

MANAGING DIRECTORS

MATTHEW PALAVIDIS
VICTOR FATTORETTO

DIRECTORS

MATTHEW SHIELDS
BEN WHITE



Lindfield Learning Village

Noise Impact Assessment

SYDNEY

A: 9 Sarah St Mascot NSW 2020
T: (02) 8339 8000
F: (02) 8338 8399

SYDNEY MELBOURNE BRISBANE CANBERRA
LONDON DUBAI SINGAPORE GREECE

ABN: 11 068 954 343

The information in this document is the property of Acoustic Logic Consultancy Pty Ltd ABN 11 068 954 343 and shall be returned on demand. It is issued on the condition that, except with our written permission, it must not be reproduced, copied or communicated to any other party nor be used for any purpose other than that stated in particular enquiry, order or contract with which it is issued.

DOCUMENT CONTROL REGISTER

Project Number	20160433.2
Project Name	Lindfield Learning Village
Document Title	Noise Impact Assessment
Document Reference	20160433.2/0303A/R2/HP
Issue Type	Email
Attention To	DesignInc Sydney Pty Limited

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	3/03/2017	20160433.2/0303A/R0/HP	HP		
1	3/03/2017	20160433.2/0303A/R1/HP	HP		HP
2	08/06/2017	20160433.2/0303A/R2/HP	HP		HP

TABLE OF CONTENTS

1	INTRODUCTION	4
2	SITE DESCRIPTION AND PROPOSED WORKS	4
3	NOISE DESCRIPTORS	6
4	SURVEY OF AMBIENT NOISE	7
4.1	UNATTENDED, LONG TERM NOISE LOGGING	7
4.2	ATTENDED NOISE MEASUREMNETS	7
4.3	RESULTS	8
5	NOISE EMISSION CRITERIA	9
5.1	KURINGGAI COUNCIL	9
5.1.1	The Kuringgai Planning Scheme Ordinance and Draft LEP 2013	9
5.1.2	Kuringgai Council Draft LEP 2013	9
5.2	EPA INDUSTRIAL NOISE POLICY	9
5.2.1	INP - Intrusiveness Assessment	10
5.2.2	INP - Amenity Assessment	10
5.3	OUTDOOR PLAY AREAS	11
5.4	NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS/DROP OFF ZONE	11
6	NOISE EMISSION ASSESSMENT	13
6.1	NOISE FROM THE PLAYGROUNDS	13
6.2	NOISE FROM USE OF CHARLES BEAN OVAL	15
6.3	NOISE FROM INTERNAL AREAS (CLASSROOMS, GYM AND AUDITORIUM)	16
6.4	VEHICLE NOISE - NOISE GENERATED BY ADDITIONAL TRAFFIC ON PUBLIC ROADS / DROP OFF ZONE	16
6.5	NOISE FROM MECHANICAL PLANT, PUBLIC ADDRESS SYSTEM AND SCHOOL BELL	18
7	RECOMMENDATIONS	19
8	NOISE INTRUSION ASSESSMENT	19
9	CONSTRUCTION NOISE AND VIBRATION	20
9.1	EPA CONSTRUCTION NOISE GUIDELINE	20
9.2	AS2436	21
9.3	VIBRATION	22
9.3.1	Structure Borne Vibrations	22
9.3.2	Assessing Amenity	22
10	ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES	23
11	CONSTRUCTION NOISE AND VIBRATION ASSESSMENT AND RECOMMENDATIONS	24
12	CONCLUSION	25

1 INTRODUCTION

Acoustic Logic Consultancy has been engaged by the DesignInc to undertake an assessment of operational noise likely to be associated with the proposed adaptive reuse of the existing UTS Kuringgai Campus into the Lindfield Learning Village.

In this report, we will:

- Identify nearby noise sensitive receivers and operational noise sources with the potential to adversely impact nearby development.
- Identify relevant Council and EPA (SEAR) noise emission criteria applicable to the development.
- Predict operational noise emissions and assess them against acoustic criteria.
- If necessary, determine building and/or management controls necessary to mitigate potential noise impacts.

2 SITE DESCRIPTION AND PROPOSED WORKS

Lindfield Learning Village is an adaptive reuse of the UTS Kuringgai site located at 100 Eton Road, Lindfield.

The final school population would cater for 6 Homebases; each with 350 students for a total of 2100 students from Kindergarten to Year 12 and 200 teachers. In addition, a dedicated Childcare Centre is proposed with an enrolment of 100 children 0-6 years. It is proposed that there would be staggered start times across the site as follows:

- Childcare Centre 6:30am to 6:30pm
- 2 Homebases starting 7:30am and concluding 2:00pm;
- 2 Homebases starting 8:30am and concluding 3:00pm;
- 2 Homebases starting 9:00am and concluding 3:30pm;

The majority of the proposed outdoor play areas are to the South and East of the building, adjoining the national park or on the rooftops.

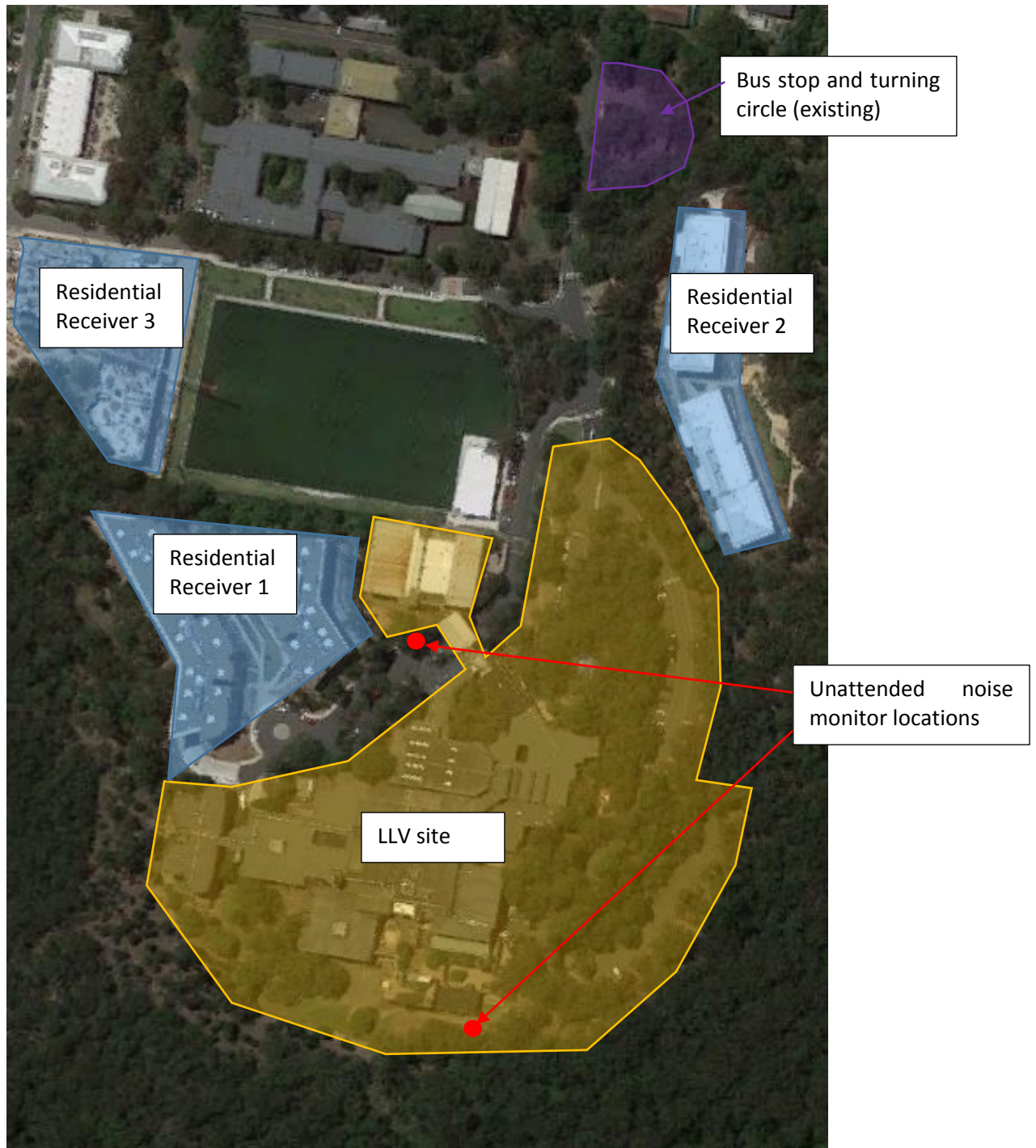
There are two car parks located along the eastern side of the site.

Pick up and drop offs for students are proposed along the western side of the Northern carpark, with parents walking to and from the school grounds to their cars.

There is a bus stop on Eton Road approximately 200m north of the site, which incorporates a turning circle allowing busses to drop/pick up and turn around efficiently.

The proposed redevelopment works consist of internal reconfiguration and refurbishment and minor changes to the external building shell to allow for the adaptive reuse along with landscaping and pedestrian improvements throughout the site.

The nearest noise sensitive development to the site consists of multi storey residential development located to the north east and north west of the site on Dunstan Grove and Tubbs View.



3 NOISE DESCRIPTORS

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

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

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

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

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

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

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

L_1 levels represent is the loudest 1% noise event during a measurement period.

4 SURVEY OF AMBIENT NOISE

Both long term unattended noise logging and attended noise measurements were conducted to quantify the existing acoustic environmental at the site.

All monitoring and measurement locations are in the aerial photo in section 2.

4.1 UNATTENDED, LONG TERM NOISE LOGGING

Long term unattended noise monitoring was conducted on site from the 1st of April 2016 to the 8th April 2016.

The monitoring locations were on the North Western Boundary – adjacent to the Gymnasium; and on the South Eastern Boundary.

At the time of the installation of noise monitors, a suitable safe location was not found for unattended noise monitoring at Residential Receiver R2 at Tubbs View (a location being representative of R2 but not impacted by specific mechanical plant serving R2 and safe for the security of the monitor and for staff installing/retrieving).

Attended background noise measurements were undertaken at the Southern logger and at the residential receivers R2 at Tubbs View and there was less than 1dB difference between the two locations. On that basis, the monitoring from the Southern logger is representative of R2.

Unattended noise monitoring was conducted using an Acoustic Research Laboratories monitors set on A-weighted fast response mode. The monitors were calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded. In accordance with the EPA Industrial Noise Policy, periods of adverse weather have been excluded when calculating background noise levels.

During the period of unattended noise monitoring, the subject site was only partially operational (part of the library was being used for filming) and on that basis, the monitoring is representative of the background noise in the absence of noise from the use of the site.

4.2 ATTENDED NOISE MEASUREMENTS

In addition to the unattended noise logging, a series of attended noise measurements were made surrounding the site in order to quantify existing traffic noise levels. These measurements were made during the morning peak hour on the 1st of April 2016.

Additional attended noise measurements were also undertaken outside of peak hour, at each unattended noise monitor location and at the residential receivers at Tubbs View (R2).

4.3 RESULTS

The results of the unattended noise monitoring are shown in the following table.

Table 1 – Unattended Monitoring Measured Noise Levels

Location	Time of Day	Rating Background Noise Level dB(A) L ₉₀ (15min)	Period Average Noise Level dB(A) L _{eq}
Gym	Day (7am – 6pm)	42	56 L _{eq} (15hr); 59L _{eq} (worst 1hr)
	Evening (6pm – 10pm)	41	
	Night (10pm – 7am)	39	47 L _{eq} (9hr); 52L _{eq} (worst 1hr)
South*	Day (7am – 6pm)	48	43 L _{eq} (15hr); 54L _{eq} (worst 1hr)
	Evening (6pm – 10pm)	47	
	Night (10pm – 7am)	36	49 L _{eq} (9hr); 54L _{eq} (worst 1hr)

*Note: Background levels at the southern location are representative of the receivers at Tubbs View

Table 2 – Attended Traffic Noise Monitoring Measured Noise Levels

Location	Time of Day	Measured Noise Level dB(A) L _{eq}
Eton Road near Tubbs View 3m from kerb	7:45am	58db(A)L _{eq} (15min) (51dB(A) at façade of Tubbs View apartments façade)
107 Abingdon Street, in line with west façade of 64 Abingdon	8:05 am, 8:21am	54db(A)L _{eq} (15min)

5 NOISE EMISSION CRITERIA

There are no mandatory EPA or similar acoustic criteria applicable to the acoustic assessment of schools.

The following noise controls provide some guidance in noise emission assessment:

- The Kuringgai Planning Scheme Ordinance PART IIID UTS Ku-ring-gai Campus site and Draft LEP 2013.
- The Association of Australian Acoustical Consultants (AAAC) guidelines for outdoor play areas for child care centres.
- EPA Industrial Noise Policy (applicable for plant/equipment noise)
- EPA Road Noise Policy (for the assessment of noise as a result of traffic generation by the site).

We note that the above criteria are not strictly applicable to school developments, and are useful as a guideline only. In our experience it is extremely common in the assessment of noise generation by schools that strict compliance with acoustic guidelines (in particular noise from playgrounds and during pick up/drop off) is not achieved (and for schools located in residential areas, it is in fact generally not achievable). Where relevant, this will be discussed in more detail below.

An outline of relevant acoustic criteria is presented below.

5.1 KURINGGAI COUNCIL

5.1.1 The Kuringgai Planning Scheme Ordinance and Draft LEP 2013

The Kuringgai Planning Scheme Ordinance requires application of the SEPP (Infrastructure) 2007. In respect of acoustics, the relevant section of the SEPP (Infrastructure) 2007 Clause 102 relates to road traffic noise intrusion into the educational establishment. Application of the SEPP (Infrastructure) 2007 internal noise goals is mandatory when a site is adjacent to or with line of sight to a roadway carrying in excess of 40,000 vehicles per day and hence does not apply to the subject site.

There are no further specific acoustic requirements under the Ordinance.

5.1.2 Kuringgai Council Draft LEP 2013

The Kuringgai Council Draft LEP 2013 does not nominate any specific acoustic requirements.

5.2 EPA INDUSTRIAL NOISE POLICY

Noise sources covered by this code will include noise from internal areas/classrooms and mechanical services noise. Both the Intrusiveness and the Amenity criteria (as set out below) must be complied with.

5.2.1 INP - Intrusiveness Assessment

Intrusiveness criteria permit noise generation to be no more than 5dB(A) above existing background noise levels. The criteria are as follow:

Table 3 – EPA Intrusiveness Criteria

Location	Time of Day	Background noise Level - dB(A)_{L90}	Intrusiveness Noise Objective dB(A)_{Leq(15min)} (Background + 5dB)
Residential Receivers 1–(Dunstan Grove) and 3 (Shout Ridge)	Day Time (7am – 6pm)	42	47
	Evening (6pm-10pm)	41	46
	Night (10pm – 7am)	39	44
Residential Receiver 2 – Tubbs View	Day Time (7am – 6pm)	48	53
	Evening (6pm-10pm)	47	52
	Night (10pm – 7am)	36	41

5.2.2 INP - Amenity Assessment

The Amenity criteria set additional criteria based on the land use of the noise sensitive receivers.

Amenity criteria are as follows:

Table 4 – EPA Amenity Criteria

Receiver Location	Land Type	Time of Day	Amenity Noise Objective dB(A)_{Leq(Period)}
All Potentially Affected Residential Properties	Suburban	Day Time (7am – 6pm)	55-60
		Evening (6pm – 10pm)	45-50
		Night (10pm-7am)	40-45

5.3 OUTDOOR PLAY AREAS

Outdoor play areas are not typically assessed with reference to the same acoustic criteria as other noise sources. Guidelines for outdoor play areas are generally less stringent than requirements imposed for other noise sources (such as mechanical plant noise). This is because:

- Noise from play areas is typically limited to day time periods, and for relatively restricted periods of time.
- Noise from children playing is typically not considered to be as intrusive as noise sources such as industrial noise.
- There is limited scope to provide mitigation treatments. Solid boundary fencing, for example, while it may provide some acoustic benefit, will often have a significant visual impact (particularly if on a street frontage) and will provide little to no benefit in the event that adjacent development is anything other than a single level residence.
- The community benefit/importance in providing outdoor activity areas in schools and child care centres is balanced against the noise impact.

Relevant published acoustic guidelines include the AAAC guidelines for child care centres, which recommend a “background+10dB(A)” noise emission goal for use of outdoor areas, provided it is limited to no more than 2 hours per day.

As the published noise emission guidelines are applicable to childcare centres, they are therefore useful more as guidance (opposed to a mandatory guideline). Decisions of the Land and Environment Court reflect this position that even if strict compliance is not achieved, the noise is not necessarily excessive/offensive (see *Pedavoli v Meriden*).

However, for assistance, a background +10dB(A) noise emission guideline is presented below.

Table 5 – Playground Day Time Noise Emission Goals (Background+10dB(A))

Noise Receiver	Background Noise Level – dB(A)L ₉₀	Background+10dB(A) noise emission goal
Receiver 1	42	52
Receiver 2	48	58

5.4 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS/DROP OFF ZONE

For land use developments with the potential to create additional traffic on public streets the development should comply with the EPA Road Noise Policy.

Noise levels generated by traffic should not exceed the noise levels set out in the table below when measured at a nearby property.

Table 6 – Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Local Road	Day (7am to 10pm)	55 dB(A) _{Leq(1hr)}
	Night (10pm to 7am)	50 dB(A) _{Leq(1hr)}

However, if existing noise levels exceed those in the table above, section 3.4 of the Road Noise Policy is applicable, which states that an increase in the existing noise level of 2dB(A) would be considered a barely perceptible increase to the average person.

It is noted that the subject site is operating in caretaker mode only and as such, the current traffic flows are not representative of what was experienced when the University was operational.

Notwithstanding, the existing night time traffic noise levels at both unattended noise monitoring locations and the daytime levels at the gym monitor already exceed the goals nominated in table 5.

6 NOISE EMISSION ASSESSMENT

An assessment of operational noise emissions is presented below. The following noise sources are assessed:

- Noise from the outdoor play areas.
- Noise from internal (classroom/hall) areas
- Noise created on public roads as a result of traffic generated by the site.
- Noise from mechanical plant, PA system and school bells.

6.1 NOISE FROM THE PLAYGROUNDS

Noise emissions from the use of the outdoor play areas is predicted at nearby residences based on the following assumptions/information:

- At the subject site, the main play areas are to the south and east of the school buildings and on the rooftops (refer attached markup of outdoor play areas and fenced areas).
- Considering the staggered starts and breaks, there could be up to 1500 children participating in play at any one time throughout the day.
- The average sound power generated by children during active/ambulatory play is 81dB(A)_{L_{eq}}, per child, and assuming that one in two children are generating noise at any one time. This sound power has been determined based on:
 - Long term noise logging of existing playground noise at another school site (Manlyvale Public School).
 - Measurements of playground noise generated at other primary schools (Trinity Grammar School at Strathfield, Erskineville Primary School at Erskineville).

We note that this noise level is consistent with AAAC guidelines for noise generated by children in the 3-6 year old range as published in the AAAC guidelines for child care centres. It is also representative of the older age groups where the noise level per person may be marginally louder, but the number of people vocalising simultaneously is less.

With respect to the noise emission predictions, we note:

- There are numerous outdoor play areas within the grounds of the school – some on natural ground and others within courtyards and/or rooftop spaces that are partially or fully open to the sky. Children will also be permitted to play within nominated indoor areas during breaks. The South Western play areas are nearest the residential receivers opposite on Dunstan Grove (Receiver 1), whilst the North Eastern play areas (including the rooftop play area for the childcare centre) are proximate to Residential Receiver 2 at Tubbs View. Noise emissions will be predicted at both of these locations.
- The population in each zone has been calculated assuming approximately 7m² per child. Taking into consideration the areas within the security fencing; this correlates to approximately 1500

school children playing outside at any one time; plus a possible 100 at the childcare centre. This presents a conservative approach as some children would be absent, or in the library, canteen etc.

Noise emissions will be predicted and compared both to a “Background+10dB(A)” noise emission goal and to existing noise levels.

Predicted noise levels are as follows:

Table 7 – Predicted Noise Emission from Playground to Residential Receivers

Noise Receiver	Predicted Noise Emission Following Expansion - dB(A) _{Leq}	“Background+10dB(A) noise emission goal – dB(A) _{Leq} ”
Residential Receiver 1	65	52
Residential Receiver 2	62	58

With respect to the above:

- Residential Receiver 1:
 - Noise emissions are predicted to exceed a background + 10dB(A) noise emission guideline.
 - Noise impacts to these receivers could be reduced by approximately 3dB(A) by limiting student access to the fenced area adjacent to the woodworking rooms; however given the limited access to outdoor play areas on natural ground level, this may present an unreasonable restriction.
- Residential Receiver 2:
 - Noise emissions are predicted to exceed a background + 10dB(A) noise emission guideline.
 - Noise impacts to these receivers could be reduced by introducing screening planting to the North East corner, which would encourage quiet play in this zone rather than active (running etc) play which tends to be louder.
- Given the potential exceedances in noise goals, noise mitigation techniques should be adopted:
 - AAAC guidelines recommend that the Background+10dB(A) noise goal only be adopted for 2 hours per day.
 - Given the potential exceedances, careful management of the playgrounds should be implemented (to ensure that the duration of use of the playground is reasonable). In particular, use of playgrounds for physical education or after school hours activities should be carefully managed with respect to duration (given that the “background+10dB(A)

guideline is typically recommended for no more than 2 hours per day, after which a “background+5dB(A)” goal is typically adopted).

- On the Western boundary, vegetation/planting along the site boundary should be considered. While screening vegetation will not provide much acoustic benefit in itself, it is likely to result in noisy activities (running etc) being located away from the western property boundary (closest to residences) and therefore providing acoustic benefit as a result of the additional distance. This will potentially reduce noise emissions a further 1-2dB(A) compared to the levels predicted in table 7.

These recommendations are discussed in more detail in section 7.

- Outside of the acoustic treatment and management controls detailed in section 7, there is little scope to further reduce noise emissions:
 - The site has finite access to suitable outdoor play areas on natural ground. Restricting access to the Western play areas could have a detrimental impact on students’ access to active play. Given the multi-storey nature of the residential receivers; acoustic screening is not a practical solution.

While it is acknowledged that the proposed playground layout results in non-compliances with (non-mandatory) acoustic guidelines, in our opinion it is still in keeping with typical school design in the Kuringgai Council local government area.

We note that a similar level of acoustic separation between playgrounds and residences also occurs at Lindfield Public School, Chatswood Primary School, Chatswood High School, Killara Public School and St Ives Preparatory School (all of which have playgrounds or sports courts with residential receivers overlooking the play areas).

The proposal is, in our opinion, as reasonable balance between the school’s needs (to provide suitable outdoor play space for the students) competing acoustic impacts and is not out of keeping to similar school development in the Kuringgai Council local government area.

6.2 NOISE FROM USE OF CHARLES BEAN OVAL

It is proposed that the school would utilise the existing Charles Bean Oval for sporting activities. The Oval is an all-weather synthetic soccer field, which can be booked through the Council. The Council nominated hours are 8am to 9:30pm Monday to Friday, 8am to 9pm Saturday and 9am to 6pm Sundays. As with other members of the community, the school will be able to book times on the oval. This would include Physical Education classes, sports training and occasional competition. Noise emitted to the neighbours would depend on the number of participants and the activities being undertaken.

Noise emission calculations are based on the following:

- General play: population 200 students distributed evenly over the Oval. Sound Power level 78dB(A) per person – predicted level to nearest receivers’ adjacent on Shout Ridge is 59dB(A) L_{eq} and 58dB(A) L_{eq} to the Dunstan Grove receivers to the south.
- Sports Gameplay (e.g. soccer/hockey): population 60 students distributed evenly over the Oval. Sound Power level 84dB(A) per person – predicted level to nearest receivers’ adjacent on Shout Ridge is 60dB(A) L_{eq} and 60dB(A) L_{eq} to the Dunstan Grove receivers to the south.

Noise emissions from use of the Charles Bean Oval have been predicted above. Noise emissions exceed a background + 10dB(A) level. The oval is an existing feature, designed for Sporting activities and available for hire from the Ku-ring-gai Council. To minimise noise emissions from school use of the sporting activities as much as practical, activities are to be planned to maximise the distance to the residential receivers. This would include locating spectators on the Eastern sideline when possible and when that is impractical, to the Northern sideline (as these are the locations with greatest distance to receivers). If the whole field is not required, activity shall be conducted in the centre of the oval and in the Eastern half (when practical). These management controls will reduce noise to neighbours by up to 5dB.

6.3 NOISE FROM INTERNAL AREAS (CLASSROOMS, GYM AND AUDITORIUM)

Being an internal area, noise from a classrooms/gymnasium/auditorium should comply with a “background +5dB(A)” noise emission goal at nearby residences (as noise from internal areas is more controllable than noise from a playground).

Noise emissions from normal use of the classrooms, with windows open for natural ventilation are predicted to comply with a background + 5dB(A) goal.

The existing gymnasium includes South West facing ventilation louvres which have the potential to impact on residences on Dunstan Grove (particularly during sporting activities). However, the impacts to the residential receivers from school use would be very similar to that of the university i.e. being used for defined periods throughout the school day and evening time for sports training. On the basis that the proposed change of use is not likely to result in any significant increase in the level or duration of noise to the previous, no additional treatments would be required.

In relation to the auditorium – it too would be used in the same fashion as previous. It would be used for larger gatherings within the school homebases during the day and for performances, conferences and the like on occasion in the evenings (up to 11pm). Given the mode and frequency of use is the same as previous, it does not require further investigation.

6.4 VEHICLE NOISE - NOISE GENERATED BY ADDITIONAL TRAFFIC ON PUBLIC ROADS / DROP OFF ZONE

Noise created as a result an increase in traffic on public roads is assessed with reference to the EPA Road Noise Policy, which targets a noise level of 55dB(A) $L_{eq(1hr)}$ as a result of noise from road traffic generated by the development (see table 6).

The Lindfield Learning Village Transport Assessment by Arup nominates 10 parking spaces for student kiss and ride drop off and an additional 10 spaces for dropping of younger children. These are proposed to be located within the northern carpark area, with minor alterations to allow for a turning head. Outside of school drop off and pickup times, these spaces would be available for visitor parking.

Based on the predictions from Arup of peak hour generation of 796 trips in and 761 trips out in the morning peak hour (and lesser impact in the afternoon peak), the predicted peak hour noise level at the worst affected residential receivers on Eton Road (which have a shorter setback than Tubbs View) of 64-67dB(A) $L_{eq (worst 1hr)}$. Based on vehicle movement numbers, the noise created by cars alone (excluding the contribution of vocal noise from children as is required by the EPA Road Noise Policy guidelines) is 64-67dB(A) $L_{eq(1hr)}$, which exceeds EPA Road Noise Policy guideline of 55dB(A) L_{eq} .

Noise Level from buses idling at the bus stop impacting Tubbs View is 68dB(A) L_{eq} per bus. On that basis, it is recommended that buses are not queued in proximity of the bus stop, but arrive in time to pickup and then depart immediately. On that basis, the impacts to Tubbs View residents would be less than 65dB(A) L_{eq} (worst 1hr).

With the first staggered start to commence at 7:30am and with the childcare centre to accept children from 6:30am, there will be vehicle movements prior to 7am and so still within the “night time” period (10pm – 7am). The existing worst 1hr noise level overnight already exceeds the EPA guideline. On that basis, noise from traffic generated by a development would typically be limited to existing plus 2dB i.e. 56dB(A) L_{eq} (worst 1hr) on Eton Road.

Assuming 25% of the first two homebases and the childcare centre arriving between 6:30 and 7am (remainder would arrive after 7am), the predicted noise level at the nearest residential receivers from early morning vehicle movements is 61dB(A) L_{eq} (worst 1hr). This exceeds the EPA noise guideline and so on that basis, it could be acoustically advantageous to advise staff and students to arrive after 7am whenever practical to limit night time impacts. However, the staggered starts have been proposed to mitigate traffic flow impacts and increasing the period over which the student drops occur will decrease the instantaneous noise level at any particular time and also alleviate potential traffic delays.

Assuming some of the night time drop-offs would use the short stay parking spaces (which are approximately 22m from Tubbs View residents); the peak noise level within the nearest residential dwellings would be less than 50dB(A) L_{Max} internally and so not likely to cause an awakening.

Some mitigation in noise generation can be achieved through relocation of the area where students queue before being taken to the bus stop. By moving the queue further within the school grounds (as opposed to directly at the existing bus stop which is in close proximity to residences), noise impacts can be marginally reduced. This is recommended if practicable.

While, strictly speaking, vehicle noise is predicted to exceed EPA guidelines (and would have exceeded when UTS was operational), in our experience almost any moderately size school located in a residential area will exceed EPA guidelines with respect to noise generated by the pick-up/drop off period. However, we note there are no feasible means employ a different pick up/drop off strategy which would have a noticeably quieter noise generation.

In our opinion the noise impact is reasonable in that it is not out of keeping with typical school development.

6.5 NOISE FROM MECHANICAL PLANT, PUBLIC ADDRESS SYSTEM AND SCHOOL BELL

Detailed acoustic design of mechanical plant cannot be undertaken at approval stage, as plant selections and locations are not finalised. However, detailed acoustic assessment of all ventilation or other plant items should be undertaken at CC stage, once equipment items are selected and location is finalised.

In regard to the school bell/PA system, the system should minimise noise spill to adjacent properties

- Speaker positioning/selection:
 - Speaker location and direction can be used to reduce noise spill to neighbouring properties while still maintaining suitable noise levels within the school grounds (typically 70-75dB(A)).
 - Broadly speaking, more speakers, closer to the noise receiver is a more effective way to provide coverage of the external areas while reducing noise spill to neighbouring properties.
 - Similarly, highly directional speakers (angled downwards) will also reduce noise spill. Speakers with a drop of at least 5dB(A) for mid-frequencies noise for each 10 degrees in the horizontal plane outside of the coverage area should be considered.
- Use of a noise limiter system:
 - By limiting the maximum possible signal sent to a speaker, this can reduce intermittent increased noise generation as a result of the system user excessively raising their voice or holding the microphone too close. The schools currently engaged contractor would most likely be able to provide such a system.
 - In all likelihood, the limiter system would require that the system be installed, and volume adjusted such that the School was satisfied that a sufficient noise level has been reached in the assembly area, and the noise limit then set based on that.

7 RECOMMENDATIONS

We recommend the following acoustic treatments/management controls are implemented to mitigate acoustic impact as much as practicable:

- Outdoor play areas:
 - Intensive use (recess, lunch, school sport) of outdoor play areas on Dunstan Grove should not exceed 2 hours per day.
 - Use of planting along the Western and North Eastern boundaries should be considered to maximise the distance between active play (noisy) areas and the residences to the west and north east.
- Relocation of the student queuing area for buses further within the school grounds should be considered to reduce noise impact on the residences at Tubbs View.
- Detailed acoustic review of all external plant items should be undertaken following equipment selection and duct layout design. All plant items will be capable of meeting noise emission requirements of Council and the EPA Industrial Noise Policy, with detailed design to be done at CC stage. This should include detailed acoustic review of any proposed PA system (speaker location, directionality, noise limiter etc).

8 NOISE INTRUSION ASSESSMENT

Compliance with the SEPP (infrastructure) 2007 is required through the SEARs. In respect of acoustics, the relevant section of the SEPP (Infrastructure) 2007, Clause 102, relates to road traffic noise intrusion into the educational establishment. Application of the SEPP (Infrastructure) 2007 internal noise goals is mandatory when a site is adjacent to or with line of sight to a roadway carrying in excess of 40,000 vehicles per day and hence does not apply to the subject site.

Notwithstanding the above, in accordance with Australian Standard AS2107:2016, application of an internal noise goal of 35-45dB(A) $L_{eq\ 15hour}$ would be appropriate for teaching spaces; and 35-40dB(A) $L_{eq\ 15hour}$ for the child care sleeping rooms. Given the environmental noise impacts on the site are relatively minor, compliance with these internal noise goals would be readily achievable with 6mm float glass without acoustic seals which would need to be closed to comply with the project internal noise goals but which could be openable for natural ventilation.

9 CONSTRUCTION NOISE AND VIBRATION

The majority of works will be conducted behind a closed façade, however there are some external alterations/refurbishments required including alterations to the landscaping and roadways.

Noise from construction shall be managed in accordance with the EPA Interim Construction Noise Guideline and Australian Standard AS2436.

Construction vibration shall be managed in accordance with the EPA Assessing Vibration: A Technical Guideline and DIN4150-3.

9.1 EPA CONSTRUCTION NOISE GUIDELINE

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise generation goals (based on ambient noise monitoring).
- Review of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *“Noise affected” level.* Where construction noise is predicted to exceed the “noise effected” level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the “noise effected level”. For residential properties, the “noise effected” level occurs when construction noise exceeds ambient levels by more than $10\text{dB(A)}_{\text{Leq}(15\text{min})}$.
- *“Highly noise affected level”.* Where noise emissions are such that nearby properties are “highly noise effected”, noise controls such as respite periods should be considered. For residential properties, the “highly noise effected” level occurs when construction noise exceeds $75\text{dB(A)}_{\text{Leq}(15\text{min})}$ at nearby residences.

In addition to the above goals for residential receivers, the ICNG nominates a Management Level of $45\text{dB(A)}_{\text{Leq}(15\text{min})}$ internally for School Classrooms and $70\text{dB(A)}_{\text{Leq}(15\text{min})}$ at commercial receptor facades (typical office, retail).

A summary is presented below.

Table 8 – Noise Management Levels - residential

Location	“Noise Affected” Level - $\text{dB(A)}_{\text{Leq}(15\text{min})}$	“Highly Noise Affected” Level - $\text{dB(A)}_{\text{Leq}(15\text{min})}$
Residential Receiver 1	52	75
Residential Receiver 2	58	

Table 9 – Noise Management Levels – other receivers

Location	Noise Management Level - dB(A)_{Leq(15min)}
School Receivers	45 internally
Commercial Receivers	70 at façade

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- If noise levels exceed “background + 5 or 10 dB(A)” noise goal at residential receiver locations, investigate and implement all practical and cost effective techniques to limit noise emissions.
- For the school receivers, a 45dB(A)_{Leq (15min)} *internal* criterion has been adopted at all times, in accordance with the EPA Interim Construction Noise Guideline.
- For the commercial receivers, a 70dB(A)_{Leq (15min)} criterion has been adopted at all times, in accordance with the EPA Interim Construction Noise Guideline.
- If the noise goal is still exceeded after applying all practical engineering controls to limit noise emissions investigate management and other techniques to mitigate noise emissions.

9.2 AS2436

Section 3 of AS 2436 states that care shall be taken in applying criteria that normally would be used to regulate noise emitted from industrial, commercial and residential premises to construction, particularly for those activities which are transitory and of short duration. For the control and regulation of noise from construction sites AS2436 nominates the following:

- That reasonable suitable noise criterion is established.
- That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes on parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours.
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

9.3 VIBRATION

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*; and
- For human exposure to vibration, the evaluation criteria presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment

The criteria and the application of this standard are discussed in separate sections below.

9.3.1 Structure Borne Vibrations

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 4.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 10 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms ⁻¹)			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

9.3.2 Assessing Amenity

Department of Environment and Conservation NSW “Assessing Vibration: A Technical Guideline” (Feb 2006) is based on the guidelines contained in BS 6472:1992. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and regulate vibration within the excavation/construction site.

Table 11 – DECCW Recommended Vibration Criteria

		RMS acceleration (m/s ²)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	Time	Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Continuous Vibration							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Offices		0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
Offices		0.64	1.28	13.0	26.0	18.0	36.0
Workshops		0.64	1.28	13.0	26.0	18.0	36.0

10 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

Typically, the most significant sources of noise or vibration generated during a construction project will be demolition, excavation and piling. As there is no extensive demolition associated with the project, the excavation of trenches and erection of poles will be the main sources of noise generation. Equipment associated with these works and associated noise levels are as follows:

Table 5 - Sound Power Levels of the Proposed Equipment

EQUIPMENT /PROCESS	SOUND POWER LEVEL dB(A)
12T Truck	108
Excavator with bucket (Up to 30t)	114
Hydraulic Hammering	120
Bobcat / Dozer D9 / Roller	105
Road Saw	105
Angle Grinder	114
Electric Saw	111
Mobile Crane	113

The noise levels presented in the above table are derived from the following sources, namely:

- Table A1 of Australian Standard 2436-2010.
- Data held by this office from other similar studies.

Noise levels take into account correction factors (for tonality, intermittency where necessary).

11 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT AND RECOMMENDATIONS

A complete construction noise and vibration management plan should be prepared after the appointment of the builder as a thorough assessment of construction impacts must consider the particular methodologies to be employed (which will vary).

Noise emissions from internal works are unlikely to exceed the “noise affected” level at the nearest residential receivers given they will occur behind a closed façade. Noise emissions from external works proximate to residential receivers will exceed the “highly noise affected” level at the residents from time to time i.e. concrete sawing/angle grinder within 20m of a residential receiver. On that basis, residents should be notified of the likely noise levels, the duration of works and contact details for the site. In addition, it may be appropriate to apply respite periods, however this should be considered on a case by case basis.

Vibration impacts from the required construction works are not likely to create significant vibration at the neighbouring residents; although the proposed works should still be reviewed in detail after appointment of the builder.

12 CONCLUSION

Noise emissions associated with the proposed Lindfield Learning Village at Eton Road, Lindfield have been assessed with reference to relevant EPA and Council acoustic guidelines.

An analysis of playground noise and noise created by traffic generation indicate that noise emissions generated by the school exceed non-mandatory acoustic. However:

- The layout of the school (position of playgrounds relative to residences) is not out of keeping with typical school design in residential areas and
- Acoustic treatment (where practicable) and noise management controls have been recommended in section 7 of this report to ensure that the amenity of nearby residents is protected as much as practicable while avoiding outcomes which will have significant visual impacts (noise screens or similar).

An analysis of noise from classrooms indicates that compliance with noise emission goals for the site is achievable. Noise emissions from the school gymnasium and main auditorium are predicted to have no noticeable change from the previous UTS use. Noise emissions from mechanical plant and equipment are capable of complying with the project noise emission goals, subject to review at CC.

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

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Hilary Pearce', with a stylized, cursive script.

Hilary Pearce



Copyright DesignInc Sydney Pty Limited
This drawing is protected by copyright. All rights are reserved. Unless permitted under the Copyright Act 1968, no part of this drawing may in any form or by any means be reproduced, published, broadcast or transmitted without the prior written permission of the copyright owner.

Please note
If the status of this drawing is not signed off For Construction it may be subject to change, alteration or amendment at the discretion of DesignInc Sydney Pty Limited. If so, DesignInc Sydney Pty Limited is not liable for any loss, damage, harm or injury whether special, consequential, direct or indirect, suffered by you or any other person as a result of your use of this drawing for construction purposes.

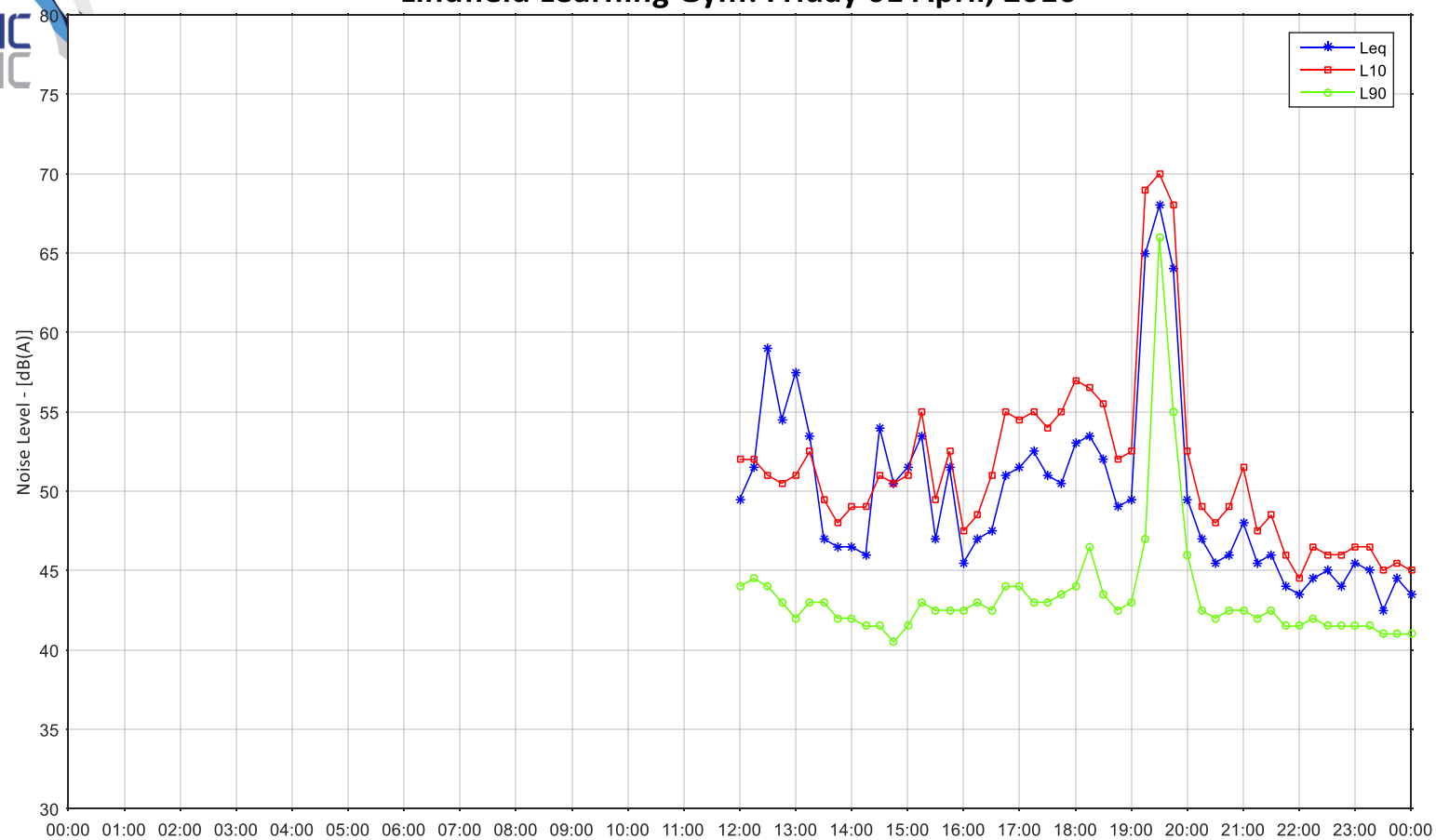
Figured dimensions take preference to scale readings. Verify all dimensions on site.
Report any discrepancies to the Architect for decision before proceeding with the work.

Nominated Architects
Anthony Quan 5421 | Sandeep Amin 7337 | Ian Armstrong 7260 | Richard Does 8126

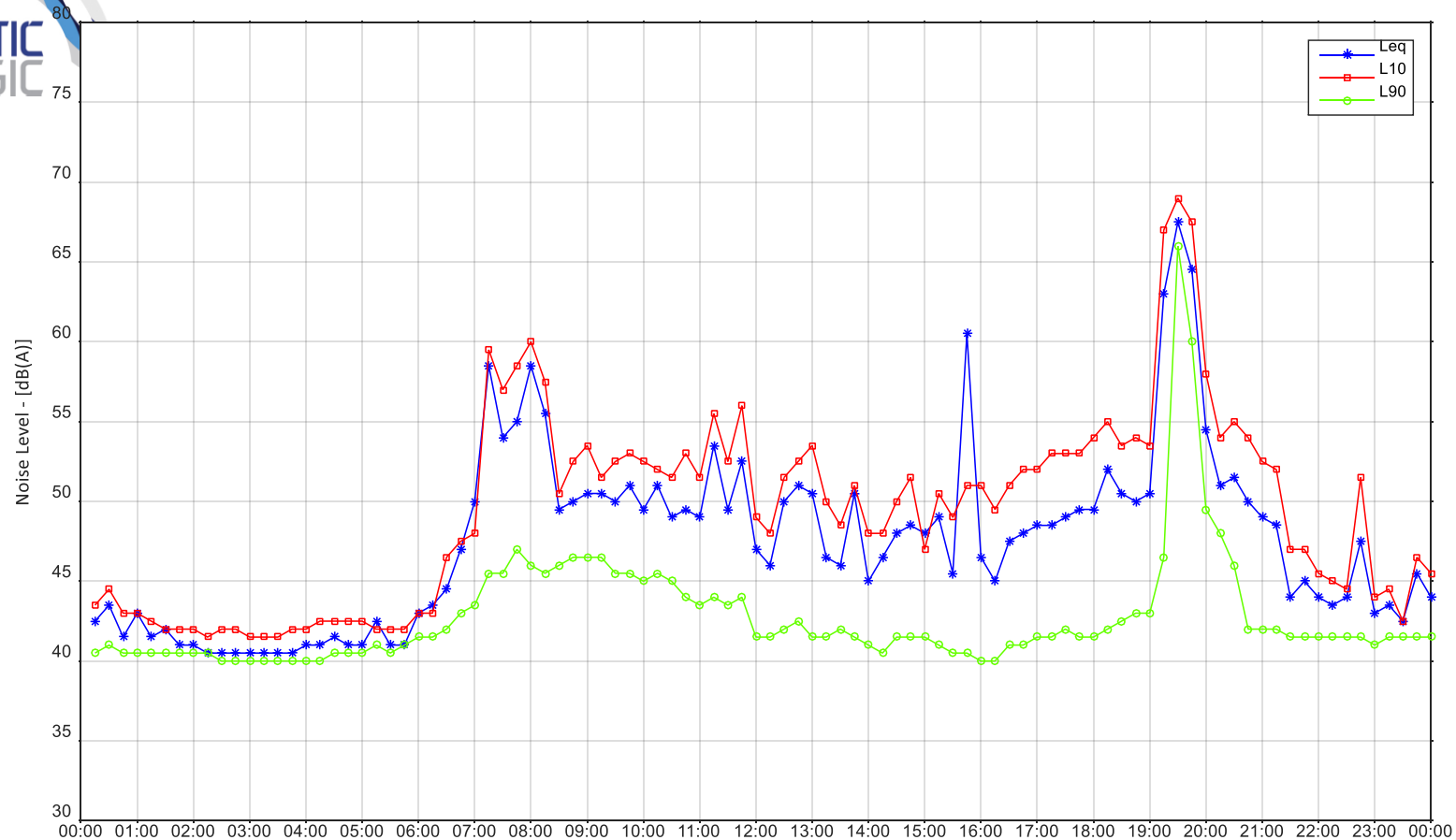
No	DATE	REVISIONS	BY
A	07/02/2017	ISSUED FOR REVIEW	RG
B	07/03/2017	PROPOSED SITE FENCE	RG

TRAFFIC ENGINEER	ARUP	ARUP
SERVICES ENGINEER	ERBAS AND ASSOCIATES	erb as
FIRE ENGINEER	AFFINITY FIRE ENGINEERING	AFFINITY FIRE ENGINEERING
CIVIL AND STRUCTURAL ENGINEER	BIRZULIS ASSOCIATES	BIRZULIS ASSOCIATES
BCA CONSULTANT	BCA LOGIC	BCA LOGIC
QUANTITY SURVEYOR	WILDE AND WOOLLARD	WILDE AND WOOLLARD
PROJECT MANAGER	SAVILLS	SAVILLS
ARCHITECT	DesignInc Lacoste + Stevenson bmc2 architects in association	
ARCHITECT	DesignInc DesignInc Sydney PTY LIMITED ACN 003008820 L12 / 77 PACIFIC HWY NORTH SYDNEY NSW 2060 AUSTRALIA PO BOX 651 NORTH SYDNEY NSW 2059 AUSTRALIA T +61 2 8905 7100 F +61 2 8905 7199 E sydney@sydney.designinc.com.au www.designinc.com.au Architecture Urban Design Interiors	
CLIENT	NSW Department of Education NSW GOVERNMENT Education	
PROJECT	Lindfield Learning Village Eton Road, Lindfield NSW 2070	
TITLE	SITE PLAN WITH FENCE	
N	DRAWN BY Author	
SCALES	1 : 2000 @A3	
PLOT DATE	03/07/17	
PROJECT N°.	S151441	REVISION B
DRAWING N°.	SK-AR-LLV-077	
DRAWING STATUS	REVIEWED BY Checker	SIGNATURE DATE
QUALITY CERTIFIED ISO 9001	Completion of the Drawing Status is evidence the design has been verified as conforming to the requirements of the Project M.S. Plan. Initiating the "Drawn By" box confirms that this drawing has been prepared in conformity with DesignInc Sydney M.S. procedures.	
Concept Design		

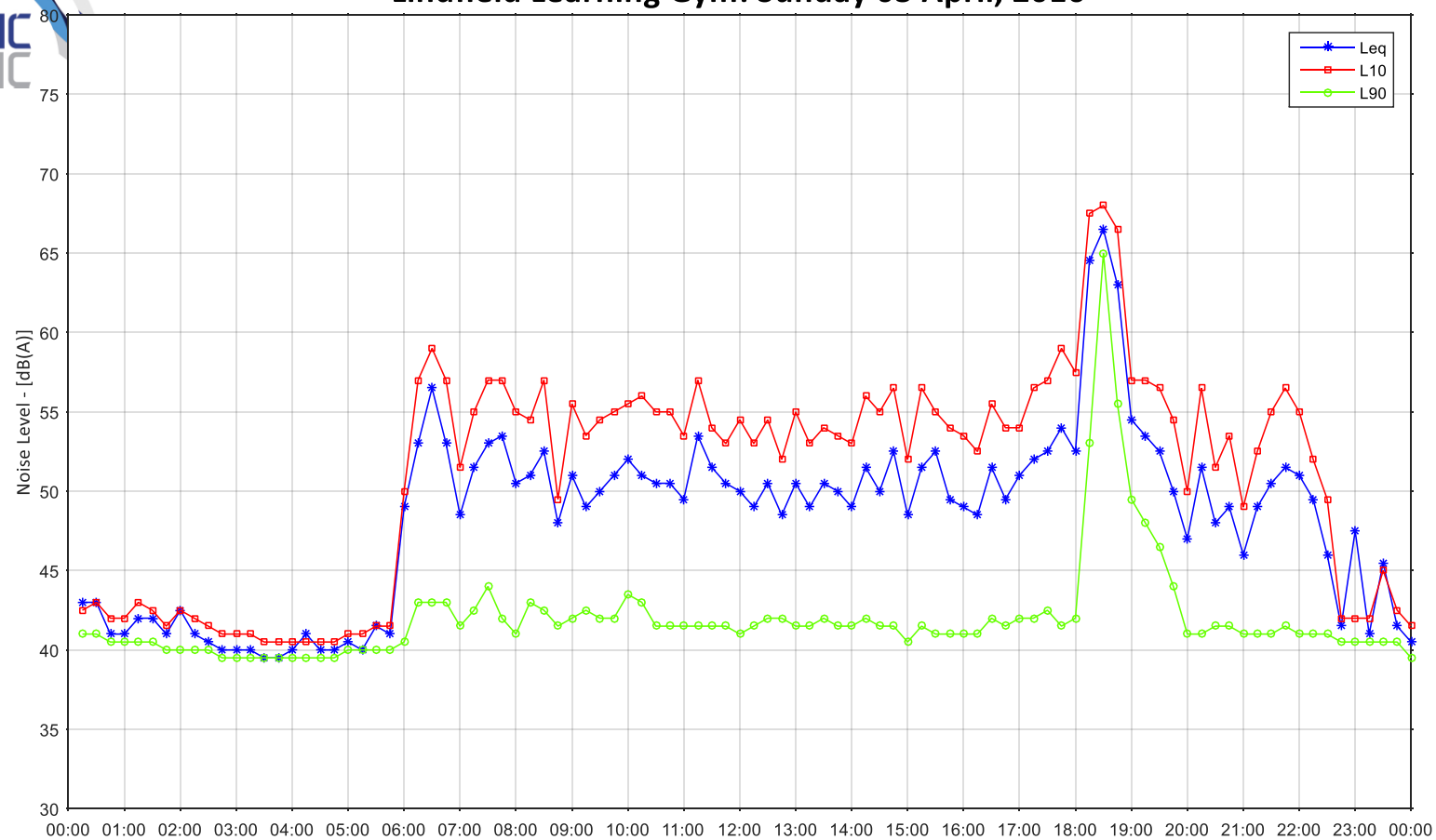
Lindfield Learning Gym: Friday 01 April, 2016



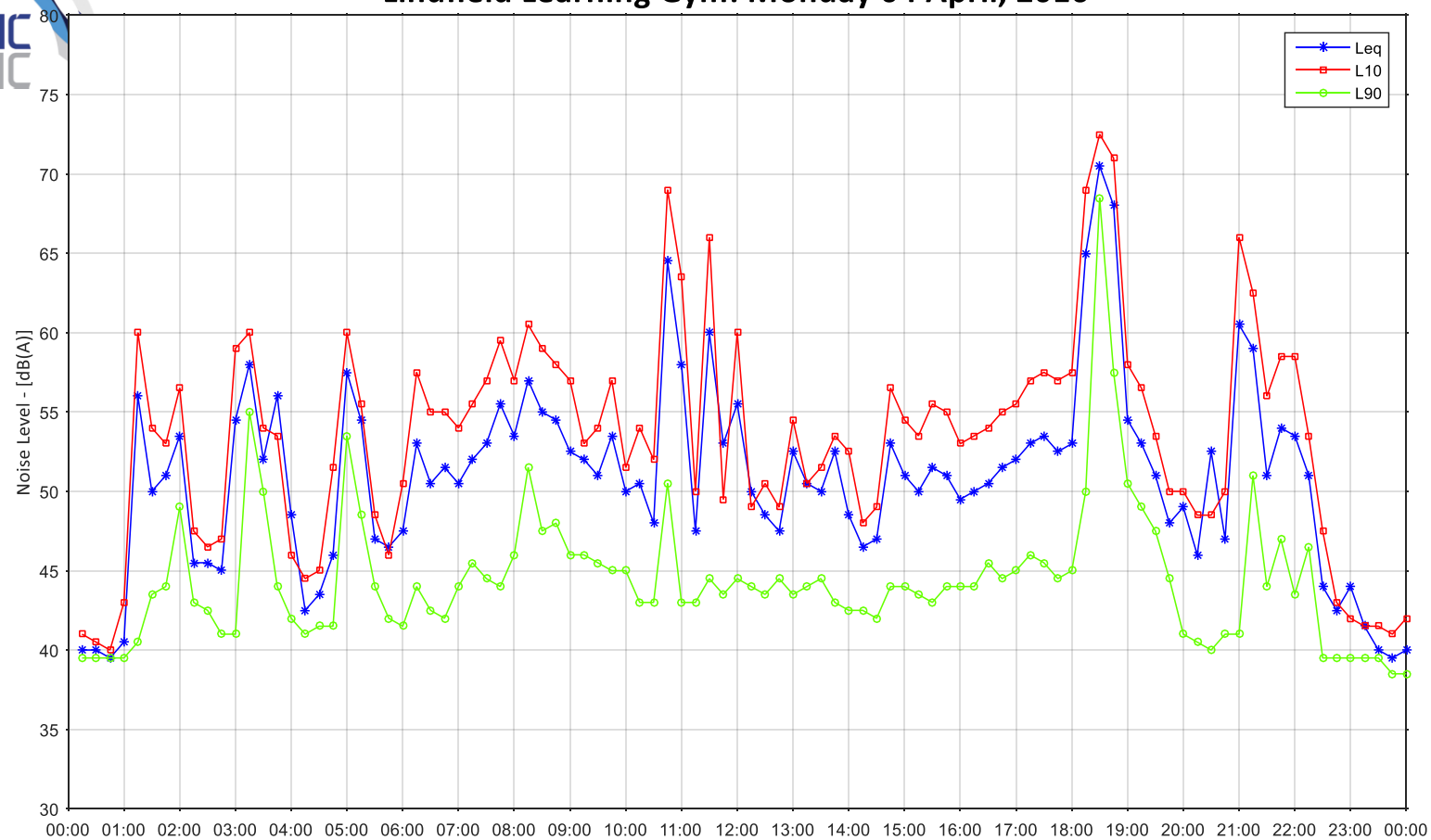
Lindfield Learning Gym: Saturday 02 April, 2016



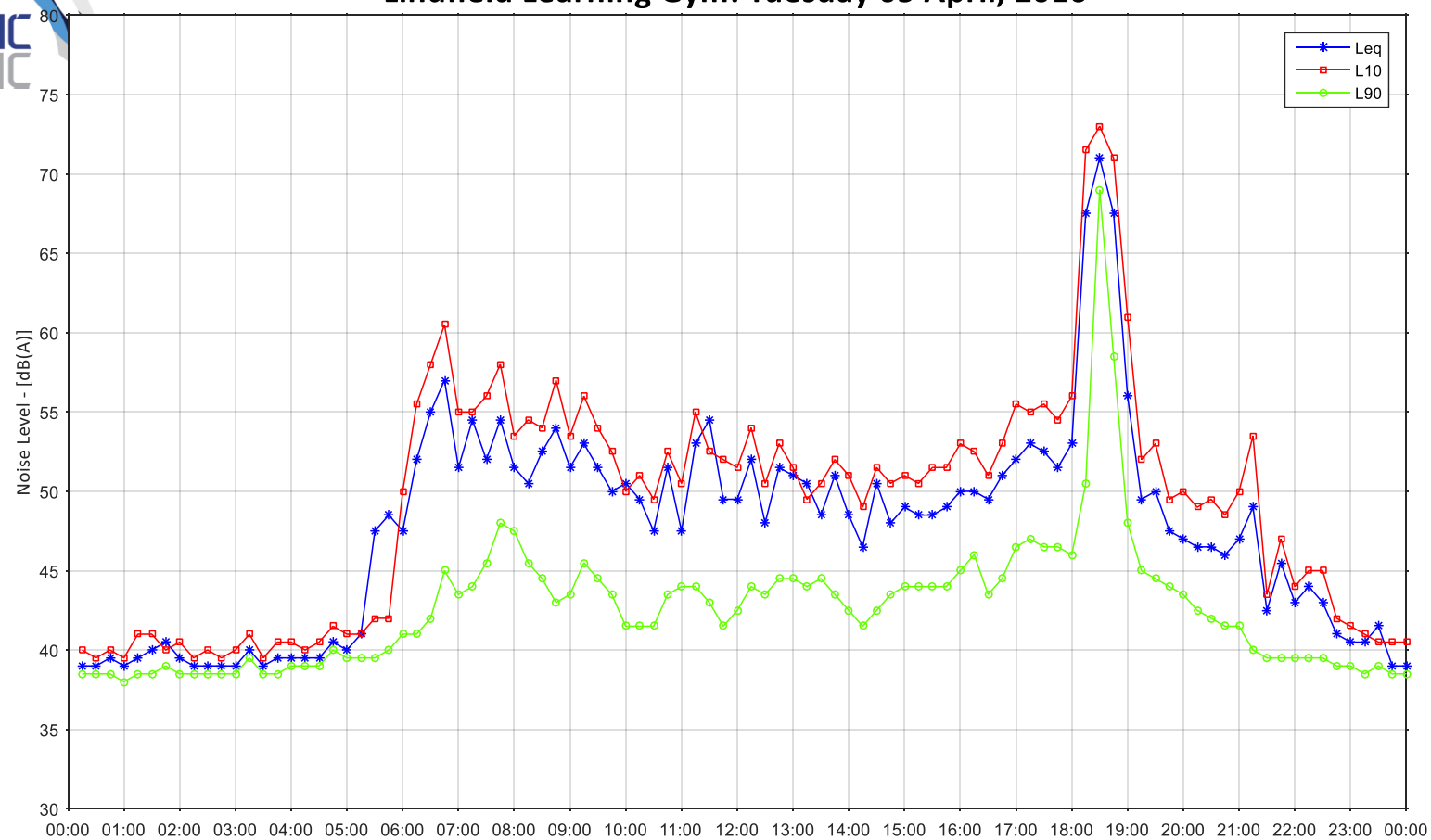
Lindfield Learning Gym: Sunday 03 April, 2016



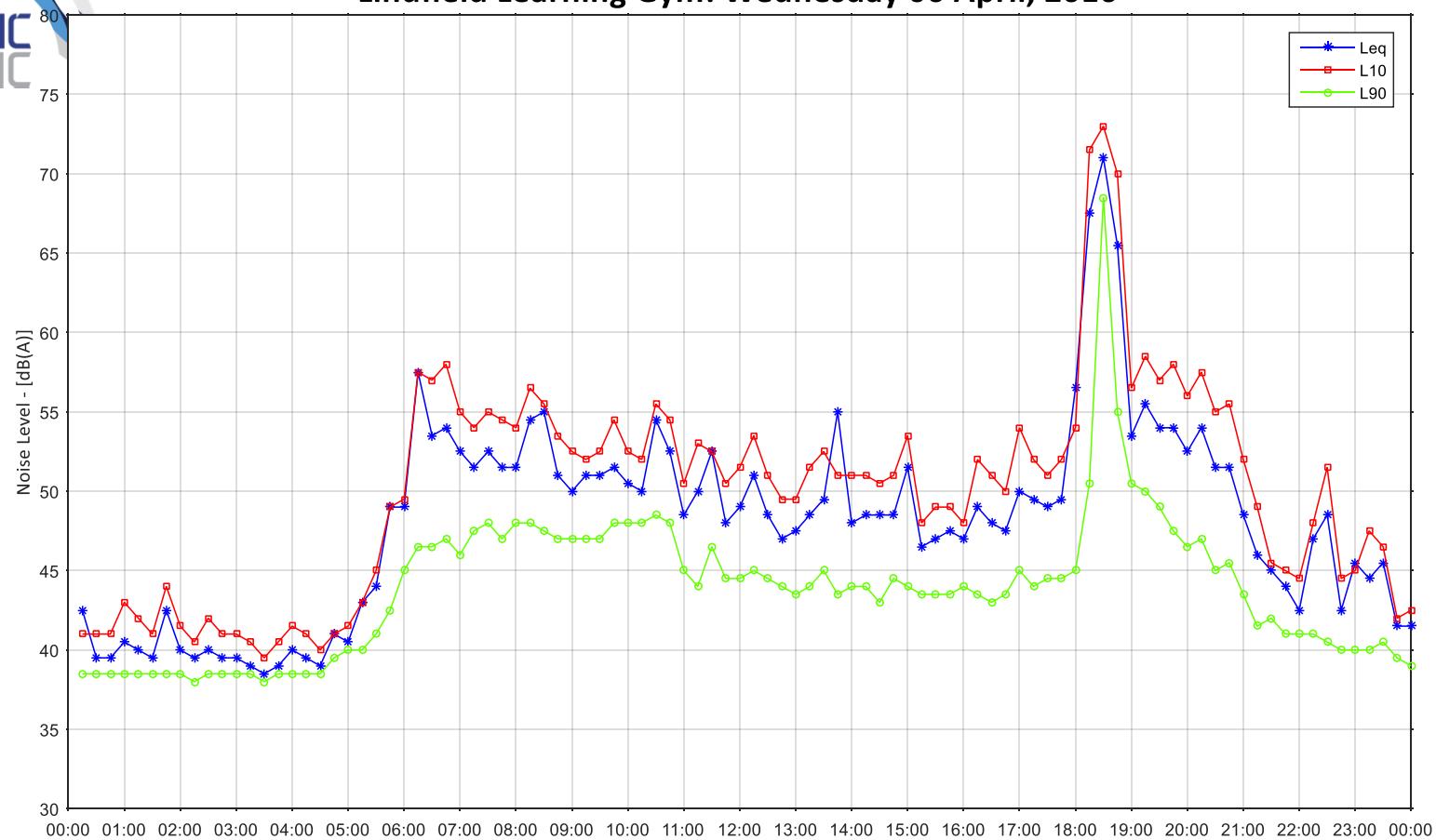
Lindfield Learning Gym: Monday 04 April, 2016



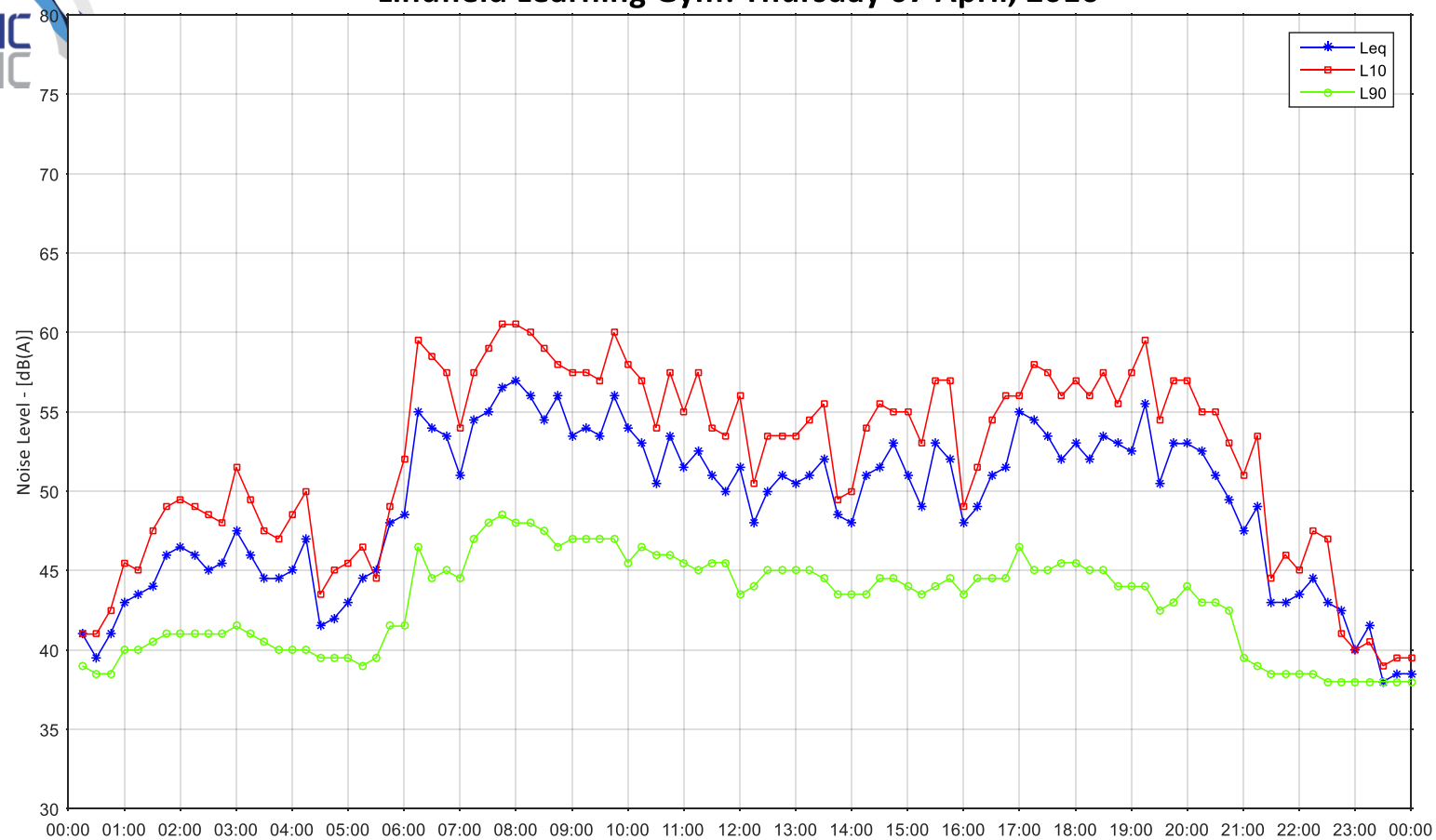
Lindfield Learning Gym: Tuesday 05 April, 2016



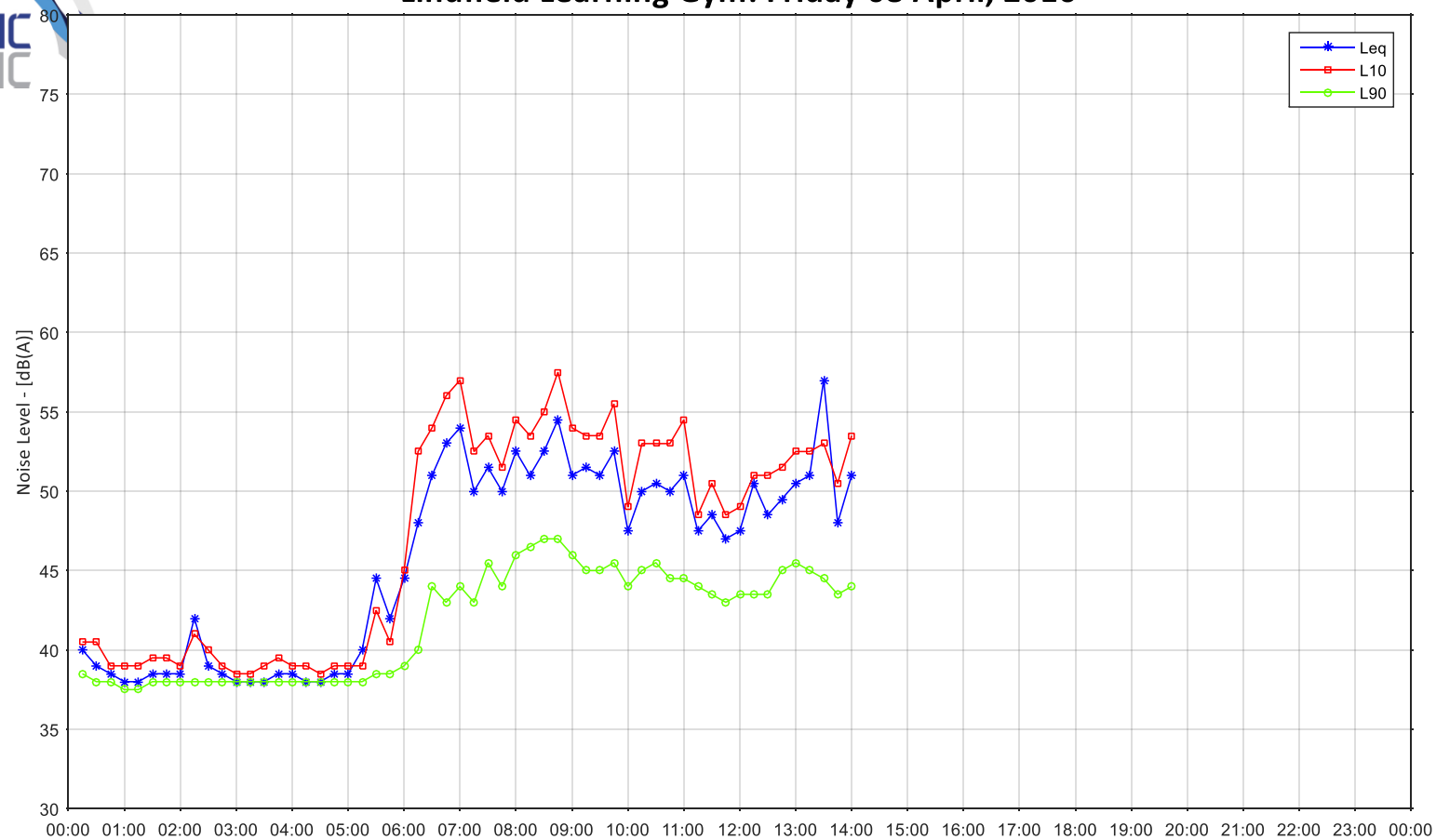
Lindfield Learning Gym: Wednesday 06 April, 2016



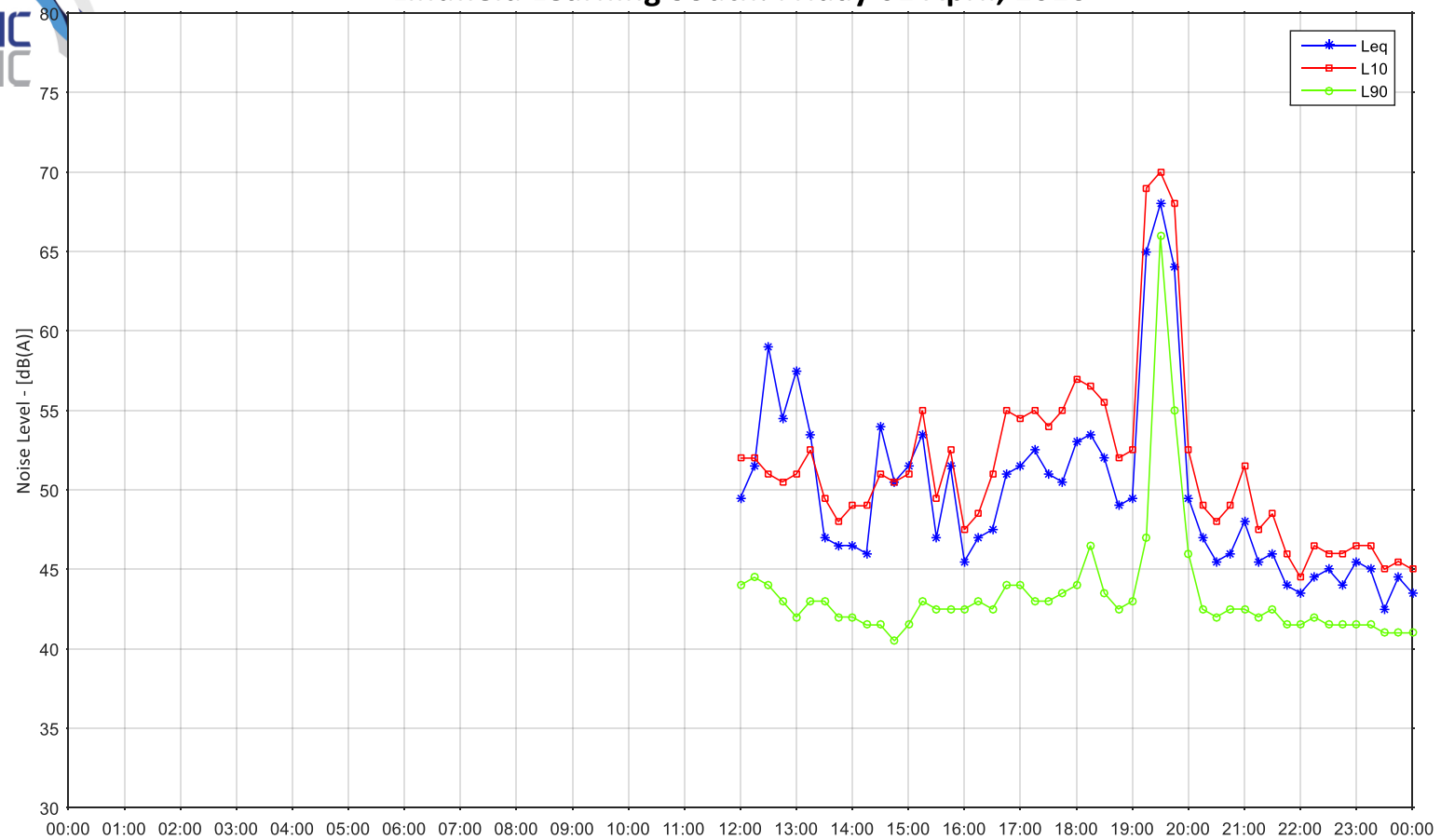
Lindfield Learning Gym: Thursday 07 April, 2016



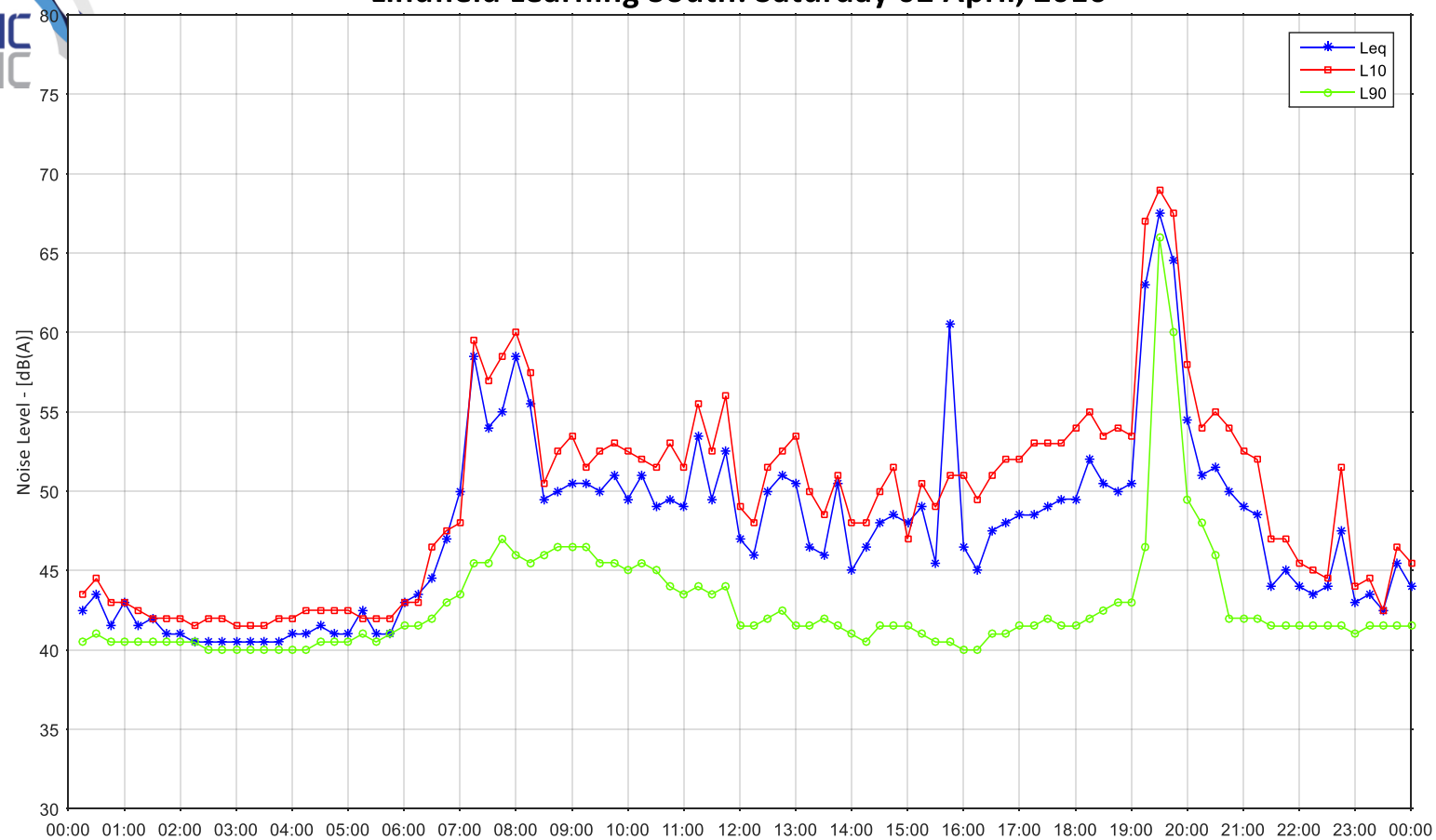
Lindfield Learning Gym: Friday 08 April, 2016



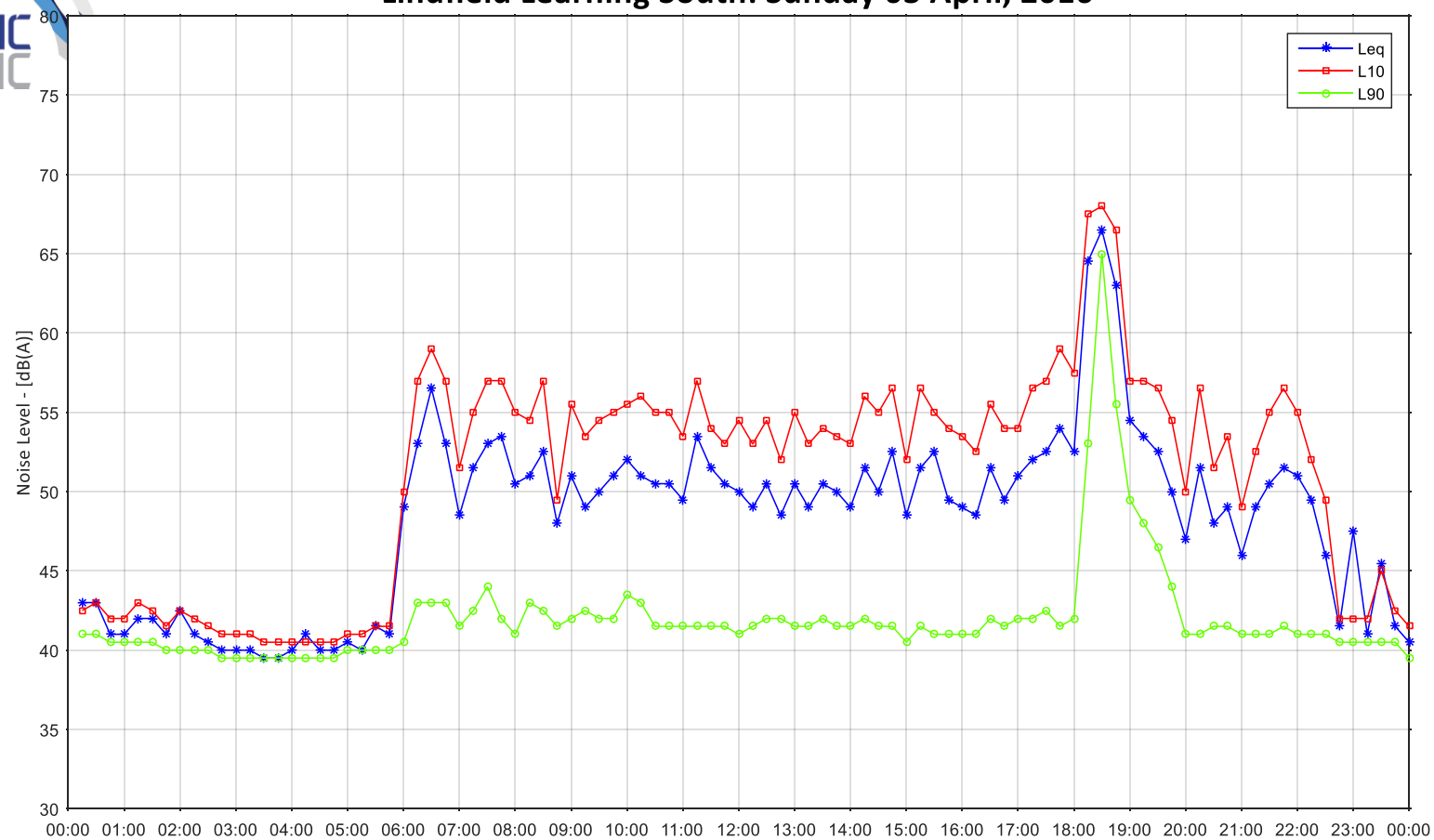
Lindfield Learning South: Friday 01 April, 2016



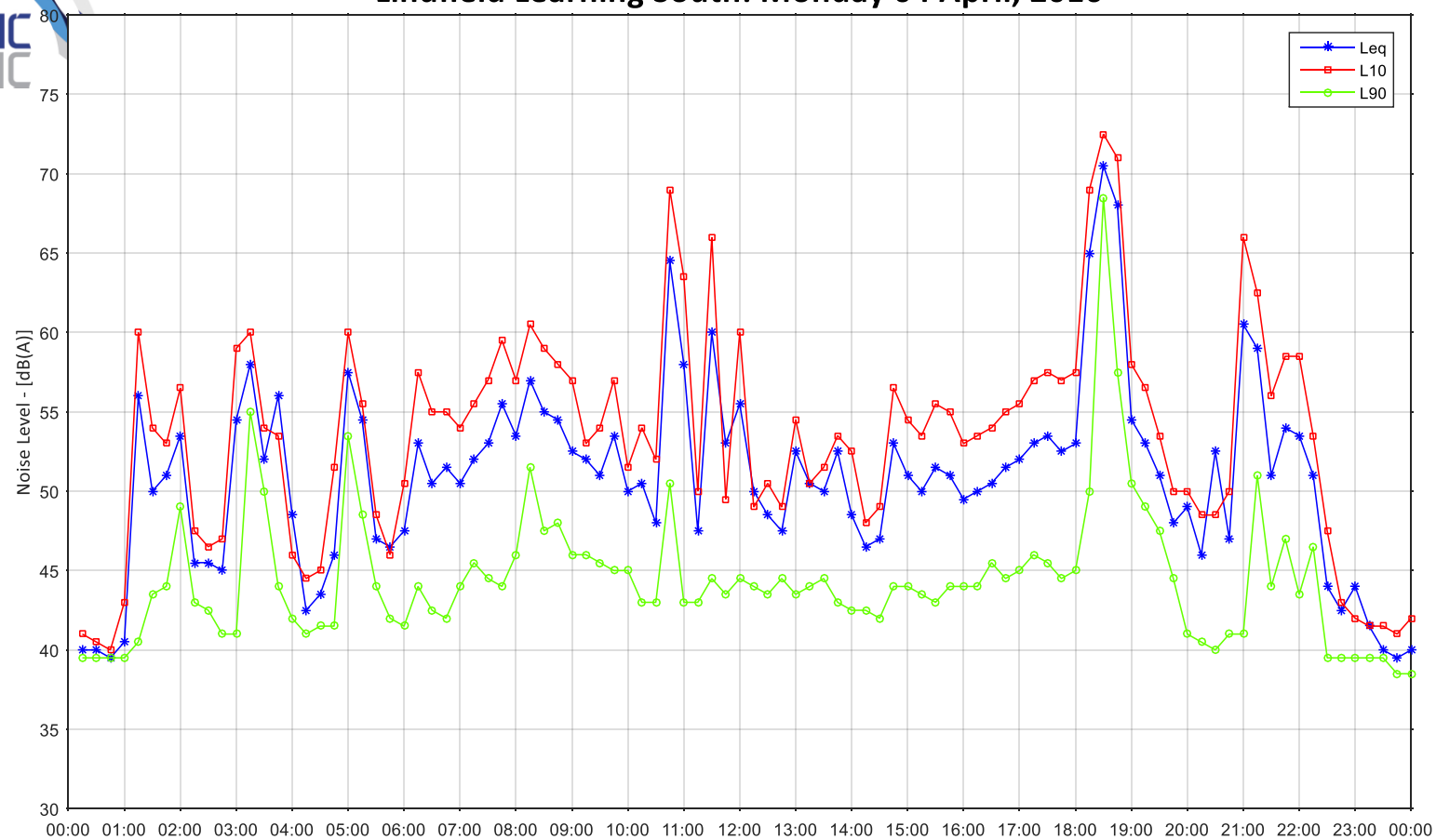
Lindfield Learning South: Saturday 02 April, 2016



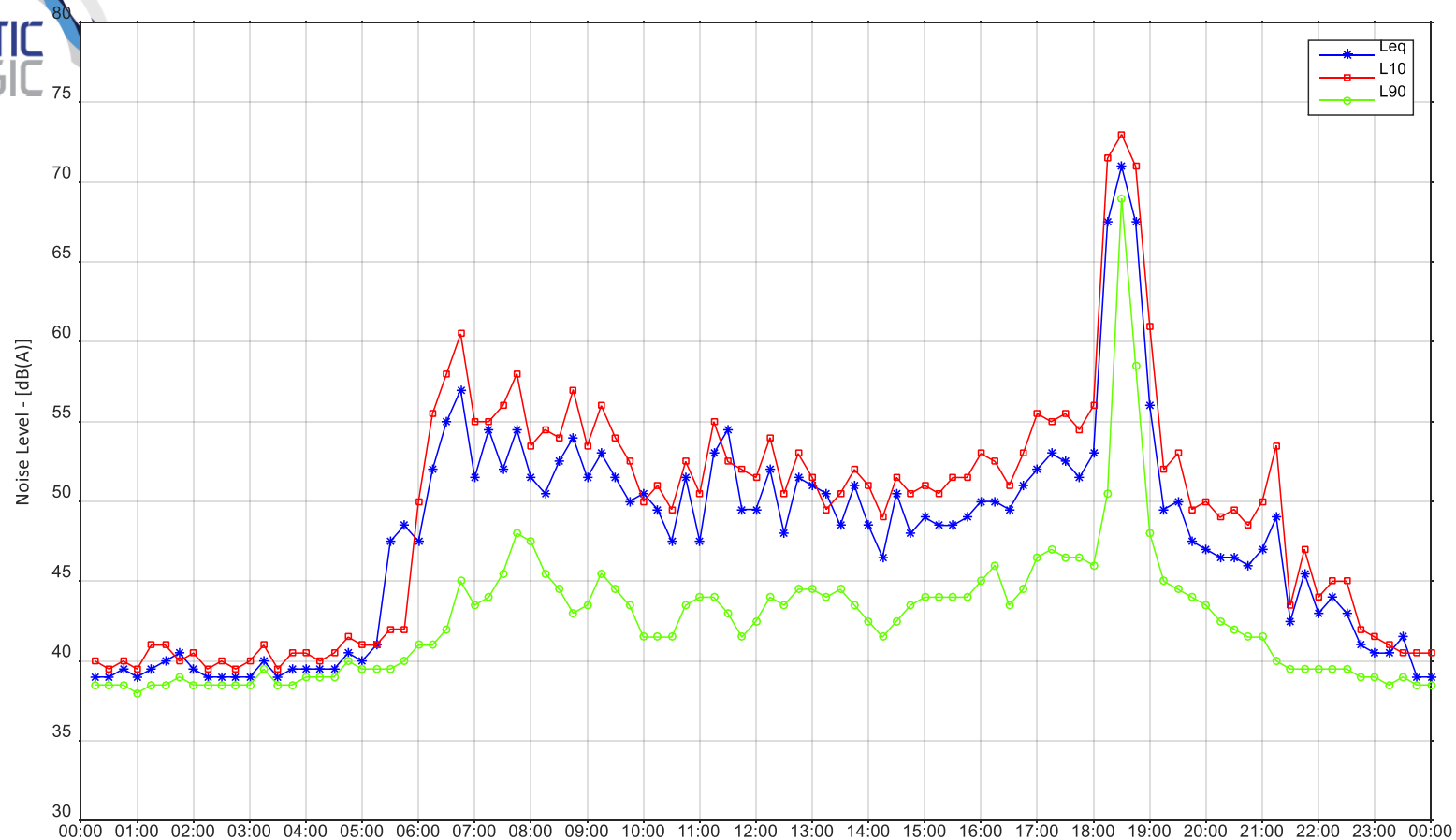
Lindfield Learning South: Sunday 03 April, 2016



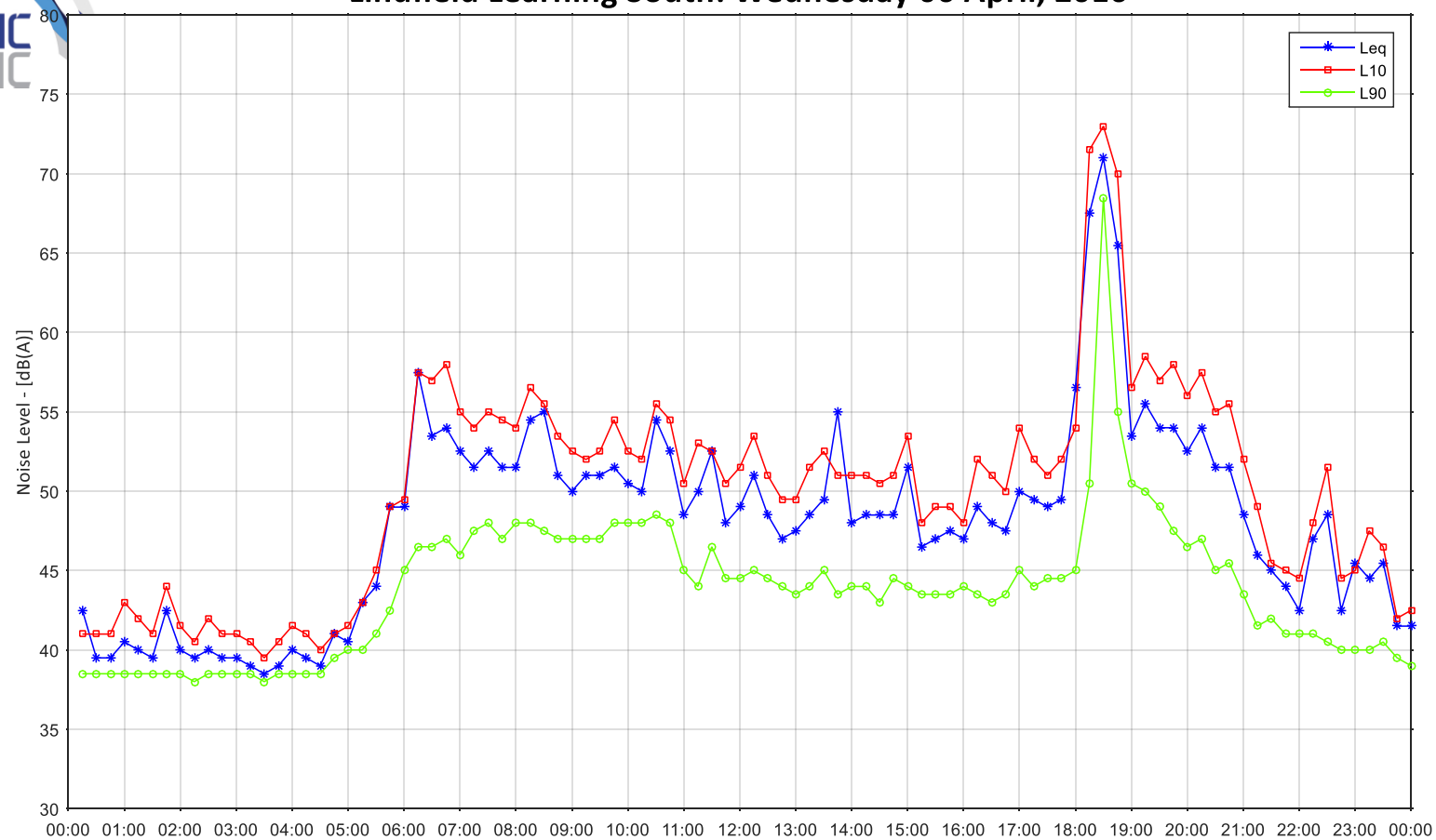
Lindfield Learning South: Monday 04 April, 2016



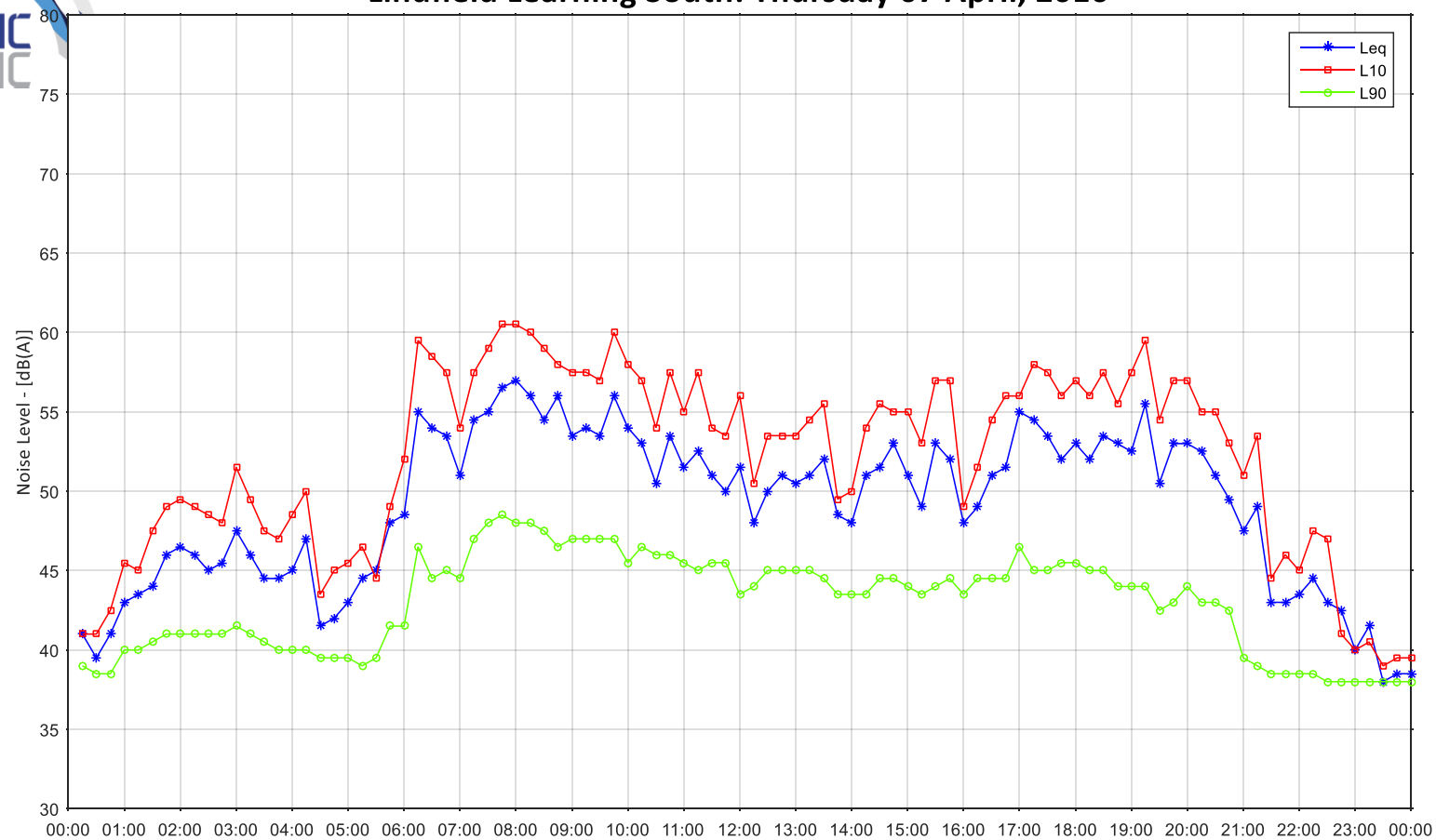
Lindfield Learning South: Tuesday 05 April, 2016



Lindfield Learning South: Wednesday 06 April, 2016



Lindfield Learning South: Thursday 07 April, 2016



Lindfield Learning South: Friday 08 April, 2016

