Appendix S

Noise and Vibration Assessment

Cudgegong Road Station Precinct South

Masterplan Noise and Vibration Assessment

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1 INTRODUCTION

The NSW Government is currently building the Sydney Metro Northwest (SMNW) that is due to start operations in 2019. The SMNW is Stage 1 of the overall Sydney Metro project and involves the construction of eight new metro stations supporting infrastructure between Cudgegong Road and Epping and converting five existing stations between Epping and Chatswood. Stage 2 will deliver a new metro rail line from Chatswood through Sydney's CBD to Sydenham (Sydney Metro City and Southwest).

Landcom and the Sydney Metro Delivery Office (SMDO), part of Transport for NSW (TfNSW), are working in collaboration to develop walkable, attractive, mixed use places around the SMNW stations. This includes using the surplus government owned land located around the Cudgegong Road Station.

The subject site, the Cudgegong Road Station Precinct South, is located between Cudgegong Road, Tallawong Road, Schofields Road and the Metro corridor and comprises around 7.8ha of government owned land. It is within the southern part of the broader Cudgegong Road Station Precinct (Area 20) of the North West Priority Growth Area, a substantial land release area for homes and jobs in Sydney's northwest.

Acoustic Logic Consultancy is engaged to carry out an assessment of noise impacts associated with the site to support the State Significant Development Application (SSDA) for the Station Precinct South concept proposal. The concept proposal allows for approximately 1,100 dwellings and 9,000 sqm of retail, commercial and community uses. It also includes a central park, new streets and supporting public domain.

In this assessment, we will:

- Identify relevant Council and Environment Protection Authority (EPA) noise emission criteria applicable to the development.
- Assess environmental noise associated with transportation noise sources on the residential component of the development, including noise from:
    - The metro line and station operations;
    - End of line services at the Sydney Metro Train Facility (SMTF);
    - Road traffic along Schofields Road; and
    - Future road traffic along Cudgegong Road, Tallawong Road and new roadways as part of the masterplan.
- Discuss potential impacts on the residential component from the operation of commercial or retail tenancies.
- In-principle acoustic treatments to the building façade to mitigate intrusive noise sources into the residential component.
- Potential impacts on existing receivers from the proposal including new commercial or retail noise sources.

- Any required measures to minimise or mitigate potential noise and vibration impacts of the proposal on surrounding uses.

A comprehensive assessment of noise impacts associated with the development has determined that the proposal can achieve the requirements of the aforementioned authorities and regulations for the all periods of operation.

Noise levels have been predicted at the receiver locations using SoundPlan™ modelling software implementing the ISO 9613-2:1996 *"Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation"* noise propagation standard.

Noise impacts have been addressed in accordance with the Secretary's Environmental Assessment Requirements (SEARs) requirement number 7.

It is noted that an assessment of construction noise and vibration impacts has not been conducted as part of this assessment in accordance with the EPA Interim Construction Noise Guideline which will form part of separate submission.

2 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (SEARS).

Noise emissions from the site will be assessed in accordance with the requirements of the Secretary's Environmental Assessment Requirements (SEARs) associated with application number SSD 9063.

7. Noise Impacts

The EIS shall include a noise impact assessment identifying:

- *Measures to minimise and mitigate potential noise and vibration impacts of the proposal on surrounding developments; and*
- *The impacts of likely noise and vibration from surrounding land uses, such as noise form the operation of the rail line and surrounding road networks and mitigation measures to protect the amenity of residents / visitors / employees.*

3 SITE PROPOSAL

3.1 DEVELOPMENT LOCATION

The Cudgegong Road Station Precinct South development is to be located South of the new Cudgegong Road metro station. The site is bounded by the metro station and line to the north, Cudgegong Road to the east, Schofields Road to the south and carparking to the west. (Refer to Figure 1)

3.2 CONCEPT PROPOSAL

The concept proposal allows for approximately 1,100 dwellings in buildings up to eight storeys in height. It includes a 2,900m2 central park and 9,000 square metres of non-residential GFA.

3.3 SURROUNDING USES

The site is included as a major redevelopment of the existing area surrounding the metro station. Uses surrounding the site as part of the ultimate masterplan will typically include:

- Sydney Metro Train Facility (SMTF) – This is the main stabling and maintenance yard for the metro project.
- The Ponds district to the south across Schofields Road.
- Endeavour Energy Power Station to the east.
- Medium density mixed use development to the north beyond the Cudgegong Road metro station. Immediately north of the proposal, the Metro line is currently under construction
- Sensitive Receivers

Sensitive uses in the vicinity of the site will typically include the following:

- Residential dwellings within the Ponds development to the south,
- Existing dwellings along Cudgegong Road to the north of the site.
- Existing dwellings along Tallawong Road to the northwest.

Figure 1: Site Location

Figure 2: Site Survey and Monitoring Positions

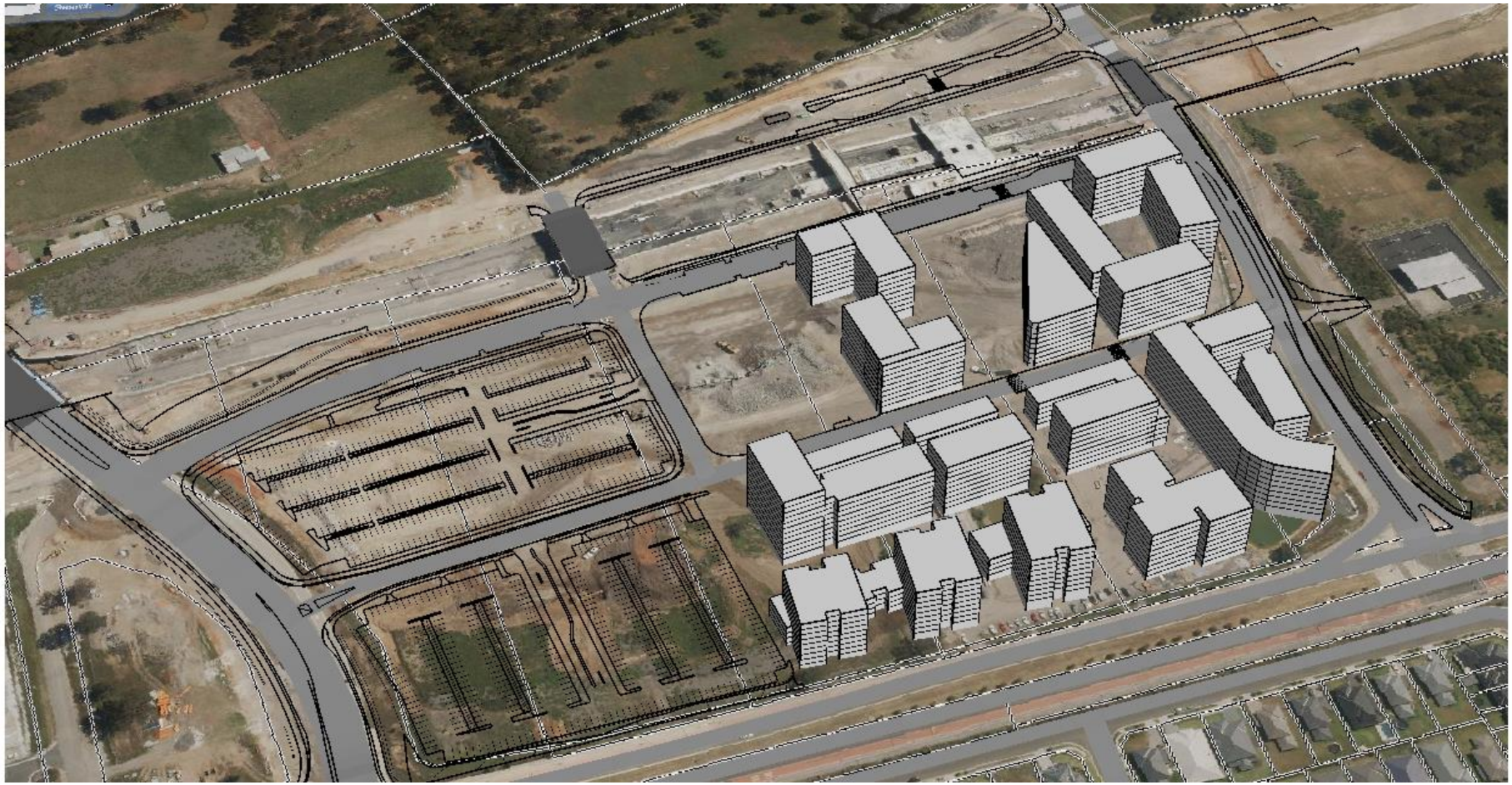


Figure 3: SoundPlan Model Overlay

4 EXISTING ACOUSTIC ENVIRONMENT

The acoustic environment is categorised by the following:

- Toward the South, West and East of the site, high background noise levels associated with traffic using Schofields Road during the day and evening and moderate background noise levels during the night.
- Toward the North, moderate background noise levels from latent traffic noise from surrounding transportation noise sources.

Acoustic monitoring has been conducted at the site and at surrounding uses to establish the existing acoustic environment.

4.1 ENVIRONMENTAL NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20-minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15-minute period. L_{eq} is important in the assessment of environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

4.2 EXISTING NOISE LEVELS

Environmental noise levels in the vicinity of the site have been adopted from the following:

- Renzo Tonin and Associates 'SSI-5414 Operational Noise and Vibration Review (ONVR)'
- Noise monitoring conducted by ALC as part of this assessment.

Noise levels which will be used as a basis for this assessment are detailed in the following sections.

4.2.1 Measurement Equipment

Unattended noise monitoring undertaken by ALC was conducted using Acoustic Research Laboratories Pty Ltd noise loggers. The loggers were programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

4.2.2 Measurement Location

The Renzo Tonin ONVR includes monitoring at the following locations which have been used for this assessment.

Table 1 – Previous Noise Monitoring

Reference Number	Monitor Location	Monitoring Period
RT1	88 Amarco Circuit, The Ponds	25 November – 2 December 2014
RT2	67 Tallawong Road, Rouse Hill	3-10 November 2014.
RT3	56 Cudgegong Road, Rouse Hill	3-10 November 2014.

Monitoring conducted by ALC as part of this assessment was conducted in the following locations (refer also to Figure 2).

- Centre of the site along southern boundary adjoining Schofields Road
- Southeast corner of the site adjoining Schofields Road

4.2.3 Measurement Period

Unattended noise monitoring was conducted during the following periods.

Table 2 – Unattended Noise Monitoring Period

Reference Number	Noise Monitor Location	Measurement Period
ALC1	Centre of site, southern boundary	17-24 November 2017
ALC2	Southeast corner of site, southern boundary	17-24 November 2017

4.2.4 Measured Noise Levels

The background noise levels established from the unattended noise monitoring are detailed in the Table below.

Table 3 – Measured Noise Level

Logger Location	Background Noise Level, dB(A) L_{90}			Average Noise Energy, L_{eq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
RT1	43	44	32	58	56	51
RT2	33	34	33	50	47	45
RT3	40	39	38	56	52	50
ALC1	47	44	28	65	63	60
ALC2	49	47	33	65	63	59

Background noise levels for receivers surrounding the RHTC will be represented by the following:

- Receivers within the Ponds by RT1.
- Receivers along Tallawong Road by RT2.
- Receiver along Cudgegong Road by RT3.

4.3 MEASURED TRAFFIC NOISE LEVELS

Traffic noise monitoring along Schofields Road was conducted to establish indicative traffic noise impacts on the residential component of the development.

Traffic noise levels from Logger Location ALC1 and ALC2 have been used to determine the typical repeatable traffic noise level along Schofields Road as indicated below.

Table 4 –Traffic Noise Levels

Road	Traffic Noise Level dB(A) $L_{eq\ 15\ hour}$	Traffic Noise Level dB(A) $L_{eq\ 9\ hour}$
Schofields Road Centre	65	59
Schofields Road / Cudgegong Road Intersection	64	59

5 PLANNING INSTRUMENTS AND NOISE AND VIBRATION GUIDELINES

The planning instruments and guidelines referenced in this assessment are:

- State Environmental Planning Policy (Infrastructure) 2007 ("Infrastructure SEPP")
- Blacktown City Council Growth Centre Precincts Development Control Plan 2016.
- Development Near Rail Corridors and Busy Roads Interim Guideline (NSW Department of Planning, 2008)
- AS NZS 2107-2016 Acoustics - Recommended design sound levels and reverberation times for building interiors
- NSW Road Noise Policy (Department of Environment, Climate change and Water NSW, March 2011)
- NSW Noise Policy for Industry (EPA, January 2017)
- Assessing Vibration: A Technical Guideline (NSW Department of Environment and Conservation, February 2006))

5.1 PLANNING CONTROLS

Noise impacts from the various local noise sources are addressed in accordance with the following planning instruments.

Table 5 – Recommended Guidelines and Regulations

Noise Source	Guideline or Regulation
• Rail noise and vibration • Stabling yard and SMTF • Cudgegong Station	• Infrastructure SEPP • Development Near Rail Corridors and Busy Roads Interim Guideline (NSW Department of Planning, 2008 • EPA 'Assessing Vibration – A technical guideline'
• Carpark Noise	• Australian Standard AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors'.
• Road traffic	• Infrastructure SEPP • Development Near Rail Corridors and Busy Roads Interim Guideline (NSW Department of Planning, 2008 • Blacktown City Council DCP

5.2 TRAFFIC NOISE CRITERIA

Traffic noise impacts on the residential component of the development have been addressed in accordance with the requirements of the Blacktown City Council Growth Centre Precincts Development Control Plan 2016 and the State Environmental Planning Policy (Infrastructure) 2007.

5.2.1 Blacktown City Council

Section 4.2.9 of the Growth Centre Precincts DCP 2016 provides guidance for acoustic privacy. Traffic noise requirements are provided in table 4-7 of the DCP which nominates the following:

Table 4-7: Noise criteria for residential premises impacted by traffic noise

	Sleeping areas	Living areas
Naturally ventilated/ windows open to 5% of the floor area (Mechanical ventilation or air conditioning systems not operating)	LAeq 15 hours (day): 40dBA LAeq 9 hour (night): 35dBA	LAeq 15 hours (day): 45dBA LAeq 9 hour (night): 40dBA
Doors and windows shut (Mechanical ventilation or air conditioning systems are operating)	LAeq 15 hours (day): 43dBA LAeq 9 hour (night): 38dBA	LAeq 15 hours (day): 46dBA LAeq 9 hour (night): 43dBA

Notes:

These levels correspond to the combined measured level of external sources and the ventilation system operating normally.

Where a naturally ventilated/windows open condition cannot be achieved, it is necessary to incorporate mechanical ventilation compliant with AS1668 and the Building Code of Australia.

LAeq 1 hour noise levels shall be determined by taking as the second highest LAeq 1 hour over the day and night period for each day and arithmetically averaging the results over a week for each period (5 or 7 day week, whichever is highest)

5.2.2 State Environment Planning Policy (Infrastructure) 2007

The SEPP (Infrastructure) details specific acoustic requirements for traffic noise intrusion into residential uses as part of a development.

The SEPP Infrastructure defines busy roads that are subject to an acoustic assessment as:

> *"Roads specified in Clause 102 of the Infrastructure SEPP: a freeway, tollway or a transit way or any other road with an average annual traffic (AADT) volume of more than 40,000 vehicles (based on the traffic volume data provided on the website of the RTA).*
>
> *Any other road – with an average annual daily traffic (AADT) volume of more than 20,000 vehicles (based on the traffic volume data published on the website of the RTA).*
>
> *Any other road – with a high level of truck movements or bus traffic."*

The Infrastructure SEPP sets out the following criteria for internal noise levels from airborne traffic noise:

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

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

(a) in any bedroom in the building—35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.

5.2.3 Discussion of Criteria

Regarding the Growth Centre Precincts DCP 2016 requirement we note:

- The SEPP (Infrastructure) 2007 is supported by the Department of Planning 'Development Near Rail Corridors and Busy Roads – Interim Guideline'. Section 3.6.1 of the guideline has provisions for naturally ventilated conditions. The guideline dictates that traffic noise intrusion is not to exceed the internal noise criteria by more than 10dB(A), in which case windows would be required to be closed to achieve the internal noise criterion.
- The Growth Centre Precinct DCP 2016 does not have the same provision and states that traffic noise intrusion is to achieve internal noise levels generally equal to the Department of Planning guidelines with windows open.
- It is ALC's understanding that the Growth Centre Precinct DCP 2016 is prepared by the Department of Planning which would normally adopt the requirements of the SEPP (Infrastructure) or follow their own 'Development Near Rail Corridors and Busy Roads – Interim Guideline' document.
- We understand the requirements of the SEPP (Infrastructure) 2007 override the requirements in the Growth Centre Precinct DCP 2016.

On this basis, ALC have adopted the internal noise levels with windows closed with a 10dB(A) dispensation for naturally ventilated conditions.

5.2.4 Summary of Traffic Noise Objectives

A summary of the relevant internal noise level criteria incorporating all relevant legislative requirements are detailed in the table below.

Table 6 - Project Traffic Noise Assessment Criteria

Space /Activity Type	Internal Use	Assessment Criteria
Residential	Bedrooms (naturally ventilated)	50 dB(A)$L_{eq(15hr)}$
		45 dB(A)$L_{eq(9hr)}$
	Bedrooms (mechanical ventilation)	43 dB(A)$L_{eq(15hr)}$
		38 dB(A)$L_{eq(9hr)}$
	Living rooms (naturally ventilated)	55 dB(A)$L_{eq(15hr)}$
		50 dB(A)$L_{eq(9hr)}$
	Living rooms (mechanical ventilation)	46 dB(A)$L_{eq(15hr)}$
		43 dB(A)$L_{eq(9hr)}$
Childcare (internal)	N/A	40dB(A)$L_{eq(15hr)}$
Places of worship	N/A	40dB(A)$L_{eq(15hr)}$

5.3 CARPARK NOISE

Noise from the commuter carpark has been assessed against the recommended internal noise levels of AS/NZS 2107:2016.

Table 7 – Carpark Noise Intrusion Requirements

Internal Use	Design Sound Level, dB(A) $L_{eq\ 15min}$
Living Room	45
Bedroom (night time)	40

5.4 RAIL NOISE AND VIBRATION CRITERIA

Traffic noise impacts on the residential component of the development have been addressed in accordance with the requirements of State Environmental Planning Policy (Infrastructure) 2007 and the NSW Department of Planning policy 'Development Near Rail Corridors and Busy Roads Interim Guideline'.

5.4.1 NSW SEPP Infrastructure (2007)

For rail noise and vibration, the following controls apply:

"87 Impact of rail noise or vibration on non-rail development

(1) This clause applies to development for any of the following purpose that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to adversely affected by rail noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purpose of this clause and published in the Gazette.

(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceed:

(a) in any bedroom in the building – 35 dB(A) at any time between 10.00 pm and 7.00 am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time."

5.4.2 Development Near Rail Corridors and Busy Roads Interim Guideline (NSW Department of Planning, 2008)

5.4.2.1 Airborne Noise Requirements

This document is the guideline issued by the Director General for the purpose of Clause 87(2) of the SEPP (Infrastructure). Table 3.1 is repeated from the Guideline below:

Table 3.1: Noise criteria

Residential Buildings			
Type of occupancy		Noise Level dBA	Applicable time period
Sleeping areas (bedroom)		35	Night 10 pm to 7 am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)		40	At any time
Non–Residential Buildings			
Type of occupancy			Recommended Max Level dBA
Educational Institutions including child care centres			40
Places of Worship			40
Hospitals	- Wards		35
	- Other noise sensitive areas		45

Note: airborne noise is calculated as L_{eq} (9h) (night) and L_{eq} (15h)(day). Groundborne noise is calculated as L_{max} (slow) for 95% of rail pass-by events.

5.4.2.2 Structure Borne Noise Requirements

The Department of Planning *'Development Near Rail Corridors and Busy Road – Interim Guideline'* only requires structure borne noise assessment to be conducted where buildings or adjacent lands are over railway tunnels. Section 3.6.2 of the standard states the following:

"…Where building are constructed over or adjacent to land over tunnels, ground-borne noise may be present without the normal masking effects of air born noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground-borne LAmax noise limit of 40 dB(A)(daytime) and 35 dB(A) (night time) measured using the "slow" response time setting on a sound level meter.

As a general guide, ground borne noise may be an issue in habitable rooms which are shielded from airborne noise from the railway. Examples are rooms that are not facing the railway, and where cuttings or noise barriers block the line of sight between the receiver room and the rail line. In addition, some structures such as suspended slabs can lend to vibration amplification."

In this case, the proposed development is not located over or adjacent to land over railway tunnels. On this basis, no further assessment of structural borne noise or vibration is required for the proposed development.

5.4.3 EPA 'Assessing Vibration – A Technical Guideline'

The Department of Planning guideline recommends that vibration should be assessed using "Assessing Vibration: A Technical Guideline".

Given the likely separation between the structures on the site and the railway lines, and buildings on the site will be modern structures, it is highly unlikely that building damage will occur. Therefore, only human comfort (also being the more stringent requirement) will require detailed assessment.

Section 2.4.1 of the EPA technical guideline provides guidance for acceptable dose values of intermittent vibration such as that caused by trains. The vibration dosage value (VDV) is the accumulation of vibration energy over a given period.

The VDV is calculated for the two periods of the day being the "Daytime" (6am-10pm) and "Night time" (10pm-6am). The overall value is then compared to the levels in Table 2.4 of the EPA guideline. For this project the aim will be for the preferred value.

Table 8 – Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime	Night-time
Residential buildings	0.2	0.13
Offices, schools, educational institutions and places of worship	0.4	0.4

6 NOISE IMPACTS FROM LOCAL NOISE SOURCES

Sensitive uses within the proposed development may be impacted by existing and future local noise sources. This section addresses noise from the following noise sources:

- Cudgegong Road Station
- Metro Line
- Sydney Metro Trains Facility (SMTF)
- Future traffic noise from Schofields Road, Cudgegong Road, Tallawong Road and roadways within the proposal.
- Retail and commercial noise

6.1 CUDGEGONG ROAD STATION

Noise emissions from the Cudgegong Road station have been adopted from the Renzo Tonin & Associates document for the Sydney Metro Northwest project titled 'SSI-5414 Operation Noise and Vibration Review (ONVR)'.

The operation of the Cudgegong Road Station is provided in Section 5.16 of the document and will be used as a basis for assessing potential noise impacts on the development. Noise associated with the Cudgegong Road station is associated with the following:

- PA announcements within the metro station;
- Mechanical and electrical services noise; and
- Car park noise.

Table 5-58 of the ONVR provides predicted noise levels to existing and future receivers in the vicinity of the station from the use of the station and carpark.

Table 9 – Predicted Noise Levels from Station Activities

Noise Sources	Time of Day	Cumulative Noise level, dB(A) $L_{eq\ 15min}$
PA announcements, mechanical and electrical services	Shoulder	25
	Day	25
	Evening	25
	Night	N/A
Carpark	Shoulder	45
	Day	48
	Evening	45
	Night	41

6.2 RAIL NOISE IMPACTS FROM METRO LINE

Noise emissions from the metro line have been adopted from the Renzo Tonin & Associates document for the Sydney Metro Northwest project titled 'SSI-5414 Operation Noise and Vibration Review (ONVR)'.

Sections 4.2 to 4.4 of the ONVR report provides guidance on the prediction of noise associated with the metro line. Appendix E of the report provides predicted noise levels from the operation of the metro line, with noise contour maps provided in Appendix F.

The ONVR report presents that the rail noise impact during the night time period (10pm to 7am). Predicted noise levels have been overlayed onto the SoundPlan noise model for the development (refer to Figure 4 and Figure 5).

The difference between the night time period and the day time period (7am to 10pm) has been determined using the expected future metro line movements presented in Table 4-7 of the ONVR report. This difference has been used to approximate the daytime noise level for the assessment of impact from the metro line.

Noise levels impacting allotments within the development are provided in the Table below based on the predicted noise levels provided in the ONVR document.

Table 10 – Predicted Noise Levels from Metro Line

Lot Number	Approximated rail noise impact, dB(A) $L_{eq\ 15\ hour}$	Approximated rail noise impact, dB(A) $L_{eq\ 9\ hour}$
Closest buildings within proposed development	< 55	< 50

6.2.1 Ground Borne Vibration Impacts

Ground borne vibration associated with the metro line is provided in Section 4.8.2.2 of the ONVR is summarised below.

- The referred vibration dosage values (VDV) for residential receivers is 0.2m/s$^{1.75}$ and 0.13m/s$^{1.75}$ for the day and night time periods respectively.
- At a distance of 15m and with consideration to the number of metro movements during the day and night time period, the estimated vibration dosage values (eVDV) will be in the order of 0.069m/s$^{1.75}$ and 0.047m/s$^{1.75}$ for the day and night time periods respectively.

Given that the nearest rail line is 45m from the nearest building as part of the development, ground borne vibration levels from the metro line will be compliant with the preferred values of the EPA document 'Assessing Vibration: A Technical Guideline'.

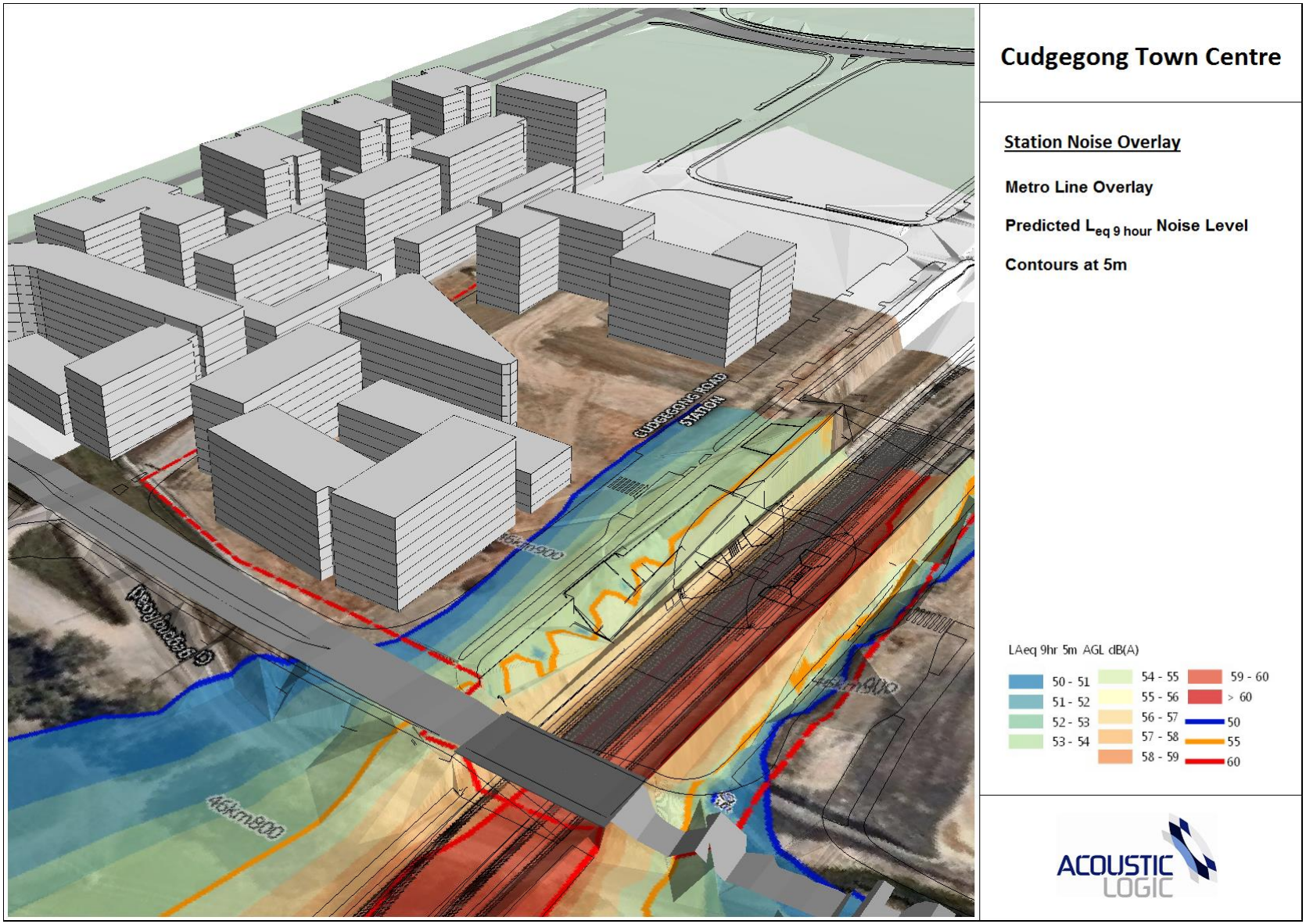


Figure 4: Rail Noise Overlay – $L_{eq\ 9\ hour}$ 5m above Ground

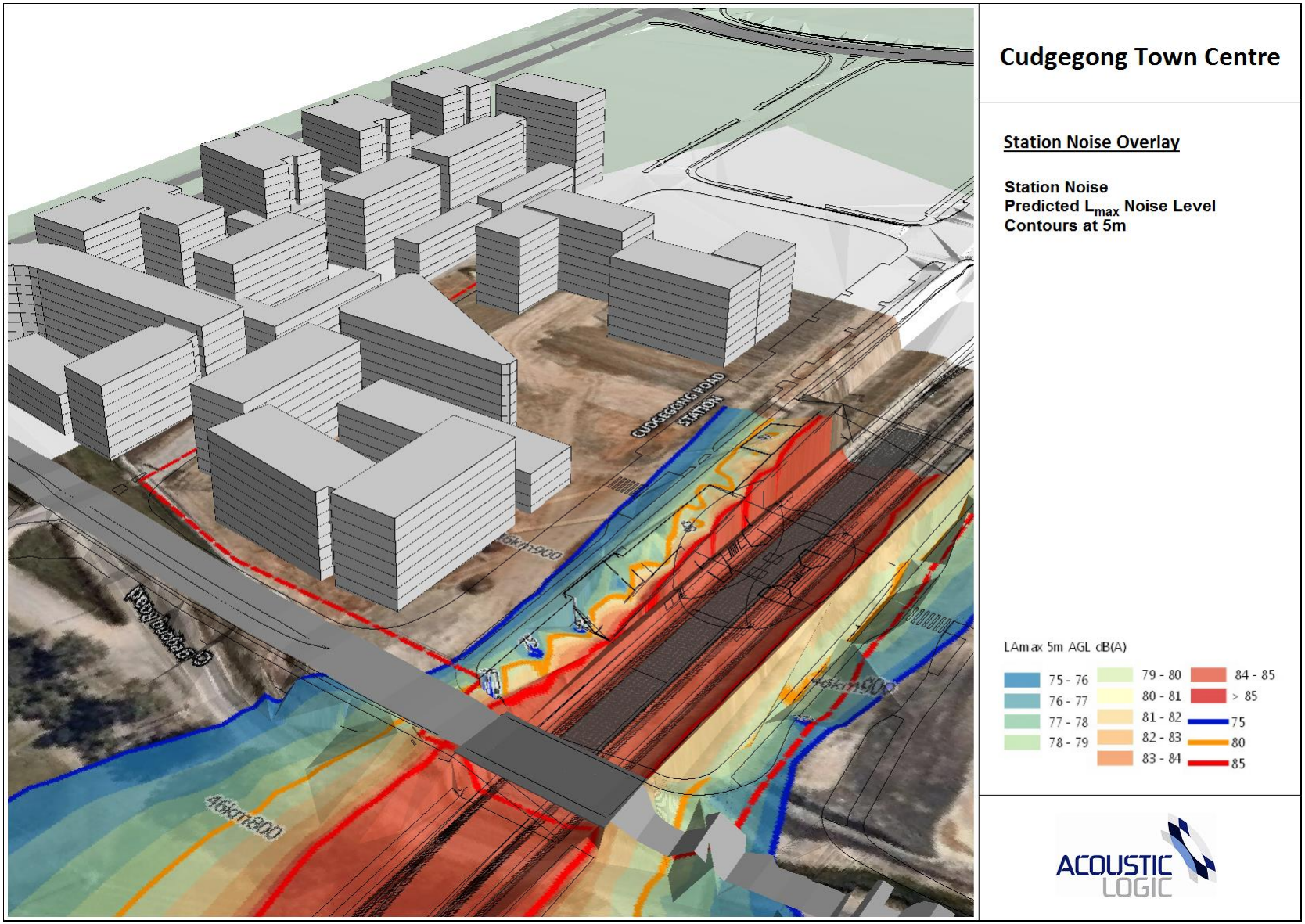


Figure 5: Rail Noise Overlay – L_{Amax} 5m above Ground

6.3 SYDNEY METRO TRAINS FACILITY

The site is located to the East of the Sydney Metro Trains Facility (SMTF). The SMTF is the main maintenance and housing facility for the metro rolling stock. Noise associated with the facility generally includes:

- Maintenance operations,
- Stabling yards,
- Train maintenance including washing facilities and wheel lathes,
- Mechanical plant,
- Carpark.

Noise from the operation of the facility has been addressed in the Renzo Tonin & Associates document for the Sydney Metro Train Facility (SMTF) project titled 'SSI-5931 Operation Noise and Vibration Review (ONVR)'.

Noise predictions presented in the document are generally for existing residential uses surrounding the site. Commentary has been provided for the proposed development area (within the area 20 urban planning area) however explicit predictions to the site have not been included.

This assessment uses worst case predicted noise levels provided in the report to establish noise emissions at uses within the development. Receivers located at 34 Tallawong Road are located approximately 330m closer to the site than the nearest building as part of the proposed development. Predicted noise levels at this location are as follows.

Table 11 – Predicted Noise Levels from SMTF

	Predicted Noise Level, dB(A) L_{eq}			
Receiver Location	**Shoulder Period**	**Daytime Period**	**Evening Period**	**Night Period**
34 Tallawong Road	39	43	41	39

The predicted noise levels for 34 Tallawong Road are expected to be substantially louder than those impacting the site even with consideration to the elevation of multi-storey receivers as part of the proposed development. In addition, noise impacts associated with the carparks adjoining the Western boundary of the proposed development are expected to be significantly louder than that associated with the SMTF.

6.4 ROAD TRAFFIC NOISE ASSESSMENT

Traffic noise impacts on future occupants of the development have been addressed in principle based on the following:

- noise monitoring conducted at the site;
- future traffic around the development on existing and future roads.

This section discussed traffic noise impacts on occupants within the development only. Noise impacts on receivers' external to the site from traffic generated from the proposal is addressed in Section 9.2.

6.4.1 Existing Traffic Noise Levels

Traffic noise levels were recorded at the site (refer to Section 4.3) which will be used to extrapolate traffic noise impacts across the site. The day and night time traffic noise levels at the monitoring locations are provided below.

Table 12 – Existing Traffic Noise Levels

Location	Distance to Carriageway (m)	Traffic Noise Level dB(A) L_{eq} Day 7am – 10pm	Traffic Noise Level dB(A) L_{eq} Night 10pm – 7am
1	Approx. 12m	65	59
2	Approx. 12m	64	59

6.4.2 Future Traffic Noise Levels

Existing and projected traffic generation from the development is provided in the SCT Consulting 'Cudgegong Road Station Precinct South – Traffic Study' dated February 2018.

An indication of potential increases in traffic noise along Schofields Road will be established by the relative increase in traffic noise volume between existing and future levels.

Table 13 – Relative Increase in Noise Level

Road	Existing Traffic Volume, veh/hr	Future Traffic Volume, veh/hr	Relative Increase, dB(A)
Schofields Road	1,564	2,318	1.7

Future traffic volumes have been used to predict traffic noise levels along Cudgegong Road and Tallawong Road and have been adopted from Table 3-5 of the traffic report. Guidance has been provided by the traffic consultant with regard to the Annual Average Daily Traffic (AADT) for the aforementioned roadways.

Table 14 – Future Traffic Volumes

Road	2036 Future Traffic Volume, veh/hr	2036 AADT
Cudgegong Road	423	4,500
Tallawong Road	1,431	12,000
Schofields Road	2,318	35,200

The distribution between the day and night traffic noise levels for Schofields Road have been adopted for Tallawong Road and Cudgegong Road.

Traffic on internal roads within the proposal are expected to be minimal in comparison with that associated with Tallawong Road, Cudgegong Road and Schofields Road.

6.4.3 Predicted Traffic Façade Noise Levels

A prediction of traffic noise has been undertaken using the SoundPlan noise modelling software based on traffic measurements conducted at the site and future traffic volumes. Façade noise maps are presented in the following figures.

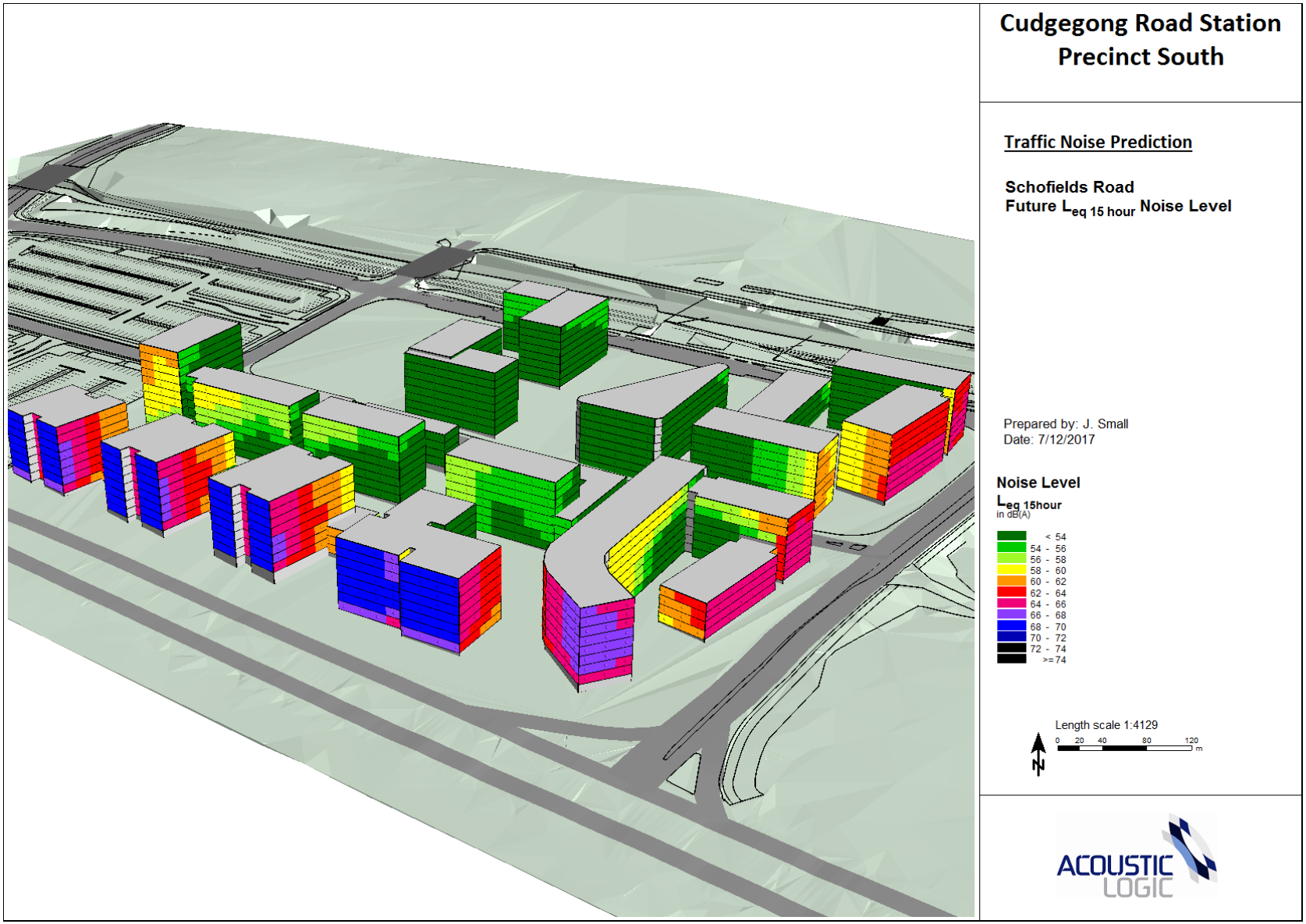


Figure 6: Traffic Facade Noise Map $L_{eq\ 15\ hr}$ – Southeast View

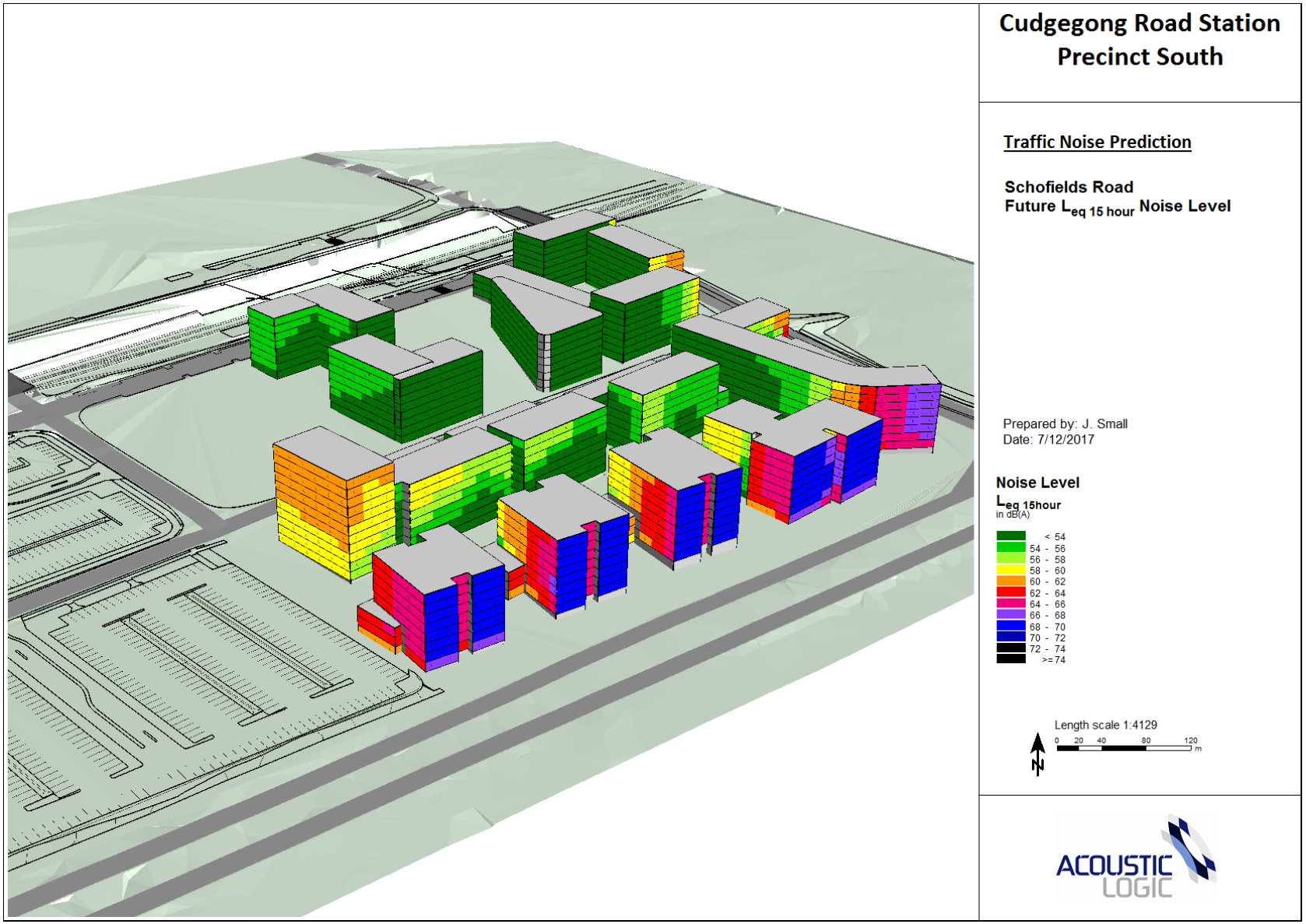


Figure 7: Traffic Facade Noise Map $L_{eq\ 15\ hr}$ – Southwest View

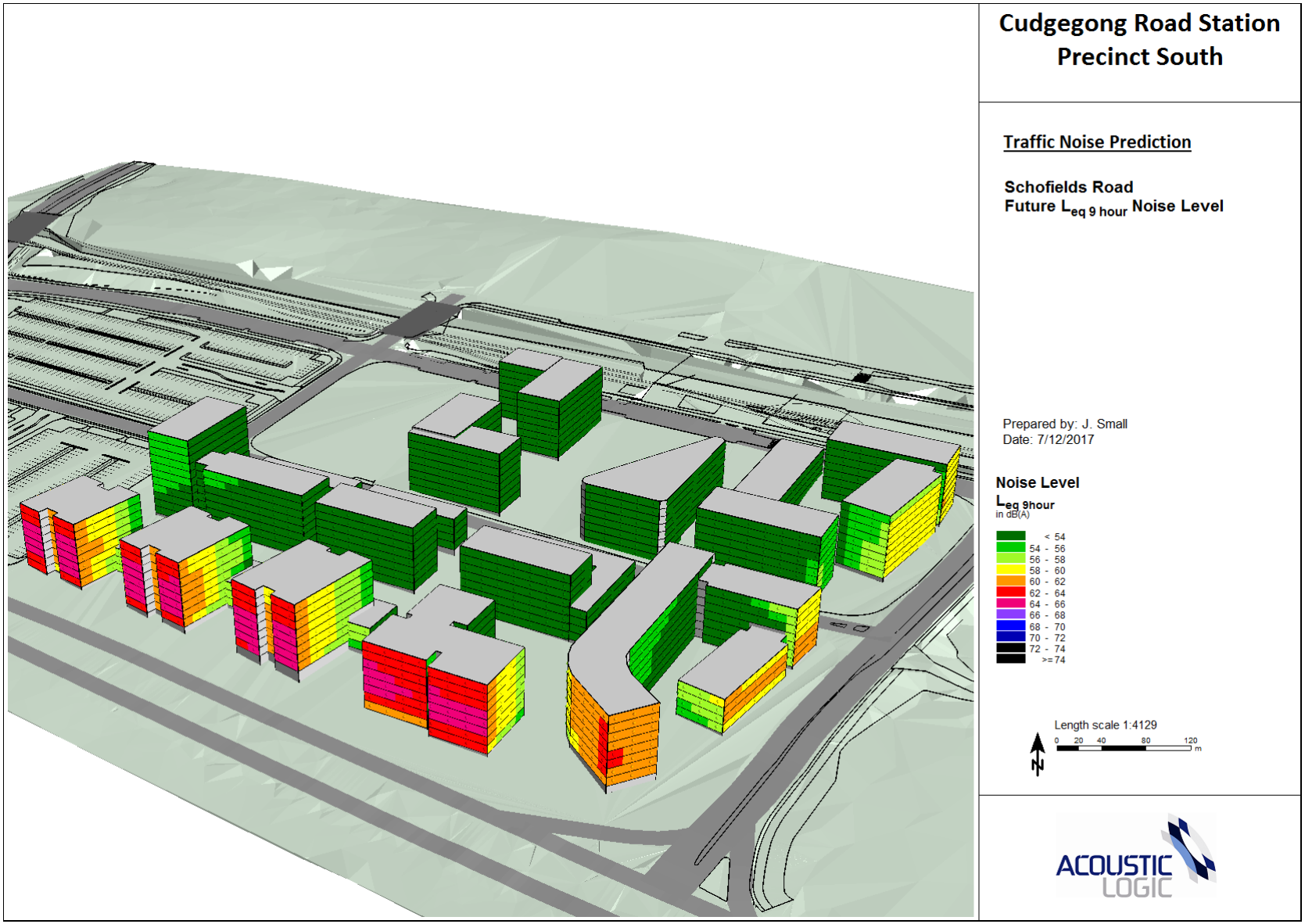


Figure 8: Traffic Facade Noise Map $L_{eq\ 9\ hr}$ – Southeast View

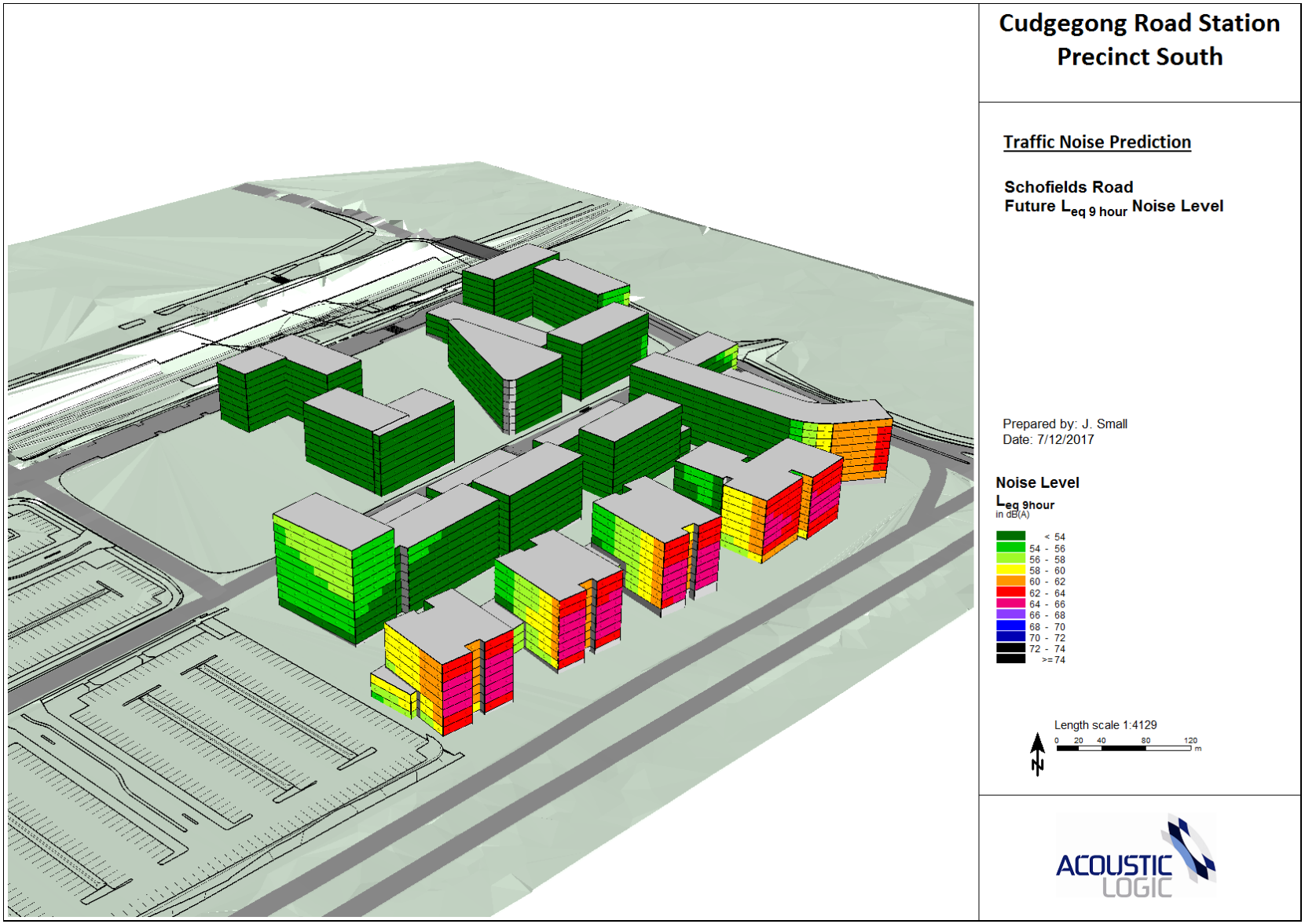


Figure 9: Traffic Facade Noise Map $L_{eq\ 9hr}$ – Southwest View

6.5 INTRUSIVE NOISE IMPACTS FROM RETAIL TENANCIES

Patron noise from retail component including potential food and beverage outlets may have the potential to impact the residential dwellings. Given the 'urban' environment that is consistent with a residential/retail interface, a certain level of noise impact would be expected. Notwithstanding, suitable internal noise levels may be achieved within residential apartments by closing doors and windows directly facing onto retail food and beverage precincts.

In any event, noise impacts associated with patrons will be unlikely to impact residential dwellings as part of the development unless operation extends into the night time period. Individual use development applications would be expected for the retail uses (typically food & beverage or licensed) in this instance.

6.6 DISCUSSION OF LOCAL NOISE IMPACTS ON THE PROPOSAL

Local noise sources impacting the site have been assessed. Predicted noise levels are summarised as follows.

6.6.1 Future Traffic Noise

Road traffic noise impact on the development is assessed against the criteria in Section 5.2.4 and is summarised as follows:

Table 15 – Traffic Noise Reduction

Facade[1]	Room	Predicted Traffic Noise Level, dB(A)		Traffic Noise Criteria, dB(A)[2]		Required Noise Reduction, dB(A)	
		Day, $L_{eq\ 15hour}$	Night, $L_{eq\ 9hour}$	Day, $L_{eq\ 15hour}$	Night, $L_{eq\ 9hour}$	Day, $L_{eq\ 15hour}$	Night, $L_{eq\ 9hour}$
West	Bedroom	65	61	40	35	25	26
	Living	65	61	43	40	22	21
South	Bedroom	70	65	40	35	30	30
	Living	70	65	43	40	27	25
East	Bedroom	67	63	40	35	27	28
	Living	67	63	43	40	24	23
North	Bedroom	63	57	40	35	23	22
	Living	63	57	43	40	20	17

Note[1] Worst case noise level in the designated façade direction.
Note[2] 3dB(A) has been allowed for the contribution from mechanical noise.

6.6.2 Rail Noise from Metro Station

Noise associated with PA announcements and services from the metro station are assessed against the 'Development Near Rail Corridors and Busy Roads Interim Guideline' and is summarised below.

Table 16 – Required Reduction from Station Noise

Façade	Room	Predicted Station Noise Level, dB(A)	Noise Criteria, dB(A)	Required Reduction
North (worst case)	Bedroom	< 30	35dB(A) $L_{eq\ night}$	-
	Living	< 30	40dB(A) $L_{eq\ day}$	-

6.6.3 Metro Station Carpark

Noise associated with the metro station carpark is assessed against AS/NZS 2107:2016 and is summarised below.

Table 17 – Required Reduction from Carpark Noise

Noise Source	Façade	Room	Predicted Station Noise Level, dB(A)	Noise Criteria, dB(A)	Required Reduction
Carpark	West (worst case)	Bedroom	41	40dB(A) $L_{eq\ 15min}$	1
		Living	48	45dB(A) $L_{eq\ 15min}$	3

6.6.4 Rail Noise Impacts

Rail noise impact on the development is assessed against the 'Development Near Rail Corridors and Busy Roads Interim Guideline' and is summarised below.

Table 18 – Rail Noise Reduction

Façade	Room	Predicted Station Noise Level, dB(A)	Noise Criteria, dB(A)	Required Reduction
North (worst case)	Bedroom	50	35dB(A) $L_{eq\ night}$	15
		50	45dB(A) $L_{eq\ night}$ (naturally ventilated)	5
	Living	55	40dB(A) $L_{eq\ day}$	15
		55	50dB(A) $L_{eq\ day}$ (naturally ventilated)	5

6.6.5 Noise from the SMTF

Noise associated with the SMTF is assessed against the 'Development Near Rail Corridors and Busy Roads Interim Guideline' and is summarised below.

Table 19 – Required Reduction from SMTF

Façade	Room	Predicted Station Noise Level, dB(A)	Noise Criteria, dB(A)	Required Reduction
West (worst case)	Bedroom	< 39	35 dB(A) $L_{eq\ night}$	4
		< 39	45dB(A) $L_{eq\ night}$ (naturally ventilated)	-
	Living	< 43	40 dB(A) $L_{eq\ day}$	3
		< 43	50dB(A) $L_{eq\ day}$ (naturally ventilated)	-

Note: Noise levels presented are from 34 Tallawong Road. Noise levels impacting the proposal are expected to be substantially less.

7 INTRUSIVE NOISE RECOMMENDATIONS

Predicted noise levels from future traffic, metro station and the SMTF have been determined. The outcomes from these predictions are discussed in the following.

Acoustic treatments should be determined in detail for each building during the development application stage to confirm compliance with the internal noise level requirements.

7.1 RECOMMENDATIONS

7.1.1 Traffic Noise

The following is recommended to mitigate traffic noise intrusion. Required noise reductions are from Section 6.6.1.

Table 20 – Traffic Noise Recommended Acoustic Treatment (Glazing)

Facade	Room	Required Noise Reduction, dB(A)	Recommended Glazing
West	Bedroom	26	Medium weight single glazing
	Living	22	Light weight single glazing
South	Bedroom	30	Heavy weight single glazing
	Living	27	Medium weight single glazing
East	Bedroom	28	Heavy weight single glazing
	Living	24	Medium weight single glazing
North	Bedroom	23	Light weight single glazing
	Living	20	Light weight single glazing

External walls of concrete or masonry construction will be acoustically satisfactory. Light weight constructions are to be acoustically designed as part of the detailed design process of each individual development.

Mechanical ventilation will be required to facades exceeding 60dB(A) $L_{eq\ 15hour}$ and 55dB(A) $L_{eq\ 9\ hour}$. Detailed assessment of traffic noise impacts is to be conducted as part of each individual building application to determine extent of required mechanical ventilation.

7.1.2 Other Noise Sources

With regard to remaining noise sources.

- Rail noise at worst case façades will typically require a 15dB(A) reduction during the day and night time period which can be satisfied by standard building constructions. Naturally ventilated conditions will be achievable with the façade open sufficient to achieve BCA natural ventilation requirements.
- PA announcements and services noise from the metro station will have negligible impact on the development. No acoustic treatment is required.
- Carpark noise to the western most buildings will require a 3dB(A) reduction during the day and 1dB(A) reduction during the night time period which is satisfied by standard building constructions. Internal noise requirements are achievable with the façade open sufficient to achieve BCA natural ventilation requirements.
- Noise from the SMTF is expected to require less than a 3dB(A) reduction during the day and 4dB(A) during the night time period which is satisfied by standard building constructions. Internal noise requirements are achievable with the façade open sufficient to achieve BCA natural ventilation requirements.

8 NOISE EMISSION CRITERIA

Criteria to govern noise emissions generated from the various noise sources as part of the site are summarised in the Table below.

Table 21 – Summary of Noise Emission Regulations and Authorities

Noise Sources	Noise Regulation / Authority
Noise in General	Blacktown Council Growth Centre Precinct DCP EPA Noise Policy for Industry
Traffic Generation on Public Roads	EPA Road Noise Policy

8.1 BLACTOWN CITY COUNCIL

The Blacktown City Council Growth Centre nominates the following with regard to noise from residential and commercial uses.

8.1.1 Residential Noise Emissions

Section 4.2.9 of the DCP nominates the following with regard to noise from residential uses.

> *No electrical, mechanical or hydraulic equipment or plant shall generate a noise level greater than 5dBA above background noise level measured at the property boundary during the hours 7.00am to 10.00pm and noise is not to exceed background levels during the hours 10.00pm to 7.00am.*

8.1.2 Commercial Noise Emissions

Section 5.2.4 of the DCP nominates the following with regard to typically commercial uses within the precinct centre and dictates the following:

> *Development in the centres must comply with DECCW's noise attenuation requirements and the controls for visual and acoustic privacy in clause 4.2.9.*

We note there are no DECCW requirements in clause 4.2.9 of the DCP. On this basis, noise from commercial uses will be addressed in accordance with the EPA Noise Policy for Industry.

8.2 EPA – NOISE POLICY FOR INDUSTRY

The Noise Policy for Industry (NPI) provides guidelines for assessing noise impacts from industrial developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPI has two requirements which must be complied with, namely an amenity criterion and an intrusiveness criterion.

Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A).

Rating background noise levels for the area have been established from long term unattended noise monitoring as detailed in Section 4.2. Given the scale of the development, the expected level of density associated with allotments and the incorporation of significant traffic noise sources within the development, setting noise criteria based on the existing rural acoustic environment particularly during the night time period would be inappropriate

Consideration should be given to specific planning noise levels and amenity criterion which will be more appropriate with the redevelopment of the area to a suburban and urban environment.

Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment. The NPI sets out acceptable noise levels for various land uses. Table 2.2 on Page 11 of the policy has three categories to distinguish different residential areas. They are rural, suburban and urban

Pursuant to Section 2.4 of the NPI, 'Suburban' and 'Urban' are defined as areas which have acoustical environments which incorporate the following characteristics.

Urban - an area with an acoustical environment that:

- Is dominated by 'urban hum' or industrial source noise
- Has through traffic characteristically heavy and continuous traffic flows during peak periods
- Is near commercial districts or industrial districts
- Has any combination of the above,

  Where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.

Suburban - An area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:

- Decreasing noise levels in the evening period (1800-2200); and/or
- Evening ambient noise levels defined by the natural environment and infrequent human activity.

Given the location of the proposal to the metro line and Schofields Road, the corresponding Amenity Criteria noise emission goals are presented below.

Table 22 – NPI Amenity Acceptable Noise Levels

Type of Receiver	Indicative Noise Amenity Area	Time of day	Recommended Acceptable Noise Level dB(A) L_{eq}
Residence	Urban	Day	60
		Evening	50
		Night	45
Commercial premises	All	When in use	65
Active recreation area	All	When in use	55

8.3 EPA ROAD NOISE POLICY

For land use developments with the potential to create additional traffic the development should comply with the requirements for new developments detailed in the EPA Road Noise Policy, criteria as follows.

The policy ensures that noise generated by additional traffic volumes associated with proposed developments does not create an unacceptable noise impact on existing land use developments.

Table 23 - Criteria for Traffic Noise for New Developments (Residential)

Land Use Development	Time of day	Criteria for Acceptable Traffic Noise Level Arterial / Sub-arterial Roads - dB(A)
Residential	Day (7am to 10pm)	60 $L_{Aeq\ (15hr)}$
	Night (10pm to 7am)	55 $L_{Aeq\ (9hr)}$

However, if existing noise levels exceed those in the table above, the provisions of section 3.4 of the Road Noise Policy will apply.

If practicable, noise on public roads as a result of increased traffic generation should not result in an increase in traffic noise level of more than 2dB(A). In this regard, the Policy relevantly states "*an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person*".

9 ASSESSMENT OF NOISE IMPACTS

Noise impacts from the development have been addressed for the following:

- Retail and commercial uses;
- Traffic noise generation on existing roadways.

Each of these uses are to be addressed in greater deal with each individual use development application. Notwithstanding, commentary in this regard has been provided in principle.

9.1 RETAIL AND COMMERCIAL

The concept proposal incorporates retail, commercial and community land uses which will likely include mixed use development, commercial and retail. Uses are expected to include food and beverage tenancies, supermarket, speciality retail and some commercial.

Noise from specialised retail and commercial tenancies will be typically associated with:

- Mechanical plant servicing these uses;
- Cars entering and exiting car parking; and
- Loading docks.

Noise from licensed food and beverage tenancies (i.e. restaurants and bars) will be typically associated with:

- Patron noise;
- Music; and
- Mechanical plant.

Each of these noise sources will be addressed as part of the individual use development applications in compliance with the NSW EPA requirements.

9.2 TRAFFIC GENERATION ON EXISTING ROADS

The potential for traffic generation on existing roads has been assessed using the SCT Consulting 'Cudgegong Road Station Precinct South – Traffic Study' dated February 2018. Section 3.5.2 provides guidance on the trip distribution based on ultimate traffic flows. With regard to potential noise impact from traffic generation we note:

- Receivers potentially impacted by increased traffic noise levels will be those along Tallawong Road and Cudgegong Road to the north of the site.
- The highest net increase in traffic compared to the 2036 baseline are as follows:
    - 7% increase for Tallawong Road AM peak;
    - 12% increase for Cudgegong Road PM peak.
- The distribution indicates that the number of vehicles from the site heading north on Tallawong Road and Cudgegong Road will be less than 10% of the net increase in traffic.

Based on the above, potential increases of traffic volumes north of the site on Tallawong Road and Cudgegong Road from the site will be less than 1% which will result in a negligible increase in traffic noise level.

10 CONCLUSION

This report presents the assessment of noise impacts associated with the proposed Cudgegong Road Station Precinct South.

A preliminary assessment of potential noise impacts associated with the development has been conducted and the following concluded:

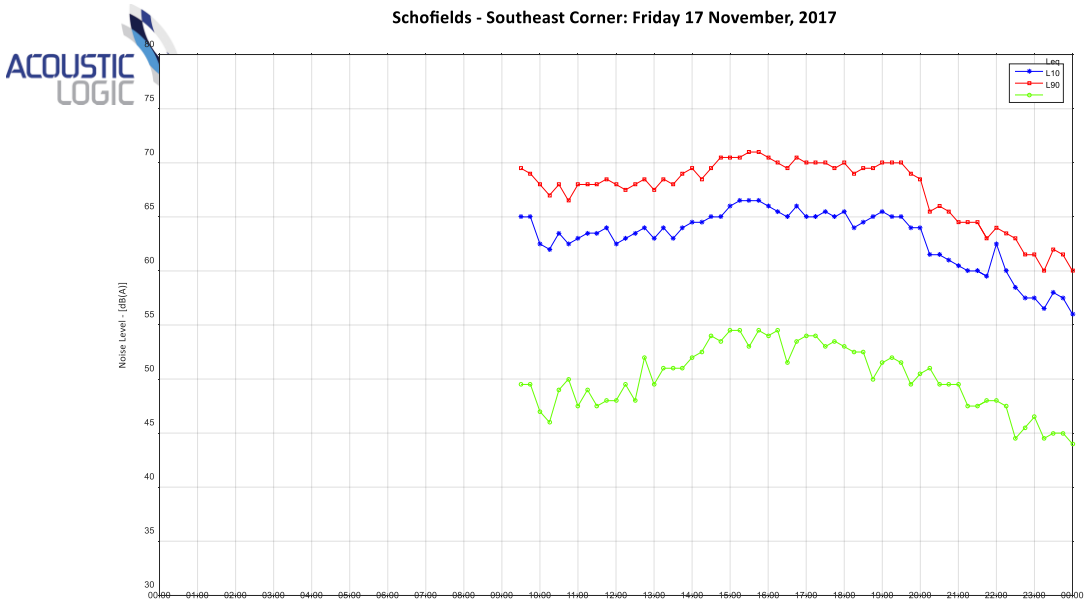
- Rail noise impacts associated with the metro line to the North of the site will have minimal acoustic impact on receivers within the nearest buildings of the proposal. Standard glazing will be acoustically suitable to satisfy rail noise objectives.
- Noise emanating from the station associated with public address systems and services equipment will have negligible acoustic impact on receivers within the nearest buildings of the proposal. No additional acoustic treatment is recommended.
- Based on predictions undertaken as part of the Sydney Metro Train Facility(SMTF) assessment, noise impacts on the proposal site will be negligible in context with the future acoustic environment.
- Traffic noise impacts from major roads surrounding the development have been addressed with consideration to future growth. In principle façade treatments have been discussed to satisfy traffic noise objectives.
- The proposed development can comply with the SEPP (Infrastructure) and planning instruments discussed in this report subject to the incorporation of suitable acoustic treatment and mitigation measures to protect the amenity of future residents.
- Acoustic advice has been provided in principle for the location planning of noise generating uses such as retail uses and potential impact on sensitive residential receivers. Noise emissions are to be addressed for each individual development application to confirm compliance with the Environmental Protection Authority.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

James Small
Acoustic Logic Consultancy

APPENDIX ONE – UNATTENDED NOISE MONITORING DATA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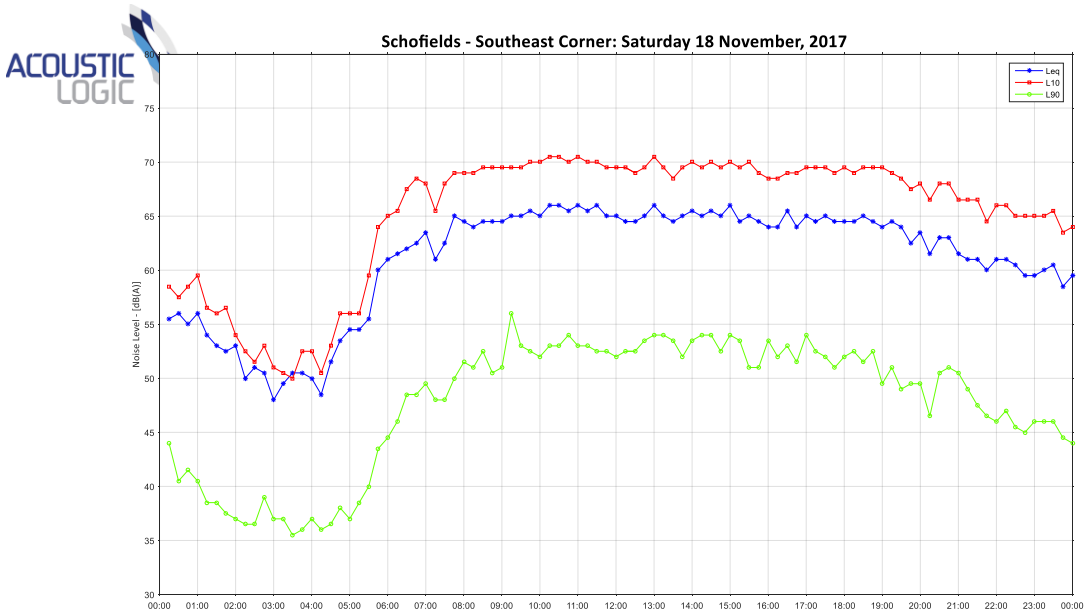
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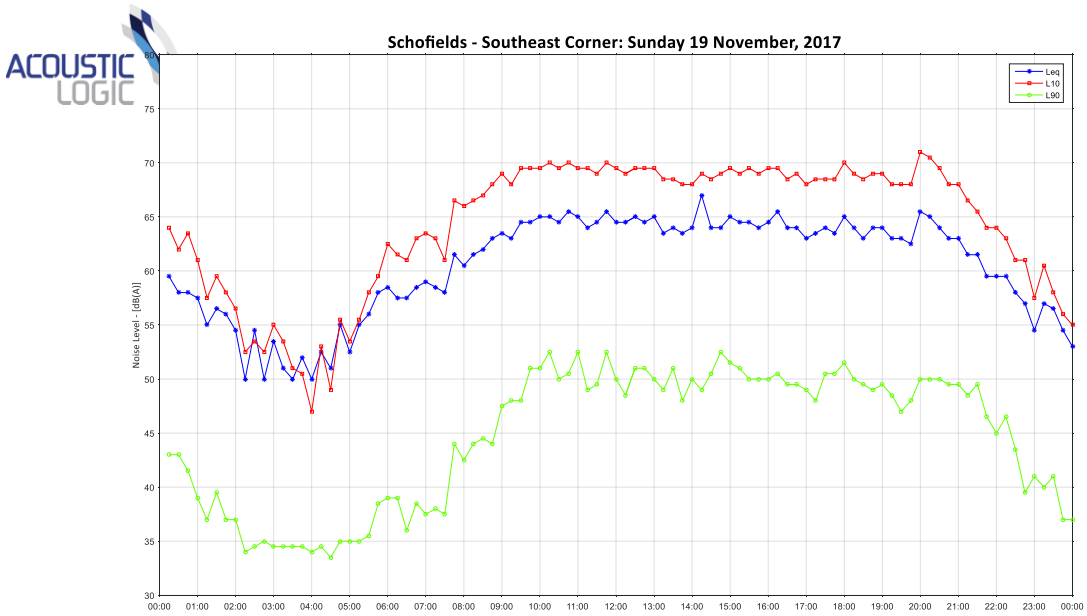
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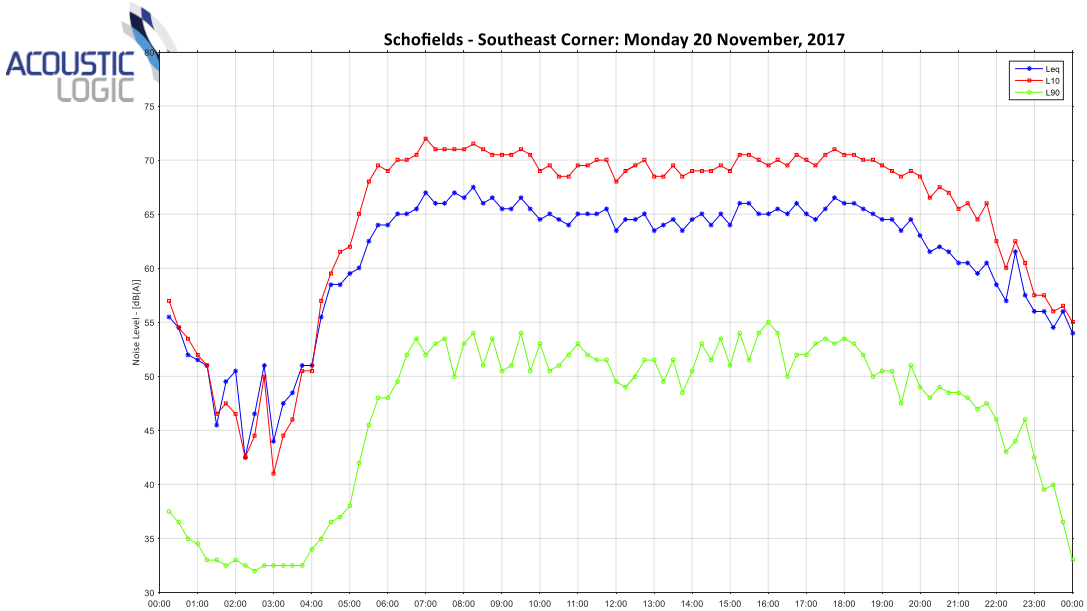
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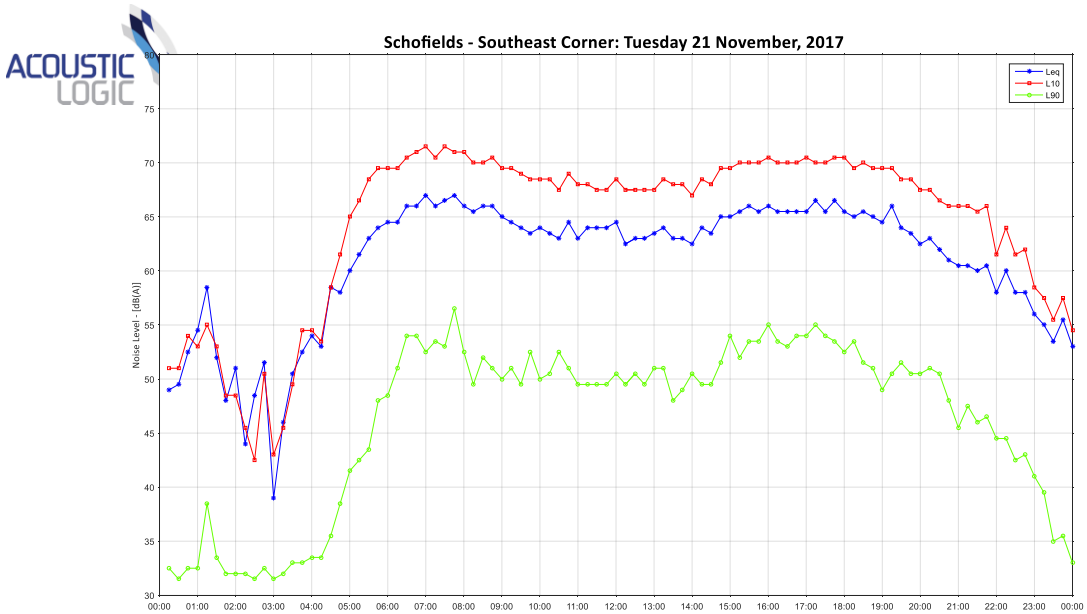
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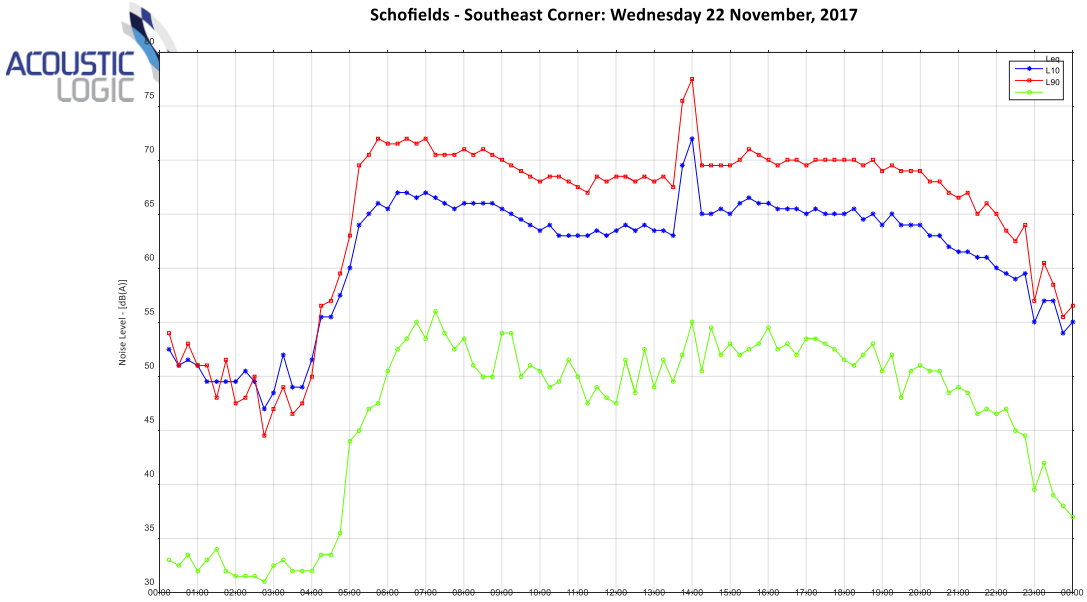
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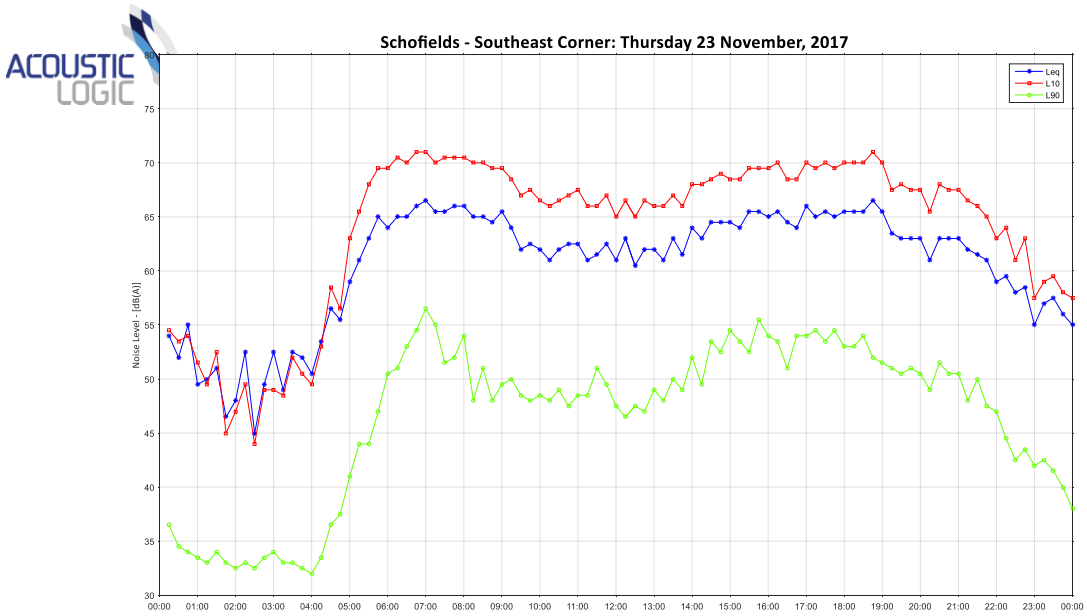
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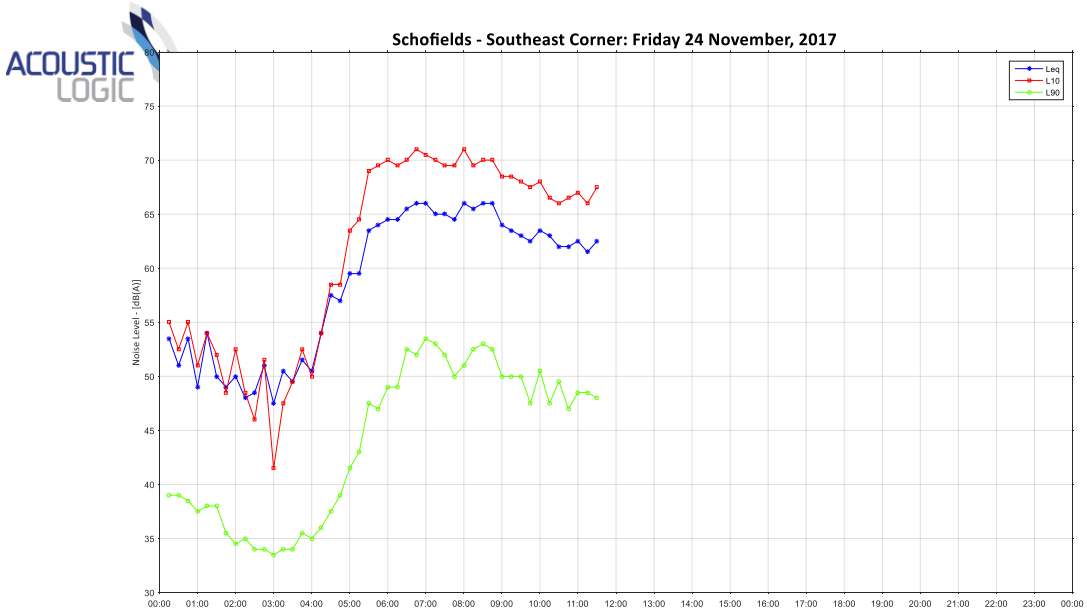
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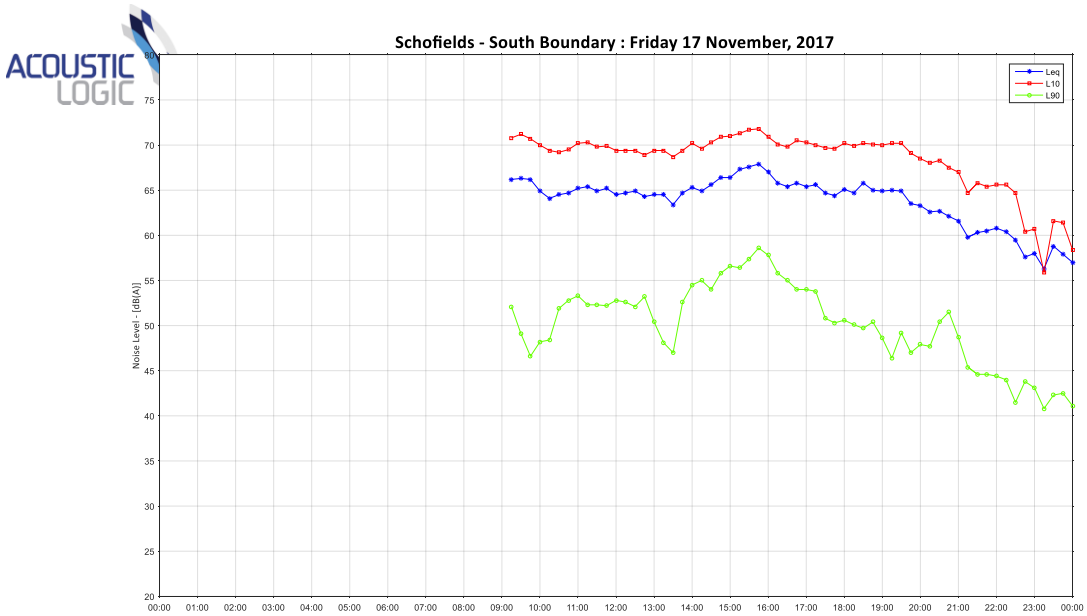
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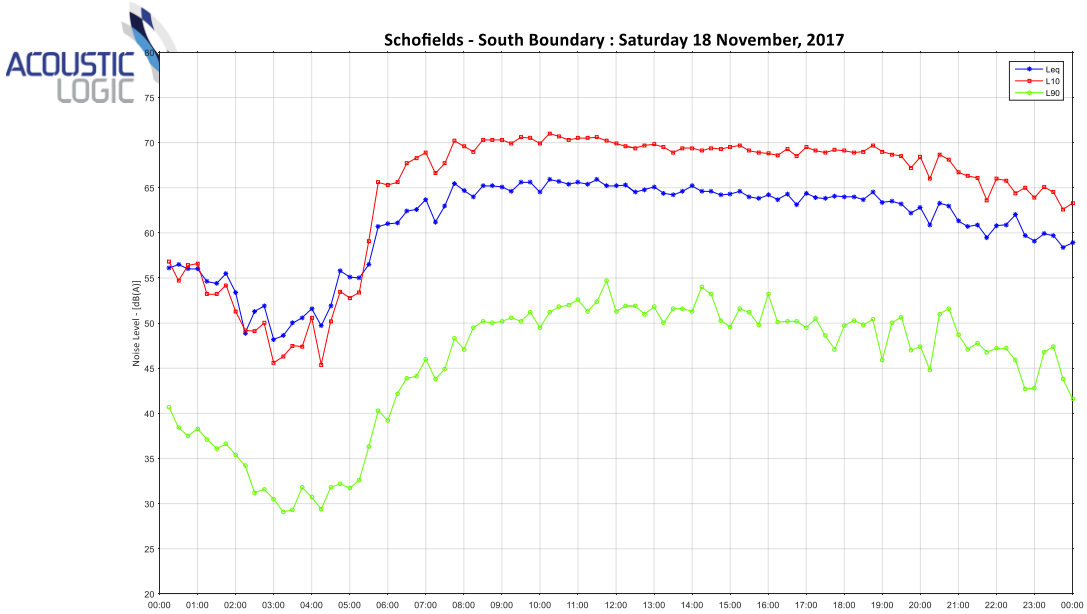
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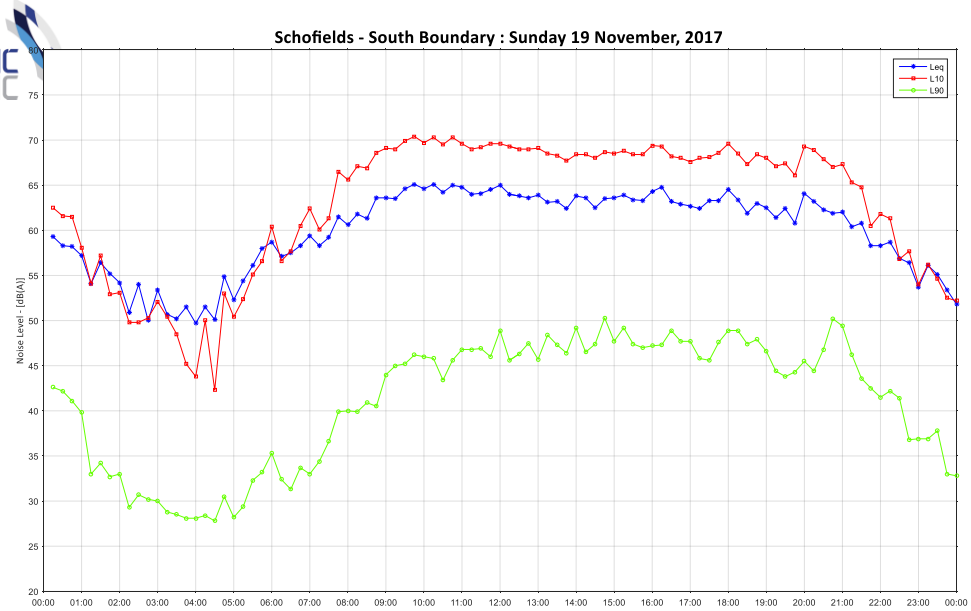
Schofields - South Boundary : Sunday 19 November, 2017
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Noise Level - [dB(A)]
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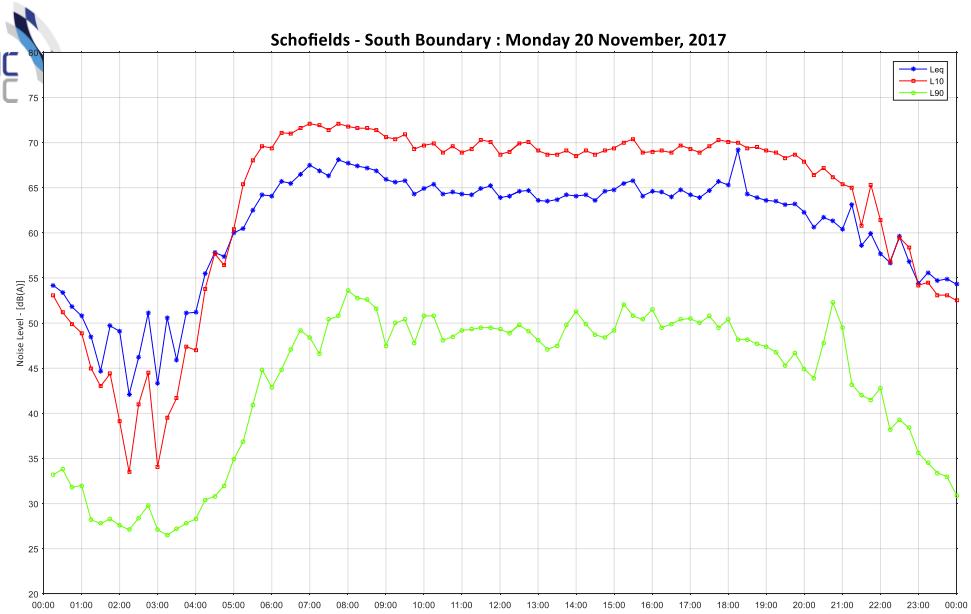
Schofields - South Boundary : Monday 20 November, 2017
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Noise Level - [dB(A)]
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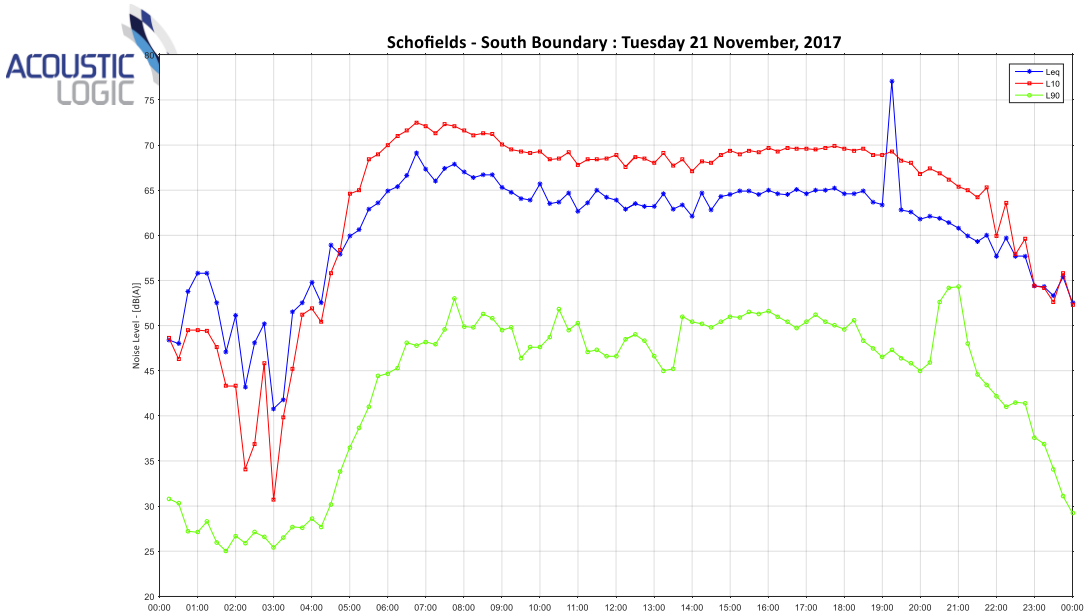
Schofields - South Boundary : Tuesday 21 November, 2017
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Noise Level - [dB(A)]
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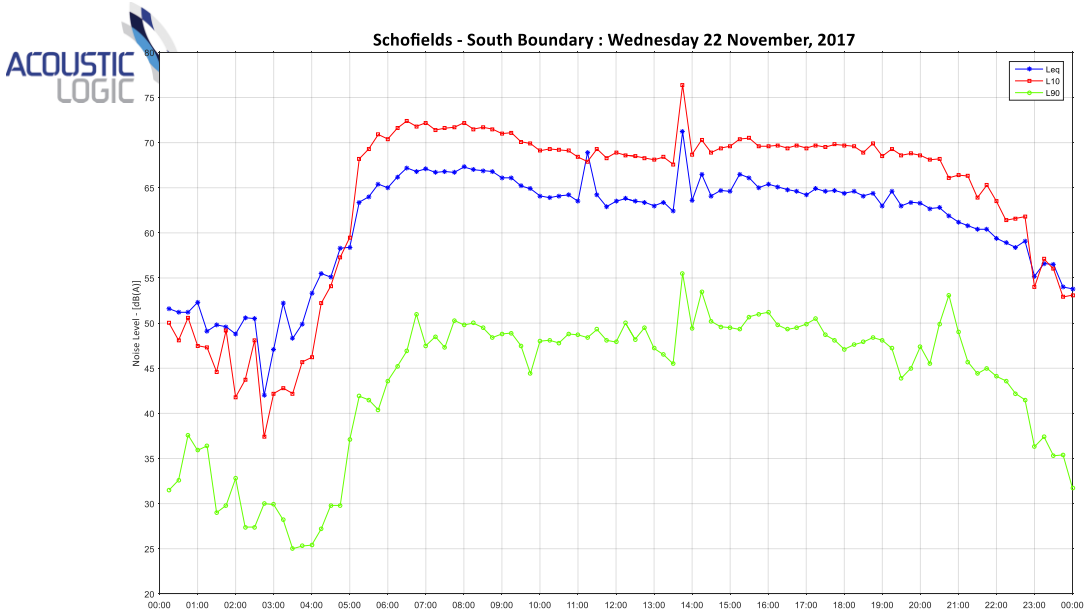
Schofields - South Boundary : Wednesday 22 November, 2017
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Noise Level - [dB(A)]
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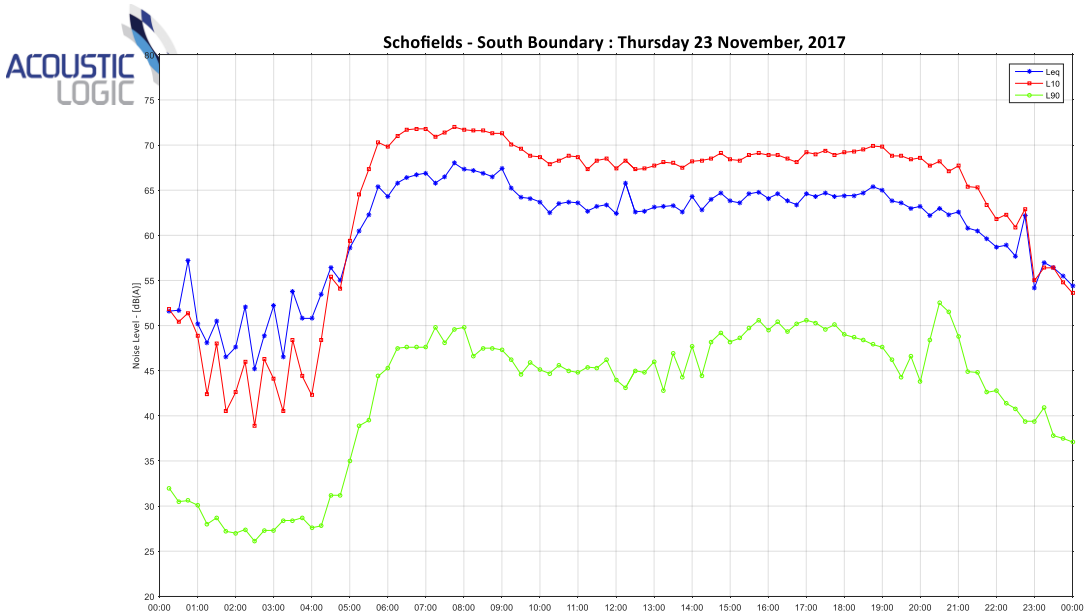
Schofields - South Boundary : Thursday 23 November, 2017
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Noise Level - [dB(A)]
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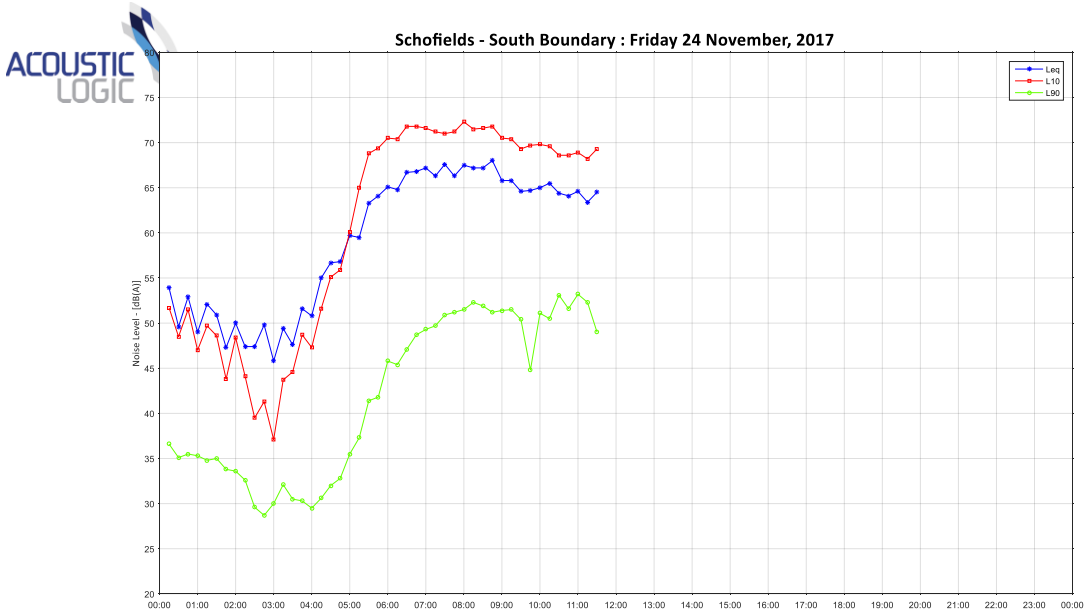
Schofields - South Boundary : Friday 24 November, 2017
Leq
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Noise Level - [dB(A)]
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