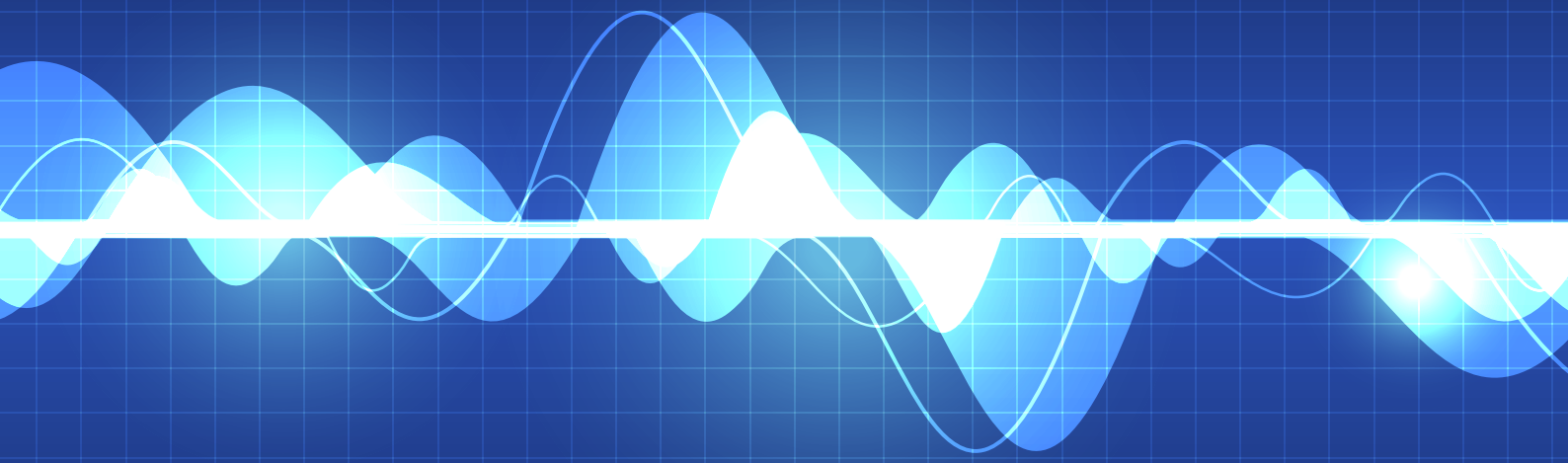
Richard Gill National Music Academy

Noise and vibration impact assessment

Prepared for Stanton Dahl Architects
May 2020



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Richard Gill National Music Academy

Noise and vibration impact assessment

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Client

Stanton Dahl Architects

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Prepared by	Approved by
	
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1 Introduction

EMM Consulting Pty Ltd (EMM) has been engaged by Stanton Dahl Architects to conduct an assessment of potential noise and vibration impacts associated with the proposed Richard Gill National Music Academy ('the project'). The project is an adaptive reuse of the existing Muswellbrook Shire Council Administration Building located at 157 Maitland Street, Muswellbrook, NSW ('the site').

This noise and vibration impact assessment (NVIA) has been prepared to accompany the state significant development (SSD) application (SSD-10380) for the development. Acoustic requirements for the application are provided in Item 9 of the NSW planning minister's Secretary's Environmental Assessment Requirements (SEARs).

The development will include a refit of the existing structure on the site and the construction of a new outdoor play area. This report addresses noise and vibration impacts associated with the construction and operation of the development.

This study addresses the following aspects of the development which may have potential acoustic impacts on surrounding noise sensitive land uses:

- noise breakout from music within the development during normal school hours;
- noise breakout from the use of the facility during evening hours for public related events;
- traffic noise generation on New England Highway due to site generated traffic;
- mechanical plant noise emissions; and
- construction noise and vibration impacts.

1.1 Relevant SEARs

The report has been prepared to address the requirements of the SEARs issued for the project. Item 9 relates to the assessment of noise impacts from the site and is described in Table 1.1.

Table 1.1 SEARs

Key issue	Requirement	Where addressed in section of this report
9	Identify and provide a quantitative assessment of the main noise and vibration generating sources during physical works and upgrades. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.	Section 5 and Section 6
	Identify and assess 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, and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.	Section 5

Table 1.1 SEARs

Key issue	Requirement	Where addressed in section of this report
	Relevant Policies and Guidelines: • NSW Noise Policy for Industry 2017 (EPA) • Interim Construction Noise Guideline (DECC) • Assessing Vibration: A Technical Guideline 2006 • Development Near Rail Corridors and Busy Roads – Interim Guideline (Department of Planning, 2008) • Australian Standard 2363:1999 Acoustics – Measurement of noise from helicopter operations	Section 4

It is noted that the proposal will not incorporate the use of helicopters and as such no further reference to AS2363 or study of helicopter noise is included in this report.

1.2 Referenced documents and guidelines

Noise and vibration impacts associated with the development have been accordance with the following guidelines (covers those in the SEARs):

- Australian Standard AS2107:2016 'Acoustics – recommended design sound levels and reverberation times for building interiors';
- Noise Policy for Industry (NPfI), NSW Environment Protection Authority (EPA), October 2017;
- Road Noise Policy (RNP), NSW Department of Climate Change and Water (DECCW), March 2011;
- Interim Construction Noise Guideline (ICNG), NSW Department of Climate Change (DECC), July 2009;
- Department of Planning (DoP), *Development near Rail Corridors and Busy Roads – Interim Guideline*, 2008; and
- Department of Environment and Conservation (DEC) NSW 2006*, Assessing Vibration: a technical guideline*.

These guidelines will form the basis of assessment for noise and vibration impacts from the development.

Reference is also made to the traffic study prepared by Seca Solution (2020) 'Proposed Redevelopment, Richard Gill National Music Academy, Muswellbrook, NSW' prepared for Stanton Dahl Architects.

1.3 Glossary of acoustic terms

A number of technical terms are required for the discussion of acoustics. These are explained in Table 1.2.

Table 1.2 Glossary of acoustic terms

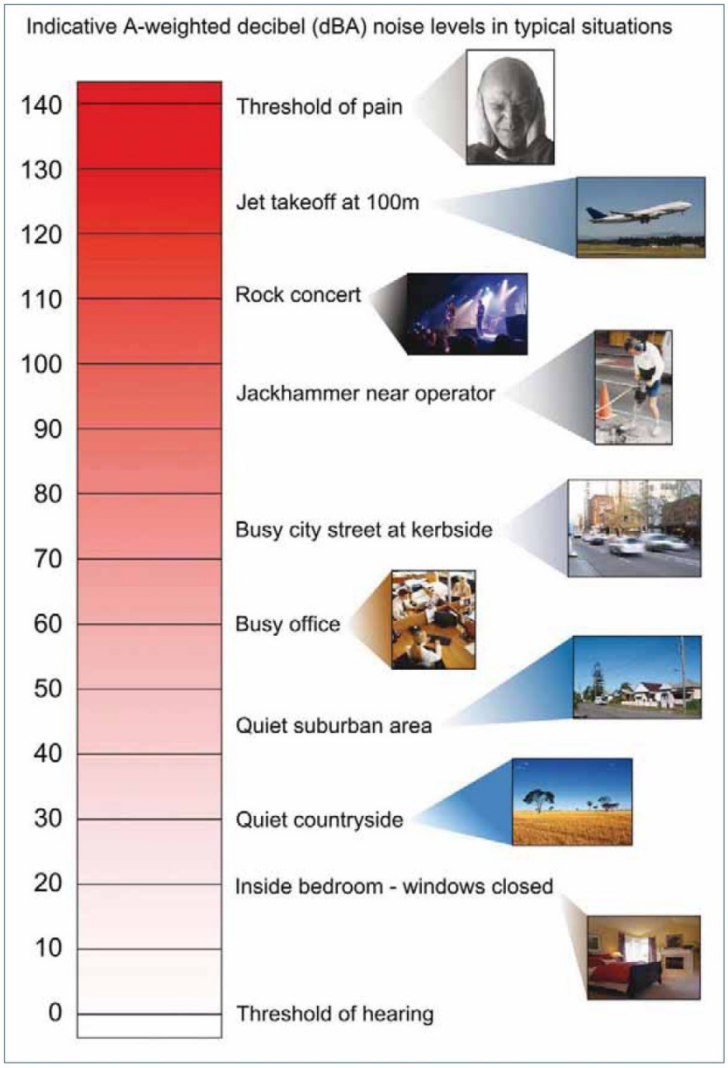
Term	Description
dB	Noise is measured in units called decibels (dB).
A-weighting	There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The A-weighted noise level exceeded for 1% of a measurement period.
L_{A10}	The A-weighted noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise levels.
L_{A90}	Commonly referred to as the background noise, this is the A-weighted level exceeded 90% of the time.
L_{Aeq}	The A-weighted energy average noise from a source and is the equivalent continuous sound pressure level over a given period. The $L_{Aeq,15min}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amax}	The maximum root mean squared A-weighted sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period.
Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.

It is useful to have an appreciation of decibel, the unit of noise measurement. Table 1.3 gives an indication as to what an average person perceives about changes in noise levels:

Table 1.3 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	typically indiscernible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

Examples of common noise levels are provided in Figure 1.1.



Source: Road Noise Policy (DECCW 2011).

Figure 1.1 Common noise levels

2 Site background

2.1 Site description

The site is currently occupied by the Muswellbrook Shire Council Administration Building and the 'Little Kindy' childcare centre. Access to the site is provided by an unsignalized T-intersection off the New England Highway bordering the north of the site. Refer to Figure 2.1.

Existing parking is provided via 12 car spaces adjacent the child-care centre and 91 car spaces within three separate car parking areas adjacent the existing Council administration building.

2.2 Development proposal

The project includes the adaptive reuse of the former Muswellbrook Shire Council Administration Building to an independent primary school. The development will be delivered over several stages, the first of which is addressed in this assessment. Stage 1 is expected to cater for up to 50 children.

The main building will typically include:

- administration and staff facilities;
- thee general learning areas (GLAs) with associated breakout space;
- library; and
- multipurpose hall.

An additional outdoor play area is also included as part of the Stage 1 works.

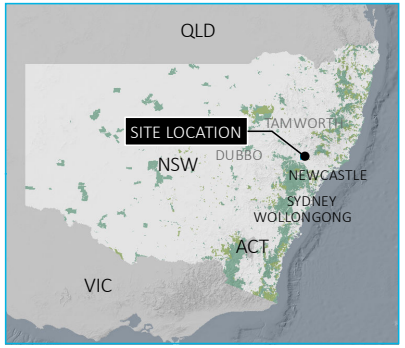
2.3 Surrounding uses and sensitive receivers

The site is generally surrounded by residential land use with some short term accommodation (motel). Assessment locations have been grouped into separate noise catchment areas (NCAs), with the worst affected assessment location in each NCA forming the basis of the assessment of potential impact.

The land uses within each NCA are summarised in Table 2.1 and illustrated in Figure 3.1.

Table 2.1 Noise catchment areas

NCA	Land uses within NCA	Representative noise monitoring position
NCA01	Residential	NM1
NCA02	Residential	NM2
NCA03	Residential Short term accommodation (motel)	NM2



KEY

- Site boundary
- Major road
- Named watercourse
- State forest

INSET KEY

- NPWS reserve
- State forest

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Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

Site location

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Figure 2.1

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3 Existing environment

Noise monitoring was conducted to establish the existing prevailing noise environment at near neighbours of the proposed development site. Two unattended noise loggers were used at points on the site's western and eastern boundaries representing receivers proximate to the project structure and proposed outdoor play area.

3.1 Measurement locations

The noise monitoring locations were selected after careful inspection of the proposed development site, giving due consideration to other noise sources which may influence the readings (e.g. mechanical plant near the monitor), the proximity of neighbouring sensitive locations to the proposed site, and security issues for the noise monitoring devices.

Noise monitoring was carried out using two ARL NGARA environmental noise loggers. The details of each noise monitoring location is provided in Table 3.1 and illustrated in Figure 3.1.

Table 3.1 Monitoring locations

Monitor ID	Equipment type and serial number	Period of measurement	Monitor location Address
NM1	ARL NGARA SN 878127	1/04/20 – 11/04/20	Eastern boundary
NM2	ARL NGARA SN 878126	01/04/20 – 15/04/20	Western boundary

Loggers were programmed to record statistical noise level indices continuously in 15 minute intervals in accordance with the requirements of the NPfI, including the L_{Amax}, L_{A1}, L_{A10}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and the L_{Aeq}. Calibration of all instrumentation was checked prior to and following measurements. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

3.2 Weather affected noise data

Weather data for the survey period was obtained from the BOM weather station at Scone Airport (ID 061363). The wind speed and the rainfall data were used to exclude noise data during periods of any rainfall and/or wind speed in excess of 5 m/s (approximately 9 knots) at the microphone height in accordance with NPfI methods.

3.3 Measured noise levels

A summary of the existing background and ambient noise levels is provided in Table 3.2. Daily results and charts from the noise logger are provided in Appendix A. The day and evening RBLs have been presented consistent with the expected hours of operation.

Table 3.2 Summary of unattended ambient noise monitoring

Noise monitoring location	Time period[1]	Existing noise levels	
		$L_{Aeq(period)}$, dB	Rating background level (RBL), dB
NM1	Day	55	41
	Evening	49	39
NM2	Day	53	41
	Evening	49	41

Note 1. The daytime is 7 am to 6 pm; evening 6 pm to 10 pm; night-time 10 pm to 7 am. On Sundays and Public Holidays, the daytime is 8 am to 6 pm; evening 6 pm to 10 pm; night-time 10 pm to 8 am.

The current site operations are nil or minor and hence did not influence measured data. The predominant source of noise in the area is associated with the New England Highway and sporadic neighbourhood noise (eg residents, lawn mowers).

3.4 Traffic noise levels

Traffic noise levels recorded at each logger location are provided in Table 3.3. The loggers were located in positions which approximate the same distance from the road as the existing structure. Extraneous noise sources which are atypical to traffic noise have been excluded from the data set.

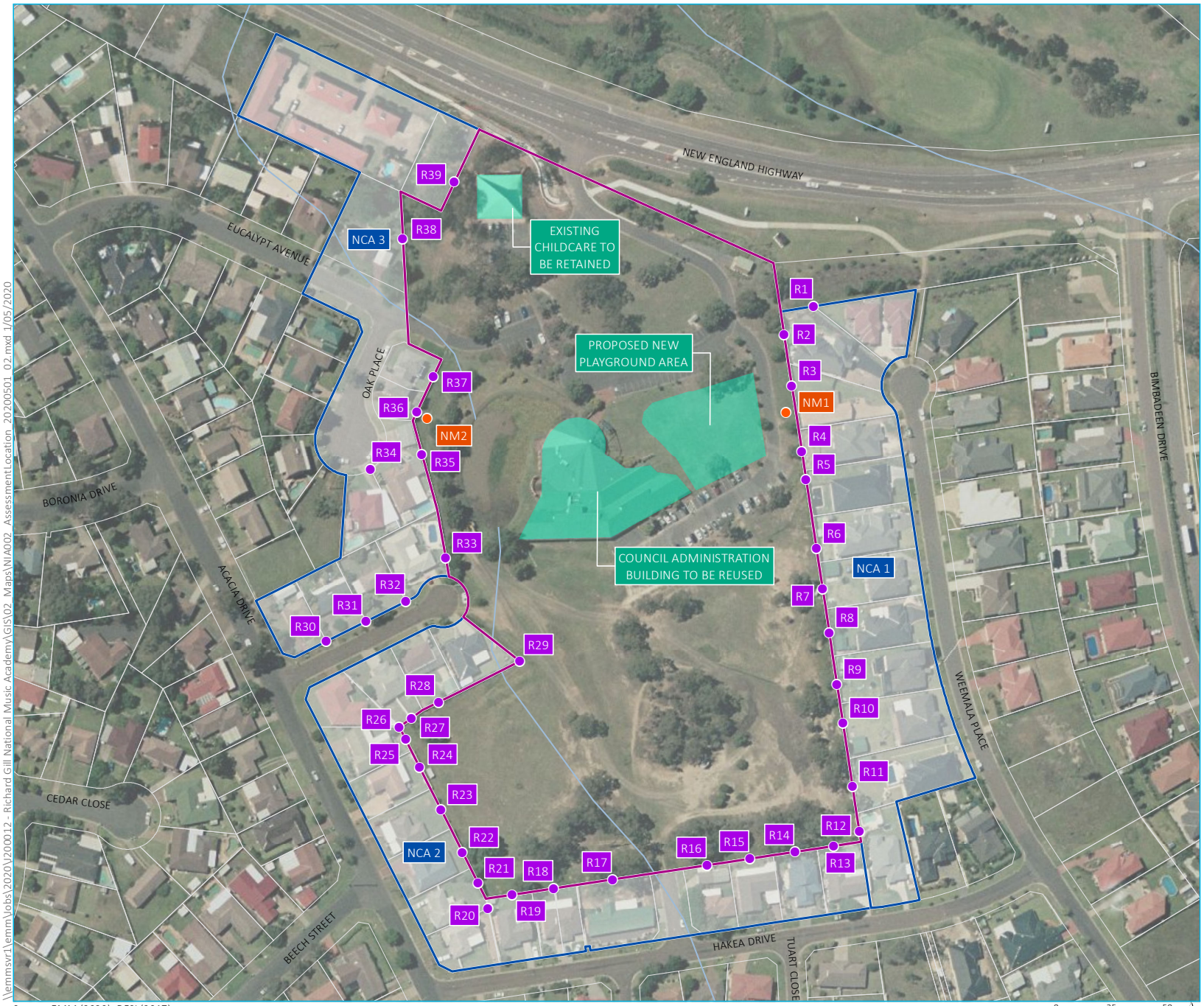
Table 3.3 Summary of unattended road traffic noise monitoring

Noise monitoring location	Road traffic noise level, $L_{Aeq\ 15hour}$ dB
NM1	51
NM2	50

Note 1. The $L_{Aeq\ 15hour}$ is 7am to 10pm

3.4.1 COVID-19

Noise monitoring has been conducted during periods where the general public is under isolation orders during the COVID-19 pandemic. As such, in the absence of normal public activity (road traffic in-particular), measured noise levels are expected to be quieter than would normally be the case. In this regard, assessment against RBLs established during this monitoring period will provide a conservative to possibly highly conservative approach. This should be given due consideration when reviewing the findings of this report.



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Source: EMM (2020); DFSI (2017)

Assessment locations and noise monitoring positions

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Figure 3.1

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4 Assessment criteria

4.1 Operational noise

4.1.1 Noise Policy for Industry (NPfI)

Although the development is not industrial, guidance is obtained from the NPfI. Noise from industrial operations or processes (eg onsite plant, vehicle movements or material processing, etc.) in NSW is regulated by the local council, DPIE and/or the EPA, and generally have a licence and/or development consent conditions stipulating noise limits. It is likely that Council will set noise limits for mechanical plant noise emissions in any consent that is issued that are based on NPfI principles. These limits are typically derived from project specific trigger or operational noise levels predicted at assessment locations. They are based on EPA guidelines (ie NPfI) or noise levels that can be achieved by a specific site following the application of all reasonable and feasible noise mitigation.

Whilst the NPfI does not apply to school developments, it provides guidance on reasonable noise targets which may be adopted in addressing noise from some elements of the proposed use. Operational noise from the development has been assessed against the NPfI intrusiveness noise criterion as relevant.

The intrusiveness criterion requires that $L_{Aeq,15min}$ noise levels from the site during the relevant operational periods do not exceed the RBL by more than 5 dB. It is noted that intrusiveness noise levels are only applicable at residential assessment locations.

Table 4.1 Project intrusiveness noise levels

NCA[1]	Assessment period[2]	Measured RBL[3], dBA	Project intrusiveness noise level (RBL + 5 dB), dB $L_{Aeq,15min}$[4]
1	Day	41	46
	Evening	39	44
2 & 3	Day	41	46
	Evening	41	46

Notes: 1. Residential assessment locations only.

2. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Morning shoulder: 6 am to 7 am Monday to Saturday, 6 am to 8 am Sundays and public holidays; Night: remaining periods.

3. The RBL is an NPfI term and is used to represent the background noise level.

4. L_{Aeq} is the energy averaged noise level over the measurement period and representative of general ambient noise.

Non-residential assessment locations are to be assessed against the amenity requirements provided in the NPfI. This includes the:

- childcare centre in the northeast corner of the site; and
- the motel in NCA1.

The corresponding non-residential recommended amenity criteria for the proposed development are given in Table 4.2.

Table 4.2 Amenity criteria – non-residential assessment locations

Receiver type	Indicative area	Period[1]	Recommended noise level dB, $L_{Aeq\ (period)}$
Motel	Urban[2]	Day	65
		Evening	55
		Night	50
Active recreation (childcare outdoor)	All	When in use	55

Notes. 1. The daytime is 7.00 am to 6.00 pm; evening 6.00 pm to 10.00 pm; night-time 10.00 pm to 7.00 am. On Sundays and Public Holidays, the daytime is 8.00 am to 6.00 pm; evening 6.00 pm to 10.00 pm; night-time 10.00 pm to 8.00 am.

2. 'Urban' acoustic environment selected due to the motel being adjacent to the New England Highway which has through-traffic with characteristically heavy continuous traffic flows during peak periods (refer Table 2.3 of NPfI).

It is noted that compliance with an external objective of 55dB L_{Aeq} for the childcare outdoor area will result in compliance with the recommended internal noise level for teaching spaces provided in AS2107 assuming windows are open to the teaching space sufficient for ventilation purposes.

The recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location. To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

- Project amenity noise level for industrial developments equals the recommended amenity noise level (Table 4.2) minus 5 dB(A).

The following exceptions to the above method to derive the project amenity noise level apply:

- in areas with high traffic noise levels;
- in proposed developments in major industrial clusters;
- where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time; and
- where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

There are currently no significant industrial or commercial noise sources in the vicinity of the site and it is located in an area of high traffic noise levels. As such, no additional correction to the amenity noise level is applied.

4.1.2 Project noise trigger level

The project-specific noise level (PNTL) is the lower of the calculated intrusive noise level for residential assessment locations and amenity criteria for non-residential assessment locations. A summary of the PNTL for assessment of operational noise from the project is presented in Table 4.3.

Table 4.3 Project noise trigger levels

NCA	Receiver type	Assessment period[1]	Intrusiveness noise level, dB $L_{Aeq,15min}$	Amenity noise level[2], dB $L_{Aeq,15min}$	PNTL[3], dB $L_{Aeq,15min}$
1	Residential	Day	46	n/a	46
		Evening	44	n/a	44
		Night	38	n/a	38
2 & 3	Residential	Day	46	n/a	46
		Evening	46	n/a	46
		Night	43	n/a	43
	Childcare	When in use	n/a	58	58
	Motel	Day	n/a	68	68
		Evening	n/a	58	58
		Night	n/a	53	53

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Morning shoulder: 6 am to 7 am Monday to Saturday, 6 am to 8 am Sundays and public holidays; Night: remaining periods.

2. Project amenity $L_{Aeq,15min}$ noise level is the recommended amenity noise level $L_{Aeq,period}$ +3 dB as per the NPfI. In the absence of existing or future industrial noise sources, the amenity level has not been adjusted 5dB.

3. PNTL is the lower of the calculated intrusiveness or amenity noise levels.

4.2 Road traffic noise

The assessment of road traffic noise intrusion into the project are addressed in accordance with the Department of Planning (DoP) *Development Near Rail Corridors and Busy Roads – Interim Guideline 2008*. The potential for increased road traffic noise on the New England Highway due to the addition of site generated traffic is assessed in accordance with the RNP.

4.2.1 Traffic noise intrusion

Traffic noise intrusion into the development is to be assessed in accordance with the noise criteria prescribed in Table 3.1 of the interim guideline which nominates a recommended maximum noise level of 40dB $L_{Aeq\ 15hour}$. Further, the interim guideline provides the following guidance with regard to naturally ventilated conditions:

> If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia

The potential for road traffic noise impact on external play areas has also been addressed. Noise targets for open space (passive use) have been adopted from the RNP. The traffic noise intrusion criteria applicable to the development is summarised in Table 4.4.

Table 4.4 Road traffic noise intrusion criteria

Type of occupancy	Assessment criteria, dB $L_{Aeq\ 15\ hour}$
Classrooms	40 (internal – windows closed) 50 (internal – windows open)
Playground (passive use)	55

4.2.2 Traffic noise generation on New England Highway

Land use developments with the potential to generate additional road traffic noise requires assessment for potential noise impact. The principle guidance to assess the impact of the road traffic noise on assessment locations is in the NSW RNP.

The road traffic noise assessment criteria for residential land uses (ie assessment locations) is presented in Table 4.5, reproduced from Table 3 of the RNP for freeway / arterial / sub-arterial roads.

Table 4.5 Road traffic noise assessment criteria for residential land uses

Road Category	Type of project/development	Assessment criteria – dBA	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway / arterial / sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)

Additionally, the RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to +2 dB.

4.3 Construction noise and vibration

The Interim Construction Noise Guideline (ICNG) (DECC 2009) has been jointly developed by NSW Government agencies including the EPA and Department of Planning, Industry and Environment (DPIE). The objectives of the guideline relevant to the planning process are to promote a clear understanding of ways to identify and minimise noise from construction and to identify 'feasible' and 'reasonable' work practices.

The guideline recommends standard construction hours where noise from construction activities is audible at residential premises (ie assessment locations):

- Monday to Friday 7.00 am to 6.00 pm;
- Saturday 8.00 am to 1.00 pm; and
- no construction work is to take place on Sundays or public holidays.

The ICNG acknowledges that works outside standard hours may be necessary, however, justification should be provided to the relevant authorities.

The ICNG provides two methodologies to assess construction noise emissions. The first is a quantitative approach, which is suited to major construction projects with typical durations of more than three weeks. This method requires noise emission predictions from construction activities at the nearest assessment locations and assessment against ICNG recommended noise levels.

The second is a qualitative approach, which is a simplified assessment process that relies more on noise management strategies. This method is suited to short-term infrastructure and maintenance projects of less than three weeks.

This assessment has adopted a quantitative approach. The qualitative aspects of the assessment include identification of assessment locations, description of likely works involved including predicted noise levels and proposed management measures that include a complaint's handling procedure which is to be further developed as part of a construction environmental noise and vibration management plan.

4.3.1 Noise management levels

Table 2 of the ICNG provides guidance on establishing noise management levels (NML) for residential receivers during standard hours and has been reproduced in Table 4.6.

Table 4.6 ICNG residential NMLs

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

Source: ICNG (DECC 2009).

Table 4.7 summarises noise management levels for non-residential land uses as defined in the ICNG. Guidance has been taken from AS2107 with regard to the motel in NCA1. With regard to establishing noise management levels for the motel we note there are no specific recommendations for motel rooms during normal construction hours (ie daytime hours). As such, noise objectives have been based on a commercial receiver during this period.

Table 4.7 ICNG noise management levels at other land uses

Land use	Management level, $L_{Aeq,15\ minute}$
Classrooms at schools and other educational institutions	Internal noise level 45 dB (when in use)
Motel (daytime)	70

Source: ICNG (DECC, 2009).

4.3.2 Project construction NMLs

The construction NMLs for residential assessment locations have been based on the RBLs provided in Table 3.2. The NMLs for standard construction hours adopted for this assessment were derived in accordance with the ICNG for all assessment locations and are presented in Table 4.8.

Table 4.8 Construction NMLs for standard hours

Assessment location	Period	RBL, dB(A)[1]	NML, $L_{Aeq,15min}$, dB	HNL[2]
NCA01 NCA02 NCA03	Day (standard ICNG hours)	41	51	75

Notes: 1. Based on the day period RBL established in Table 3.2.
2. HNL – highly noise affected level

5 Operational noise assessment

Noise generated by the operation of the site will typically be associated with noise breakout from music within the multi-purpose hall and from on-site vehicle traffic, as well as playground noise. It is important to note that peak activities for each of these operations will not coincide, e.g. a concert in the music hall will mean vehicles are stationary.

5.1 Noise breakout from the multi-purpose hall

Noise breakout from the multi-purpose hall will be associated with music and amplified speech. For the most part, this will occur during school hours however the hall may also be utilised during the evening period and as such has also been addressed for this time period.

Noise emanating from the multi-purpose hall has been addressed using the following modelling assumptions:

- An internal sound pressure level within the hall of 95dB $L_{Aeq\ 15min}$. This has been adopted from measurements conducted by EMM during an orchestra rehearsal within a reverberant community hall. Such a level is expected to be a worst case for the proposed use.

  It is expected that noise within the proposed hall will be reduced with the introduction of acoustically absorbent materials which will undoubtedly be incorporated as part of the detailed design.

- The existing roof is sheet metal and has been considered in the predictions of noise breakout. In the first instance, a ceiling within the hall has not been assumed. A perforated acoustic ceiling will likely be installed which will have some acoustic benefit in containing noise within the building envelope.

Predicted noise levels are provided in Table 5.4. Noise predictions are compared against the relatively stricter evening noise criterion as the hall may be utilised during the evening period for sporadic events. Compliance with the evening criteria will imply compliance with the day criterion. The worst-case receiver in each catchment area is presented.

Table 5.1 Noise breakout from music in the multipurpose hall – predicted noise levels

NCA	Receiver location	Predicted noise level, dB $L_{Aeq\ 15min}$	Evening noise objective, dB $L_{Aeq\ 15min}$
1	R3	35	44
2	R29	36	46
3	R37	39	46
On-site	Childcare	36	55

Notes: 1. Based on the RBL + 5dB intrusiveness noise criterion provided in Table 4.3.

5.2 On-site vehicle movements

Noise associated with on-site vehicles is addressed using the sound power levels provided in Table 5.2. Noise modelling has conservatively assumed that all sources are operating simultaneously. The vehicle noise sources in Table 5.2 have been assessed based on design plans supplied by Stanton Dahl Architects.

Table 5.2 Vehicle source noise levels

Noise source	Sound power level, dB $L_{Aeq\ 15min}$
Passenger vehicle at 10km/h	84

The proposed school's traffic volumes have been adopted from Table 4 of the Seca Solution (2020) traffic study and is reproduced in Table 5.2. Traffic noise associated with the childcare centre has not been considered given its an existing use and that its impacts will be limited to residences in its proximity. The potentially most exposed residences to the proposed school onsite traffic are not the most exposed to the existing childcare centre noise and hence combined impacts are not expected.

Table 5.3 Expected traffic generation (Seca Solutions, 2020)

Time period	Total traffic generation, vehicles per hour (vph)
AM peak hour	100 (50 in / 50 out)
PM peak hour	100 (50 in / 50 out)

Predicted noise levels from proposed onsite traffic related to the school operations are provided in Table 5.4. Noise predictions are compared against the evening noise criterion as the hall may be utilised during the evening period for sporadic events. Compliance with the evening criterion will imply compliance with the day criterion. The worst-case receiver in each catchment area is presented.

Table 5.4 On-site vehicle movements – predicted noise levels

NCA	Receiver location	Predicted noise level, dB $L_{Aeq\ 15min}$	Evening noise objective, dB $L_{Aeq\ 15min}$
1	R3	41	44
2	R14	<40	44
3	R39	<40	46
On-site	Childcare	<40	55

Notes: 1. Based on the RBL + 5dB intrusiveness noise criterion provided in Table 4.3.

5.3 New outdoor playground

The new outdoor playground was assessed for noise associated with children playing and the potential impact on residents bordering the eastern boundary in NCA1.

Source noise levels have been adopted from the Association of Australasian Acoustical Consultants (AAAC) *Guideline for Child Care Centre Acoustic Assessment*. Source noise levels are categorised into different aged groups and are based on ten children playing at one time. The number of proposed children and AAAC recommended sound power levels are provided in Table 5.5.

Source noise levels assume half the children (25 children) are utilising the outdoor play area at any one time. In our experience, this age group would be a worst case representation for noise from older children of a primary school. The noise model does not consider the boundary fence which will provide additional attenuation.

Table 5.5 AAAC children playing source noise levels

Age group	Number of children	Sound power level	Children utilising outdoor area
3 to 6 years	10	87	25

Note: The 3 to 6 year noise level has been conservatively adopted to represent primary school students.

Playground predicted noise levels are provided in Table 5.6. Noise predictions are compared against the day noise criterion representative of school hours. The worst-case receiver in each catchment area is presented.

Table 5.6 Outdoor play area – predicted noise levels

NCA	Receiver location	Predicted noise level, dB $L_{Aeq\ 15min}$	Daytime noise objective, dB $L_{Aeq\ 15min}$
1	R3	45	46
2	R13	< 40	44
3	R37	<40	44
On-site	Childcare	< 40	55

Notes: 1. Based on the RBL + 5dB intrusiveness noise criterion provided in Table 4.3.

5.4 Mechanical noise emissions

A detailed review of mechanical plant cannot be undertaken at the development application stage given that the mechanical design is only in its infancy. A detailed review is generally conducted during the detailed design and construction phases of the project. However, an in-principle assessment of operational noise impacts has been undertaken to discuss potential mitigation measures which may be employed to reduced mechanical noise emissions from the site.

The following provides an indication of likely treatments which may be employed to achieve the operational noise requirements provided in Section 4.1.2.

Ventilation fans can be typically treated using a combination of the following:

- Internally lined duct work or acoustic attenuators on intake and discharge grilles; and
- enclosure of fan casings within plant rooms or localised plant enclosures.

Condenser units located around the main building would not likely generate significant noise that would warrant additional acoustic screening or attenuation given the separation distances to residences.

A detailed review of mechanical plant should be undertaken as part of the detailed design and construction phases to ensure that noise emissions comply with the intrusiveness noise criterion provided in Section 4.3.2.

5.5 School bell and PA system

A use of a school bell and PA system may have the potential for intermittent noise impact on surrounding residential assessment locations. There are no specific noise requirements to govern bells and PA equipment for school announcements, as these occur sporadically and not for any prolonged length of time. However, best practice measures may be employed to minimise noise impact on surrounding receivers, which include may include using directional speakers or speakers directed into the school and away from receiver locations. Given the size of the

school at the outset, it is not anticipated that a significant amount of sound would need to be generated to raise attention to students within the grounds. Hence, a relatively modest low level sound system should be sufficient and fit for purpose.

5.6 Road traffic noise intrusion assessment

Road traffic noise levels recorded at the site are provided in Table 3.3. With regard to achieving the assessment criteria provided in Table 4.4 we provide the following commentary:

- road traffic noise levels impacting the main building of the project are in the order of 50-51dB $L_{Aeq,\ 15\ hour}$ which indicates that:
  - the internal noise requirement of 40dB $L_{Aeq,\ 15\ hour}$ will be achievable with windows closed using standard building constructions (ie minimum 4mm float glass, no acoustic seals); and
  - a 10dB reduction across a façade open sufficient for ventilation purposes will result in an internal noise level in the order of 40-41dB $L_{Aeq,\ 15\ hour}$, satisfying the noise requirement of 50 dB $L_{Aeq,\ 15\ hour}$ under naturally ventilated conditions.
- Road traffic noise levels in the proposed playground area will be in the order of 51dB $L_{Aeq,\ 15\ hour}$, satisfying the open space (passive recreation) requirement of 55dB $L_{Aeq,\ 15\ hour}$.

As such, no additional acoustic treatment is required to satisfy road traffic noise intrusion requirements at this time. It is however noted that traffic noise levels recorded at the site were undertaken during periods of reduced volume possibly due to COVID-19 restrictions. The Seca Solution (2020) report noted a 10-12% reduction in traffic volumes observed in their traffic surveys when compared to those previously conducted in 2018, likely due to the effects of COVID-19. This 10% reduction in traffic would generally result in a 0.4dB reduction in road traffic noise level. Even when factoring in this 0.4dB increase to approximate road traffic noise levels under normal conditions, no additional acoustic treatment would be required to comply with the road traffic noise intrusion objectives.

It is recommended that an additional road traffic noise study be conducted as part of the detailed design of the development to confirm the outcomes of this assessment.

5.7 Traffic noise generated by the development

Existing traffic volumes along the New England Highway are presented in Table 2 of the Seca Solution (2020) traffic study, which indicates a two-way volume of 956 and 1,220 vehicles for the AM and PM peak 1-hour periods respectively.

Traffic noise for freeway/arterial roads is assessed with reference to a 15-hour (7am-10pm) and 9-hour (10pm-7am) noise level. Noise generated by the school over the course of the whole day (15-hour) will be minimal in comparison with the peak hour period during drop-off and pick-up. For the purposes of this assessment, this conservative approach has been adopted.

The site is expected to generate in the order of 100 vehicles during the AM and PM peak periods. In comparison with the existing volumes along the New England Highway, this results in an increase of road traffic noise along New England Highway of 0.4dB(A) and 0.35dB(A) respectively for these peak periods. These increases are less than 2dB(A) and as such comply with the requirements of the RNP, albeit this is a 15-hour daytime period requirement. It is noted that should the traffic generation from the school be averaged over a 15-hour period consistent with the assessment criteria of the RNP, traffic noise increases will be significantly less than that provided above and as such the assessment is conservative.

6 Construction noise and vibration impact assessment

A preliminary assessment of noise and vibration impacts from the construction of the site has been undertaken. At this stage, a detailed construction methodology has not been developed. As such, noise predictions are based on the likely worst-case activities that may be deployed on site for each stage of construction.

6.1 Construction activities

The project is a reuse of the existing building on the site and as such construction activities will be generally associated with internal demolition and fit-out works. The retention of the façade will ensure that noise breakout to surrounding noise sensitive uses is minimised.

The predominant sources of construction noise will be associated with:

- the delivery of construction materials and the removal of waste from the site; and
- site clearing and levelling works associated with the new outdoor play area.

Preliminary predictions of noise associated with these works is provided herein.

6.2 Construction noise modelling

6.2.1 Equipment sound power levels

Equipment sound power levels have been taken from the Department of Environment, Food and Rural Affairs (DEFRA) 2005, *Update of Noise Database for Prediction of Noise on Construction and Open Sites*, where relevant to the project. Otherwise data was sourced from an EMM database of similar equipment which is based on measurements at other construction sites as indicated.

Acoustically significant mobile equipment items were considered in the model for each construction area and adopted typical worst-case scenarios and utilisation.

Table 6.1 Construction activity and equipment sound power levels

Construction activity	Construction appliance	Sound power level, dB $L_{Aeq\ 15min}$
Noise breakout	Demolition works – based on angle grinding on steel[1,2]	108[1]
	Construction works – based on angle grinding on steel[1,2]	108[1]
Site deliveries	Dump trucks / semi-trailer	103
	Dump truck / semi-trailer idling	91[1]
Site clearing for playground	Excavator (earthworks) [1]	106[1]
	Dump trucks	103

Notes: 1. Noise level adopted from DEFRA noise database.

2. Angle grinding will likely occur during both demolition and construction works and will be representative of the worst-case general works.

6.2.2 Modelling assumptions

Predicted noise levels are based on construction works at locations closest to each assessment location and assume the following:

- the building façade is retained resulting in a generally contained internal construction area;
- deliveries are based on a singular truck movement with the truck idling for five minutes adjacent the existing building under demolition / fitout works; and
- the excavator (playground clearing) will be working right up to the limits of the outdoor play area.

6.3 Predicted noise levels

The proponent will manage construction noise levels where exceedances of NMLs have been identified. The construction noise management methods will be detailed in a construction noise and vibration management plan (CNVMP) as discussed further in Section 6.4.

The ICNG recommends the following where NMLs are predicted to be exceeded:

- application of feasible and reasonable work practices to minimise noise; and
- inform potentially impacted residents of the nature of the works to be carried out, expected noise levels and duration and relevant contact details.

Noise predictions have been presented for the most affected assessment location in each NCA. Where there are several types of land use within the NCA, predictions are presented for the most affected assessment location for that land use.

6.3.1 Predicted noise levels – construction works

Noise predictions from typical construction works are presented in Table 6.2. Presented noise levels are from individual items of plant.

Table 6.2 Predicted construction noise levels during excavation

Activity	NCA	Land use	Assessment location	Predicted construction noise level, dB $L_{Aeq\ 15min}$	'Noise affected' NML, dB $L_{Aeq\ 15min}$[1]	'Highly noise affected' level, dB $L_{Aeq\ 15min}$[2]
Excavator – new playground	1	Residential	R3	67	51	75
	2	Residential	R29	47	51	75
	3	Residential	R37	50	51	75
	Site grounds	Childcare	Childcare	50	55	n/a
Interior fitout / demolition works	1	Residential	R4	44	51	75
	2	Residential	R29	47	51	75
	3	Residential	R33	48	51	75

Table 6.2 Predicted construction noise levels during excavation

Activity	NCA	Land use	Assessment location	Predicted construction noise level, dB $L_{Aeq\ 15min}$	'Noise affected' NML, dB $L_{Aeq\ 15min}$[1]	'Highly noise affected' level, dB $L_{Aeq\ 15min}$[2]
	Site grounds	Childcare	Childcare	43	55	n/a
Site delivery	1	Residential	R3	43	51	75
	2	Residential	R29	< 35	51	75
	3	Residential	R33	< 35	51	75
	Site grounds	Childcare	Childcare	< 40	55	n/a

Notes: 1. Noise affected level based on RBL + 5dB in accordance with the ICNG.

2. Highly noise affected level based on 75dBA in accordance with the ICNG.

Noise predictions indicate that construction noise levels for the majority of works will comply with the 'noise affected' NMLs at all assessment locations. The 'highly noise affected' level is not expected to be exceeded during any construction phase.

The site clearing works for the playground may result in some exceedance of the NML for residents in NCA1, however these works are not expected to occur for a sustained period of time. Such exceedances are common when proximity to residences is unavoidable, as is often the case in residential areas.

Possible mitigation measures are discussed in Section 6.4. Noise mitigation measures and strategies should be formulated as part of the detailed construction management plan.

6.4 Construction noise mitigation

Mitigation measures which may be employed to further minimise noise impacts from the construction of the project are discussed in this section. These can include physical measures, such as acoustic screens or shrouds, or noise management measures such as scheduling, community consultation and the like.

6.4.1 Community consultation

Community consultation and complaints handling procedures should be developed such that noise affected receivers may be kept apprised of:

- construction timeline;
- expected noisy works particularly concrete pours which may extend into the evening; and
- readily available avenues to address a noise complaint.

6.4.2 Acoustically rated site hoarding

Acoustically rated site hoarding may be employed between the site and surrounding receiver locations. The use of imperforate materials such as plywood (a typically standard hoarding material) can provide realistic noise reductions in the order of 10-15dB assuming that the barrier inhibits line of sight to receptor locations.

6.4.3 Temporary noise barriers

Temporary noise barriers may be incorporated around particularly noisy static equipment to minimise noise being transmitted to surrounding noise sensitive locations.

6.4.4 Scheduling of works

Noisy works may be scheduled to times which are more mutually agreeable to surrounding noise receptors. This can also include scheduling works such that multiple pieces of noisy plant equipment are not being utilised in close proximity to a particular noise receptor.

6.4.5 Plant and equipment

Additional measures for plant and equipment include:

- where possible, choose quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks;
- operate plant and equipment in the quietest and most efficient manner; and
- regularly inspect and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.

6.4.6 Work practices

Work practice methods include:

- regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration;
- regular identification of noisy activities and adoption of improvement techniques;
- avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby residents;
- locating vehicles to minimise noise;
- where possible, avoid the use of equipment that generates impulsive noise (i.e. hammering);
- minimise the movement of materials and plant and unnecessary metal-on-metal contact; and
- minimise truck movements.

6.5 Construction vibration

Construction vibration has been addressed with consideration to the Department of Environment and Conservation (DEC) *Assessing Vibration: A technical guideline* 2006. The guideline makes reference to British Standard BS6472 'Guide to evaluation of human exposure to vibration (1 Hz to 80 Hz)'.

Cosmetic damage has been addressed with reference to BS 7385 'Evaluation and measurement for vibration in buildings'.

Safe working distances for typical items of vibration intensive plant are listed in Table 6.3. The safe working distances are quoted for both "Cosmetic Damage" (refer British Standard BS 7385) and "Human Comfort" (refer British Standard BS 6472-1).

Table 6.3 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Small hydraulic hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium hydraulic hammer	(900 kg - 12 to 18t excavator)	7 m	23 m
Large hydraulic hammer	(1600 kg - 18 to 34t excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand-held	1 m (nominal)	Avoid contact with structure
Vibratory Rollers	<50kN (Typically 1-2 tonnes)	5 m	15 to 20 m
	<100kN (Typically 2-4 tonnes)	6 m	20 m
	<200kN (Typically 4-6 tonnes)	12 m	40 m
	<300kN (Typically 7-13 tonnes)	15 m	100 m
	>300kN (Typically 13-18 tonnes)	20 m	100 m
	>300kN (>18 tonnes)	25 m	100 m

Source: From Transport Infrastructure Development Corporation Construction's Construction Noise Strategy (Rail Projects), November 2007 – based on residential building.

Safe work distances relate to continuous vibration. For most construction activity, vibration emissions are intermittent in nature. The safe working distances are therefore conservative.

The safe working distances presented in Table 6.3 are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions. The equipment provided in Table 6.3 generates significantly higher vibration than that associated with minor excavator works associated with the proposed playground.

Construction activities likely to be used on site do not pose vibration emissions as high as those listed in Table 6.3, and hence are not expected to generate significant levels of vibration which may exceed cosmetic damage or human response limits because the distances quoted in Table 6.3 (eg small hydraulic hammer) will be adhered to.

7 Conclusion

EMM has prepared a noise and vibration impact assessment in support of the SSD application for the Richard Gill National Music Academy to be located at 157 Maitland Street, Muswellbrook, NSW.

An assessment of likely noise levels generated by the operation of the site has been completed. The outcomes from the assessment are summarised as follows:

- noise breakout from music within the multipurpose hall has been addressed for operation during the day and evening for special events. Predicted noise levels indicate compliance with the project noise trigger levels. No additional acoustic treatment is therefore required;
- noise from children in the outdoor play area has been assessed. Predicted noise levels indicate compliance with the project noise trigger levels. No additional acoustic treatment or management conditions are therefore required;
- noise from on-site vehicle movements has been assessed. Predicted noise levels indicate compliance with the project noise trigger levels. No additional acoustic treatment or management conditions are therefore required; and
- road traffic noise intrusion into the development has been addressed using on-site noise monitoring. Preliminary noise levels indicate that no additional acoustic treatment would be required to achieve the recommendations of the DoP *Development Near Rail Corridors and Busy Roads – Interim Guideline 2008*.

A detailed review of mechanical plant is to be undertaken as part of the design and construction phases of the project to ensure compliance with the noise emission criteria. Impacts from such are not anticipated if conventional measures are adopted.

Construction noise predictions indicate that exceedances of the project NML at assessment locations surrounding the site are unlikely for the vast majority of works. Exceedances of the construction NMLs may occur during the construction of the outdoor play area, however these works are expected to be limited in duration.

A detailed construction noise and vibration management plan should be prepared as part of the main works contract to ensure that all feasible and reasonable treatments and management conditions are considered to minimise noise and vibration from construction. This review would be undertaken once demolition, excavation and construction methodologies and equipment can be detailed appropriately.

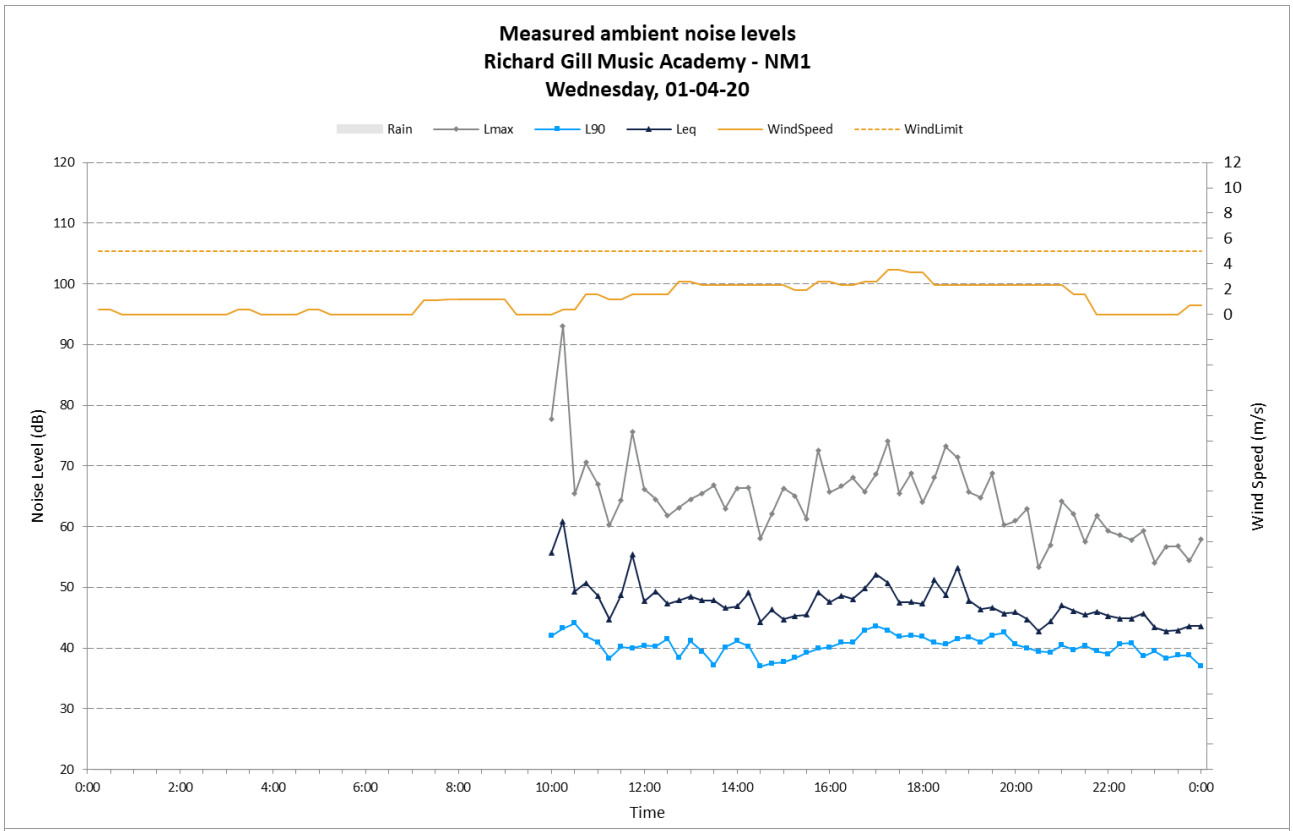
Appendix A

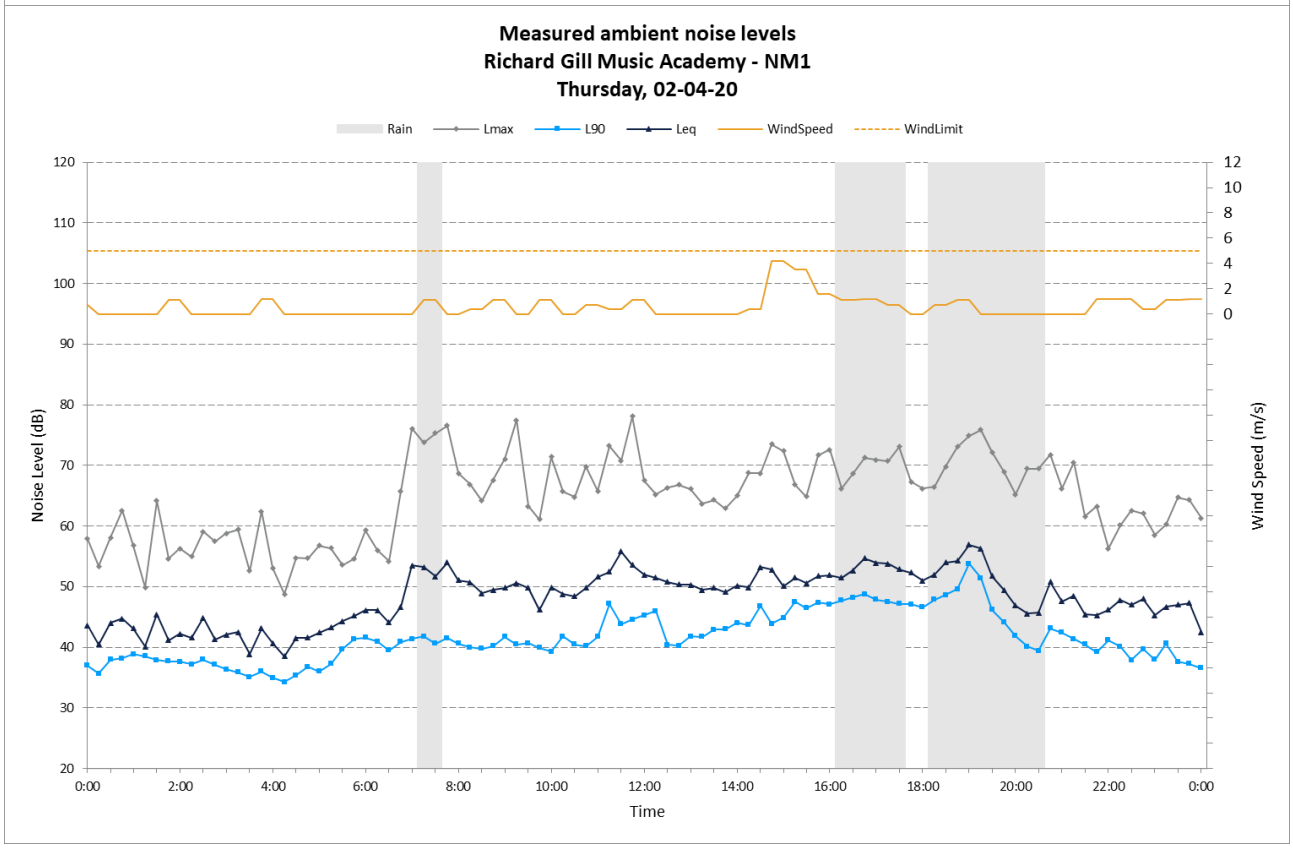
Unattended noise monitoring results

Table A.1 Summary of daily noise logging results – NM1

Date	ABL Day[1]	ABL Evening[1]	ABL Night[1]
Wednesday, 01-04-20	0	39	35
Thursday, 02-04-20	40	0	35
Friday, 03-04-20	0	0	0
Saturday, 04-04-20	0	39	35
Sunday, 05-04-20	42	40	36
Monday, 06-04-20	42	39	31
Tuesday, 07-04-20	41	38	29
Wednesday, 08-04-20	40	40	31
Thursday, 09-04-20	41	35	32
Friday, 10-04-20	41	40	33
Saturday, 11-04-20	0	0	0
Summary Values	41	39	33

Notes: 1. A "0" indicates insufficient data samples due to adverse weather or other extraneous effects.


Measured ambient noise levels
Richard Gill Music Academy - NM1
Wednesday, 01-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM1
Thursday, 02-04-20
Rain
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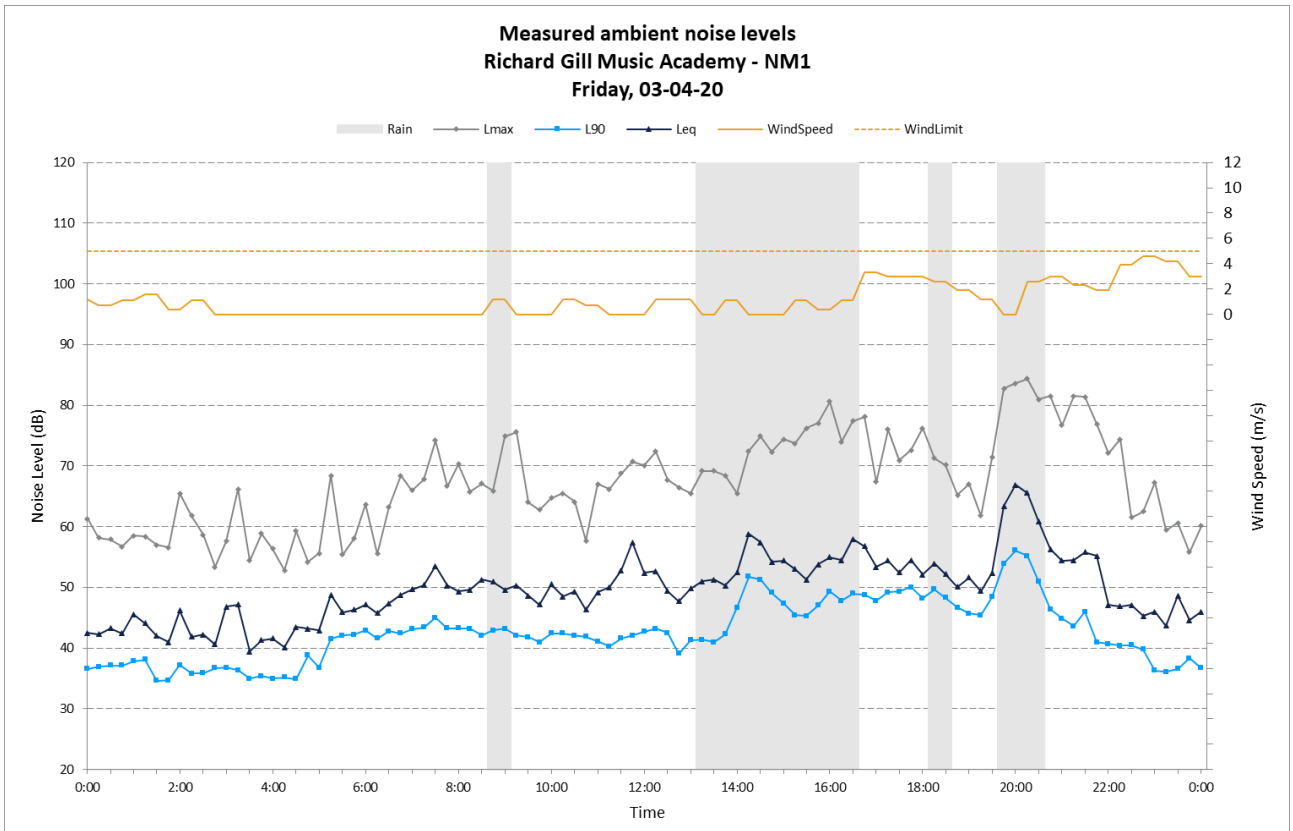
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM1
Friday, 03-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
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18:00
20:00
22:00
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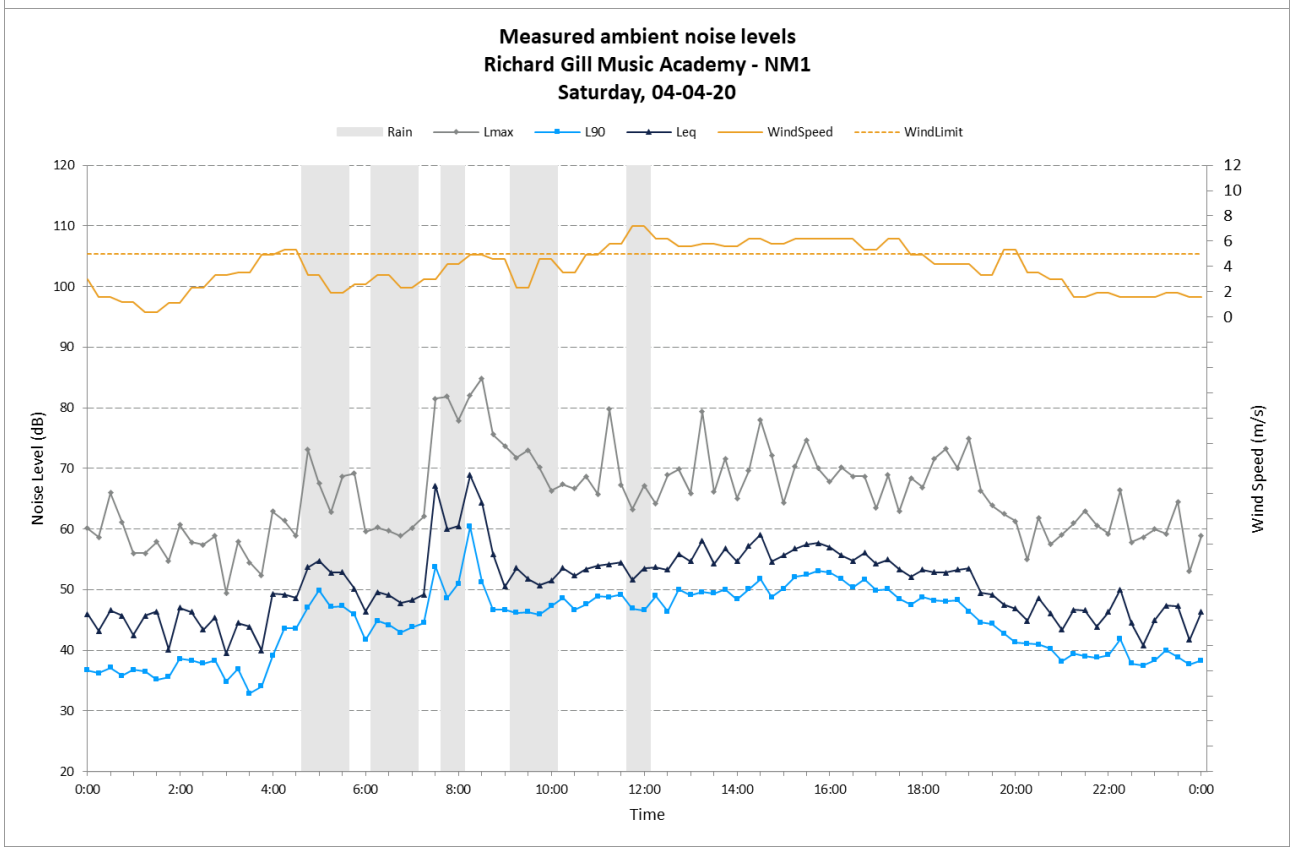
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Richard Gill Music Academy - NM1
Saturday, 04-04-20
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Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
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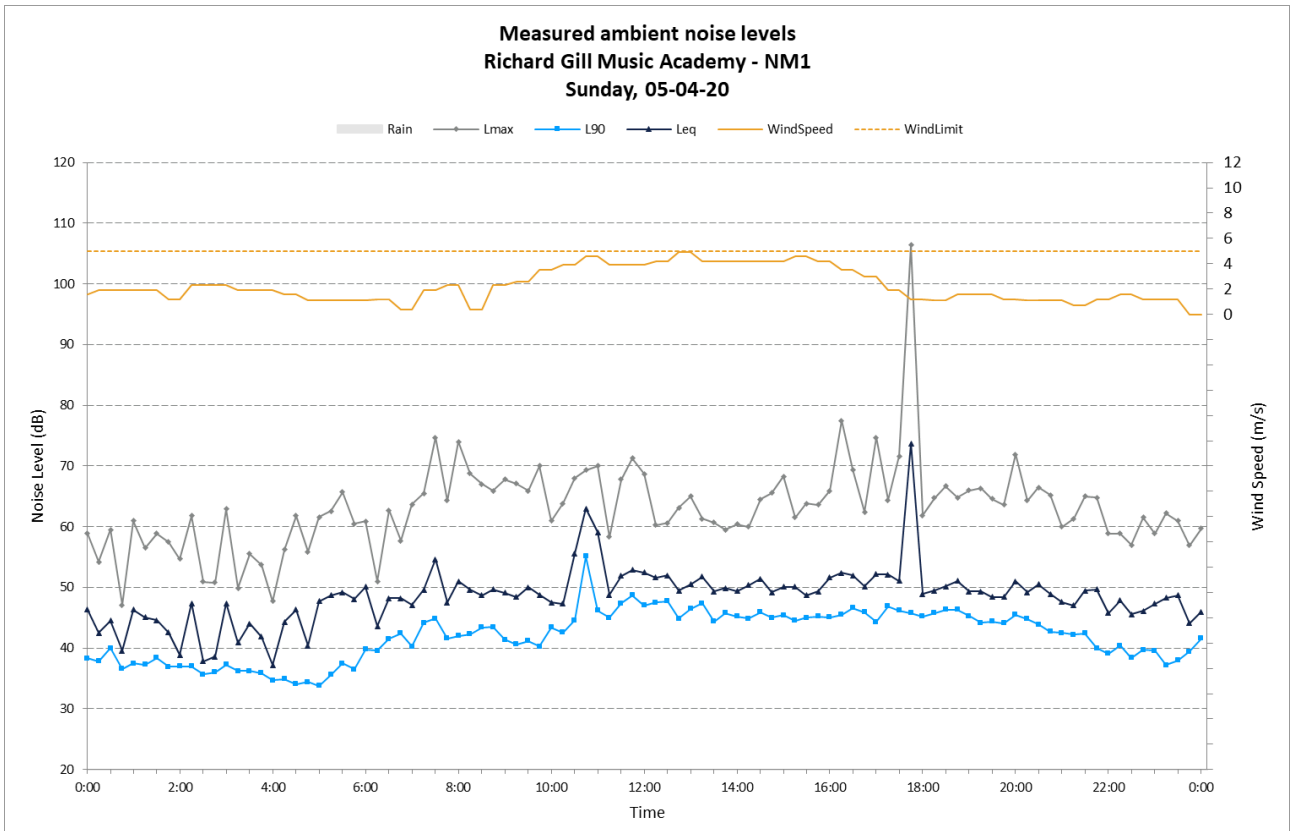
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Sunday, 05-04-20
Rain
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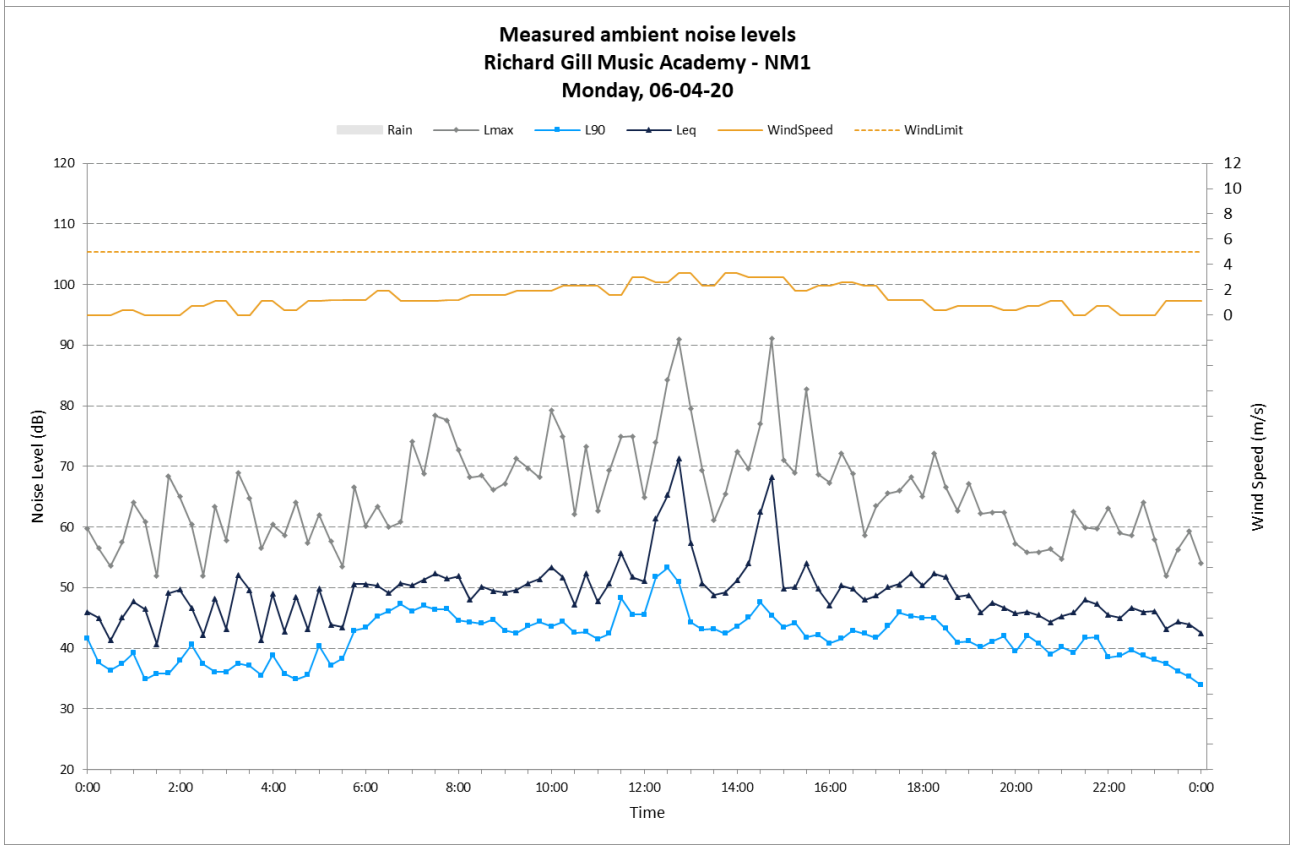
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM1
Monday, 06-04-20
Rain
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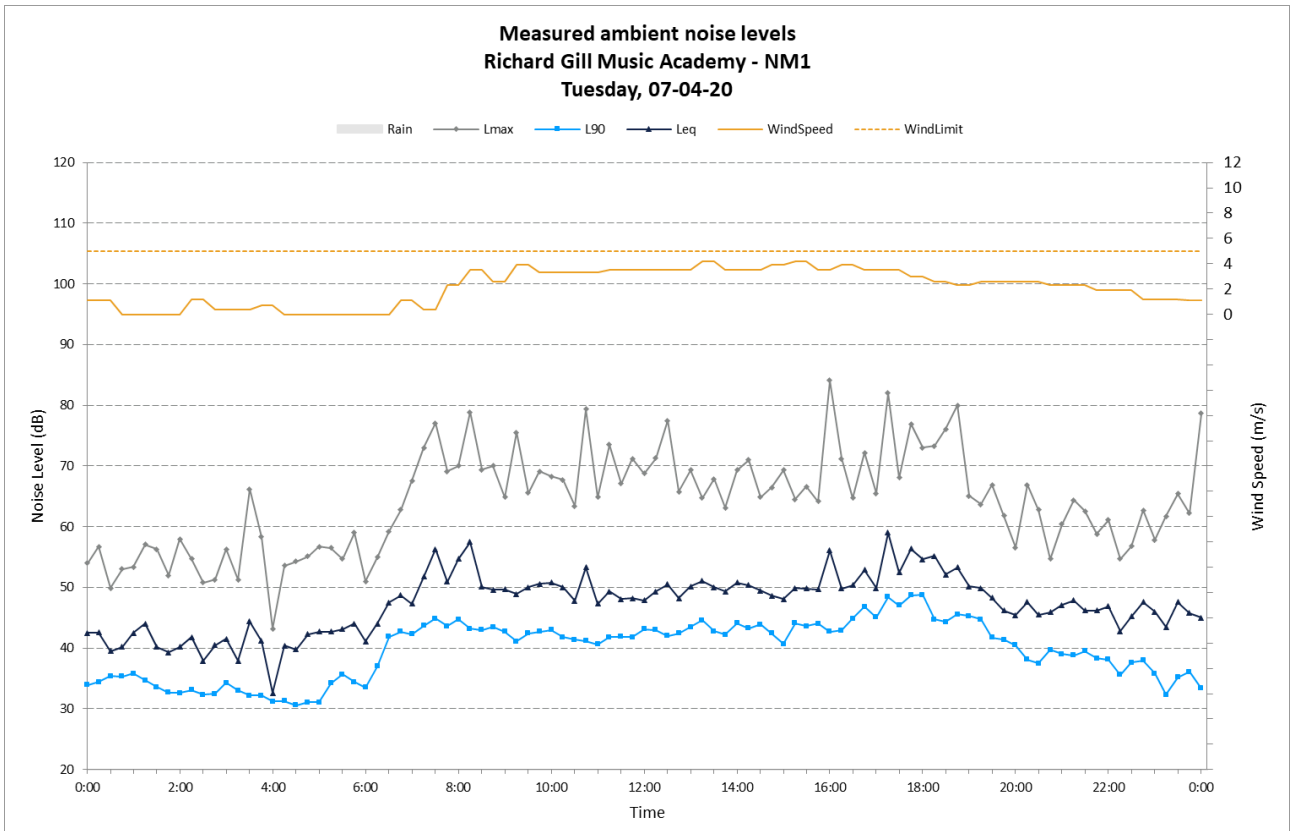
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM1
Tuesday, 07-04-20
Rain
Lmax
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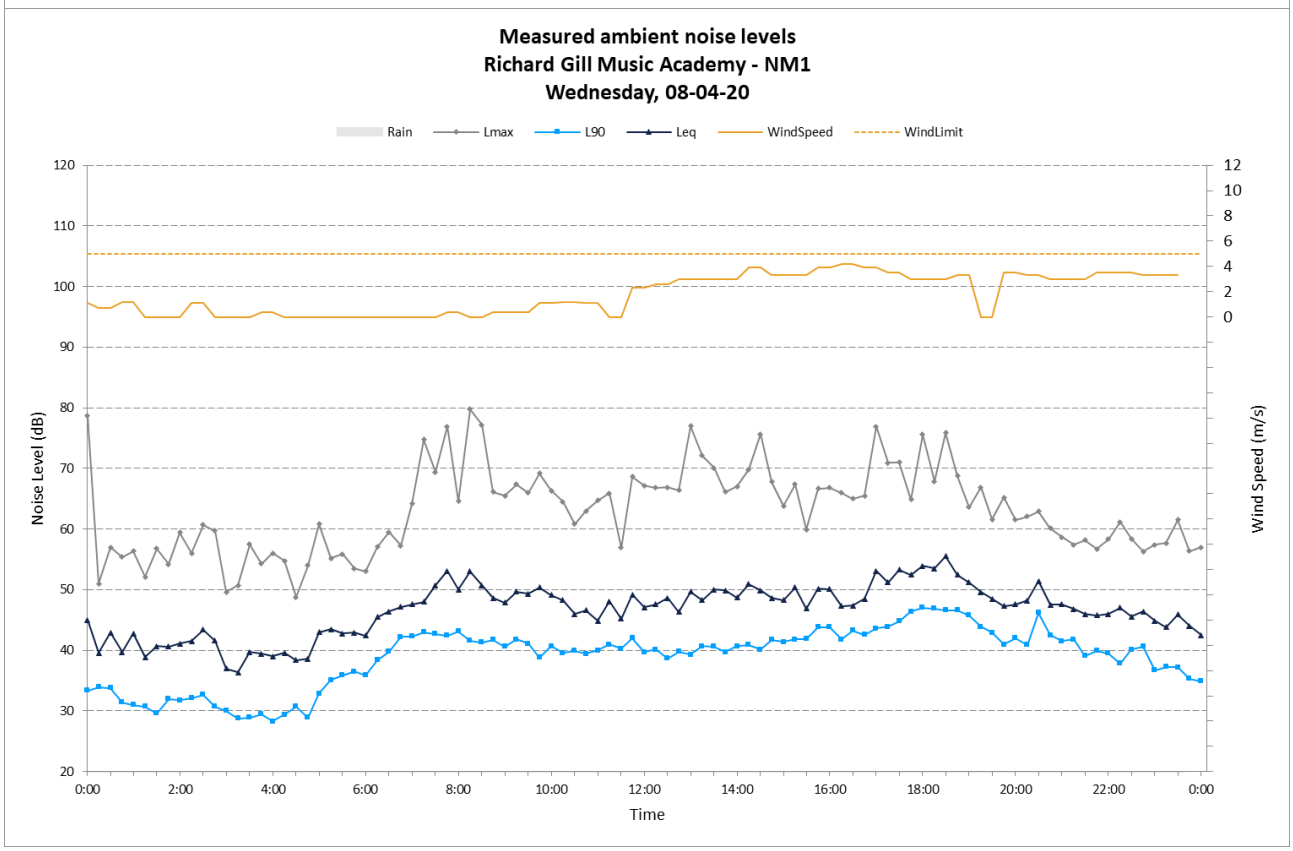
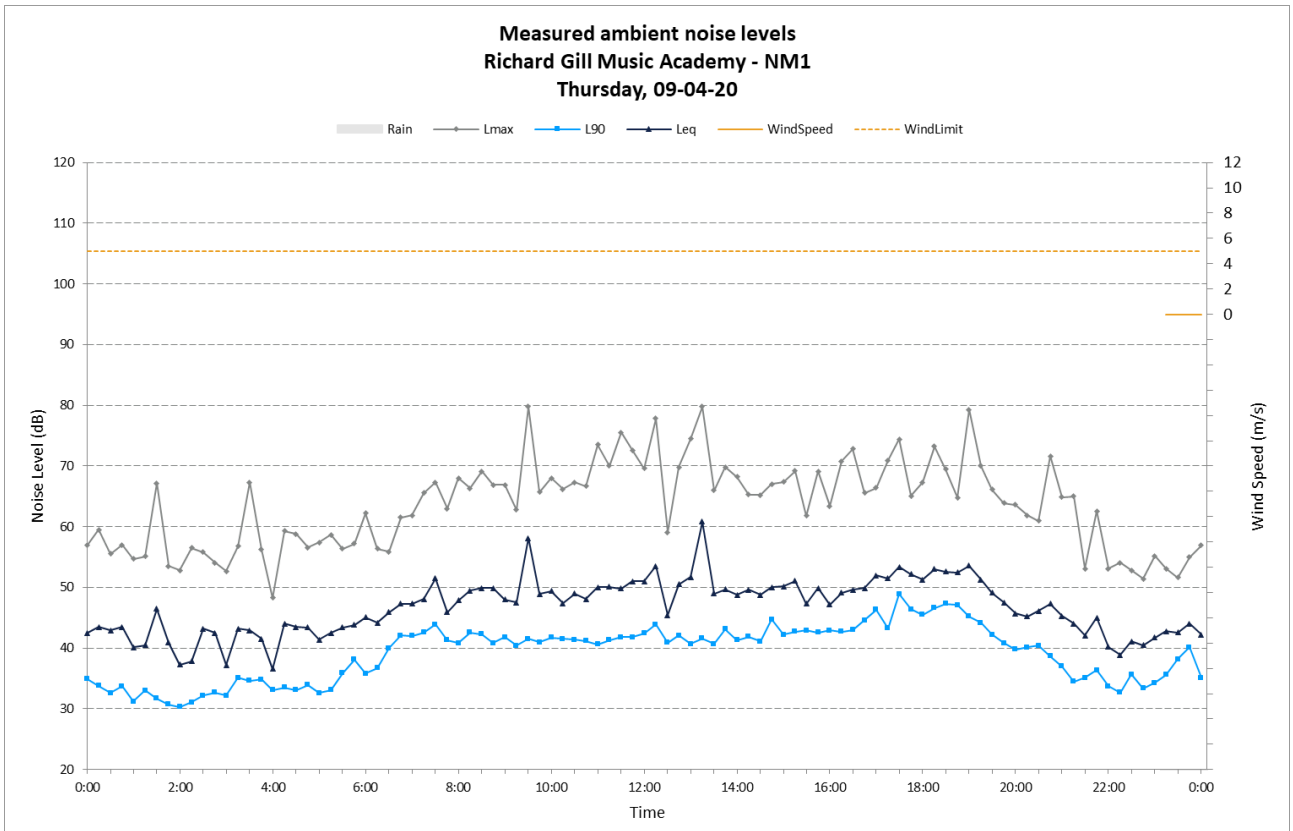
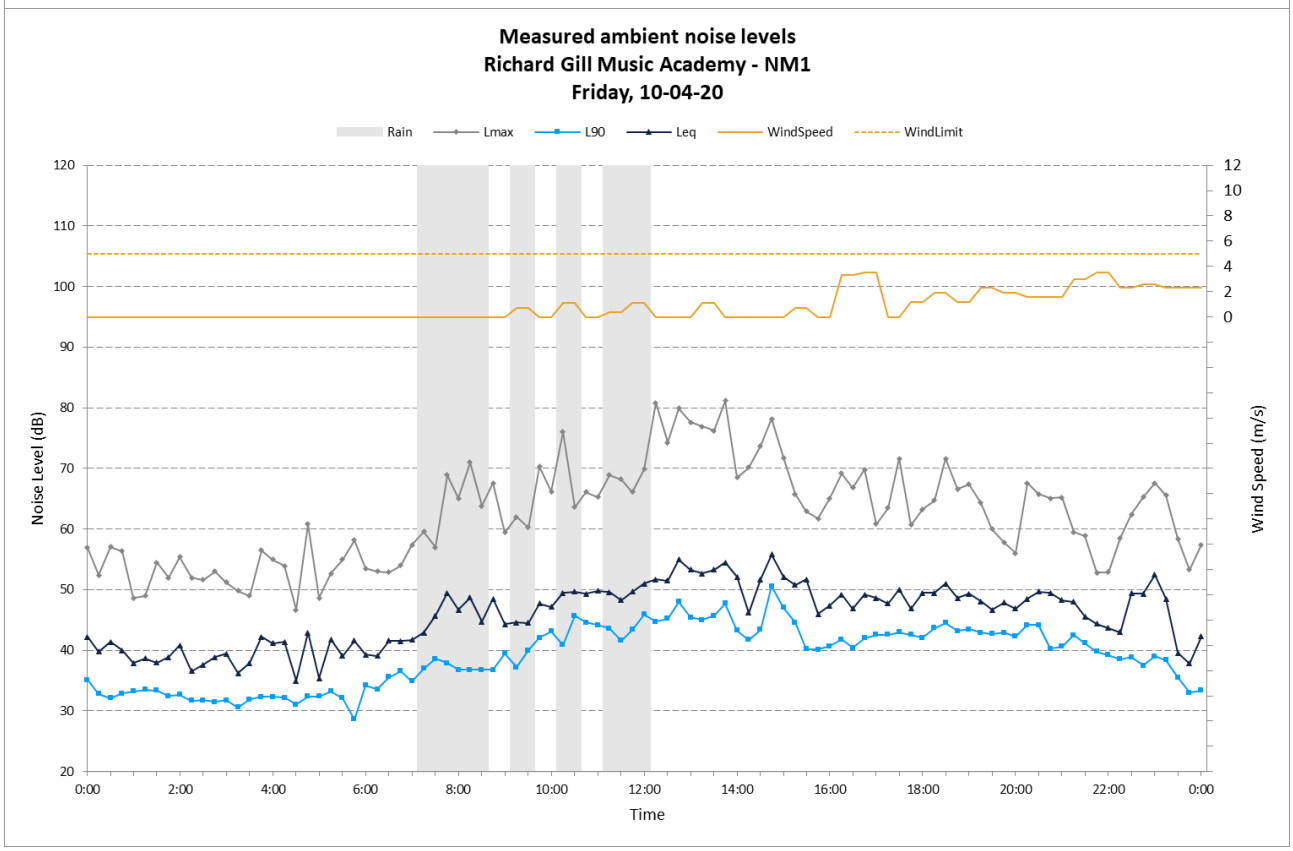
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM1
Wednesday, 08-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM1
Thursday, 09-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM1
Friday, 10-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

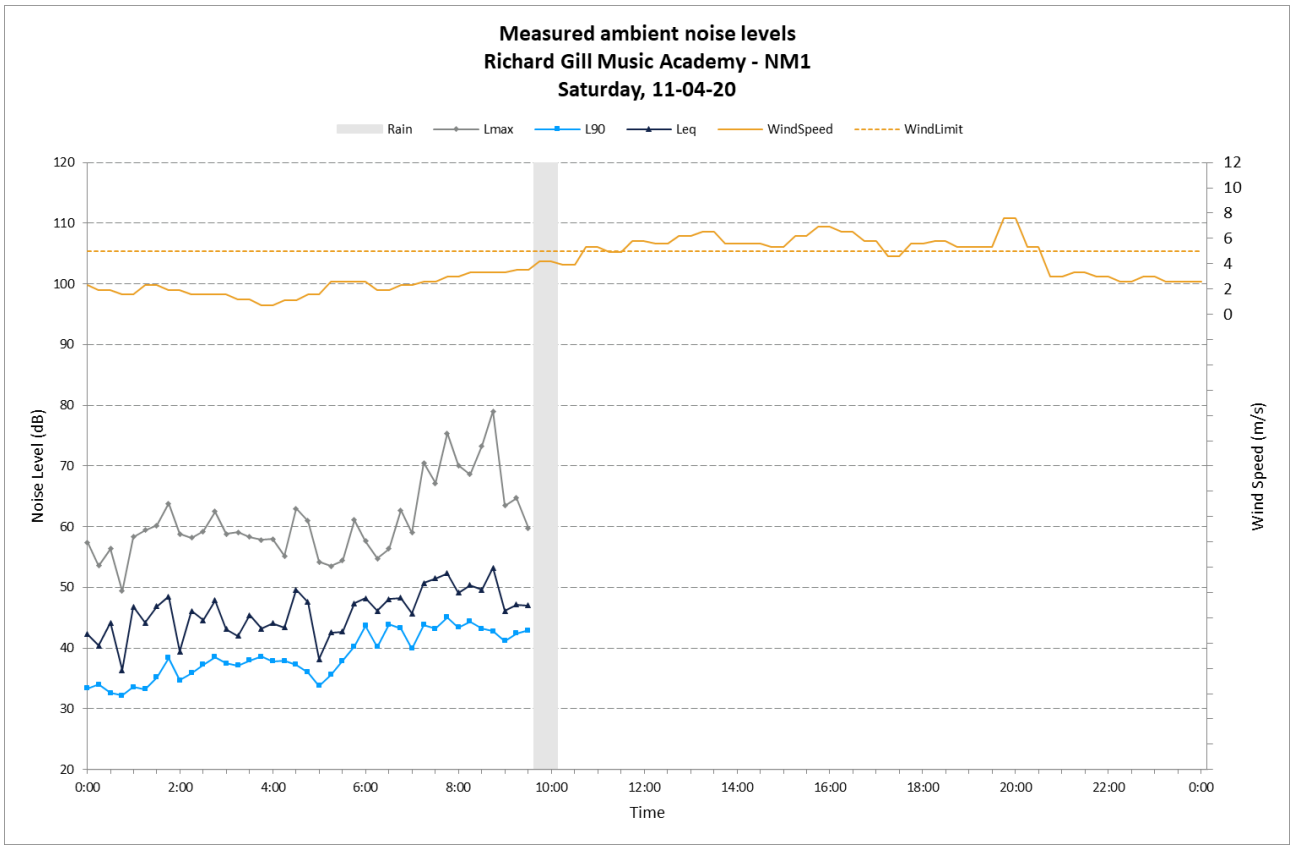
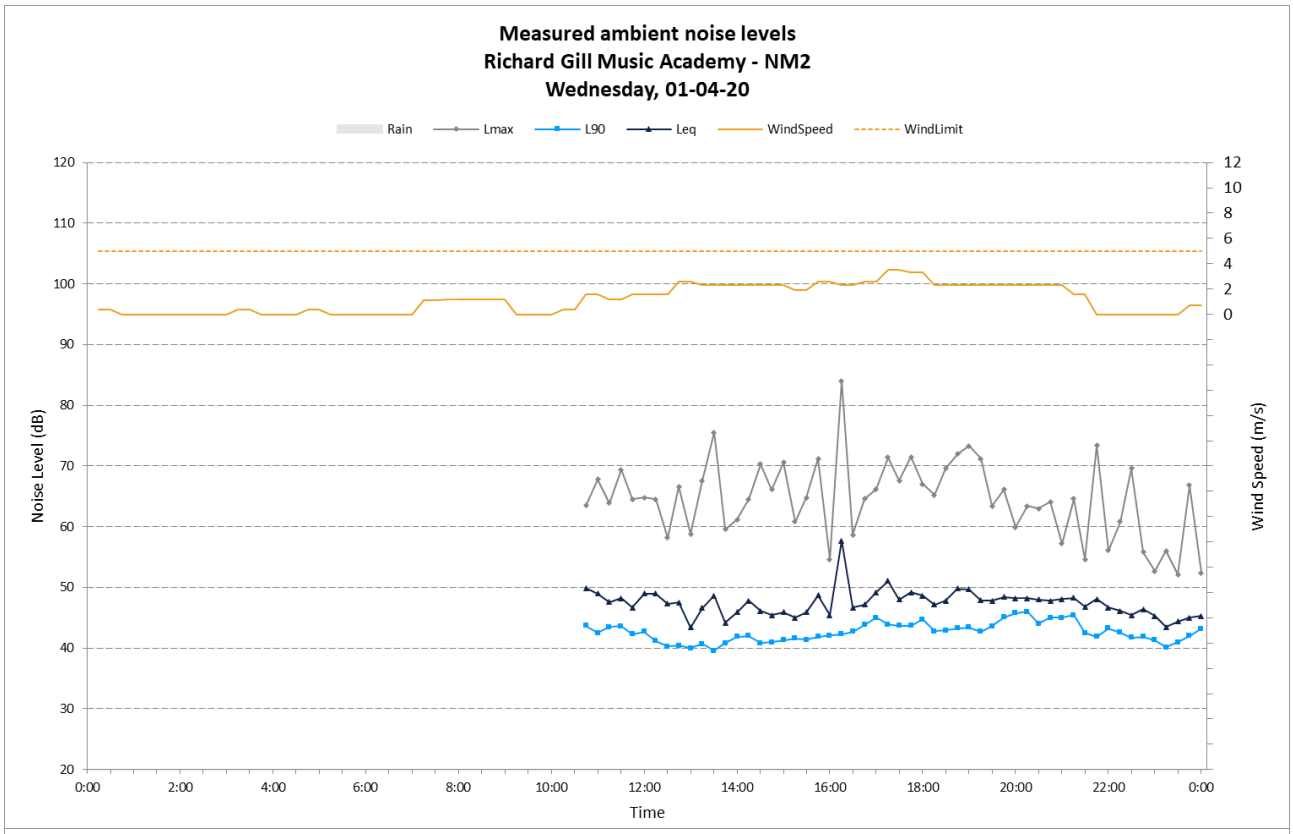
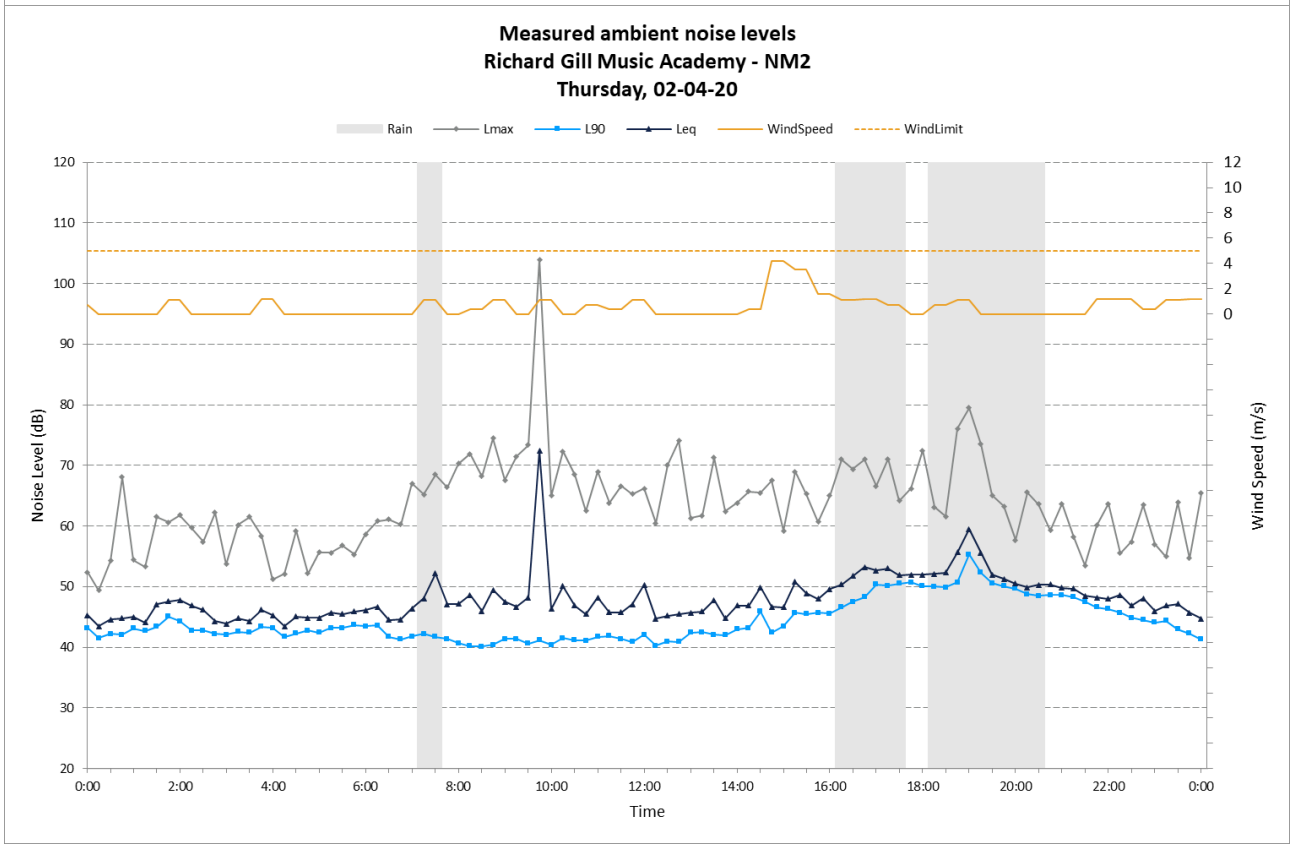

Measured ambient noise levels
Richard Gill Music Academy - NM1
Saturday, 11-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

Table A.2 Summary of daily noise logging results – NM2

Date	ABL Day[1]	ABL Evening[1]	ABL Night[1]
Wednesday, 01-04-20	0	43	41
Thursday, 02-04-20	40	0	39
Friday, 03-04-20	0	0	0
Saturday, 04-04-20	0	41	37
Sunday, 05-04-20	42	41	38
Monday, 06-04-20	43	41	39
Tuesday, 07-04-20	43	41	37
Wednesday, 08-04-20	41	41	36
Thursday, 09-04-20	42	39	36
Friday, 10-04-20	0	42	39
Saturday, 11-04-20	0	0	35
Sunday, 12-04-20	38	38	38
Monday, 13-04-20	39	40	38
Tuesday, 14-04-20	41	45	38
Wednesday, 15-04-20	41	43	39
Summary Values	41	41	38

Notes: 1. A “0” indicates insufficient data samples due to adverse weather or other extraneous effects.


Measured ambient noise levels
Richard Gill Music Academy - NM2
Wednesday, 01-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time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Richard Gill Music Academy - NM2
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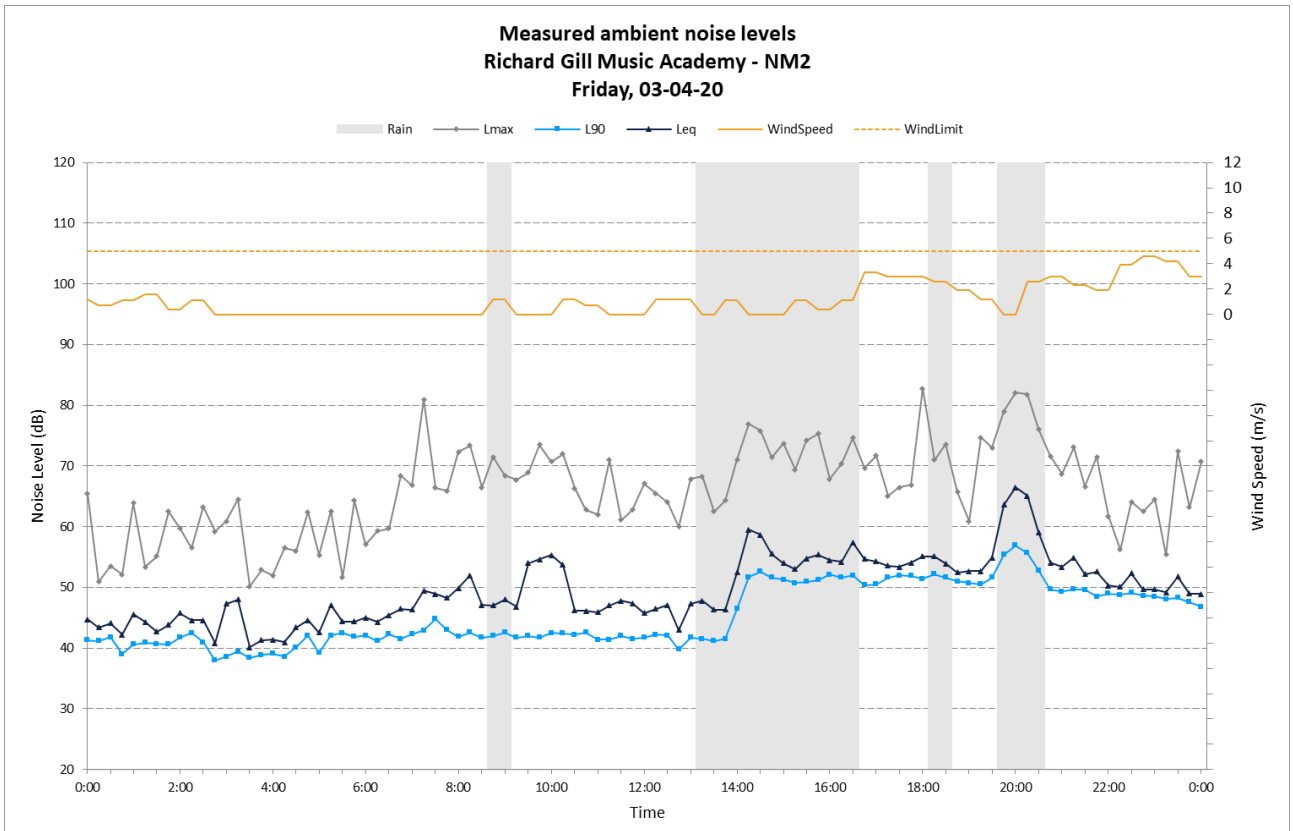
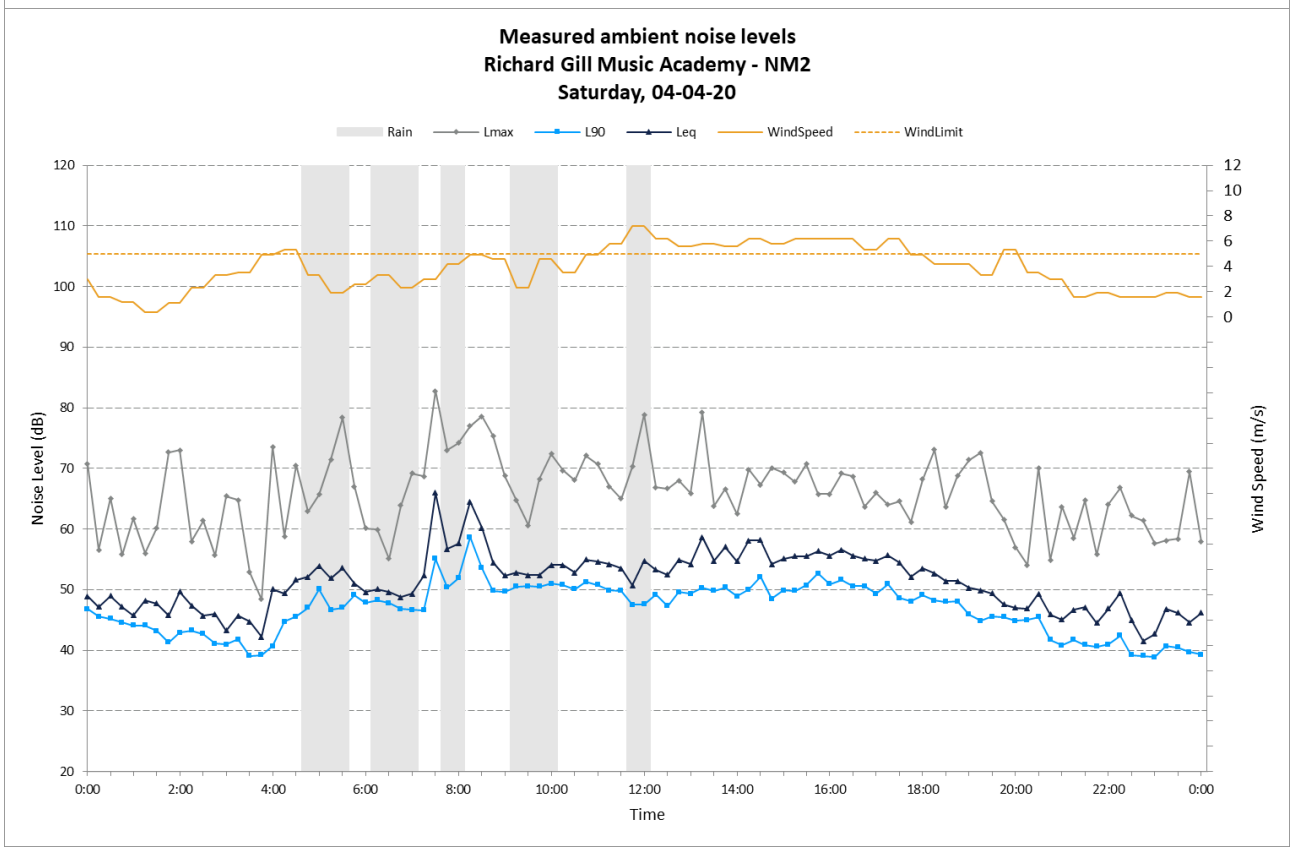
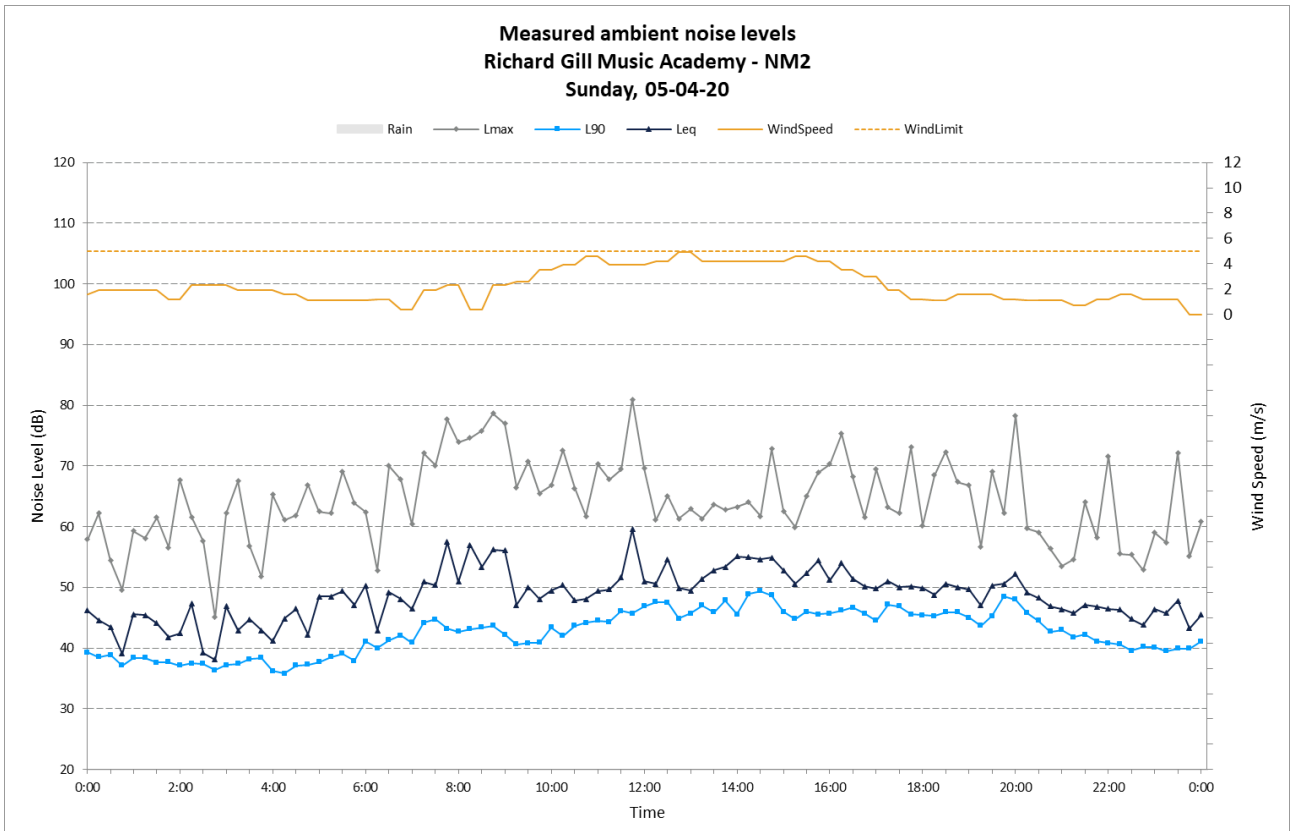
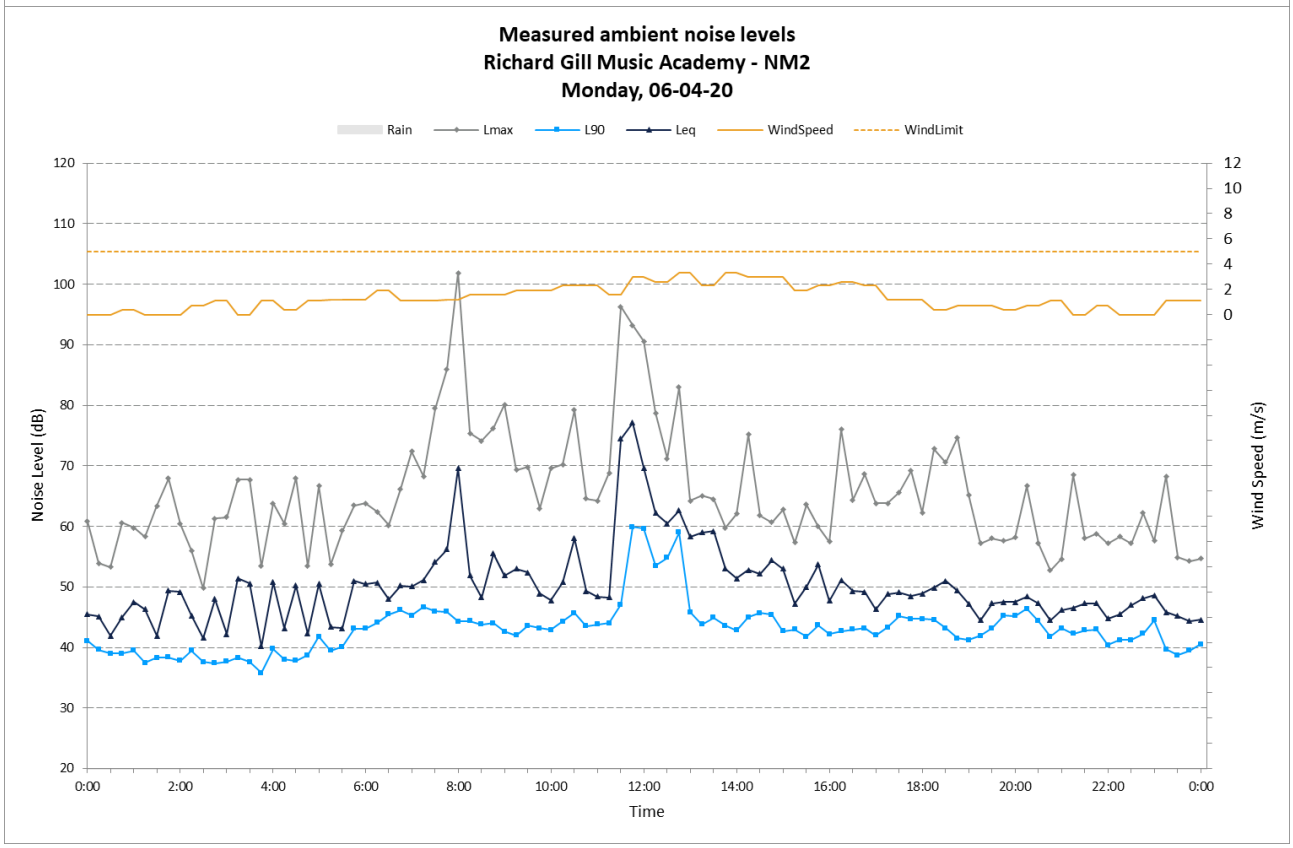
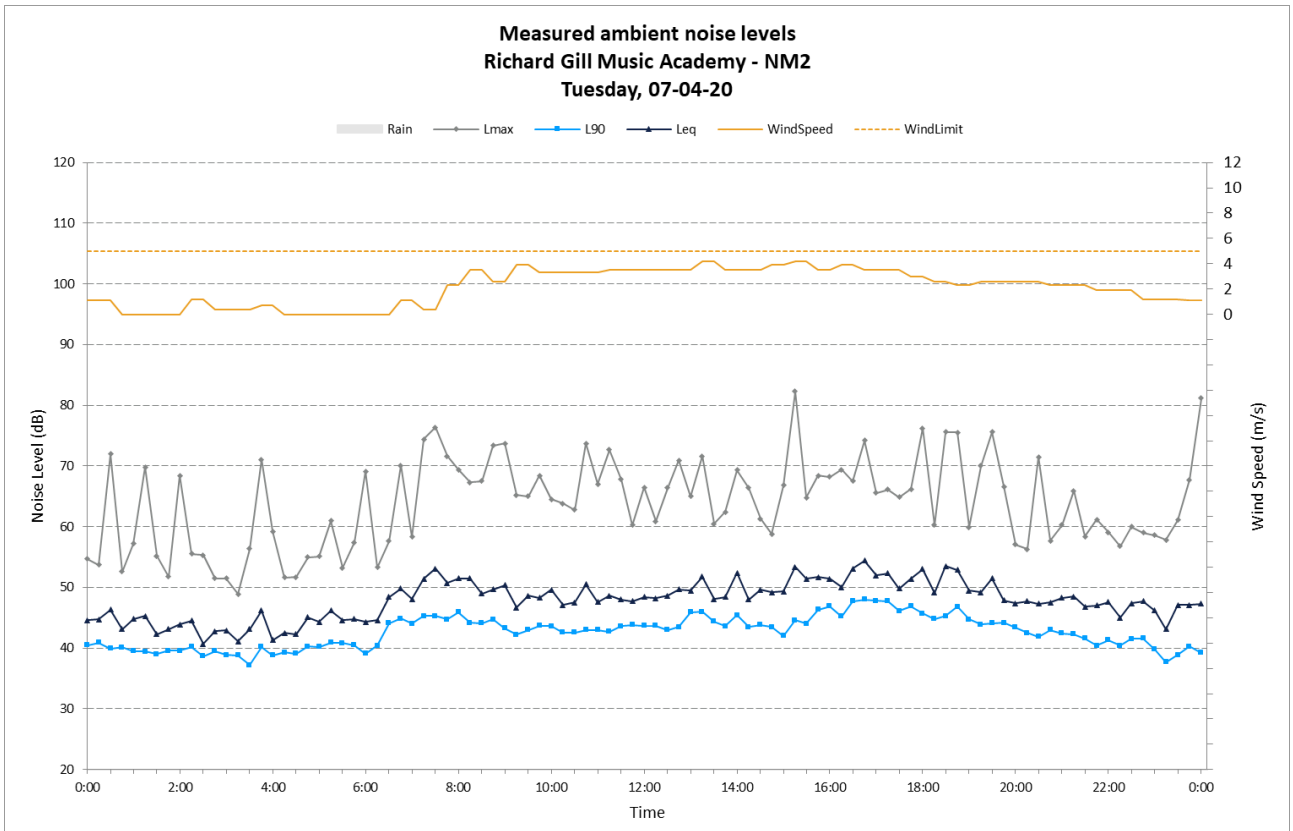
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

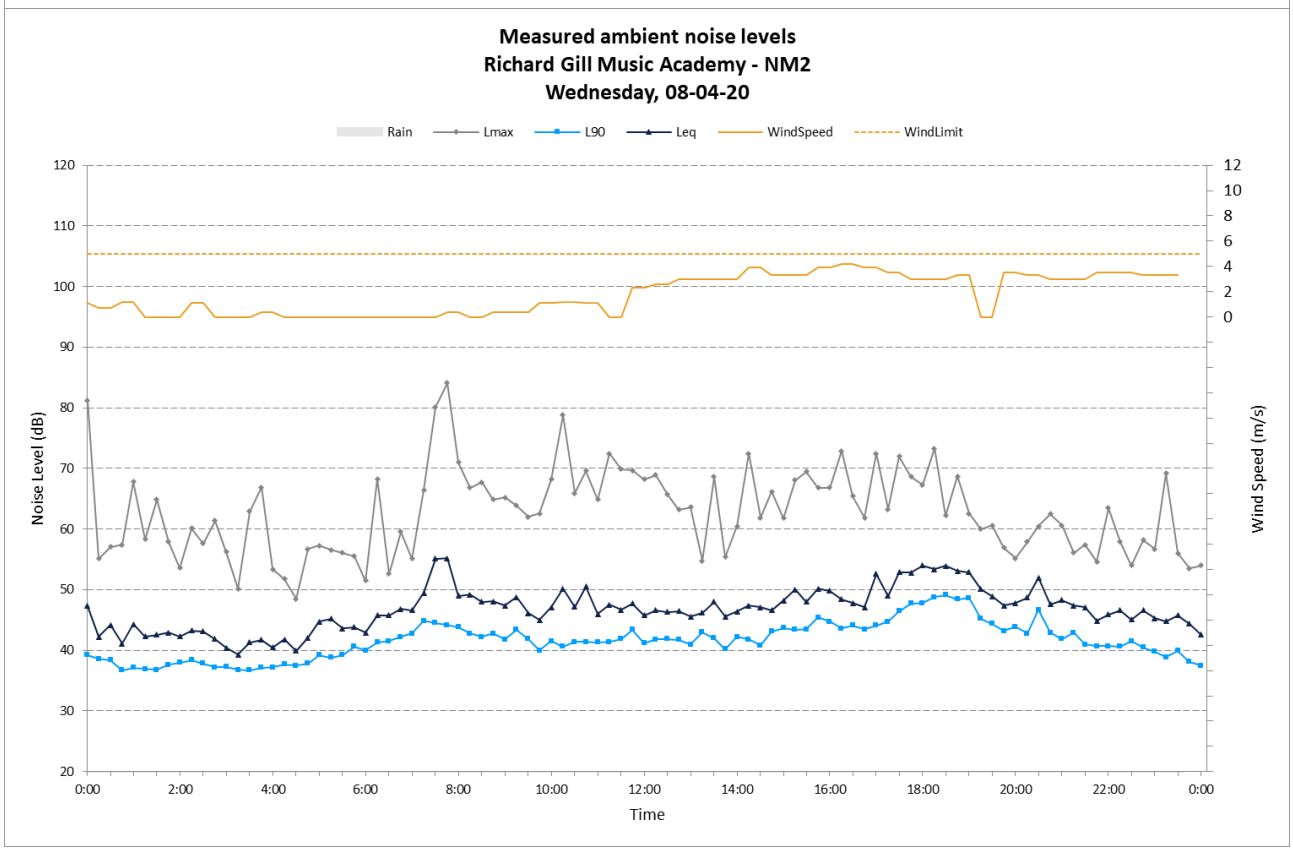

Measured ambient noise levels
Richard Gill Music Academy - NM2
Friday, 03-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

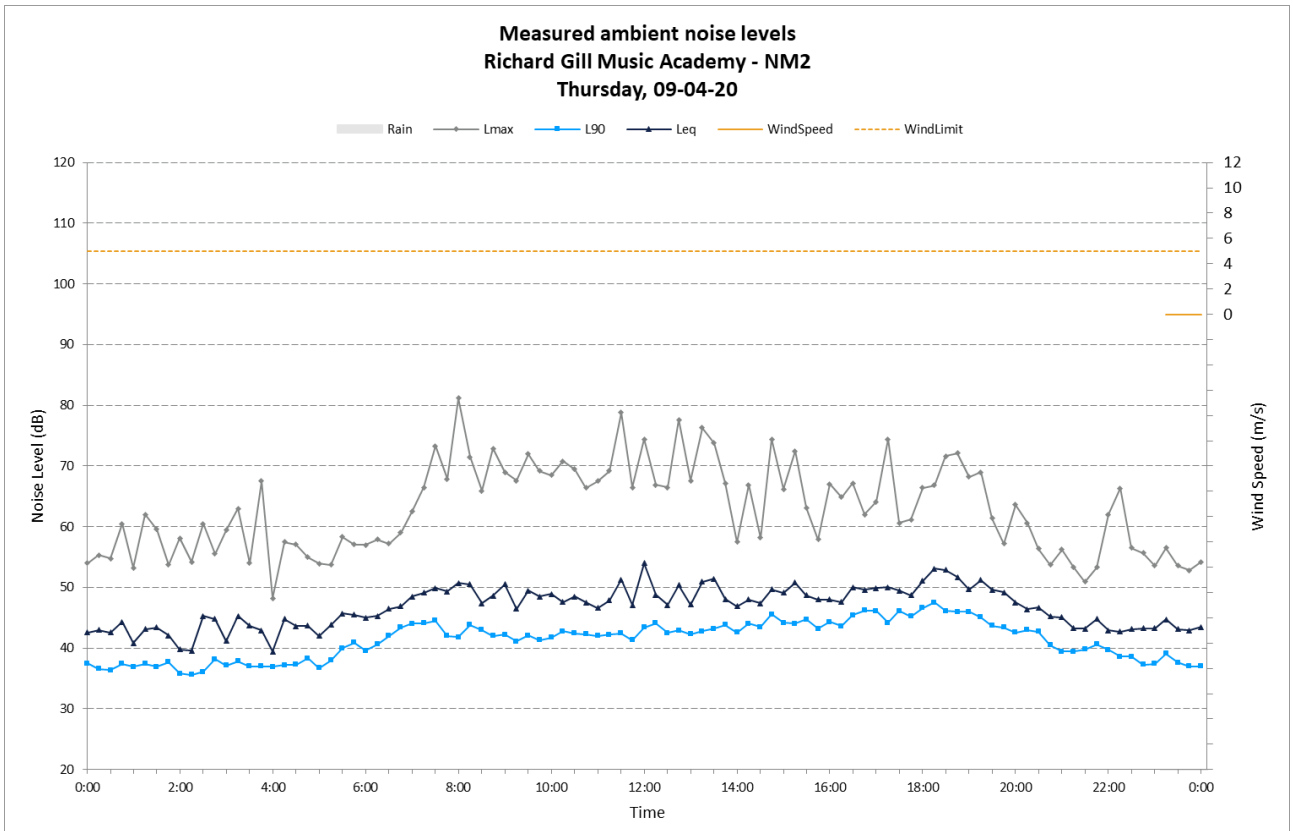

Measured ambient noise levels
Richard Gill Music Academy - NM2
Saturday, 04-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

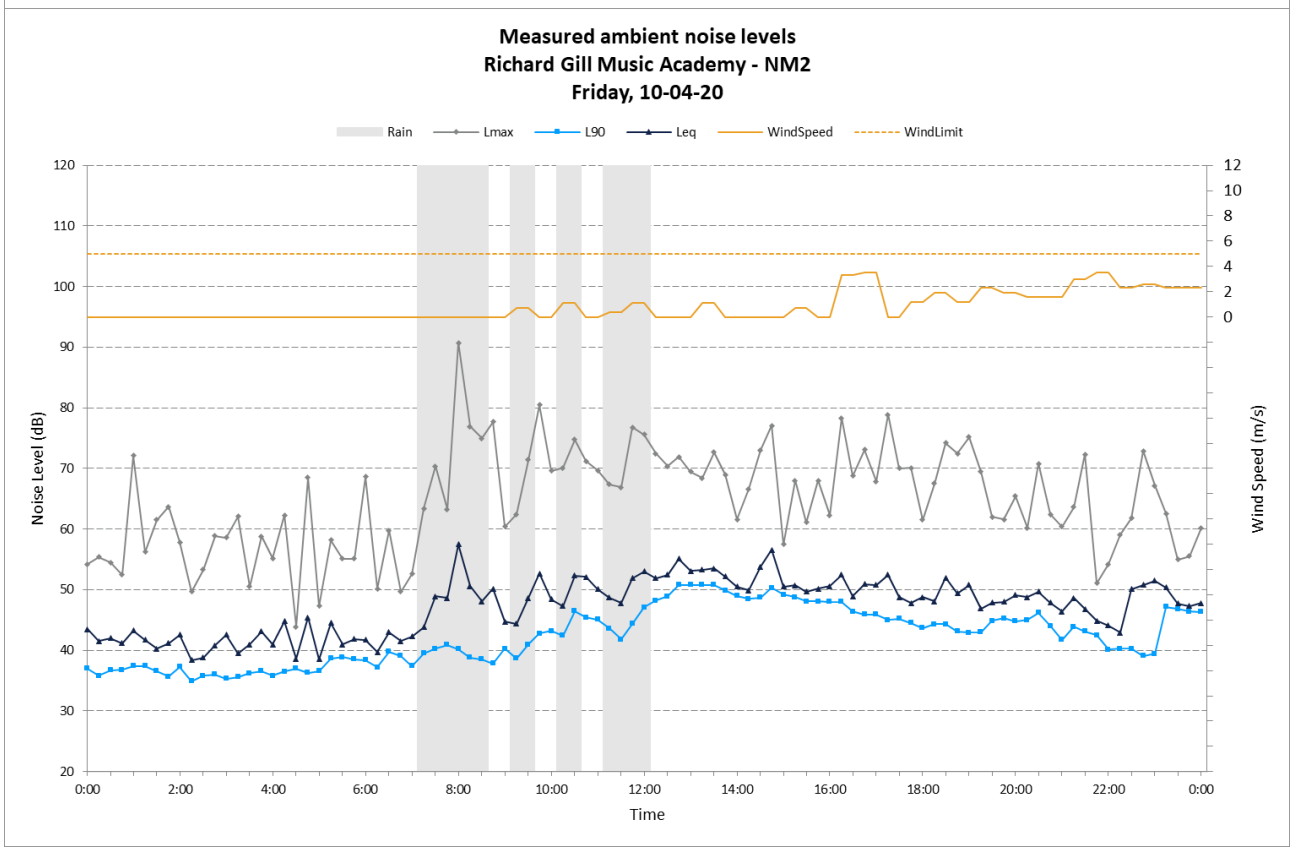

Measured ambient noise levels
Richard Gill Music Academy - NM2
Sunday, 05-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

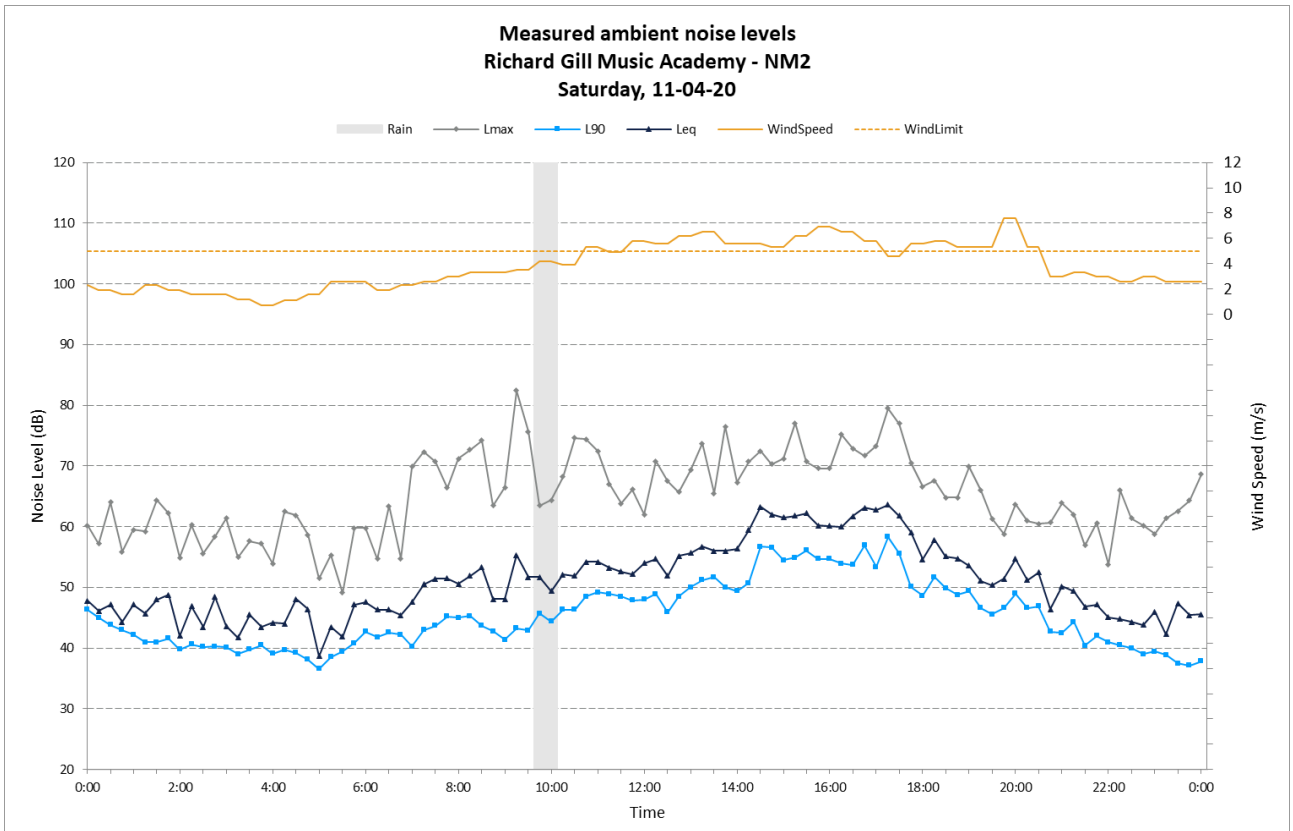

Measured ambient noise levels
Richard Gill Music Academy - NM2
Monday, 06-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

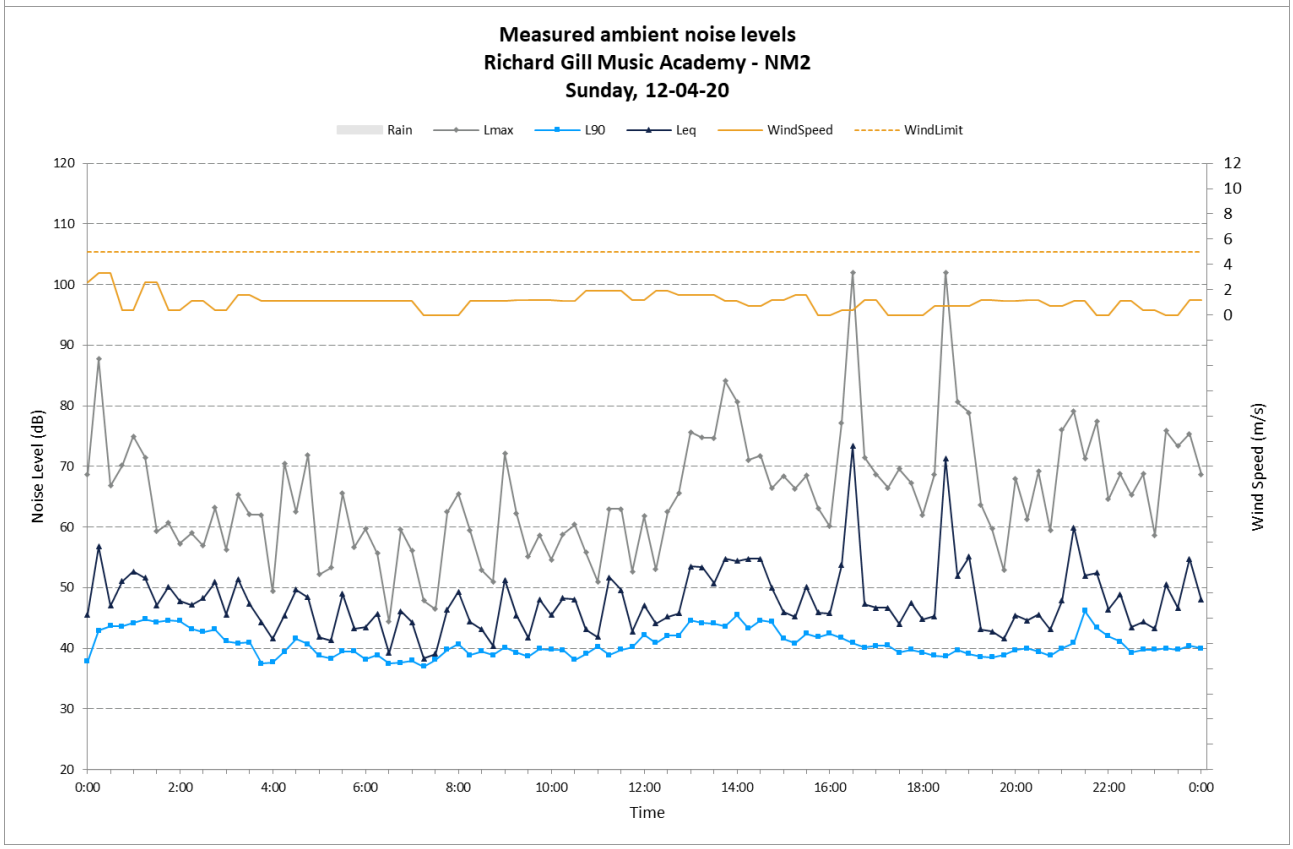

Measured ambient noise levels
Richard Gill Music Academy - NM2
Tuesday, 07-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

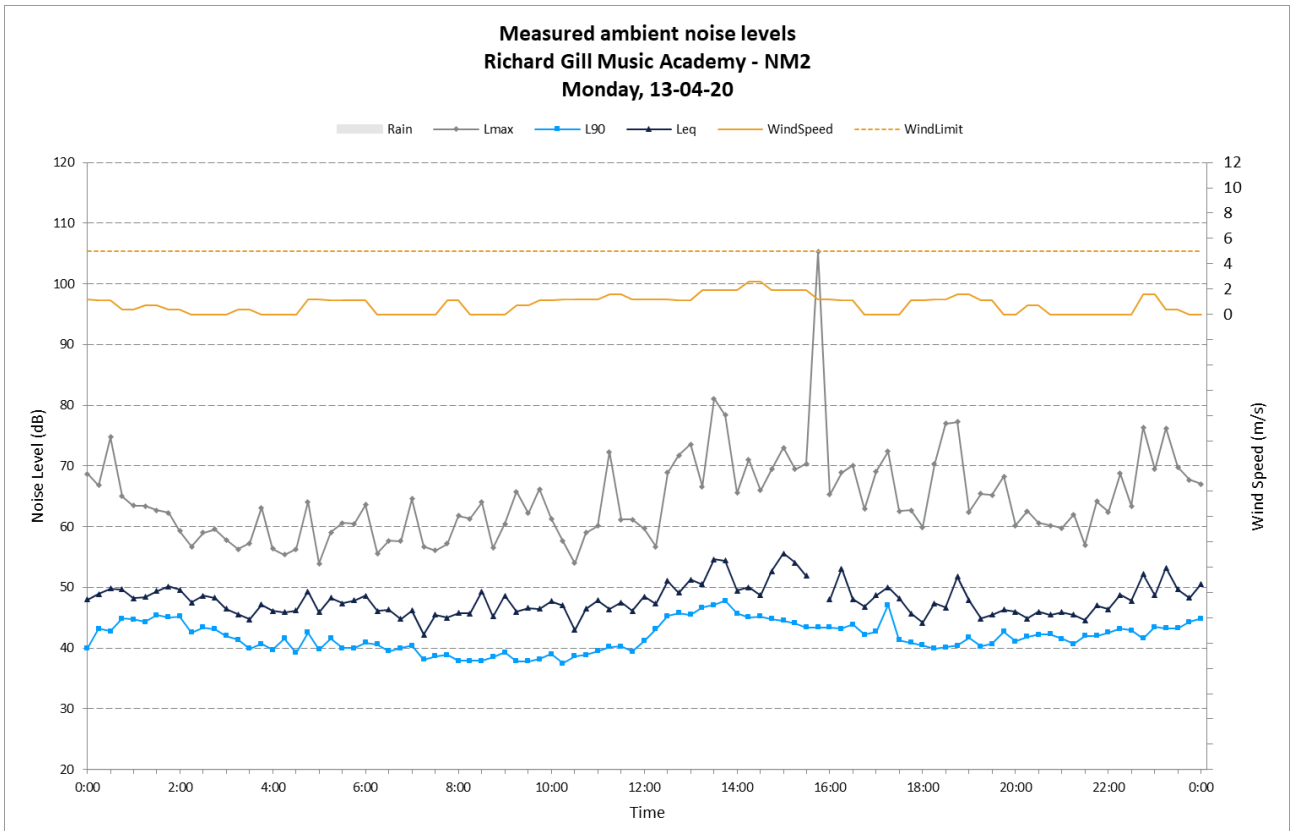

Measured ambient noise levels
Richard Gill Music Academy - NM2
Wednesday, 08-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

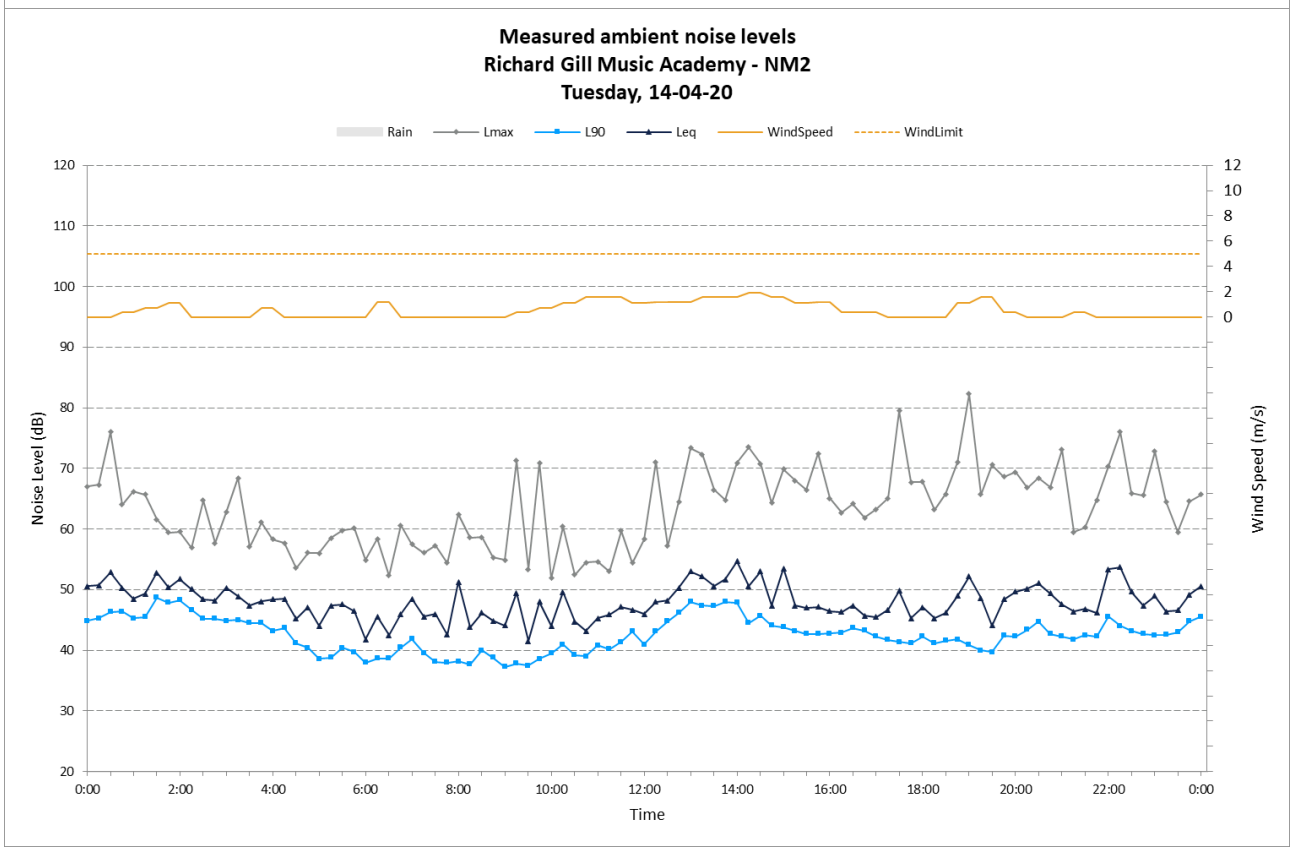

Measured ambient noise levels
Richard Gill Music Academy - NM2
Thursday, 09-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time

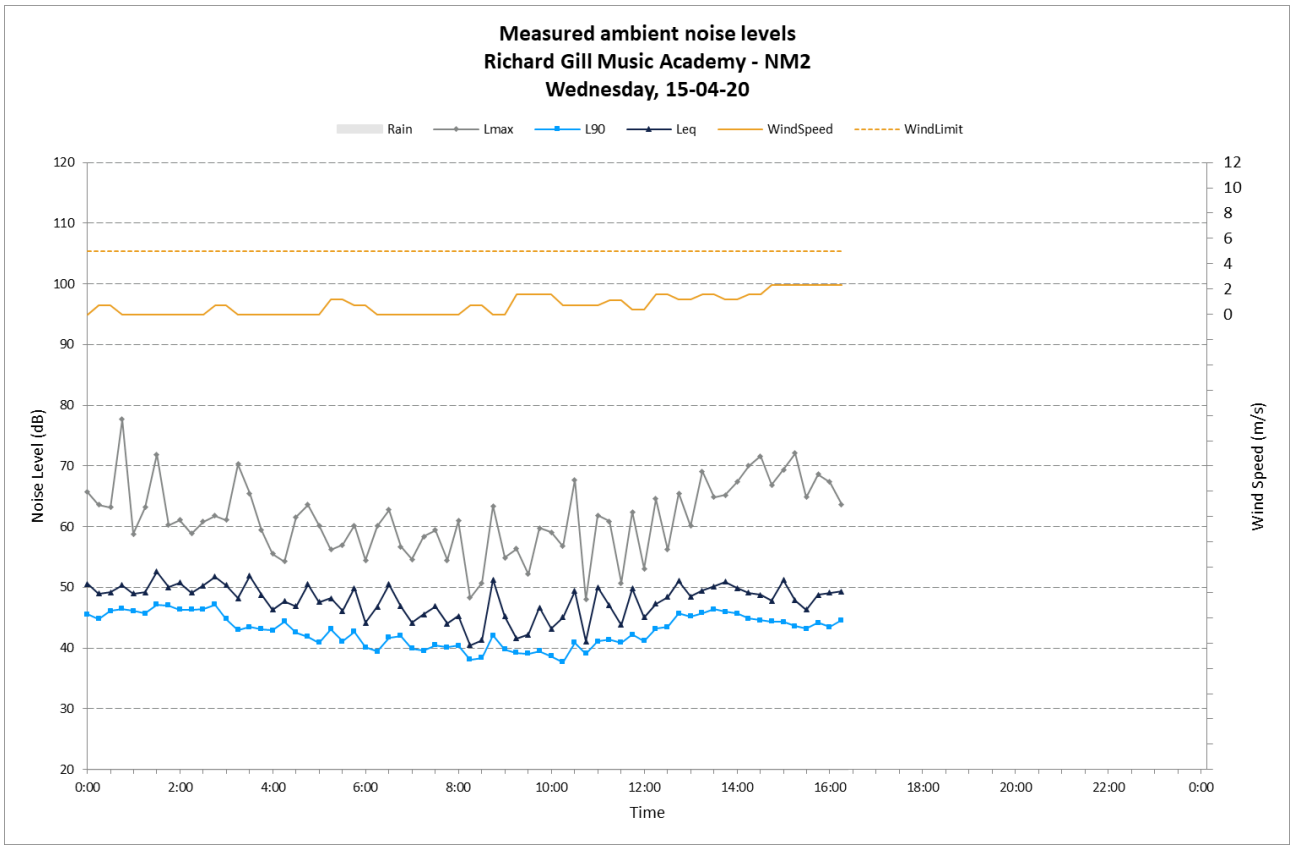

Measured ambient noise levels
Richard Gill Music Academy - NM2
Friday, 10-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM2
Saturday, 11-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM2
Sunday, 12-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM2
Monday, 13-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM2
Tuesday, 14-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time


Measured ambient noise levels
Richard Gill Music Academy - NM2
Wednesday, 15-04-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00