St Ives High School Sports Complex

Noise Impact Assessment

NSW Department of Education

Job No:	1019962
Doc Ref:	1019962-RPT-AS001
Revision:	B
Revision Date:	16 November 2018

Project title	St Ives High School Sports Complex	**Job Number**
Report title	Noise Impact Assessment	1019962

Document Revision History

Revision Ref	Issue Date	Purpose of issue / description of revision
—	08 November 2018	Issue for comments
A	15 November 2018	Update to include construction work description
B	16 November 2018	Description and drawing dates update

Document Validation (latest issue)

X 
Principal author

X 
Checked by

X 
Verified by

Executive Summary

This report presents acoustic input in relation to noise criteria for the proposed development at St Ives High School, St Ives NSW.

The analysis has been undertaken based upon an on-site noise survey carried out between 19th October 2018 and 1st November 2018. Acoustic design targets have been determined, based on appropriate standards and guidelines to achieve acceptable noise levels for internal design noise levels, noise ingress and noise egress.

Specific items of building services equipment 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.

Nosie from future sporting activities within the Sports Complex have been reviewed and controls by means of building construction have been provided.

Noise ingress from the surrounding environment affecting the proposed development has been identified as noise from road traffic. This will be controlled by the selection of appropriate façade glazing, external construction, and ventilation strategy to meet the recommended internal noise levels. Glazing sound insulation requirements have been provided for attenuation of road traffic noise and school activities within the Sports Complex.

Standard Council conditions on construction activity and good practice guidance for controlling noise from construction and demolition activity has also been identified and outlined within this report.

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Appendices

Appendix A Acoustic terminology

1.0

Introduction

1.0 Introduction

Cundall has been engaged by JDH Architects on behalf of NSW Department of Education to carry out a noise impact assessment of the proposed development within the grounds of the existing St Ives High School, located at Yarrabung Road St Ives, NSW. The assessment will consider noise ingress and egress of the proposed development.

This report is based on the architect's information provided to Cundall dated 6 November 2018.

1.1 Proposed development

The proposed development includes:

- Demolition of the existing Block B, footpaths and existing sports courts;
- new sports facility (Sports Complex);
- new landscape area.

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 proposed development location is in the local government area of Ku-ring-gai Council. A review of the Ku-ring-gai Council policies has found no specific requirement with respect to the acoustic design of school sports facility. In the absence of Council's requirement, the 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 Noise Policy for Industry' [NPfI] (October 2017);
- State Environmental Planning Policy – (Infrastructure) 2007 [SEPP];
- State Environmental Planning Policy - Educational Establishments and Child Care Facilities 2017 [SEPP Education];
- 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).
- Interim construction noise guideline (NSW Environment Protection Authority, 2009);
- Australian Standard AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*

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

2.0

Site description

2.0 Site description

2.1 Existing site and general observation

The existing St Ives High School is surrounded by residential receivers. Roads with significant contribution to the proposal has been identified as Horace Street (west).

Figure 1 indicates the site and the immediate surrounds of the school, an indicative location of the proposed new building and noise monitoring locations (refer to Section 3.0).

Figure 1 Existing site location and surrounds (Google Maps)

2.2 Proposed development

Figure 2 outlines demolition footprints of existing structures to make way for new landscaped areas. Figure 3 presents the proposed new Sports Complex within the existing school grounds adjacent to the western boundary of the school.

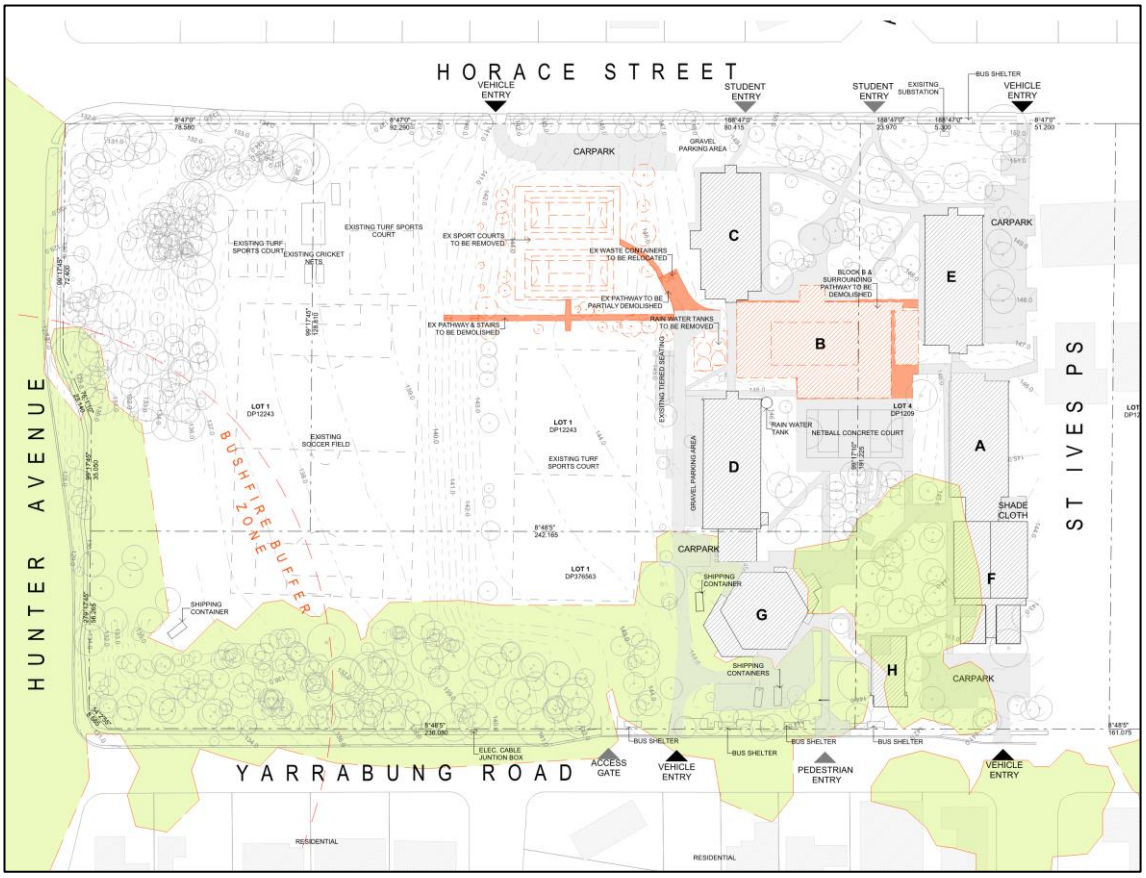

Figure 2 Proposed demolition plan - Drawing number DA-02 Rev E, dated 14/11/2018 (JDH Architects)

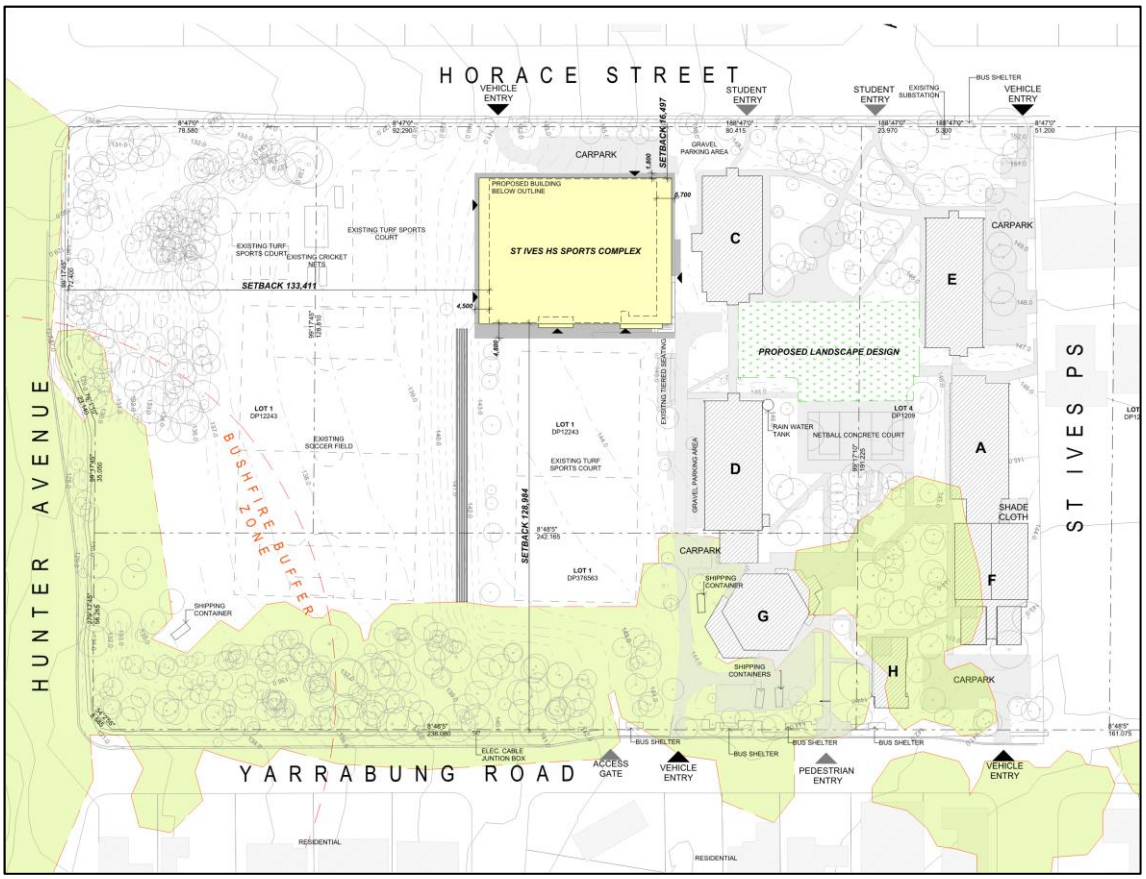

Figure 3 Proposed site plan - Drawing number: DA-03 Rev E, dated: 14/11/18 (JDH Architects)

3.0

Existing environment

3.0 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 north of the school grounds. The logger was positioned at ground level along Horace Street, approximately 10 m setback from the 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 affected adjacent residential properties on Horace Street.

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 19th October 2018 and 1st November 2018.

3.2 Weather conditions

Weather conditions at the nearest weather station (Observatory Hill[1]) have been monitored throughout the logging period. Overall weather conditions were observed to be acceptable over the unattended logging period. Any weather affected periods have been excluded as per guidance within the NPfI.

3.3 Monitoring results and observations

3.3.1 Unattended monitoring results

The Figure 4 illustrates the recorded L_{Aeq} and L_{A90} noise levels over the long-term monitoring period, based on the 15-minute survey data.

[1] Ref: *http://www.bom.gov.au/products/IDN60901/IDN60901.94768.shtml*

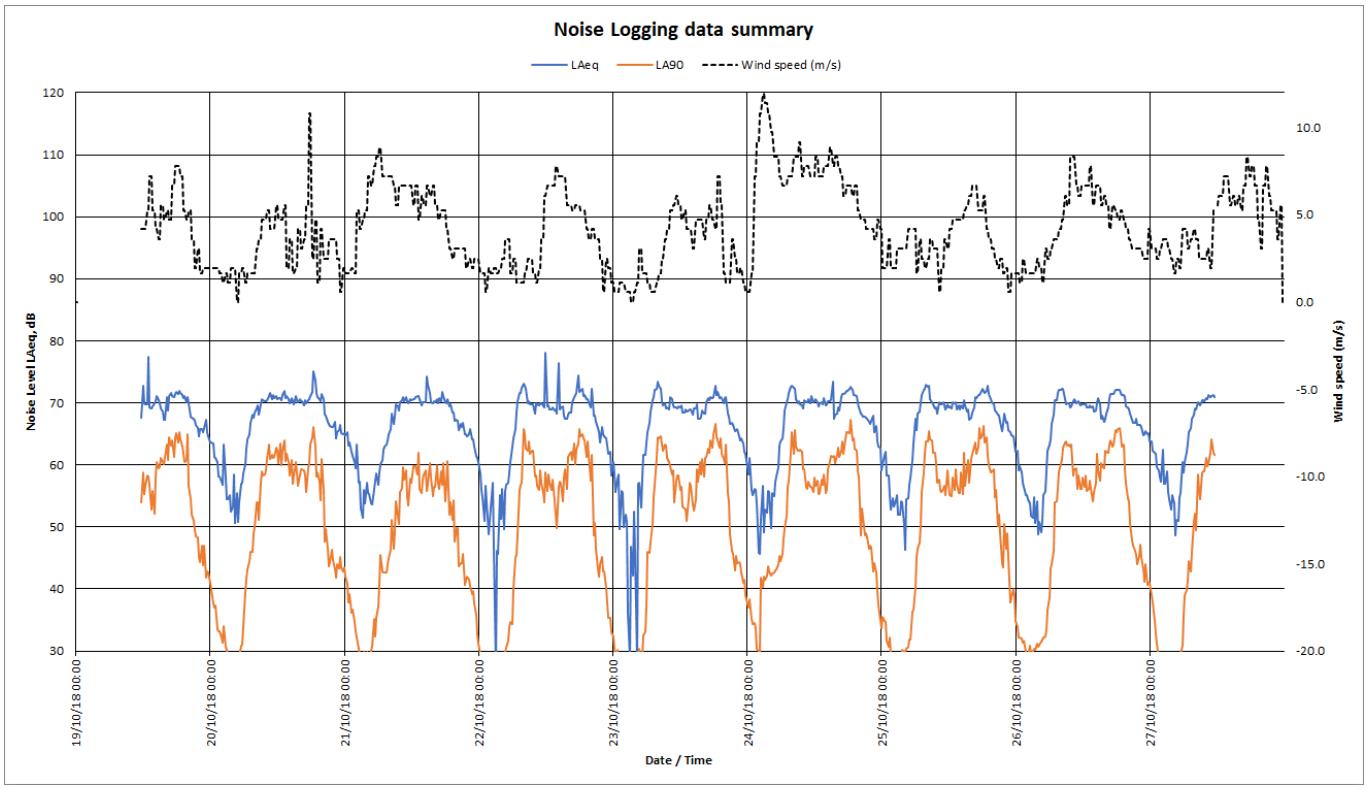

Figure 4 Long-term noise level measurements

The Table 1 presents the summary of measured ambient noise levels dB, L_{Aeq} and dB, L_{A90} across the whole survey period.

Table 1 Summary of measured ambient noise levels

Measurement location	Measured Ambient Noise Level (dB, L_{Aeq})			Measured Background Noise Level (dB, L_{A90})		
	Daytime	Evening	Night-time	Daytime	Evening	Night-time
BG01	71	69	62	56	45	28

Table 2 presents the summary of measured road traffic noise at the noise monitoring location.

Table 2 Summary of measured octave band road traffic noise levels

Descriptor	Measured Noise Level								
	Total	Octave band Frequency, Hz (Linear, dB)							
		31.5	63	125	250	500	1000	2000	4000	8000
Daytime peak [2] (6:00 am -8:00 am) $L_{Aeq(1hr)}$	72	66	72	70	66	66	69	65	55	46

1) Free-field noise level

Based on the measurement data and the proposed façade setback distance of approximately 28 m, the noise levels used for the design of the building façade are presented in Table 3.

Table 3 Summary of design road traffic noise levels

Façade direction	Calculated facade noise level dB $L_{Aeq(1hr)}$
N	66
E	55
S	68
W	69

4.0

Environmental noise

4.0 Environmental noise

4.1 State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017

The State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017 [Education SEPP] provide controls of noise from a new building and alteration of existing building which are in line with the intrusive criteria of the NSW Environment Protection Authority's Noise Policy for Industry [NPfI] dated October 2017 (detailed in the following sections). It should be noted that this design criteria are applicable to the design of the school building and not noise from children.

An extract of the development control provided by Education SEPP, Part 7, Schedule 2 Schools—complying development are presented below:

> *6 Noise*
>
> *A new building or (if the development is an alteration or addition to an existing building for the purpose of changing its use) an existing building that is to be used for the purpose of a school or school-based child care must be designed so as not to emit noise exceeding an L_{Aeq} of 5 dB(A) above background noise when measured at any lot boundary.*

4.2 Noise egress design criteria

It is understood that the development proposal may include mechanical ventilation/cooling systems to the new Sports Complex. As such there is potential for some localised items of plant (e.g. toilet extract fans, mechanical services for classrooms) to be installed as part of the proposal.

Any environmental emissions from the proposed development should be designed to comply with the requirements of the NSW Environment Protection Authority's *Noise Policy for Industry* [NPfI] dated October 2017.

The objective of the NPfI is to ensure noise impacts from the proposed developments are assessed and managed in a consistent and transparent manner. If it is predicted that the development is likely to cause the project noise trigger level to be exceeded at noise-sensitive receivers, management measures need to be considered to seek to reduce the potential noise level.

The project noise trigger level provides an objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response; for example, further investigation of mitigation measures. The project noise trigger level, feasible and reasonable mitigation measures, and consideration of residual noise impacts are used together to assess noise impact and manage the potential noise from a proposal or site.

The project noise trigger level is the lower (that is, the more stringent) value of the project intrusiveness noise level and project amenity noise level. The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that intrusive noise is limited, amenity is protected, and that no single development can unacceptably change the noise level of an area.

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

Table 4 NPfI time periods

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

It is noted that the dB, L_{Aeq} noise level is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods.

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.

4.2.1 Selection of noise sensitive receivers

The most affected sensitive receivers to potential noise from the proposed development are the residential properties on Horace Street located approximately 40 m to the west. Should mechanical plant noise emissions meet the requirements at this location then other, more distant, properties will be appropriately protected.

4.2.2 Project intrusiveness level

A shorter sampling period over 15-minute 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 applicable intrusiveness criteria for the development based on site measurement data[2] are provided in Table 5.

Table 5 NPfI - Intrusive criteria

Location	Reference monitoring location	Time period	RBL (Measured)	Intrusive criteria RBL + 5 dB
			dBA	dB, $L_{Aeq,15min}$
Nearest residential properties	BG01	Daytime	56	61
		Evening [1]	45	50
		Night-time[1]	28	35[2]

1) The school activity is not anticipated during these periods.
2) Where the measured RBL noise level during the night-time period is found to be less than 30 dB $L_{A90,}$ the night-time Intrusive noise criterion is based on the NPfI minimum night-time background noise level of 30 dB L_{A90}.

4.2.3 Project amenity level

The protection of noise amenity applies to noise from all industrial noise sources including noise emitted from the proposed development. Criteria considers the type of receiver, the area classification and the time of day the noise is proposed to occur. The amenity criterion is set so that the L_{Aeq} noise level from the industrial noise source does not

[2] Because of the variable nature of background noise levels, the NPfI 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.

increase the total industrial noise levels at the receiver above the recommended amenity noise level [ANL] for that receiver.

In cases where no other industries are present in the area, the project amenity noise level is set to the ANL for the proposed development.

A summary of the amenity criteria using data from the noise logger is presented in Table 6.

Table 6 NPfI – Amenity criteria

Location	Classification	Time period	Measured noise level dB $L_{Aeq,15min}$	ANL[1,2] dB $L_{Aeq, period}$	Amenity criteria dB $L_{Aeq,15min}$
Nearest residential properties	Suburban	Daytime	71	55	53 (55-5+3)
		Evening[3]	69	45	43 (45-5+3)
		Night-time[3]	62	40	38 (40-5+3)

1) Acceptable Noise Level for suburban residences, according to Table 2.2 of NSW NPfI, 2017.
2) To standardise the assessment period for the intrusiveness and amenity noise levels, the policy assumes $L_{Aeq,15min} = L_{Aeq, period} + 3$ dB.
3) The school activity is not anticipated during these periods.

4.2.4 Applicable project-specific trigger levels

The most stringent of the intrusiveness and the amenity criteria should be set as the project-specific trigger level to be met by the development. Table 7 compares the intrusiveness and the amenity criteria and identifies the limiting criterion for each time period.

Table 7 NPfI – Project-specific noise trigger levels

Location	Classification	Time period	Intrusive criteria dB $L_{Aeq,15min}$	Amenity criteria dB $L_{Aeq,15min}$	Project -specific trigger level dB $L_{Aeq,15min}$
Nearest residential properties	Suburban	Daytime	61	53	53
		Evening[1]	50	43	43
		Night-time[1]	35	38	35

1) The school activity is not anticipated during these periods.

4.2.5 Compliance with State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017

Compliance with the established project-specific trigger levels (Table 7) will also comply with the Clause 6 of the SEPP Education (Section 4.1).

4.3 Noise egress design recommendations

As specific plant items have not been selected at this stage, the project-specific noise trigger levels have been established for consideration during the subsequent design stage. Noise from any mechanical plant associated with the proposed development 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.

4.3.1 Management of other operational activities

Noise generated by waste collection, services or delivery vehicles is not pacificated from the proposal. However, noise from general operation such as waste collection, services or delivery vehicles should be controlled by management of

the collection/delivery times to minimise disturbance to nearby residents. Out of hours (evening and night-time period) activities are not anticipated for the proposed development. Incorporation of Best Management Practice will ensure that impacts to the adjacent receivers, if any, will be reduced during operation.

5.0

Internal acoustic design

5.0 Internal acoustic design

5.1 Design targets

The Educational Facilities Standards & Guidelines (EFSG) Design Guide DG11 provides guidance on the acoustic performance requirements of the various areas and spaces within a school. The design targets provided within this section have been derived from the NSW Department of Education website[3] and are applicable to all new buildings.

5.1.1 Internal noise level and reverberation time targets

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

Recommended design levels for steady-state internal noise and reverberation times within educational buildings are given within the EFSG which are in line with the values provided within Australian Standard AS2107:2016.

Table 8 outlines internal noise levels and reverberation times design targets for typical spaces within the proposed development.

Table 8 Summary of recommended room acoustics design targets

Room	Internal noise level (dB L_{Aeq})	Reverberation time, s RT_{60} (Average 500 Hz and 1 kHz octave bands)
Corridors and lobbies	45	Minimise
Dining rooms	45	<1
Dance Studios	40	<1.2
Duplicating rooms/stores	50	-
Gymnasiums	40	<1.5
Medical rooms (First aid)	40	<0.8
Office areas	40	<0.8
Teaching spaces – Secondary schools	35	<0.6
Toilet/change/showers	50	-

5.1.2 Rain noise

Rain noise impact is to be assessed only for the following spaces or otherwise directed:

- Movement studios
- Halls

The design rain intensity level shall use using the one-year annual recurrence, one-hour event for the region as reported by the Bureau of Meteorology (one-hour even rain fall of Rainfall Intensity-Frequency-Duration, Rainfall IFD).

The guidance provided within EFSG does not specify internal noise level during rain event. Guidance from Victorian Department of Education and Training (DET) *Building Quality Standards Handbook* (BQSH) dated May 2017 has been adopted for the design.

The BQSH described the rain noise during a moderate rain event (up to 25 mm/hr rate) as not cause the ambient noise levels to be exceeded by more than 5 dB within learning and speech use areas. Based upon this guidance, the internal

[3] Department of Education, *Educational Facilities Standards and Guidelines – Design Guide DG11*, https://efsg.det.nsw.edu.au/design/design/dg11acoustics, access date 2 August 2018.

design noise level during rain event shall not exceeded the nominated internal noise levels of the respective spaces as detailed in Table 8 by more than 5 dB.

5.2 Acoustic design recommendations

5.2.1 Internal ambient noise levels

With reference to the internal noise level design targets (Section 5.1.1), it is recommended that the building envelope (including glazed elements) and ventilation strategies (including any openings) be designed such that an internal noise level can be achieved within all noise-sensitive spaces.

5.2.1.1 External noise intrusion

The building façade should be designed such that the maximum ambient noise level criteria detailed in Table 8 would be achieved with doors and windows closed. Given the location of the site and based on the measurement data, requirements should be achieved with standard building envelope constructions.

Table 9 Minimum façade glazing requirement

Façade direction	Calculated facade noise level dB $L_{Aeq(1hr)}$	Internal design criteria dB $L_{Aeq(1hr)}$	dB R_w rating requirement	Glazing recommendation system option[1]
				Single glazed system
N	66	35	35	6.38 mm lam
E	55	40	20	6 mm float
S	68	40	35	6.38 mm lam
W	69	40	35	6.38 mm lam

1) Based on current design and glazing areas

Attention should be given to provide the necessary sound insulation performance of the façade and glazing and the selection of suitable ventilation systems. The acoustic performance of glazing systems should not be compromised by the framing system or seals.

The transmission loss performance of the building envelope used in the calculation is presented in Table 10.

Table 10 Glazing transmission loss specification used in calculation

	Transmission loss performance (dB)						
Octave band Frequency	63	125	250	500	1000	2000	4000
6 mm float glazing	17	20	24	31	35	29	34
6.38mm laminated glazing	14	17	20	24	31	35	33
Brick structure	36	39	35	39	47	55	60
Roof construction	42	44	34	35	37	36	29

5.2.1.2 Internal mechanical services noise

Noise from any fans serving internal spaces is likely to be adequately controlled using standard acoustic treatment such as lined ductwork and acoustic attenuators.

Any open ventilation path passing between noise sensitive teaching or leaving spaces is likely to require a crosstalk attenuator or internally lined ductwork situated across (or immediately adjacent to) the dividing partition.

5.2.2 Roof construction for rain noise

Design rainfall has been obtained from the Bureau of Meteorology Rainfall Intensity-Frequency-Duration (Rainfall IFD). The Rainfall IFD indicate a one-hour even rain fall with 63.2% Annual Exceedance Probability (AEP) of 27.9 mm.

Based on this design level, the following constructions providing a nominal Sound Intensity Level of 45 dB, L_{iA} are recommended for all lightweight roofs above occupied spaces to minimise the impact of rain noise. This performance will allow compliance of 5 dB above the nominated internal noise levels of the respective spaces detailed in Table 8 during the design rainfall:

Either;

- Minimum 0.48 mm thick metal deck roof
- 50 mm thick, minimum 10 kg/m^3 acoustic cavity insulation sandwiched between roof metal and purlins
- Minimum 100 mm airgap (purling/joist depth), with additional layer of 50 mm thick minimum 10 kg/m^3 acoustic cavity insulation
- 10 mm thick plasterboard, or equivalent
- Selected architectural ceiling finish

Or;

- Minimum 0.48 mm thick metal deck roof
- 50 mm thick, minimum 10 kg/m^3 acoustic cavity insulation sandwiched between roof metal and purlins
- Minimum 150 mm airgap (lightweight suspension system)
- Mineral fibre tile ceiling (NRC ≥ 0.8) in grid

Alternative roofing systems can be assessed if required.

6.0

School operation noise

6.0 Consideration of school operation noise

6.1 School 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. Currently 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.

The Project site is an existing and established school, covering a large area, and therefore adjacent noise-sensitive dwellings will already be acclimatised to the sounds of general school activity.

The proposed upgrades will provide enclosed Sports Complex (two basketball courts, two class rooms and a fitness lab). Based on the current layout, the area where noise emission is likely to be the highest are the basketball courts. The proposals do not include new spaces with a high level of activity noise (such as music rooms) and no new outdoor activity areas are being proposed in locations where this is not already the case.

There is currently no design capacity within the Sports Complex and there may be use of public address system within the Sports Complex. The noise prediction of the court usage assumes reverberant level of up to 85 dB $L_{Aeq(15min)}$ through the proposed glazing system provided in Section 5.2.1.1. The noise level due to Sports Complex usage at the nearest sensitive receiver during the daytime is predicted to be below the nominated daytime and evening criteria of 53 dB $L_{Aeq,15min}$ and 43 dB $L_{Aeq,15min}$ (Table 7).

In addition to the above, the school activity noise will be limited to the daytime and some evening periods. As a result, it is not anticipated that there will be a significant change to the prevailing acoustic environment and additional assessment is not necessary.

7.0

Construction noise

7.0 Consideration of construction noise

As the detailed plan of construction has not been established at this stage of the project, an assessment of demolition and construction noise is to be assessed once the information becomes available. It should be noted that all construction works, including demolition, excavation, and building work should comply with the following guideline as a minimum:

- Interim construction noise guideline (NSW Environment Protection Authority, 2009)
- Australian Standard AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*
- Local council policies (Ku-ring-gai Council)

It is recommended that a Construction Noise and Vibration Management Plan (CNVMP) be developed at a later stage of the project, prior to the commencement of site works, once a contractor has been appointed and a programme of construction activities confirmed. This section will discuss the preliminary construction programs to identify any potential impacts and provide in principle mitigation options.

7.1 Proposed construction

Based on the site plans, the summary of the works are as follow:

- Demolition of:
  - Block B;
  - Footpaths; and
  - existing sports courts.
- Construction of new Sports Complex; and
- New landscape area.

7.2 Construction traffic

Detail of the vehicle traffic due to construction was not available at the time of the assessment. Careful planning of construction program and onsite management is required to minimise noise impact due to delivery and construction vehicle to site and is recommended to be included in the Construction Noise and Vibration Management Plan (CNVMP).

7.3 Construction hours

The complying standard hours of construction as per the Ku-ring-gai Council are as follows:

- 07:00 to 17:00 Monday to Friday
- 08:00 to 13:00 Saturday
- No work Sundays or public holidays

Construction outside of the standard hours (out of hours works) are possible with appropriate permit for works requiring special condition. The following work categories might be undertaken outside the recommended standard hours:

- The delivery of oversized plant or structures that police or other authorities determine require 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

For the following items, the proposal should provide the relevant authority with clear justification for reasons requiring the works to occur outside of standard hours other than convenience, such as to sustain operational integrity of road, rail and utility networks:

- 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 hours.

Application for out of hours works permit requires approval by Council. Surrounding residents nearby the project site are to be notified in advance of the out of hours works.

7.3.1 Respite periods

Provision of respite break should be considered for noisy activity (e.g. excavation works). The Council has stated a respite break of 45 minutes between 12:00 pm and 1:00 pm on weekdays and no use of machinery for excavation on Saturdays.

7.4 General construction noise and vibration control measures

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

- Prior to construction, a site-specific Construction Noise and Vibration Management Plan (CNVMP) should be prepared as part of the environmental management plan. The CNVMP should include but not limited to:
  - Identification of nearby residences and other sensitive land uses;
  - Detail of construction criteria - Noise (and vibration, where applicable) Management Levels;
  - Description of approved hours of work and what work will be undertaken;
  - Description of what work practices will be applied to minimise noise;
  - Description of complains handling process.
- 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;
- Where practical, undertake the noisiest works during the recommended standard hours;
- Turn off plant that is not being used;
- 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 replacemenat 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;
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling – turn off when not in use);
- No queuing / marshalling of construction vehicles is to occur in any public road, especially along Memorial Avenue and local roads;
- Minimise the reversing movement of vehicles on site;
- Employ broadband reversing alarm for mobile equipment where practicable.

8.0

Conclusion

8.0 Conclusion

This report presents environmental acoustic input to the DA submission for the proposed development at St Ives High School, St Ives NSW. The proposal includes construction of new Sports Complex on the west boundary of existing school ground and demolition of Block B and new landscape design.

Mechanical services systems have not been selected at this stage. Noise trigger levels compliant with the Noise Policy for Industry (NPfI) have been established for the surrounding residential receivers.

Assessment of noise generated from school activity within the new Sports Complex have been reviewed and assessed. Recommendations to achieve compliance with the nominated design criteria and targets have been provided.

Internal noise design levels have been established, based on appropriate standards and guidelines. Intrusive noise impact on the development from the surroundings (primarily road traffic noise) has been assessed. Recommendations to achieve the design internal noise levels within the development have been provided.

Standard Council conditions on construction activity and good practice guidance for controlling noise from construction and demolition activity has also been identified and outlined within this report.

Appendices

Appendix A Acoustic terminology

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.

WEIGHTED STANDARDISED SOUND PRESSURE LEVEL ($L_{nT,w}$)

The in-situ impact sound insulation performance of a floor/ceiling when impacted by a standardised, calibrated tapping-machine. Lower values indicate higher performance.

WEIGHTED SOUND REDUCTION INDEX (R_w)

The laboratory sound insulation performance usually provided by manufacturers and suppliers is the weighted sound reduction index, R_w. The higher the rating, the better the sound reduction between spaces.

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