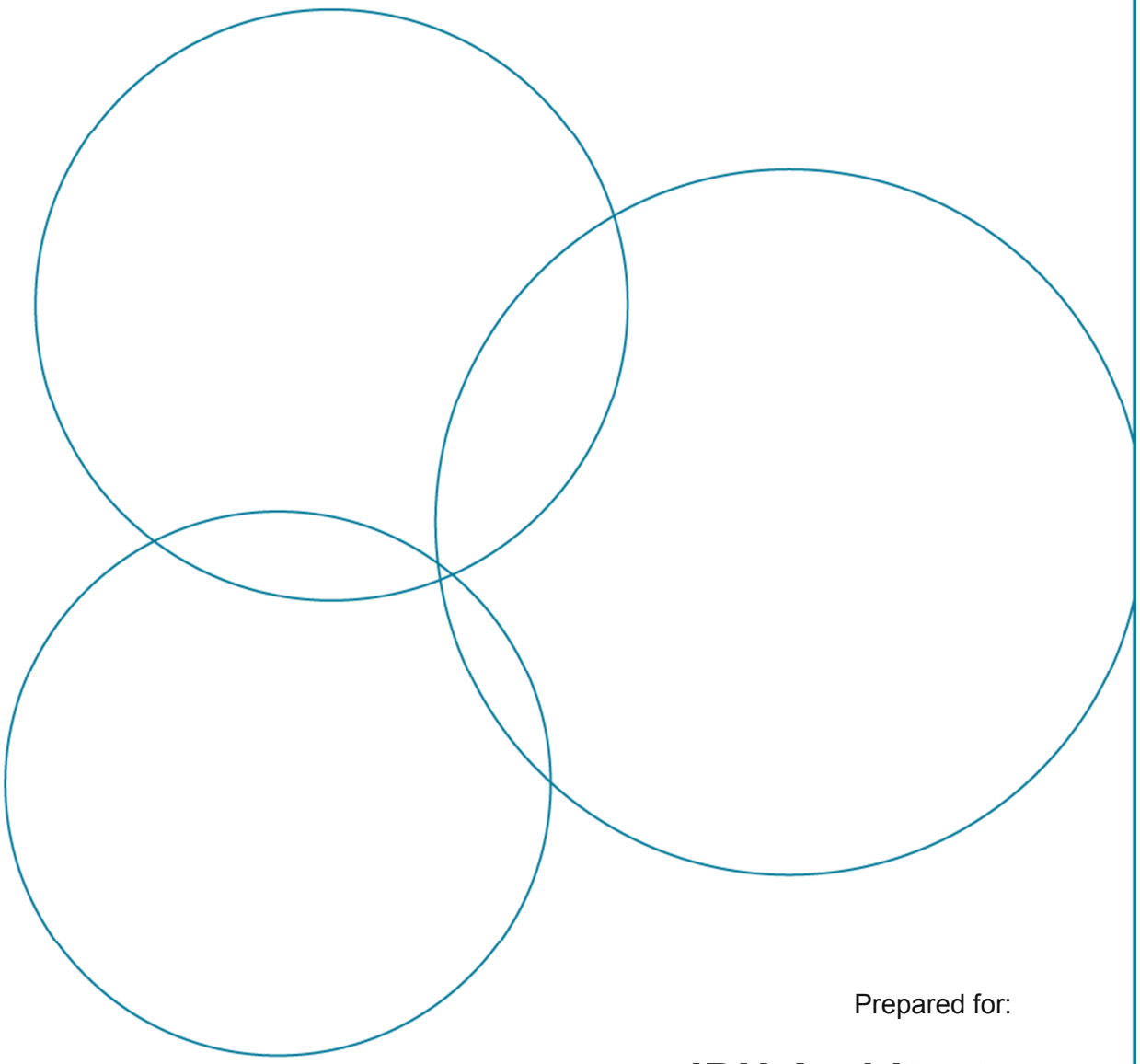
10 July 2017

Acoustic Report for DA Submission

1015561 – Merrylands Public School



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-	First Issue for comment	12/07/2017
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The success and realisation of the proposed initiatives will be dependent upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved.

Contents

Executive Summary

This report presents acoustic input to the DA submission for the proposed development at Merrylands Public School.

The acoustic analysis has been undertaken based upon data from noise surveys at the site. Acoustic design targets have been determined, based on appropriate standards and guidelines to achieve acceptable noise levels for:

- Noise break-in to the development and internal noise levels;
- Noise break-out to the community.

Noise intrusion from the surroundings affecting the development, such as general road traffic, will be controlled by the selection of appropriate façade glazing, external construction, and ventilation strategy to meet the recommended internal noise levels.

Items of building services plant have not been identified at this stage, however it is considered that typical external noise sources could be adequately controlled using standard acoustic treatment techniques.

Consideration has been given to the potential for change in activity noise due to an increased number of students, and an increased number of vehicle movements. Good practice guidance for controlling noise from construction sites has also been identified.

1 Introduction

Cundall has been commissioned by JDH Architects to carry out an assessment of noise levels affecting a proposed development at Merrylands Public School, Merrylands NSW, and consider noise break-out affecting neighbouring properties.

This report is based on the project brief provided to Cundall dated 5 May 2017.

1.1 Proposed development

Ground within the existing school site will be developed to provide the following facilities:

- New three storey building comprising 10 general learning areas, withdrawal areas, breakout spaces and wet areas.

1.2 Design criteria

In this report, acoustic design targets are established for:

- Noise impact of the surrounding community on the development, including internal noise levels;
- Noise impact of the development on the surrounding community.

The acoustic design targets and guidance have been derived from relevant Australian codes, standards, and guidance, including the following:

- NSW Educational Facilities Standards and Guidelines [EFSG], DG11 – Acoustics;
- EPA 'NSW Industrial Noise Policy' [INP] (January 2000);
- State Environmental Planning Policy – (Infrastructure) 2007 [ISEPP];
- Cumberland Council 'Holroyd Development Control Plan 2013';
- Australian Standard AS2107 'Acoustics – Recommended design sound levels and reverberation times for building interiors' (2016);
- Association of Australia Acoustical Consultants [AAAC] 'Guideline for educational facilities acoustics' (September 2010).

A glossary of acoustic terminology used in this report is included in Appendix A.

2 Site description

2.1 Existing site

The subject site is known as 68 Fowler Road, Merrylands. The immediate vicinity is predominantly residential in nature, with dwellings located to the north (across Morris Street), east (across Holdsworth Street) and west (across Fowler Road). Matthew Street, to the south, is a no through road past the site, with residential properties and Fowler Road School located on the opposite side of the road.

Fowler Road is the main thoroughfare past the site and rises as it passes by the school grounds.

The figure below indicates the site and the immediate surrounds.

Figure 1 – Site location and surrounds

2.2 Proposed site

The figure below indicates the proposed location of the new three storey development, which will replace an existing building.

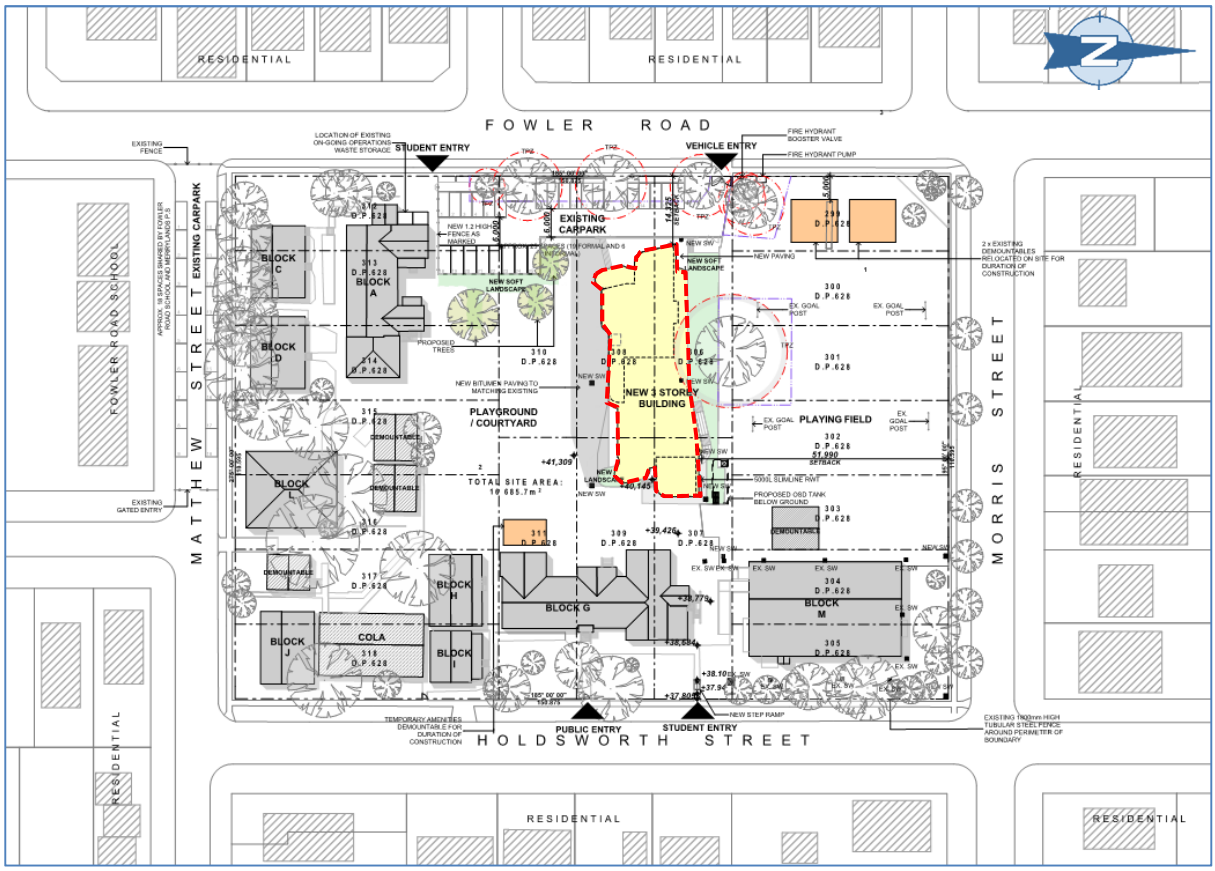

Figure 2 – Outline development proposals (new-build highlighted)

The proposed upgrades will provide for an additional 138 students and an anticipated net gain of six teaching staff. There will be no additional parking provided on site as part of the works.

The development will increase the number of students at the school by more than 50, and therefore the proposal is considered as ‘traffic generating development’ under Schedule 3 of ISEPP. Consideration of the potential acoustic impact of additional staff, students, and vehicle movements associated with the proposals will be considered further below.

3 Noise survey

The purpose of the noise survey was primarily to:

- Identify sources of noise that are likely to affect the development and their expected levels;
- Quantify existing ambient noise levels, to assist in setting appropriate noise criteria to assess the impact of the proposed development on the surroundings;
- Identify potential noise sensitive receivers in the vicinity.

3.1 Methodology

The environmental noise survey was based on a long-term unattended monitoring position, located to the east of the school grounds adjacent to Fowler Road. This location was considered representative of noise levels on the most exposed façades of the development (subject to distance attenuation corrections where necessary) and characteristic of the background noise levels at the nearest adjacent residential properties on Fowler Road.

The logger recorded at variety of noise parameters at 15 minute intervals, including the prevailing noise level (L_{Aeq}) and background noise level (L_{A90}). Measurements were made between June 23 – 29.

In addition to the long-term measurements, attended surveys were undertaken on June 23 & 29. A position on Morris Street was chosen, set back from Fowler Road by the same distance as the nearest proposed façade from the main road. The position was considered representative of noise levels at both the new building and at residential properties on Morris Street.

3.2 Conditions

Reported weather conditions at the nearest monitoring location[1] were fine over the unattended logging periods. Conditions were therefore considered appropriate for representative noise data.

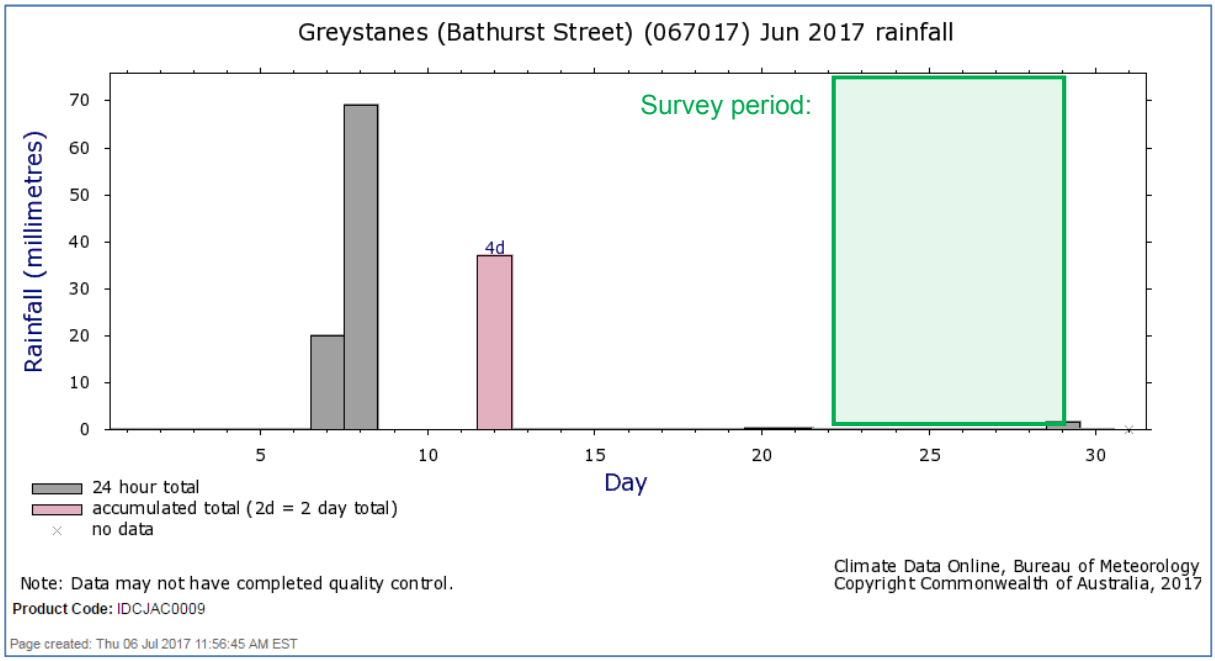

Figure 3 – June rainfall at the nearest monitoring location

[1] Ref: *http://www.bom.gov.au/climate/data/stations/*

It is considered that the survey generally meets recommendations given in relevant guidance documents.

3.3 Observations

From our site visits, the predominant noise source affecting the site was considered to be road traffic on Fowler Road.

3.4 Results

3.4.1 Attended measurements

Attended measurements indicated a typical average noise level of 55 dB L_{Aeq} at a location approximately 28 m from the centre of Fowler Road (equivalent to the most exposed façade).

3.4.2 Long-term measurements

The figure below illustrates the recorded L_{Aeq} and L_{A90} noise levels over the long-term monitoring period, based on the 15 minute survey data.

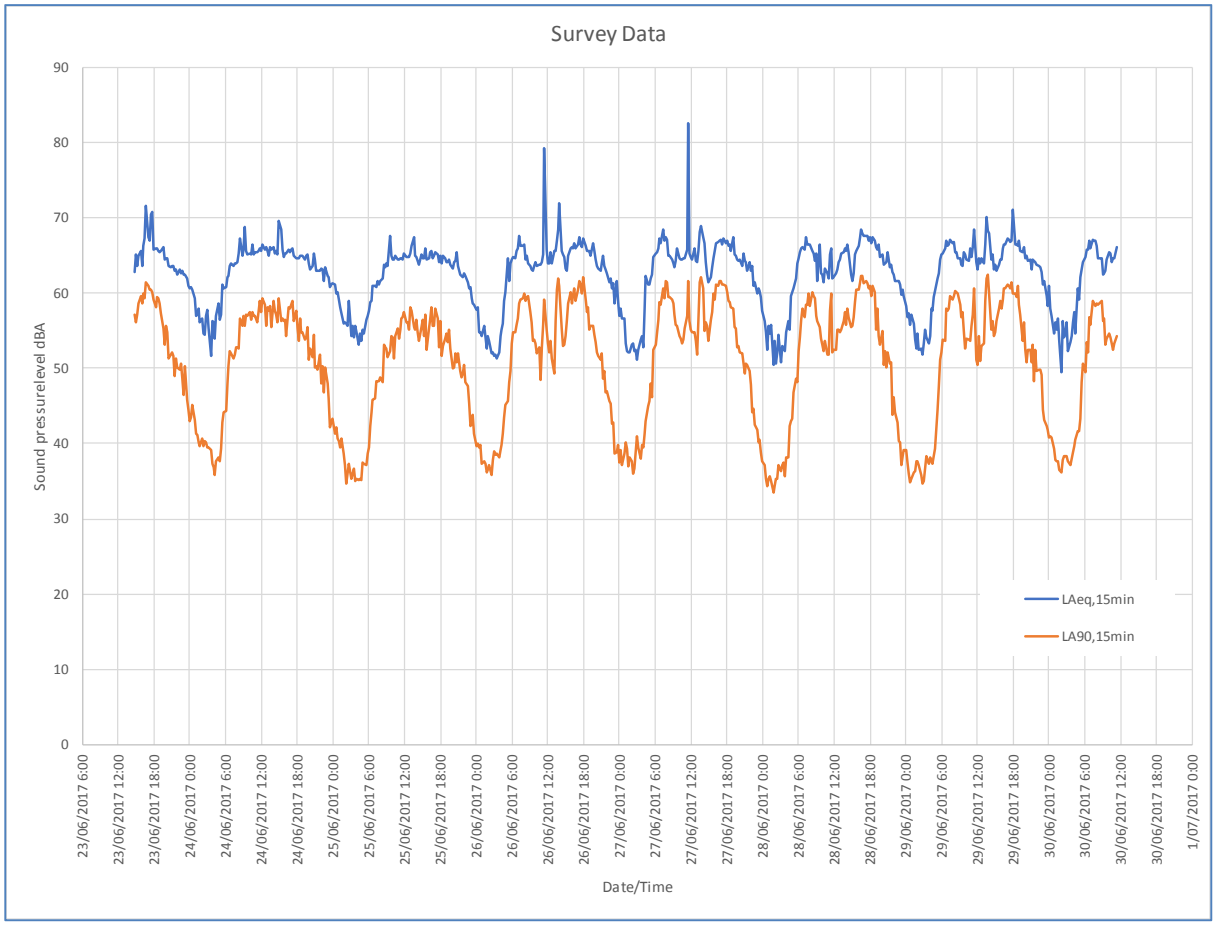

Figure 4 – Long-term noise level measurements

The two peaks in noise level (at 11:30 hours on the Monday & Tuesday) are considered to be due to children shouting on the adjacent sports field, and have been excluded from the analysis below.

The Table below presents the logarithmically averaged 15 minute L_{Aeq} values and typical L_{A90} values recorded across the whole survey period. It can be seen that there is only slight little variation in the noise levels across each daytime, evening, and night-time period[2].

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
23 June (Fri)	62.3	64.8	59.9	57.1	51.4	37.7
24 June (Sat)	65.8	64.4	59.4	52.9	52.9	35.3
25 June (Sun)	64.9	64.0	59.8	52.2	49.6	37.3
26 June (Mon)	65.6	65.0	60.7	52.3	49.2	37.4
27 June (Tue)	65.7	65.2	60.2	53.9	50.1	35.2
28 Jun (Wed)	65.4	65.5	60.5	52.5	50.3	35.6
29 June (Thu)	65.8	66.0	60.9	53.1	50.9	37.7
30 June (Fri)	61.4	n/a	n/a	53.3	n/a	n/a

Table 1 – Averaged 15 minute noise levels

The table below summarises the average weekday and weekend hourly L_{Aeq} values, based on the values given above.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
Weekday	65	65	60	54	50	37
Weekend	65	64	60	53	51	36

Table 2 – Averaged weekday and weekend noise levels

The measurement location was approximately 12 m from the centre of the road, whereas the nearest affected façade is approximately 28 m. A correction due to the additional distance should therefore be applied to the measurement results. Considering each vehicle passing as a separate point source, the correction to measured levels can be determined as follows:

- Attenuation = 20 x $\log_{10}$[12/27] = – 7 dB

The typical average noise level at the most exposed (nearest) façade would therefore be expected to be approximately 58 dB L_{Aeq}.

[2] Refer to Table 4 for definition of time periods.

4 Internal acoustic criteria

4.1 Internal noise level targets

The internal noise level within each space is the combination of any building services and intrusive external noise levels.

Recommended design levels for steady-state internal noise levels within educational buildings are given in Australian Standard AS2107:2016 and referred to within the AAAC Guideline for Educational Facilities Acoustics. The table below gives requirements for typical spaces within the proposed development.

Room type	Design sound level range (dB $L_{Aeq,T}$)
Classroom	35 to 45
Open-plan teaching	35 to 45
Computer rooms	40 to 45
Staff room	40 to 45

Room type	Design sound level range (dB $L_{Aeq,T}$)
Office – General	40 to 45
Office – Admin	35 to 40
Toilet	< 55
Corridors & Lobbies	< 50

Table 3 – Internal noise level requirements

4.2 Applicable project-specific noise levels

With reference to the above considerations, it is recommended that the building envelope (including glazed elements) and ventilation strategies (including any openings) be designed such that an internal noise level of ≤ 40 dB $L_{Aeq,T}$ can be achieved in all noise-sensitive spaces.

4.3 Acoustic design recommendations

Daytime noise levels monitored are objectively moderately low, even at the nearest proposed façade. To comply with the internal noise criteria given in Section 4.2, attention should be given to provide the necessary sound insulation performance of the façade and glazing and the selection of suitable ventilation systems.

Based on the worst-case façade noise level of 58 dBA, rooms will need to provide a glazing attenuation performance of 18 dB R_w+C_{tr} to adequately control intrusiveness of road traffic noise.

This level of performance can be easily achieved by standard single or double-glazed units such as 6 mm thick float glass or 6/12/6 double glazed units.

The acoustic performance of glazing systems should not be compromised by the framing system or seals. It is recommended that any selected systems be reviewed by a suitably qualified acoustic consultant.

5 External plant noise emissions

It is understood that the development proposals do not include mechanical ventilation or cooling systems to homebases, however there is the potential for localised items of plant (e.g. toilet extract fans, server room services).

Any environmental emissions from the proposed development must be designed to comply with the requirements of the NSW Environment Protection Authority's Industrial Noise Policy [INP] dated January 2000.

The objective of the INP is to protect residential areas and other sensitive receivers from noise generated by commercial, industrial, or trade premises. Noise limits are set based on land use in the area and existing background noise levels. Compliance is achieved if the adjusted L_{Aeq} noise level at any residence affected by noise from the facility is below these noise limits. The adjusted L_{Aeq} is determined by applying corrections for such noise characteristics as duration, intermittency, tonality, and impulsiveness.

The INP separates the day into three different time periods – day, evening and night. These time periods are detailed below.

Period	Day of week	Time period
Day	Monday-Saturday Sunday, Public Holiday	07:00 – 18:00 hours 08:00 – 18:00 hours
Evening	Monday-Sunday	18:00 – 22:00 hours
Night	Monday-Saturday Sunday, Public Holiday	22:00 – 07:00 hours 22:00 – 08:00 hours

Table 4 – INP Time periods

The INP provides guidance on acceptable noise levels from the introduction of new industrial noise sources to an area. The assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short term for residences; and
- Protecting noise level amenity for particular land uses such as residences and commercial offices etc.

Both of these components suggest noise criteria that should not be exceeded in order to minimise adverse noise impacts on the affected areas. Both criteria should be taken into account when assessing the noise impact of industrial source(s) associated with the proposed development, and where the intrusiveness and the amenity criterion differ, the lower of the noise criteria should be adopted as the project-specific noise criterion.

It should be noted that the assessment is based on industrial noise sources, which in this case would relate to mechanical services plant etc. Activity noise from children falls outside of this assessment and is considered further below.

5.1 Selection of noise sensitive receivers

The existing buildings most affected by potential noise from the development are the residential properties on Fowler Road to the west and Morris Road to the north.

5.2 Intrusiveness criteria

A 15-minute sampling period is typically used when measuring the level of intrusive noise. This is taken to be a reasonable estimate of the period over which annoyance may occur. The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15min} \leq L_{A90,15min}$ (i.e. background level) + 5 dB.

Because of the variable nature of background noise levels, the INP specifies single number background noise levels for use in setting the intrusiveness noise criterion. The Assessment Background Level [ABL] for each time period is the level exceeded by 90% of the $L_{A90,15min}$ measurements. The Rating Background Level [RBL] for a particular time period is the median of the ABL values for that time period for each day of the measurement period.

The applicable intrusiveness criteria for the development based on site measurement data from the noise logger are provided below.

Location	Time period	RBL	Intrusiveness Criterion
		dBA	RBL + 5 dB
Nearest residential properties	Day	53	58
	Evening	50	55
	Night	37	42

Table 5 – Derivation of Intrusiveness Criteria

5.3 Amenity criteria

Criteria for the protection of amenity are given for various types of receiver and different times of day. The amenity criterion is set so that the L_{Aeq} noise level from the industrial noise source does not increase the total industrial noise levels at the receiver above the acceptable noise level [ANL] for that receiver.

The amenity criterion is set based on how close the existing average L_{Aeq} industrial noise levels are to the ANL, using the adjustment factors given in Table 2.2 of the INP.

In cases where the existing L_{Aeq}, average noise levels exceed the ANL by more than 2 dB, and the existing noise levels are unlikely to decrease in future, then the amenity criterion is set to be 10 dB lower than the existing noise levels at the receiver.

A summary of the amenity criteria using data from the noise logger is presented below.

Location	Classification	Time period	Existing noise level dB L_{Aeq} [3]	ANL[4] dB L_{Aeq}	Modification factor [5] dB	Amenity Criterion dB L_{Aeq}
Nearest residential properties	Suburban	Day	65	55	L_{Aeq} – 10	55
		Evening	65	45	L_{Aeq} – 10	55
		Night	60	40	L_{Aeq} – 10	50

Table 6 – Derivation of Amenity Criteria

[3] Ref: Lowest values recorded in Table 2 above.
[4] Ref: Acceptable Noise Level for suburban residences, according to Table 2 of NSW INP, 2000.
[5] Ref: According to Table 2.2 of NSW INP, 2000.

5.4 Applicable project-specific noise levels

The most stringent of the intrusiveness and the amenity criteria should be set as the limiting project-specific noise level to be met by the development. The Table below compares the intrusiveness and the amenity criteria, and identifies the limiting criterion for each time period.

Location	Classification	Time period	Intrusiveness Criterion	Amenity Criterion	Project-specific Criterion dB $L_{Aeq,15min}$
Nearest residential properties	Suburban	Day	58	55	**55**
		Evening	55	55	**55**
		Night	42	50	**42**

Table 7 – Project-specific noise levels

5.5 Acoustic design recommendations

No mechanical services plant has been identified on the design proposals at this time.

Noise from any mechanical plant, however, should be controlled to meet the criteria given in Table 7 when assessed at the nearest affected noise-sensitive location.

Typical noise mitigation strategies include selection of low noise outdoor equipment, locating plant to take advantage of shielding from building elements, and the use of plant enclosures or screens if necessary.

5.5.1 Additional guidelines

Noise generated by waste collection or other service vehicles should be controlled by management of the collection/delivery times to ensure that disturbance to nearby residents during typical sleeping hours is avoided.

Other simple measures that should be adopted include the use of self-close gates with soft close hinges, and ensuring car park surfaces and access ways are smooth.

6 Consideration of activity noise

Student activity noise from schools is typically one of the most understandable, and tangible, causes of concern from the occupants of neighbouring premises.

There are no specific State criteria for children activity noise from schools and the local DCP does not reference educational facilities other than childcare centres.

6.1 Current noise impacts

The site is an existing and established school, covering a large site, and therefore adjacent noise-sensitive dwellings will already be acclimatised to the sounds of general school activity. It is noted that there are no residential properties immediately adjacent to the site boundary, as the school site is buffered on all sides by roads.

6.2 Potential noise impacts

The proposed upgrades will provide for an additional 138 students (approximately 30% increase).
The proposals do not include spaces with a high level of activity noise (such as music rooms). No new outdoor activity areas are being proposed in locations where this is not already the case.

6.3 Conclusion

In light of the above, it is not anticipated that there will be a significant change to the prevailing acoustic environment and additional assessment is not necessary.

It is also noted that activity noise will also be limited to the daytime period and would be unusual at weekends or public holidays.

7 Consideration of additional road traffic

A Traffic and Transport Assessment has been carried out as part of the DA submission, identifying the likely changes to road traffic as a result of the proposed development.

The report notes that Merrylands Public School is well served by public transport (both bus and train links) and an abundance of unrestricted parking areas. It is noted that spare capacity exists within existing staff parking areas and any additional student drop-off / pick-up demand generated can easily be accommodated within the adjacent streets.

The proposed upgrades include a net increase of six teaching spaces, accommodating 138 additional students and an assumed six additional staff. A total of 42 additional vehicular trips are forecast. The Traffic and Transport Assessment concludes that 'the addition of 42 vehicular trips distributed through the permeable nature of the road network will not affect the overall road network performance.'

7.1 Noise impact

Specific state guidance on the change to road traffic noise with increased traffic flow is not available, however the Design Manual for Roads and Bridges notes[6] that:

- an increase in traffic noise of 1 dB is associated with an increase of traffic flow of 25%.

Traffic count data are not available on the roads surrounding the school, however it is not anticipated that an additional 42 vehicle movements would result in an increase to traffic flows in excess of 25% and therefore the worst-case noise impact would be less than 1 dB.

7.2 Conclusion

It is not considered that there will be any significant change in road traffic noise generation on the basis of 42 additional vehicle movements, even assuming a worst-case assessment that all new vehicle movements affect one specific location.

On this basis, it is considered that any change to the noise impact from road traffic on adjacent sensitive receptors will be negligible, and the noise impact on the school itself will not be affected.

[6] Volume 11, Section 3, Part 7 – Traffic noise and vibration, Paragraph 3.5.

8 Consideration of construction noise

Assessment of demolition and construction noise is outside the scope of this DA report, however it should be noted that all work, including demolition, excavation, and building work should comply with the current Cumberland Council policy and Australian Standard 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites.

It is recommended that a construction noise and vibration management plan be developed at a later stage of the project, prior to the commencement of site works, once a contractor has been appointed and construction activities confirmed.

8.1 Other measures

Standard good-practice procedures should be adopted on site, including the following:

- Where possible, noise generating equipment should be strategically positioned to take advantage of natural screening from structures to reduce the transmission of noise to sensitive receptors;
- Fixed plant should be appropriately selected and sited and, where necessary, fitted with appropriate silencers or acoustic enclosures;
- Noisy plant operating simultaneously close together should be avoided to the greatest extent practicable, adjacent to noise affected sensitive receptors;
- All plant and equipment should be maintained in a proper and efficient manner to minimise noise emissions, including the replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and the repair of leakages in air lines;
- All plant and equipment should be operated in the correct manner to minimise noise emissions;
- Noise generating equipment should be orientated away from nearby receivers where feasible to minimise noise impacts;
- Minimise plant and vehicles idling when not in use;
- PPE including hearing protection should be made available and worn where noise levels require.

9 Conclusions

This report presents acoustic input to the DA submission for the proposed development at Merrylands Public School.

Based on appropriate standards and guidance, intrusive noise impact on the development from the surroundings (primarily road traffic noise) has been assessed. It has been determined that standard glazing solutions should provide an acceptable environment within the development.

Although external plant items are not identified on current plans, noise limits on emissions from plant have been set to see that any noise impact of the development on the surrounding community is acceptable.

Consideration has been given to the potential for change in activity noise due to an increased number of students, and an increased number of vehicle movements. Good practice guidance for controlling noise from construction sites has also been identified.

Appendices

Appendix A Acoustic Terms

ASSESSMENT BACKGROUND LEVEL (ABL)

A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background L_{A90} noise levels – i.e. the measured background noise is above the ABL 90% of the time.

'A'-WEIGHTED SOUND LEVEL dBA

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dBA. An A-weighting network can be built into a sound level measuring instrument such that sound levels in dBA can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

DECIBEL

The ratio of sound pressures which we can hear is a ratio of one million to one. For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

EQUIVALENT CONTINUOUS SOUND LEVEL (L_{Aeq})

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

FREQUENCY

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used.

For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrower frequency bands.

RATING BACKGROUND LEVEL (RBL)

A single-number figure used to characterise the background noise levels from a complete noise survey.

The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.

SOUND POWER AND SOUND PRESSURE

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source.

The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

STATISTICAL NOISE LEVELS

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index that allows for this variation. 'A'-weighted statistical noise levels are denoted L_{A10}, dB L_{A90} etc. The reference time period (T) is normally included, e.g. dB $L_{A10\ 5min}$ or dB $L_{A90,8hr}$.

$L_{A90\ (T)}$

Refers to the sound pressure level measured in dBA, exceeded for 90% of the time interval (T) – i.e. measured noise levels were greater than this value for 90% of the time interval. This is also often referred to the background noise level.

$L_{A10\ (T)}$

Refers to the sound pressure level measured in dBA, exceeded for 10% of the time interval (T). This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

$L_{A1\ (T)}$

Refers to the sound pressure level measured in dBA, exceeded for 1% of the time interval (T). This is often used to represent the maximum noise level from a period of measurement.