MARSHALL DAY Acoustics

BUDAWANG SCHOOL
ACOUSTIC ASSESSMENT FOR SEARS

Rp 002 r01 20200658 | 15 April 2021

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Project: **BUDAWANG SSP**

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EXECUTIVE SUMMARY

Marshall Day Acoustics (MDA) has been commissioned by School Infrastructure NSW to conduct an assessment of noise and vibration relating to the construction and operation of the proposed Budawang School located in Milton. Assessment of the Budawang school has considered the following:

- Planning Secretary's Environmental Assessment Requirements (SEARs) (Application Number: SSD 8845345)
- *NSW Noise Policy for Industry 2017, NSW Environment Protection Authority (NPfI)*
- *Interim Construction Noise Guideline, Department of Environment and Climate Change (ICNG)*
- *Assessing Vibration: A Technical Guideline 2006, NSW Environment Protection Authority (AV:ATG)*
- *State Environmental Planning Policy (Schedule 2: Educational Establishments and Child Care Facilities), NSW Department of Planning and Environment SEPP 2017 (EECF SEPP)*
- *Protection of the Environment Operations Act 1997, NSW Environment Protection Authority (POEO)*
- *Noise Guideline for Local Government, NSW Environment Protection Authority 2013 (NGLG)*
- *Road Noise Policy, NSW Department of Environment, Climate Change and Water 2011 (RNP)*
- *AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction*

Noise from construction activities have been assessed based on assumed plant equipment likely to be used during the three stages of construction (Site Preparation and Demolition, Bulk Excavation and Construction). Noise at four primary receiver groups has been considered:

- Residents located immediately east of the proposed site
- A commercial receiver located immediately east of the proposed site
- Residents along Croobyar Road located north of the proposed site
- A residential receiver located west of the proposed site.

Noise from construction is expected to be below the derived "Highly Noise Affected" management goals for all the surrounding receivers for both "Worst-Case" and "Average" scenarios during all stages of construction.

For the most noise affected receiver surrounding the site, noise from typical Site Preparation and Demolition, Bulk Excavation and Construction activities may exceed the ''Noise Affected'' goals from the EPA criteria for both "Worst-Case" and "Average" scenarios by up to 23 dB and 13 dB respectively, whilst remaining below the "Highly Noise Affected" management levels.

As predicted construction noise levels are expected to be above the "Noise Affected" management goals, MDA has provided a schedule of appropriate noise control recommendations and an example Construction Noise and Vibration Management Plan, to assist in controlling noise impacts from construction stages. All feasible noise controls and management practises detailed in this report should be adopted as a matter of course. A full, detailed and specific CNVMP must be prepared at a later once a builder is appointed and detailed construction methodology is known.

Assessment of human responses to vibration levels is considered in this report. Vibration levels from construction activities are not expected to give rise to adverse vibration impacts at any nearby receivers, with sufficient vibration control provided by the distance between the future work site and receiver locations.

It should be noticed that 'Assessing Vibration: A Technical Guideline' presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. This guideline does not address vibration-induced damage to

buildings or structures. It is noted that the Bakery building located west of the proposed site at 197-201 Princes Highway, is listed as a heritage site. A full, detailed and specific vibration impact assessment for the heritage-listed site, and other receivers, should be prepared at a later stage once a detailed construction methodology is known.

With respect to operational noise, noise emissions from the following sources have been considered:

- Public Address System
- School Bell
- Mechanical Services
- Outdoor Activities
- Traffic Noise Ingress
- Traffic Noise on Public Roads
- Car Park
- Helicopter Noise

At this early point in the development of the project design, the specification of the public address system, school bell and mechanical services is not sufficiently progressed such that noise emissions can be evaluated in detail. General comments and derived maximum noise levels have, however, been provided in order to assist the ongoing design and ensure noise emissions from these sources can be properly controlled.

Outdoor activity noise has been qualitatively assessed based on the subjective assessment guidance described in the Protection of the Environment Operations Act 1997, and the EPA Noise Guideline for Local Government. Noise from outdoor play activities has been established as not qualifying for description as offensive noise.

Assessment of road traffic noise ingress to the Budawang school spaces has been conducted in this report. Results indicate that traffic noise levels within some internal spaces of the closest building to Croobyar Road are likely to be above the recommended target noise levels during the busiest traffic hours of the day with windows open. However, with windows closed, traffic noise levels are expected to be fully controlled by the building façade recommendations provided in this report.

Noise generated by additional traffic on the surrounding public roads and the activities associated with the car park have been conducted in this report. Based on guidance provided by the NSW Department of Environment, Climate Change and Water's Road Noise Policy, noise generated by additional traffic on public roads is unlikely to give rise adverse impact. Moreover, traffic noise from the operations of the car park is expected to comply with the noise criteria set out in this report during the primary use of the school (Day period).

Noise ingress from the operation of the nearby Milton Heliport has been assessed. The required acoustic performance of building elements to achieve the EFSG indoor noise targets are provided in this report, requiring moderate upgrades from standard building constructions. The constructions detailed in this report will also be sufficient to control noise breakout from internal use of the school buildings to nearby noise sensitive receivers.

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1.0 INTRODUCTION

Marshall Day Acoustics (MDA) have been commissioned by School Infrastructure NSW to conduct an assessment of noise and vibration relating to the construction and operation of the proposed Budawang School located in Milton. It is proposed to redevelop portions of the existing Shoalhaven Anglican School site to form a new, replacement Budawang School. The Project aims to accommodate the needs of students with a range of physical and intellectual disabilities with specialised support.

This assessment is to satisfy the requirements of the Planning Secretary's Environmental Assessment Requirements (SEARs) (Application Number: SSD 8845345) issued 7 September 2020, with respect to Noise and Vibration.

The extent of our engagement relates to:

- General project and site descriptions including nearby noise sensitive receivers
- Derivation of criteria applicable to the Project based on advice provides in the SEARs documentation with additional reference made to other guidance applied outside of the SEARs requirements
- Qualitative assessment of outdoor play activities
- Quantitative assessment of noise emissions from internal school activities
- Quantitative assessment of noise generated by additional traffic on public roads
- Quantitative assessment of noise generated by activities associated with the car park
- Quantitative assessment of construction noise with additional comments with respect to construction vibration
- Qualitative assessment of noise from the nearby industrial sites to the proposed site
- Qualitative assessment of noise from helicopter events to the proposed site
- Comments regarding noise from mechanical services
- Provision of maximum noise levels from PA and school bell operation
- Provision of measures to mitigate and minimise noise impacts where required

Acoustic advice provided in this report is based on the following documentation:

- Concept Design Report- Budawang School prepared by Cardno (ref. 80820243, Issued: 01 May 2020)
- Budawang School Concept design Report prepared by Group GSA (Revision: 5, Issued: July 2020)
- Updated Site Plan (*'SITE PLAN'* Drawing No. SSDA-2000, Issue D, dated 08/04/2021)
- Traffic report *'Budawang School SSDA -Traffic Impact Assessment'* provided by PTC Consultants, dated 18 February 2021

Technical terms used throughout this report are described in Appendix A.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Location

The purpose-built facilities for Budawang School would be located on the Shoalhaven Anglican School site. The site of the former Shoalhaven Anglican School is located on Croobyar Road in Milton, near the junction with the Princes Highway.

The school site is bounded by Croobyar Road to the north, low-density residential properties along the Princes Highway to the east, a residential property to the west and existing school buildings to the south. Located to the West of the site is the Milton Heliport, which provides a landing pad for helicopters, utilised for emergency evacuations by the nearby Milton Ulladulla Hospital.

The site is currently zoned as RU1 primary production, which permits the use of land for educational establishments with the relevant consents. The nearest noise sensitive residential receivers are located to the east of the site, with further residential receivers to the north over Croobyar Road.

The nearest noise sensitive receivers surrounding the proposed site are listed in Table 1. A site plan is provided in Appendix B with aerial imagery depicting nearby receivers detailed in Appendix C.

Table 1: Noise sensitive receivers selected for assessment

Receiver ID	Location	Receiver Type	Description
R1	East of the proposed site	Residential	Single-storey residential buildings with a common boundary with the proposed development. This group of residential receivers represents the closest sensitive residential receivers located east of the subject site.
C1	East of the proposed site	Commercial	A heritage-listed double-storey commercial building (a bakery) with a common boundary with the proposed development. This receiver is identified as the closest commercial receiver to the subject site.
R2	North of the proposed site	Residential	Single-storey residential buildings located approximately 20 m north of the proposed development. This group of residential receivers represents the closest sensitive residential receivers located north of the subject site.
R3	West of the proposed site	Residential	A single-storey residential building located approximately 70 m west of the proposed development. This location represents the closest sensitive residential receiver west of the subject site.

2.2 Project Overview

Description: It is proposed to redevelop portions of the existing Shoalhaven Anglican School site to form a new, replacement Budawang School. The Project aims to accommodate the needs of students with a range of physical and intellectual disabilities with specialised support. The school will have a capacity for approximately 42 students. The project includes the following:

- Block A1 with admin, staff and library spaces
- Block A2 with a multipurpose space, kitchenette and special program space
- Block B with 3 homebases, withdrawal and practical activities spaces
- Block C with 4 homebases, withdrawal and practical activities spaces
- Future expansion with 3 additional homebases
- Hydrotherapy block with associated spaces and facilities

Hours of use: School buildings will generally be used during the day period only. Primary use of the multipurpose space will also be during school hours. The multipurpose space and hydrotherapy block may be used by the community in the evening times. It is not anticipated that any school spaces will be in use during the night-time period (2200-0700 hrs).

Mechanical services: The objective of this assessment is to review externally located equipment with respect to noise emissions to the environment. As equipment selections have not yet been finalised, conceptual advice and performance targets are provided to inform the ongoing design.

3.0 PLANNING SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Key issue requirements applicable to the Project are detailed in the Planning Secretary's Environmental Assessment Requirements (SEARs) (Application Number: SSD 8845345) issued 7 September 2020. The SEARs provide the following requirements for Noise and Vibration:

Noise and Vibration

Provide a noise and vibration impact assessment that:

- *includes a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation and construction*
- *details the proposed construction hours and provide details of, and justification for, instances where it is expected that works would be carried out outside standard construction hours*
- *includes a quantitative assessment of the main sources of operational noise, including consideration of any public-address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of school facilities*
- *outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers*
- *considers sources of external noise intrusion in proximity to the site (including, road rail and aviation operations) and identifies building performance requirements for the proposed development to achieve appropriate internal amenity standards demonstrates that the assessment has been prepared in accordance with polices and guidelines relevant to the context of the site and the*

Relevant Policies and Guidelines:

- *NSW Noise Policy for Industry 2017, NSW Environment Protection Authority (NPfI)*
- *Interim Construction Noise Guideline, Department of Environment and Climate Change (ICNG)*
- *Assessing Vibration: A Technical Guideline 2006 (Department of Environment and Conservation, 2006)*

In addition to the above policies and guidelines, the following have also been considered:

- *State Environmental Planning Policy (Schedule 2: Educational Establishments and Child Care Facilities), NSW Department of Planning and Environment SEPP 2017 (EECF SEPP)*
- *Protection of the Environment Operations Act 1997, NSW Environment Protection Authority (POEO)*
- *Noise Guideline for Local Government, NSW Environment Protection Authority 2013 (NGLG)*
- *Road Noise Policy, NSW Department of Environment, Climate Change and Water 2011 (RNP)*
- *AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction*

3.1 Noise and Vibration Sources

Based on the above, Table 2 shows the expected noise and vibration sources associated with the development of the Project and the documents referred for assessment. Note that vibration has been considered for the construction sources only as no operation sources are expected to give rise to perceptible vibration levels at residential receivers.

Table 2: Project noise and vibration sources and assessment references

Noise/Vibration Source	Assessment Reference
Construction	
- Site Preparation	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
- Bulk Excavation	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
- Construction	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
Operation	
- Public Address System	'NSW Noise Policy for Industry' 'Educational Establishments and Child Care Facilities SEPP 2017'
- School Bell	'NSW Noise Policy for Industry' 'Educational Establishments and Child Care Facilities SEPP 2017'
- Mechanical Services	'NSW Noise Policy for Industry'
- Outdoor Activities	'Noise Guideline for Local Government' 'Protection of the Environment Operations Act'
- Traffic Noise	'Road Noise Policy'
- Car park noise	'NSW Noise Policy for Industry'
- Helicopter Noise	'AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction'
- Industrial Sites	'NSW Noise Policy for Industry'

4.0 BACKGROUND NOISE SURVEY

A survey of background noise levels was conducted at a location close to the site boundary from 19 July 2020 to 25 July 2020, using a 01 dB noise logger (S/N: CUBE 10656). The selected location provided a good representation of noise levels in the local environment and nearby noise sensitive receivers. This position is shown in Appendix C.

The measurement equipment was calibrated before and after the survey with no significant drift observed.

Average L_{A90} and L_{Aeq} noise levels measured during the long-term noise survey are shown in Table 3 and have been derived in accordance with the data exclusion rules described in the NPfI. Graphs of the measured noise levels during the measurement period are provided in at the end of this report.

Primary use of the school will be during the Daytime period (0700-1800 hrs) Additionally, the multipurpose space and hydrotherapy facilities may be used by the community in the evening period (1800-2200 hrs). As such the Night-time period is not required for assessment and has been omitted.

Table 3: Measured average background and ambient noise levels

Period	Time of day	RBL L_{A90} dB	L_{Aeq} dB
Day	0700-1800 hrs	41	59
Evening	1800-2200 hrs	31	53

5.0 CONSTRUCTION NOISE AND VIBRATION

5.1 Construction Noise and Vibration Criteria

Noise and vibration criteria applicable to the project site with respect to construction activities have been derived considering the references detailed in Table 2, and are summarised in the following sections. The full derivation of criteria is provided in Appendix D.

5.1.1 Interim Construction Noise Guideline

Noise criteria applicable to the subject site are derived in accordance with the ICNG and are summarised in Table 4. These criteria apply to airborne noise emissions related to construction activity during the recommended standard hours only (see Appendix D for further details).

Table 4: 'Interim Construction Noise Guideline' airborne noise criteria

Receiver Type	Management Level, $L_{Aeq\,(15\,min)}$	
	Noise Affected	Highly Noise Affected
Residential	51	75
Commercial	70	

The "Noise Affected" level is the point above which there may be some community reaction to noise. The "Highly Noise Affected" level represents the point above which there may be a strong community reaction to noise. Where the "Noise Affected" management level is predicted to be exceeded, the ICNG requires that all feasible and reasonable work practices be employed. Where it is predicted that the "Highly Noise Affected" management level will be exceeded, respite periods may need to be considered.

5.1.2 Assessing Vibration: A Technical Guideline

Vibration criteria applicable to the site, derived in accordance with the Technical Guideline are summarised in Table 5. These criteria apply to vibration events at residential receivers related to construction activities. Only Day time criterion is provided as no out of hours construction activities are expected.

Table 5: 'Assessing Vibration: A Technical Guideline'; construction vibration criteria

Daytime (0600-2200hrs)	
Preferred Value, VDV	**Maximum Value, VDV**
0.20	0.40

Note: It should be noticed that *'Assessing Vibration: A Technical Guideline'* presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. This guideline does not address vibration-induced damage to buildings or structures. It is noted that the Bakery building located west of the proposed site at 197-201 Princes Highway, is listed as a heritage site. A full, detailed and specific vibration impact assessment for the heritage-listed site must be prepared at a later stage once a detailed construction methodology is known.

5.2 Assumed Construction Plant Items

At this early planning stage, specific details regarding proposed construction processes are not known, with the types of activities, plant and scheduling not yet determined. A general plan of construction staging is understood to be:

- Site Preparation
- Bulk Excavation
- Construction

On this basis, plant equipment used during each stage of construction works have been assumed based on typical work practices. These assumptions must be reviewed by others. If the plant items to be used differ from that assumed, further assessment of construction noise and vibration will be required. Assumed plant items are detailed in Table 6. Sound power data for these plant items is provided in Appendix D.

Table 6: Anticipated construction activities and assumed equipment schedule

Phase	Activities	Equipment
Site Preparation and demolition	Concrete removal	1 x 22t excavator
	Removal of waste material from the site	Bogie truck, no trailer
	General	Generator
		Air compressor & lines
Excavation	Bulk & detailed excavation works	2 x excavators (22 tonne, 27 tonne) with a hydraulic hammer, eccentric rock ripper, buckets, rock grinder, demolition grab, rock-saw
		Compacting plate
		Jack hammer & breaker
		Concrete saw - road
	Delivery of materials & removal of waste materials	Flatbed truck
		Bogie truck
	General	Generator
		Air compressor & lines
		De-watering plant
Construction	Concreting	Concrete pump
		Brick saw
		Concrete vibrator
		Concrete floats
		Concrete saw/ring saw
		Diamond core drill
		Nail guns
		Hydraulic bar cutter
	Delivery of materials	Concrete truck
		Bogie truck
	General	Generator
		Air compressor & lines
		De-watering plant
		Electric winch & materials hoist

5.3 Noise Control Recommendations

MDA recommends that the noise control measures detailed in Table 7 are implemented on-site. Predicted construction noise levels in this assessment, include the effect of these recommendations.

Table 7: Noise control recommendations for site

Phase	Equipment/Location	Recommendation
Site preparation	Generator	- Localised noise barriers should be utilised when this equipment is in use. - Barriers should be mobile and extend to a height 1 m above noise source. - Barrier should envelop the work location to ensure no direct line of sight to nearby receivers. - Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source.
	Site boundary	- Northern boundary: Solid hoarding of minimum 2 m height along the Croobyar Rd - Eastern boundary: where solid boundary fencing is not available, solid hoarding of minimum 2 m height along the eastern boundary of the proposed site is required
Bulk Excavation	Jack hammer & breaker Concrete saw Generator Compacting Plate	- Localised noise barriers should be utilised when this equipment is in use. - Barriers should be mobile and extend to a height 1 m above noise source. - Barrier should envelop the work location to ensure no direct line of sight to nearby receivers. - Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source.
	Site boundary	- Northern boundary: Solid hoarding of minimum 2 m height along the Croobyar Rd - Eastern boundary: where solid boundary fencing is not available, solid hoarding of minimum 2 m height along the eastern boundary of the proposed site is required
Construction	Concrete saw/ring saw Generator	- Localised noise barriers should be utilised when this equipment is in use. - Barriers should be mobile and extend to a height 1 m above noise source. - Barrier should envelop the work location to ensure no direct line of sight to nearby receivers. - Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source.
	Site boundary	- Northern boundary: Solid hoarding of minimum 2 m height along the Croobyar Rd - Eastern boundary: where solid boundary fencing is not available, solid hoarding of minimum 2 m height along the eastern boundary of the proposed site is required

The above noise control recommendations are provided in the absence of a detailed construction methodology. A full CNVMP will be required later to be prepared by the builder once appointed and detailed construction methodology is available. An example plan is detailed in the section below.

5.4 Example Construction Noise and Vibration Management Plan

Many complaints about construction noise are due to preventable activities during construction periods. The following should be considered for adoption on site:

- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise
- Ensure site managers periodically check the site and nearby residences and other sensitive land uses for noise problems so that solutions can be quickly applied
- Include in tenders, employment contracts, subcontractor agreements and work method statements clauses that require minimisation of noise and compliance with directions from management to minimise noise
- Avoid the use of radios or stereos outdoors where neighbours can be affected
- Avoid the overuse of public address systems
- Avoid shouting and minimise talking loudly and slamming vehicle doors
- 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)
- Develop a one-page summary of approval or consent conditions that relate to relevant work practices and pin it to a noticeboard so that all site operators can quickly reference noise information
- Workers may at times need to discuss or negotiate practices with their managers

5.4.1 Consultation and negotiation

The community is more likely to be understanding and accepting of noise if the information provided is frank, does not attempt to understate the likely noise level, and if commitments are firmly adhered to.

Notification Before and During Construction

- Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. For works outside standard hours, inform affected residents and other sensitive land use occupants between five and 14 days before commencement.
- Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information
- Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. This signage should be clearly visible from the outside and include after-hours emergency contact details
- Maintain good communication between the community and the project staff
- Appoint a community liaison officer where required

- For larger projects consider a regular newsletter with site news, significant project events and timing of different activities
- Provide a toll-free contact phone number for enquiries during the works
- Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise

Complaints Handling

- Provide a readily accessible contact point, for example, through a 24-hour toll-free information and complaints line
- Give complaints a fair hearing
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night-time only if requested by the complainant to avoid further disturbance
- Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information
- Implement all feasible and reasonable measures to address the source of the complaint
- Keep a register of any complaints, including details of the complaint such as date, time, the person receiving the complaint, complainant's contact number, the person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate

5.4.2 Plant and equipment

In terms of both cost and results, controlling noise at the source is one of the most effective methods of minimising the noise impacts from any construction activities.

Use quieter methods

- Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fracture. The suitability of alternative methods should be considered on a case-by-case basis
- Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences

Use quieter equipment

- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber-wheeled tractors can be less noisy than steel tracked tractors
- Noise labels are required by NSW legislation for pavement breakers, mobile compressors, chainsaws and mobile garbage compactors. These noise labels can be used to assist in selecting a less noisy plant
- Pneumatic equipment is traditionally a problem – select super silenced compressors, silenced jackhammers and damped bits where possible

- When renting, select quieter items of plant and equipment where feasible and reasonable
- When purchasing, select, where feasible and reasonable, the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise

Operate plant in a quiet and efficient manner

- Reduce throttle setting and turn off equipment when not being used.
- Examine and implement, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin

Maintain equipment

- Regularly inspect and maintain equipment to ensure it is in good working order. Also, check the condition of mufflers
- Equipment must not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified
- For machines with enclosures, check that doors and door seals are in good working order and that the doors close properly against the seals
- Return any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair
- Ensure air lines on pneumatic equipment do not leak

5.4.3 On-site

Barriers and acoustic sheds are most suited to longer-term fixed works, as in these cases the associated cost is typically outweighed by the overall time savings.

Location of plant

- Place as much distance as possible between the plant or equipment and residences and other sensitive land uses
- Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times
- Locate site vehicle entrances away from residences and other sensitive land uses
- Carry out noisy fabrication work at another site (for example, within enclosed factory premises) and then transport to site

Alternatives to reversing alarms

- Avoid the use of reversing alarms by designing site layout to avoid reversing, such as by including drive-through for parking and deliveries
- Install where feasible and reasonable, less annoying alternatives to the typical 'beeper' alarms taking into account the requirements of the Occupational Health and Safety legislation; examples are smart alarms that adjust their volume depending on the ambient level of noise and multifrequency alarms that emit noise over a wide range of frequencies
- In all circumstances, the requirements of the relevant Occupational Health and Safety legislation must be complied with. For information on replacing audible warning alarms on a mobile plant with less annoying alternatives, see Appendix C

Maximise shielding

- Reuse existing structures rather than demolish and reconstruct

- Use temporary site buildings and materials stockpiles as noise barriers
- Schedule construction of any permanent walls so that they can be used as early as possible as noise barriers
- Use natural landform as a noise barrier – place fixed equipment in cuttings, or behind earth berms
- Note large reflecting surfaces on and off-site that might increase noise levels and avoid placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures

5.4.4 Work scheduling

Scheduling noisy work during periods when people are least affected is an important way of reducing noise impact.

Provide respite periods

- Consult with affected education facilities to ensure that noise-generating construction works in the vicinity of affected education buildings are not scheduled to occur during examination periods, unless other arrangements (such as relocation to an alternative location) acceptable to the affected parties can be made.
- Where night work near residences cannot be feasibly or reasonably avoided, restrict the number of nights per week and/or the number of nights per calendar month that the works are undertaken, in consultation with residents who will be most affected.

Schedule activities to minimise noise impacts

- Organise work to be undertaken during the recommended standard hours where possible
- When works outside the recommended standard hours are planned, avoid scheduling on Sundays or public holidays
- Schedule work when neighbours are not present (for example, commercial neighbours, colleges and schools may not be present outside business hours or on weekends)
- Schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) where possible to provide masking or to reduce the amount that the construction noise intrudes above the background
- Consult with affected neighbours about scheduling activities to minimise noise impacts

Organise deliveries and access

- Nominate an off-site truck parking area, away from residences, for trucks arriving prior to gates opening
- Optimise the number of vehicle trips to and from the site – movements can be organised to amalgamate loads rather than using a number of vehicles with smaller loads
- Designate access routes to the site, through consultation with potentially noise-affected residences and other sensitive land uses and make drivers aware of nominated vehicle routes
- Provide on-site parking for staff and on-site truck waiting areas away from residences and other sensitive land uses. Truck waiting areas may require bunding or walls to minimise noise
- Schedule deliveries to nominated hours only

5.4.5 Transmission path

Physical methods to reduce the transmission of noise between the construction works and residences or other sensitive land uses are generally suited to works where there is longer-term exposure to the noise.

- Reduce the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers
- Temporary noise barriers can be constructed from hoarding (plywood boards, panels of steel sheeting or compressed fibre cement board) with no gaps between the panels at the site boundary. Stockpiles, shipping containers and site office transportable can be effective barriers
- Erect temporary noise barriers before work commences to reduce noise from works as soon as possible
- Consult with most affected neighbours about how effective the proposed noise mitigation measures will be in addressing their concerns

5.5 Summary of Construction Noise Assessment

Predicted noise levels from construction activities have been calculated, a detailed assessment, including predicted noise levels, are provided in Appendix F.

For all the surrounding receivers, predicted L_{Aeq} levels from the proposed construction equipment indicate that noise from all phases of construction will be below the "Highly Noise Affected" project-specific management levels for both "Worst-Case" and "Average" scenarios.

For the closest receivers surrounding the site, noise from typical site preparation, bulk excavation and construction activities may exceed the ''Noise Affected'' goals from the EPA criteria for both "Worst-Case" and "Average" scenarios by up to 23 dB and 13 dB respectively, whilst remaining below the "Highly Noise Affected" management levels.

Within standard hours (Monday – Friday: 0700-1700 hrs, Saturday 0800-1300 hrs) the "Average" noise levels from typical operations at the most noise affected receivers are probable to be;

- Site Preparation and Demolition activities are calculated to be:
  - Up to 5 dB above the "Noise Affected" goals
- Bulk Excavation activities are calculated to be:
  - Up to 13 dB above the "Noise Affected" goals
- Construction activities are calculated to be:
  - Up to 12 dB above the "Noise Affected" goals

For "Worst Case" scenarios, the residential receivers may experience short periods of noise levels up to 23 dB above the "Noise Affected" goal for some works. It should be noted that the "Average" scenario is likely to be representative of the overall noise emissions across the duration of each phase.

Exceedances of "Noise Affected" goals are typical of construction sites in suburban areas as background noise levels tend to be relatively low. Further, since all construction works are restricted to take place only during the daytime, noise impacts will not be experienced during the most sensitive time period i.e. night-time.

It is not expected that the "Highly Noise Affected" levels will be exceeded at any receivers during typical operations.

The dominant noise sources for each phase of construction are indicated in Table 8.

Table 8: Dominant noise generating equipment

Phase	Dominant noise generating equipment
Site Preparation and Demolition	Bogie truck, 22T excavator
Bulk Excavation	Jack hammer
Construction	Concrete pump

As construction noise levels are predicted to exceed the "Noise Affected" goals, due diligence by the site operator requires community consultation and negotiation. Notification should be provided of the proposed construction activities to nearby residents and non-residential receivers.

The ICNG recommends that for situations in which the "Noise Affected" management levels are exceeded; all feasible and reasonable work practises should be adopted. Additionally, all potentially impacted residents should be informed of the nature of the works, expected noise levels and duration, as well as contact details for site representatives. These requirements are described in detail in the noise control recommendations in Section 5.3 and the example Construction Noise and Vibration Management Plan described in Section 5.4.

5.6 Summary of Construction Vibration Assessment

Based on the assumed plant and equipment summarised in Table 6, the distances between the proposed school site and the residential receivers are sufficiently great such that even the most significant vibration generating equipment items that have been assumed for the site are unlikely to give rise to vibration levels exceeding the criteria for the Daytime period in accordance with the *'Assessing Vibration: A Technical Guideline'* (noting that construction is not expected during the Night-time). On this basis, vibration impacts from construction works related to the Project are not expected to require any specific control beyond the work practises highlighted in Section 5.4.

It should be noticed that 'Assessing Vibration: A Technical Guideline' presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. This guideline does not address vibration-induced damage to buildings or structures. It is noted that the Bakery building located west of the proposed site at 197-201 Princes Highway, is listed as a heritage site. A full, detailed and specific vibration impact assessment for the heritage-listed site must be prepared at a later stage once a detailed construction methodology is known.

6.0 OPERATIONAL NOISE

6.1 Operational Noise Criteria

Noise criteria applicable to the project site with respect to operational activities have been developed considering the references detailed in Table 2 and are summarised in the following sections. The full derivation of criteria is provided in Appendix D.

6.1.1 'Noise Policy for Industry'

Airborne noise criteria applicable to the site derived in accordance with the NPfI are summarised in Table 9. These criteria apply (in accordance with the SEARs) to airborne noise emission related to the PA system, school bell and mechanical services.

Table 9: NPfI Project Noise Trigger Levels

Receiver	Period	Project Noise Trigger Level, $L_{Aeq,15min}$, dB
Residential	Day	46
	Evening	36
Commercial Premises	When in use	63

6.1.2 'Noise Guideline for Local Government'

The NGLG is designed to assist local government officers in assessing noise impacts and associated decision making. In determining whether a source of noise may be offensive, the following checklist is considered:

Q1: Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?

Q2: Does the noise include characteristics that make it particularly irritating?

Q3: Does the noise occur at times when people expect to enjoy peace and quiet?

Q4: Is the noise atypical for the area?

Q5: Does the noise occur often?

Q6: Are a number of people affected by the noise?

Above assessment checklist has been considered in assessing noise from outdoor play activities.

6.1.3 'Protection of the Environment Operations Act 1997'

The PoEO provides a qualitative basis on which to assess impacts from noise sources and outlines assessment considerations designed to establish whether noise can be objectively considered offensive. Offensive noise is defined in the PoEO act as being noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

The PoEO subjective assessment has been considered in evaluating noise from outdoor play.

6.1.4 'Road Noise Policy'

The Road Noise Policy provides a noise criterion for existing residences affected by additional traffic on existing local and arterial roads generated by land-use developments. This is specified as $L_{Aeq\,(15\,hr)}$ 60 dBA assessed at the boundary of a residence along arterial roads; and $L_{Aeq\,(1\,hr)}$ 55 dBA assessed at the boundary of a residence along local roads.

Additionally, the RNP notes that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. An increase of 2 dB equates to an approximate increase in traffic volume in the order of 60%.

6.2 Operational Noise Emissions

6.2.1 PA System and school bell

At this early stage, no detailed information has been provided with respect to the PA system or school bell. It is not known whether bell or PA functions occur externally or are limited to internal spaces.

Noise from internal speakers will be well controlled by the building façade. Noise emissions from outdoor sources will need to be reviewed in more detail at a later stage once the number and location of bells and speakers are known. Noise from new PA or school bell noise sources must be designed such that the criteria shown in Table 9 are achieved when assessed cumulatively with all site-related operational noise emissions.

Additionally;

- Speakers should be positioned to minimise noise spill
- Consider the use of highly directional speaker units
- A distributed system of smaller, lower output speakers rather than a system of fewer, higher output speakers allows better control of noise spill and lower noise levels
- External speaker use should be limited to the provision of short PA announcements and bell functions only and should not be used for playing music, radio or other continuous noise sources

6.2.2 Mechanical services

The mechanical services design finalised equipment selections have not yet been made. As such, a quantitative assessment of mechanical services noise emissions cannot be conducted. The mechanical services are expected to comprise a fully ducted system with various external plant items likely to give rise to noise emissions from the school.

Any noise emissions related to the Project from external mechanical services items must be designed and selected such that the applicable NPfI noise criteria is achieved at the residential receivers when assessed cumulatively with all other noise emissions from the school as a whole.

Noise control measures that may be required to control noise emissions from external plant could include:

- Noise control barriers
- Selection of low-noise equipment
- Vibration isolation of items
- Attenuators to ducting

It is expected that noise emissions from the plant will be reviewed in detail as part of the ongoing mechanical services design.

6.2.3 Outdoor activities

Noise from children outside engaging in sports activities has been assessed. No information has been provided with respect to proposed numbers, positioning or scheduling of outdoor play activities. In order to conduct an assessment of noise impacts, MDA has made assumptions regarding the nature of the outdoor activities and provides comments below.

It should be noted that no specific quantitative criteria for the assessment of outdoor play associated with schools are available. NSW EPA indicates consideration of the Noise Guideline for Local Government and the Protection of the Environment Operations Act for the assessment of such sources. These sources provide qualitative guidance for assessment only, however approximate

predicted noise levels have been developed to aid in understanding the nature of any noise impacts on nearby receivers.

Outdoor Play Areas

For outdoor play activities, it is assumed that up to 42 children may be engaging in active play within the playing fields located in the middle of the proposed buildings. It is assumed that children will be dispersed over the entire playing field area. It is also assumed that children may be vocalising on a 1 in 2 basis.

Noise levels from play activities of this nature are predicted to be in the order of 50 dBA at the nearest eastern residential receiver, and 44 dBA at the nearest northern and western residential receivers.

Based on a subjective assessment under the NGLG our assessment has established that noise from outdoor activities at the school is unlikely to be considered offensive on the basis shown in Table 10.

Table 10: NGLG Subjective Assessment

NGLG Subjective Assessment of Outdoor Activity Noise
Q1: Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?
Noise levels from outdoor play activities are predicted to be likely above background noise levels, however, unlikely to be significantly above noise from typical traffic noise along Croobyar Road when the absolute level is considered.
Q2: Does the noise include characteristics that make it particularly irritating?
Court judgements about intrusive noise from schools have indicated that noise from children playing may be considered more acceptable and less irritating than the noise of an equivalent level from industrial, commercial or other noise sources
Q3: Does the noise occur at times when people expect to enjoy peace and quiet?
Outdoor play is expected to occur during the Daytime period 0700-1800hrs during which residents are generally expecting to be impacted by community noise sources.
Q4: Is the noise atypical for the area?
The site is currently zoned as RU1 primary production, which permits the use of land for educational establishments with the relevant consents. Therefore noise from children outdoors or at play is not considered out of character for the intended land use. Moreover, the site has been used for educational purposes since 1991, and is currently configured as a school.
Q5: Does the noise occur often?
Noise from students utilising the outdoor areas of the school is expected to occur in varying numbers throughout the day. The worst-case scenario of all students outside simultaneously playing is likely to occur for one of two periods of less than an hour on weekday only.
Q6: Are a number of people affected by the noise?
The number of receivers affected by the noise is likely to be in the order of 20-30 residences.

With regards to assessment under the PoEO Act, noise from outdoor activities is not considered to be offensive. A summary of our subjective assessment is described in Table 11.

Table 11: PoEO Act Subjective Assessment

PoEO Act Subjective Assessment of Outdoor Activity Noise
(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted,
Noise from outdoor play is not excessive in level, has acceptable character and occurs during the Daytime period. On this basis, outdoor activity noise is unlikely to be harmful to a receiver outside of the school.
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
Outdoor play will occur during the Daytime period (0700-1800hrs). Receivers are generally less noise-sensitive during this period due to increase in other noise-generating activities not related to the school, reduced likelihood of residents sleeping, increased likelihood of residents being away from the premises and increase in general activities in the community.
(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.
The proposed school site is currently zoned RU1 which permits the use of land for educational establishments with the relevant consents. Therefore, noise from children outdoors or at play is not out of character for the intended land use. Moreover, the site has been used for educational purposes since 1991, and is currently configured as a school.

6.2.4 Car park

A noise assessment has been carried out for the car park to be located north of the subject site. Traffic data in the report *'Budawang School SSDA -Traffic Impact Assessment'* provided by PTC Consultants, dated 18 February 2021, is used to carry out an assessment of the expected noise levels at the nearest sensitive receivers from the car park operations.

In accordance with the traffic report, 30 staff spaces, three pick-up and drop-off spaces, one loading bay and one bus bay are proposed. It is anticipated that the school will be serviced by 58 vehicles (48 private vehicle and 10 minibuses) associated with the student pick-up/drop-off activity. It is anticipated that the same parking demand will be applicable during both the morning and afternoon, with 58 vehicles to be processed in a pick-up and drop-off time frame of 60 minutes. Furthermore, it is noted that the majority of staff will likely travel by private car.

As such, for a conservative assessment in this report, the following vehicle movements during morning and afternoon peak hour are assumed in this report:

- Pick-up and Drop-off Provision: 48 private vehicle and 10 minibuses will visit the three pick-up and drop-off spaces during the peak hour (1 hr)
- Car Parking: all the 30 staff spaces will be occupied during the peak hour (1 hr)
- Loading bay: details of anticipated deliveries to the hydrotherapy pool and waste collection is not provided. However, one truck movement per hour is included in this assessment

Noise levels have been predicted using proprietary acoustic modelling software, SoundPlan v8.1. The relevant module of SoundPlan uses the ISO 9613-2:1996 methodology for the propagation of minibuses and cars. Noise levels used for the calculation of noise impacts to the identified nearest receivers are presented in Table 4.

Table 12: Assumed Sound Power Levels, L_{WAeq}

Description	Overall L_{WAeq}, dB
Minibuses[1]	90
Cars[1]	88
Light rigid truck[2]	93
Door slam and Engine start[2]	90

Note: 1 – Based on AAAC "Guideline for Child Care Centre Acoustic Assessment"
2 – Based on measurements conducted by MDA on previous projects

Based on anticipated vehicle movements, noise levels from the operation of the proposed car park are predicted and detailed in Table 13.

Table 13: Car Park Assessment - NPfI Compliance

Receiver	Time Period	Project Noise Trigger Level, $L_{Aeq,\ 15min}$, dB	Calculated noise level, $L_{Aeq,\ 15min}$, dB	Compliance
R1	Day	46	39	✓
C1	Day	63	39	✓
R2	Day	46	44	✓
R3	Day	46	39	✓

Based on the predicted noise levels presented in the above table; operations of car parks and delivery truck movements are capable of complying with the noise criteria set out in this report during the primary use of the school (Day period).

The school buildings will generally be used during the day period only. The primary use of the multipurpose space will also be during the school hours. The multipurpose space and hydrotherapy block may be used by the community in the evening times. The traffic assessment report for the use of the hydrotherapy block is not available at this stage. Therefore, the assessment of traffic noise associated with the use of hydrotherapy block during the evening period (1800-2200 hrs) is not assessed in this report.

6.2.5 Future traffic on public roads

A noise assessment has been carried out for the of noise generated by additional traffic on public roads based on the traffic data in 'Budawang School SSDA -Traffic Impact Assessment' provided by PTC Consultants, dated 18 February 2021.

MDA has conducted a review of the traffic volumes detailed in the report. Based on the predicted traffic volume increases, MDA has determined that associated traffic noise level changes will remain below 2 dB. The RNP indicates that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. On this basis, no noise control design or mitigation measures are required with respect to future traffic on public roads.

7.0 ROAD TRAFFIC NOISE INGRESS TO SCHOOL SPACES

7.1 Noise Targets

In order to establish likely noise targets for the school receivers NSW EPA Road Noise Policy have been considered. The school receivers considered for assessment are detailed in Table 14 alongside expected noise targets and reference guidelines.

Table 14: Receiver locations and expected noise targets

Receiver	Recommended noise target	Reference Guideline
Internal spaces (school classroom etc.)	$L_{Aeq\ 1\ hr}$ 40	Road Noise Policy
External – Active Use	$L_{Aeq\ 15\ hr}$ 60	Road Noise Policy
External – Passive Use	$L_{Aeq\ 15\ hr}$ 55	Road Noise Policy

NSW EPA Road Noise Policy (RNP) recognises 'Open space (active use)' and 'Open space (passive use)' as sensitive land uses and sets criteria for these land uses. In this report, both uses of the outdoor play areas are considered.

7.2 Assessment Results

Traffic noise levels have been measured as part of the long term noise logging detailed in section 4.0.

7.2.1 Traffic noise ingress to outdoor play areas

MDA have carried out distance attenuation calculations between the traffic noise measurement location and the proposed outdoor play area locations. Table 15 shows the calculated traffic noise levels at the proposed outdoor play areas.

Table 15: Calculated traffic noise levels at outdoor play areas

Receiver area	Expected noise level	Recommended noise target
Outdoor play areas	$L_{Aeq\ 15\ hr}$ < 45	$L_{Aeq\ 15\ hr}$ 55 (External – Passive Use) $L_{Aeq\ 15\ hr}$ 60 (External – Active Use)

Analyses of the measurement results, shown in Table 15, indicate that the recommended traffic noise targets within the school outdoor areas are expected to be achieved. Therefore, no further mitigation measures are required.

7.2.2 Traffic noise ingress upon internal areas

Table 16 shows the calculated traffic noise levels at various locations within the site representing the closest future building façade locations to Croobyar Road. These figures do not include façade reflections.

Table 16: Calculated traffic noise levels at various locations

Receiver building	Façade direction[1]	Expected noise level, $L_{Aeq\ 1\ hr}$	Recommended noise target, $L_{Aeq\ 1\ hr}$	Comply
Block A1	Northern	< 54 (External)	40 (Internal) 50 (External)[2]	Less than 4 dB above target
	Eastern and western	< 51 (External)		Less than 1 dB above target
	Southern	< 45 (External)		Yes
Block A2	Northern	< 54 (External)	40 (Internal) 50 (External)[2]	Less than 4 dB above target
	Eastern and western	< 51 (External)		Less than 1 dB above target
	Southern	< 45 (External)		Yes

[1] The northern façade is the façade facing Croobyar Road

[2] A minimum of 10 dB(A) reduction from external noise levels to internal noise levels has been adopted.

7.3 Noise Mitigation Requirements

7.3.1 Architectural treatments

Results shown in Table 16 indicate that traffic noise levels within some internal spaces of Block A1 and Block A2 (at the most affected northern façade) are predicted to be up to 4 dB above the recommended target noise levels during the busiest traffic hours of the day with windows open. With windows closed, traffic noise levels are fully controlled by the building façade (based on the constructions detailed in Table 18). Where windows are required to be closed to control traffic noise alternative ventilation (to provide adequate fresh air indoors) may be necessary.

Traffic noise levels are expected to be below the Recommended Noise Levels at all the remaining building façades (Blocks B and C).

The required alternate ventilation may involve acoustically treated vents etc., mechanical driven fresh air systems, air-conditioning (incorporating fresh air) or some other design to provide fresh air to space. Where alternative ventilation is required this should be considered during the design of the building. Consideration should be given (by others) to the ventilation requirements of the internal spaces with respect to AS 1668 and the Building Code of Australia.

Any mechanical plant should be designed to comply with Council's internal and external limits for mechanical plant noise.

8.0 HELICOPTER NOISE INGRESS TO SCHOOL SPACES

The Milton Heliport is located west of the site and provides a landing pad for helicopters, utilised for emergency evacuations by the nearby Milton Ulladulla Hospital. Potential helicopter noise impact to the school indoor spaces is considered in this section.

8.1 Noise Targets

In order to establish noise targets for the school, *'AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction'* has been considered. In accordance with Table 3.3 in this standard, the applicable indoor design sound levels for the Project are provided in Table 17.

Table 17: Indoor design sound levels targets for helicopter noise

Building type and activity (AS 2021)	Nominated Project space	Indoor design sound level dB(A)
Schools and universities		
- Library, study areas	Practical activities	50
	Interview/Office	
	Multi-Purpose	
	Library Sensory	
	Library Main Area	
	Sick Bay	
	Librarian Office	
	Admin	
	Staff Lounge	
	Staff Study	
	Withdrawal	
	Special Program	
	Homebase	
	KLA	

Building type and activity (AS 2021)	Nominated Project space	Indoor design sound level dB(A)
- Teaching areas and assembly areas	Corridors Kitchenette Toilet / Changing Hydrotherapy pool	65

8.2 Measurement Results

MDA has extracted noise data for helicopter events from the long term logging data.

During the long-term measurements, only one helicopter event (Sunday 19th at 00:15 am) was registered. The maximum sound pressure level (L_{max}) of this event is found to be 79 dBA at the logger location L1. In the absence of the flight information e.g. altitude and flight path, the measured maximum sound pressure level without further adjustments, is used for the analysis presented in this report.

8.2.1 Architectural treatments

Calculations have been conducted to establish sound levels to evaluate noise ingress from the operation of the nearby Milton Heliport. Based on the measured maximum sound pressure level of 79 L_{Amax}, noise from the helicopter events can be controlled with closed windows and the external glazing, wall and roof acoustic performance requirements detailed in Table 18. It should be noted that example constructions are provided for information only and the required performance is achievable through various construction options, with the building element performance requirement being the crucial consideration. Construction details will need to be developed during the ongoing design development.

Table 18: Performance requirements for school building elements, R_w

Building element	Performance requirement, R_w	Example construction
Roof/Ceiling	48	- Metal roof (0.6 mm) - 12 mm plywood - 300 mm air gap with 75 mm thick 14 kg/m^3 density insulation - Suspended set 13 mm plasterboard ceiling (perforated not permitted) Any penetrations through the suspended set plasterboard ceiling will require acoustic treatment to ensure the isolation performance of the roof/ceiling element is not degraded. Shadow-lines and open-air grilles should be avoided. Allowance should be made for absorption to some areas of the underside of the set plasterboard ceiling. This may comprise a direct stick acoustically absorptive finish (such as Autex Quietspace panel), perforated plywood/plasterboard or similar high-performance treatment. It should be noted that a perforated plasterboard/plywood type product will require additional framing and cavities to achieve effective absorption.

Building element	Performance requirement, R_w	Example construction
External walls	45	- Brickwork - 70mm timber stud with 75mm 14 kg/m^3 insulation - 13mm set plasterboard Similar to the roof/ceiling element, allowance should be made for absorption to some areas of the internal face of the building wall envelope.
Glazing	35	- 6mm thick framed glazing - 12mm air gap - 6 mm thick-framed glazing This also applies to the glazing sections at high level.

9.0 INDUSTRIAL NOISE INGRESS TO SCHOOL SPACES

The following industrial sites are identified in proximity to the proposed site:

- Ulladulla Diesel Services & Mobile Repairs Pty Ltd, located at 9A Wilfords Lane. This facility is located approximately 110 m west of the existing Shoalhaven Anglican school
- Boral Concrete, located at 13 Wilfords Lane, Milton. This facility is located approximately 110 m west of the existing Shoalhaven Anglican school
- McConnell Steel & Fabrication, located at 17 Wilfords Lane. This facility is located approximately 60 m west the existing Shoalhaven Anglican school.

MDA do not have specific details regarding the existing operations of the above industrial sites or their existing consent or licence conditions. Given the lack of such details, and that operations of the identified industrial sites are out of the control of the developer, we are not able to make detailed recommendations regarding impacts from the facility.

Environment Protection Licences and council conditions applicable to the above industrial sites set out noise and vibration emission criteria and requires the facilities to manage their operation such that the applicable criteria are achieved at the most affected nearby receiver locations.

It is assumed that these sites are currently operated in a generally responsible manner, compliant with applicable noise criteria and implementing appropriate management controls.

The most affected nearby receivers to the identified industrial sites are:

- The eastern boundaries of the residential property at 21 Croobyar Road located 60 m east of the industrial sites
- Shoalhaven Anglican School active recreation area located approximately 150 m east of the industrial sites
- Shoalhaven Anglican School buildings located approximately 200 m east of the industrial sites

The proposed Budawang School site is approximately 200 m east of the identified industrial sites (at a similar distance to the existing Shoalhaven Anglican School's classrooms).

As the industrial sites will be required to comply with more onerous criteria applicable to the 21 Croobyar Rd residence, compliance at the residence will also mean compliance at the proposed school site.

APPENDIX A GLOSSARY OF TERMINOLOGY

SPL or L_P	Sound Pressure Level A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels.
SWL or L_W	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 µPa i.e. dB = 20 x log(P/Pr)
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\ (t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{A90\ (t)}$	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
SEL or L_{AE}	Sound Exposure Level The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
R_w	Weighted Sound Reduction Index A single number rating of the sound insulation performance of a specific building element. Rw is measured in a laboratory. Rw is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.
Vibration	When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity.

Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).

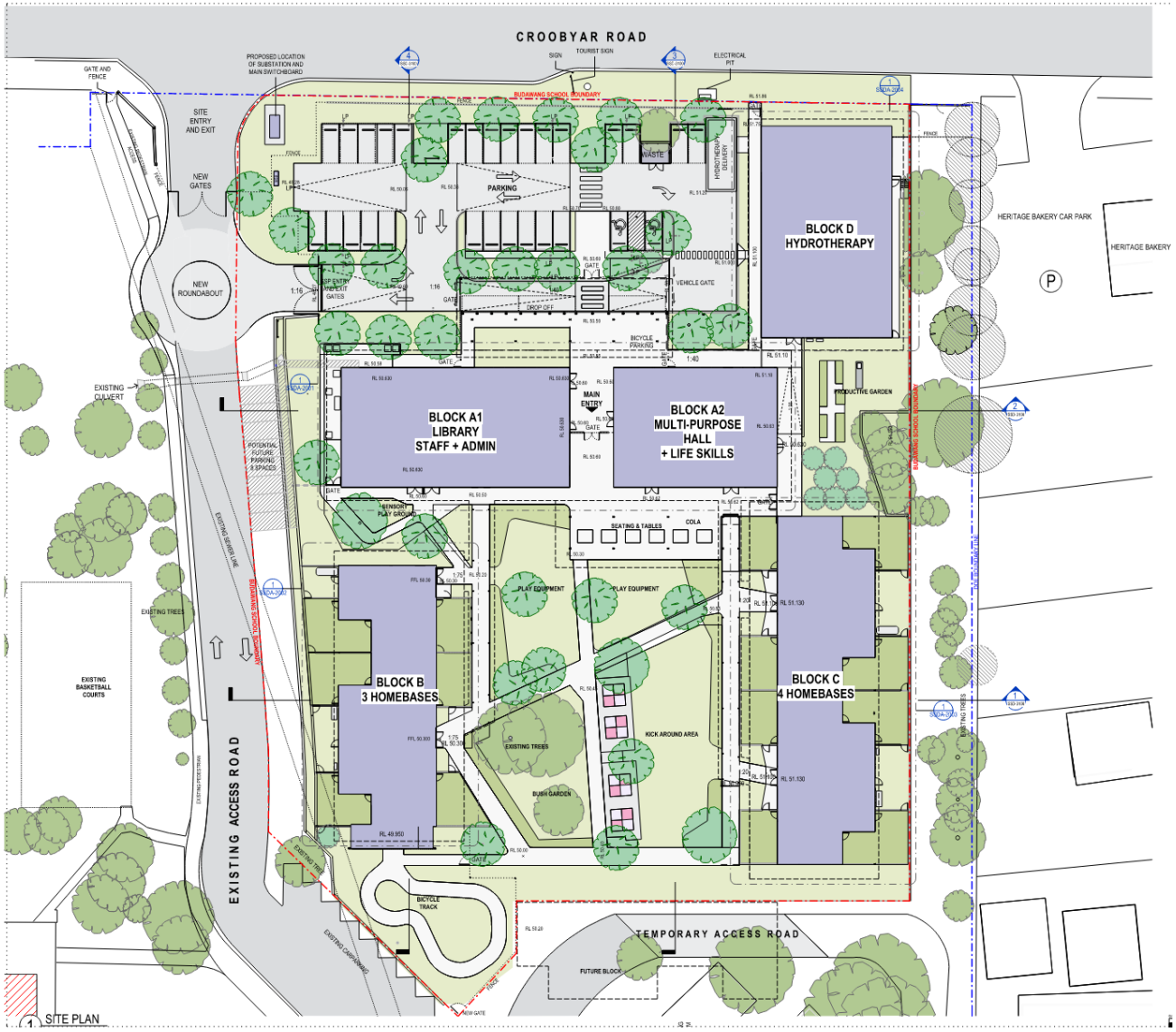
VDV

Vibration Dose Value

Vibration Dose Value is based on British Standard BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz) and provides guidelines for the evaluation of whole body exposure to intermittent vibration.

VDV can be used to take into account the weighted measured RMS vibration from many vibration sources including rail vehicles, construction equipment such as jackhammers and industry. VDV takes into account the duration of each event and the number of events per day, either at present or in the foreseeable future and calculates a single value index.

APPENDIX B SITE PLAN



APPENDIX C AERIAL IMAGE OF SITE WITH RECEIVERS

APPENDIX D PROJECT SPECIFIC CRITERIA

D1 'Interim Construction Noise Guideline'

The 'Interim Construction Noise Guideline' (ICNG) aims to provide a clear understanding of ways to identify and minimise noise from construction works through applying all 'feasible' and 'reasonable' work practises to control noise impacts. The guideline identifies sensitive land uses and recommends construction hours, provides quantitative and qualitative assessment methods and subsequently advises on appropriate work practises.

For the project site, nearby commercial and residential receivers have been identified as sensitive land uses for consideration. It is understood that construction activities on-site will not extend outside of the recommended standard hours detailed in Table B1.

Table B1: 'Interim Construction Noise Guideline' recommended standard ours of work

Work Type	Recommended standard hours of work
Normal Construction	Monday to Friday 0700 to 1800 hrs Saturdays 0800 to 1300 hrs No work on Sundays or public holidays

Based on the recommended standard hours, the guideline provides airborne noise criteria for commercial and residential receivers as detailed in Table B2. The "Noise Affected" management level is derived on a Rating Background Level (RBL) + 10 dB basis, with RBL values taken from the measured average background noise levels shown in Table 3. The "Highly Noise Affected" management level is prescriptively set at $L_{Aeq\ (15\ min)}$ 75 dB. The management level for commercial receivers is not distinguished as either "Noise Affected" or "Highly Noise Affected" but is set as a single criterion of $L_{Aeq\ (15\ min)}$ 70 dB.

Table B2: 'Interim Construction Noise Guideline' airborne noise criteria

Receiver Type	Management Level, $L_{Aeq\ (15\ min)}$	
	Noise Affected	Highly Noise Affected
Residential	51	75
Commercial	70	

Where noise from construction works is above the Noise Affected level, all feasible and reasonable work practises should be applied. Where the noise from construction works is above "Highly Affected" management level, restrictions to the hours of construction may be required.

Additional criteria are provided for ground-borne noise from construction vibration, applicable during the Evening and Night periods only. As construction is not expected to occur during these periods, ground-borne noise has not been assessed.

D2 'Assessing Vibration: A Technical Guideline'

The Technical Guideline is designed to assist in evaluating and assessing the effects on the amenity of vibration emissions from industry, transportation and machinery, and provides a useful reference in assessing the vibration impacts caused by the construction or operation of new developments.

Construction activities typically give rise to vibration events defined in the Guideline as Intermittent, with interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude.

The Guideline provides acceptable values for intermittent vibration based on Vibration Dose Values. These criteria, applicable to residential receivers, are summarised in Table B3. The Guideline also allows for assessment for other receiver types such as offices, schools, places of worship and workshops. However, none of these types are located close to the Project site and have been omitted.

Table B3: Assessing Vibration: A Technical Guideline; construction vibration criteria

Daytime (0700-200hrs)		Night-time (2200-0700hrs)	
Preferred Value, VDV	**Maximum Value, VDV**	**Preferred Value, VDV**	**Maximum Value, VDV**
0.20	0.40	0.13	0.26

D3 'Noise Policy for Industry'

In NSW, the NPfI is the guideline used for assessing noise from large industrial premises scheduled by the EPA. However, some Councils also apply the NPfI to the assessment of noise emissions from other developments with noise sources that may be considered to be industrial in nature. Whilst the EPA has indicated that the NPfI is inappropriate for the assessment of educational facilities, specifically with regard to noise from children, the NPfI can be used as guidance to inform project-specific criteria that may be developed for a school development from industrial type noise sources such as mechanical plant.

The NPfI sets out a procedure where a noise source can be evaluated against a series of noise assessment levels. In the NPfI, these project-specific noise levels are derived from an analysis of the ambient noise environment and zoning information.

The ambient noise levels for this project are summarised in Table D1. In the NPfI, the background noise level is called the Rating Background Level (RBL). As the primary use of the facility will only occur during the Daytime and Evening periods (0700-1800 hrs and 1800-2200 hrs), the Night-time period is not required for assessment and has been omitted.

Table D1: NPfI periods and measured background noise levels

Period	Time of day	RBL $L_{A90,\ 15min}$ dB
Day	0700-1800 hrs	41
Evening	1800-2200 hrs	31

Intrusiveness noise levels

The intrusiveness noise assessment is applicable to residential receivers and is based on knowledge of the background noise level at the receiver location. The intrusiveness level is the background noise level at the nearest noise-sensitive location plus 5 dB. Therefore, the noise emissions from the premises are considered to be intrusive if the A-weighted source noise level ($L_{Aeq,\ 15min}$) is greater than the background noise level (L_{A90}) plus 5 dB.

Based upon the background noise data summarised in Table D1, noise limits for Intrusiveness have been calculated in accordance with the NPfI and are presented in Table D2.

Table D2: Derived Intrusiveness noise levels

Period	Rating Background Level, $L_{A90,\ 15min}$ dB	Intrusiveness Noise Level (RBL + 5 dB), $L_{Aeq,\ 15\ min}$ dB
Day	41	46
Evening	31	36

Amenity noise levels

The project amenity noise levels are designed to prevent industrial noise continually increasing above an acceptable level. The initial stage in determining the project amenity level is to determine the recommended amenity noise levels for the appropriate amenity area and time of day.

A review of the noise levels measured indicates that the residential noise environment is typical of a Suburban area with intermittent traffic-related noise source during the Day and Evening ambient noise levels defined by the natural environment and human activity. As such, the recommended amenity noise levels for

a Suburban residential receiver as described in Table 2.2 of the NPfI have been selected. The appropriate recommended amenity noise levels are then modified to convert an $L_{Aeq\ period}$ time descriptor to an $L_{Aeq\ 15\ min}$ descriptor, with further modification available to allow for existing industrial and commercial premises (as detailed in Section 2.4 of the NPfI).

Given the above, and considering the various receivers identified in Section 2.0, the NPfI project amenity noise levels applicable to the development are detailed in Table D3.

Table D3: Derived project amenity noise levels

Receiver	Period	Recommended Amenity Noise Level $L_{Aeq,\ period}$ dB	Project Amenity Noise Level $L_{Aeq,\ 15min}$ dB
Residential (Suburban)	Day	55	53
	Evening	45	43
Commercial Premises	When in use	65	63

Source: Table 2.2 NSW Noise Policy for Industry

Determination of Project Noise Trigger Levels

The final process in determining the operational noise limits according to the NPfI is to derive the Project Noise Trigger Levels. The Project Noise Trigger Levels are levels 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 Levels are derived by selecting the more stringent of either the intrusiveness or project amenity noise levels. For residential receivers, each assessment time period is evaluated individually. For non-residential receivers, only the Amenity noise level applies. The NPfI Project Noise Trigger Levels applicable to the site are shown in Table D4.

Table D4: NPfI Project Noise Trigger Levels

Receiver	Period	Project Noise Trigger Level, $L_{Aeq,15min,}$ dB
Residential	Day	46
	Evening	36
Commercial Premises	When in use	63

APPENDIX E CONSTRUCTION NOISE SOURCES

A variety of excavation and construction equipment will be used for this project. At this early stage, a comprehensive plan of staging and equipment selection is not known. Table E1 provides a schedule of construction equipment that is anticipated to be used on this site and their noise levels as taken from:

- AS2436-2010: *Guide to noise and vibration control on construction, demolition and maintenance sites*
- BS5228-1-2009: *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*

Table E 1: Construction noise source sound power levels, dB L_{Aeq}

Noise source	A-weighted sound power level, L_{Aeq} dB SWL	Source
22 tonne excavator	99	AS2436-2010
27 tonne excavator	103	BS5228-1-2009
Jack hammer & breaker	121	AS2436-2010
Compacting plate	117	BS5228-1-2009
Concrete saw	117	BS5228-1-2009
Concrete truck & pump	108	AS2436-2010
Brick saw	107	BS5228-1-2009
Concrete vibrator	103	AS2436-2010
Concrete floats	100	BS5228-1-2009
Nail gun	101	BS5228-1-2009
Hydraulic bar cutter	107	BS5228-1-2009
Bogie truck	107	AS2436-2010
Flatbed truck	107	AS2436-2010
Generator	99	AS2436-2010
Air compressor	101	AS2436-2010
Electric winch & materials hoist	96	BS5228-1-2009
De-watering plant (water pumps)	99	BS5228-1-2009

APPENDIX F CONSTRUCTION NOISE IMPACT ASSESSMENT

Noise levels during the Site Preparation and Demolition, Bulk Excavation and Construction phases have been calculated at the nominated receivers. These noise levels have been predicted under guidance from *AS2436-2010 Guide to noise control on construction, maintenance and demolition sites* and utilising the information provided in *BS 5228-1-2009 Code of practise for noise and vibration control on construction and open sites*.

Levels have been calculated for "Worst-Case" situations where noise sources will either be closest to the noise-sensitive receiver and/or not screened by existing site structures. Noise levels have also been calculated for the "Average" situation, with noise sources located towards the centre of the site. The latter is likely to be representative of the longer-term noise emissions.

For the purpose of our calculation, we have assumed that the following plant items will be working together simultaneously for between 25 to 100% of the time over a 15-minute period for the demolition, excavation and construction phases.

Table F1: Equipment assumed to be operating simultaneously in a 15-minute period

Construction Equipment	Site Preparation	Bulk Excavation	Construction
22 tonne excavator	✓		
27 tonne excavator		✓	
Jack hammer & breaker		✓	✓
Compacting plate		✓	✓
Concrete saw		✓	✓
Concrete truck & pump			✓
Brick saw			✓
Concrete vibrator			✓
Concrete floats			✓
Nail gun			✓
Hydraulic bar cutter			✓
Bogie truck	✓	✓	✓
Flatbed truck		✓	
Generator	✓	✓	✓
Air compressor	✓	✓	✓
Electric winch & materials hoist			✓
De-watering plant (water pumps)		✓	✓

F1 Site Preparation and Demolition Phase

Table F2 details the predicted noise levels at the nominated receivers' occupancies during the Site Preparation and Demolition phase. Noise levels have been calculated at a position within the receiver that is most exposed to noise from associated activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.3.

The calculated levels indicate that noise from Site Preparation and Demolition activities is below the "Highly Noise Affected" goals for the "Worst-Case" and "Average" assessment position for all the identified nearby receivers (commercial and residential).

For the Commercial receiver C1, predicted noise levels are below the "Noise Affected" goals for the "Worst-Case" and "Average" assessment position.

For the residential receivers surrounding the site, predicted noise levels are expected to be up 5 dB above the "Noise Affected" goals for the "Average" assessment, and up to 14 dB above the "Noise Affected" goals for the "Worst-Case" assessment.

During the Site Preparation and Demolition phase, the use of bogie trucks and excavator has the highest potential to impact on the noise receivers.

F2 Bulk Excavation Phase

Table F3 details the predicted noise levels at the nominated receivers during the Bulk Excavation phase. Noise levels have been calculated at a position within the receiver that is most exposed to noise from Bulk Excavation activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.3.

The calculated levels indicate that noise from Bulk Excavation activities is below the "Highly Noise Affected" goals for the "Worst-Case" and "Average" assessment position for all the identified nearby receivers (commercial and residential).

For the Commercial receiver C1, predicted noise levels are below the "Noise Affected" goals for the "Worst-Case" and "Average" assessment position.

For the residential receivers surrounding the site, predicted noise levels are expected to be up 13 dB above the "Noise Affected" goals for the "Average" assessment, and up to 23 dB above the "Noise Affected" goals for the "Worst-Case" assessment.

During the Bulk Excavation phase, the use of jack hammers has the highest potential to impact on the noise receivers at the adjacent residential receivers (Receiver Group R1).

F3 Construction Phase

Table F4 details the predicted noise levels at the nominated receivers during the Construction phase. Noise levels have been calculated at the position within the receiver that is most exposed to noise from Construction activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.3.

The calculated levels indicate that noise from Construction activities is below the "Highly Noise Affected" goals for the "Worst-Case" and "Average" assessment position for all the identified nearby receivers (commercial and residential).

For the Commercial receiver C1, predicted noise levels are below the "Noise Affected" goals for the "Worst-Case" and "Average" assessment position.

For the residential receivers surrounding the site, predicted noise levels are expected to be up 12 dB above the "Noise Affected" goals for the "Average" assessment, and up to 21 dB above the "Noise Affected" goals for the "Worst-Case" assessment.

During the Construction phase, the use of the concrete pump has the highest potential to impact on the noise receivers at the adjacent residential receivers (Receiver Group R1).

F4 Comments

Background noise levels in the vicinity of the residential receivers are relatively low. Whilst noise levels associated with each stage of the construction works are typically at the lower end of that emitted by such activities, the emergence above the ambient noise level means that some community reaction may occur. The ICNG recommends that for situations in which the “Noise Affected” management levels are exceeded; all feasible and reasonable work practises should be adopted. Additionally, all potentially impacted residents should be informed of the nature of the works, expected noise levels and duration, as well as contact details for site representatives. These requirements are described in detail in the noise control recommendations in Section 5.3 and the Construction Noise and Vibration Management Plan described in Section 5.4.

Table F2: Predicted noise levels during Site Preparation and Demolition works

Receiver Group	Period	Assessment	Calculated noise level[2], dB $L_{Aeq, 15min}$[3]	"Noise Affected"		"Highly Noise Affected"	
				Management level, dB $L_{Aeq, 15min}$	Exceedance, dB	Management level, dB $L_{Aeq,15mins}$	Exceedance, dB
R1	Within guideline hours[2]	Worst-case	65	51	14	75	--
		Average	56		5		--
C1	Within guideline hours[2]	Worst-case	66	70	--	N/A	N/A
		Average	53		--		N/A
R2	Within guideline hours[2]	Worst-case	61	51	10	75	--
		Average	52		1		--
R3	Within guideline hours[2]	Worst-case	57	51	6	75	--
		Average	55		4		--

[1] Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

[2] Calculations included the recommended noise controls detailed in Section 5.2

[3] Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the ICNG. Noise levels at upper floors without shielding are likely to be higher.

Table F3: Predicted noise levels during Bulk Excavation works

Receiver Group	Period	Assessment	Calculated noise level[2], dB $L_{Aeq, 15min}$[3]	"Noise Affected"		"Highly Noise Affected"	
				Management level, dB $L_{Aeq, 15min}$	Exceedance, dB	Management level, dB $L_{Aeq,15mins}$	Exceedance, dB
R1	Within guideline hours[2]	Worst-case	74	51	23	75	--
		Average	64		13		--
C1	Within guideline hours[2]	Worst-case	69	70	--	N/A	N/A
		Average	63		--		N/A
R2	Within guideline hours[2]	Worst-case	69	51	18	75	--
		Average	61		10		--
R3	Within guideline hours[2]	Worst-case	63	51	12	75	--
		Average	59		8		--

[1] Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

[2] Calculations included the recommended noise controls detailed in Section 5.3

[3] Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the ICNG. Noise levels at upper floors without shielding are likely to be higher.

Table F4: Predicted noise levels during Construction works

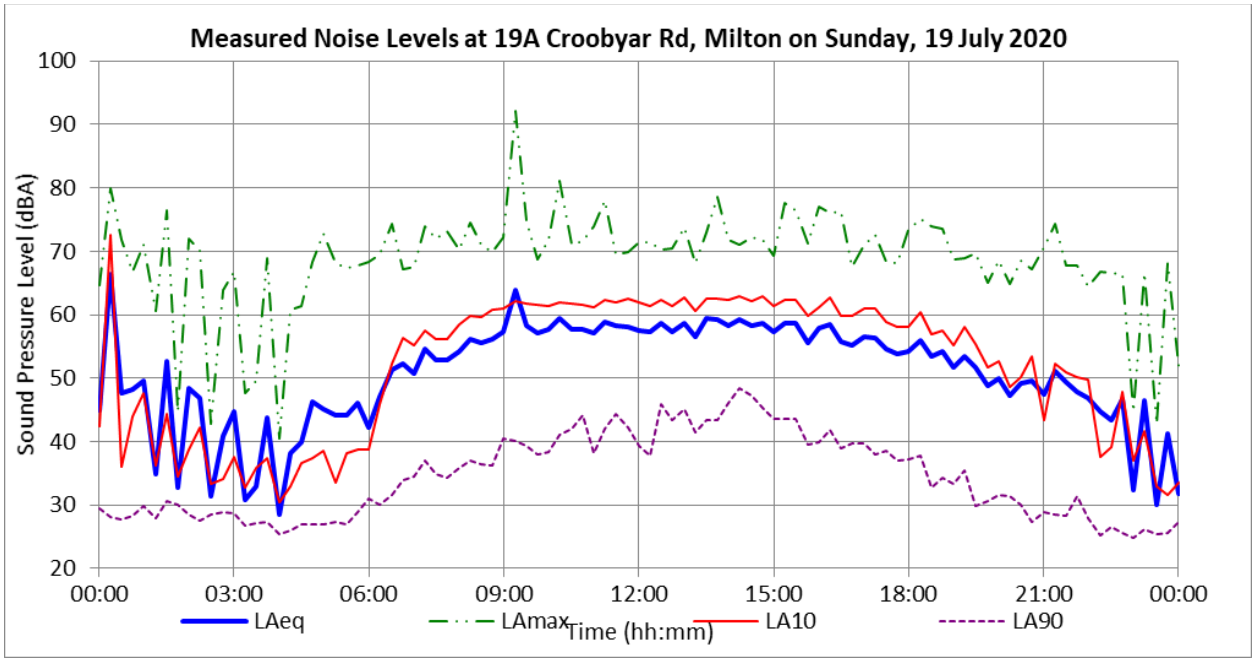
Receiver Group	Period	Assessment	Calculated noise level[2], dB $L_{Aeq, 15min}$[3]	"Noise Affected"		"Highly Noise Affected"	
				Management level, dB $L_{Aeq, 15min}$	Exceedance, dB	Management level, dB $L_{Aeq,15mins}$	Exceedance, dB
R1	Within guideline hours[2]	Worst-case	72	51	21	75	--
		Average	63		12		--
C1	Within guideline hours[2]	Worst-case	69	70	--	N/A	N/A
		Average	62		--		N/A
R2	Within guideline hours[2]	Worst-case	68	51	17	75	--
		Average	59		8		--
R3	Within guideline hours[2]	Worst-case	64	51	13	75	--
		Average	59		8		--

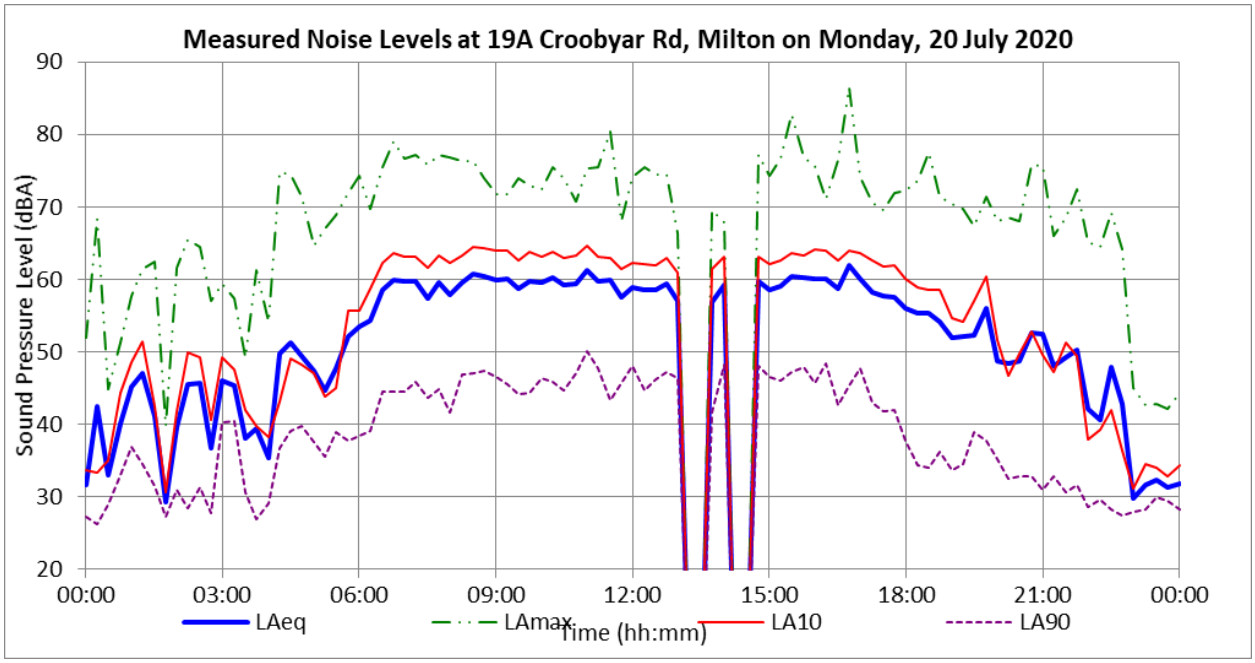
[1] Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

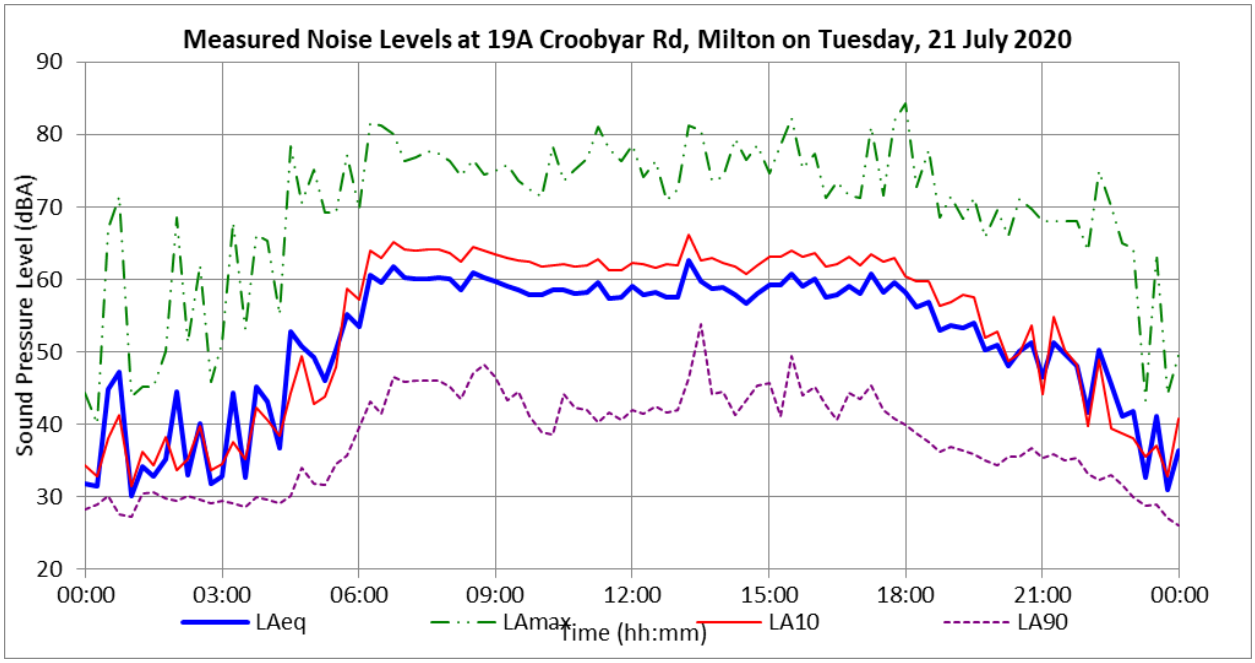
[2] Calculations included the recommended noise controls detailed in Section 5.3

[3] Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the CNG. Noise levels at upper floors without shielding are likely to be higher.

MONITORING RESULTS



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Sound Pressure Level (dBA)
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80
70
60
50
40
30
20
00:00
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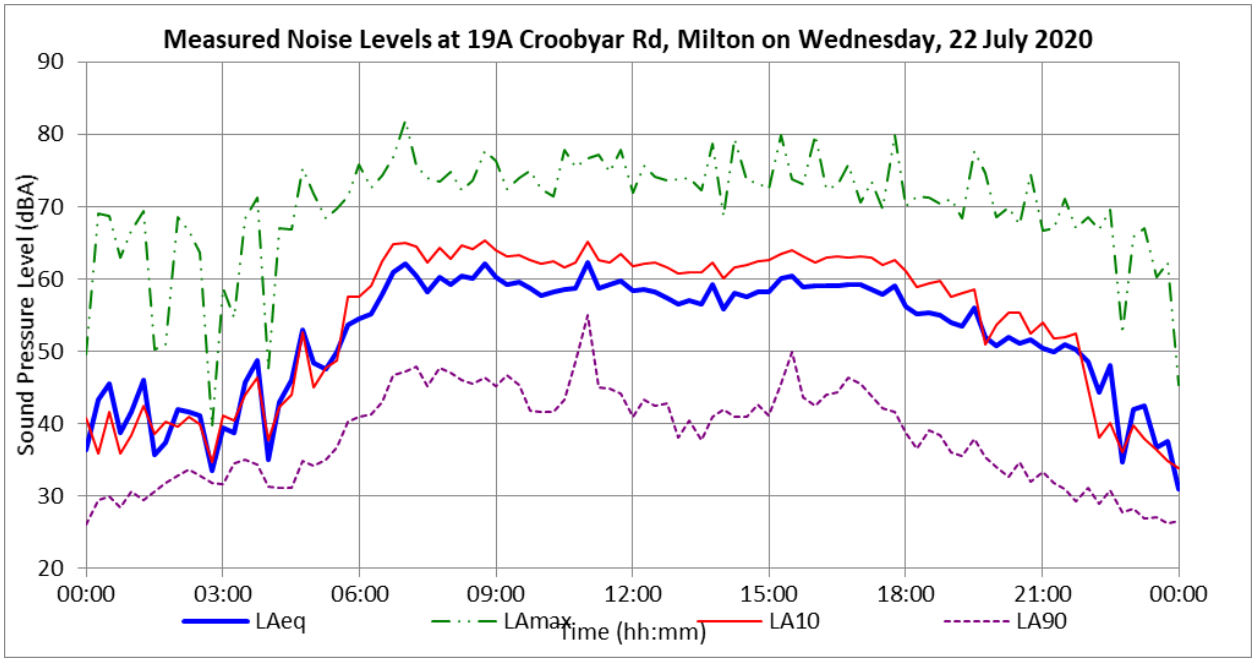
Time (hh:mm)


Measured Noise Levels at 19A Croobyar Rd, Milton on Wednesday, 22 July 2020
Sound Pressure Level (dBA)
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70
60
50
40
30
20
00:00
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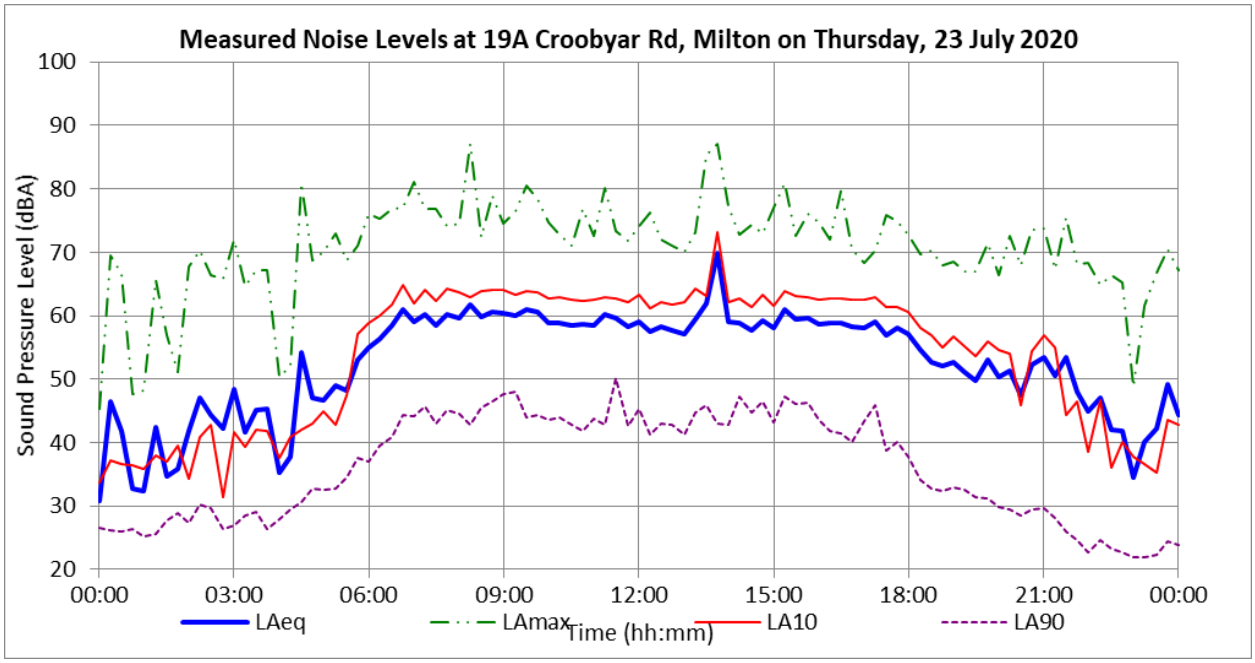
LAeq
LAmax
LA10
LA90
Time (hh:mm)


Measured Noise Levels at 19A Croobyar Rd, Milton on Thursday, 23 July 2020
Sound Pressure Level (dBA)
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80
70
60
50
40
30
20
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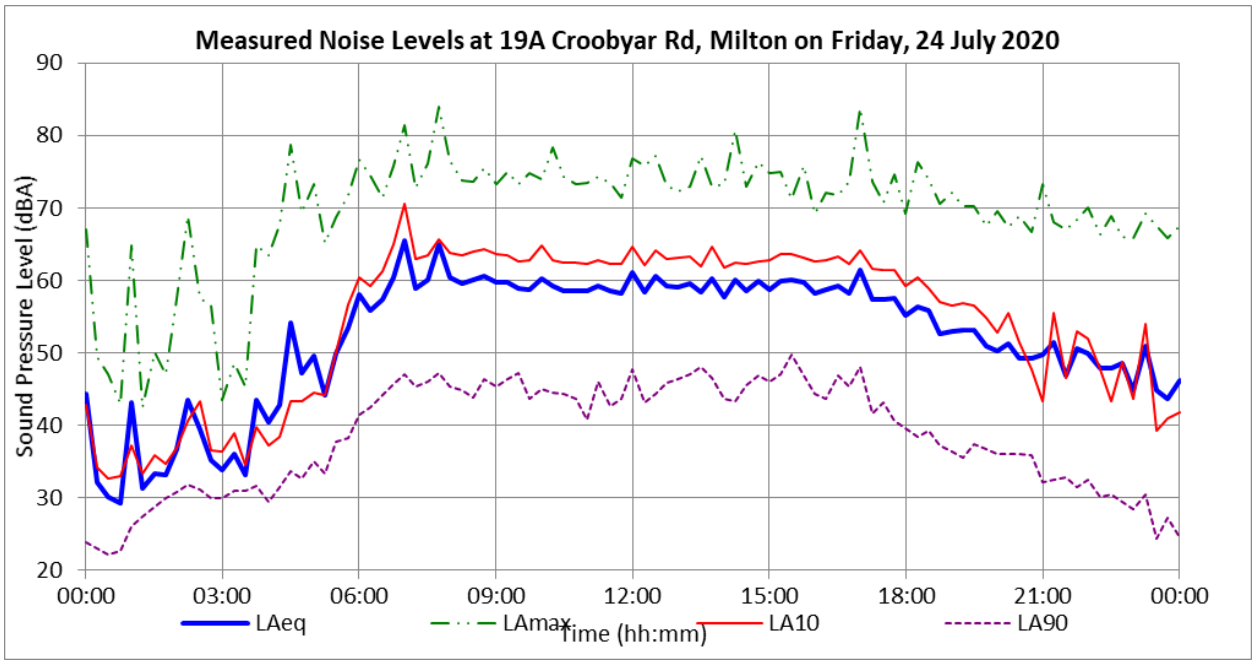
00:00
LAeq
LAmax
LA10
LA90
Time (hh:mm)


Measured Noise Levels at 19A Croobyar Rd, Milton on Friday, 24 July 2020
Sound Pressure Level (dBA)
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30
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LAeq
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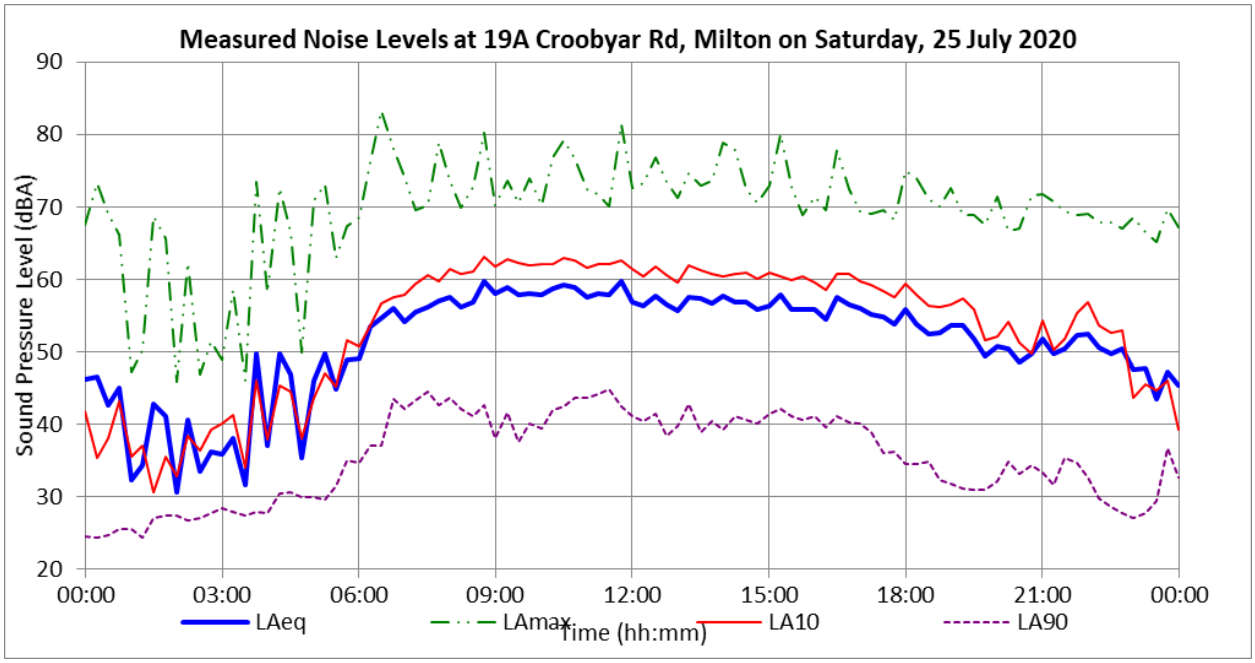
LA90
Time (hh:mm)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Sound Pressure Level (dBA)
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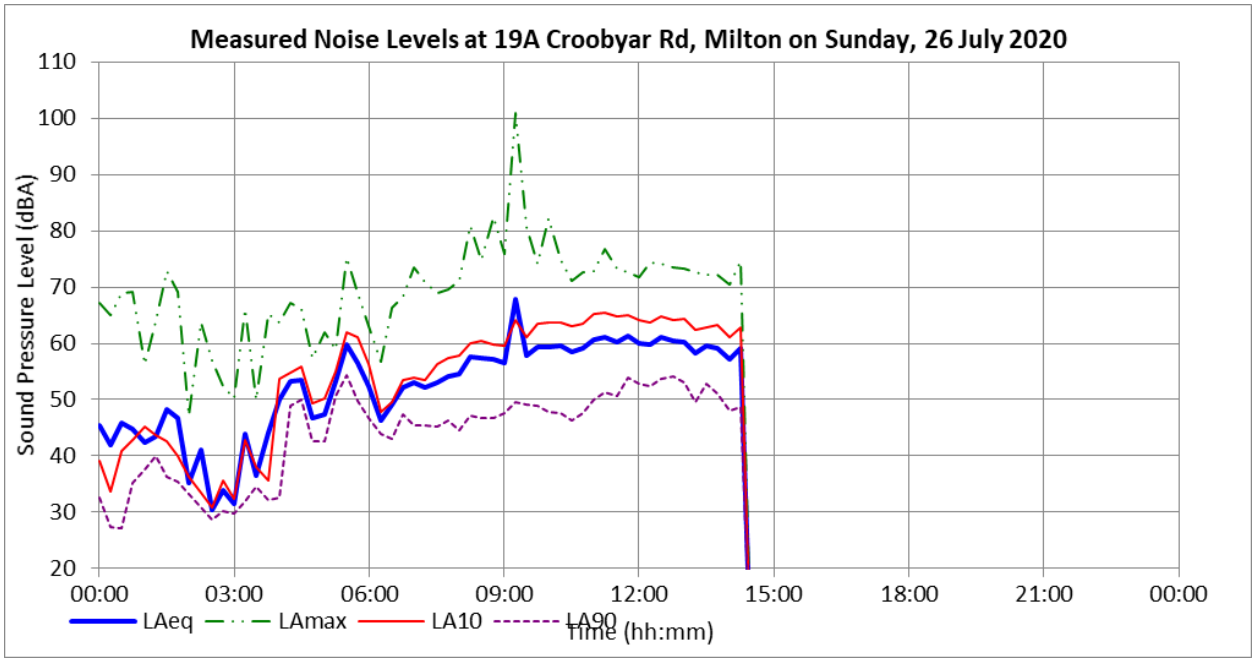
18:00
21:00
00:00
LAeq
LAmax
LA10
LA90
Time (hh:mm)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Sound Pressure Level (dBA)
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03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
LAeq
LAmax
LA10
LA90
Time (hh:mm)