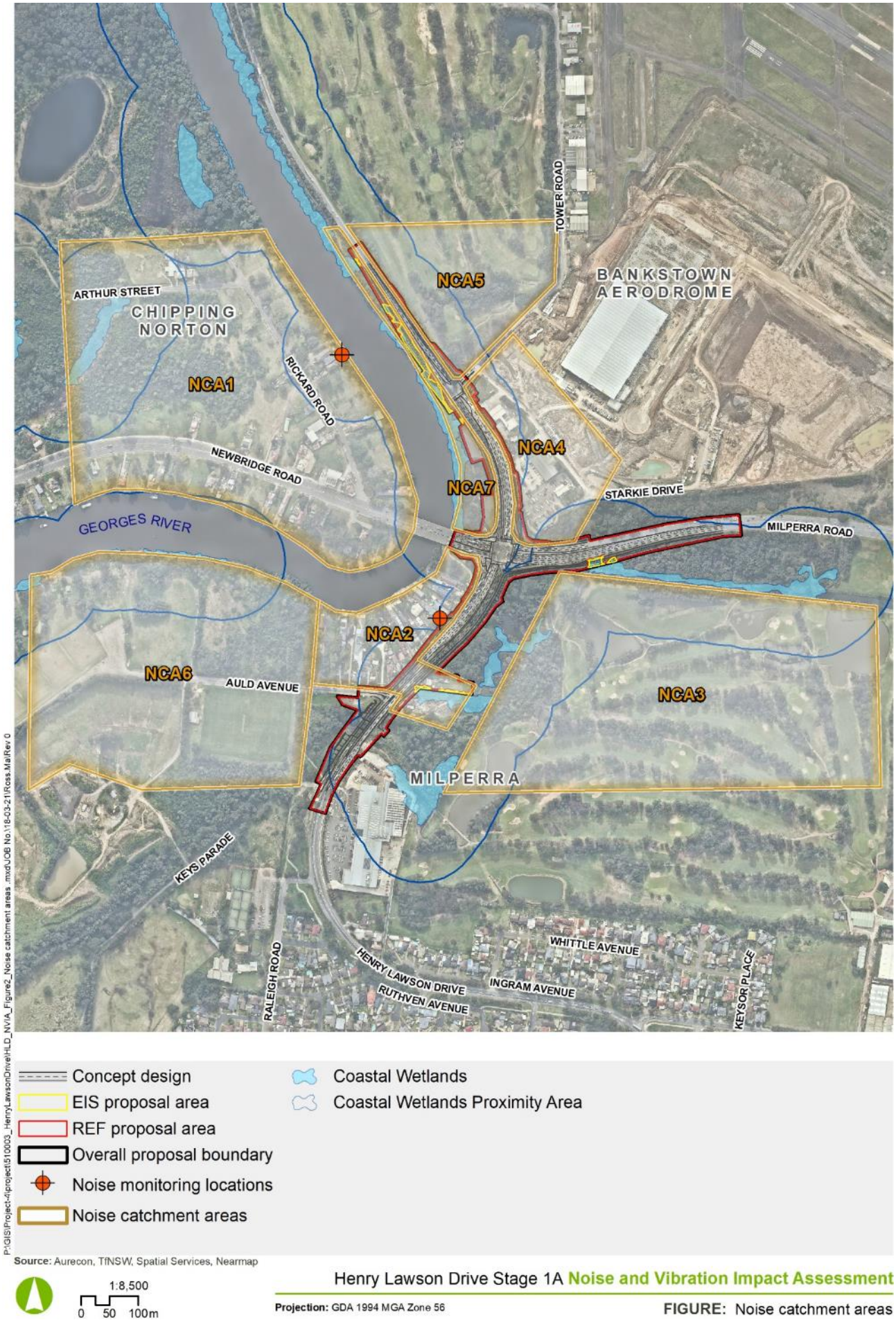

Figure 2-1 Noise catchment areas and noise monitoring locations

2.2 Noise monitoring

Long term unattended noise monitoring was conducted between the 16 September 2020 and 28 September 2020 at two residential receivers as shown in Figure 2-1.

The addresses of the monitoring locations are detailed below.

- 40 Rickard Road, Chipping Norton (most Northern location)
- 392 Henry Lawson Drive, Milperra (most Southern location)

The equipment used to conduct the noise measurements are listed in Table 2-2.

The noise loggers were placed in a free field position, 1.5 m above ground level, placed on the most exposed side of the residence to road traffic noise. Both monitoring locations were exposed to road traffic noise from Henry Lawson Drive, north and south of the Milperra/Newbridge Road intersection.

Weather information was obtained from the Bureau of Meteorology. Data affected by erroneous noise such as wind and rain were excluded from the processing. Appendix B graphically presents the daily noise logging data at the two noise logging locations.

40 Rickard Road is considered a representative noise sensitive receptor for NCA 1, while 392 Henry Lawson Drive is considered representative of NCA 2.

Table 2-2 Equipment list

Equipment	Make	Model	Serial No.
Noise logger	ARL	315	15-203-504
Noise logger	ARL	315	15-203-506
Calibrator	ARL	ND9	N435847

2.3 Ambient noise levels

The results of the noise monitoring at the locations are detailed in Table 2-3.

Table 2-3 Measured existing ambient (dBL_{Aeq}) and background noise levels (dBL_{A90})

Location	Ambient noise level, dBL_{Aeq}			Background noise level, dBL_{A90}		
	Day	Evening	Night	Day	Evening	Night
40 Rickard Road, Chipping Norton	60.3	57.0	54.7	53.1	51.5	40.7
392 Henry Lawson Drive, Milperra	64.5	60.8	59.0	51.9	47.4	40.7

2.4 Existing traffic noise levels

Concurrent 24-hour traffic counts were undertaken during the noise monitoring period. Counts were taken along: Henry Lawson Drive (north of Milperra Road), Henry Lawson Drive (south of Milperra Road) and on Milperra Road (east of Henry Lawson Drive). These traffic counts are summarised in Appendix A.

The summary of the existing day and night traffic noise levels is detailed in Table 2-4.

Table 2-4 Measured existing traffic noise levels

Location	Day traffic noise level, $dBL_{Aeq\ (15\ hr)}$	Night traffic noise level, $dBL_{Aeq\ (9\ hr)}$
40 Rickard Road, Chipping Norton	59.7	54.7
392 Henry Lawson Drive, Milperra	63.9	58.9

3 Policies and guidelines

The potential noise and vibration impacts of the proposal have been assessed to the following NSW guidelines:

- Interim Construction Noise Guideline (ICNG) (DECC, 2009)
- Road Noise Policy (RNP) (DECCW, 2011)
- BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2, BSI, 1993
- DIN 4150:Part 3-2016 Structural vibration – Effects of vibration on structures, Deutsches Institute fur Normung, 1999
- Assessing Vibration: a technical guideline (DEC, 2006)
- Model Validation Guideline (Roads and Maritime, 2018)
- Noise Criteria Guidelines (Roads and Maritime, 2015)
- Noise Mitigation Guidelines (Roads and Maritime, 2015)
- Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime, 2016)

3.1 Construction noise

The ICNG (NSW DECC 2009) generally applies to the management of construction noise in NSW. This guideline provides recommendations on standard construction hours and construction noise management levels (NMLs).

3.1.1 Recommended standard hours

Section 2.2 of the ICNG recommends standard hours for construction work as follows:

- Monday to Friday: 7.00 am to 6.00 pm
- Saturday: 8.00 am to 1.00 pm
- No work on Sundays or public holidays

The ICNG notes that the recommended standard hours of work are not mandatory and acknowledges that some activities could be undertaken outside the recommended standard hours of work, assuming all feasible and reasonable mitigation measures are implemented to minimise the impacts to any surrounding sensitive land uses. These activities include:

- The delivery of oversized plant or structures that police or other authorities determine requires special arrangements to transport along public roads
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- Public infrastructure works that shorten the length of the project and are supported by the affected community
- Works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- Works which maintain noise levels at receivers to below the noise management levels outside of the recommended standard construction hours

3.1.2 Construction noise management levels

The construction noise criteria are defined as NMLs. The NMLs represent a noise level that, if exceeded, would require management measures including the following:

- Reasonable and feasible work practices
- Consultation with residences to inform them of the nature of works to be carried out, the expected noise levels and durations and contact details

The management measures aim to reduce noise impacts on the residential receivers; however, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The construction NMLs during recommended standard hours of work are not intended as a noise limit but rather a level where noise management is required. The construction NMLs outside of recommended standard hours would be considered as noise limits unless consultation and notification measures have occurred with the affected residential receivers and all feasible and reasonable noise mitigation has been implemented with reference to standard and additional mitigation measures outlined in the CNVG (RMS 2016).

Table 3-1 and Table 3-2 are extracted from the ICNG, and derive the NMLs for residential receivers as well as other sensitive land uses applicable for the proposal.

Table 3-1 Noise management levels at residential receivers

Time of day	Noise management level, dB$L_{Aeq\ (15\ min)}$ [1]	How to apply
Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours (OOHW)[2]	Noise affected RBL + 5 dB(A)	A strong justification should typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements refer Section 7.2.2 of the ICNG.

Table notes:

1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

2 OOHW Period 1 (Day) – Saturdays 7.00 am to 8.00 am and 1.00 pm to 6.00 pm; Sundays and public holidays 8.00 am to 6.00 pm.
OOHW Period 1 (Evening) – Monday to Saturday 6.00 pm to 10.00 pm.
OOHW Period 2 – Monday to Saturday 10.00 pm to 7.00 am; Sundays and public holidays 6.00 pm to 8.00 am.

Table 3-2 Noise management levels for other sensitive land uses

Land use	Noise management level, $dBL_{Aeq\ (15\ min)}$[1]
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Commercial premises	External noise level 70 dB(A)

Table note:

1 Internal noise levels are to be assessed at the centre of the occupied room. External noise levels are to be assessed at the most affected point within 50 m of the area boundary. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB. Some buildings may achieve greater performance, such as where windows are fixed (that is, cannot be opened).

3.1.3 Construction traffic noise criteria

The ICNG does not outline specific guidelines surrounding construction traffic noise requirements. Construction related traffic noise objectives are sorted through the CNVG The CNVG states that if a quantitative assessment is required then the objectives should be based upon the RNP.

With respect to the RNP, an initial screening of the additional construction traffic is required to evaluate whether the noise levels would increase more than 2 dBA.

This initial screening would involve the comparison of the construction induced traffic and the current traffic volumes on Henry Lawson Drive, Milperra Road and Newbridge Road.

If the increases are greater than 2 dBA further assessment is required under the RNP and the Construction Noise Guidelines.

3.1.4 Construction sleep disturbance

Construction noise during the night-time period (10.00 pm to 7.00 am), has the potential to disturb people's sleep patterns. Guidance in the ICNG references further information in the NSW EPA RNP, that discusses criteria for the assessment of sleep disturbance.

The RNP suggests a screening level of $L_{1(1min)}$ dB(A), equivalent to the RBL + 15 dB. Where this level is exceeded, further analysis is required, as detailed in section 5.4 of the RNP:

- Maximum internal noise levels below 50 – 55 dB(A) would be unlikely to result in people's sleep being disturbed, and
- If the noise exceeds 65 – 70 dB(A) once or twice each night, the disturbance would be unlikely to have any notable health or wellbeing effects.

The guidance within the RNP indicates that internal noise levels of 50 to 55 dBA are unlikely to cause sleep awakenings. It follows that at levels above 55 dBA, sleep disturbance would be considered likely. Assuming that receivers may have windows partially open for ventilation, a 10 dB outside to inside correction has been adopted as indicated in the ICNG. On this basis, a sleep disturbance screening criterion of RBL+15 dB has been adopted for this assessment and where this level is predicted to be exceeded, assessment against the maximum external noise limit of 65 dBL_{Amax} should be considered, to determine all feasible and reasonable safeguards.

3.1.5 Proposal construction noise criteria

Based on the noise management levels for residential receivers and other sensitive receivers, the specific noise management levels for the proposal are detailed in Table 3-3.

Table 3-3 Noise catchment area specific noise management levels

NCA	Assessment period	Noise management level, dBLAeq (15 min)*
NCA 1	Day (Standard Hours)	63
	OOHW Period 1 (Day)	58
	OOHW Period 1 (Evening)	57
	OOHW Period 2 (Night)	46
NCA 2	Day (Standard Hours)	62
	OOHW Period 1 (Day)	57
	OOHW Period 1 (Evening)	52
	OOHW Period 2 (Night)	46
NCA 3	Day (Standard Hours) – Golf Course	External noise level - 65 dB(A)
NCA 4	When in use – Commercial	External noise level – 70 dB(A)
NCA 5	Day (Standard Hours) – Golf Course	External noise level - 65 dB(A)
NCA 6	Day (Standard Hours) – Recreation	External noise level - 65 dB(A)
NCA	Day (Standard Hours) – Recreation	External noise level - 65 dB(A)

3.1.6 Construction vibration criteria

The effects of vibration in buildings can be divided into three main categories; those in which the occupants or users of the building are inconvenienced or possibly disturbed, those where the building contents may be affected and those in which the integrity of the building or the structure itself may be prejudiced.

Human comfort

Human comfort criterion is detailed in Section 7 of the CNVG, which provides guidance on disturbance to human occupants of buildings as a result of vibration. This document provides criteria which have been based on the British Standard BS 6472-1992, Evaluation of human exposure to vibration in buildings (1-80 Hz).

For the purpose of this assessment, vibration can be defined as follows:

- Continuous – where vibration occurs uninterrupted for a defined period. This can include sources such as machinery and steady road traffic.
- Impulsive – where vibration occurs as a rapid build-up of the vibration energy to a peak followed by a decay. It can also consist of a sudden application of several cycles at approximately the same amplitude, provided that the duration is short, typically less than two seconds. This may include activities such as occasional dropping of heavy equipment or loading/unloading activities.
- Intermittent – where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, pile driving and passing heavy vehicles or trains.

The criteria are applied to a single weighted root mean square (RMS) acceleration source level in each orthogonal axis, as required in the guideline. Preferred and maximum values for continuous and impulsive vibration have been defined in Table 3-4 and Table 3-5.

Table 3-4 Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration, 1-80 Hz

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Residences	Daytime	0.010 m/s^2	0.0071 m/s^2	0.020 m/s^2	0.014 m/s^2
	Night-time	0.007 m/s^2	0.005 m/s^2	0.014 m/s^2	0.010 m/s^2
Offices, Schools, educational institutions and places of worship	Day- or night-time	0.020 m/s^2	0.014 m/s^2	0.040 m/s^2	0.028 m/s^2
Impulsive vibration					
Residences	Daytime	0.300 m/s^2	0.210 m/s^2	0.600 m/s^2	0.420 m/s^2
	Night-time	0.100 m/s^2	0.071 m/s^2	0.200 m/s^2	0.140 m/s^2
Offices, Schools, educational institutions and places of worship	Day- or night-time	0.640 m/s^2	0.460 m/s^2	1.280 m/s^2	0.920 m/s^2

Table note:

Daytime is 7:00 am to 10.00 pm and night-time is 10:00 pm to 7:00 am

Table 3-5 Acceptable vibration dose value for intermittent vibration

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Intermittent vibration					
Residences	Daytime	0.20 $m/s^{1.75}$		0.40 $m/s^{1.75}$	
	Night-time	0.13 $m/s^{1.75}$		0.26 $m/s^{1.75}$	
Offices, Schools, educational institutions and places of worship	Day- or night-time	0.40 $m/s^{1.75}$		0.80 $m/s^{1.75}$	

Table note:

Daytime is 7:00 am to 10.00 pm and night-time is 10:00 pm to 7:00 am

Structural damage

British Standard BS 7385 recommends vibration limits for transient vibration judged to give a minimal risk of vibration induced damage to affected buildings. It is noted that the only heritage items in the vicinity of the area are the Bankstown Airport Control Tower and Bankstown Aerodrome. The minimal risk of cosmetic damage to residential and industrial buildings limits are presented in Table 3-6.

Table 3-6 Transient vibration guide values – Minimal risk of cosmetic damage

Type of structure	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4Hz increasing to 20 mm/s and 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

3.2 Operational traffic noise criteria

The NSW RNP is used to assess and manage potential noise impact from new and redeveloped road proposals. The RNP identifies the potential noise impacts for new roads (ie new road infrastructure where there is no road) or redeveloped road (widening or upgrade of existing road infrastructure).

Should the criteria be exceeded, then feasible and reasonable management measures should be considered in accordance with the Noise Mitigation Guidelines.

The proposal is deemed to be a redevelopment of the existing arterial roads of Henry Lawson Drive and Milperra Road. Noise criteria for redeveloped road is extracted from the RNP for sensitive receivers and is applicable for this proposal, residential and open space. No other sensitive receivers are present in the surrounding proposal area.

Relevant criteria are detailed in Table 3-7 and Table 3-8.

Table 3-7 RNP Criteria for redevelopments of existing arterial roads for residential and non-residential land uses

Road category	Type of project/land use	Assessment criteria (dBA)	
		Day (7.00 am – 10.00 pm)	Night (10.00 pm – 7.00 am)
Freeway/Arterial/ Sub-Arterial Roads	Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	$L_{Aeq\ (15hr)}$ 60 (External)	$L_{Aeq\ (9hr)}$ 55 (External)
Freeway/Arterial/Sub-Arterial Roads	Open Space (Active Use) These spaces include: ■ Bankstown Golf Course ■ Georges River Golf Course ■ Georges River Trail walk ■ Vale of Ah Reserve ■ Vale of Ah Dog Park	$L_{Aeq\ (15hr)}$ 60 (External)	-

Table 3-8 RNP Relative increase criteria for residential land uses.

Road category	Type of project/land use	Assessment criteria (dBA)	
		Day (7.00 am – 10.00 pm)	Night (10.00 pm – 7.00 am)
Freeway/Arterial/ Sub-Arterial Roads	New road corridor/ redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{Aeq\ (15hr)}$ + 12 (External)	Existing traffic $L_{Aeq\ (9hr)}$ + 12 (External)

Of the two relevant criteria for residential land uses, the controlling criterion is the criterion with the greatest exceedances. Given existing road traffic noise was measured and detailed in Table 2-4 for the proposal area it is clear the controlling criterion is stated in Table 3-7 and will be the prevailing criterion for residential land uses for this proposal.

However, as the proposal area may be already exposed to road traffic noise exceeding the applicable road traffic noise criteria, a comparison of the No Build and Build scenarios has been undertaken to determine the difference in noise levels.

Receivers may be eligible for mitigation with respect to the Noise Mitigation Guidelines (NMG). The NMG provides three triggers where a receiver may be eligible for mitigation. These are:

- Trigger 1 – the predicted 'Build' noise level exceeds the NCG controlling criterion and the noise level increase due to the project (ie the noise predictions for the 'Build' minus the 'No Build') is greater than 2.0 dB

- Trigger 2 – the predicted Build noise level is 5.0 dB or more above the NCG controlling criterion (ie exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the project
- Trigger 3 – the noise level contribution from the road project is acute (daytime $L_{Aeq(15\ hour)}$ 65 dBA or higher, or night-time $L_{Aeq(9\ hour)}$ 60 dBA or higher) even if noise levels are dominated by a non-project road

3.2.1 Sleep disturbance (maximum noise level assessment)

Operational road traffic has the potential to disturb sleep patterns, but the relationship between noise and sleep disturbance has yet to be comprehensively linked.

The RNP identifies that:

- Maximum internal noise levels below 50 – 55 dBA are unlikely to cause awakening
- One of two noise events per night, with maximum internal noise levels of 65 – 70 dBA are not likely to affect health and wellbeing significantly

The RNP recommends that the methodology for the assessment of maximum noise levels is based on the Environmental Noise Management Manual (ENMM), Practice Note III.

Based on the RNP and the ENMM, a maximum noise event is defined as a L_{Amax} greater than 65 dBA, where the L_{Amax} is greater than the $L_{Aeq(1hr)}$ by 15 dBA. For example,

$$L_{Amax} \geq L_{Aeq,\ 1\ hour} + 15\ dB(A)$$

The assessment of maximum noise levels is based upon the existing operational traffic noise emissions. Maximum noise level event profiles are derived from detailed long-term noise monitoring and compared to future scenarios to identify the potential of additional exceedances.

It should be noted that the maximum noise assessment should be used as a tool to help prioritise and rank mitigation strategies, but should not be applied as a decisive criterion in itself.

4 Methodology for assessment

The methodology for the operational traffic noise and construction noise and vibration impact assessments are detailed in Sections 4.1 and 4.2 respectively.

4.1 Operational noise assessment

- Noise monitoring at two locations and concurrent traffic counts at three locations across the proposal area. Baseline noise levels were recorded over a minimum of seven consecutive days. The concurrent automatic traffic counts established existing traffic volumes and characteristics over this period. The traffic data would also be used to validate the predictive noise model.
- Following the noise survey, site specific noise catchment areas, representing groups of sensitive receivers of similar background noise and similar level of impact from the proposal, were established to then determine the most appropriate noise assessment criteria.
- Computational noise modelling was done using SoundPlan v8.1, with reference to Roads and Maritime's Noise Criteria Guideline requirements. This model incorporated terrain, receiver locations, proposal geometry (existing and proposed design) and traffic data for the operational assessments.
- The noise impact assessment for operational traffic noise was undertaken in accordance with the Transport guidelines for noise impact assessments. An assessment of operational noise impacts included the assessment of the following scenarios:
  - Year of opening: 2026, without upgrade
  - Year of opening: 2026, with upgrade
  - 10 years after opening: 2036, without upgrade
  - 10 years after opening: 2036, with upgrade
- Noise predictions for each scenario for all sensitive receivers within 600 m of the proposal and assessment of level of impact. This included acute and cumulative noise levels, maximum noise level predictions and predictions of sleep disturbance impacts, where relevant.
- Identification of the need and type of noise management measures considered feasible for installation

4.1.1 Operational traffic volumes

The operational traffic volumes for the road traffic noise assessment were obtained from Transport traffic modelling. These volumes were calibrated against the Matrix traffic monitoring data undertaken in 2020. The traffic volumes are summarised in Appendix A.

4.1.2 Modelling

The operational road traffic noise of the overall proposal has been assessed using SoundPLAN, a computational acoustic model. Details of the modelling parameters and inputs have been provided in Table 4-1.

The computational acoustic model has been validated with noise monitoring with concurrent traffic counts, this detailed in Section 4.1.3.

The predicted road traffic noise levels have been modelled for with respect to year of proposal opening (2026) as well as 10 years after opening (2036). The following scenarios were modelled:

- No Build 2026
- No Build 2036
- Build 2026
- Build 2036

Table 4-1 Noise modelling parameters

Inputs	Comments
Prediction methodology	Calculation of Road Traffic Noise (CoRTN 88), UK Department of Transport 1988
Software package	SoundPLAN 8.1
Receivers	The receiver height is modelled at 1.5 m above ground level, 1 m from the centre of the building façade facing or most exposed to traffic noise. Property fences are not included in the acoustic model.
Building heights	Building heights were assumed to be the following, Single Storey – 4.5 m Double Storey – 7 m
Road traffic speed	All modelling scenarios have used the proposed speed limit for each section of road. Henry Lawson Drive – 60 kmph (Posted Speed) Milperra Road/Newbridge Road – 70 kmph (Posted Speed)
Road source line	Road source lines are modelled at the following heights ■ 0.5 m above the design level as per CoRTN 88. Replicating light and heavy vehicle tyre noise. ■ 1.5 m above the design level to replicate heavy vehicle engine ■ 3.6 m above design level to replicate heavy vehicle exhaust noise
Road surface correction	Dense Graded Asphalt (DGA): 0 (No correction factor) Road Source Line Corrections ■ 0.5 m, no correction factor ■ 1.5 m, -0.8 dB correction factor ■ 3.6 m, -8.0 dB correction factor These correction factors have been used on previous Transport projects.
Vehicle classifications	Vehicles classified as a heavy vehicle based on requirements of CoRTN and the AUSTROADS Vehicle Classification System
Modelled terrain	Provided by Transport for New South Wales (Transport)
Façade correction	Façade correction of 2.5 dB as per CoRTN 88 is used within the SoundPlan Modelling.
Ground absorption	Ground absorption has been modelled in accordance to the RMS Noise Model Validation Guideline. Details of the Ground Absorptions are listed below: ■ Water - 0.0 ■ Residential Areas - 0.5 ■ Open Grass Areas - 0.75

4.1.3 Model validation

The operational acoustic model has been validated using the noise monitoring at the two locations as well as concurrent traffic counts. The noise monitoring was undertaken in free field; hence the model validation predictions have also been undertaken in free field.

Table 4-2 details the results of the validation.

Table 4-2 Noise model validation results

Location	Day traffic noise level, $L_{Aeq\ (15\ hr)}$			Night traffic noise level, $L_{Aeq\ (9\ hr)}$		
	Measured	Predicted	Difference	Measured	Predicted	Difference
40 Rickard Road, Chipping Norton	58.6	59.6	-1.0	54.7	53.0	1.7
392 Henry Lawson Drive, Milperra	63.9	64.7	-0.8	58.9	57.8	1.1
Overall Variance (Rounded)			-0.9			1.4

As the variance of the predicted day and night traffic noise levels are within ± 2.0 dBA, the model is calibrated and does not require any additional correction factors.

4.2 Construction noise and vibration assessment

- Construction noise assessment is based on the construction methodology (equipment types and quantity, location of site facilities) (refer Chapter 5). This assessed noise impacts to sensitive receivers, within around 600 m of the proposal.
- Predicted noise levels were compared against applicable assessment criteria (including evaluation of exceedances), in line with the requirements of the Roads and Maritime Construction Noise and Vibration Guideline and NSW EPA Interim Construction Noise Guideline. Appropriate control measures have also been considered in accordance with the Roads and Maritime Noise Mitigation Guidelines.
- A qualitative discussion of potential noise impacts from construction traffic on haulage routes.
- A vibration impact assessment based on typical safe working distances for vibration-intensive equipment and identification of locations where receivers may be within the safe working distance for structural and human comfort impacts. Identification of consideration for any vibration management measures have been identified.

5 Construction noise and vibration impacts

5.1 Construction period and duration

Construction is expected to commence in 2023 and forecasted to extend over a 24-month period.

Construction works are proposed to be undertaken during both standard recommended hours and OOHW for the proposal.

OOHW would be required to minimise disruptions to the road network. The main works that would be required to occur out of hours would include:

- Intersection works at the Milperra Road/ Henry Lawson Drive and Tower Road/ Henry Lawson Drive intersections
- Auld Avenue bridge upgrade works

It is assumed that widening and pavement works will occur at night and hence it has been assessed for sleep disturbance in this assessment.

Construction scheduling would be revisited during the detailed design stage and if necessary, further assessment of noise impacts should be considered.

5.2 Construction activities and construction noise sources

The construction scenarios required for the upgrade proposal have been detailed in Table 5-1. Each scenario has indicative equipment/machinery listed, with corresponding cumulative sound power levels forming the basis for this assessment also detailed. The relevance of each scenario to the REF and EIS proposals are also noted.

Table 5-1 Proposal construction scenarios and associated sound power levels

Scenarios	Indicative equipment/machinery	Scenario total sound power levels*	
		L_{Aeq}	L_{AMax}
Preliminary works (REF and EIS proposal)	Vacuum truck, light vehicles, bogie tipper truck	112	118
Utility works (REF and EIS proposal)	Vacuum truck, light vehicles, backhoe/ excavator, concrete saw, daymaker, generator, crane, whacker plate, compactor, bogie tipper truck, jumping jack	119	125
Building and fencing removal (REF and EIS proposal)	Light vehicle, vacuum truck, excavator, rigid truck, handheld tools, hammer drill, crane, bogie tipper truck	118	123
Earthworks (REF and EIS proposal)	Excavator, grader, light vehicles, bogie tipper truck, rigid truck, backhoe/ excavator, loader, profiler, truck and dog, vacuum truck, water cart, road sweeper, daymaker, generator	120	124
Widening and pavement works (REF and EIS proposal)	Trencher, trucks, hand held tools, angle grinder, backhoe/ excavator, vacuum truck, paver and asphalt finisher, compactor, vibratory roller, concrete saw, concrete pump, concrete agitators, line marking machine, road sweeper, water cart, daymaker, generator, vibratory roller, jumping jack, grader, crane	123	128
Bridge and drainage works (REF and EIS proposal) (No bridge works in the EIS proposal)	Hand held tools, angle grinder, underbore directional drill, vacuum truck, bored piling rig, rigid truck, truck and dog, light vehicle, concrete saw, concrete pump, concrete agitators, road sweeper, water cart, hiab crane, daymaker, vibratory roller, water truck, asphalt paver, grader, crane, large capacity crane	123	127

Scenarios	Indicative equipment/machinery	Scenario total sound power levels*	
		L_{Aeq}	L_{AMax}
Pedestrian pathway, intersection crossings and shared path works (REF and EIS proposal)	Handheld tools, angle grinder, vacuum truck, rigid truck, excavator, road sweeper, water cart, concrete saw, concrete pump, concrete agitators, water truck, whacker plate, crane, daymaker, generator	121	126
Intersection configuration and traffic signals (REF proposal only)	Crane, daymaker, vacuum truck, light vehicle, rigid truck, excavator, concrete saw, generator	118	124
Landscaping and finishing works (REF and EIS proposal)	Grader, bobcat, trucks, handheld tools, compactor, trencher, light vehicle, bogie tipper truck, crane, whacker plate, front loader	120	125
Removal of ancillary facilities and site rehabilitation (REF and EIS proposal)	Light vehicle, excavator, trucks, bobcat, handheld tools, crane, bogie tipper truck	114	121

Table note:

* Sound power levels of equipment were sourced from the following documents:
- EPA NSW, (2009) Interim Construction Noise Guideline
- Construction Noise and Vibration Guideline (CNVG) (RMS, 2016)
- British Standard 5228: Part 1 (2009 including amendment 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise

5.3 Construction noise assessment

For each of the construction scenarios listed in Table 5-1, propagation noise contours as well as predicted noise levels at the property boundaries of the receivers have been generated to understand the propagation of the construction noise to the NCAs.

A conservative approach was adopted for the construction noise assessment. The approach assumes the following:

- All equipment/ machinery associated with a construction scenario are in operation at the same time and operate continuously during the 15-minute assessment interval
- Equipment/ machinery for a construction scenario can occur anywhere within the construction footprint.
- Only distance propagation loss from the construction footprint to the property boundary have been considered for this assessment.
- No barriers have been taken into consideration during the assessment.
- Property boundaries directly adjacent the construction footprint have been assumed to have a noise propagation of 1 m

5.3.1 Construction noise predictions

Predicted construction noise emissions for the construction scenarios are detailed in Appendix C, with the indicative noise contours provided in the below sections.

In general, the proposal NMLs are predicted to be exceeded for most sensitive receivers within proximity of the proposal, for all proposed construction scenarios. Specific details of the construction impacts on each NCAs is detailed below.

NCA 1

Construction noise impacts to the receivers within NCA 1 are expected to exceed the proposal NMLs during both the recommended standard hours and out-of-hours work (OOHW) periods without mitigation. During standard hours, exceedances of the NMLs are experienced along Rickard Road for all construction scenarios. Receivers along Newbridge Road would also experience exceedances of the standard hours noise levels for widening and pavement works and bridge and drainage works. Whilst during OOHW periods the majority of the receivers within the NCA exceed the NMLs. Exceedance of the highly noise affected management level is also predicted for six receivers in this NCA for the Bridge and Drainage works construction scenario.

Less noise intrusive construction scenarios such as preliminary works and removal of ancillary facilities and site rehabilitation achieved compliance with the NMLs for properties far west along Newbridge Road for standard hours of work. These receivers had sufficient setback distances from the construction footprint. However, for other construction scenarios such as the widening and pavement works as well as bridge and drainage works, exceedances of up to 30 dB are predicted for the nearest affected receivers, given their proximity to the construction footprint. The highly noise affected noise management level is expected to be exceeded for properties within 100 m of the construction footprint.

NCA 2

The receivers within NCA 2 experience exceedances of the NMLs for both standard working hours as well as OOHW. The highly affected noise management level was exceeded for most of the receivers for all of the construction activities. This is due to most receivers within NCA 2 are adjacent to or within 100 m of the construction footprint.

Open space (NCA 3, 5, 6 and 7)

The open space receivers within NCA 3,5,6 and 7 experience exceedances of the NMLs for both standard working hours as well as for OOHW for all construction activities. As is the case for NCA 2, the two golf courses and the Georges River Walking Trail are both adjacent to the construction footprint and there is no setback distance from the construction activity. The Vale of Ah Reserve and Vale of Ah Dog Park are setback at least 200 m from the construction footprint and do comply with the NMLs for several the construction activities.

Commercial properties (NCA 4)

The commercial receivers located in NCA 4 include the BP, Wild Bean Café, ALDI, the Hungry Jacks and the KFC. These commercial properties all exceed the NMLs for all construction activities due to their proximity to the construction works.

It should be noted that construction work would be done progressively along the alignment, so that one group of receivers would not be exposed to such noise levels for that whole period. Further investigation would be required by the construction contractor to ascertain when NMLs may be exceeded and for what periods of time.

Noise mitigation of construction activities is recommended for the proposal. This is discussed later in this report, with specific mitigation measures for each NCA also detailed.

5.3.2 EIS proposal

There are no sensitive receivers located within the EIS proposal areas and therefore there would not be any noise impacts on sensitive receivers in these areas. EIS proposal area 3 forms part of a residential property, however this would be acquired by Transport prior to works.

However, it is noted that the works to be undertaken in the EIS proposal areas, would contribute to the noise created by the construction of the overall proposal, albeit a small contribution compared to the overall proposal.

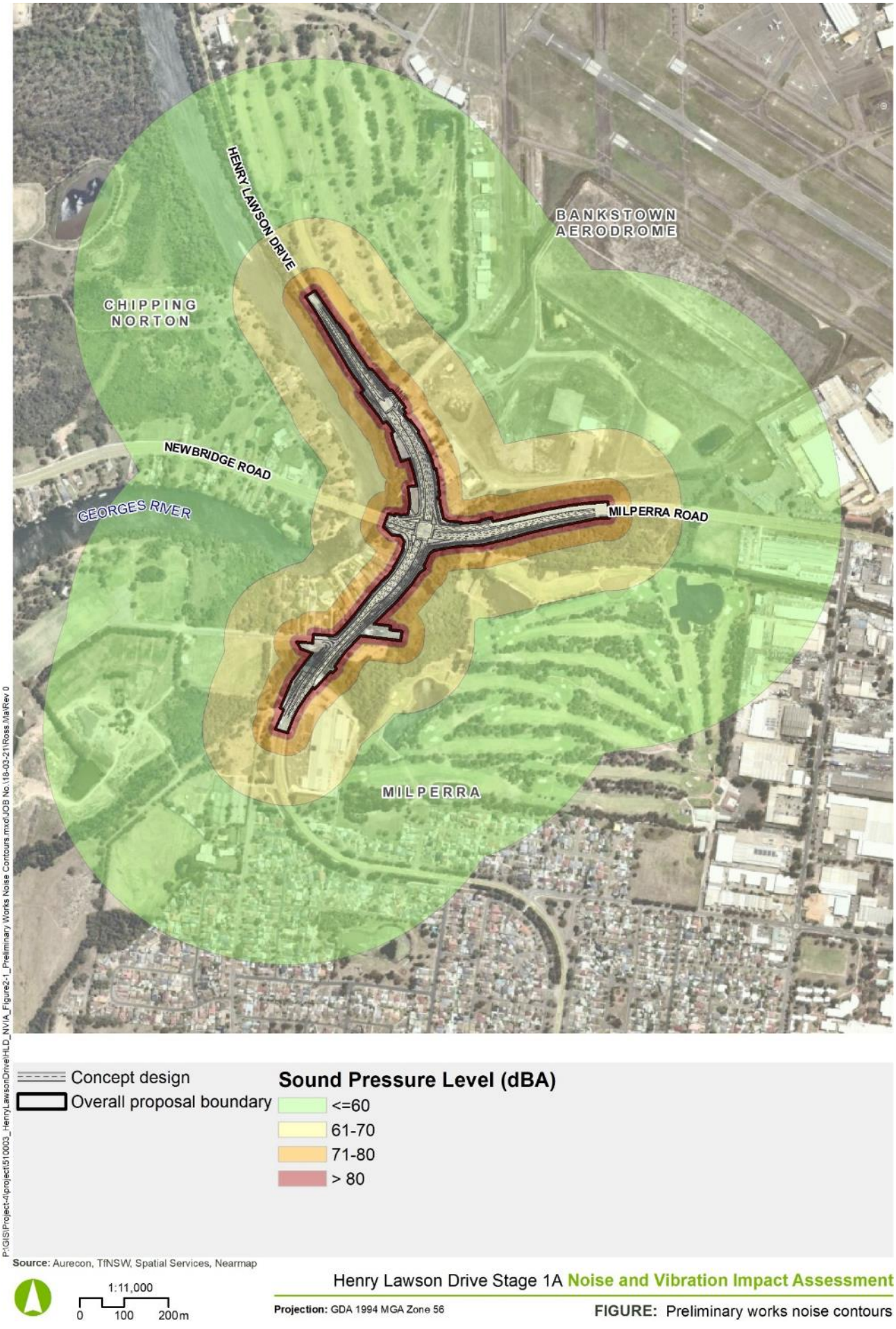

Figure 5-1 Preliminary works noise contours

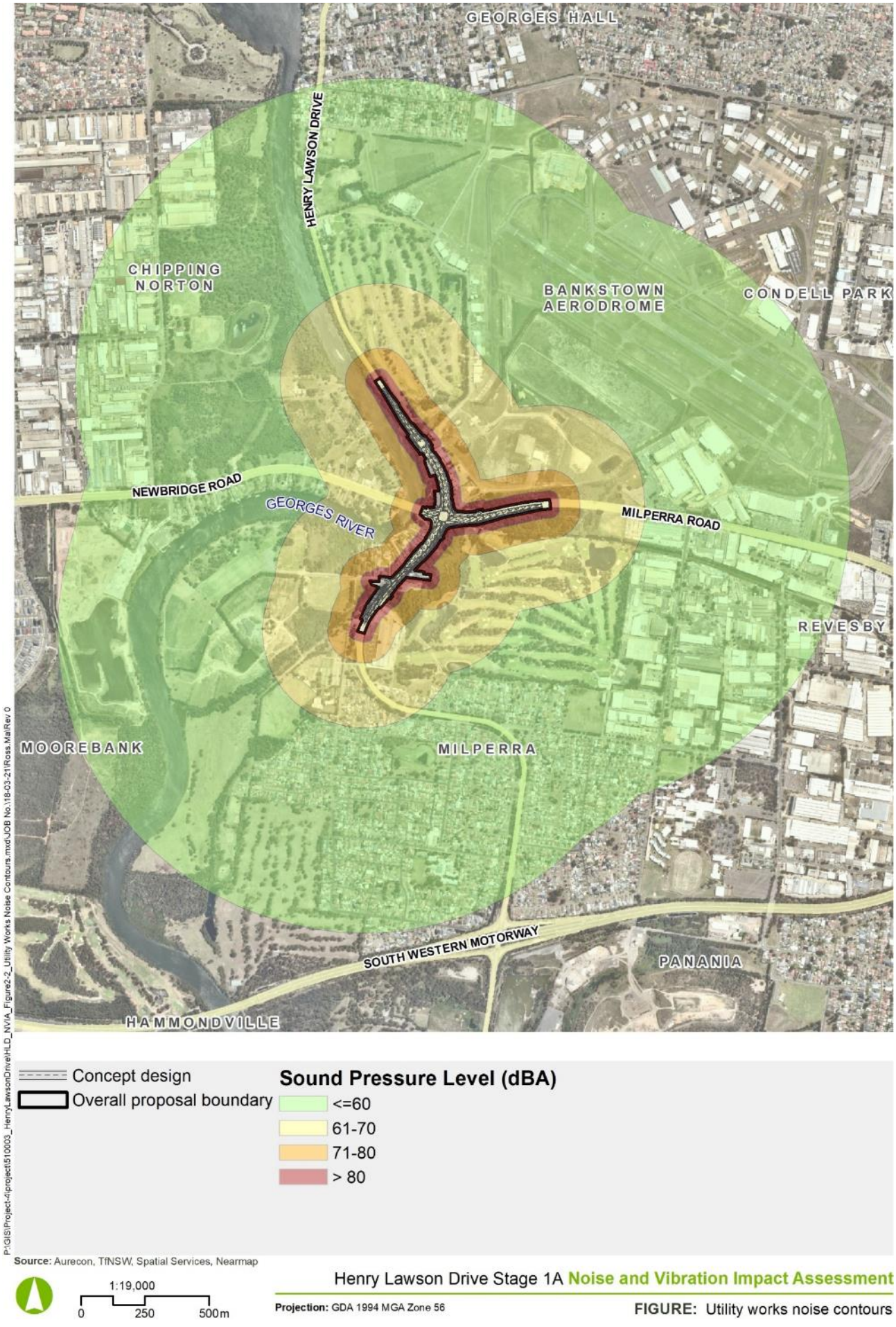

Figure 5-2 Utility works noise contour

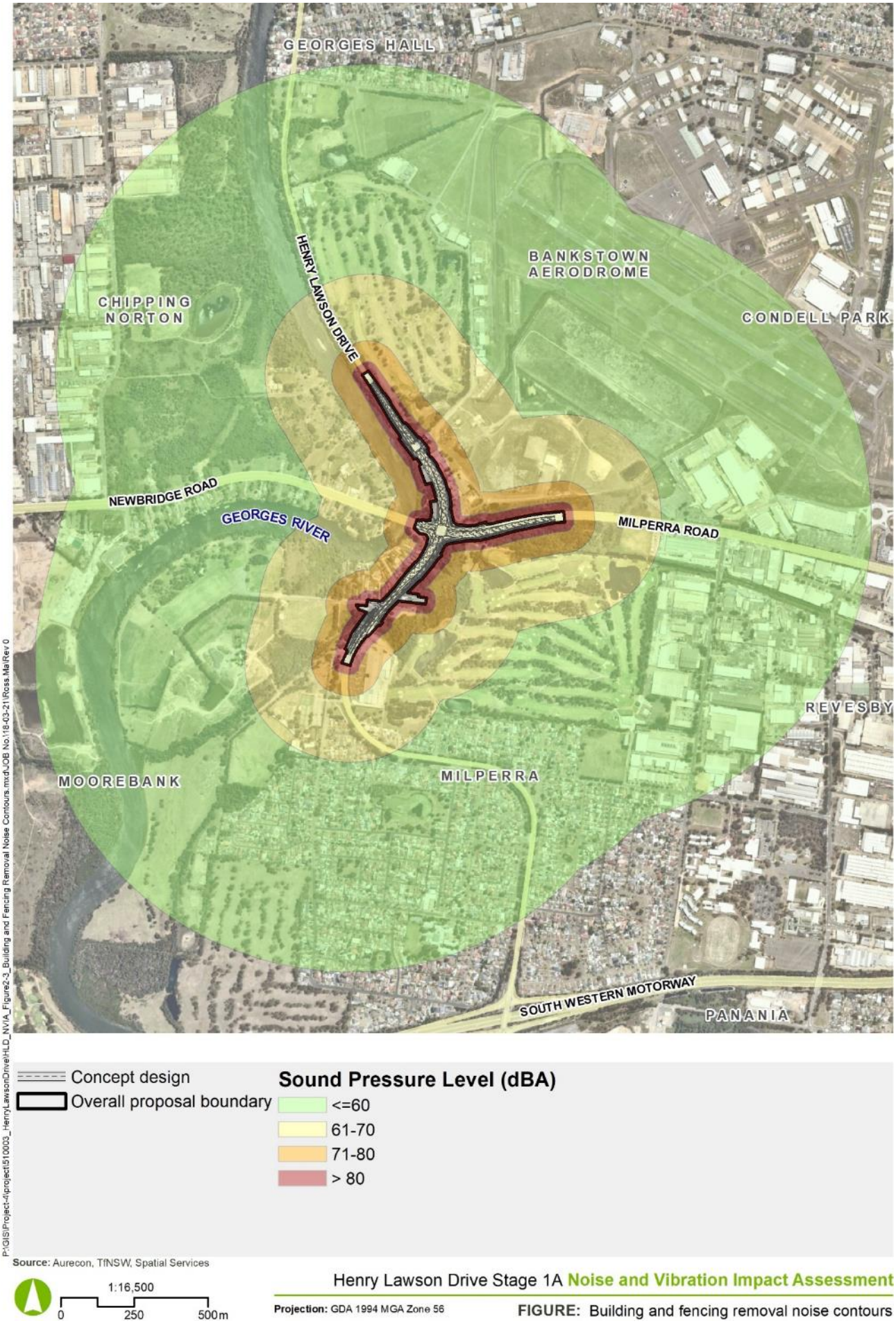

Figure 5-3 Building and fencing removal noise contours

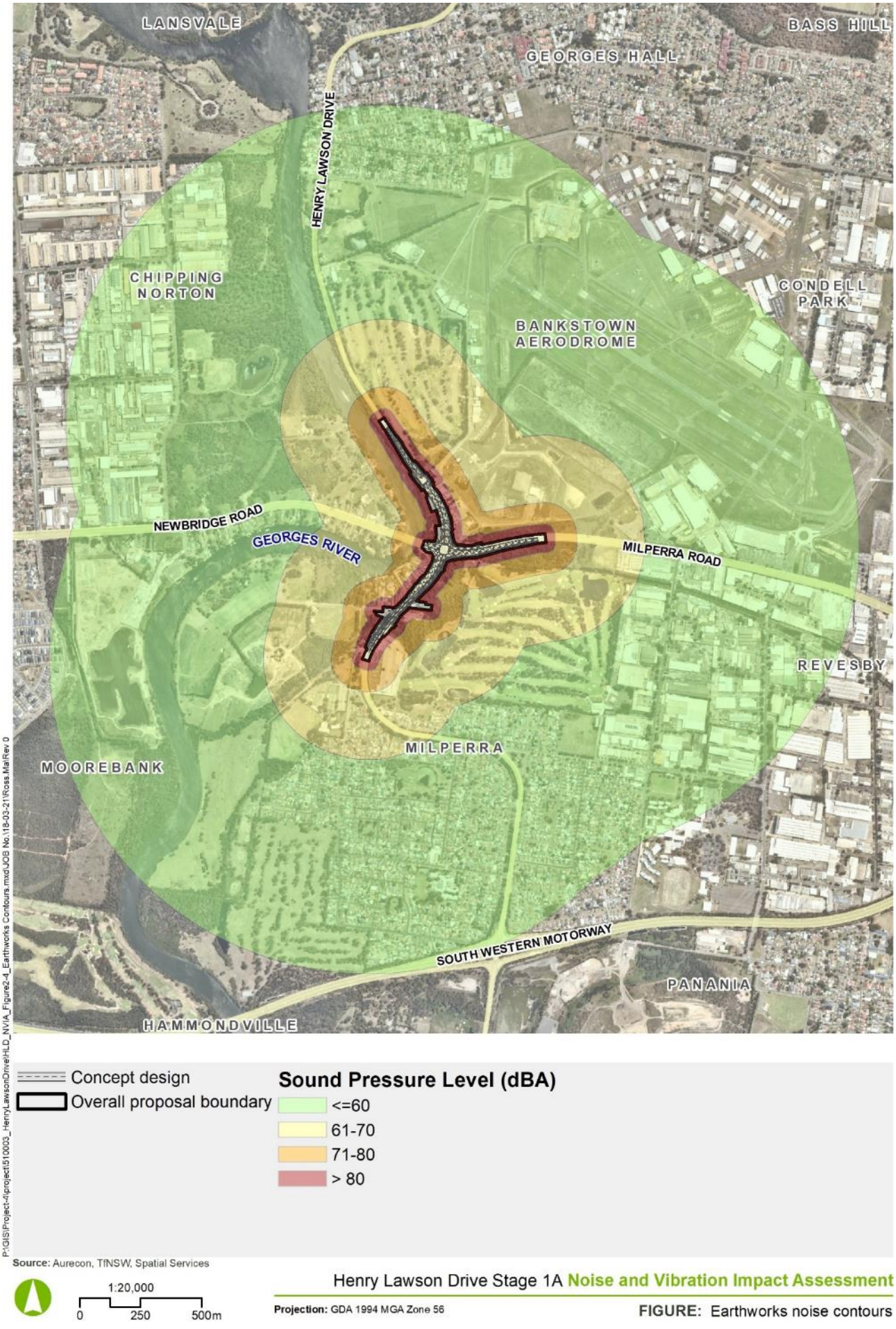

Figure 5-4 Earthworks noise contours

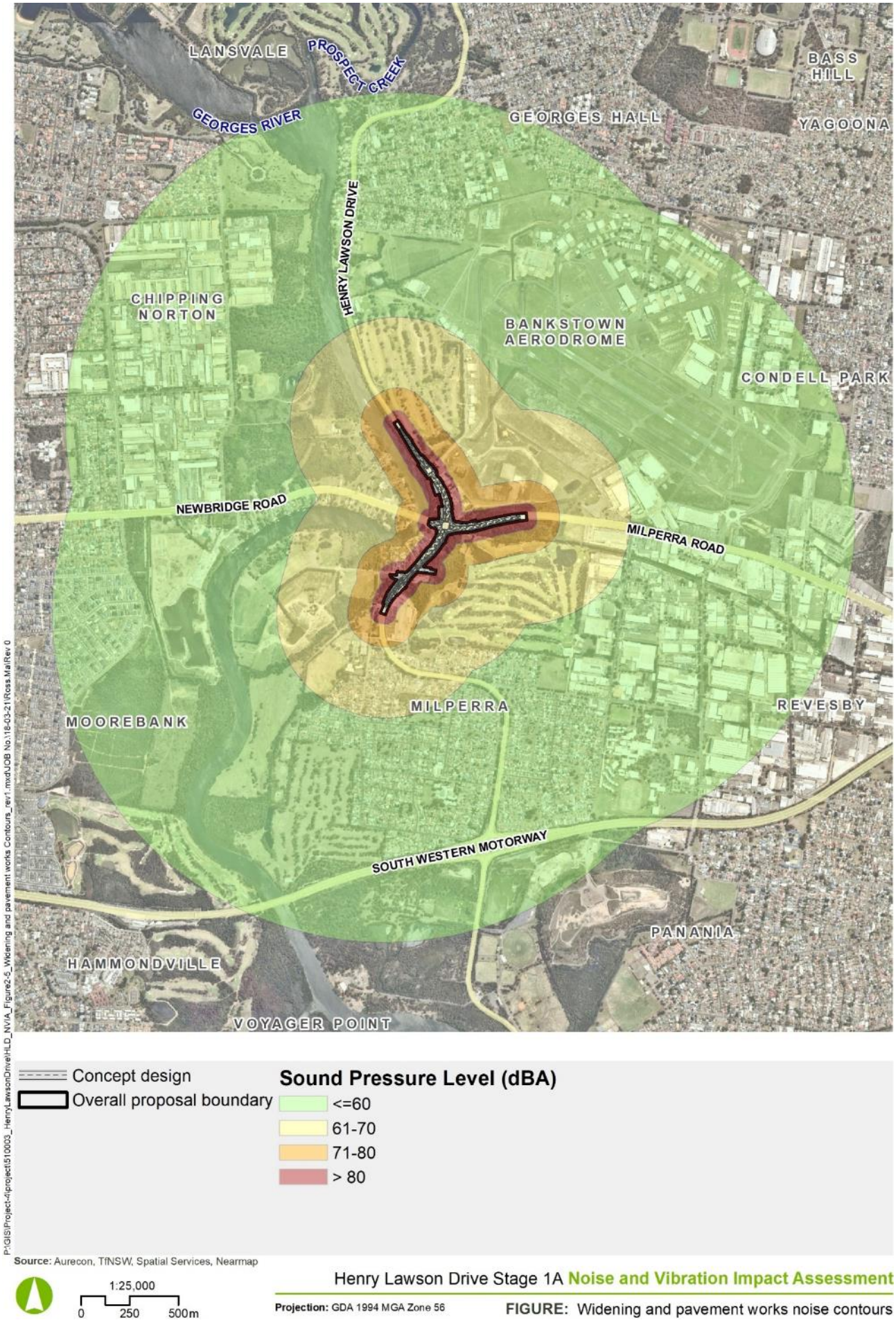

Figure 5-5 Widening and pavement works noise contours

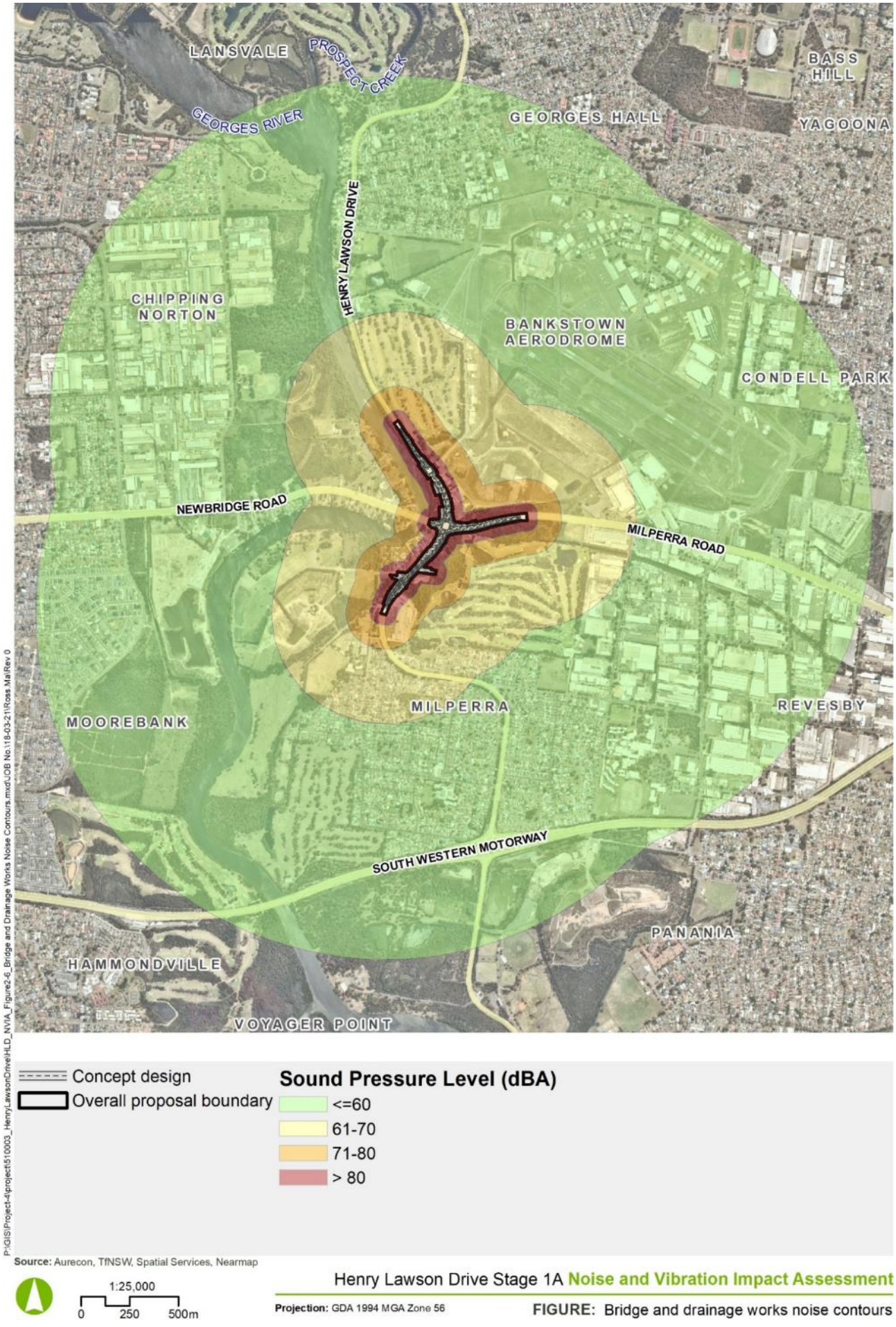

Figure 5-6 Bridge and drainage works noise contours

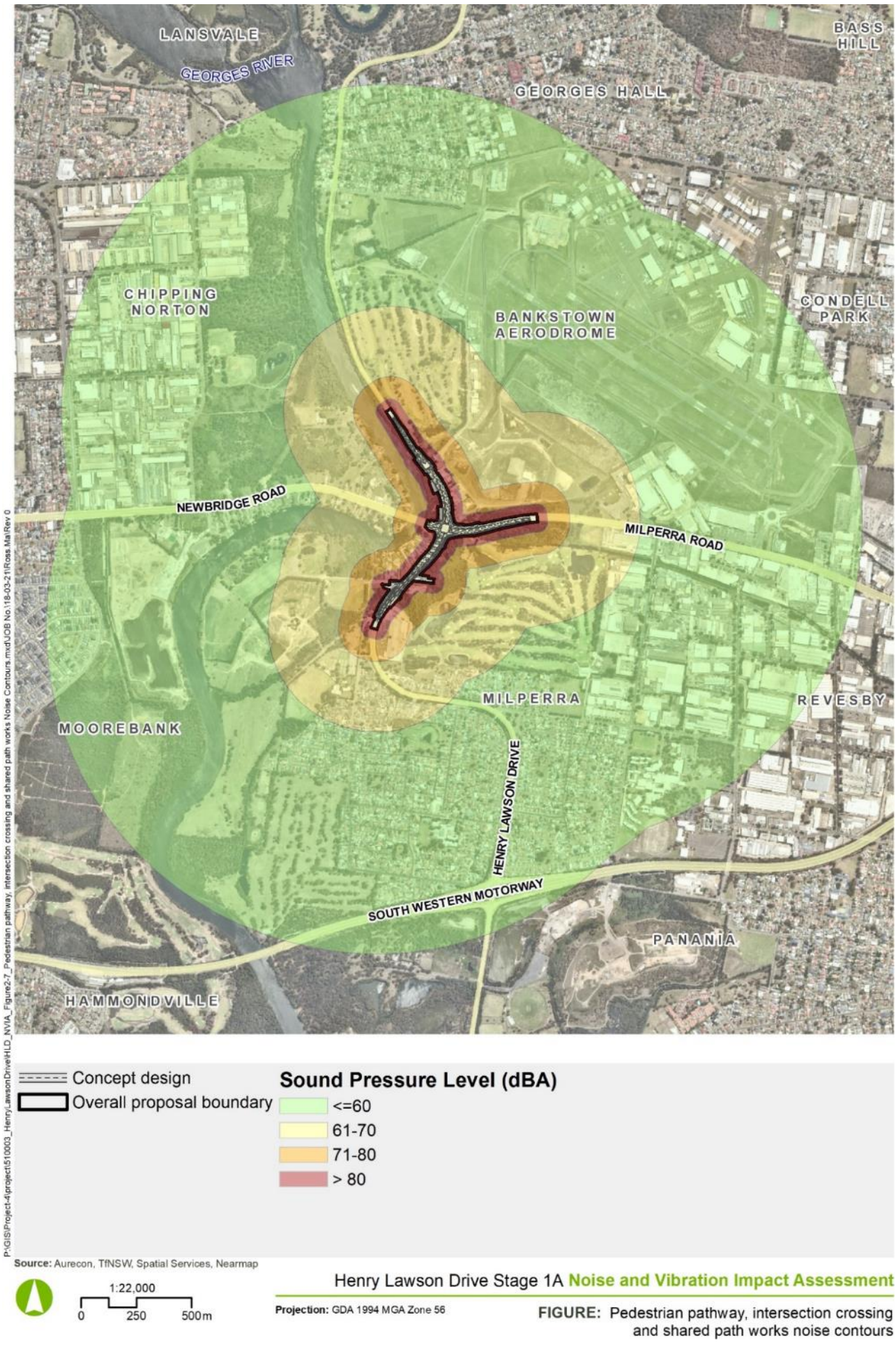

Figure 5-7 Pedestrian pathway, intersection crossing and share path works noise contours

Figure 5-8 Intersection configuration and traffic signals noise contours

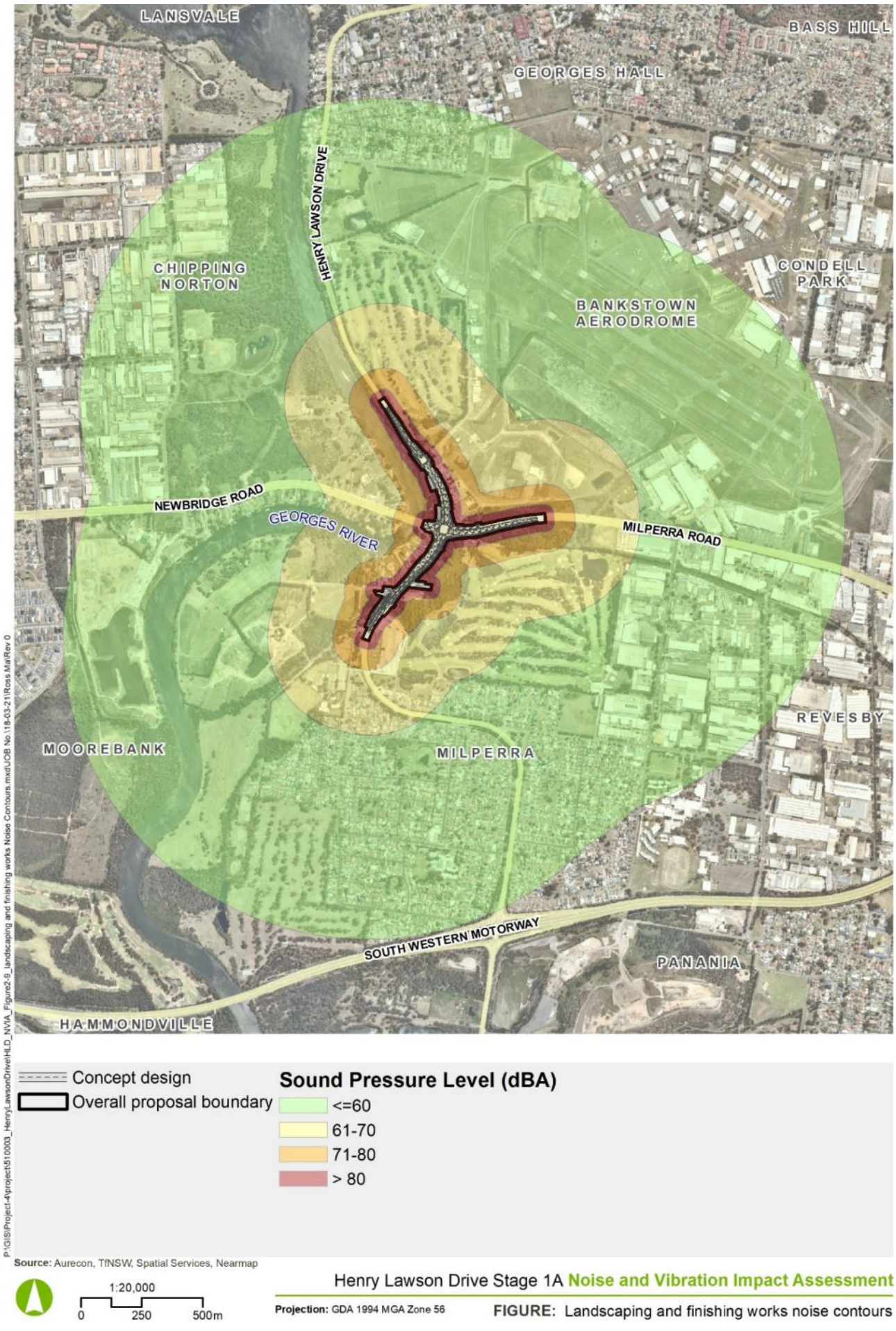

Figure 5-9 Landscaping and finishing works noise contours

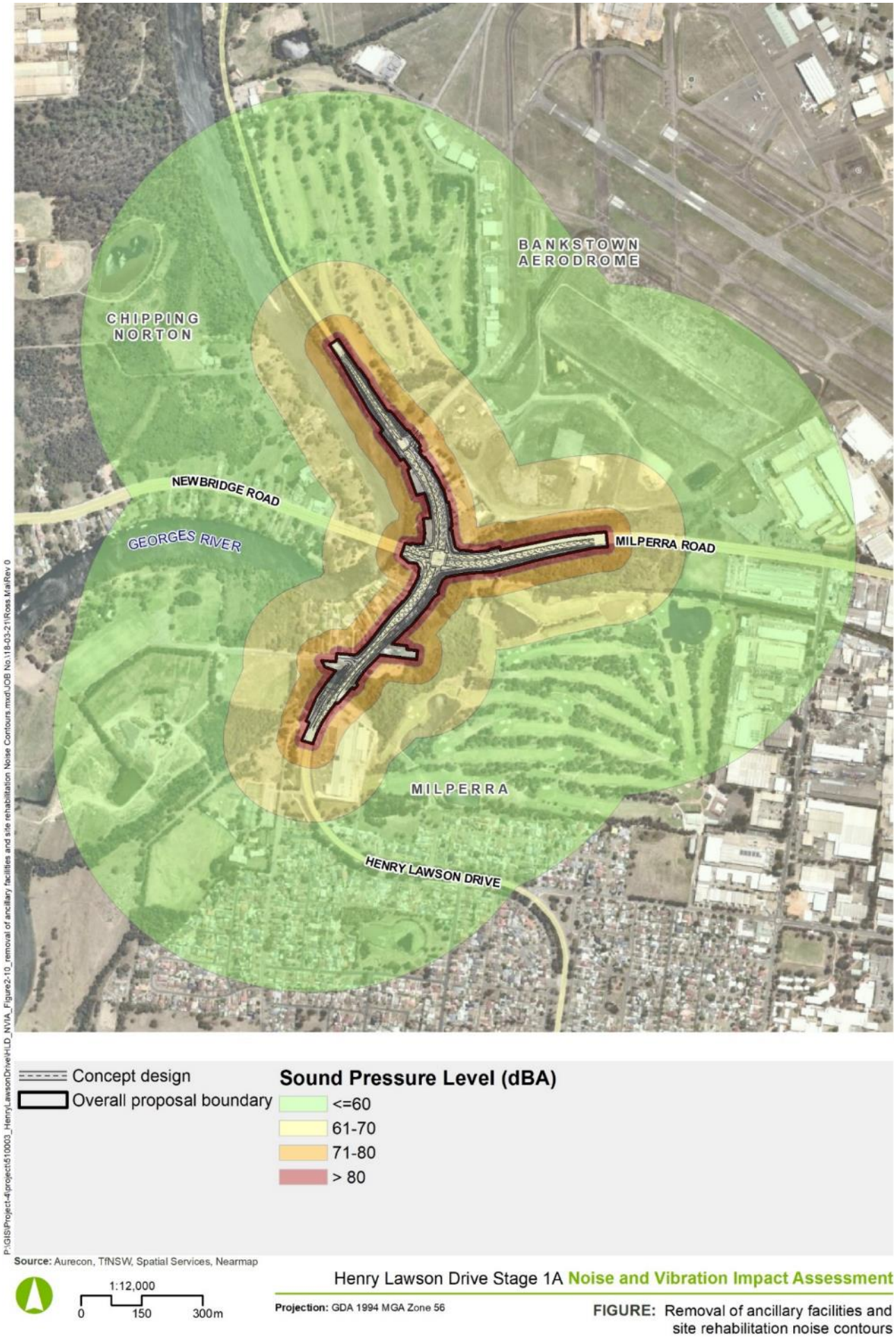

Figure 5-10 Removal of ancillary facilities and site rehabilitation noise contours

5.3.3 Sleep disturbance assessment

A sleep disturbance assessment has been undertaken considering the construction scenario that would be undertaken during OOHW, with the greatest L_{Amax}. This is widening and pavement works. Figure 5-11 details the possible areas where sleep disturbance may be an issue. The red shaded area indicates all receivers where maximum construction noise levels are expected to be greater than 65 dBA, assuming activities occur at the closest possible location to a specific receiver. Maximum external noise levels >65 dBA have the potential to cause sleep awakenings and mitigation measures/management strategies will be required to reduce these noise impacts.

Widening and pavement works may take up to 2-3 months, and would be done progressively along the alignment, so that the sensitive receivers in one area would not be exposed to such noise levels for that whole period.

This assessment also does not consider intervening structural features that may reduce the noise impacts (such as intervening buildings between a receiver and the works).

Figure 5-11 Possible sleep disturbance due to out of hours widening and pavement works

5.4 Construction traffic noise assessment

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers which are adjacent to construction haulage routes. Construction traffic to the proposal area and access to the ancillary facilities would be via Henry Lawson Drive, Milperra Road and Newbridge Road.

Estimated construction traffic volumes during the construction period are detailed in Table 5-2.

Table 5-2 Estimated construction traffic induced by the proposal

Vehicle type	Total vehicle movements per day	Vehicle movements per day at peak construction period
Construction personnel (cars and private vehicles)	15	30
Light construction vehicles and utes	20	40
Heavy vehicles and trucks	30	60

The current road traffic volumes along Milperra Road, Newbridge Road and Henry Lawson Drive are detailed in Appendix A. The construction traffic only comprises a small proportion of the overall traffic numbers.

A screening assessment of the construction traffic uplift due to the proposal was undertaken comparing the existing traffic counts with the additional peak construction traffic summarised in Table 5-2, this is considered the worse-case scenario. A maximum increase in road traffic noise level was predicted to be 1.4 dB during the night period along Henry Lawson Drive. This is less than the 2dB change in noise level which would invoke a detailed assessment and possible mitigation.

5.5 Construction vibration assessment

The key vibration intensive equipment/machinery proposed for the construction of the overall proposal, is a vibratory roller. As the size of the vibratory roller has not been specified, so a worse-case 18 T rated vibratory roller has been assumed for this assessment.

Figure 5-12 details the minimum working distances from the construction footprint for a 18T vibratory roller to avoid cosmetic building damage and human comfort.

The most affected sensitive receivers from vibration of the vibratory roller are the properties immediately adjacent Henry Lawson Drive, between Auld Avenue and Newbridge Road. These properties are both exposed to vibration levels affecting the building as well as human comfort. Recommendations around mitigation for these receivers are detailed in Section 7.2.

The CNVG sets out minimum distances for typical vibration intensive construction equipment for both cosmetic damage and human comfort. Works beyond these distances are considered to not impact structures or humans. Table 5-3 details the minimum distances required for typical vibration intensive equipment to prevent cosmetic damage to buildings and impact to humans. No buildings of heritage value are located within or directly adjacent to the proposal boundary.

Table 5-3 Minimum distance for vibration intensive equipment

Plant item	Rating/description	Cosmetic damage minimum distance	Human response minimum distance (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	
Vibratory roller	<50 kN (1–2 tonne)	5 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	20 m
	<200 kN (4–6 tonne)	12 m	40 m
	<300 kN (7–13 tonne)	15 m	100 m
	>300 kN (13–18 tonne)	20 m	100 m
	>300 kN (>18 tonne)	25 m	100 m
Small hydraulic hammer	300 kg (5 to 12 t excavator)	2 m	7 m
Medium hydraulic hammer	900 kg (12 to 18 t excavator)	7 m	23 m
Large hydraulic hammer	1,600 kg (18 to 34 t excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Piling rig – bored	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Handheld	1 m (nominal)	2 m

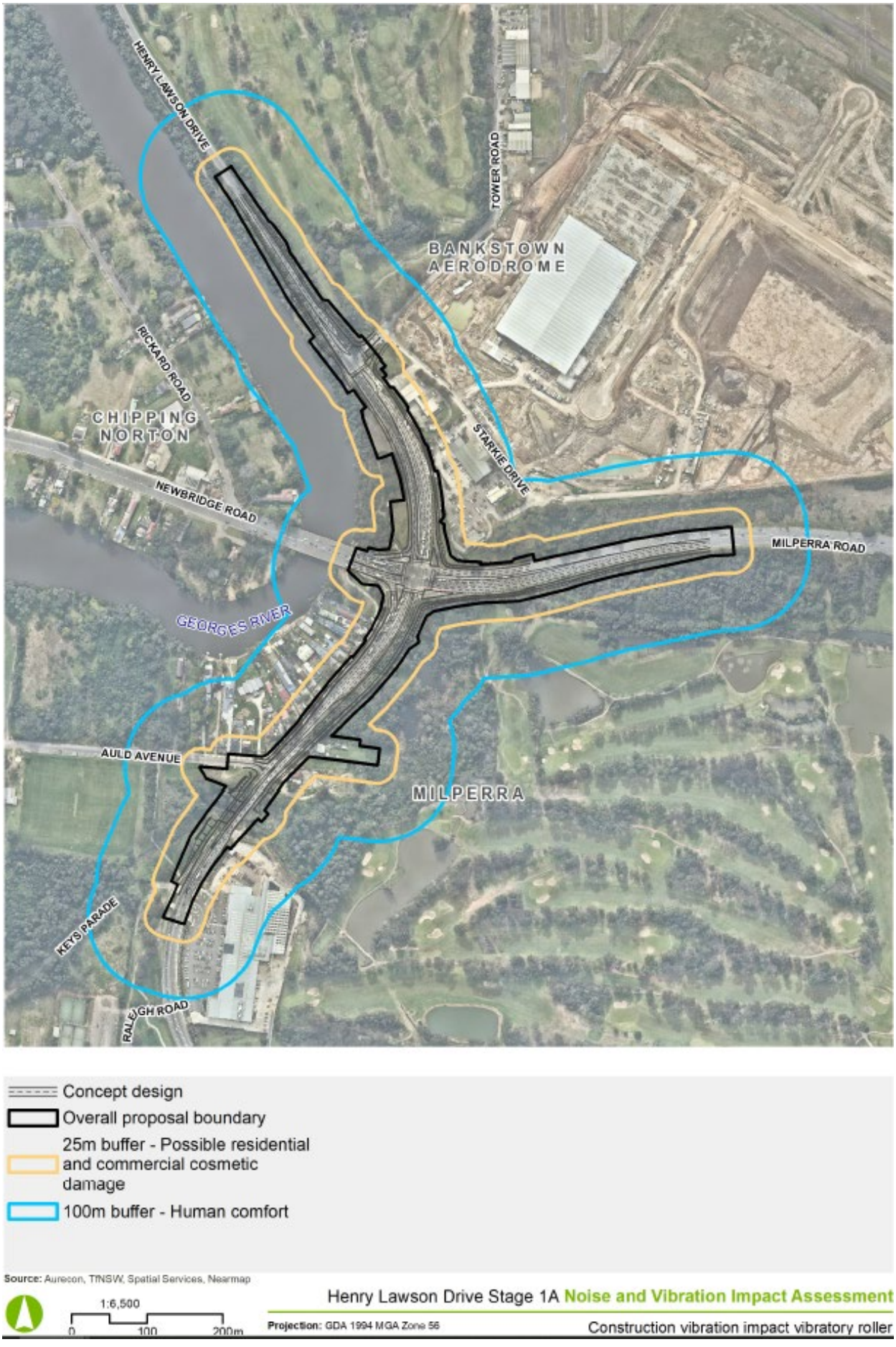

Figure 5-12 Minimum working distances for a 18T vibratory roller

6 Operational noise impacts

6.1 Operational traffic noise assessment

Operational noise impacts have been predicted to all sensitive receivers within 600 m of the outer most lanes of the overall proposal. The predicted noise levels to the sensitive receivers from the overall proposal are detailed in Table 6-1.

For NCA 1 and 2, all sensitive receivers have been listed, an overall average change in the predicted noise levels for all the receivers within NCA 1 and 2 has been detailed to show the overall impact of the No Build and Build Scenarios.

Within the following tables, compliance with the RNP criteria has been detailed for each of the assessed receivers. An assessment has also been undertaken with respect to the acute and cumulative noise levels detailed in the NMG to detail which receivers are eligible for mitigation.

The existing road traffic noise levels (measured) are already greater than the RNP criteria of 60 $dBL_{Aeq\ (15hr)}$ and 55 $dBL_{Aeq\ (9hr)}$ for day and night respectively for the receivers directly adjacent to Henry Lawson Drive (NCA 2). Due to this, the criteria for NCA1 and NCA 2, the redeveloped road criteria should be considered.

The assessment of the proposal is to be analysed with respect to the change in noise levels from the No Build to Build scenarios. From the predicted noise levels above, depending on the receiver locations, there is a decrease or increase in predicted road traffic noise levels between the No Build and Build scenarios.

For NCA 1, there is a slight increase in noise levels from the No Build and Build Scenarios for both day and night periods in 2026 and 2036 scenarios. These increases are up to 1.0 dBA, which is not perceptible to the human ear. The slight increase in noise levels in NCA 1 is primarily due to the overall increase in traffic volumes in the future scenarios through the northern section of Henry Lawson Drive, but could also be contributed by the slight shift of the alignment west of the existing road.

For NCA 2, there is a slight improvement in the predicted noise levels, with the majority of sensitive receivers experiencing a slight decrease in noise levels between the No Build and Build scenarios in both 2026 and 2036 scenarios for both day and night periods. The general improvement in predicted noise levels for NCA 2 is most likely due to the shift of the southbound Henry Lawson Drive lane further east, away from majority of the receivers within NCA 2. Even with a general increase in traffic volumes from the No Build and Build scenarios, this shift in the alignment east still improved the predicted noise levels at these receivers.

Even though there is a general decrease in predicted noise levels for NCA 2, there is an increase of up to 1 dBA between the No Build and Build Scenarios at 443 Henry Lawson Drive for both day and night periods. This property is the sole property on the eastern side of Henry Lawson Drive and is due to the traffic lanes shifting closer to this receiver.

The cumulative or acute NMG noise criteria have been exceeded within NCA 2 for 11 properties. These properties are directly adjacent Henry Lawson Drive where noise levels are expected to be greater than the daytime 65 $dBL_{Aeq\ (15\text{-}hour)}$ and night-time 60 $dBL_{Aeq\ (9\text{-}hour)}$ respectively. As these properties are exceeding the NMG noise criteria for a redeveloped road, they are eligible for noise mitigation.

Table 6-1 Predicted traffic noise levels for No Build/Build, 2026/2036 scenarios

Address	Fl	Day										Night										Mitigation (Y/N)
		Predicted traffic noise levels ($L_{Aeq\ (15\ hr)}$)							Mitigation triggers			Predicted traffic noise levels ($L_{Aeq\ (9\ hr)}$)							Mitigation triggers			
		2026			2036				Trigger 1: (≥ 60 $L_{Aeq\ (15\ hr)}$ and project contributes to ≥ 2.0dB increase)	Trigger 2: (≥ 65 $L_{Aeq\ (15\ hr)}$ due to project roads)	Trigger 3: Build (Project Roads Only) ≥ 65 $L_{Aeq\ (15\ hr)}$	2026			2036				Trigger 1: (≥ 55 $L_{Aeq\ (9\ hr)}$ and project contributes to ≥ 2.0dB increase)	Trigger 2: (≥ 60 $L_{Aeq\ (9\ hr)}$ due to project roads)	Trigger 3: Build (Project Roads Only) ≥ 60 $L_{Aeq\ (9\ hr)}$	
		No Build	Build	Δ (dBA)	No Build	Build	Δ (dBA)	Build (Project Roads Only)				No Build	Build	Δ (dBA)	No Build	Build	Δ (dBA)	Build (Project Roads Only)				
NCA 1																						
3 Arthur Street	GF	52.1	52.5	0.4	52.1	52.7	0.6	51.6	N	N	N	44.9	45.4	0.5	45.5	45.5	0.0	44.3	N	N	N	N
34 Rickard Road	GF	57.8	58.7	0.9	57.9	58.9	1.0	58.8	N	N	N	50.6	51.4	0.8	51.1	51.6	0.5	51.5	N	N	N	N
38 Rickard Road	GF	62.2	62.8	0.6	62.3	63.0	0.7	62.6	N	N	N	55.0	55.6	0.6	55.7	55.8	0.1	55.4	N	N	N	N
40 Rickard Road	GF	62.0	62.7	0.7	62.1	62.8	0.7	62.5	N	N	N	54.8	55.4	0.6	55.6	55.6	0.0	55.2	N	N	N	N
42 Rickard Road	GF	62.2	62.8	0.6	62.3	63.0	0.7	62.6	N	N	N	55.0	55.6	0.6	55.8	55.8	0.0	55.3	N	N	N	N
31 Rickard Road	GF	55.9	56.0	0.1	56.0	56.6	0.6	55.4	N	N	N	48.7	48.8	0.1	49.9	49.0	-0.9	48.1	N	N	N	N
39-41 Rickard Road	GF	59.1	59.5	0.4	59.2	59.8	0.6	58.5	N	N	N	52.0	52.2	0.2	52.8	52.4	-0.4	51.1	N	N	N	N
47 Rickard Road	GF	59.4	59.8	0.4	59.4	60.3	0.9	56.2	N	N	N	52.3	52.6	0.3	52.8	52.8	0.0	49.0	N	N	N	N
60 Rickard Road	GF	56.7	57.3	0.6	56.7	57.5	0.8	46.5	N	N	N	49.6	50.0	0.4	49.6	50.2	0.6	39.2	N	N	N	N
62 Rickard Road	GF	63.4	63.9	0.5	63.5	64.1	0.6	63.1	N	N	N	56.3	56.6	0.3	57.4	56.8	-0.6	55.9	N	N	N	N
78 Rickard Road (West)	GF	69.0	69.4	0.4	68.9	69.5	0.6	51.4	N	N	N	61.8	62.1	0.3	61.7	62.2	0.5	43.8	N	N	N	N
78 Rickard Road (South)	GF	69.1	69.5	0.4	69.0	69.6	0.6	56.3	N	N	N	61.9	62.2	0.3	61.9	62.3	0.4	48.9	N	N	N	N
15 Newbridge Road	GF	60.3	61.1	0.8	60.2	61.3	1.1	46.9	N	N	N	53.1	53.7	0.6	53.0	53.9	0.9	39.5	N	N	N	N
23 Newbridge Road	GF	54.8	55.6	0.8	55.0	55.8	0.8	53.0	N	N	N	47.8	48.3	0.5	48.4	48.5	0.1	45.6	N	N	N	N
23 Newbridge Road	F 1	56.6	57.4	0.8	56.7	57.6	0.9	54.1	N	N	N	49.6	50.1	0.5	50.1	50.3	0.2	46.8	N	N	N	N
21 Newbridge Road	GF	54.3	54.8	0.5	54.4	55.1	0.7	53.0	N	N	N	47.2	47.6	0.4	48.1	47.8	-0.3	45.6	N	N	N	N
21 Newbridge Road	F 1	55.7	56.3	0.6	55.8	56.5	0.7	54.0	N	N	N	48.6	49.1	0.5	49.4	49.3	-0.1	46.7	N	N	N	N
27 Newbridge Road	GF	51.4	51.7	0.3	51.4	51.9	0.5	51.0	N	N	N	44.2	44.5	0.3	44.9	44.7	-0.2	43.7	N	N	N	N
27 Newbridge Road	F 1	53.2	53.6	0.4	53.3	53.7	0.4	52.4	N	N	N	46.1	46.4	0.3	46.8	46.6	-0.2	45.0	N	N	N	N
39 Newbridge Road	GF	55.5	56.3	0.8	55.5	56.5	1.0	50.6	N	N	N	48.3	49.0	0.7	48.5	49.1	0.6	43.3	N	N	N	N
39 Newbridge Road	F 1	56.8	57.4	0.6	56.8	57.6	0.8	51.8	N	N	N	49.7	50.2	0.5	49.8	50.3	0.5	44.4	N	N	N	N
70 Newbridge Road	GF	45.7	46.1	0.4	45.8	46.6	0.8	45.6	N	N	N	38.5	39.0	0.5	39.2	39.1	-0.1	38.2	N	N	N	N
62 Newbridge Road	GF	44.0	44.4	0.4	44.1	45.3	1.2	44.8	N	N	N	36.9	37.2	0.3	37.5	37.4	-0.1	37.4	N	N	N	N
60 Newbridge Road	GF	47.5	48.0	0.5	47.6	48.6	1.0	47.2	N	N	N	40.4	40.8	0.4	41.2	40.9	-0.3	39.8	N	N	N	N
44 Newbridge Road	GF	50.7	51.1	0.4	50.6	51.3	0.7	46.7	N	N	N	43.6	43.8	0.2	43.8	44.0	0.2	39.3	N	N	N	N
42a Newbridge Road	GF	57.1	57.6	0.5	56.9	57.8	0.9	49.4	N	N	N	49.4	50.1	0.7	49.6	50.3	0.7	42.1	N	N	N	N
40 Newbridge Road	GF	57.6	58.1	0.5	57.3	58.2	0.9	50.1	N	N	N	49.9	50.5	0.6	50.0	50.7	0.7	42.8	N	N	N	N
42 Newbridge Road	GF	51.6	51.5	-0.1	51.6	51.7	0.1	50.7	N	N	N	44.5	44.3	-0.2	45.0	44.5	-0.5	43.4	N	N	N	N
30 Newbridge Road	GF	49.8	50.3	0.5	49.9	50.5	0.6	49.8	N	N	N	42.6	43.0	0.4	43.8	43.2	-0.6	42.5	N	N	N	N
26 Newbridge Road	GF	62.0	62.4	0.4	61.8	62.6	0.8	52.0	N	N	N	54.2	54.8	0.6	54.3	55.0	0.7	44.6	N	N	N	N
22 Newbridge Road	GF	55.6	56.1	0.5	55.6	56.3	0.7	50.8	N	N	N	48.4	48.9	0.5	48.7	49.0	0.3	43.5	N	N	N	N
20 Newbridge Road	GF	55.4	55.9	0.5	55.4	56.1	0.7	51.1	N	N	N	48.2	48.7	0.5	48.5	48.8	0.3	43.8	N	N	N	N
14 Newbridge Road	GF	68.2	68.6	0.4	68.0	68.8	0.8	53.6	N	N	N	60.5	61.0	0.5	60.4	61.2	0.8	46.2	N	N	N	N

Address	Fl	Day										Night										Mitigation (Y/N)
		Predicted traffic noise levels ($L_{Aeq\ (15\ hr)}$)							Mitigation triggers			Predicted traffic noise levels ($L_{Aeq\ (9\ hr)}$)							Mitigation triggers			
		2026			2036				Trigger 1: (≥ 60 $L_{Aeq\ (15\ hr)}$ and project contributes to ≥ 2.0dB increase)	Trigger 2: (≥ 65 $L_{Aeq\ (15\ hr)}$ due to project roads)	Trigger 3: Build (Project Roads Only) ≥ 65 $L_{Aeq\ (15\ hr)}$	2026			2036				Trigger 1: (≥ 55 $L_{Aeq\ (9\ hr)}$ and project contributes to ≥ 2.0dB increase)	Trigger 2: (≥ 60 $L_{Aeq\ (9\ hr)}$ due to project roads)	Trigger 3: Build (Project Roads Only) ≥ 60 $L_{Aeq\ (9\ hr)}$	
		No Build	Build	Δ (dBA)	No Build	Build	Δ (dBA)	Build (Project Roads Only)				No Build	Build	Δ (dBA)	No Build	Build	Δ (dBA)	Build (Project Roads Only)				
12 Newbridge Road	GF	69.7	70.5	0.8	69.6	70.6	1.0	54.4	N	N	N	62.6	63.2	0.6	62.5	63.3	0.8	47.0	N	N	N	N
10 Newbridge Road	GF	62.7	63.4	0.7	62.7	63.5	0.8	50.8	N	N	N	55.6	56.2	0.6	55.6	56.3	0.7	43.5	N	N	N	N
6 Newbridge Road	GF	67.3	68.0	0.7	67.2	68.1	0.9	54.8	N	N	N	60.2	60.7	0.5	60.1	60.9	0.8	47.4	N	N	N	N
NCA 2																						
2/386 Henry Lawson Drive	GF	66.7	67.2	0.5	66.7	67.3	0.6	59.5	N	N	N	59.7	60	0.3	59.8	60.1	0.3	52.1	N	N	N	N
384 Henry Lawson Drive	GF	68	67.6	-0.4	68	67.8	-0.2	65.9	N	Y	Y	60.7	60.4	-0.3	60.9	60.5	-0.4	58.5	N	Y	N	Y
386 Henry Lawson Drive	GF	68.3	67.8	-0.5	68.3	68	-0.3	66.5	N	Y	Y	61	60.5	-0.5	61.2	60.7	-0.5	59	N	Y	N	Y
388 Henry Lawson Drive	GF	66.3	65.7	-0.6	66.3	66	-0.3	64.9	N	Y	Y	59	58.5	-0.5	59.3	58.6	-0.7	57.4	N	N	N	Y
388A Henry Lawson Drive	GF	70.1	68.8	-1.3	70	69.1	-0.9	68.5	N	Y	Y	62.4	61.4	-1	62.4	61.6	-0.8	60.8	N	Y	Y	Y
388A Henry Lawson Drive	F 1	71.4	70.3	-1.1	71.4	70.5	-0.9	69.9	N	Y	Y	63.7	62.9	-0.8	63.8	63	-0.8	62.3	N	Y	Y	Y
390 Henry Lawson Drive	GF	65.4	64.4	-1	65.3	64.7	-0.6	64.6	N	Y	Y	58.1	57.1	-1	58	57.3	-0.7	57.2	N	N	N	Y
392 Henry Lawson Drive	GF	65.6	64.5	-1.1	65.5	64.8	-0.7	64.8	N	Y	Y	58.3	57.2	-1.1	58.2	57.4	-0.8	57.3	N	N	N	Y
392 Henry Lawson Drive	F 1	67	66.1	-0.9	66.9	66.4	-0.5	66.2	N	Y	Y	59.7	58.9	-0.8	59.7	59	-0.7	58.9	N	N	N	Y
394 Henry Lawson Drive	GF	60.6	60.1	-0.5	60.6	60.4	-0.2	60.2	N	N	N	53.4	52.8	-0.6	53.3	53	-0.3	52.8	N	N	N	N
396 Henry Lawson Drive	GF	66.7	65.8	-0.9	66.7	66	-0.7	65.6	N	Y	Y	59.5	58.6	-0.9	59.5	58.7	-0.8	58.2	N	N	N	Y
398 Henry Lawson Drive	GF	58.5	58.5	0	58.5	58.8	0.3	58.4	N	N	N	51.3	51.3	0	51.3	51.4	0.1	51	N	N	N	N
402 Henry Lawson Drive	GF	61.9	61.9	0	61.9	62.2	0.3	61.5	N	N	N	54.7	54.7	0	54.7	54.8	0.1	54.1	N	N	N	N
404 Henry Lawson Drive	GF	58.8	59.3	0.5	58.8	59.5	0.7	55.3	N	N	N	51.7	52	0.3	51.7	52.2	0.5	47.9	N	N	N	N
406 Henry Lawson Drive	GF	67.6	67.9	0.3	67.4	68.1	0.7	68.1	N	Y	Y	60.2	60.5	0.3	60.1	60.6	0.5	60.6	N	Y	Y	Y
406 Henry Lawson Drive	F 1	68.7	69	0.3	68.6	69.2	0.6	69.2	N	Y	Y	61.4	61.6	0.2	61.3	61.7	0.4	61.7	N	Y	Y	Y
3 Auld Ave	GF	56.1	56.5	0.4	56	56.8	0.8	56.3	N	N	N	48.9	49.3	0.4	48.9	49.4	0.5	49	N	N	N	N
3 Auld Ave	F 1	60.1	60.5	0.4	60.1	60.7	0.6	59.3	N	N	N	53	53.2	0.2	53	53.4	0.4	51.9	N	N	N	N
5 Auld Ave	GF	65.2	64.6	-0.6	65.1	64.9	-0.2	64.8	N	Y	Y	58	57.3	-0.7	57.8	57.5	-0.3	57.5	N	N	N	Y
7 Auld Ave	GF	63.5	62.8	-0.7	63.4	63	-0.4	62.9	N	N	N	56.3	55.5	-0.8	56.1	55.7	-0.4	55.6	N	N	N	N
7 Auld Ave	F 1	65	64.4	-0.6	64.9	64.5	-0.4	64.2	N	Y	N	57.8	57.1	-0.7	57.6	57.3	-0.3	57	N	N	N	Y
9A Auld Ave	GF	59	57.2	-1.8	58.9	57.5	-1.4	57.3	N	N	N	51.8	50	-1.8	51.6	50.1	-1.5	49.9	N	N	N	N
13 Auld Ave	GF	55.6	54.7	-0.9	55.5	54.9	-0.6	54.5	N	N	N	48.4	47.4	-1	48.2	47.6	-0.6	47.2	N	N	N	N
13 Auld Ave	GF	56.1	55.4	-0.7	56	55.5	-0.5	54.8	N	N	N	48.9	48.1	-0.8	48.8	48.3	-0.5	47.6	N	N	N	N
15 Auld Ave	GF	57.3	55.7	-1.6	57.1	55.9	-1.2	55.6	N	N	N	50	48.4	-1.6	49.9	48.6	-1.3	48.3	N	N	N	N
19 Auld Ave	GF	55.7	54.3	-1.4	55.6	54.5	-1.1	54.1	N	N	N	48.5	47	-1.5	48.3	47.1	-1.2	46.7	N	N	N	N
443 Henry Lawson Drive	GF	69.5	70.1	0.6	69.4	70.5	1.1	70.5	N	Y	Y	61.8	61.8	0	61.7	62.1	0.4	62.1	N	Y	Y	Y
Open Space (Active)																						
Bankstown Golf Course	GF	68.3	69.1	0.8	67.7	69.2	1.5	62.2	N	Y	N	-	-	-	-	-	-		-	-	-	-
Georges River Golf Course #2	GF	67.1	67.9	0.8	66.7	68.4	1.7	68.2	N	Y	N	-	-	-	-	-	-		-	-	-	-

Address	FI	Day										Night										Mitigation (Y/N)
		Predicted traffic noise levels ($L_{Aeq\ (15\ hr)}$)							Mitigation triggers			Predicted traffic noise levels ($L_{Aeq\ (9\ hr)}$)							Mitigation triggers			
		2026			2036				Trigger 1: (≥ 60 $L_{Aeq\ (15\ hr)}$ and project contributes to ≥ 2.0dB increase)	Trigger 2: (≥ 65 $L_{Aeq\ (15\ hr)}$ due to project roads)	Trigger 3: Build (Project Roads Only) ≥ 65 $L_{Aeq\ (15\ hr)}$	2026			2036				Trigger 1: (≥ 55 $L_{Aeq\ (9\ hr)}$ and project contributes to ≥ 2.0dB increase)	Trigger 2: (≥ 60 $L_{Aeq\ (9\ hr)}$ due to project roads)	Trigger 3: Build (Project Roads Only) ≥ 60 $L_{Aeq\ (9\ hr)}$	
		No Build	Build	Δ (dBA)	No Build	Build	Δ (dBA)	Build (Project Roads Only)				No Build	Build	Δ (dBA)	No Build	Build	Δ (dBA)	Build (Project Roads Only)				
Georges River Golf Course #3	GF	56.1	56.5	0.4	55.5	56.8	1.3	55.7	N	N	N	-	-	-	-	-	-		-	-	-	-
Georges River Golf Course #1	GF	57.7	58.1	0.4	57	58.7	1.7	58.1	N	N	N	-	-	-	-	-	-		-	-	-	-
Gordon Parker Reserve	GF	55.1	54.6	-0.5	54.3	54.8	0.5	53.6	N	N	N	-	-	-	-	-	-		-	-	-	-
Vale of Ah Reserve	GF	52	51.9	-0.1	51.2	52.1	0.9	50.5	N	N	N	-	-	-	-	-	-		-	-	-	-
Vale of Ah Dog Park	GF	52.3	52.3	0	51.6	52.5	0.9	49	N	N	N	-	-	-	-	-	-		-	-	-	-
Georges River Walking Trail	GF	67.6	67.7	0.1	67	67.9	0.9	65.9	N	Y	N	-	-	-	-	-	-		-	-	-	-

6.1.1 Maximum noise level assessment

A qualitative assessment has been undertaken for the maximum noise levels from road traffic noise along Henry Lawson Drive.

The relationship between noise and sleep disturbance has yet to be comprehensively linked but the RNP identifies that:

- Maximum Internal noise levels below 50 – 55 dBA are unlikely to cause awaking
- One of two noise events per night, with maximum internal noise levels of 65 – 70 dBA are not likely to affect health and wellbeing significantly.

The RNP recommends the methodology for the assessment of maximum noise levels be based upon the ENMM, Practice Note III.

The Practice Note details to undertake the following:

- Evaluate whether maximum noise impacts will reduce or increase for the design year.
- On the basis of this evaluation, take account of maximum noise levels when prioritising, selecting and designing noise control measures

The Practice Note also suggests that, where road traffic is continuous rather than intermittent, the $L_{Aeq\ 9hr}$ (Night-time) target noise levels should sufficiently account for sleep disturbance impacts.

At this point in time, a qualitative assessment of maximum noise levels is undertaken due to the limited data acquired during long-term noise monitoring. Due to the high levels of heavy vehicle traffic along the corridor, this approach assumes that heavy vehicle traffic and high noise levels are strongly correlated, especially for receivers adjacent to Henry Lawson Drive south of Milperra Road. For this qualitative assessment, NCA 2 has specifically been assessed as receivers are adjacent to Henry Lawson Drive and are exposed to heavy vehicle pass-bys which have been assumed to generate noise levels greater than 65 dBA.

NCA 2 – Henry Lawson Drive South

As the receivers in NCA 2 are directly adjacent to Henry Lawson Drive, they are more likely to be affected by heavy vehicle traffic pass-bys. Table 6-2 details the heavy vehicle numbers counted for the year 2020 and modelled for the years 2026 and 2036.

Table 6-2 Heavy vehicle traffic numbers on Henry Lawson Drive south of Milperra Road

NCA 2	Southbound and northbound average hourly heavy traffic volumes				
Hour	2020	2026 No Build	2026 Build	2036 No Build	2036 Build
22:00	14	30	33	29	35
23:00	10	26	29	26	31
0:00	9	22	24	21	26
1:00	6	21	23	21	25
2:00	8	19	21	18	22
3:00	12	29	32	28	34
4:00	18	61	69	60	72
5:00	49	158	176	154	186
6:00	82	301	333	292	353

Table note:
The modelled traffic numbers for the future scenarios have been based on factors derived from traffic counts.

There is an increase in heavy vehicle numbers during the night period for all future scenarios when compared to the existing counts, with the build scenarios modelled to have more heavy vehicles travelling on Henry Lawson Drive.

It is assumed that existing sleep disturbance impacts occur for receivers in NCA 2 with a number of heavy vehicle pass-bys during the night period. As the location of NCA 2 is close to the Milperra Road, Henry Lawson Drive intersection, interrupted traffic flow of acceleration and deacceleration of heavy vehicles is very likely. As there is an increase in heavy vehicles numbers for all future scenarios it is assumed that there will be an increase in potential sleep disturbance events.

The proposal incorporates additional lanes along Henry Lawson Drive moving southbound traffic further away from receivers, however the northbound traffic does shift marginally closer to receivers along Henry Lawson Drive, which may have an increase in the number of maximum noise levels exceedances.

6.1.2 EIS proposal

As mentioned previously, there are no sensitive receivers located within the EIS proposal areas, for there to be any noise impacts.

However, some of the works in the EIS proposal areas would make a minor contribution to the noise created by the operation of the overall proposal. In particular, these include small areas of road pavement in EIS proposal areas 1 and 2.

Upon construction completion, EIS proposal area 3 (which forms part of a larger property) would be handed back to Canterbury Bankstown City Council for recreational purposes.

7 Management measures

7.1 Construction noise mitigation

7.1.1 Standard mitigation measures

Section 8.1 of the CNVG details standard mitigation measures that should be applied to the overall proposal to minimise construction noise where feasible and reasonable to do so, prior to additional mitigation measures are considered further. These standard mitigation measures are detailed in Table 7-1.

Table 7-1 Standard construction noise mitigation

Action required	Details
Management measures	
Implement community consultation and notification measures	Periodic notification (3-monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works. In addition to periodic notification, the following strategies may be adopted on a case-by-case basis: ■ Project specific website ■ Project Infoline ■ Construction response line ■ Email distribution list ■ Web-based surveys ■ Social media ■ Community and stakeholder meetings ■ Community based forums (if required by approval conditions).
Register of noise and vibration sensitive receivers	A register of most affected noise and vibration sensitive receivers would be kept on site. The register would include the following details for each noise and vibration sensitive receiver: ■ Address of receiver ■ Category of receiver (eg residential, commercial etc.) ■ Contact name and phone number The register may be included as part of the Proposal's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise levels should be scheduled during less sensitive time periods.
Construction respite period	Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than a 1-hour respite between ceasing and recommencing any of the work. No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7 day period, unless otherwise approved by the relevant authority.

Action required	Details
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: ■ All proposal specific and relevant standard noise and vibration mitigation measures ■ Relevant licence and approval conditions ■ Permissible hours of work ■ Any limitations on high noise generating activities ■ Location of nearest sensitive receivers ■ Construction employee parking areas ■ Designated loading/unloading areas and procedures ■ Site opening/closing times (including deliveries) ■ Environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air.
Monitoring	A noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration. Management Plan and any approval and licence conditions.
Update Construction Environmental Management Plans	The CEMP must be regularly updated to account for changes in noise management issues and strategies
Source controls	
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Equipment selection	Use quieter and less noise emitting construction methods where feasible and reasonable.
Maximum Noise Levels	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the allowable noise levels in Appendix C of the CNVG.
Rental plant and equipment	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the allowable noise levels in Appendix C of the CNVG
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Non-tonal and ambient sensitive reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of material/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Construction Related Traffic	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.

Action required	Details
Silencers on Mobile Plant	Where possible reduce noise from mobile plant through additional fittings including: ■ Residential grade mufflers ■ Damped hammers such as “City” Model Rammer Hammers ■ Air Parking brake engagement is silenced
Prefabrication of materials off-site	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.
Engine compression braking	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission’s ‘in-service test procedure’ and standard.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable); noise curtains and consideration of site topography when situating plant.

7.1.2 Additional mitigation measures

Section 8.2 of the CNVG details additional noise mitigation measures that could be implemented where the standard noise mitigation measures are not sufficient in reducing the construction noise impacts. These additional noise mitigation measures are:

- Project Notification (PN)
- Specific notifications (SN)
- Respite Period (RP)
- Duration Respite (DR)
- Alternative Accommodation (AA)
- Project Specific Respite Offer (RO)
- Verification (V)

Table 7-2 details the triggers for additional mitigation measures for construction noise.

Table 7-2 Implementation of additional airborne noise management measures (Table 9, CNVG)

Construction hours	Receiver perception	dB(A) above RBL[1]	dB(A) above ANML	Additional management measures
Standard hours Monday – Friday (7.00 am – 6.00 pm) Saturday (8.00 am – 1.00 pm)	Noticeable	5 to 10	0	-
	Clearly Audible	>10 to 20	<10	-
	Moderately Intrusive	>20 to 30	>10 to 20	PN, V
	Highly Intrusive	>30	> 20	PN, V
	75dBA or greater	N/A	N/A	PN, V, SN
OOHW Period 1 Monday-Friday (6.00 pm-10.00 pm) Saturday (7.00 am-8.00 am, 1.00 pm-10.00 pm) Sunday/PH (8.00 am-6.00 pm)	Noticeable	5 to 10	<5	-
	Clearly Audible	>10 to 20	5 to 15	PN
	Moderately Intrusive	>20 to 30	>15 to 25	PN, V, SN, RO
	Highly Intrusive	>30	>25	PN, V, SN, RO, RP[2], DR[2]

Construction hours	Receiver perception	dB(A) above RBL[1]	dB(A) above ANML	Additional management measures
OOHW Period 2 Monday-Saturday (12.00 am-7.00 am, 10.00 pm-12.00 am) Sunday/PH (12.00 am-8.00 am, 6.00 pm-12.00 am)	Noticeable	0 to 10	<5	PN
	Clearly Audible	>10 to 20	5 to 15	PN, V
	Moderately Intrusive	>20 to 30	>15 to 25	PN, V, SN, RP, DR
	Highly Intrusive	>30	>25	PN, V, SN, AA, RP, DR

Table notes:

1 SWLs used for the purpose of estimating noise impact shall be increased by 5 dBA where works will include: power saws for the cutting of timber, masonry and steel; grinding of metal, concrete or masonry; rock/line drilling; bitumen milling and profiling; jack hammering, rock hammering and rock breaking; or impact piling as a correction factor for noise with special audible characteristics. It is noted that this correction factor is automatically calculated under Step 2 of the Construction Noise Estimator Tool.

2 Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 Day only (ie Saturday 6.00 am to 7.00 am and 1.00 pm to 6.00 pm, Sundays/Public Holidays 8.00 am to 6.00 pm)

The construction impacts for all the NCAs range from noticeable to highly intrusive. The perception at the receivers is dependent on what construction activity as well as the distance of the receiver to the construction footprint.

Based on the construction scenario propagation noise contours (refer Figure 5-1 to Figure 5-10) and the predicted exceedances of the NML in Appendix C, additional mitigation measures are recommended for the receivers within NCA 1 and 2. If appropriate setback distances cannot be maintained, additional management measures should be considered. These additional management measures (and corresponding setback distances) are detailed in Table 7-3.

It is noted that further construction noise assessment would be undertaken once construction scheduling is confirmed prior to construction, to further evaluate noise impacts and required noise mitigation.

Table 7-3 Additional mitigation measures for Henry Lawson Drive Stage 1A

Construction hours	Receiver perception	NCA 1 Setback distances from construction footprint (m)	NCA 2 Setback distances from construction footprint (m)	Additional management measures
Standard Hours Monday – Friday (7.00 am – 6.00 pm) Saturday (8.00 am – 1.00 pm)	Noticeable			-
	Clearly Audible			-
	Moderately Intrusive	126	126	PN, V
	Highly Intrusive	40	40	PN, V
	75 dBA or greater	100	100	PN, V, SN
OOHW Period 1 Monday-Friday (6.00 pm-10.00 pm) Saturday (7.00 am-8.00 am, 1.00 pm-10.00 pm) Sunday/PH (8.00 am-6.00 pm)	Noticeable			-
	Clearly Audible	448	709	PN
	Moderately Intrusive	142	224	PN, V, SN, RO
	Highly Intrusive	45	71	PN, V, SN, RO, RP[2], DR[2]
OOHW Period 2 Monday-Saturday (12.00 am-7.00 am 10.00 pm-12.00 am)| Sunday/PH (12.00 am-8.00 am, 6.00 pm-12.00 am)	Noticeable			PN
	Clearly Audible	1588	1588	PN, V
	Moderately Intrusive	502	502	PN, V, SN, RP, DR
	Highly Intrusive	159	159	PN, V, SN, AA, RP, DR

The requirement for ‘additional mitigation measures’ would be further evaluated as the overall proposal progresses and detailed construction scheduling information becomes available. A Construction Noise and Vibration Management Plan (CNVMP) will be prepared by the contractor before construction and would detail the approach to construction mitigation.

7.2 Construction vibration mitigation

Section 8.1 of the CNVG details standard mitigation measures for construction vibration affecting human comfort as well as cosmetic building damage. These specific vibration details have been summarised in Table 7-4. These measures should be considered where vibration works would be undertaken in proximity of structures, particularly NCA 2 and NCA 4.

Table 7-4 Vibration management measures

Action required	Details
Management measures	
Implement community consultation or notification measures	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works. In addition to periodic notification, the following strategies may be adopted on a case-by-case basis: ■ Proposal specific website ■ Proposal Infoline ■ Construction response line ■ Email distribution list ■ Web-based surveys ■ Social media ■ Community and stakeholder meetings ■ Community based forums (if required by approval conditions).
Register of noise and vibration sensitive receivers	A register of most affected noise and vibration sensitive receivers would be kept on site. The register would include the following details for each noise and vibration sensitive receiver: ■ Address of receiver ■ Category of receiver (eg residential, commercial etc.) ■ Contact name and phone number. The register may be included as part of the Proposal’s Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.
Construction hours and scheduling	Where feasible and reasonable, vibration intensive operations should be carried out during the standard daytime working hours. This will reduce the potential for human comfort impacts during the evening and night-time, periods with a higher likelihood of receiver occupancy and hence higher change of complaints.
Construction respite period	Vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block. ‘Continuous’ includes any period during which there is less than a 1-hour respite between ceasing and recommencing any of the work. No more than two consecutive nights of vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.

Action required	Details
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: ■ All proposal specific and relevant standard noise and vibration mitigation measures ■ Relevant licence and approval conditions ■ Permissible hours of work ■ Location of nearest sensitive receivers and structures ■ Construction employee parking areas ■ Designated loading/unloading areas and procedures ■ Site opening/closing times (including deliveries) ■ Environmental incident procedures
Attended Vibration Measurements	Attended vibration measurements shall be undertaken at all buildings within 25 m of vibration generating activities when these activities commence to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	The CEMP must be regularly updated to account for changes in noise management issues and strategies
Building Condition Surveys	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to major project construction activities with the potential to cause property damage.
Source controls	
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Equipment selection	Use quieter and less noise emitting construction methods where feasible and reasonable.

7.3 Operational noise mitigation measures

The NMG provides guidance on mitigation measures to reduce operational road traffic noise to receivers. For the proposal, receivers that have exceeded of the acute operational road traffic noise levels for the day or night period has been detailed in Table 6-1.

The receivers that are eligible for noise mitigation based on the NMG are listed below:

- 384 Henry Lawson Drive
- 386 Henry Lawson Drive
- 388 Henry Lawson Drive
- 388A Henry Lawson Drive
- 390 Henry Lawson Drive
- 392 Henry Lawson Drive
- 396 Henry Lawson Drive
- 406 Henry Lawson Drive
- 443 Henry Lawson Drive
- 5 Auld Ave
- 7 Auld Ave

All of the properties listed above are situated in NCA 2. These properties are directly adjacent to Henry Lawson Drive which is considered a redeveloped project road.

7.3.1 Operational road traffic noise mitigation measures

There are numerous mitigation methods for operational road traffic noise, these have been listed below in order of preference:

- Quieter Pavement Surfaces
- Noise Mounds
- Noise Barriers
- At-property treatments

All of the methods above have been considered in order to reduce operational road traffic noise for the properties listed above.

Implementing quieter road surface types such as Open Graded Asphalt or Stone Mastic Asphalt may be beneficial for the areas of the proposal where free flowing traffic is located. However, quieter pavement surfaces are not preferred in areas of low operational speeds as well as locations of intermittent traffic flow. The locations of the properties eligible for mitigation within NCA 2 are in close proximity of the Henry Lawson Drive, Milperra Road and Newbridge Road intersection. A quieter pavement surface is not the preferred mitigation measurement for these properties as intermittent traffic flow as well as low traffic design speeds are expected in this area of the proposal.

Noise mounds and barriers require land between the receiver and the road to allow for an increase in path difference for noise propagation. For the case for the properties in NCA 2, there is no land between Henry Lawson Drive and their property. An effective noise barrier cannot be erected between the properties and Henry Lawson Drive due to Henry Lawson Drive being a point of access for the properties. With this in mind, noise barriers and mounds would additionally not be considered as a noise mitigation method.

At-property noise treatment would be the prevailing noise mitigation measure as the more preferred options are not feasibility applicable to mitigate road traffic noise for NCA 2 properties.

8 Conclusion

Aurecon Australasia has undertaken a Noise and Vibration Impact Assessment on the proposed Henry Lawson Drive Upgrade. Impacts on NCAs in relation to construction noise and vibration as well as operational road traffic noise were assessed.

The construction noise of the proposal has been assessed and potentially exceed the NMLs for the NCAs for both standard hours and out of hour construction periods. As out of hour construction is expected, a sleep disturbance assessment was also undertaken. The activity with the highest predicted maximum noise level (dBL_{Amax}), widening and pavement works, was analysed and areas where predicted noise levels greater than 65 dBA were highlighted.

As there are exceedances to the NMLs as well as the sleep disturbance awakening limits, standard and proposal-specific additional noise mitigation measures have been identified in accordance with the CNVG, which aims to reduce construction noise impacts.

Construction vibration may potentially impact near-by residences as a vibratory roller has been proposed for the construction of the proposal. Minimum working distances with respect to the construction footprint have been mapped and recommended. Residences falling within these minimum working distances required vibration mitigation measures which also have been highlighted in this assessment.

Construction traffic noise impacts were assessed by comparing the daily construction induced traffic with the existing traffic volumes. The additional construction induced traffic is not expected to increase the noise levels by more than 2 dB.

Noise emissions from the day period and night period traffic noise were predicted for the future No Build and Build scenarios. Exceedances of the RNP criteria have been predicted for No Build and Build Scenarios due to the proximity of the receivers to the road sources. Maximum increases in road traffic noise levels of up to 1 dB along Newbridge Road are due to increases in traffic volumes, whilst there are decreases noise levels of up to 1 dB between the future No Build and Build scenarios for receivers along Henry Lawson Drive south of the Newbridge Road and Milperra Road due to the shift of the southbound traffic further away from the receivers.

At property mitigation has been proposed for properties within NCA 2 which exceed the cumulative or acute NMG criteria. These properties are affected by Henry Lawson Drive, which is a project road and is eligible for mitigation. Quieter pavement surfaces, noise mounds and noise barriers are not considered as mitigation measures for these properties as they would be ineffective due to the intermittent road traffic and the access to Henry Lawson Drive for the properties.

Appendix A
Traffic Volumes

2020 traffic volumes (counted by Matrix Traffic between the 16 September and 28 September 2020)

Table A1 Concurrent 2020 traffic volumes with noise monitoring (Interpolated from the Matrix ATC Report, September 2020)

Road section	Locality	Direction	Day (7.00 am - 10.00 pm)		Night (10.00 pm to 7.00 am)		Average speeds	
			LV	HV	LV	HV	Day (kmph)	Night (kmph)
Milperra Road	West	EB	12685	165	3312	308	67.1	69.8
Milperra Road	West	WB	11425	1365	2512	99	62.8	71.5
Henry Lawson Drive	North	NB	9568	965	1805	120	51.7	64.6
Henry Lawson Drive	North	SB	9611	945	1793	210	51.6	61.6
Henry Lawson Drive	South	NB	8029	763	1160	113	51	62.5
Henry Lawson Drive	South	SB	7234	846	1028	149	51.6	60.4

Day traffic volumes No Build and Build 2026 and 2036

Table A2 Day time traffic volumes for the No Build and Build Scenarios for 2026 and 2036 as provided by Transport

Road section	Locality	Direction	2026 No Build		2036 No Build		2026 Build		2036 Build	
			Total vehicles	HV percentage (%)	Total vehicles	HV percentage (%)	Total vehicles	HV percentage (%)	Total vehicles	HV percentage (%)
Newbridge Road	West	EB	32540	7	32840	7	37880	7	39640	7
Newbridge Road	West	WB	19790	13	20040	13	22510	13	23530	14
Milperra Road	East	EB	26710	8	25530	8	27170	9	28130	8
Milperra Road	East	WB	14820	13	15120	12	15550	14	16050	14
Henry Lawson Drive	North	NB	15460	9	16970	8	21850	8	21210	9
Henry Lawson Drive	North	SB	11670	18	11640	16	12630	16	13710	16
Henry Lawson Drive	South	NB	12030	7	12190	7	14920	7	14750	7
Henry Lawson Drive	South	SB	11670	13	11640	12	12630	13	13710	13
Turning Lane - HLD N	North	EB	5530	14	4940	13	6460	12	5880	13
Turning Lane - HLD N	North	WB	3580	8	3700	6	3660	7	3900	7
Turning Lane - HLD S	South	EB	430	2	490	4	640	3	710	3
Turning Lane - HLD S	South	WB	4730	7	4900	7	6080	7	6310	7
Turning Lane - Newbridge	West	NB	5900	7	6860	6	11290	6	11190	5
Turning Lane - Newbridge	West	SB	5890	9	5880	8	6520	9	6910	9
Turning Lane - Milperra	East	NB	2690	19	3310	15	2360	24	2290	26
Turning Lane - Milperra	East	SB	650	2	370	0	420	0	440	0

Night traffic volumes No Build and Build, 2026 and 2036

Table A3 Night time traffic volumes for the No Build and Build Scenarios for 2026 and 2036 as provided by Transport

Road Section	Locality	Direction	2026 No Build		2036 No Build		2026 Build		2036 Build	
			Total vehicles	HV percentage (%)	Total vehicles	HV percentage (%)	Total vehicles	HV percentage (%)	Total vehicles	HV percentage (%)
Newbridge Road	West	EB	6100	7	6160	7	7090	7	7410	7
Newbridge Road	West	WB	3700	14	3750	13	4220	13	4400	14
Milperra Road	East	EB	5010	8	4780	8	5090	9	5260	8
Milperra Road	East	WB	2780	13	2830	12	2910	13	3000	14
Henry Lawson Drive	North	NB	2890	9	3190	8	4090	8	3970	9
Henry Lawson Drive	North	SB	2190	18	2180	16	2370	16	2560	16
Henry Lawson Drive	South	NB	2240	7	2290	7	2800	7	2760	7
Henry Lawson Drive	South	SB	2190	13	2180	12	2370	13	2560	13
Turning Lane - HLD N	North	EB	1040	14	920	13	1210	12	1100	13
Turning Lane - HLD N	North	WB	670	7	690	6	690	7	730	7
Turning Lane - HLD S	South	EB	80	0	90	0	120	0	130	0
Turning Lane - HLD S	South	WB	880	7	920	7	1140	7	1180	7
Turning Lane - Newbridge	West	NB	1100	7	1290	6	2110	6	2090	5
Turning Lane - Newbridge	West	SB	1110	9	1100	8	1220	9	1290	9
Turning Lane - Milperra	East	NB	510	20	620	15	440	23	430	26
Turning Lane - Milperra	East	SB	120	0	70	0	80	0	80	0

Appendix B
Long Term Noise Monitoring Results

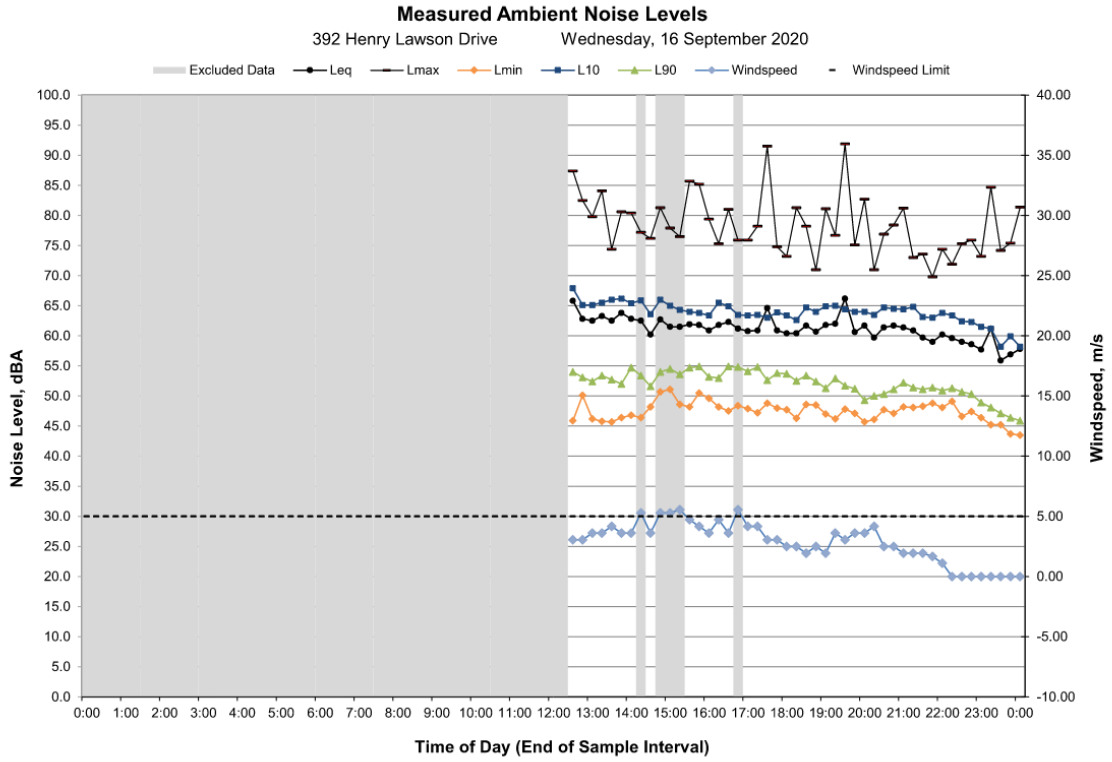

Figure B1 Long-term monitoring on Wednesday 16 September 2020 at 392 Henry Lawson Drive

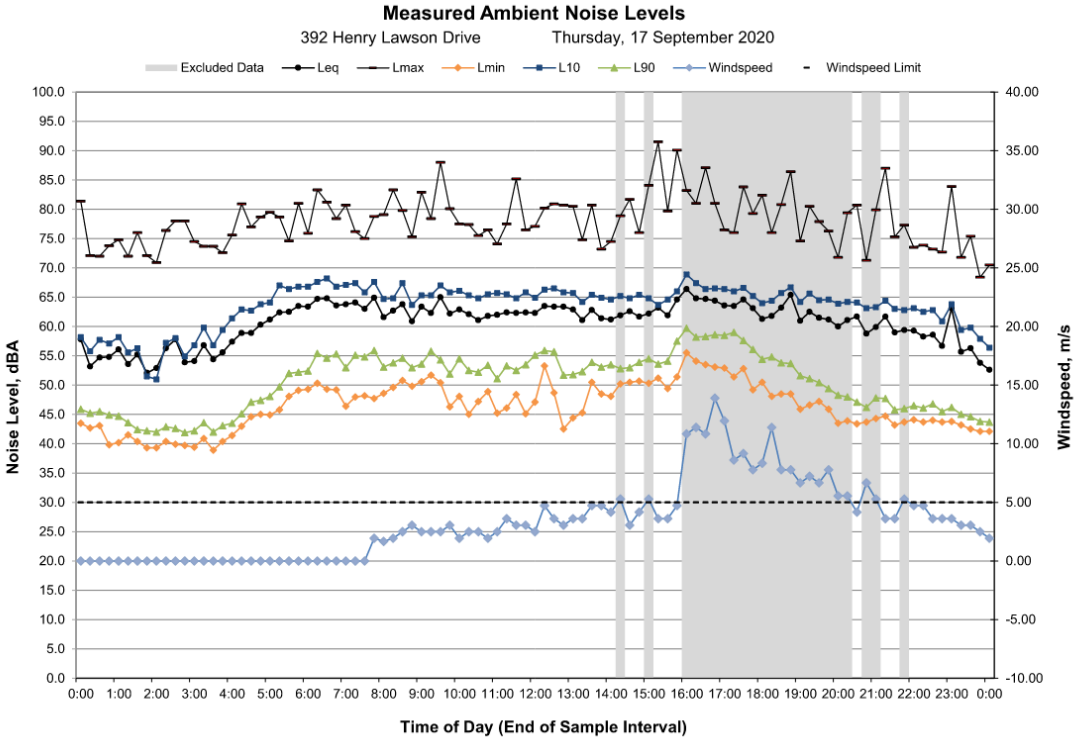

Figure B2 Long-term monitoring on Thursday, 17 September 2020 at 392 Henry Lawson Drive

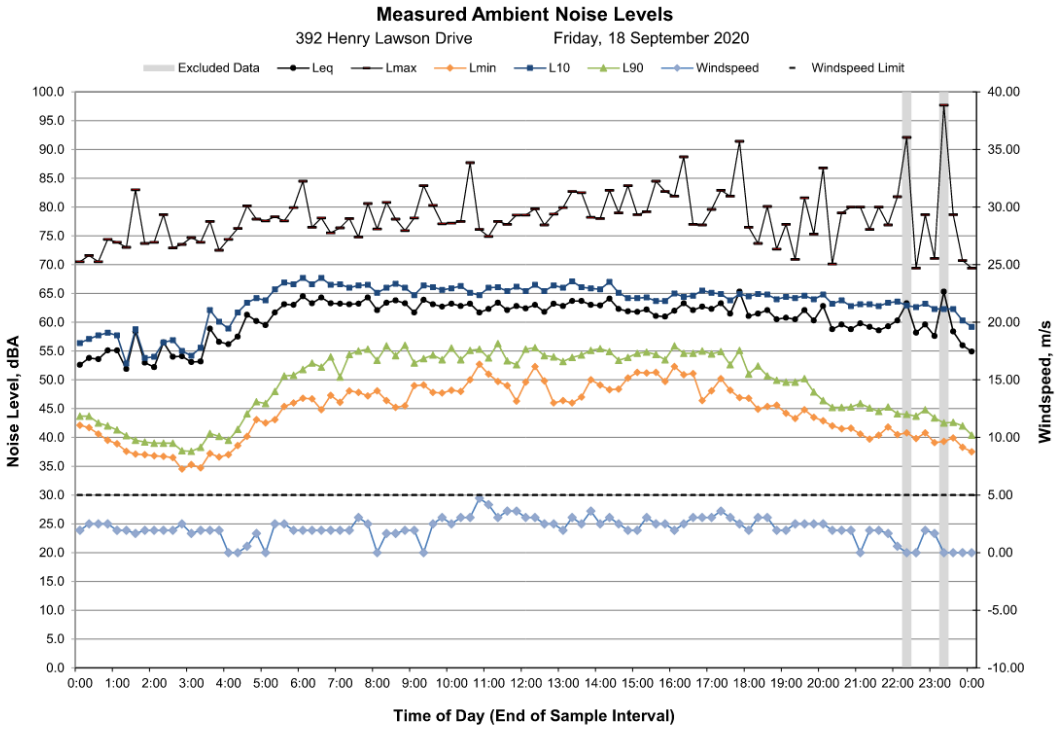

Figure B3 Long-term monitoring on Friday, 18 September 2020 at 392 Henry Lawson Drive

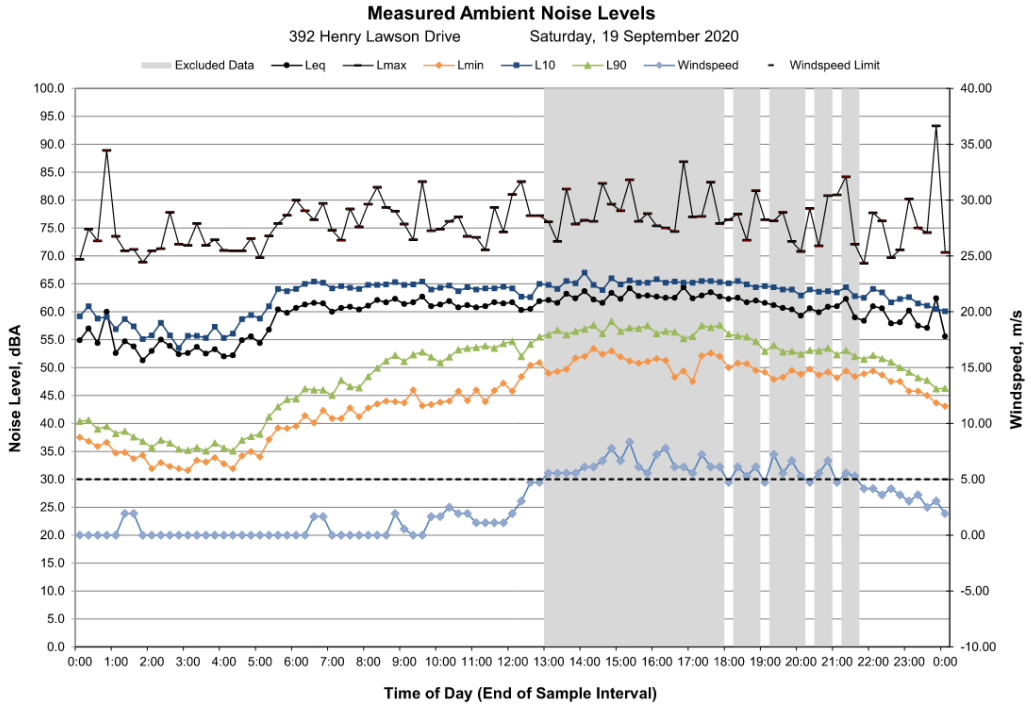

Figure B4 Long-term monitoring on Saturday, 19 September 2020 at 392 Henry Lawson Drive

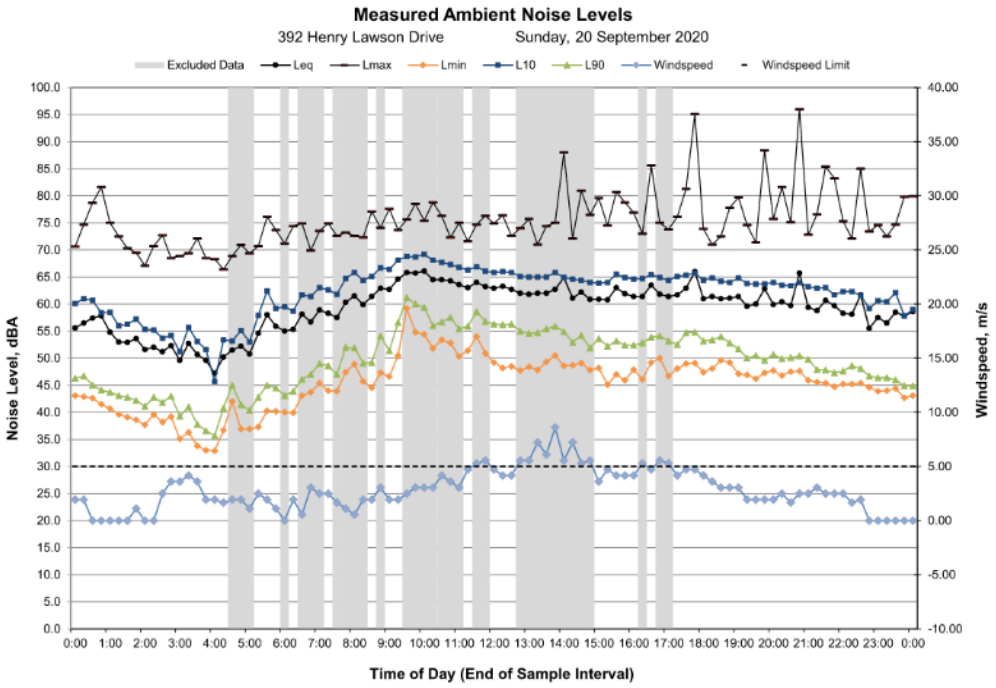

Figure B5 Long-term monitoring on Sunday, 20 September 2020 at 392 Henry Lawson Drive

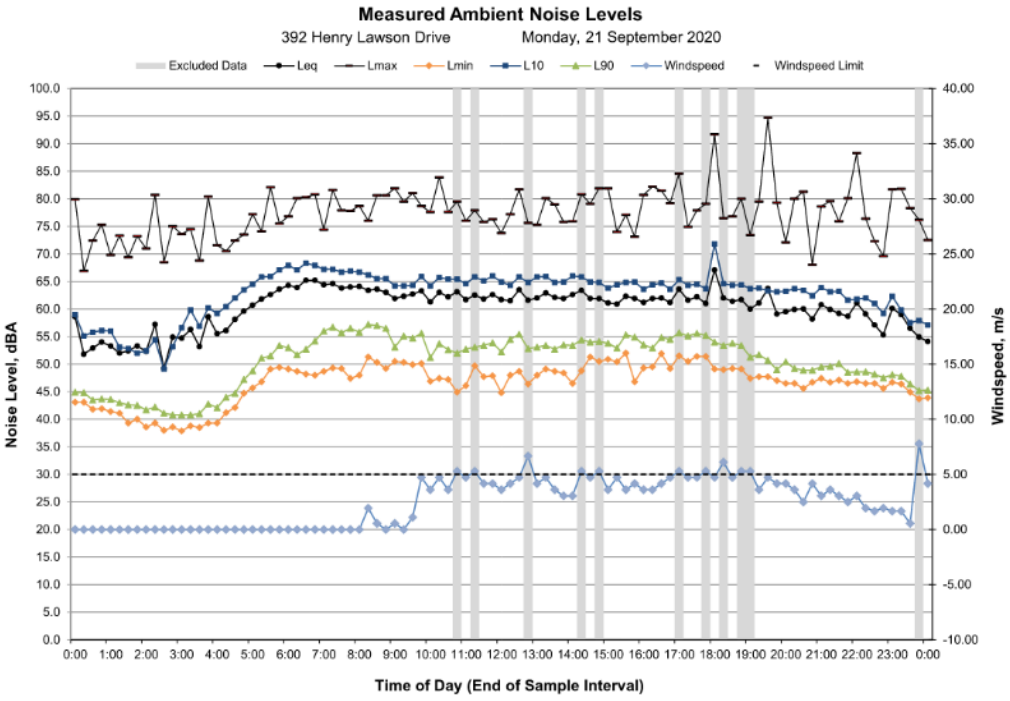

Figure B6 Long-term monitoring on Monday, 21 September 2020 at 392 Henry Lawson Drive

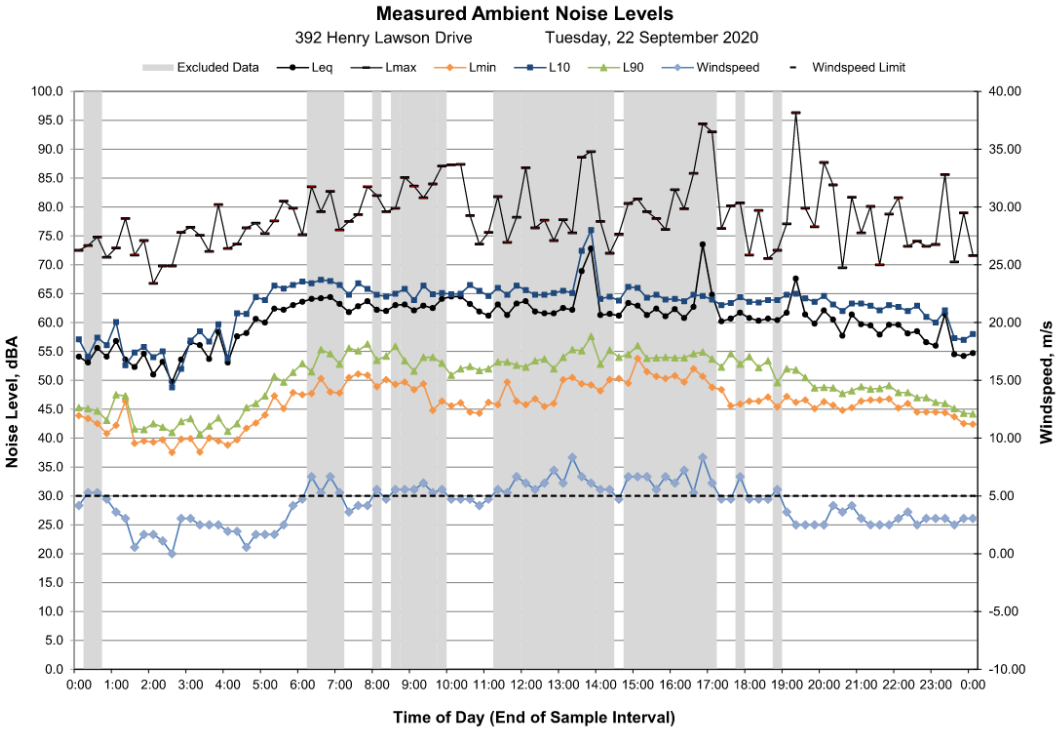

Figure B7 Long-term monitoring on Tuesday, 22 September 2020 at 392 Henry Lawson Drive

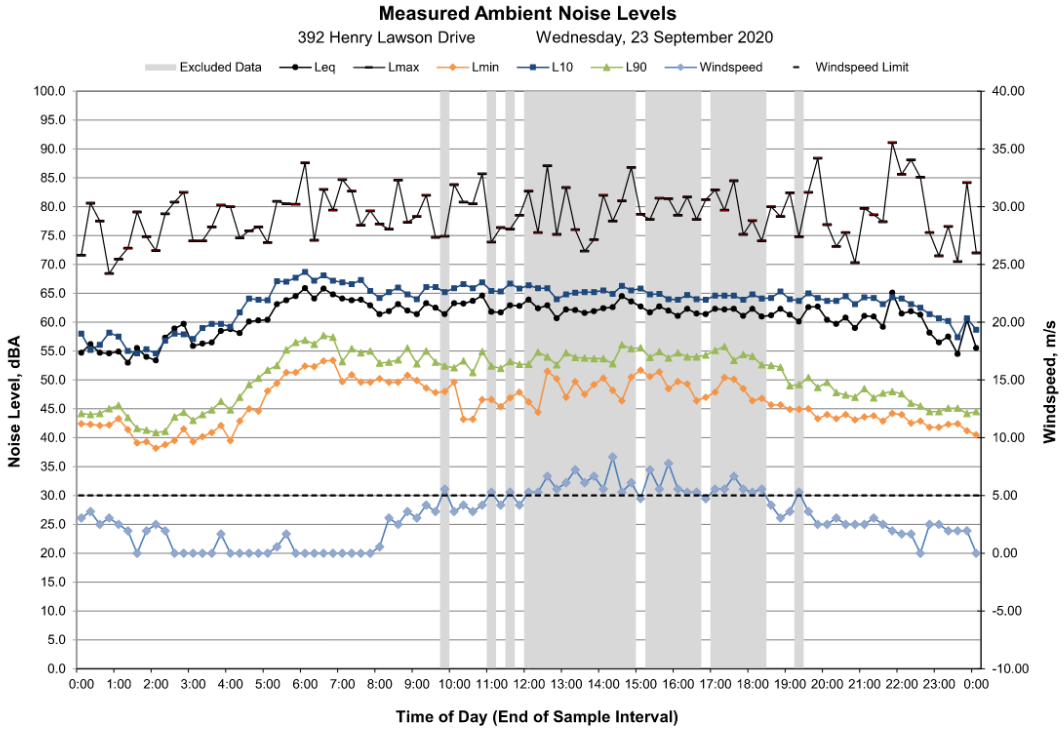

Figure B8 Long-term monitoring on Wednesday, 23 September 2020 at 392 Henry Lawson Drive

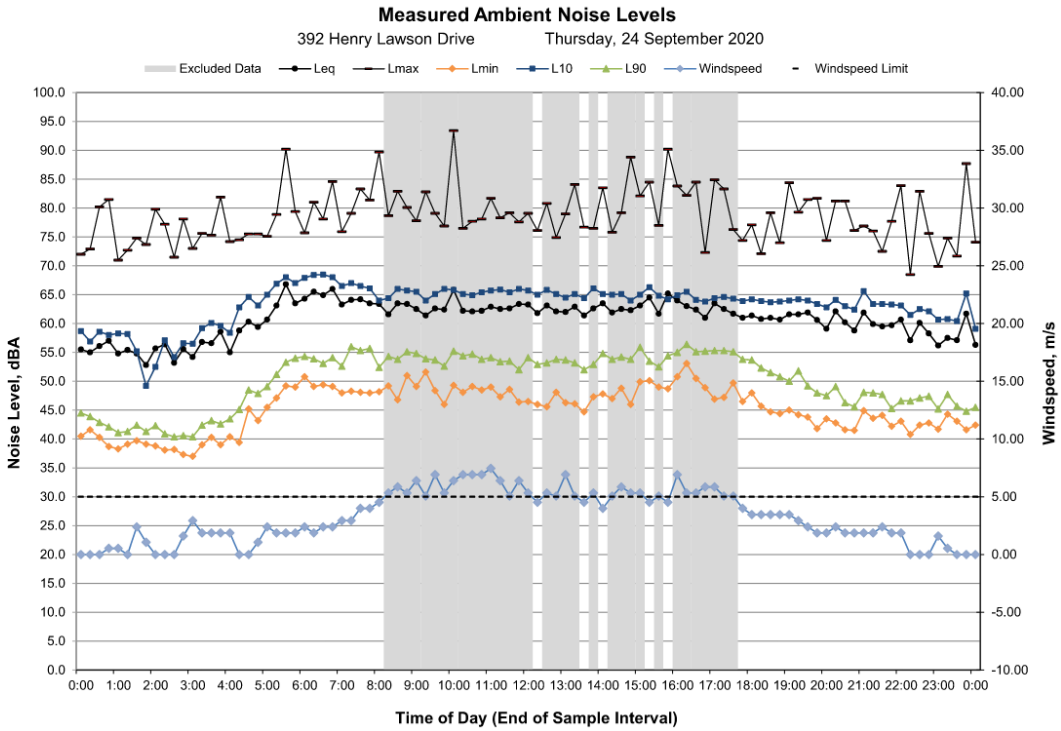

Figure B9 Long-term monitoring on Thursday, 24 September 2020 at 392 Henry Lawson Drive

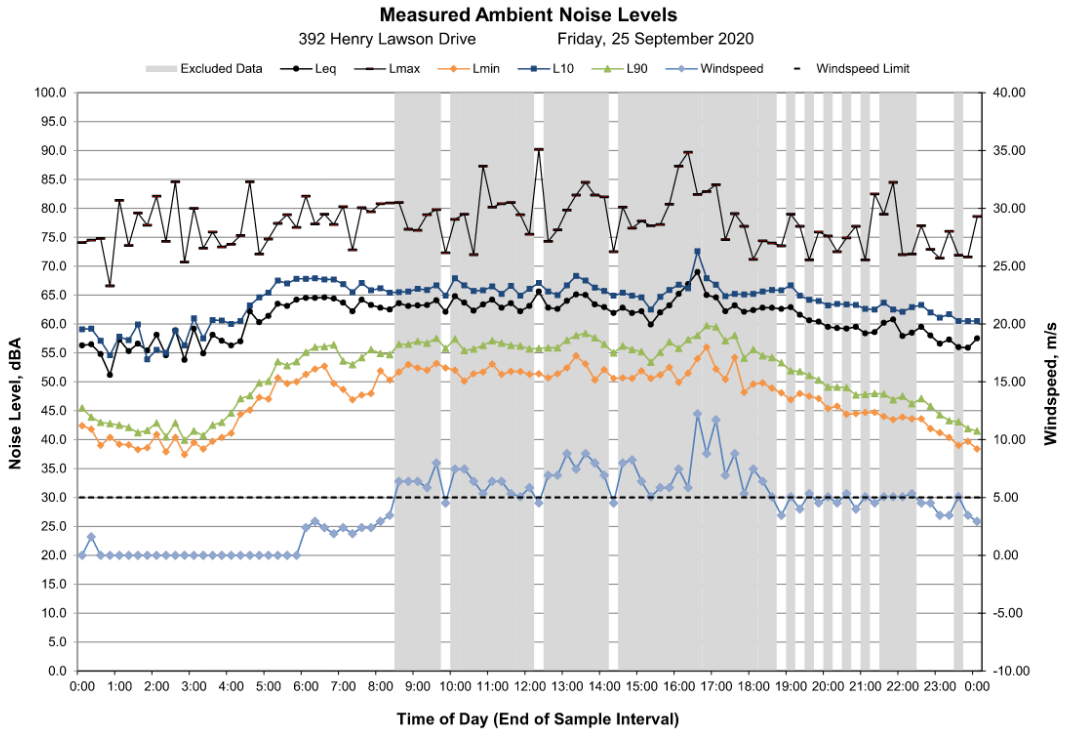

Figure B10 Long-term monitoring on Friday, 25 September 2020 at 392 Henry Lawson Drive

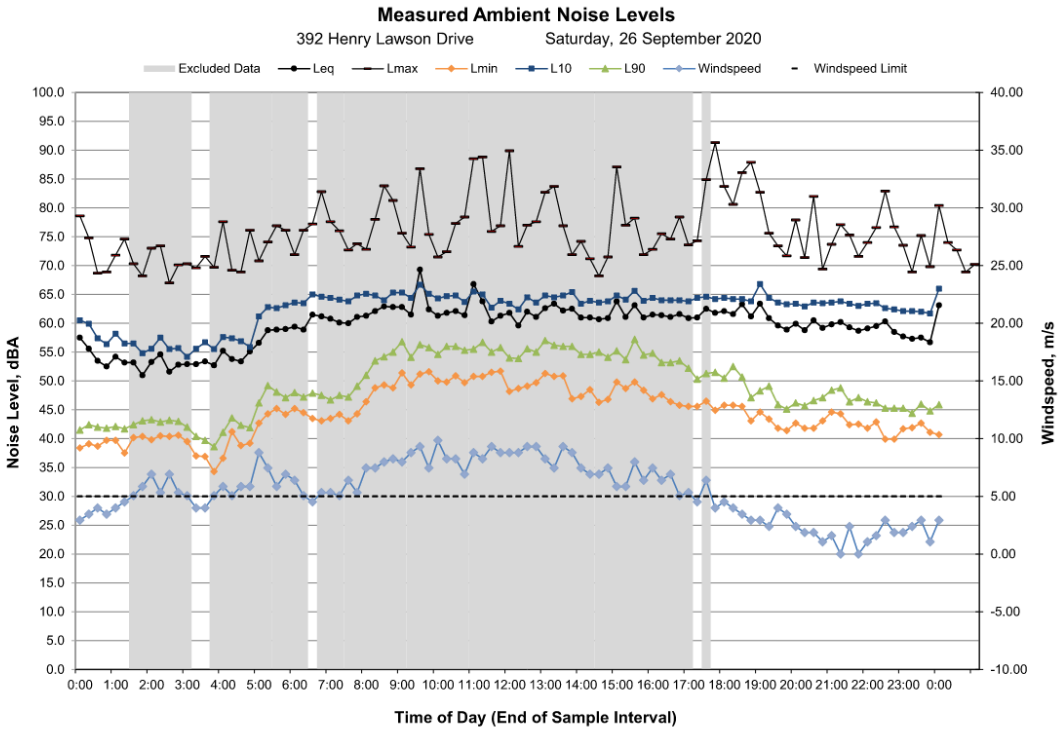

Figure B11 Long-term monitoring on Saturday, 26 September 2020 at 392 Henry Lawson Drive

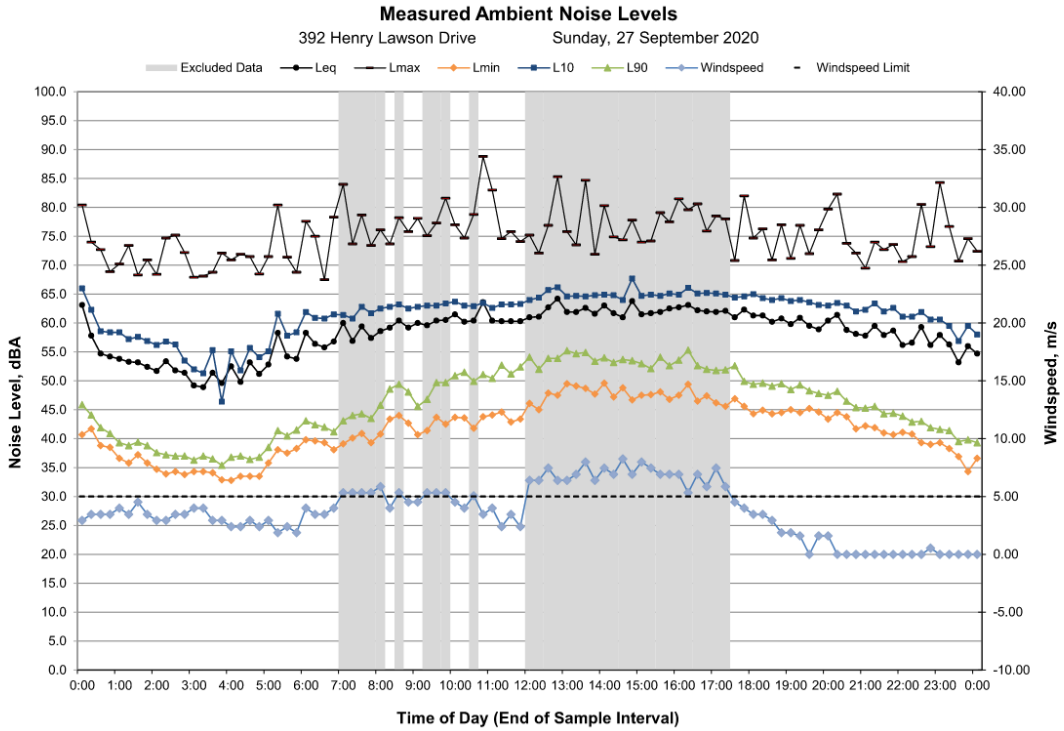

Figure B12 Long-term monitoring on Sunday, 27 September 2020 at 392 Henry Lawson Drive

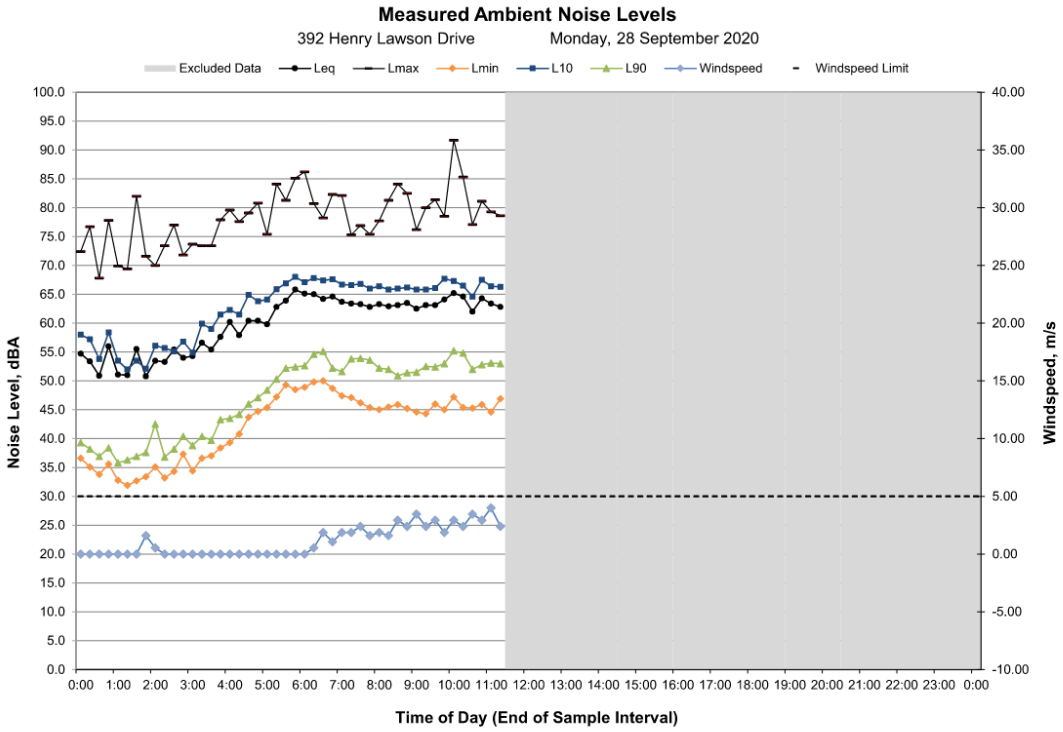

Figure B13 Long-term monitoring on Monday, 28 September 2020 at 392 Henry Lawson Drive

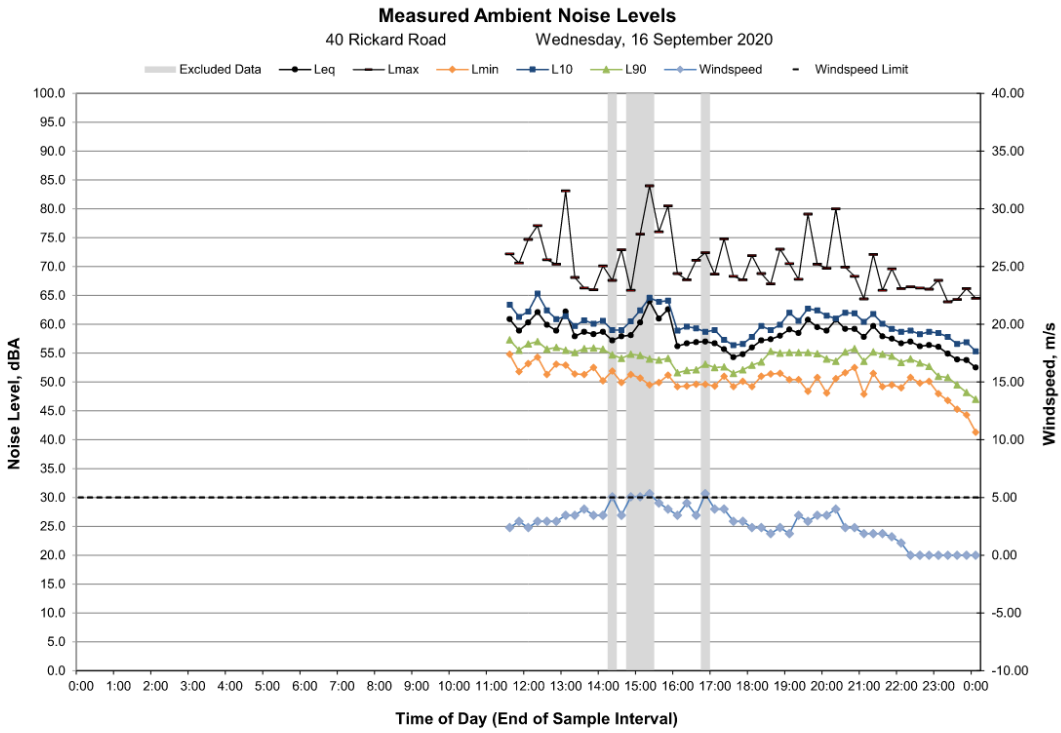

Figure B14 Long-term monitoring on Wednesday, 16 September 2020 at 40 Rickard Road

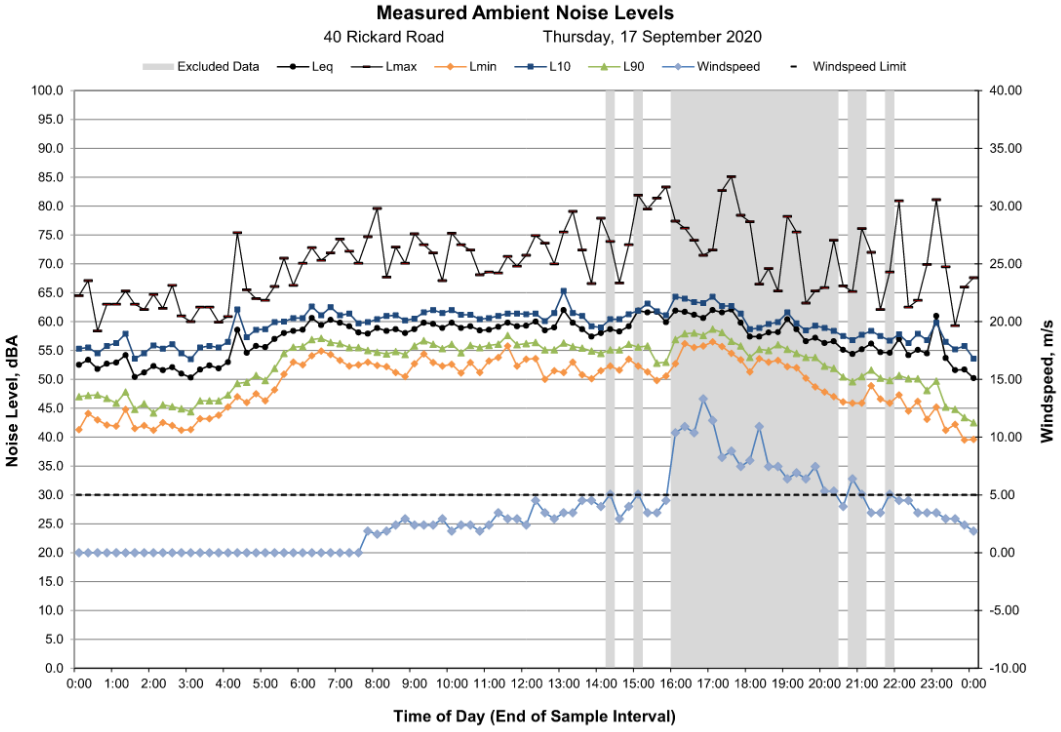

Figure B15 Long-term monitoring on Thursday, 17 September 2020 at 40 Rickard Road

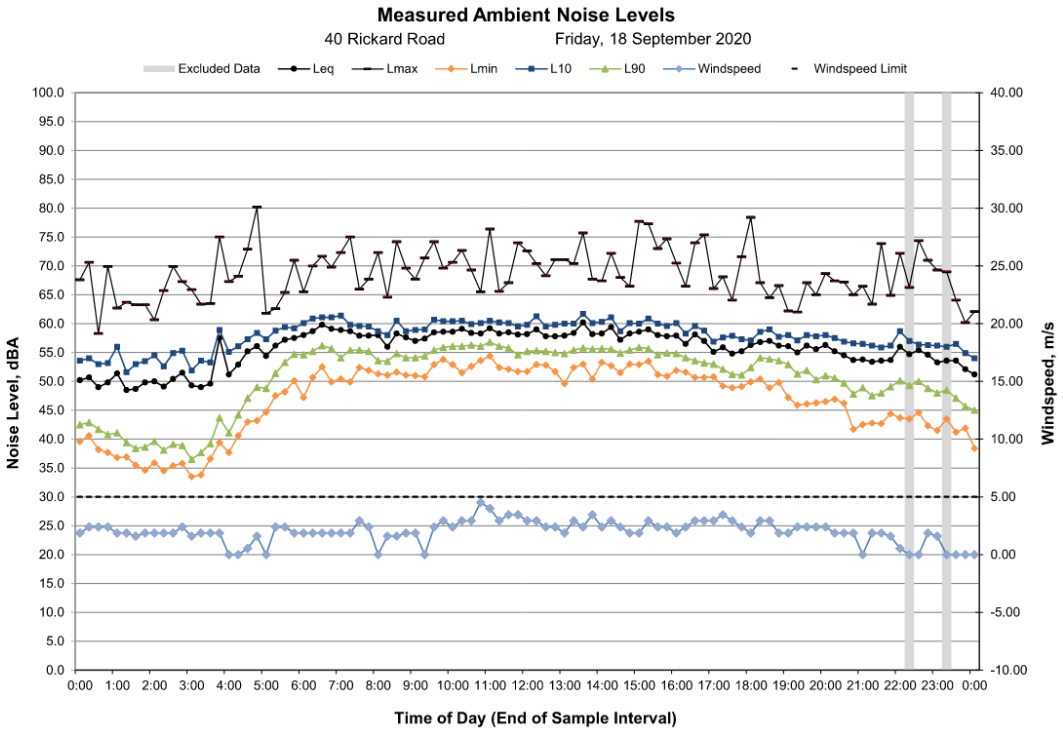

Figure B16 Long-term monitoring on Friday, 18 September 2020 at 40 Rickard Road

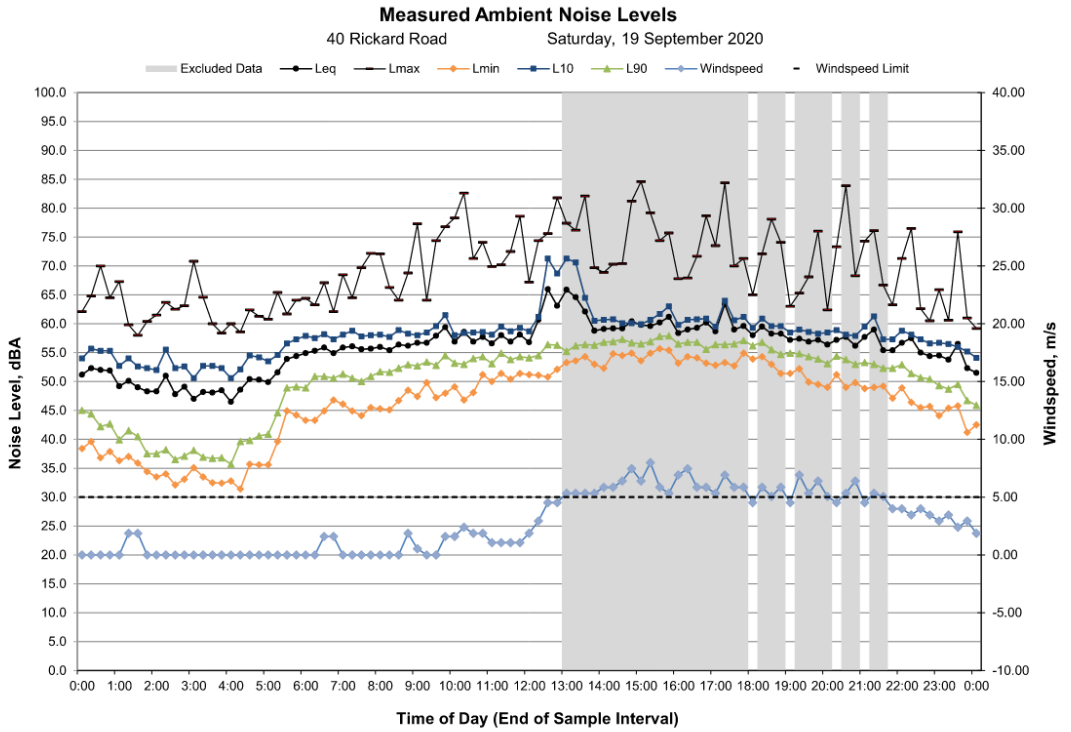

Figure B17 Long-term monitoring on Saturday, 19 September 2020 at 40 Rickard Road

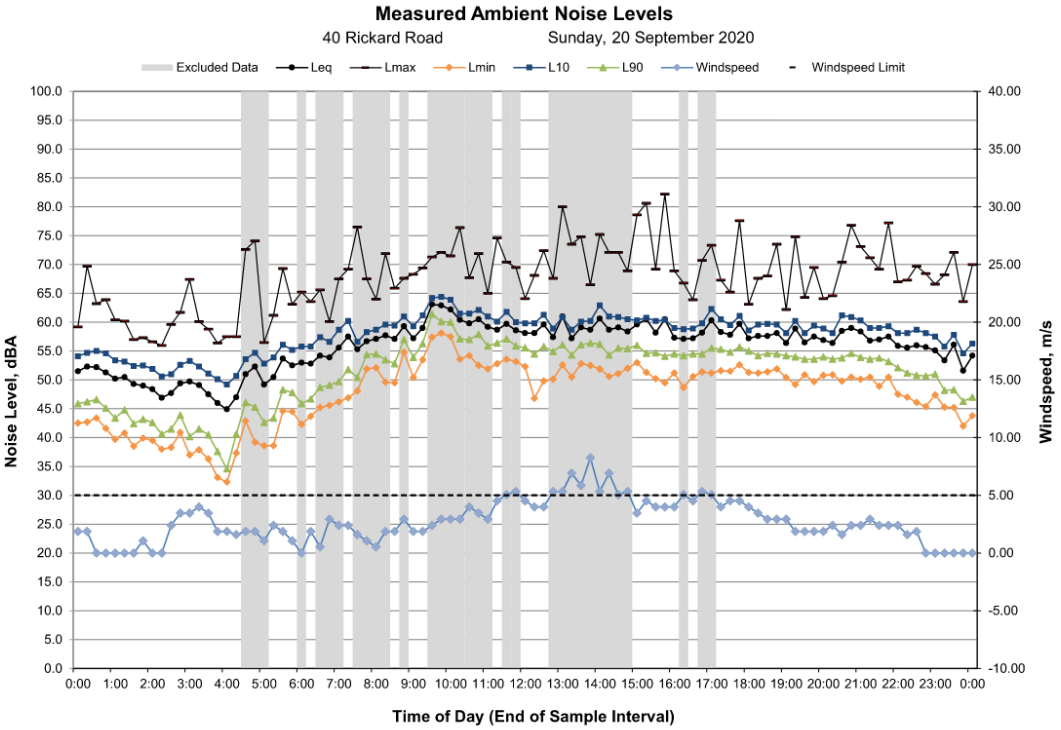

Figure B18 Long-term monitoring on Sunday, 20 September 2020 at 40 Rickard Road

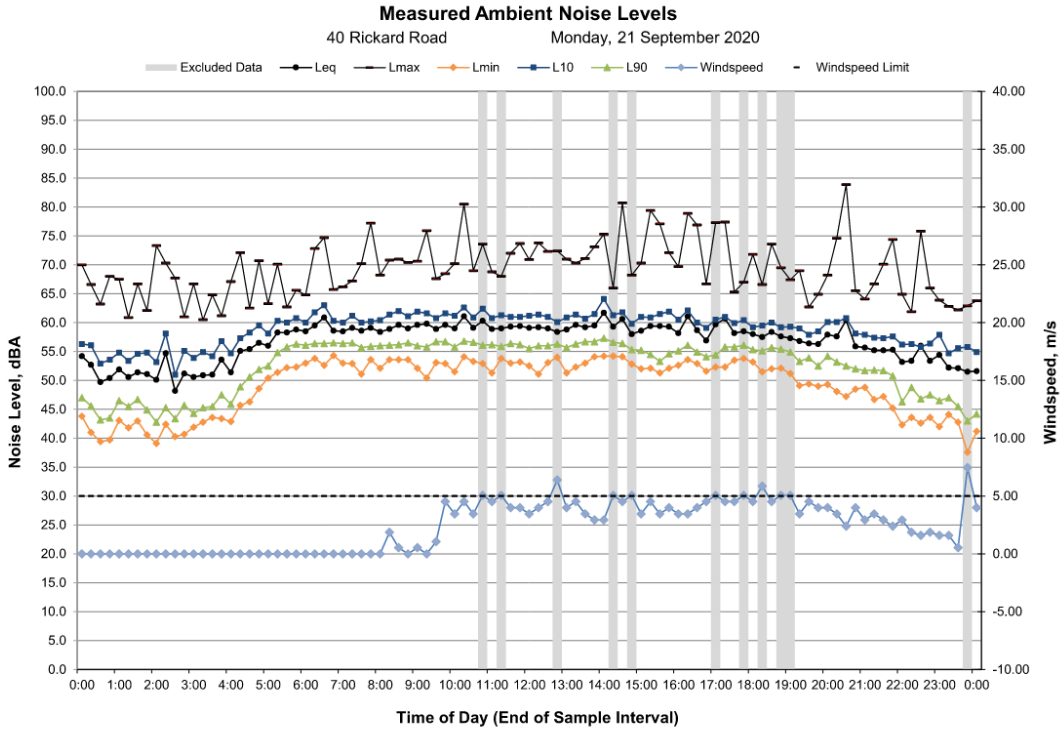

Figure B19 Long-term monitoring on Monday, 21 September 2020 at 40 Rickard Road

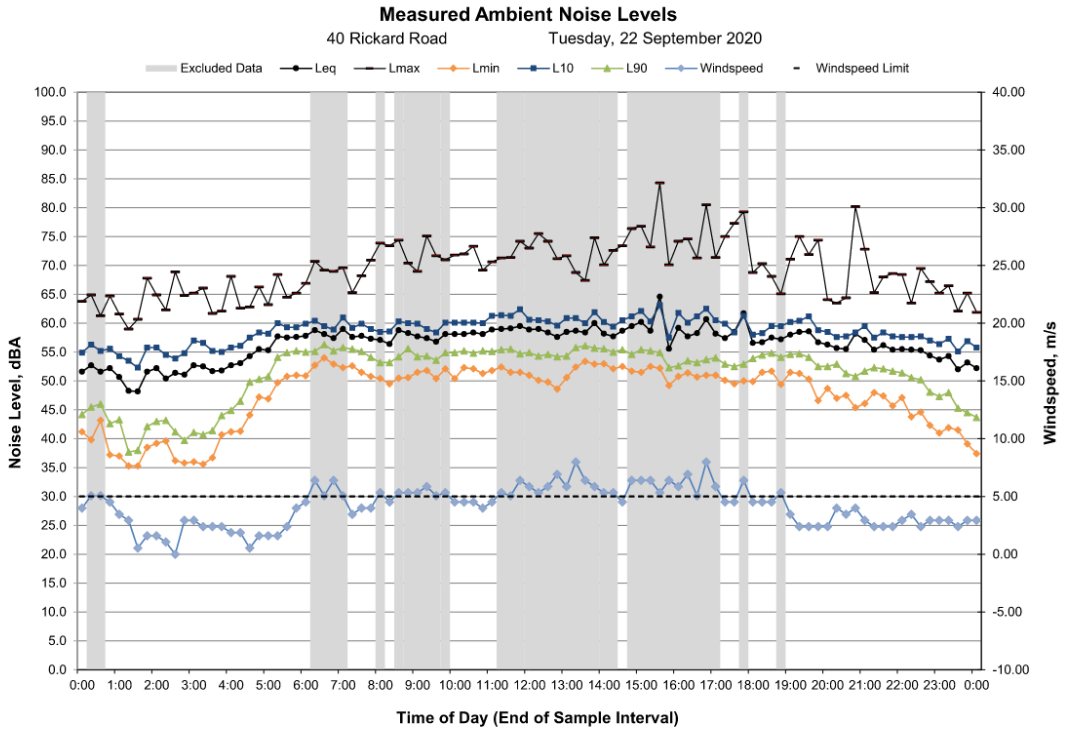

Figure B20 Long-term monitoring on Tuesday, 22 September 2020 at 40 Rickard Road

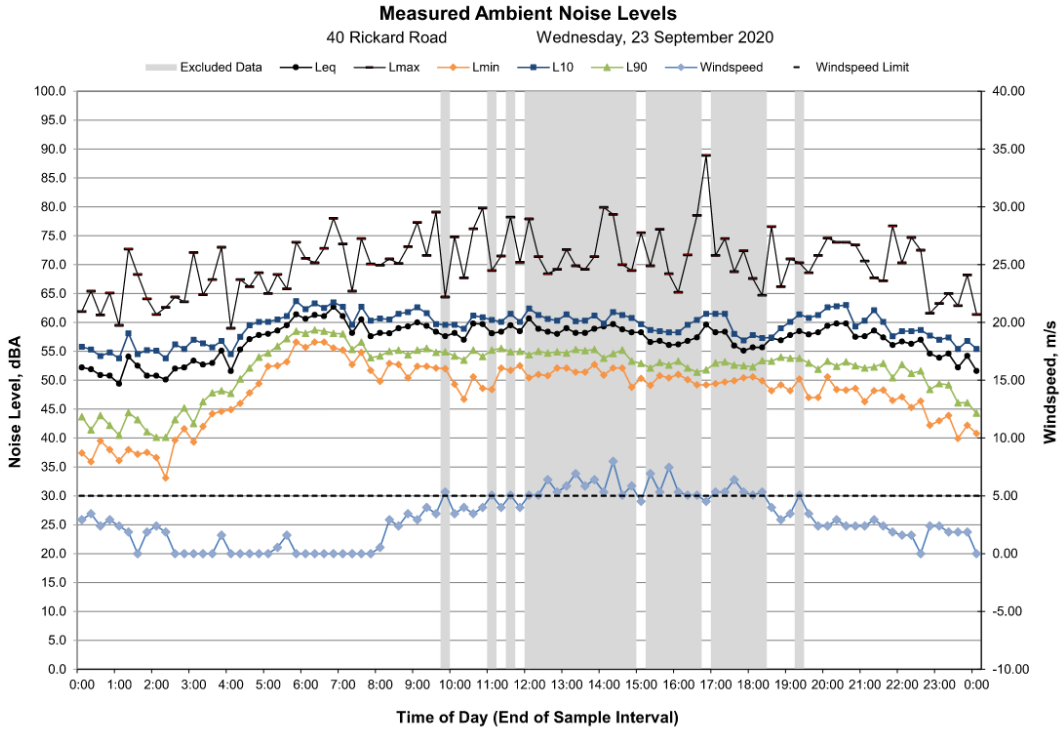

Figure B21 Long-term monitoring on Wednesday, 23 September 2020 at 40 Rickard Road

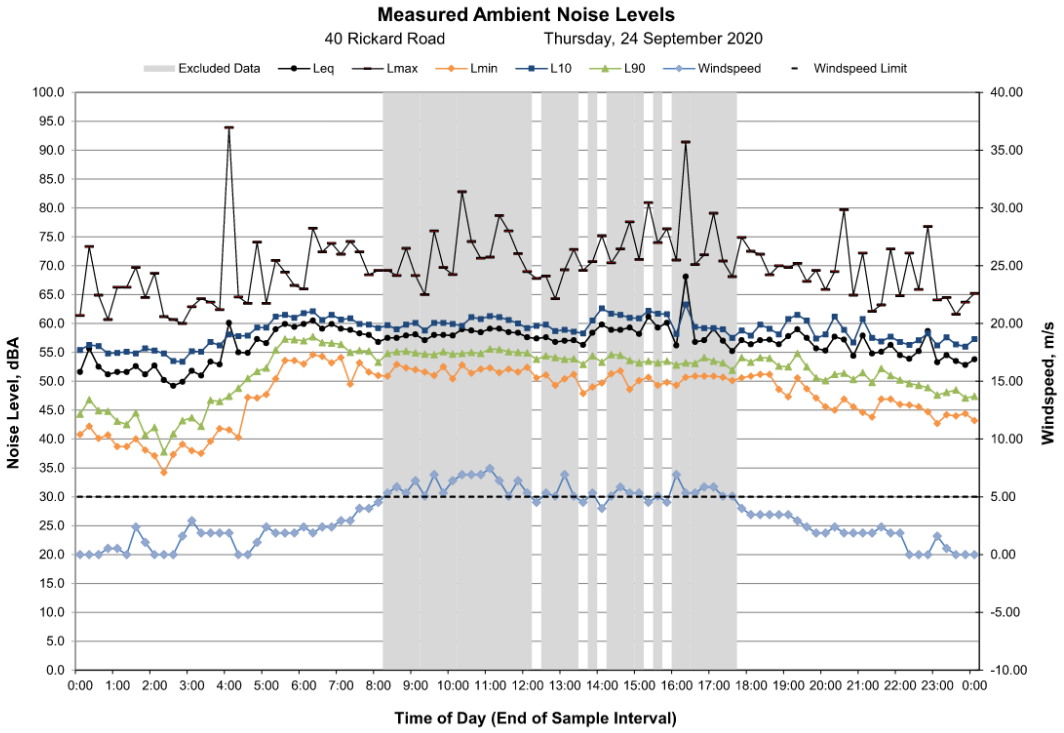

Figure B22 Long-term monitoring on Thursday, 24 September 2020 at 40 Rickard Road

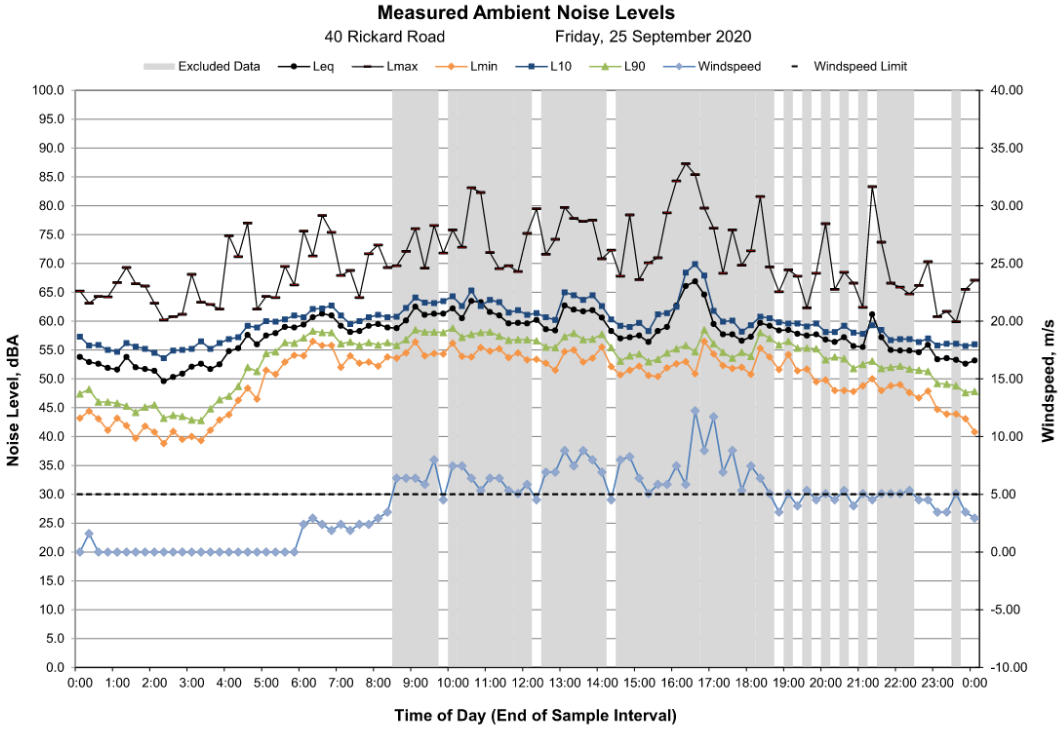

Figure B23 Long-term monitoring on Friday, 25 September 2020 at 40 Rickard Road

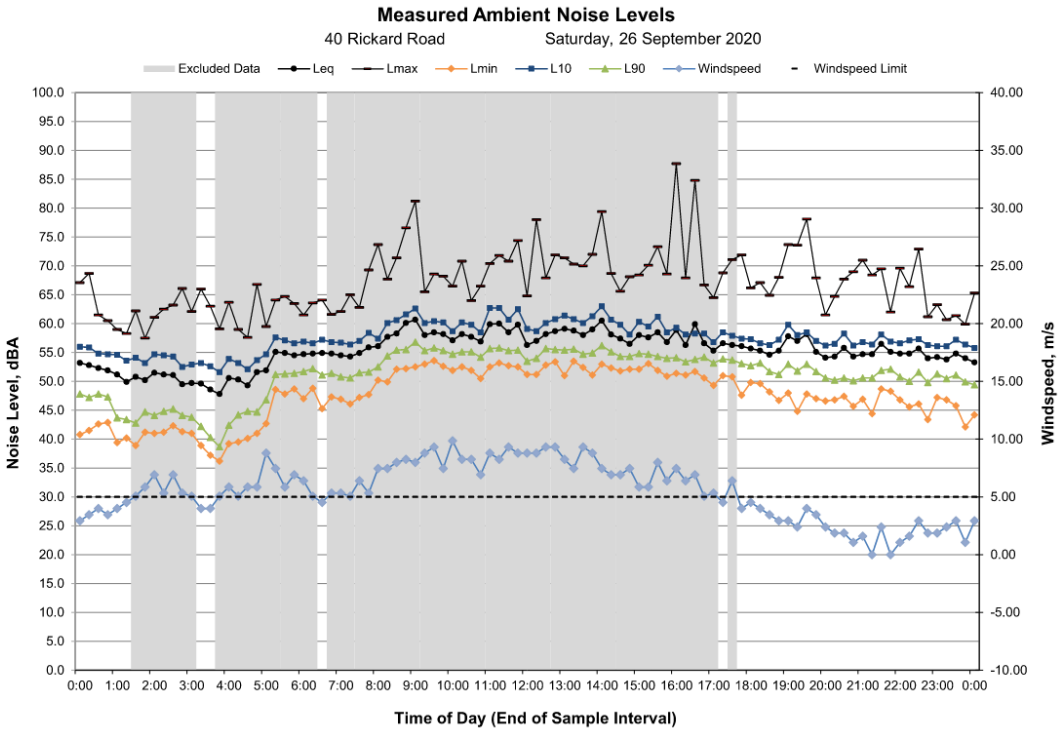

Figure B24 Long-term monitoring on Saturday, 26 September 2020 at 40 Rickard Road

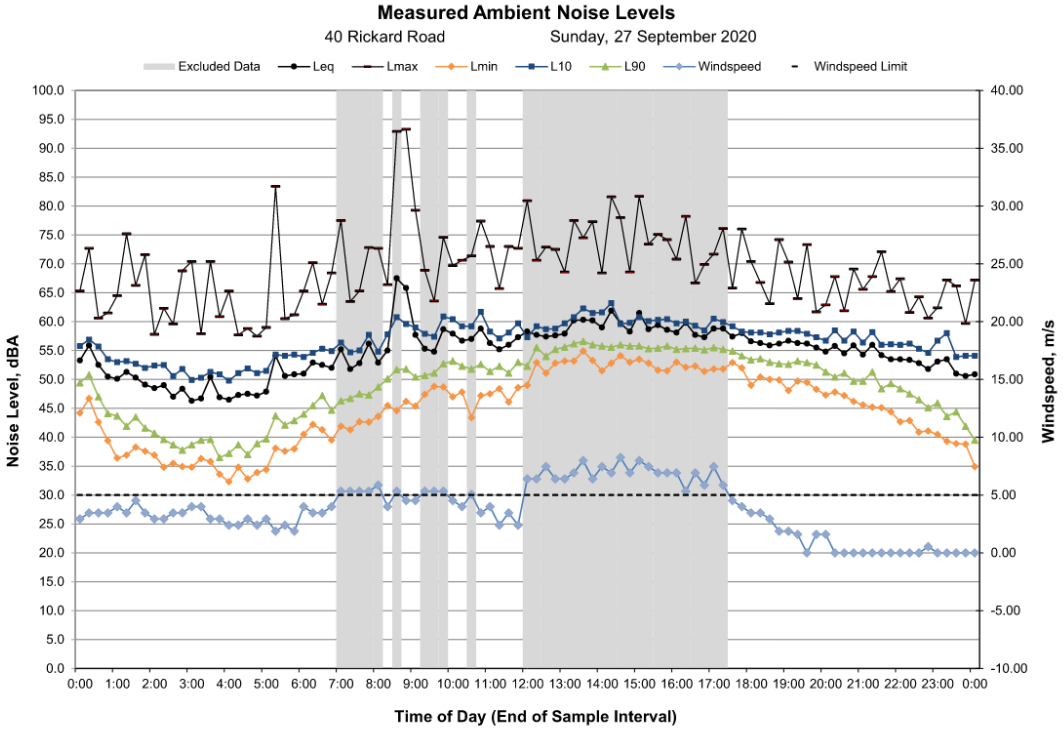

Figure B25 Long-term monitoring on Sunday, 27 September 2020 at 40 Rickard Road

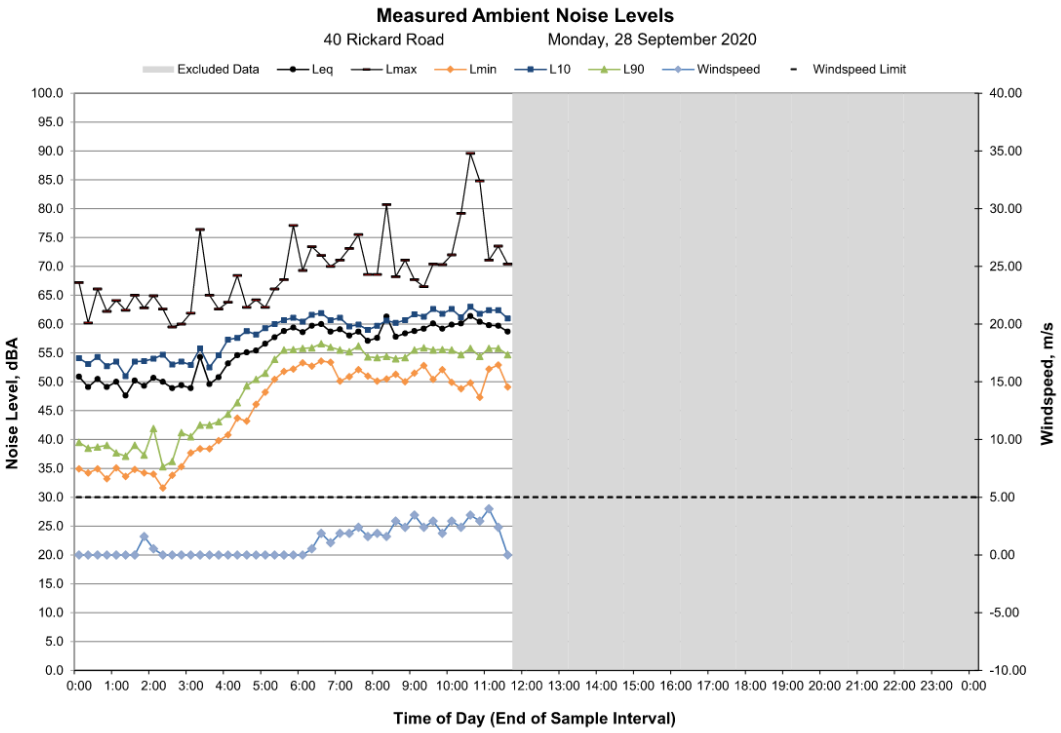

Figure B26 Long-term monitoring on Monday, 28 September 2020 at 40 Rickard Road

Appendix C
Construction Noise Predictions

Table C1 Predicted construction noise levels for construction activities Part 1

Receiver	Approximate Distance from Construction Footprint (m)	NMLs			Preliminary Works				Utility works				Building and fencing removal				Earthworks				Widening and pavement works			
					Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML		
					112	D	E	N	119	D	E	N	118	D	E	N	120	D	E	N	123	D	E	N
		Day (D)	Evening (E)	Night (N)	Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)			
NCA 1																								
3 Arthur Street	297	63	57	46	55	-8	-2	9	62	-1	5	16	61	-2	4	15	63	0	6	17	65	2	8	19
34 Rickard Road	97	63	57	46	65	2	8	19	72	9	15	26	71	8	14	25	72	9	15	26	75	12	18	29
38 Rickard Road	97	63	57	46	65	2	8	19	72	9	15	26	71	8	14	25	72	9	15	26	75	12	18	29
40 Rickard Road	97	63	57	46	65	2	8	19	72	9	15	26	71	8	14	25	72	9	15	26	75	12	18	29
42 Rickard Road	97	63	57	46	65	2	8	19	72	9	15	26	71	8	14	25	72	9	15	26	75	12	18	29
31 Rickard Road	180	63	57	46	59	-4	2	13	66	3	9	20	65	2	8	19	67	4	10	21	69	6	12	23
39-41 Rickard Road	186	63	57	46	59	-4	2	13	66	3	9	20	65	2	8	19	67	4	10	21	69	6	12	23
47 Rickard Road	184	63	57	46	59	-4	2	13	66	3	9	20	65	2	8	19	67	4	10	21	69	6	12	23
60 Rickard Road	94	63	57	46	65	2	8	19	72	9	15	26	71	8	14	25	73	10	16	27	75	12	18	29
62 Rickard Road	94	63	57	46	65	2	8	19	72	9	15	26	71	8	14	25	73	10	16	27	75	12	18	29
78 Rickard Road	107	63	57	46	64	1	7	18	71	8	14	25	70	7	13	24	72	9	15	26	74	11	17	28
15 Newbridge Road	248	63	57	46	57	-6	0	11	64	1	7	18	62	-1	5	16	64	1	7	18	67	4	10	21
23 Newbridge Road	218	63	57	46	58	-5	1	12	65	2	8	19	64	1	7	18	65	2	8	19	68	5	11	22
21 Newbridge Road	286	63	57	46	55	-8	-2	9	62	-1	5	16	61	-2	4	15	63	0	6	17	65	2	8	19
27 Newbridge Road	291	63	57	46	55	-8	-2	9	62	-1	5	16	61	-2	4	15	63	0	6	17	65	2	8	19
39 Newbridge Road	350	63	57	46	54	-9	-3	8	61	-2	4	15	59	-4	2	13	61	-2	4	15	64	1	7	18
70 Newbridge Road	512	63	57	46	50	-13	-7	4	57	-6	0	11	56	-7	-1	10	58	-5	1	12	60	-3	3	14
62 Newbridge Road	474	63	57	46	51	-12	-6	5	58	-5	1	12	57	-6	0	11	59	-4	2	13	61	-2	4	15
60 Newbridge Road	467	63	57	46	51	-12	-6	5	58	-5	1	12	57	-6	0	11	59	-4	2	13	61	-2	4	15
44 Newbridge Road	395	63	57	46	52	-11	-5	6	59	-4	2	13	58	-5	1	12	60	-3	3	14	63	0	6	17
42a Newbridge Road	369	63	57	46	53	-10	-4	7	60	-3	3	14	59	-4	2	13	61	-2	4	15	63	0	6	17
40 Newbridge Road	358	63	57	46	53	-10	-4	7	60	-3	3	14	59	-4	2	13	61	-2	4	15	63	0	6	17
42 Newbridge Road	380	63	57	46	53	-10	-4	7	60	-3	3	14	59	-4	2	13	61	-2	4	15	63	0	6	17
30 Newbridge Road	322	63	57	46	54	-9	-3	8	61	-2	4	15	60	-3	3	14	62	-1	5	16	64	1	7	18
26 Newbridge Road	287	63	57	46	55	-8	-2	9	62	-1	5	16	61	-2	4	15	63	0	6	17	65	2	8	19
22 Newbridge Road	274	63	57	46	56	-7	-1	10	63	0	6	17	62	-1	5	16	63	0	6	17	66	3	9	20
20 Newbridge Road	250	63	57	46	56	-7	-1	10	63	0	6	17	62	-1	5	16	64	1	7	18	67	4	10	21
14 Newbridge Road	213	63	57	46	58	-5	1	12	65	2	8	19	64	1	7	18	66	3	9	20	68	5	11	22
12 Newbridge Road	158	63	57	46	60	-3	3	14	67	4	10	21	66	3	9	20	68	5	11	22	71	8	14	25
10 Newbridge Road	144	63	57	46	61	-2	4	15	68	5	11	22	67	4	10	21	69	6	12	23	71	8	14	25
6 Newbridge Road	115	63	57	46	63	0	6	17	70	7	13	24	69	6	12	23	71	8	14	25	73	10	16	27
NCA 2																								
2/386 Henry Lawson Drive	54	62	53	46	70	8	17	24	77	15	24	31	76	13	19	30	78	16	25	32	80	18	27	34
384 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
386 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
388 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69

Receiver	Approximate Distance from Construction Footprint (m)	NMLs			Preliminary Works				Utility works				Building and fencing removal				Earthworks				Widening and pavement works			
					Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML		
					112	D	E	N	119	D	E	N	118	D	E	N	120	D	E	N	123	D	E	N
		Day (D)	Evening (E)	Night (N)	Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)			
388A Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
390 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
392 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
394 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
396 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
398 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
402 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
404 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
406 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
3 Auld Ave	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
5 Auld Ave	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
7 Auld Ave	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
9A Auld Ave	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
13 Auld Ave	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
13 Auld Ave	22	62	53	46	78	16	25	32	85	23	32	39	84	21	27	38	85	23	32	39	88	26	35	42
15 Auld Ave	22	62	53	46	78	16	25	32	85	23	32	39	84	21	27	38	85	23	32	39	88	26	35	42
19 Auld Ave	168	62	53	46	60	-2	7	14	67	5	14	21	66	3	9	20	68	6	15	22	70	8	17	24
443 Henry Lawson Drive	1	62	53	46	104	42	51	58	111	49	58	65	110	47	53	64	112	50	59	66	115	53	62	69
Open Space																								
Bankstown Golf Course	1	65	-	-	104	39	-	-	111	49	-	-	110	47	-	-	112	50	-	-	115	52	-	-
Georges River Golf Course	1	65	-	-	104	39	-	-	111	49	-	-	110	47	-	-	112	50	-	-	115	52	-	-
Gordon Parker Reserve	52	65	-	-	70	5	-	-	77	15	-	-	76	13	-	-	78	16	-	-	80	17	-	-
Vale of Ah Reserve	257	65	-	-	56	-9	-	-	63	1	-	-	62	-1	-	-	64	2	-	-	66	3	-	-
Vale of Ah Dog Park	252	65	-	-	56	-9	-	-	63	1	-	-	62	-1	-	-	64	2	-	-	67	4	-	-
Georges River Walking Trail	1	65	-	-	104	39	-	-	111	49	-	-	110	47	-	-	112	50	-	-	115	52	-	-

Table C2 Predicted construction noise levels for construction activities Part 2

Receiver	Approximate Distance from Construction Footprint (m)	NMLs			Bridge and Drainage Works				Pedestrian pathway, intersection crossing and shared path works				Intersection configuration and traffic signals				Landscaping and finishing works				Removal of ancillary facilities and site rehabilitation			
					Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML		
					123	D	E	N	121	D	E	N	118	D	E	N	120	D	E	N	114	D	E	N
		Day (D)	Evening (E)	Night (N)	Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)			
NCA 1																								
3 Arthur Street	297	63	57	46	66	3	9	20	64	1	7	18	61	-2	4	15	62	-1	5	16	56	-7	-1	10
34 Rickard Road	97	63	57	46	75	12	18	29	74	11	17	28	71	8	14	25	72	9	15	26	66	3	9	20
38 Rickard Road	97	63	57	46	75	12	18	29	74	11	17	28	71	8	14	25	72	9	15	26	66	3	9	20
40 Rickard Road	97	63	57	46	75	12	18	29	74	11	17	28	71	8	14	25	72	9	15	26	66	3	9	20
42 Rickard Road	97	63	57	46	75	12	18	29	74	11	17	28	71	8	14	25	72	9	15	26	66	3	9	20
31 Rickard Road	180	63	57	46	70	7	13	24	68	5	11	22	65	2	8	19	67	4	10	21	61	-2	4	15
39-41 Rickard Road	186	63	57	46	70	7	13	24	68	5	11	22	65	2	8	19	66	3	9	20	60	-3	3	14
47 Rickard Road	184	63	57	46	70	7	13	24	68	5	11	22	65	2	8	19	67	4	10	21	61	-2	4	15
60 Rickard Road	94	63	57	46	76	13	19	30	74	11	17	28	71	8	14	25	72	9	15	26	66	3	9	20
62 Rickard Road	94	63	57	46	76	13	19	30	74	11	17	28	71	8	14	25	72	9	15	26	66	3	9	20
78 Rickard Road	107	63	57	46	74	11	17	28	73	10	16	27	70	7	13	24	71	8	14	25	65	2	8	19
15 Newbridge Road	248	63	57	46	67	4	10	21	65	2	8	19	63	0	6	17	64	1	7	18	58	-5	1	12
23 Newbridge Road	218	63	57	46	68	5	11	22	67	4	10	21	64	1	7	18	65	2	8	19	59	-4	2	13
21 Newbridge Road	286	63	57	46	66	3	9	20	64	1	7	18	61	-2	4	15	63	0	6	17	57	-6	0	11
27 Newbridge Road	291	63	57	46	66	3	9	20	64	1	7	18	61	-2	4	15	63	0	6	17	57	-6	0	11
39 Newbridge Road	350	63	57	46	64	1	7	18	62	-1	5	16	60	-3	3	14	61	-2	4	15	55	-8	-2	9
70 Newbridge Road	512	63	57	46	61	-2	4	15	59	-4	2	13	56	-7	-1	10	58	-5	1	12	52	-11	-5	6
62 Newbridge Road	474	63	57	46	61	-2	4	15	60	-3	3	14	57	-6	0	11	58	-5	1	12	52	-11	-5	6
60 Newbridge Road	467	63	57	46	62	-1	5	16	60	-3	3	14	57	-6	0	11	58	-5	1	12	52	-11	-5	6
44 Newbridge Road	395	63	57	46	63	0	6	17	61	-2	4	15	59	-4	2	13	60	-3	3	14	54	-9	-3	8
42a Newbridge Road	369	63	57	46	64	1	7	18	62	-1	5	16	59	-4	2	13	60	-3	3	14	54	-9	-3	8
40 Newbridge Road	358	63	57	46	64	1	7	18	62	-1	5	16	59	-4	2	13	61	-2	4	15	55	-8	-2	9
42 Newbridge Road	380	63	57	46	63	0	6	17	62	-1	5	16	59	-4	2	13	60	-3	3	14	54	-9	-3	8
30 Newbridge Road	322	63	57	46	65	2	8	19	63	0	6	17	60	-3	3	14	62	-1	5	16	56	-7	-1	10
26 Newbridge Road	287	63	57	46	66	3	9	20	64	1	7	18	61	-2	4	15	63	0	6	17	57	-6	0	11
22 Newbridge Road	274	63	57	46	66	3	9	20	65	2	8	19	62	-1	5	16	63	0	6	17	57	-6	0	11
20 Newbridge Road	250	63	57	46	67	4	10	21	65	2	8	19	63	0	6	17	64	1	7	18	58	-5	1	12
14 Newbridge Road	213	63	57	46	68	5	11	22	67	4	10	21	64	1	7	18	65	2	8	19	59	-4	2	13
12 Newbridge Road	158	63	57	46	71	8	14	25	69	6	12	23	66	3	9	20	68	5	11	22	62	-1	5	16
10 Newbridge Road	144	63	57	46	72	9	15	26	70	7	13	24	67	4	10	21	69	6	12	23	63	0	6	17
6 Newbridge Road	115	63	57	46	74	11	17	28	72	9	15	26	69	6	12	23	71	8	14	25	65	2	8	19
NCA 2																								
2/386 Henry Lawson Drive	54	62	53	46	80	18	27	34	79	17	26	33	76	14	23	30	77	15	24	31	71	9	18	25
384 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
386 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60

Receiver	Approximate Distance from Construction Footprint (m)	NMLs			Bridge and Drainage Works				Pedestrian pathway, intersection crossing and shared path works				Intersection configuration and traffic signals				Landscaping and finishing works				Removal of ancillary facilities and site rehabilitation			
					Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML			Total SWL	Exceedance of NML		
					123	D	E	N	121	D	E	N	118	D	E	N	120	D	E	N	114	D	E	N
		Day (D)	Evening (E)	Night (N)	Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)				Predicted SPL (dBA)			
388 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
388A Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
390 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
392 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
394 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
396 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
398 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
402 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
404 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
406 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
3 Auld Ave	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
5 Auld Ave	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
7 Auld Ave	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
9A Auld Ave	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
13 Auld Ave	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
13 Auld Ave	22	62	53	46	88	26	35	42	87	25	34	41	84	22	31	38	85	23	32	39	79	17	26	33
15 Auld Ave	22	62	53	46	88	26	35	42	87	25	34	41	84	22	31	38	85	23	32	39	79	17	26	33
19 Auld Ave	168	62	53	46	70	8	17	24	69	7	16	23	66	4	13	20	67	5	14	21	61	-1	8	15
443 Henry Lawson Drive	1	62	53	46	115	53	62	69	113	51	60	67	110	48	57	64	112	50	59	66	106	44	53	60
Open Space																								
Bankstown Golf Course	1	65	-	-	115	50	-	-	113	50	-	-	110	45	-	-	112	47	-	-	106	41	-	-
Georges River Golf Course	1	65	-	-	115	50	-	-	113	50	-	-	110	45	-	-	112	47	-	-	106	41	-	-
Gordon Parker Reserve	52	65	-	-	81	16	-	-	79	16	-	-	76	11	-	-	78	13	-	-	71	6	-	-
Vale of Ah Reserve	257	65	-	-	67	2	-	-	65	2	-	-	62	-3	-	-	64	-1	-	-	58	-7	-	-
Vale of Ah Dog Park	252	65	-	-	67	2	-	-	65	2	-	-	62	-3	-	-	64	-1	-	-	58	-7	-	-
Georges River Walking Trail	1	65	-	-	115	50	-	-	113	50	-	-	110	45	-	-	112	47	-	-	106	41	-	-

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