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Green Square Integrated Community Facility and School

Noise & Vibration Impact Assessment

SSD 10381

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1 INTRODUCTION

This Noise Impact Assessment has been prepared by Acoustic Logic Consultancy (ALC) for the development known as the Green Square Integrated Community Facility and School, located at 3 Joynton Street Zetland.. This is a joint project between School Infrastructure NSW and City of Sydney.

The development will comprise a four-storey building made up of various indoor and outdoor functional spaces including:

- Primary education facilities for up to 600 kindergarten to year 6 students
    - Indoor and outdoor learning spaces
    - Administration and staff rooms
    - Library and School community hall
- shared multi-function spaces within for school and community use
    - 2 x multipurpose community facilities rooms to be operated solely by City of Sydney
    - 2 x multipurpose rooms to be shared by the City of Sydney and the primary school
- At ground level there is:
    - play spaces which will be a shared use between school and community.
    - multipurpose games court

This report has been prepared to assess the potential acoustic impacts of the development. In this report, we will:

- Identify nearby noise sensitive receivers and operational noise sources with the potential to adversely impact the nearby development.
- Identify relevant noise emission criteria applicable to the development.
- If necessary, determine building and/or management controls necessary to mitigate potential noise and vibration impacts.
- Provide a preliminary review of construction noise and vibration impacts from the proposed development.

The proposed layout of the school buildings provides a partially enclosed rooftop play area, with other active play areas (including sports courts) located on the ground level. Currently proposed layout of school buildings and primary noise sources are detailed in Figures 2 & 3.

This assessment has been based on the architectural drawings provided by BVN Architecture (Project Number: 1908014, Issue 2, Dated 19/03/2021).

1.1 RESPONSE TO SEARS

This report addresses the requirements detailed by the Secretary's Environment Assessment Requirements (SEARs) for SSD 10381. Table 1 presents the relevant SEAR's requirements and relevant reference within this report. It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 10381) for the new Green Square Integrated Community Facility and School.

Table 1 - SEARs and Report Reference

SEARs Item	Requirement	Report Reference
6. Environmental Amenity	Assess amenity impacts on the surrounding locality, including solar access, visual privacy, visual amenity, overshadowing and acoustic impacts.	Sections 5-9
	Identify any proposed use of the school outside of school hours (including weekends) and assess the resultant amenity impacts on the immediate locality and proposed mitigation measures.	Sections 2 & 5-6
	Detail amenity impacts including solar access, acoustic impacts, visual privacy, view loss, overshadowing and wind impacts. A high level of environmental amenity for any surrounding residential land uses must be demonstrated.	Sections 5-9
13. Noise and Vibration	Identify and provide a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation, construction. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.	Section 9
	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 impact on surrounding occupiers of land.	Sections 5-9
	An assessment of the likely vibration amenity and structural impacts of the project under the German Standard DIN 4150-3 Structural Vibration – Effects of vibration on structures, including consideration of impacts to the structural integrity and significant of heritage items.	Section 9
	<u>Relevant Policies and Guidelines:</u> • 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)	Sections 5-9

2 SITE DESCRIPTION AND PROPOSED WORKS

2.1 SITE DESCRIPTION

The proposed location of Green Square Public School is between Portman Street and Joynton Avenue, within the Green Square precinct. Surrounding land uses and potential noise impacts associated with the site are as follows;

- Joynton Avenue to the east of site, which carries a moderate volume of road traffic.
- Zetland Avenue bounding the site to the north, which is yet to be constructed. Further north of this is a multistorey residential development currently under construction.
- Portman Street bounding the site to the west, which carries a low to moderate volume of road traffic. Further west is a proposed public open space which is yet to be constructed.
- South west of the site across Portman Street is an existing multi storey residential development.

A site map detailing the site and measurement locations is presented in Figure 1.

2.2 NEARBY NOISE RECEIVERS

Based on the site investigations, the following receivers are those most likely to be potentially impacted by the proposed school development, given their proximity to the school facility. Residential receivers 1, 2 & 3 are located closest to the proposed development, whilst other noise sensitive receivers are located a greater distance from the site and as such will be exposed to lower noise levels from both construction and operation. By demonstrating compliance with noise emission goals at the closest receivers, appropriate noise levels will also be achieved further from the site.

A summary of the potentially noise affected receivers is summarised below.

Receiver 1: Existing residential development at 105-115 Portman Street, Zetland.

Receiver 2: Green Square Site 15 approved residential development, not yet under construction.

Receiver 3: 811 Elizabeth Street, Zetland. Residential development currently under construction north of site.

Receiver 4: Existing childcare centre bounding the site to the east.

Receiver 5: Existing residential development, EON Apartments

Receiver 6: Aquatic Centre

Receiver 7: Existing residential development at 130 Portman Street, Zetland.

Refer to Figure 1 for detail and measurement locations.

2.3 PROPOSED SCHOOL OPERATION

The following table describes the general operation of the school as currently proposed.

Table 2- School & Community Uses Operating Times

Item	Use	Times
General	The proposed Green Square Public School will cater for students K- Year 6, with a capacity of 600 students	General operating hours for the school will be Monday – Friday 8am – 3.30pm.
Shared Space Ground Floor	Courtyard, Communal Hall, Multipurpose Space 2 and Sports Court	School Use 7am – 6:30pm Monday – Friday during School Terms Community Use 6:30pm – 10:30pm Weekdays 8am – 10:30pm Weekends & School Holidays
OOSH	Out of school hours (OOSH) use, utilising the ground floor courtyard, sports court, communal hall and multipurpose space 2.	7am – 8am & 3:30pm – 6:30pm (During School Term) 7am – 6:30pm (School Holidays)
Library	Located on Level 3, intended use by school only.	Within general operating hours for the school Monday – Friday 8am – 3.30pm.
Dedicated Community Multipurpose Space on Ground Floor	Community use of the ground floor multipurpose space is currently proposed, to be operated by City of Sydney.	8am – 10:30pm Any Day

Figure 1 – Site Survey and Unattended Measurement Locations

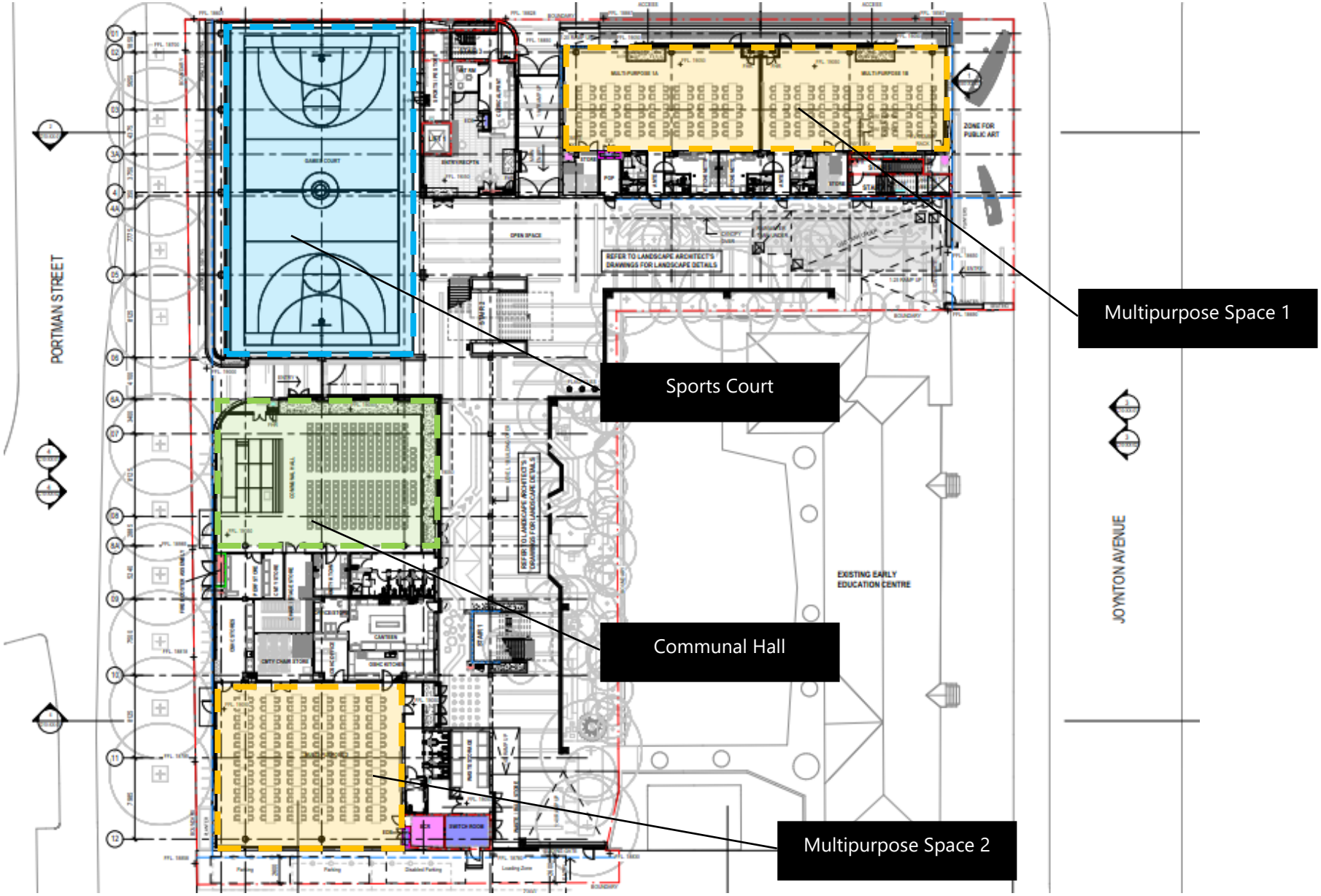


Figure 2 – Ground Floor Layout, Indicating Sports Court and Multipurpose Spaces

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.

The L_{max} level represents the loudest noise event during a measurement period.

4 SURVEY OF ENVIRONMENTAL NOISE LEVELS

Long term unattended noise monitoring was conducted to quantify the existing acoustic environment at the site. It is noted that there is ongoing development in the area, and so some periods during the daytime may have been impacted by construction noise. Attended background noise measurements were taken in the absence of any construction noise to verify the measured rating background noise level is representative.

4.1 MEASURED NOISE LEVELS

Long term unattended noise measurements were undertaken between the 1st and 8th of July to determine the existing acoustic environment of the surrounding area. The noise monitor was placed at 1.5m above ground level and at approximately 10m from Joynton Avenue.

The unattended monitoring was conducted using Acoustic Research Laboratory noise loggers. The loggers were programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period.

The measured background noise levels have been processed and are summarised below.

Table 3 – Measured Rating Background Noise Levels

Location	Period/Time	Background Noise Level dB(A) L_{90}
Along Portman Street, on the Western Boundary of site (refer to Figure 1)	Day (7:00am – 6:00pm)	49
	Evening (6:00pm – 10:00pm)	48
	Late Evening (10pm – 11pm)	47
North of Site, on Boundary of Northern Residential Receiver (refer to Figure 1)	Day (7:00am – 6:00pm)	50
	Evening (6:00pm – 10:00pm)	45
	Late Evening (10pm – 11pm)	43
East of Site Along Joynton Avenue (refer to Figure 1)	Day (7:00am – 6:00pm)	50
	Evening (6:00pm – 10:00pm)	45
	Late Evening (10pm – 11pm)	43

It is noted that the day-time background noise levels as presented above have been intermittently affected by noise from construction activities around the site. In order to obtain a conservative estimate of the actual background noise levels, the background levels immediately prior to construction commencing (7am) and after it ceased (typically 5pm to 6pm weekdays and 3pm Saturdays) were also considered.

Attended measurements at the monitoring location and adjacent residential receivers to the west were taken on the afternoon (5pm to 6pm) of 25th of August, 2020 (refer Figure 1 for location). Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

Measurements were undertaken to confirm the measured background noise level was consistent with that of the long term unattended noise monitor on site, and that the measurement was background level determined was unaffected by construction noise – there was no construction activity for the duration of attended noise measurements. Measured noise levels are presented below.

Table 4 –Attended Background Noise Measurements

Location	Period/Time	Background Noise Level dB(A) $L_{90(15min)}$
At Unattended Monitoring Location	Daytime (5pm – 5:30pm)	51
Attended Noise Measurements Geddes Avenue, Adjacent to Existing Residential Receivers	Daytime (5:30pm – 6pm)	51

The attended noise measurements were consistent between both locations, and are marginally higher than the measured daytime rating background noise levels. This indicates that the daytime rating background noise levels at the monitoring position are representative of the surrounding residential receivers.

5 OPERATIONAL NOISE EMISSION CRITERIA

Operational noise sources associated with the school are generally expected to include mechanical services (e.g. air conditioning plant), use of any school hall/multipurpose rooms for functions etc. (both during and outside school hours), use of public address/school bell and community use of the facility after school hours. This section will outline relevant noise emission criteria to determine potential acoustic impacts on surrounding noise sensitive receivers.

There are no specific EPA criteria applicable to the acoustic assessment of schools. The NSW Educational SEPP requirement relating to noise emissions is:

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

NSW Department of Education -EFSG:

Noise emission considerations include:

- *Noise emission from school activity (e.g.: music performance, sporting activity)*
- *Noise emission from a mechanical services (such as air conditioning unit or fan)*

Other relevant guidelines which will form a basis for this assessment are provided below:

- EPA Noise Policy for Industry 2017 (NPI) – applicable for plant/equipment noise
- Development Near Rail Corridors and Busy Roads –Interim Guideline (Department of Planning 2008) (to assess noise from traffic on the subject development)

We note that the EPA Noise Policy for Industry noise trigger levels are not strictly applicable to school developments. They are primarily intended to assess noise emissions from industrial/commercial developments. However, it is the most useful guideline policy for the assessment of plant and equipment noise impact to surrounding receivers.

In our experience it is common in the assessment of noise generation by schools that compliance with acoustic guidelines (in particular noise from playgrounds and during pick up/drop off) is not required (and for schools located in residential areas, it is in fact generally not achievable). The NSW Educational SEPP requires noise emissions from school buildings to be limited, and there is no requirement related to external uses.

An outline of relevant acoustic criteria is presented below.

5.1 EDUCATIONAL SEPP

The following table outlines the criteria to assess noise emissions from school buildings:

Table 5- NSW Educational SEPP Criteria

Location	Time of Day	Rating Background Noise Level dB(A)L_{90}	Education SEPP Criteria dB(A) $L_{eq(15min)}$ (Background + 5dB)
Residents Surrounding	Day Time (7am – 6pm)	49	54
	Evening (6pm-10pm)	48	53
	Late Evening (10:00pm – 11pm)	47	52

5.2 EPA NOISE POLICY FOR INDUSTRY (NPI)

The EPA NPI provides guidelines for assessing noise impacts from developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPI has two requirements which must both be complied with, namely an amenity criterion and an intrusiveness criterion.

5.2.1 Intrusiveness Noise Level

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). A summary of the relevant intrusiveness levels are presented in the table below.

Table 6 - NPI Intrusiveness Noise Levels

Receiver	Time of day	Background Noise Level dB(A)$L_{90(Period)}$	Intrusiveness Criteria (Background + 5dB(A)$L_{eq(15min)}$
Residents Surrounding Site	Day (7:00am-6:00pm)	49	54
	Evening (6:00pm-10:00pm)	48	53
	Late Evening (10:00pm – 11pm)	47	52

5.2.2 Amenity Noise Level

The EPA's NPI sets out acceptable noise levels for various localities. The recommended noise amenity area is based upon the measured background noise levels at the sensitive receiver. Based on the measured background noise levels detailed in Table 3, the Noise Policy for Industry suggests the adoption of the 'urban' categorisation.

The guideline is intended to limit the absolute noise level from all noise sources to a level that is likely to be acceptable and meet subjective expectations for a majority of communities.

In order to standardise the time period for assessment, he NPI recommends amenity noise levels presented as an $L_{eq(15min)}$, equivalent to the intrusiveness level, by adding 3dB to the relevant amenity goal. The project amenity goal is then calculated in the following manner:

$$L_{Aeq,15min} = \text{Recommended Amenity Noise Level} - 5\ dB(A) + 3\ dB(A)$$

The amenity levels appropriate for the receivers surrounding the project site are presented in Table 7

Table 7 – EPA NPI Amenity Noise Levels

Type of Receiver	Time of day	Recommended Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq(15min)}$
Residential – Urban	Day	60	58
	Evening	50	48
	Night	45	43
Commercial premises	When in use	65	63
Active Recreation Area	When in use	55	53

5.2.3 Sleep Arousal Assessment

In addition to the above, the NSW EPA *NPfI* provides an assessment procedure for assessing any potential sleep arousal impacts for when any noise is generated between 10:00pm and 7:00am (i.e. night period). Sleep arousal is a function of both the noise level and the duration of the noise.

As recommended in the *NPfI*, to assess potential sleep arousal impacts a two-stage test is carried out:

- Step 1 – Section 2.5 *Maximum noise level event assessment* from the NPfI states the following:

  Where the subject development/premises night-time noise levels at a residential location exceed:

  - $L_{Aeq,15min}$ *40dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
  - L_{AFmax} *52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater,*

  a detailed maximum noise level event assessment should be undertaken.

- Step 2 - If there are noise events that could exceed the average/maximum criteria detailed in the tables above, then an assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number of occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA *NPfI*, this more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy. Most relevantly, the Road Noise Policy states:

  For the research on sleep disturbance to date it can be concluded that:

  - *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep.*
  - *One to two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.*

5.2.4 Summarised NPI Project Noise Trigger Levels

Table 8 – Summarised NPI Project Noise Trigger Levels

Receiver	Time of Day	Intrusiveness Level dB(A) $L_{eq(15min)}$	Amenity Level dB(A) $L_{eq(15min)}$	Sleep Arousal
Residents Surrounding Site	Daytime (7am – 6pm)	**54**	58	-
	Evening (6pm – 10pm)	53	**48**	-
	Late Evening (10:00pm – 11pm)	52	**43**	**52 dB(A) $L_{eq(15min)}$** **62 dB(A) $L_{max(fast)}$**
Commercial Premises	When in Use	-	63	-
Active Recreation Area (Park)	When in use	-	53	-

Bolded values in the table above indicate governing project noise trigger levels

6 OPERATIONAL NOISE EMISSION ASSESSMENT

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

- Noise from internal areas
- Noise from mechanical plant.
- Waste Removal
- External activities
- Community use of sports courts and multipurpose areas after school hours.
- Noise from public address system and school bell.

6.1 NOISE FROM INTERNAL SPACES

6.1.1 Teaching Spaces

The administration and teaching spaces generate low to medium levels of noise. The teaching spaces are typically at least 25-35m from any residential receiver. Emissions from these spaces would be expected to readily comply with the SEPP (Education) requirements.

6.1.2 Multipurpose Rooms and Communal Hall

The ground floor layout of the school contains two multipurpose rooms on the northern façade, a multipurpose room on the south western corner, and a communal hall along the western façade.

All of these spaces contain large areas of fixed glazing, as well as entrance doors on the façade. In addition to use throughout the daytime period associated with the school, evening community use of the spaces may also be expected. During school hours the noise emission requirements of the Education SEPP apply (BG+5), and at night it is proposed that the NPI project noise trigger levels be applied.

Noise emissions to the surrounding properties have been calculated based on the following assumptions:

- Internal noise level of 85 dB(A) $L_{eq,15min}$, representing the sound level during a music performance.
- When used for the purposes of amplified music or functions, external doors will be closed. Doors are to have a minimum sound insulation rating of R_w30.
- Fixed façade elements are constructed of 12.38mm glazing with minimum performance of R_w 37.

Table 9 – Predicted Noise Levels from Use of Multipurpose Rooms and Hall

Space	Receiver Location	Predicted Noise Level	Noise Objective	Comments
Multipurpose Rooms 1A & 1B	R2/R3 (Future Residents North of Site)	<40 dB(A) $L_{eq(15min)}$	≤ 54 dB(A) $L_{eq(15min)}$ (daytime, Education SEPP)	Achieves Noise Objective
Multipurpose Room 2	R1 (Existing Residents West of Site)	<40 dB(A) $L_{eq(15min)}$	≤ 54 dB(A) $L_{eq(15min)}$ (daytime, Education SEPP)	Achieves Noise Objective
Community Hall	R1 (Existing Residents West of Site)	<40 dB(A) $L_{eq(15min)}$	≤ 54 dB(A) $L_{eq(15min)}$ (daytime, Education SEPP)	Achieves Noise Objective

For less noise intensive activities such as general teaching activities (without amplified sound equipment), windows or doors could be opened to allow for ventilation whilst still meeting relevant noise emission requirements.

6.2 NOISE FROM MECHANICAL PLANT

Given the proposed buildings are remote from existing and future residential buildings, it is both possible and practical to treat noise from the operation of the proposed mechanical equipment to comply with the EPA NPI criteria less 10 dB(A) which is detailed below to avoid cumulative noise impact from mechanical plant items to the residential receivers:

Table 10 – Plant Noise Emission Criteria

Receiver	Time Period	dB(A)$L_{eq\ 15min}$
Residential Boundary	Day	44
	Evening	38
	Late Evening	33
Commercial	When In use	53
Active Recreation Area	When in use	43

Preliminary mechanical services drawings provided by Stantec (Project Number 301346826, Revision F, dated 19/03/2021) have been reviewed for noise emissions from proposed equipment layouts and plant item selections. Based on the review, the proposed mechanical services are capable of achieving the above noise emission targets.

It is recommended that a further review of mechanical services proposed for the site be undertaken during the detailed design phase of the project to ensure that any alterations to layouts or proposed equipment is able to meet the acoustic requirements for the site.

6.3 WASTE REMOVAL

Waste collection from the site will be in accordance with the Operational Waste Management Plan, and be undertaken during routine collections within the area. Given the collection will be part of the regular waste collection for the area, there will be no additional noise impacts generated by the school

6.4 NOISE FROM SCHOOL BUILDINGS PUBLIC ADDRESS SYSTEM AND SCHOOL BELL

With regard to the school bell/PA system, the system should minimise noise spill to adjacent properties. General design principles which could be used to manage this noise include the following:

- 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.

6.5 NON-SCHOOL USES, AND AFTER HOUR SCHOOL ACTIVITIES

Noise generating after hour school activities would largely relate to use of the multipurpose rooms, communal hall and sports court, which have been described and assessed in the preceding sections of the report. There may also be other "quiet" or passive activities as part of the community use of the school ground that may occur externally or within the buildings that would not result in significant emissions. This would include parent/teacher nights, election activities, etc. Where music practice occurs within a school classroom outside of normal hours the windows of the rooms should be kept closed.

Given the use of these facilities will extend to the evening period, and also be outside of school operation, a more stringent noise emission criteria will be required in order to minimise noise impact to surrounding residents. Whilst not strictly applicable to the development, for the community use of school facilities it is proposed to adopt the project noise trigger levels detailed in the NSW EPA NPI.

Noise levels from community use of these facilities will be similar to those during school operating hours, and the same assumptions have been applied.

Noise levels from use of the sports court have been predicted at the receiver locations using SoundPlan™ modelling software implementing the ISO 9613-2:1996 *"Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation"* noise propagation standard. SoundPlan images detailing the results of the simulation are detailed in the appendices of the report.

Predicted noise levels to façades have included absorption to the soffit above the court area. Absorptive treatment is to be applied to the fully practicable extent of the soffit and have a minimum absorptive performance of NRC > 0.9.

The cumulative noise from the simultaneous use of the sports court and Multipurpose Rooms/Hall have been predicted to surrounding residents during the evening period, and is presented in the table below.

Table 11 – Predicted Noise Levels from Use of Multipurpose Rooms and Hall

Space/Activities	Receiver Location	Predicted Noise Level	Noise Objective	Comments
Sports Court / Multipurpose Rooms 1A & 1B	R2/R3 (Future Residents North of Site)	48 dB(A) $L_{eq(15min)}$	≤ 48 dB(A) $L_{eq(15min)}$ (evening, NPI)	Achieves Noise Objective
	Public Open Space West of Site	53 dB(A) $L_{eq(15min)}$	≤ 53 dB(A) $L_{eq(15min)}$ (NPI Amenity Level)	Achieves Noise Objective
Communal Hall / Multipurpose Room 2	R1 (Existing Residents West of Site)	35 dB(A) $L_{eq(15min)}$	≤ 43 dB(A) $L_{eq(15min)}$ (Late Evening, NPI)	Achieves Noise Objective

With regard to community use of the external sports court after 10pm, we note the following:

- The relevant night time project amenity level for residents surrounding the site (urban) is 40 dB(A) $L_{90(period)}$, which applies over the full night time period (10pm – 7am) and also considers the potential cumulative impacts of other development in the area.
- The amenity level is intended to limit continuing increases in the background noise levels of an area. Given the sports courts would only be operating for a limited extent of the night time period (approximately 10%), the use during this time period would not result in an increase to the measured rating background noise level for the night time period.

- The NPI provides a conversion of the period amenity level, such that it can be directly compared to the 'intrusive' level, which is assessed over a 15 minute period. The standard adjustment is to add 3dB(A) to the project noise level, effectively equating to the assumption that the noise source in question would be operating for only 50% of the time.
- In this case, the sports court would only be operating for approximately 10% of the time, and so it would be reasonable to justify an alternative adjustment to the project amenity level utilising the same approach as the NPI. For a noise source which would be operating for only 10% of the relevant amenity period, an increase of up to 10dB(A) could be considered (assuming that there is no noise generated from the use between 11pm and 7am the following day). This corresponds to a 'late evening' amenity level of 50 dB(A) $L_{eq(15min)}$.
- When considering the potential intrusive impacts from the use, it must be noted that between the evening and late evening period, the reduction in background noise level is only 1-2dB(A) at any residential receiver near to the site. This is an imperceptible reduction in the background noise level.
- The proposal for the use of the sports courts is to extend use up to 11pm each evening, which would be considered as a shoulder period under the NSW EPA NPI. The background noise level at this time at the closest residential receivers is 48 dB(A) $L_{90(period)}$, and so the predicted noise from the sports courts would be significantly below the 'intrusive' noise requirement of the NPI.
- In light of the above, use of the external sports courts can be justified up to 11pm. We note that the bookable time for the courts may need to be marginally reduced (up to 10:45pm, for example), which would allow for occupants of the space to depart the facility prior to 11pm. It would also not be recommended that whistles be used after 10pm.

It is proposed that there would be an outside of hours school care facility which operated from the school both before and after regular school hours. This facility would typically operate between 7am – 8am (before school) and 3pm – 6:00pm (after school). Cleaning of the facility would occur between 6-6:30pm, before handover to community use of the facilities.

OOSH would operate at the same times during vacation periods of the school term, and also include regular school hours, i.e. vacation care would accommodate students between the hours of 7am – 6pm. Noise impacts during this time are likely to be lower than during the regular school term, as the number of students attending vacation care will be substantially reduced as compared to the school term.

During OOSH times it would be expected that students would make use of ground floor external areas of the school as well as internal activities within Multipurpose Room 2 and the communal hall on the southern portion of site.

Provided the façade to the west and south is closed, internal use of the space (including moderate amplified music) would meet the cumulative noise emission requirements to surrounding residents. External activities would presumably occur mostly in the courtyard area immediately outside the multipurpose rooms, adjacent the communal hall and within the sports court. Noise screening provided by the building form would provide adequate acoustic separation to surrounding residents from use of the courtyard for external play. In order to minimise any potential disturbance, external use by the OOSH care should be limited prior to 7am or after 6pm.

It is recommended that a management plan for the out of hours care be prepared detailing the measures required to meet the noise emission requirements in Section 5 of this report – an acoustic assessment may be required to confirm the appropriateness of these measures. Provided that suitable management controls are implemented, it expected that operation of the out of school hours facility would be able to achieve the noise emission criteria.

7 OPERATIONAL VIBRATION EMISSION ASSESSMENT

There would be no vibration impact from the proposal as there would be no vibration sources that would produce perceptible vibration on any surrounding property.

8 NOISE INTRUSION ASSESSMENT

8.1 TRAFFIC NOISE LEVELS

Traffic noise levels have been measured on the roadways surrounding the site. There is a new roadway (Zetland Avenue) which will also be constructed on the northern boundary of the site. A summary of the façade noise levels measured at the site is presented in the table below.

Table 12 – Façade Traffic Noise Levels

Façade	Noise Level
Eastern - (Joynton Avenue)	66 dB(A) $L_{eq(1\ hour)}$
Western - (Portman Street)	60 dB(A) $L_{eq(1\ hour)}$

8.2 DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS –INTERIM GUIDELINE (DEPARTMENT OF PLANNING 2008)

The guideline recommends a maximum noise level within classrooms of 40 dB(A) $L_{eq,1hr}$.

8.3 RECOMMENDED TREATMENT

Glazing thickness has been marked and attached to this report with minimum R_w rating below.

Table 13 – Rw Rating for Glazing

Glazing Thickness	R_w Rating
6mm	29
6.38mm Lam	31
10.38mm Lam	35
12.38mm Lam	37

9 CONSTRUCTION NOISE ASSESSMENT

An assessment of likely construction noise impacts has been undertaken. The assessment includes:

- Identification of the noise and vibration guidelines which will be applicable to this project.
- Identification of potentially impacted nearby sensitive receivers.
- Identify likely sources of noise and vibration generation and predicted noise levels at nearby development.
- Formulation of a strategy to address the guidelines identified and including mitigation treatments.

9.1 SITE DESCRIPTION

Construction works for the proposed school will consist primarily of site establishment works, general construction activities and completion landscaping/external works. The proposal consists of a single building comprising a hall, general teaching areas and administrative offices, and sports court.

There are limited below ground / basement levels proposed, meaning that significant excavation and piling will not be required. Demolition of existing buildings on site will need to be undertaken prior to the beginning of main works. Construction works (and typical loudest plant/equipment) expected for the project are as follows:

- Demolition of existing structures
- Erection of building structure (powered hand tools for formwork, concrete pump, vibrators, crane);
- Internal fit out.
- Landscaping (front end loaders etc);

Standard work hours have been reviewed as part of this assessment, as detailed in the NSW EPA Interim Construction Noise Guideline and reproduced below:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- Sundays or Public Holidays: No work.

Note that construction works may be required outside of the above hours, however at this stage the specific activities, duration and times which may be required are not known. Where out of hours construction works may be required, these should be considered on a case by case basis and be supported by a review of the potential noise/vibration impacts and associated mitigation measures which may be considered to be reasonable and feasible.

9.2 RECEIVER LOCATIONS

Noise sensitive receivers are detailed in Section 2.2.

9.3 NOISE AND VIBRATION GUIDELINES

9.3.1 EPA Interim Construction Noise Guideline

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

- Determination of noise management levels (based on ambient noise monitoring);
- Review of generated noise levels at nearby development;
- Recommendation of noise controls strategies when noise management levels are exceeded.

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 affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.

- "*Highly noise affected level"*. Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary of the above noise management levels from the ICNG is presented below in Table 14. In order to present a conservative assessment, the lowest daytime rating background noise level determined from monitoring has been used as a basis for calculation of the 'Noise Affected Level'.

Table 14 – Noise Management Levels - Residential

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
All Residential Receivers	59	75

If noise levels exceed the exceed the management levels identified above, reasonable and feasible noise management techniques will be reviewed.

9.3.2 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 levels 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.

9.3.2.1 Structure Borne Vibrations (Building Damage Levels)

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

It is noted that the peak velocity is the 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 15 – 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

The surrounding recievers would generally be classified as follows:

- Residential – Type 2
- Commercial – Type 1
- Heritage/sensitive buildings – Type 1

9.3.2.2 Assessing Amenity

The NSW EPA document "*Assessing Vibration: A Technical Guideline*" provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings and is used in the assessment of vibration impact on amenity. Relevant vibration levels are presented below.

Table 16 – EPA Recommended Vibration Levels

		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

9.4 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

We note that demolition works associated with the site have already be addressed under a separate approval, and as such are not considered as part of this proposal. The primary noise and vibration generating sources associated with the construction of the facility are detailed below:

- Site Preparation
  - Trucks
  - Bobcat
  - Powered Hand Tools
- Bulk Excavation
  - Excavated Mounted Hammer
  - Trucks
  - Bobcat
- Construction
  - Concrete Pump
  - Trucks
  - Bobcat
  - Crane
  - Powered Hand Tools

The following table presents assessment noise levels for typical construction equipment expected to be used during the relevant construction phases of the project.

Table 17 - Sound Power Levels of the Typical Equipment

Equipment / Process	Sound Power Level dB(A)*
Excavator Mounted Hammer	120
Concrete Pump	110
Trucks	100
Bobcat	105
Crane (electric)	85
Powered Hand Tools	95-100

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).

9.5 NOISE PREDICTIONS

The predicted noise levels during excavation and construction will depend on:

- The activity undertaken.
- The distance between the work site and the receiver. The distance between the noise source and the receiver will vary depending on which end of the site the work is undertaken. For this reason, the predicted noise levels will be presented as a range.

Predicted noise levels are presented in the following tables. Predictions take into account the expected noise reduction as a result of distance only.

Table 18 – Predicted Noise Generation to Residential Receivers Surrounding Site

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Excavator Mounted Hammer	68 - 79	Exceeds Highly Noise Affected Management Level (HNAML)
Concrete Pump	58 - 69	Generally Exceeds Noise Affected Management Level (NAML)
Trucks	48 - 59	Within NAML
Bobcat	53 - 64	Generally Within NAML, Except when Operating at Boundaries of Site
Crane (electric)	< 50	Within NAML
Powered Hand Tools (Externally)	48 - 59	Within NAML

9.6 DISCUSSION – NOISE

During the site preparation phase, noise levels are expected to generally be below the noise affected management level, except for when bobcats or similar equipment would operate close to residential boundaries.

Noise at nearby sensitive receivers are likely to exceed the noise management levels from time to time, and depending on the specific process in use. Other than for the use of excavator mounted hammers which may be required during the excavation phase, noise emissions from construction activities are expected to be below the highly noise affected noise management level at all times. We note that the excavation of the site is relatively limited and likely to be of a short duration.

Use of concrete pumps during structural works of the construction phase are likely to exceed the noise affected management level, depending on the ultimate location it is placed on site (or surrounding streets). In order to minimise potential noise impact, it is recommended that the concrete pump be located as far as practicable from adjacent residential buildings, in order to maximise the distance between the source and receiver. It is also noted that concrete pumping works are generally intermittent (occurring for a single day at a time), and will be scheduled as part of the works. As such, notification of residents likely to be impacted may be considered.

In consideration of the above, reasonable and feasible mitigation should be applied in accordance with the *Control of Construction Noise and Vibration – Procedural Steps* outlined below. Additional time management also be required to manage noise impacts.

9.7 DISCUSSION - VIBRATION

Vibration impacts to the nearby heritage building are to be mitigated, primarily during the demolition stage. An initial level of 3mm/s is suggested, however if required a structural and heritage consultant may be needed to determine the potential impact of vibration on the building, and the current structural adequacy. It is likely that vibration monitoring will be required to ensure that vibration levels are not exceeded at the structure.

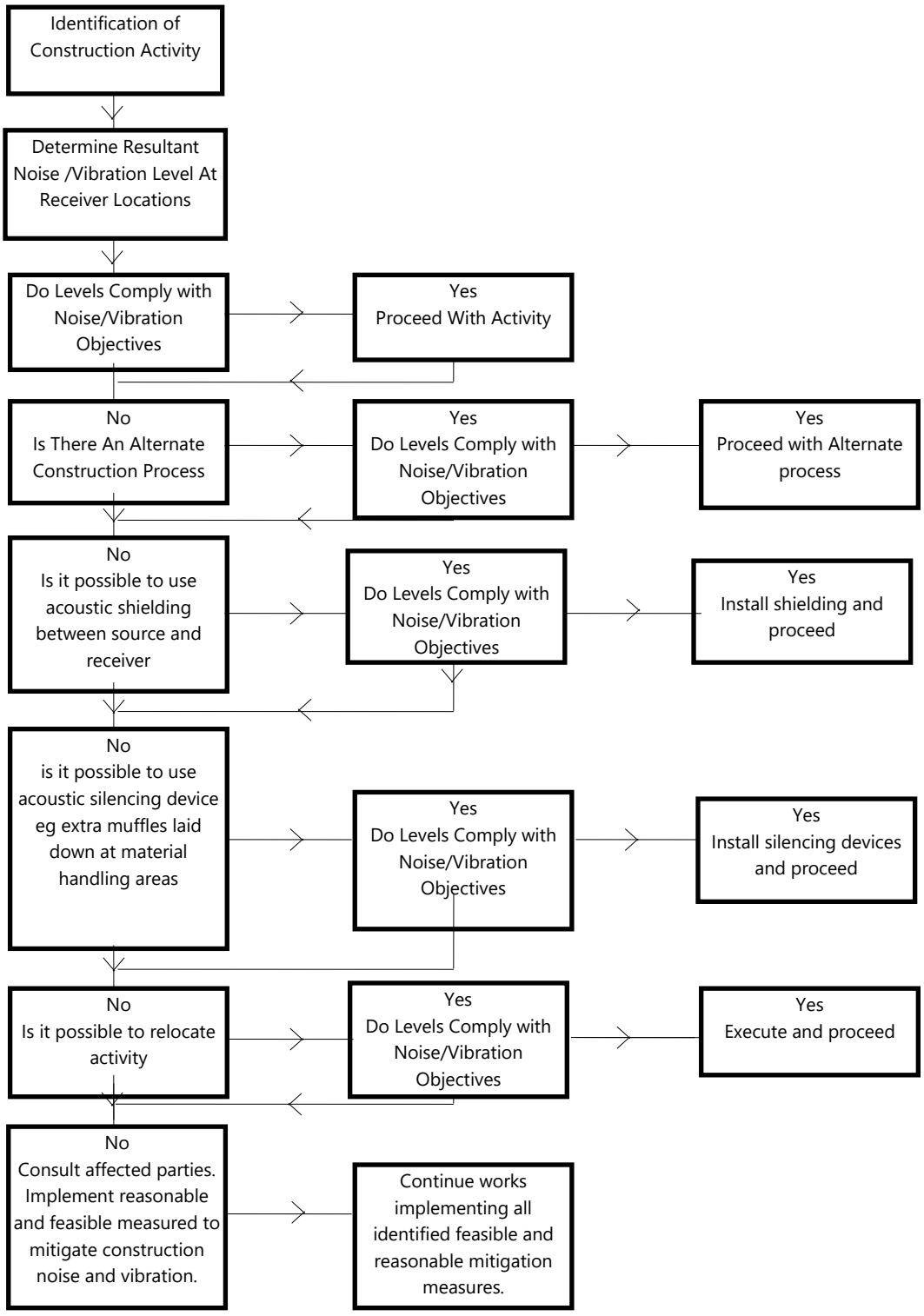
9.8 RECOMMENDATIONS

In light of the above, the following recommendations are made:

- A detailed noise management plan should be developed by the main contractor that describes in detail the construction phases, programme, processes and equipment used, noise impact assessment and proposed mitigation and management.
- Quiet work methods/technologies:
    - Materials handling/vehicles:
        - Trucks and bobcats to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.
        - Avoid careless dropping of construction materials into empty trucks.
        - Trucks, trailers and concrete trucks (if feasible) should turn off their engines during idling to reduce noise impacts (unless truck ignition needs to remain on during concrete pumping).
    - The location of concrete pumping trucks should be to maximise the distance to surrounding residents, where this is feasible with the working location.
- Complaints handling - In the event of complaint, the procedures outlined in Sections 9.9, 9.10 and 9.11 should be adopted.
- Site Induction:
    - A copy of the Noise Management Plan is to be available to contractors. The location of the Noise Management Plan should be advised in any site induction.
    - Site induction should also detail the site contact is to be notified in the event of noise complaint.
- Whilst not strictly required or considered as part of the NSW EPA *Interim Construction Noise Guideline*, it is likely that other projects in the vicinity of site may also be under construction during the project. Where this is the case, consideration should be given to the potential for cumulative noise/vibration impacts. If possible, feasible and reasonable mitigation measures should be implemented to minimise acoustic impacts on surrounding uses.

9.9 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that will be followed in assessing construction activities.



9.10 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS

In the event of complaints, there are a number of noise mitigation strategies available which can be considered.

The determination of appropriate noise control measures will be dependent on the particular activities and construction appliances. This section provides an outline of available methods.

9.10.1 Selection of Alternate Appliance or Process

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. Undertaking this activity using bulldozers, ripping and/or milling machines will result in lower noise levels. This measure has the potential to reduce noise emissions by 10 dB(A) or more.

9.10.2 Acoustic Barriers

Given the position of adjacent development, it is unlikely that noise screens will provide significant acoustic benefit for commercial or residential receivers but will provide noticeable improvement for those on ground level.

The placement of barriers at the source is generally only effective for static plant. Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

9.10.3 Material Handling

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

9.10.4 Treatment of Specific Equipment

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

9.10.5 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. A more detailed management plan will be developed for this project in accordance to the construction methodology outlining work procedures and methods for minimising noise.

9.10.6 Combination of Methods

In some cases, it may be necessary that two or more control measures be implemented to minimise noise.

9.11 ADDRESSING COMPLAINTS

Should ongoing complaints of excessive noise or vibration levels occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices.

If a noise complaint is received the complaint should be recorded. Any complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

10 SUMMARY OF RECOMMENDATIONS

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

- 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 in Table 9 which is 10 dB(A) lower than requirements of NPI and the detailed design to be done at CC stage.
- Indicative façade constructions are presented in Appendix 2. These are to be reviewed during the design finalisation process.
- The school hall doors and other large ventilation openings should be closed where the activity involves amplified loud music or speech.
- For the sports court, the full practicable extent of the soffit is to be lined with an acoustically absorptive material (NRC $\geq$ 0.9).
- Community use of the school buildings is acceptable up to 11pm, provided the management controls detailed above are adopted (i.e. closure of external façade). Community events should be organised to conclude by 10.45pm, so that occupants are able to exit the grounds prior to 11pm.
- Community use of the external portions of the school are to conclude at 11pm.
- Construction noise impacts should be managed as outlined in Section 9.8.

11 CONCLUSION

Noise emissions associated with the proposed Green Square Public School have been assessed with reference to relevant EPA and NSW Department of Education -EFSG guidelines.

The following noise emission sources have been addressed:

- Noise from internal areas
- Noise from mechanical plant, PA system and school bells.
- Waste Removal
- Community use of sports courts and multipurpose areas after school hours.
- Construction noise and vibration impacts.

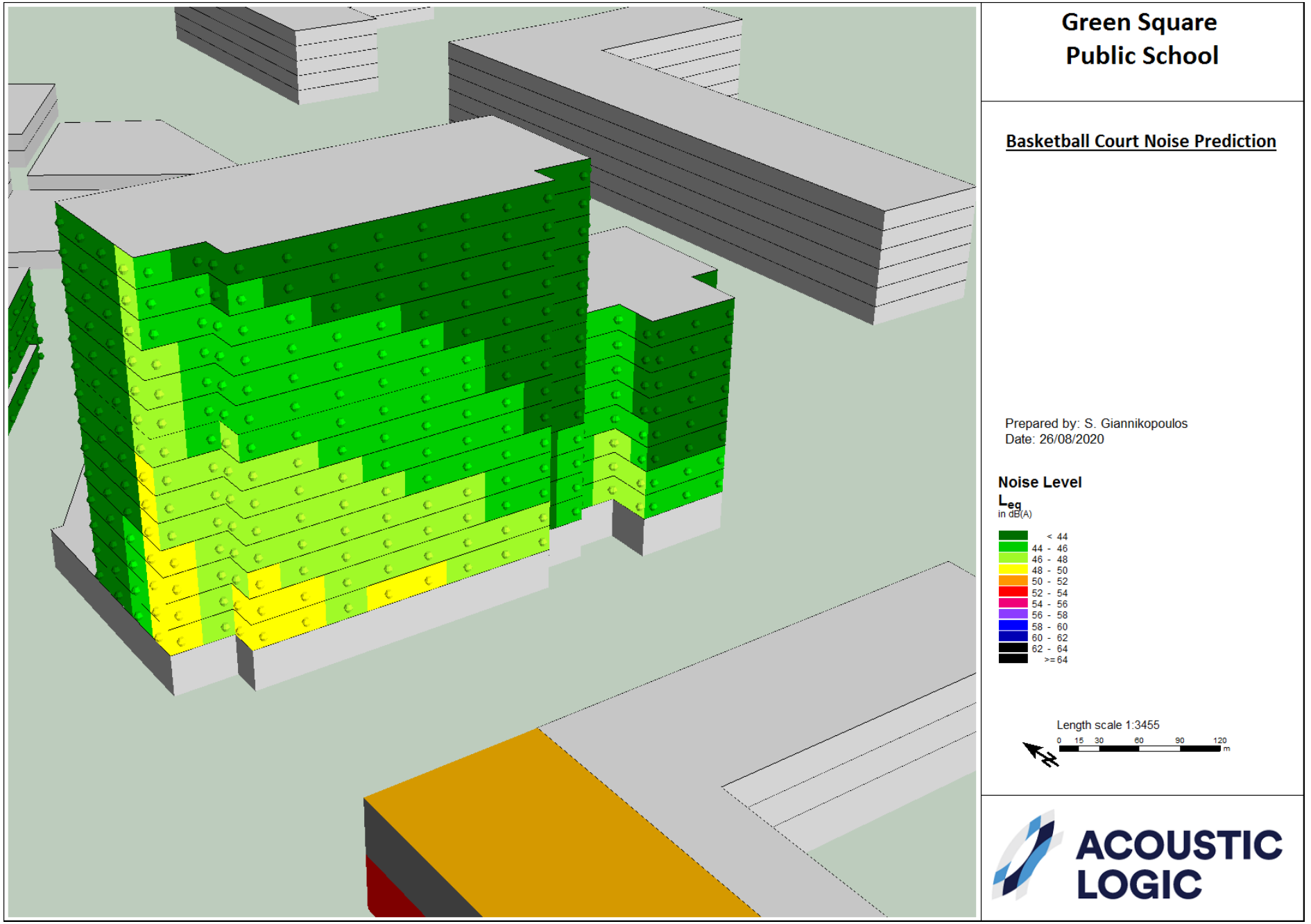
Recommendations have been made to ensure that noise emissions from the school do not adversely impact the surrounding properties. Provided the recommendations are adopted the proposed school will not adversely impact the acoustic amenity of surrounding receivers.

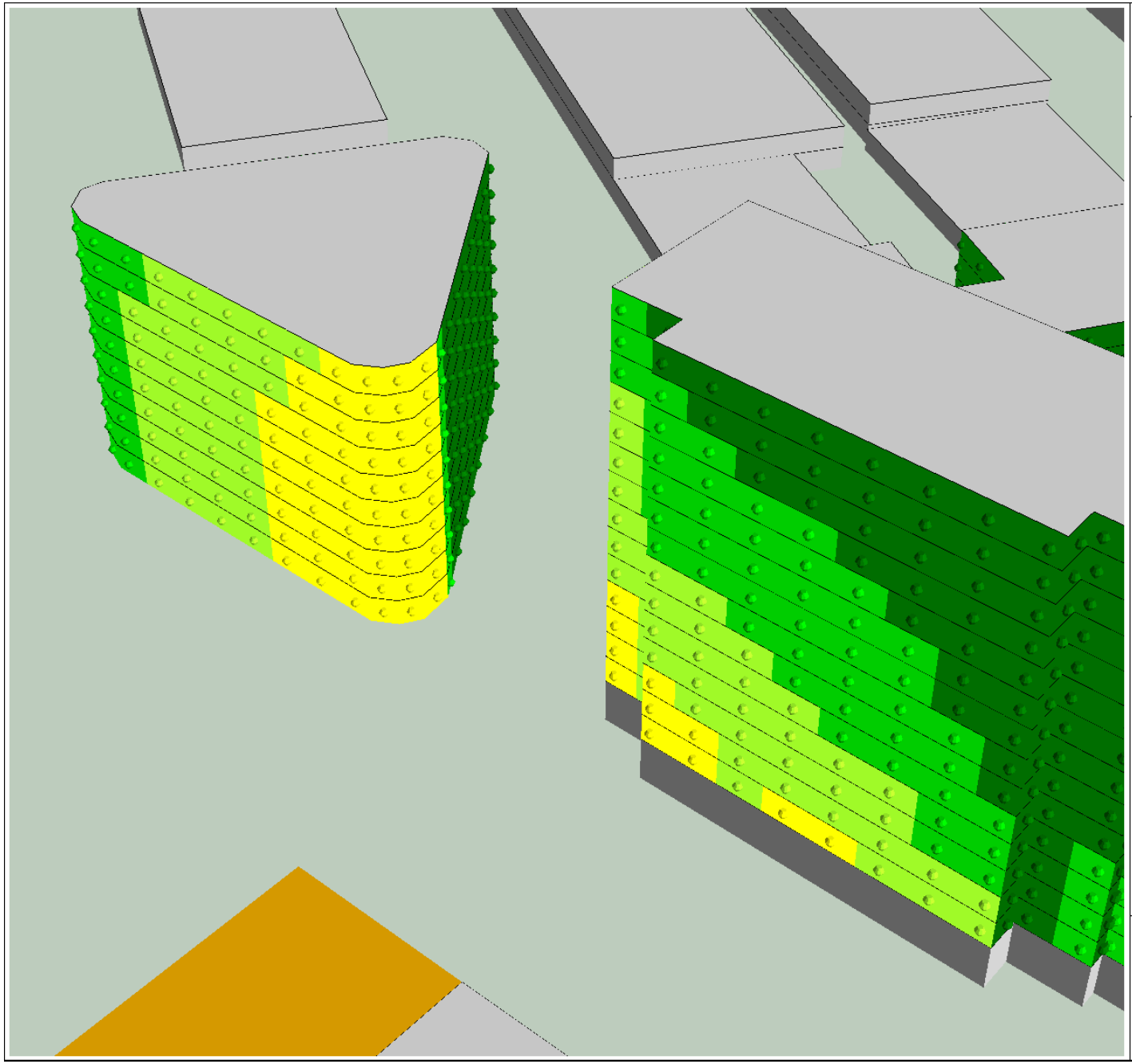
Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Alex Washer

APPENDIX ONE – SOUND PLAN NOISE PREDICTIONS, SPORTS COURT


Green Square
Public School
Basketball Court Noise Prediction
Prepared by: S. Giannikopoulos
Date: 26/08/2020
Noise Level
L_{eq}
in dB(A)
< 44
44 - 46
46 - 48
48 - 50
50 - 52
52 - 54
54 - 56
56 - 58
58 - 60
60 - 62
62 - 64
>= 64
Length scale 1:3455
0 15 30 60 90 120
m
N
ACOUSTIC
LOGIC



Green Square Public School

Basketball Court Noise Prediction

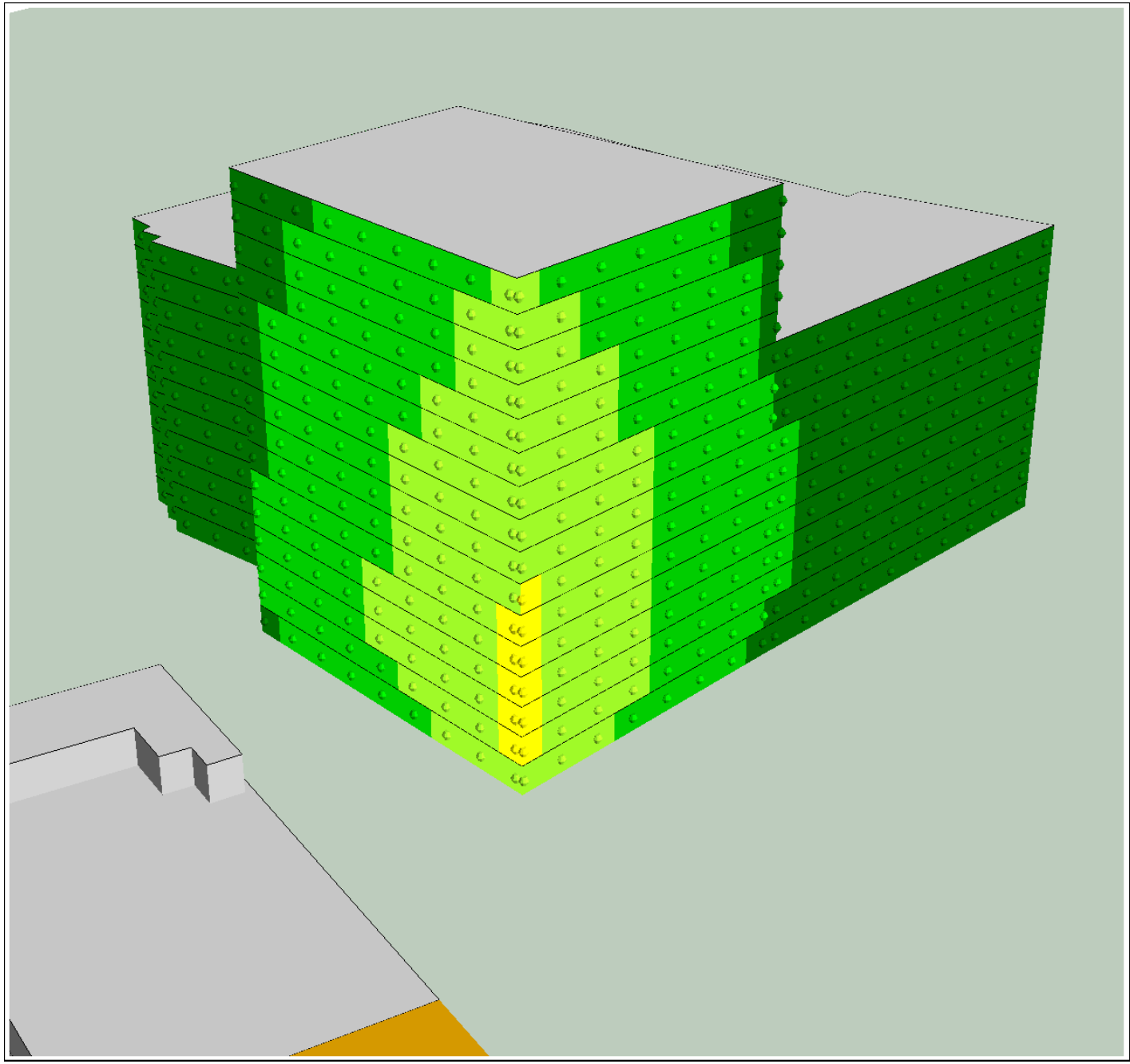
Prepared by: S. Giannikopoulos
Date: 26/08/2020

Noise Level
L_{eq}
in dB(A)

< 44
44 - 46
46 - 48
48 - 50
50 - 52
52 - 54
54 - 56
56 - 58
58 - 60
60 - 62
62 - 64
>= 64

Length scale 1:3455
0 15 30 60 90 120 m

ACOUSTIC LOGIC



Green Square Public School

Basketball Court Noise Prediction

Prepared by: S. Giannikopoulos
Date: 26/08/2020

Noise Level
L_{eq}
in dB(A)

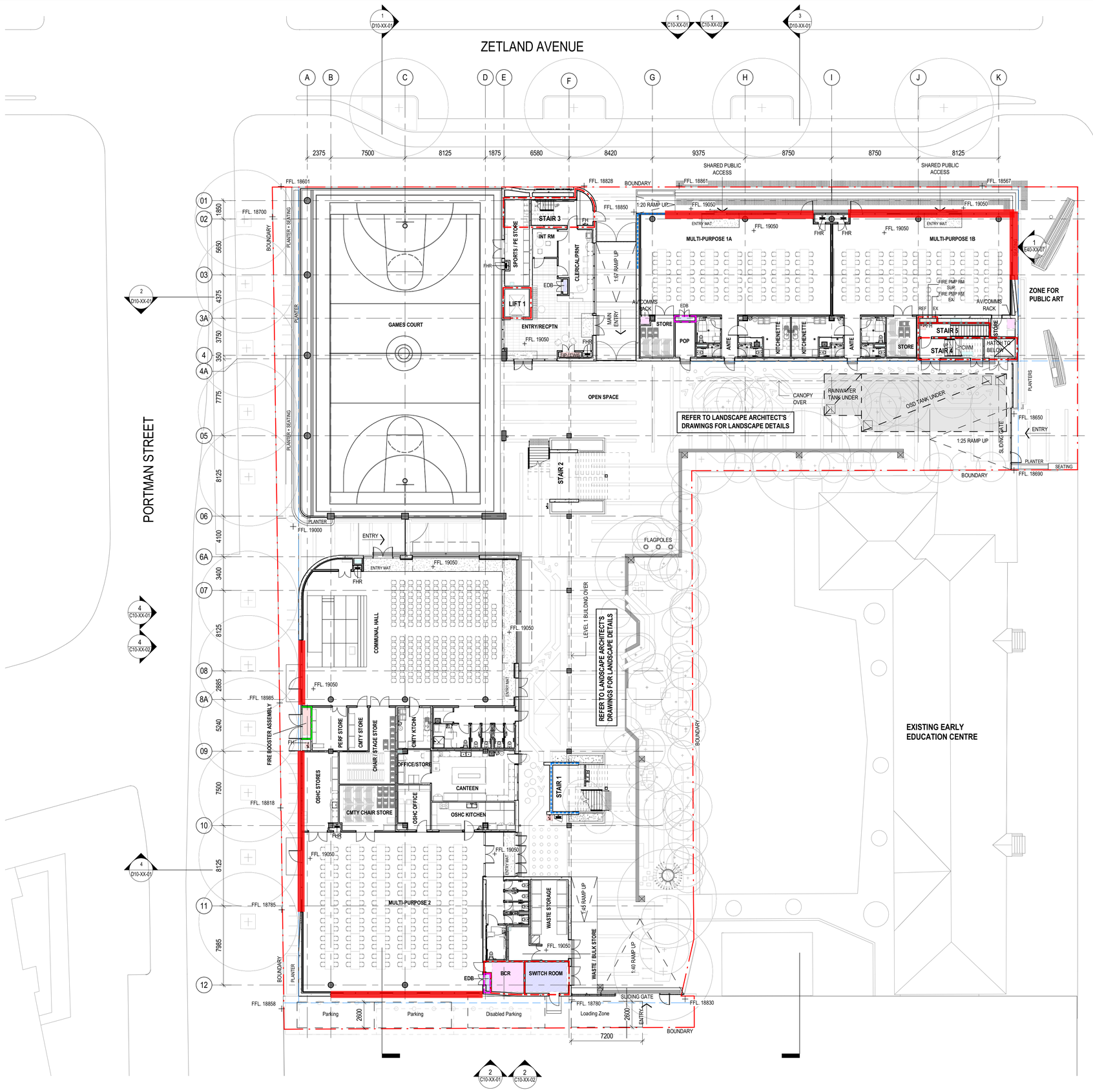
< 44
44 - 46
46 - 48
48 - 50
50 - 52
52 - 54
54 - 56
56 - 58
58 - 60
60 - 62
62 - 64
>= 64

Length scale 1:3455

0 15 30 60 90 120 m

ACOUSTIC LOGIC

APPENDIX TWO – GLAZING MARKUP



Glazing Thickness Mark-ups

- 12.38mm laminated
- 6.38mm laminated
- 6mm float

FIRE RATED WALLS

1 HOUR

SERVICES ABBREVIATIONS

BCR	BUILDING COMMS ROOM
EDB	ELECTRICAL DISTRIBUTION BOARD
EX	EXHAUST
GE	GARBAGE ROOM EXHAUST
KE	KITCHEN EXHAUST
MCR	MAIN COMMS ROOM
REF	REFRIGERANT PIPEWORK
TE	TOILET EXHAUST

BVN

SW ARCHITECTS REGISTRATION BOARD / OMINATED ARCHITECTS

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NOTE

CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF WORK OR PREPARATION OF SHOP DRAWINGS. DO NOT SCALE THIS DRAWING

ISSUE	DATE	FOR
1	12/03/21	FOR INFORMATION
2	19/03/21	50% DESIGN DEVELOPMENT

STRUCTURAL AND CIVIL ENGINEER
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END USER
NSW DEPARTMENT OF EDUCATION
1300 679 332

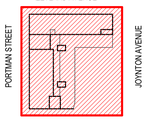
CLIENT

SCHOOL INFRASTRUCTURE NSW
PROJECT

GREEN SQUARE INTEGRATED COMMUNITY FACILITY AND SCHOOL
ZETLAND AVENUE, GREEN SQUARE 2017

BVN PROJECT NUMBER
1908014.000

DRAWING KEY



TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
0 4000 10000

SCALE
1 : 200@A1

STATUS
DESIGN DEVELOPMENT

DRAWING
GA PLAN - GROUND LEVEL

AR-B10-00-00 | ISSUE 2

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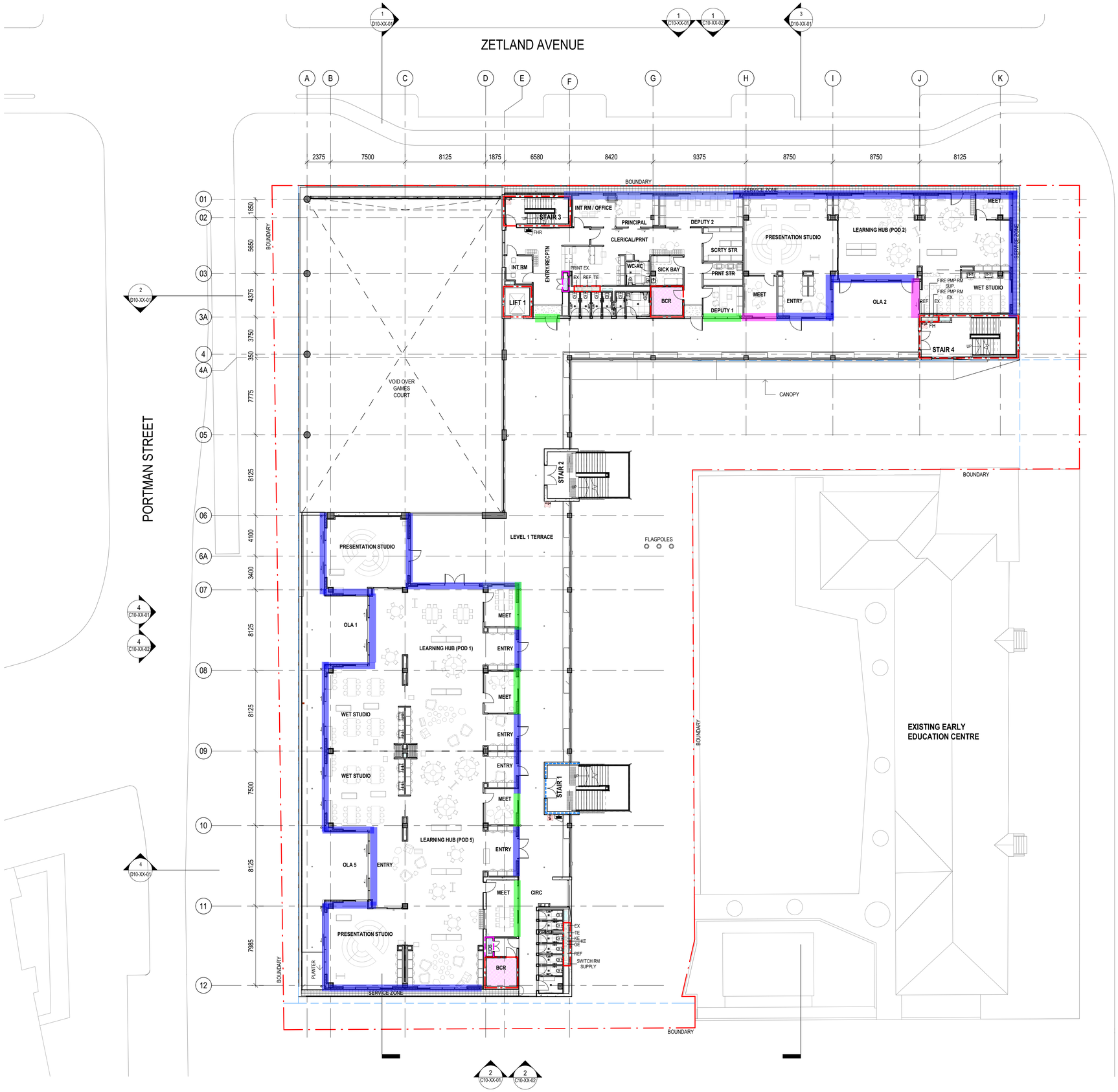

Glazing Thickness Mark-ups

- 12.38mm laminated
- 10.38mm laminated
- 6.38mm laminated
- 6mm float

FIRE RATED WALLS

1 HOUR

BCR	BUILDING COMMS ROOM
EDB	ELECTRICAL DISTRIBUTION BOARD
EX	EXHAUST
GE	GARBAGE ROOM EXHAUST
KE	KITCHEN EXHAUST
MCR	MAIN COMMS ROOM
REF	REFRIGERANT PIPEWORK
TE	TOILET EXHAUST

BVN

SW ARCHITECTS REGISTRATION BOARD / OMINATED ARCHITECTS

56 NINOTSCHKA TITCHKOSKY
15 JULIAN ASHTON
53 MATTHEW BLAIR
51 PHILLIP ROSSINGTON
37 JAMES GROSE

ntephone +61 2 8297 7200
xcsimile +61 2 8297 7299
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ISSUE	DATE	FOR
1	12/03/21	FOR INFORMATION
2	19/03/21	50% DESIGN DEVELOPMENT

STRUCTURAL AND CIVIL ENGINEER
MEINHARDT BONACCI
+61 2 8247 8400

BUILDING SERVICES
STANTEC
+61 2 9493 9700

ESD & GREEN STAR
NDY
+61 2 9928 6800

LANDSCAPE ARCHITECT
TURF DESIGN
+61 2 8394 9990

BCA AND DDA
PHILLIP CHUN
+61 2 9412 23202

PROJECT MANAGER
COLLIERS INTERNATIONAL
+61 2 9257 0222

END USER
CITY OF SYDNEY
+61 2 9265 9333

END USER
NSW DEPARTMENT OF EDUCATION
1300 679 332

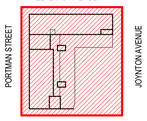
CLIENT

SCHOOL INFRASTRUCTURE NSW
PROJECT

GREEN SQUARE INTEGRATED COMMUNITY FACILITY AND SCHOOL
ZETLAND AVENUE, GREEN SQUARE 2017

BVN PROJECT NUMBER
1908014.000

DRAWING KEY



TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
0 4000 10000

SCALE
1 : 200@A1

STATUS
DESIGN DEVELOPMENT

DRAWING
GA PLAN - LEVEL 01

AR-B10-01-00 | ISSUE 2

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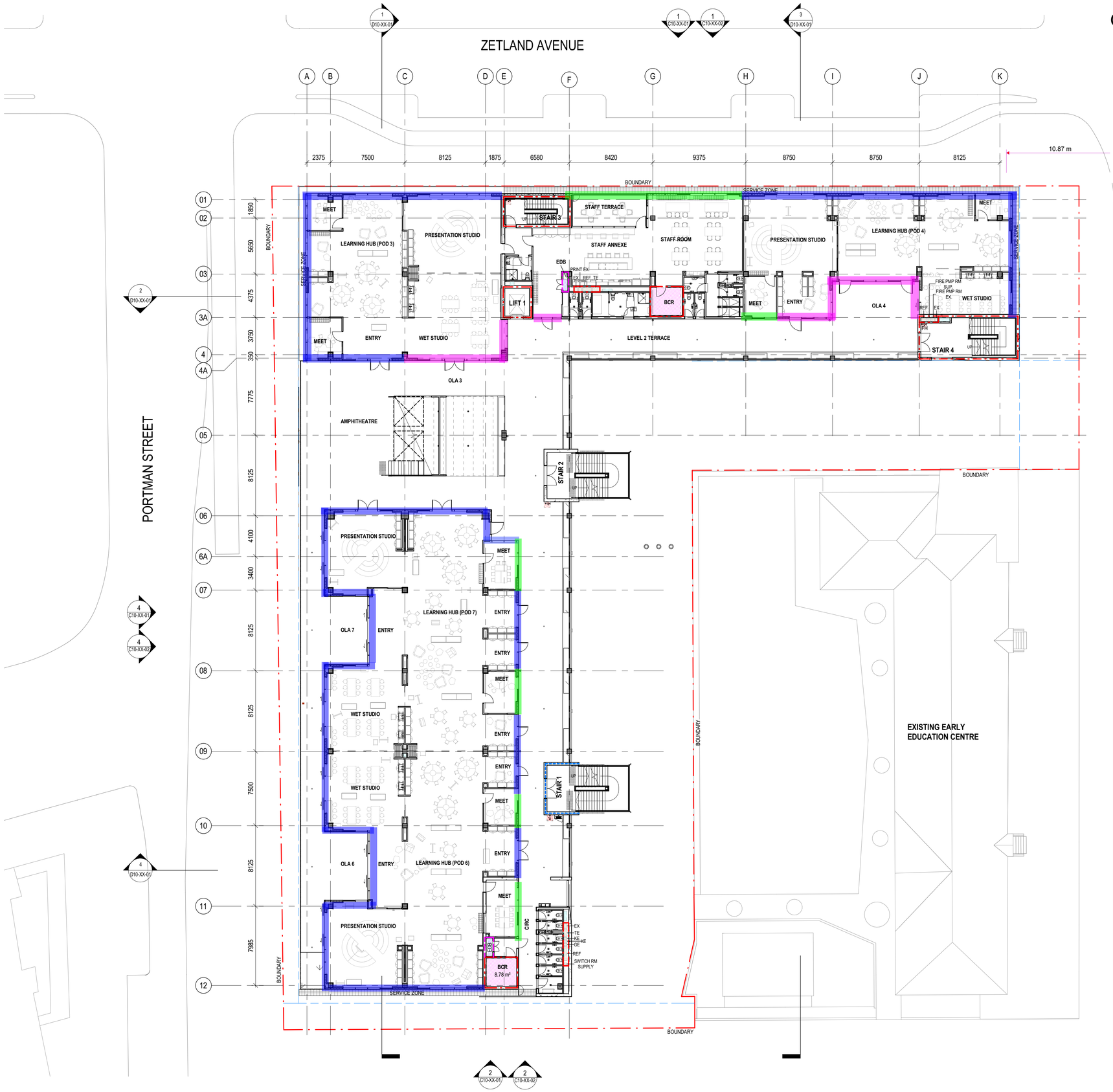

FIRE RATED WALLS

Glazing Thickness Mark-ups

- 12.38mm laminated
- 10.38mm laminated
- 6.38mm laminated
- 6mm float

EDB	ELECTRICAL DISTRIBUTION BOARD
EX	EXHAUST
GE	GARBAGE ROOM EXHAUST
KE	KITCHEN EXHAUST
MCR	MAIN COMMS ROOM
REF	REFRIGERANT PIPEWORK
TE	TOILET EXHAUST

BVN

NSW ARCHITECTS REGISTRATION BOARD / NOMINATED ARCHITECTS
9356 NINOTSCHKA TITCHKOSKY
7115 JULIAN ASHTON
7053 MATTHEW BLAIR
7151 PHILLIP ROSSINGTON
4937 JAMES GROSE

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2	19/03/21	50% DESIGN DEVELOPMENT

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+61 2 8247 8400

BUILDING SERVICES
STANTEC
+61 2 9493 9700

ESD & GREEN STAR
NDY
+61 2 9928 6800

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TURF DESIGN
+61 2 8394 9990

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+61 2 9412 23202

PROJECT MANAGER
COLLIERS INTERNATIONAL
+61 2 9257 0222

END USER
CITY OF SYDNEY
+61 2 9265 9333

END USER
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1300 679 332

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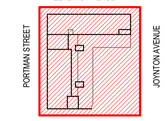
SCHOOL INFRASTRUCTURE NSW
PROJECT

GREEN SQUARE INTEGRATED COMMUNITY FACILITY AND SCHOOL
ZETLAND AVENUE, GREEN SQUARE 2017

BVN PROJECT NUMBER
1908014.000

DRAWING KEY



TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
0 4000 10000

SCALE
1 : 200@A1

STATUS
DESIGN DEVELOPMENT

DRAWING
GA PLAN - LEVEL 02

AR-B10-02-00 | ISSUE 2

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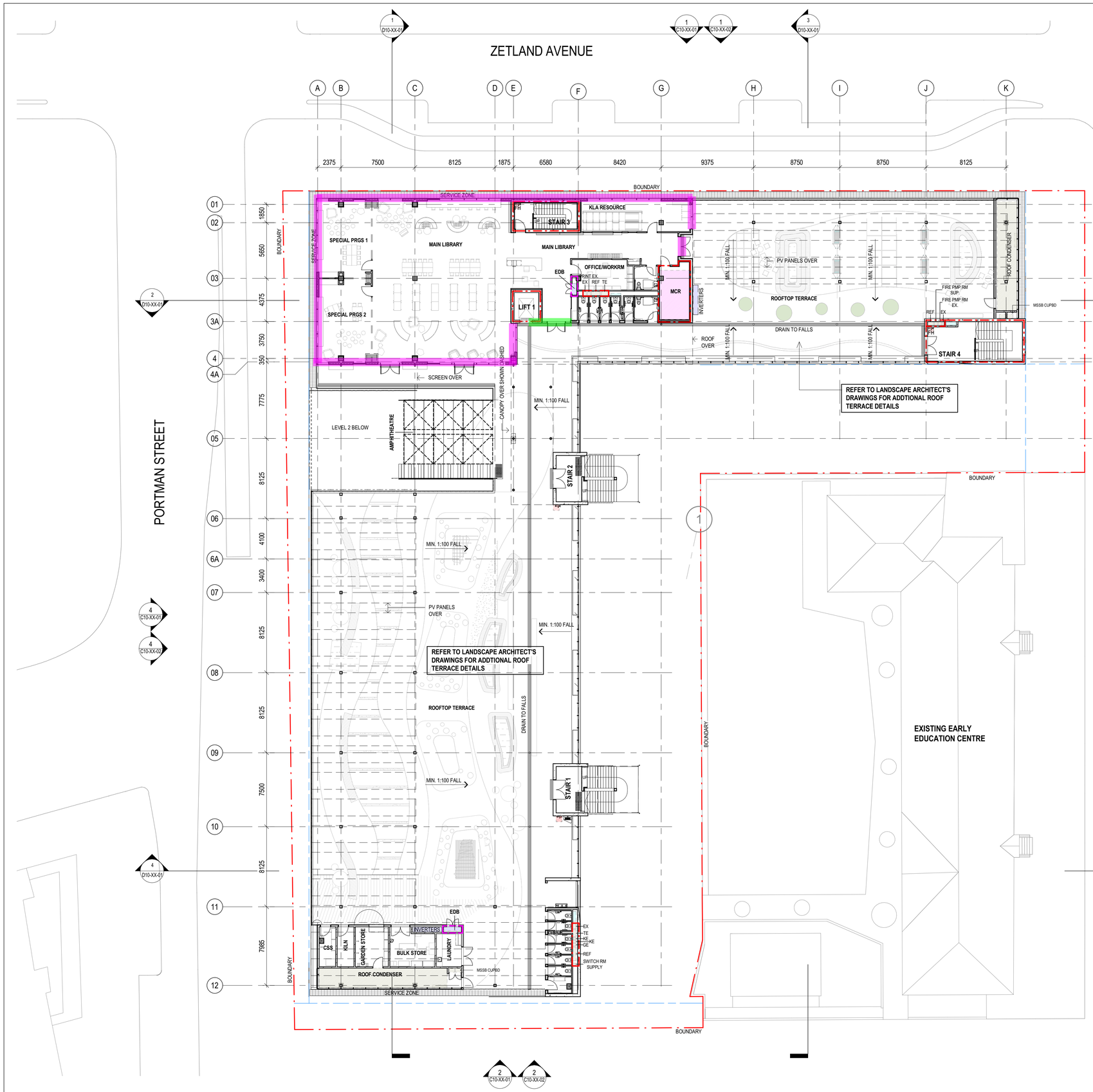

FIRE RATED WALLS

1 HOUR

Glazing Thickness Mark-ups

- 6.38mm laminated
- 6mm float

HYDRAULIC SERVICES

SERVICES ABBREVIATIONS

BCR	BUILDING COMMS ROOM
EDB	ELECTRICAL DISTRIBUTION BOARD
EX	EXHAUST
GE	GARBAGE ROOM EXHAUST
KE	KITCHEN EXHAUST
MCR	MAIN COMMS ROOM
REF	REFRIGERANT PIPEWORK
TE	TOILET EXHAUST

BVN

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2	19/03/21	50% DESIGN DEVELOPMENT

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ESD & GREEN STAR
NDY
+61 2 9928 6800

LANDSCAPE ARCHITECT
TURF DESIGN
+61 2 8394 9990

BCA AND DDA
PHILLIP CHUN
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PROJECT MANAGER
COLLIERS INTERNATIONAL
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END USER
CITY OF SYDNEY
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NSW DEPARTMENT OF EDUCATION
1300 679 332

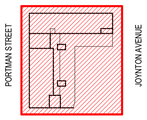
CLIENT

SCHOOL INFRASTRUCTURE NSW
PROJECT

GREEN SQUARE INTEGRATED COMMUNITY FACILITY AND SCHOOL
ZETLAND AVENUE, GREEN SQUARE 2017

BVN PROJECT NUMBER
1908014.000

DRAWING KEY



TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
0 4000 10000

SCALE
1 : 200@A1

STATUS
DESIGN DEVELOPMENT

DRAWING
GA PLAN - LEVEL 03

AR-B10-03-00 | ISSUE 2

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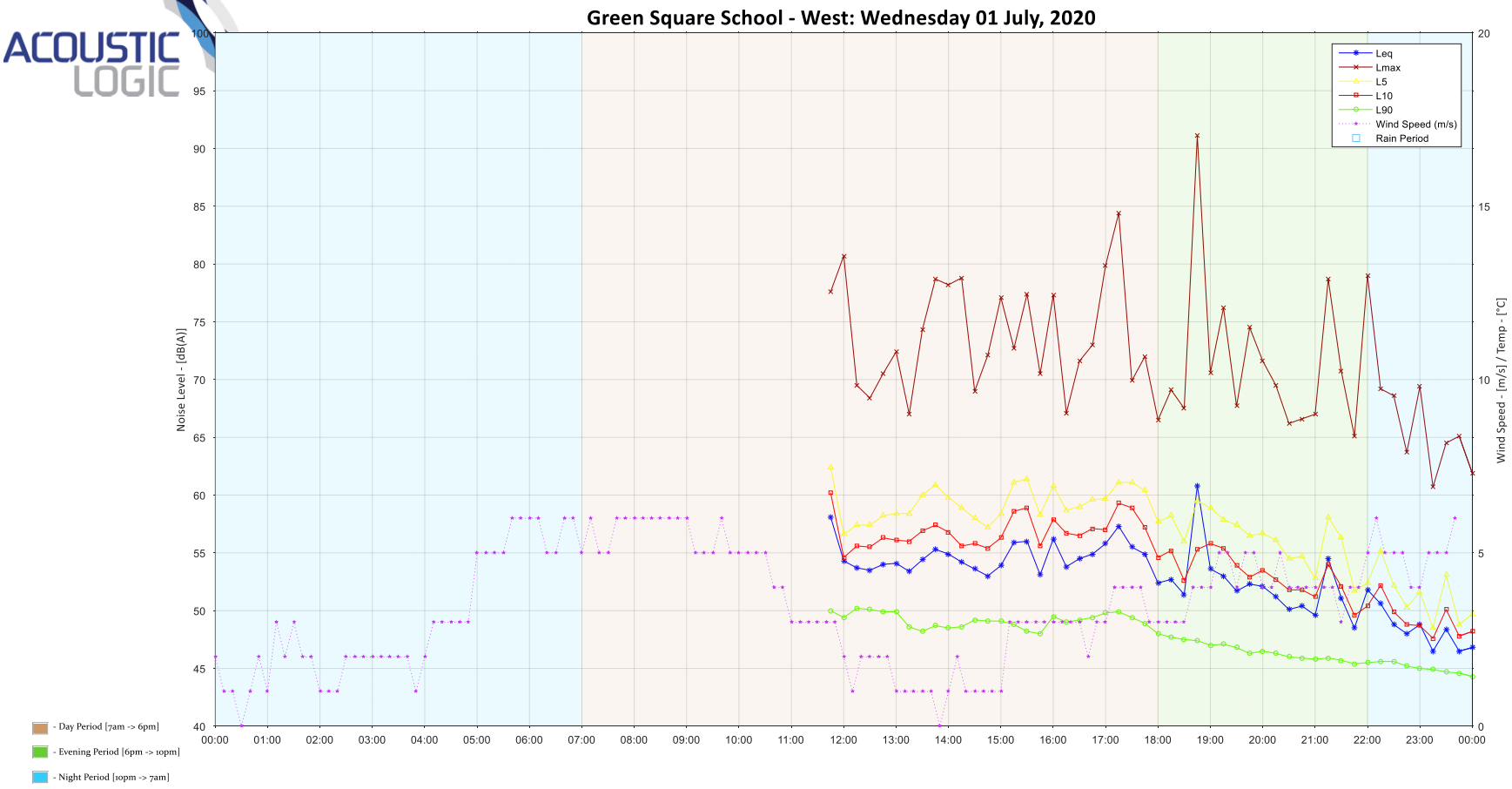
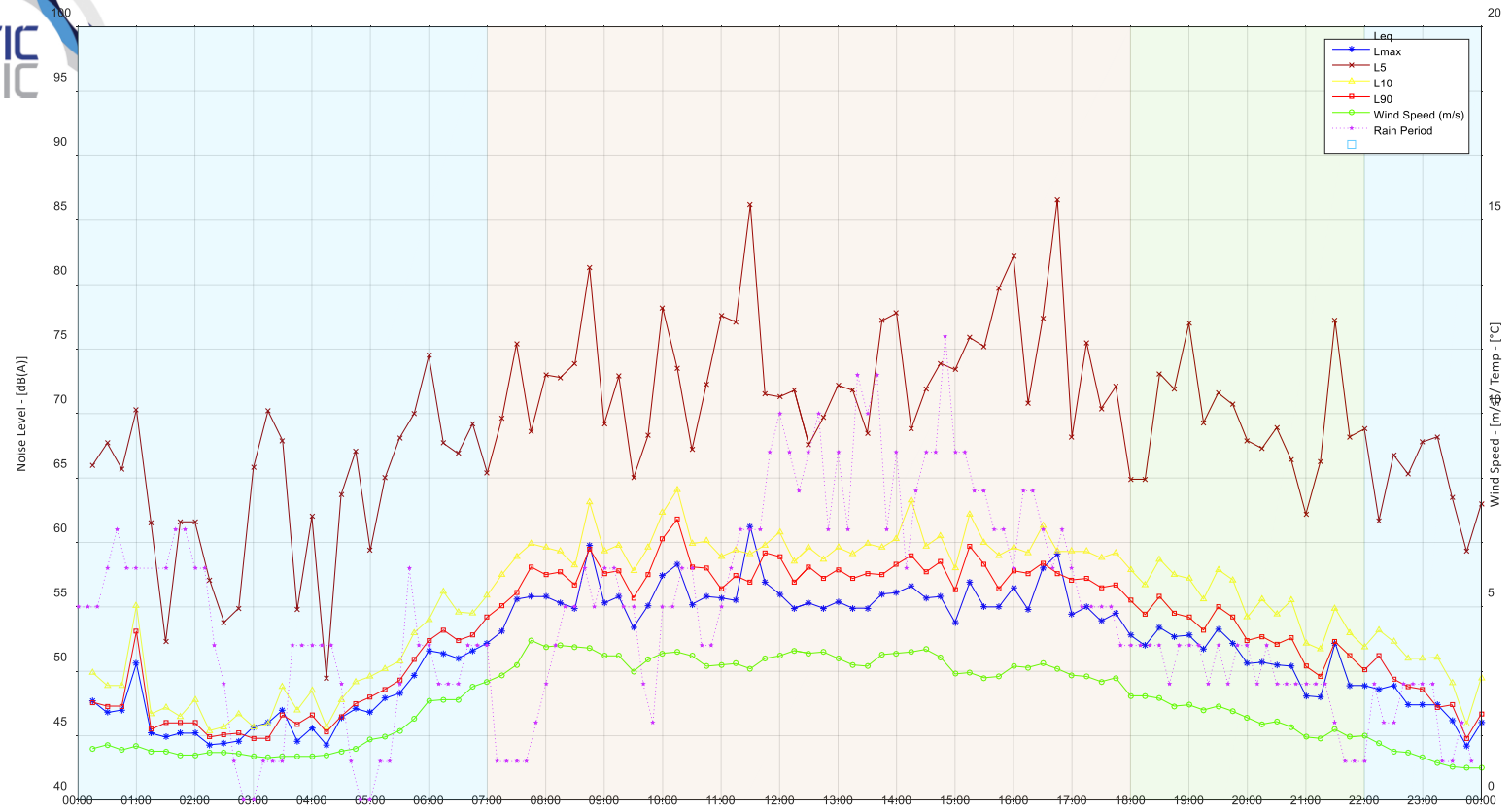
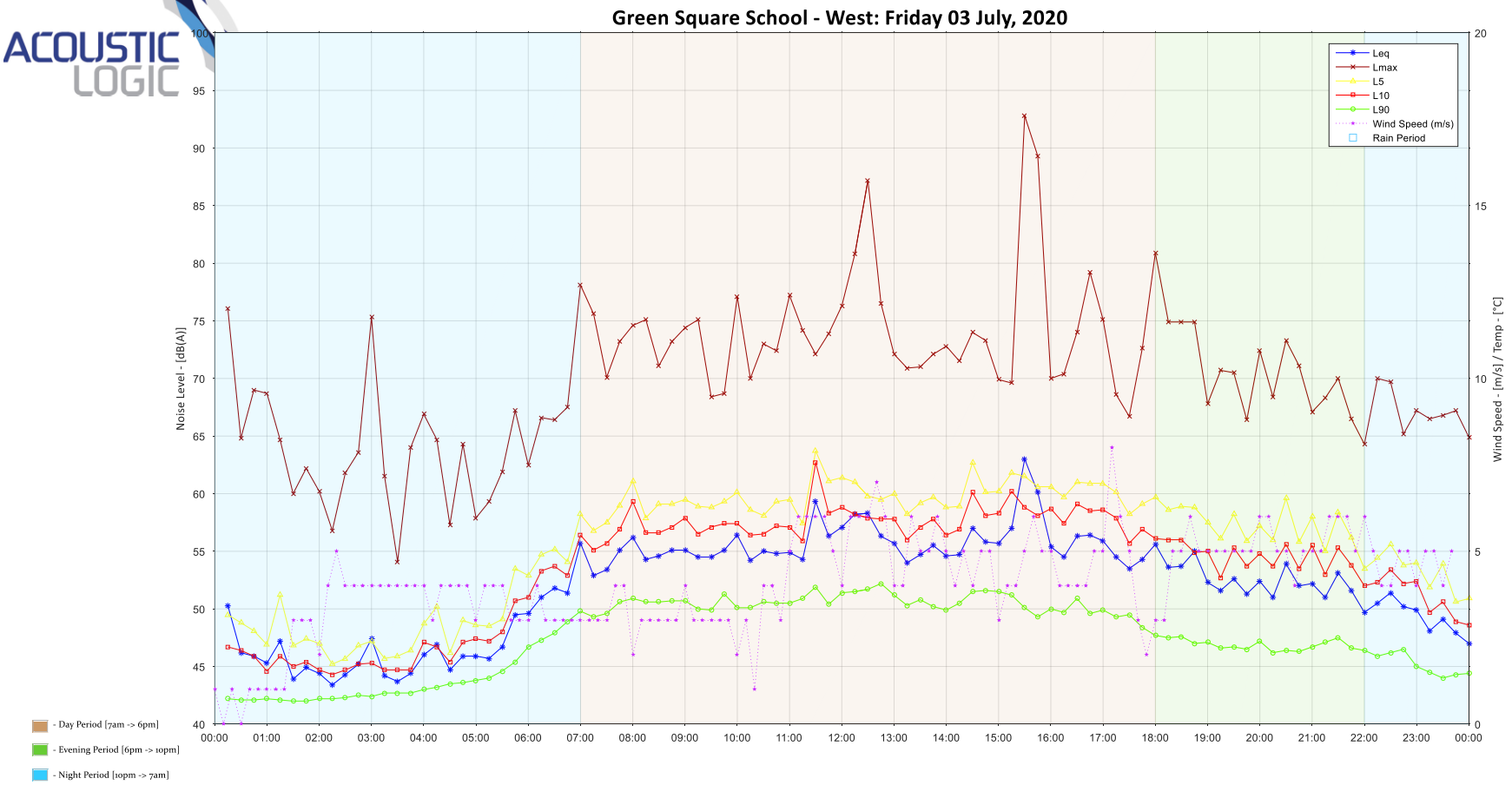
APPENDIX THREE – UNATTENDED NOISE MEASUREMENT DATA

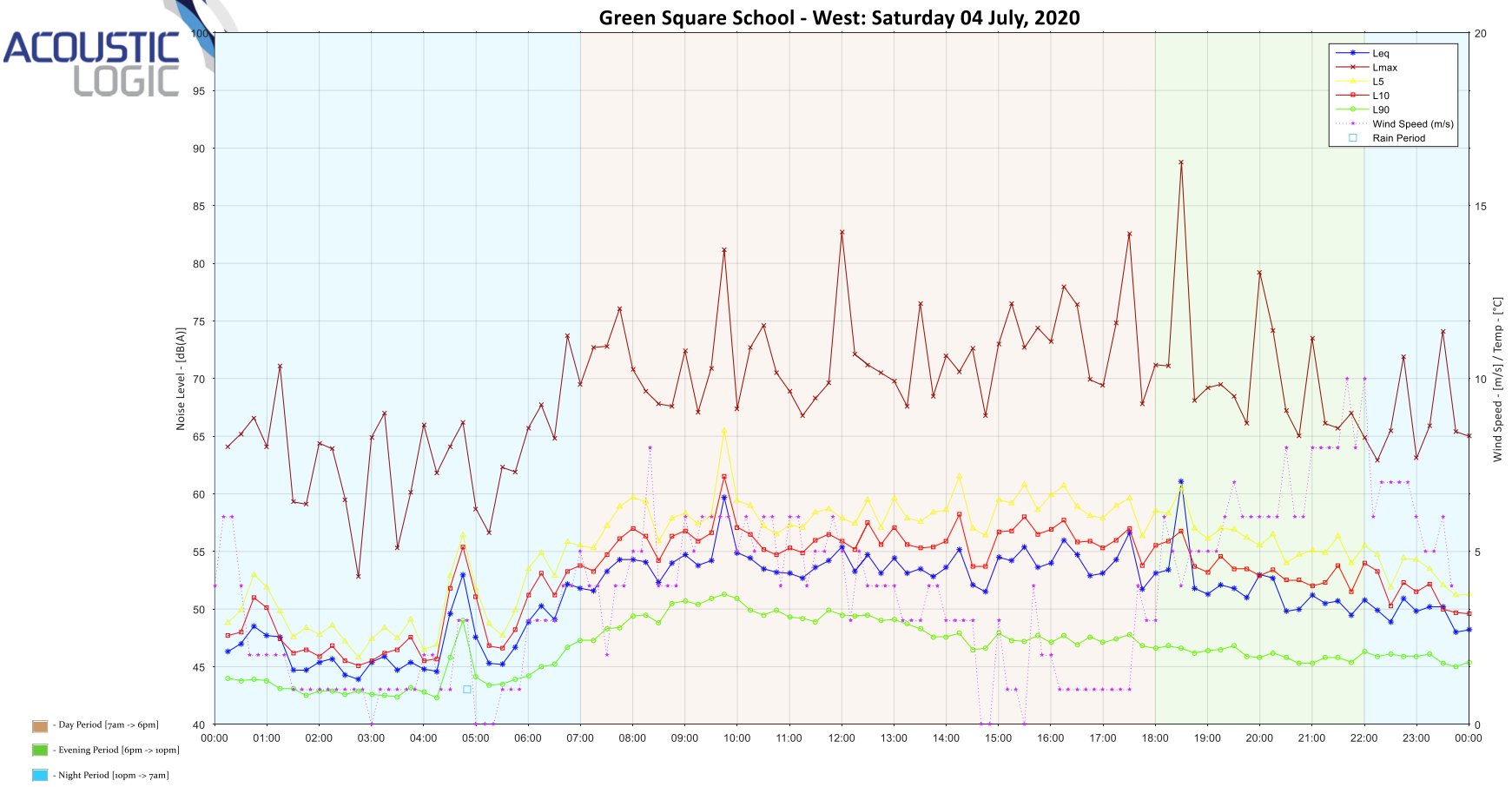
Portman Street Noise Monitor (Western Portion of Site)

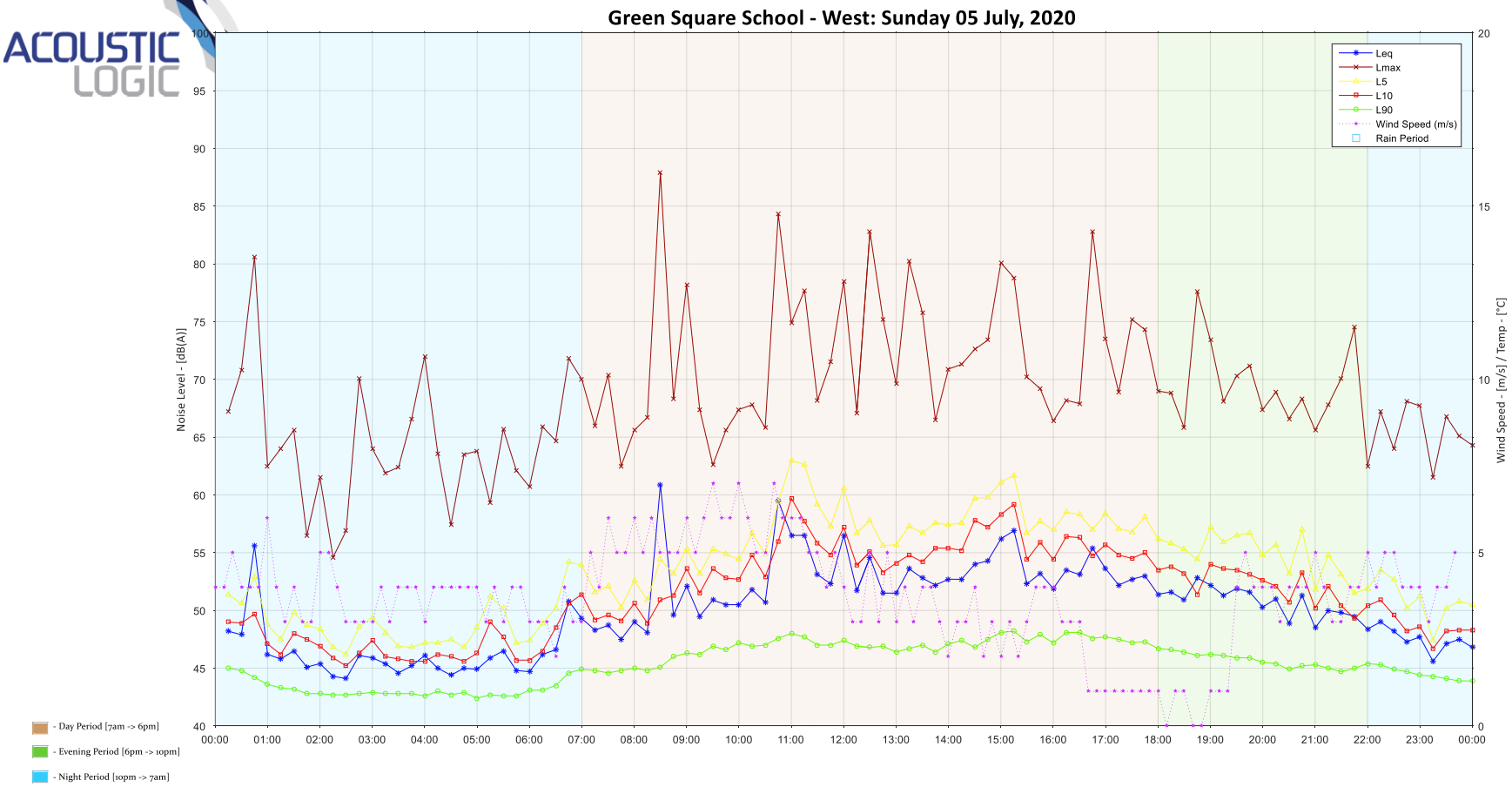

Green Square School - West: Wednesday 01 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L5
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

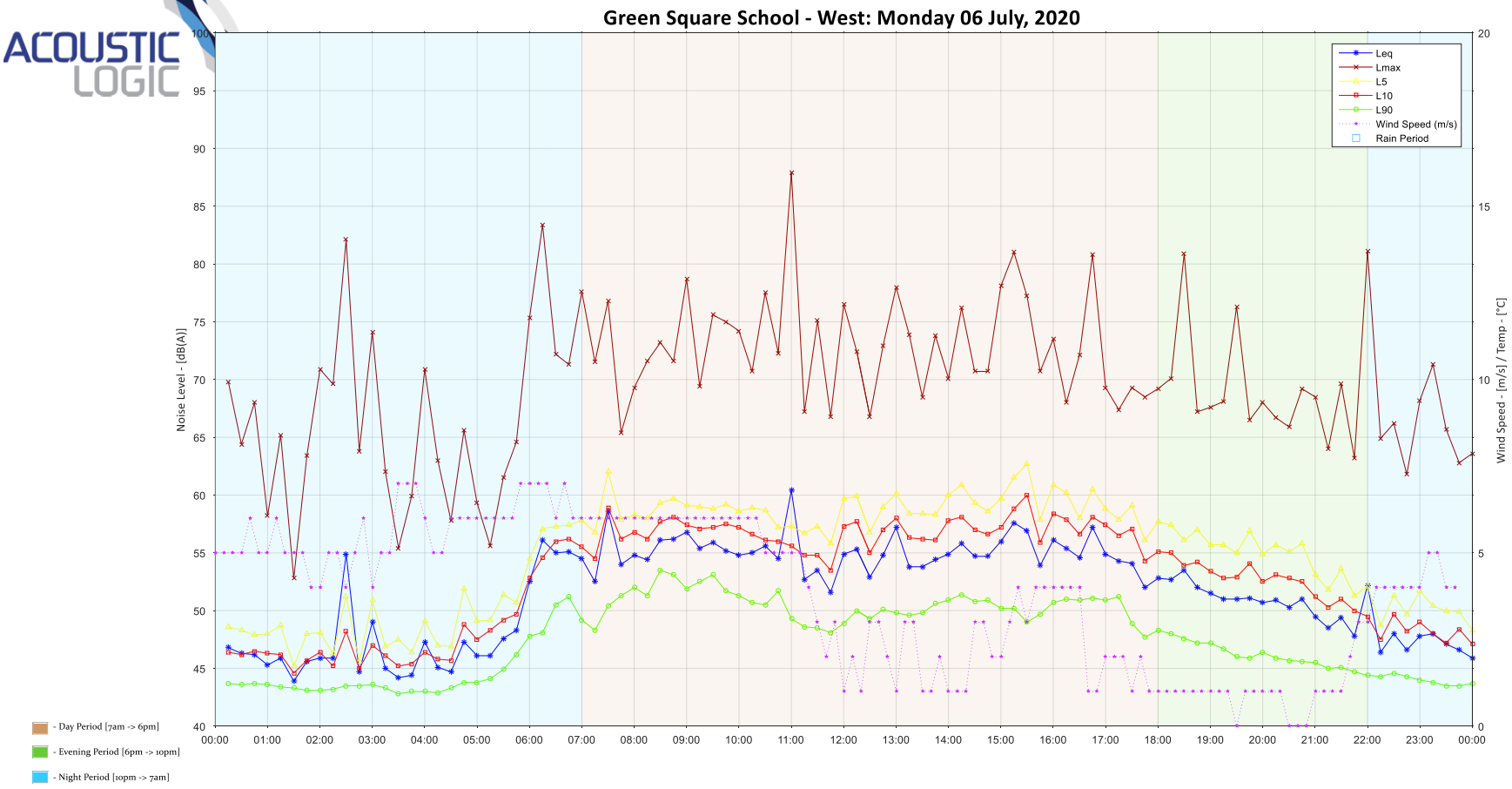
Green Square School - West: Thursday 02 July, 2020

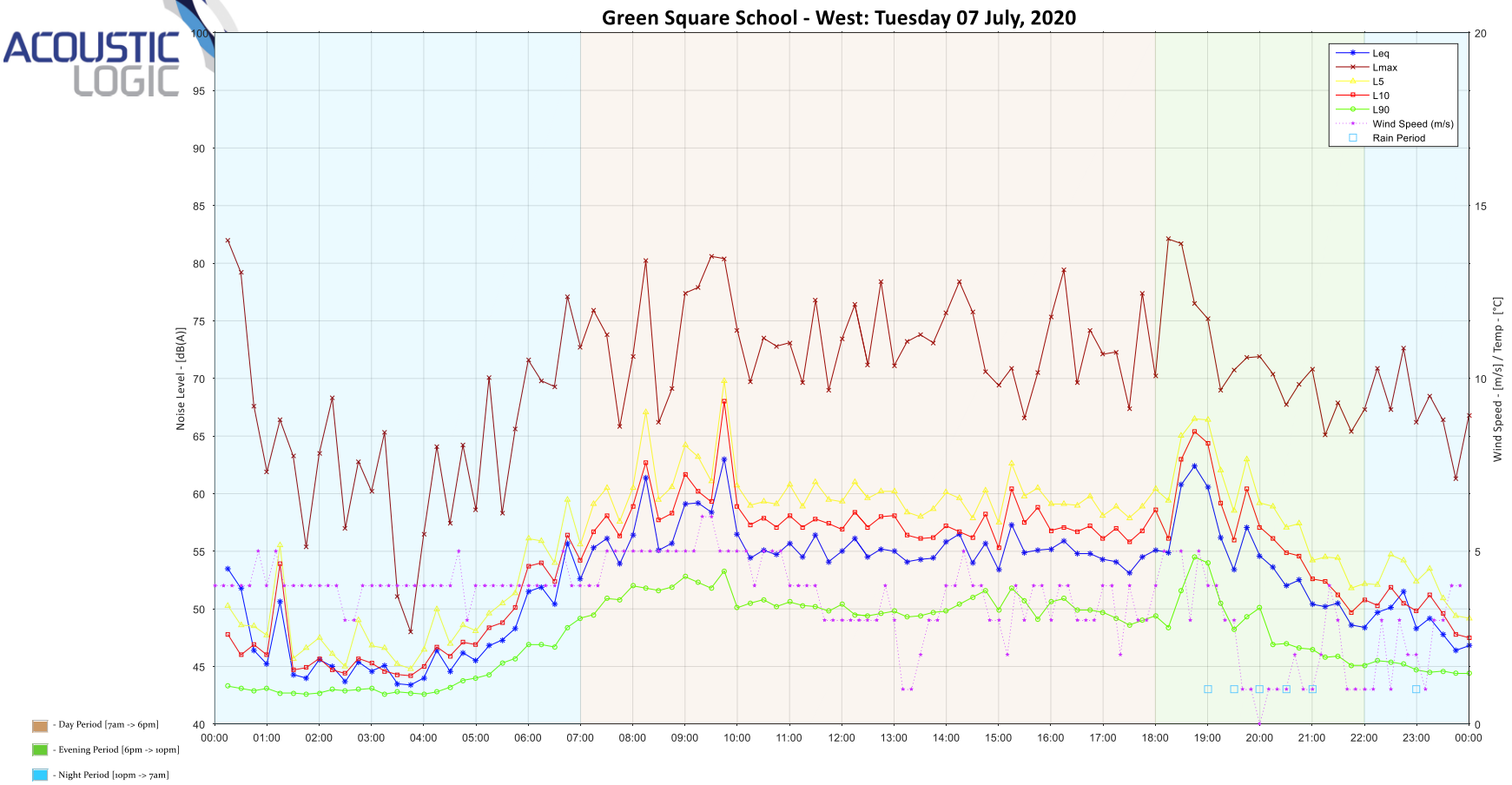


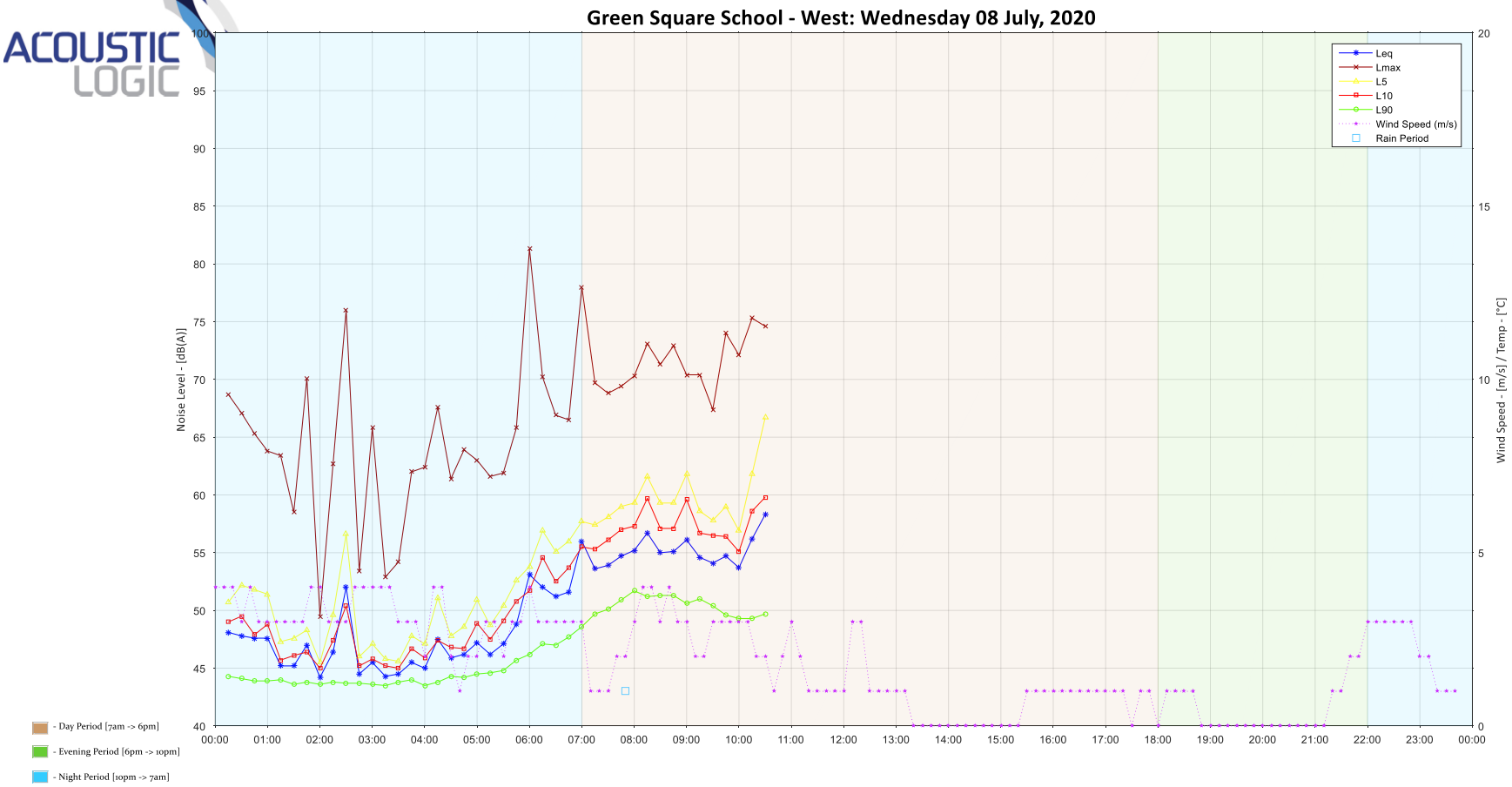

Green Square School - West: Friday 03 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L5
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Green Square School - West: Saturday 04 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L5
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

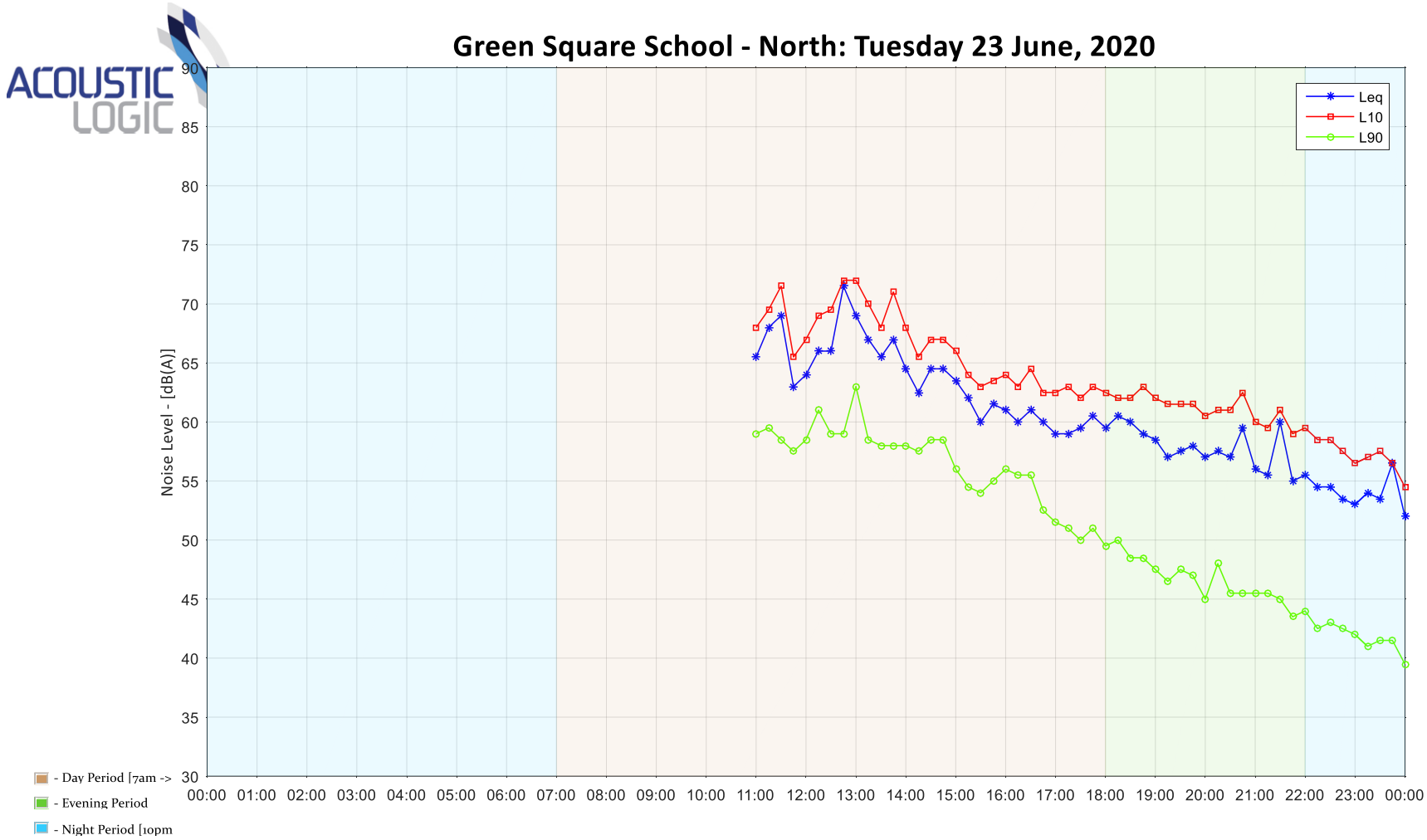

Green Square School - West: Sunday 05 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L5
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

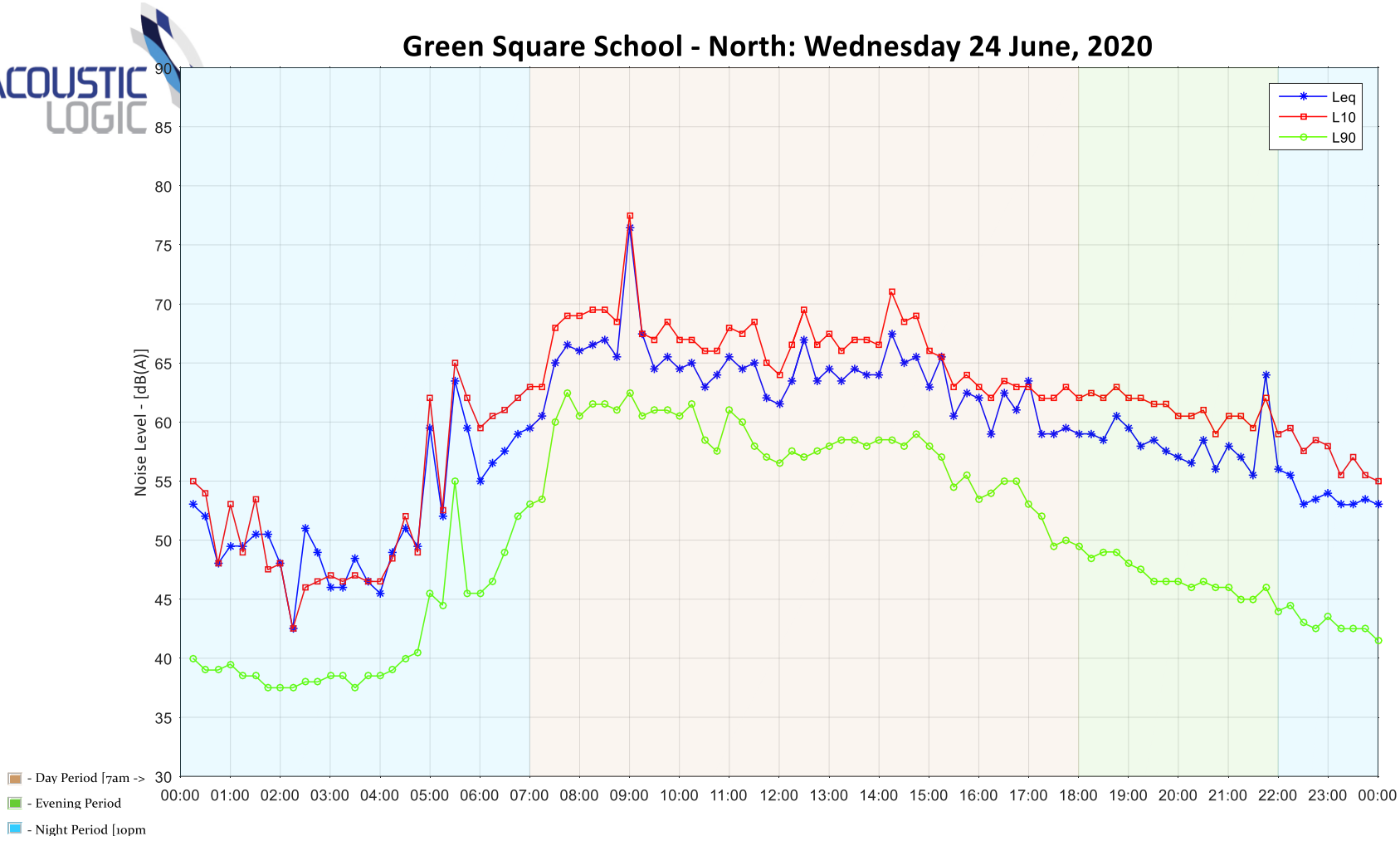

Green Square School - West: Monday 06 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L5
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

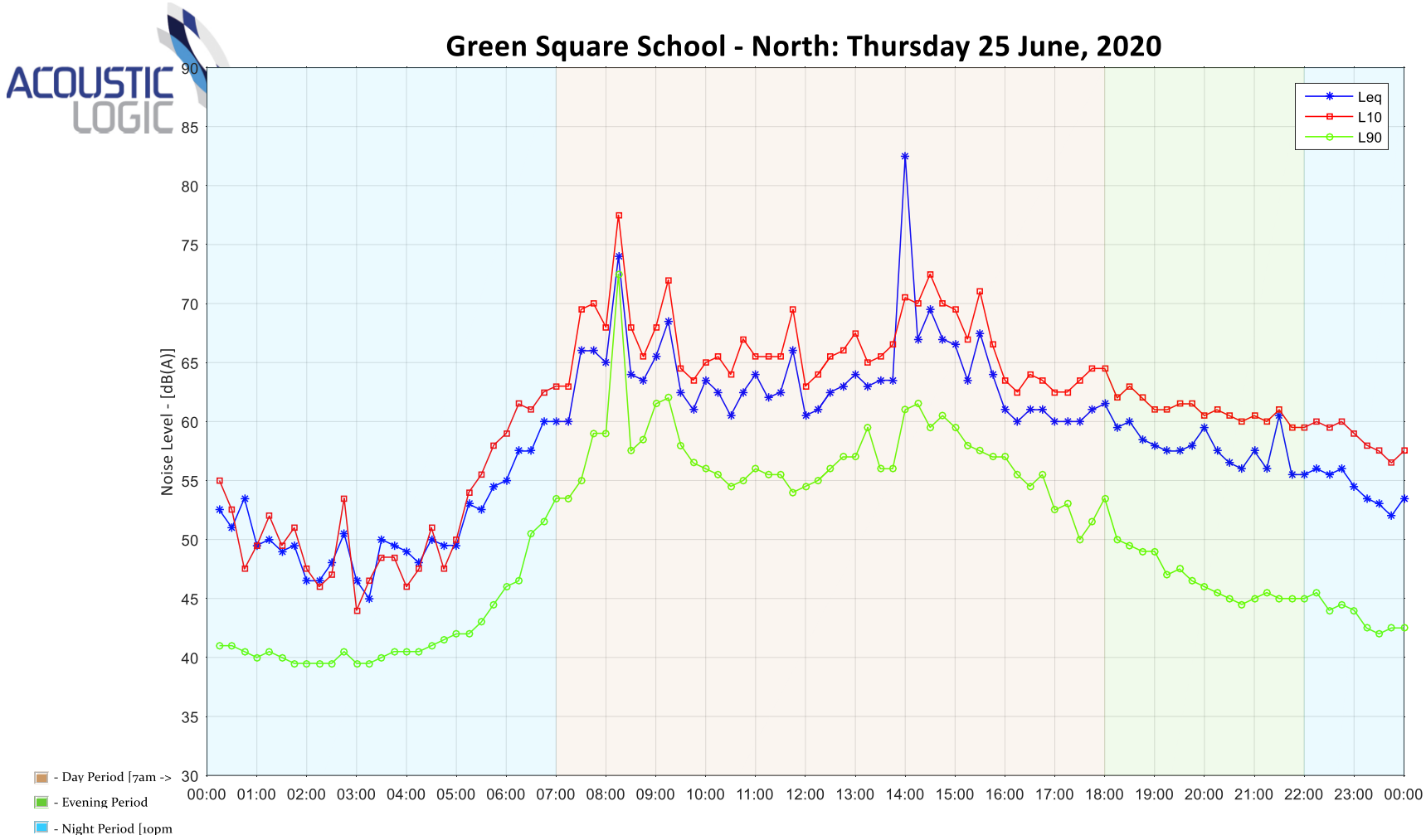

Green Square School - West: Tuesday 07 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L5
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

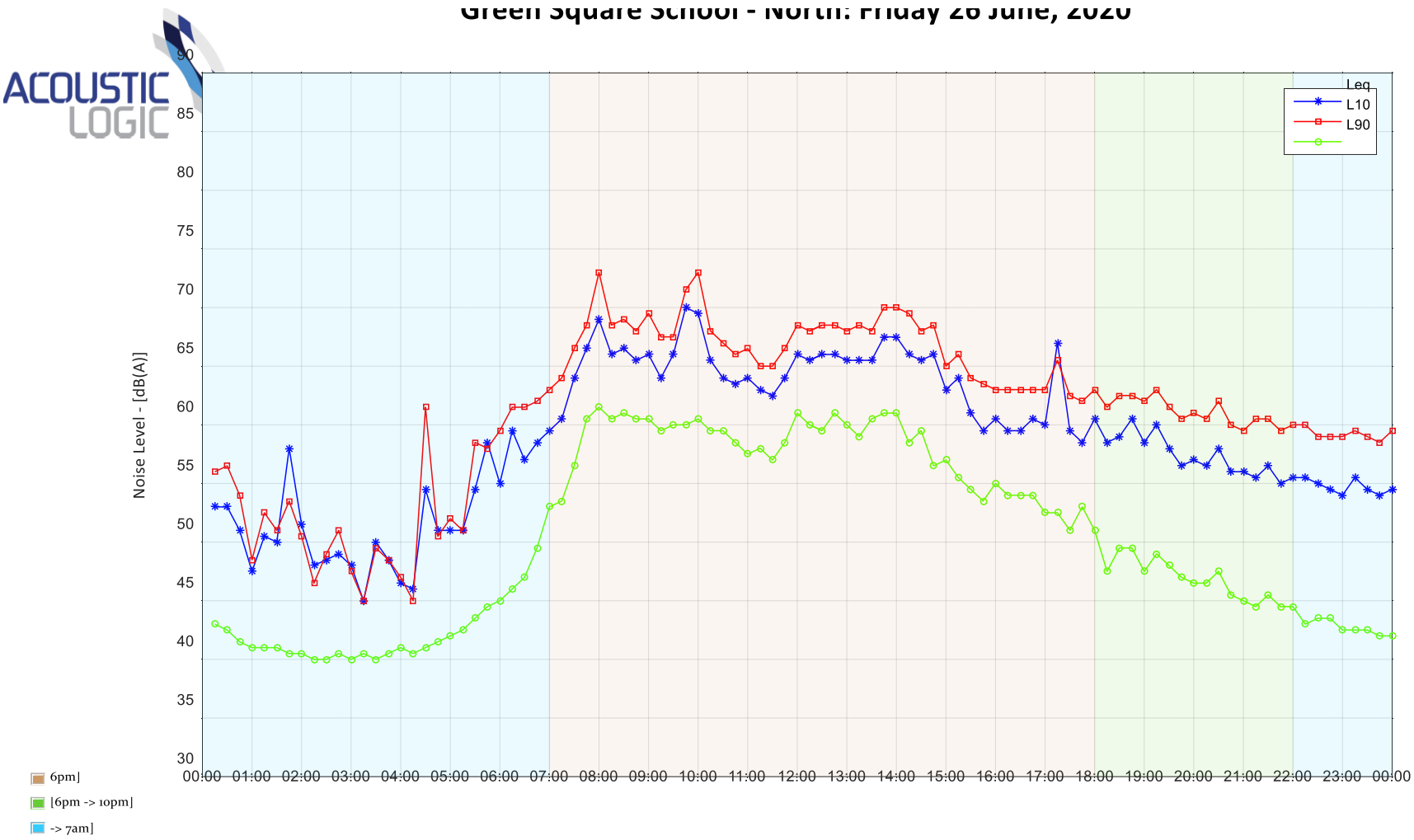

Green Square School - West: Wednesday 08 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L5
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

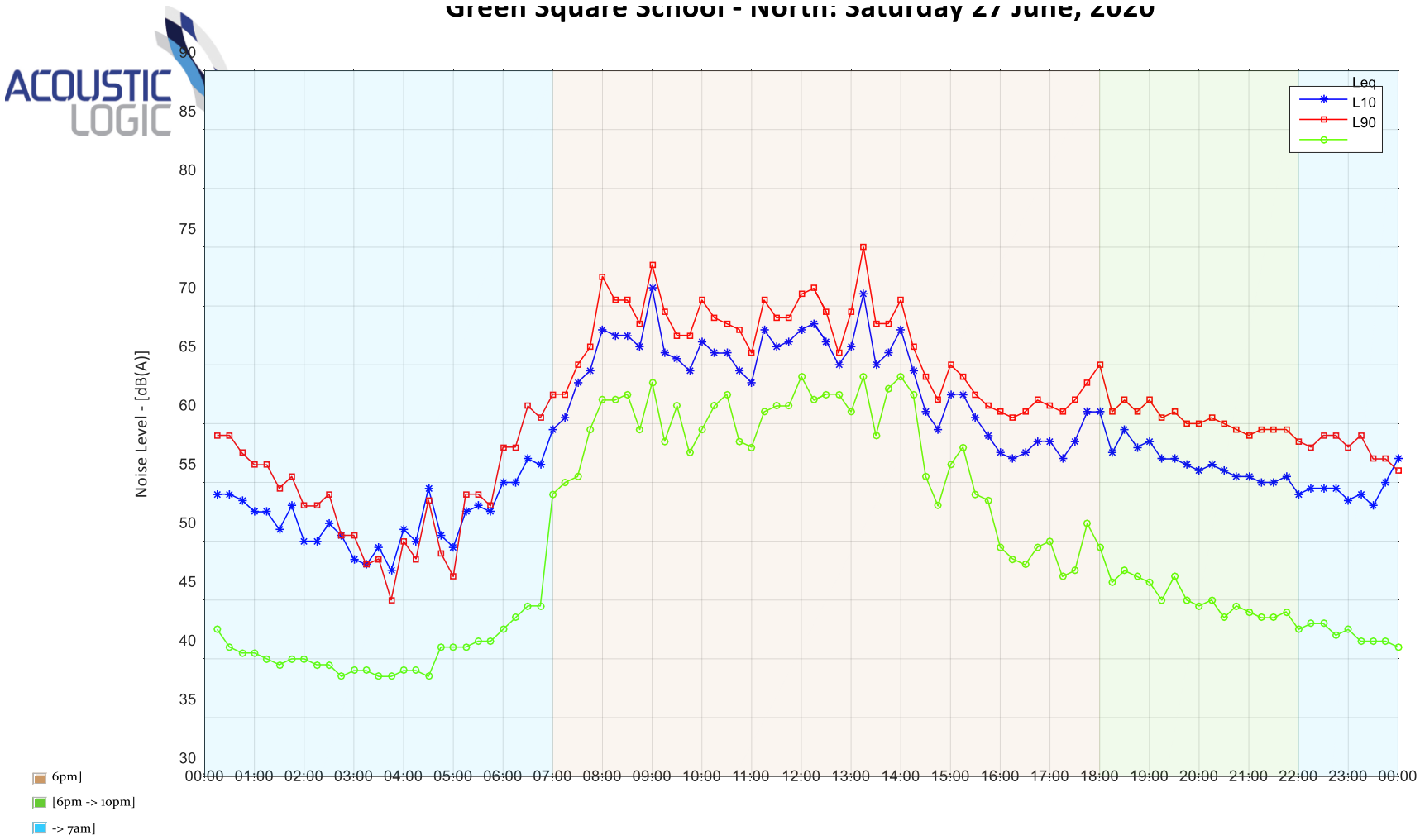
Northern Noise Monitor (Residential Boundary North of Site)

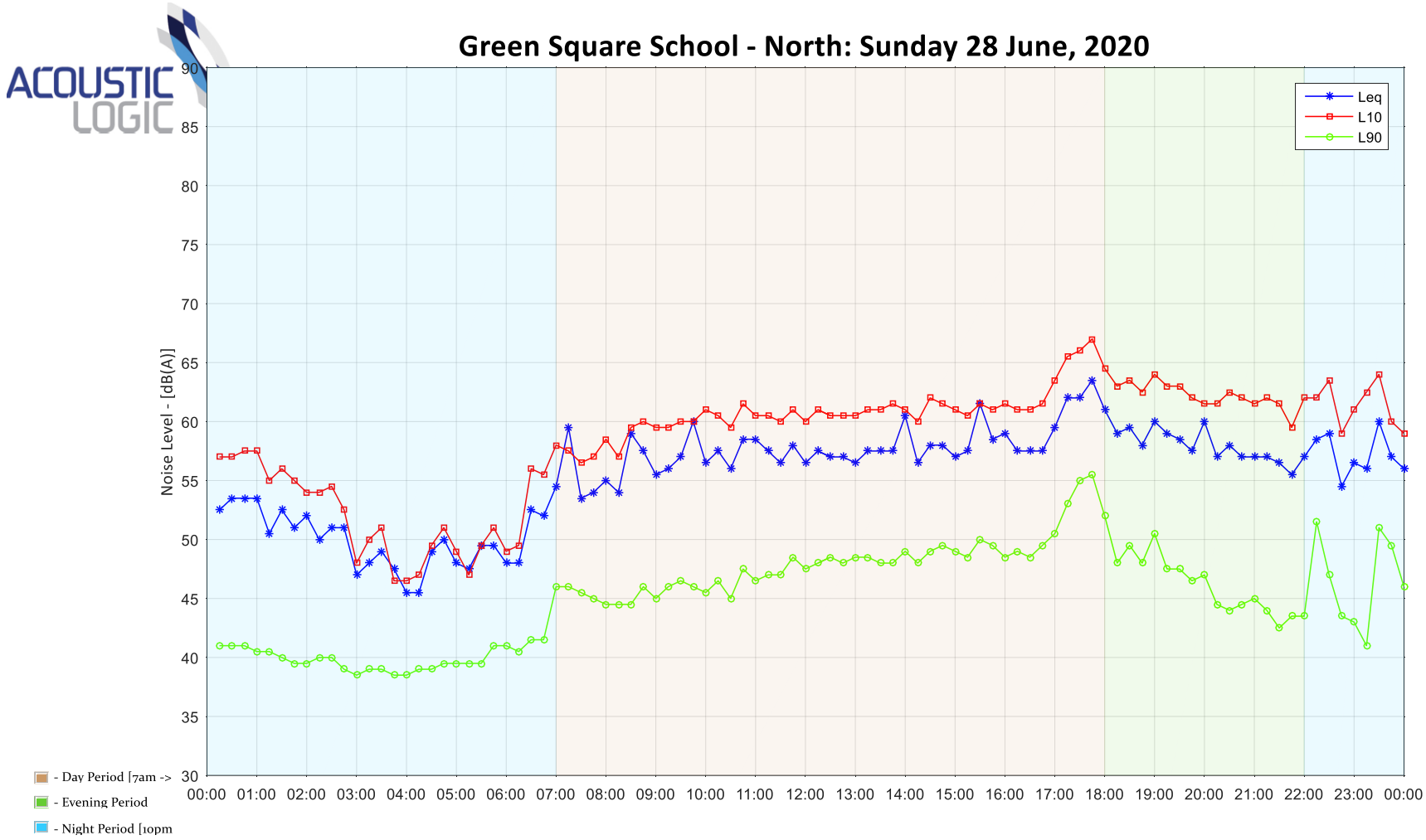

Green Square School - North: Tuesday 23 June, 2020
Noise Level - [dB(A)]
90
85
80
75
70
65
60
55
50
45
40
35
30
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Leq
L10
L90
- Day Period [7am ->
- Evening Period
- Night Period [10pm

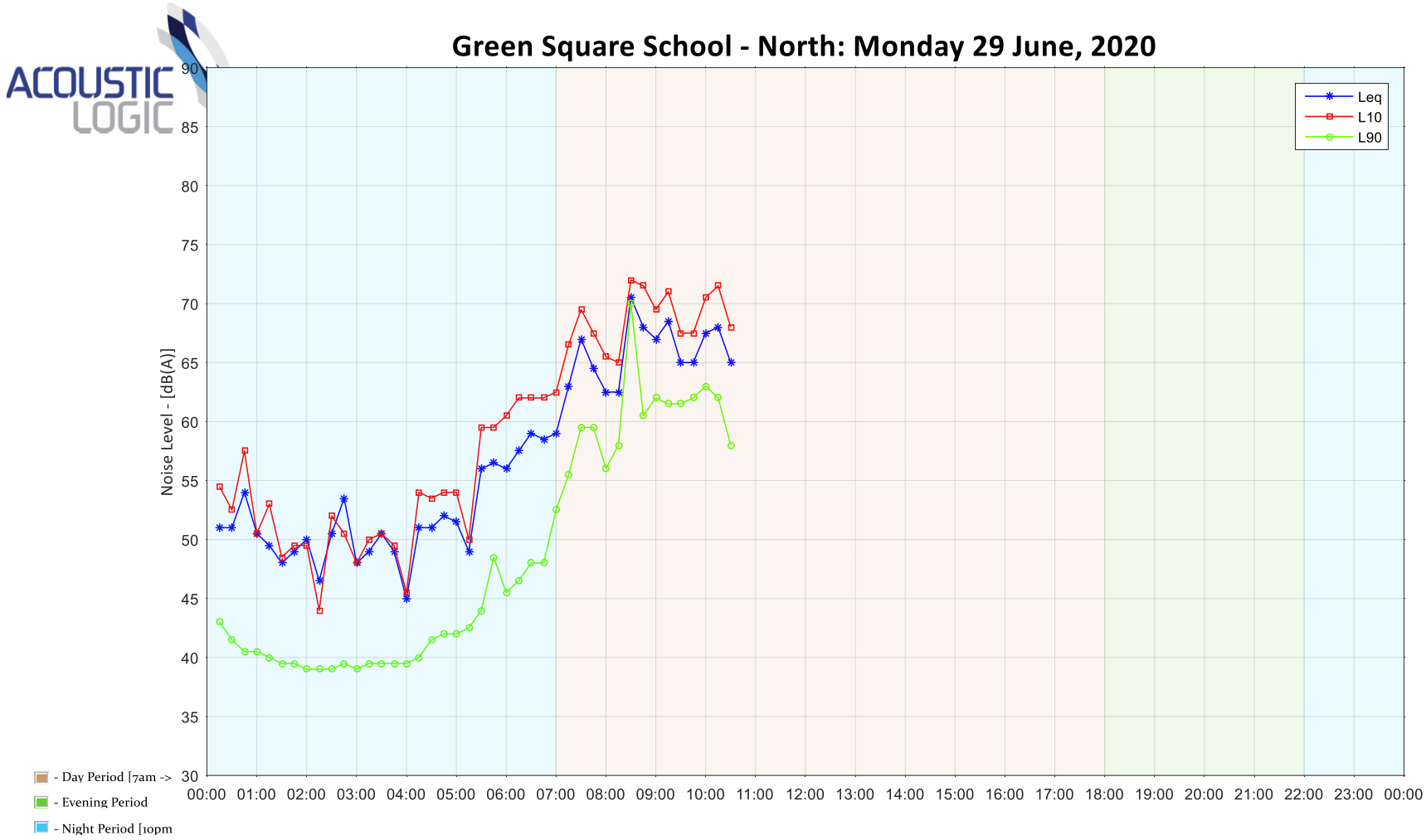

Green Square School - North: Wednesday 24 June, 2020
Noise Level - [dB(A)]
90
85
80
75
70
65
60
55
50
45
40
35
30
Leq
L10
L90
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
- Day Period [7am ->
- Evening Period
- Night Period [10pm


Green Square School - North: Thursday 25 June, 2020
Noise Level - [dB(A)]
90
85
80
75
70
65
60
55
50
45
40
35
30
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Leq
L10
L90
- Day Period [7am ->
- Evening Period
- Night Period [10pm

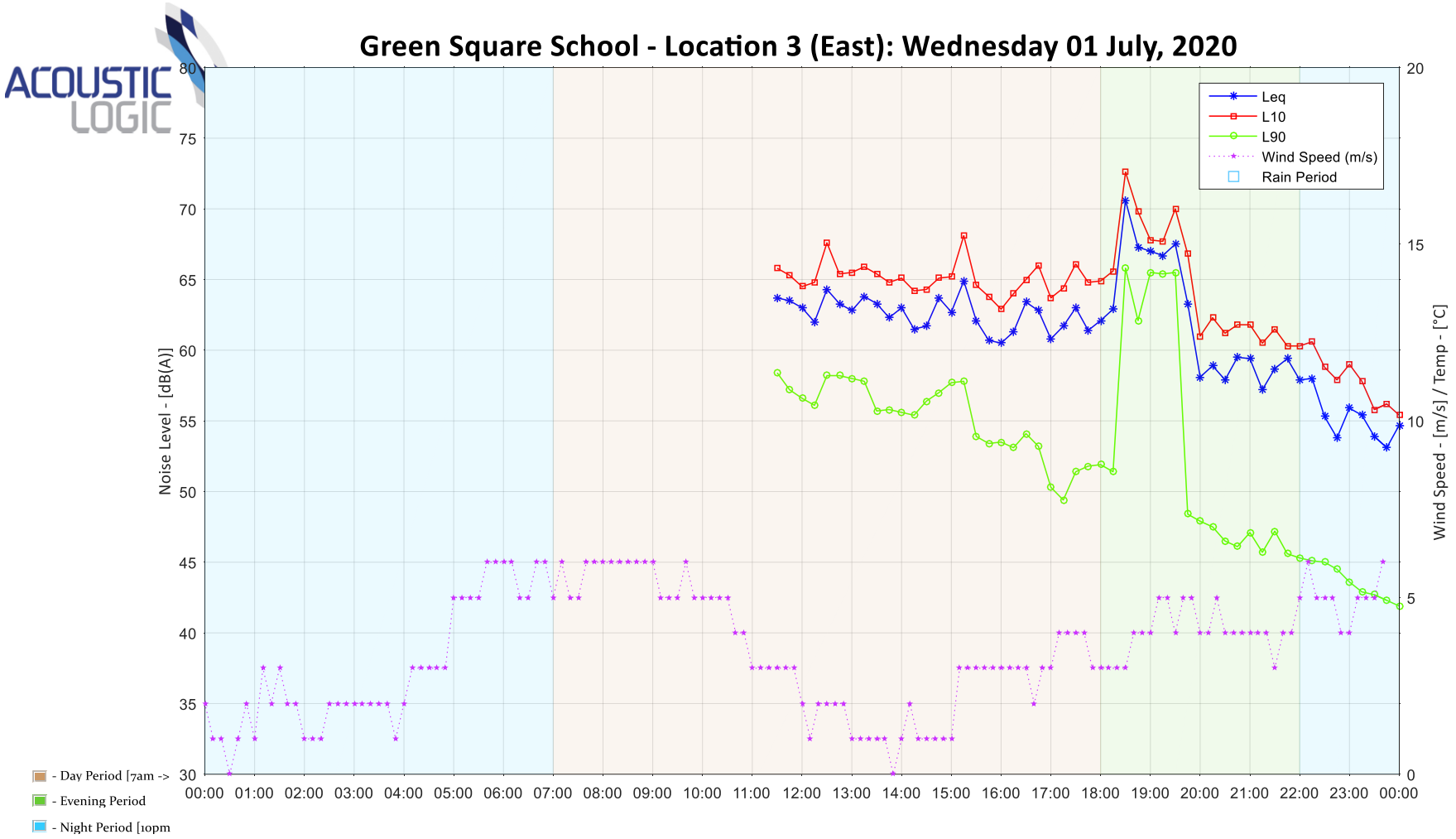

Green Square School - North: Friday 26 June, 2020
Noise Level - [dB(A)]
90
85
80
75
70
65
60
55
50
45
40
35
30
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Leq
L10
L90
6pm]
[6pm -> 10pm]
-> 7am]

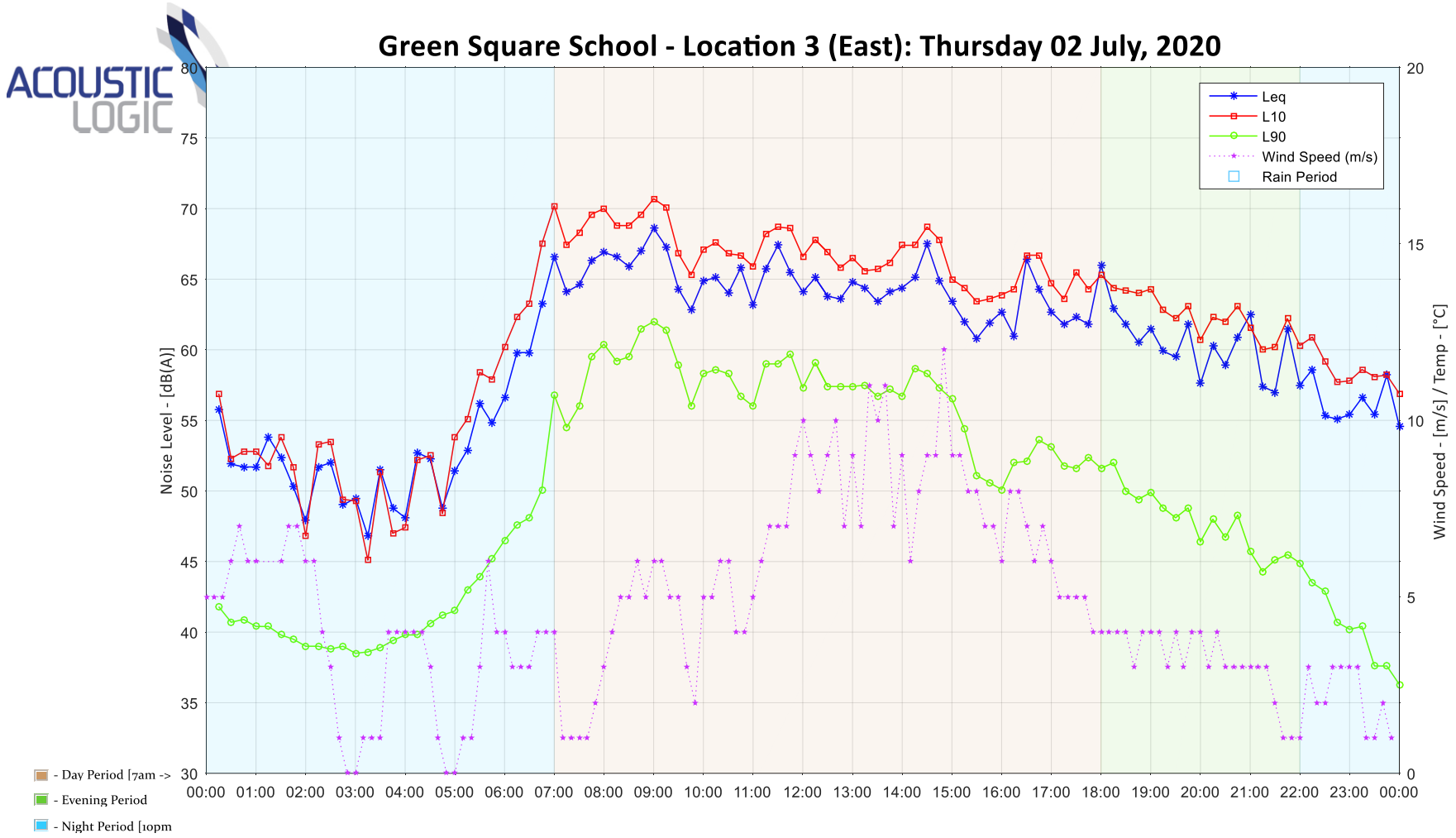

Green Square School - North: Saturday 27 June, 2020
Noise Level - [dB(A)]
90
85
80
75
70
65
60
55
50
45
40
35
30
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Leq
L10
L90
6pm]
[6pm -> 10pm]
-> 7am]

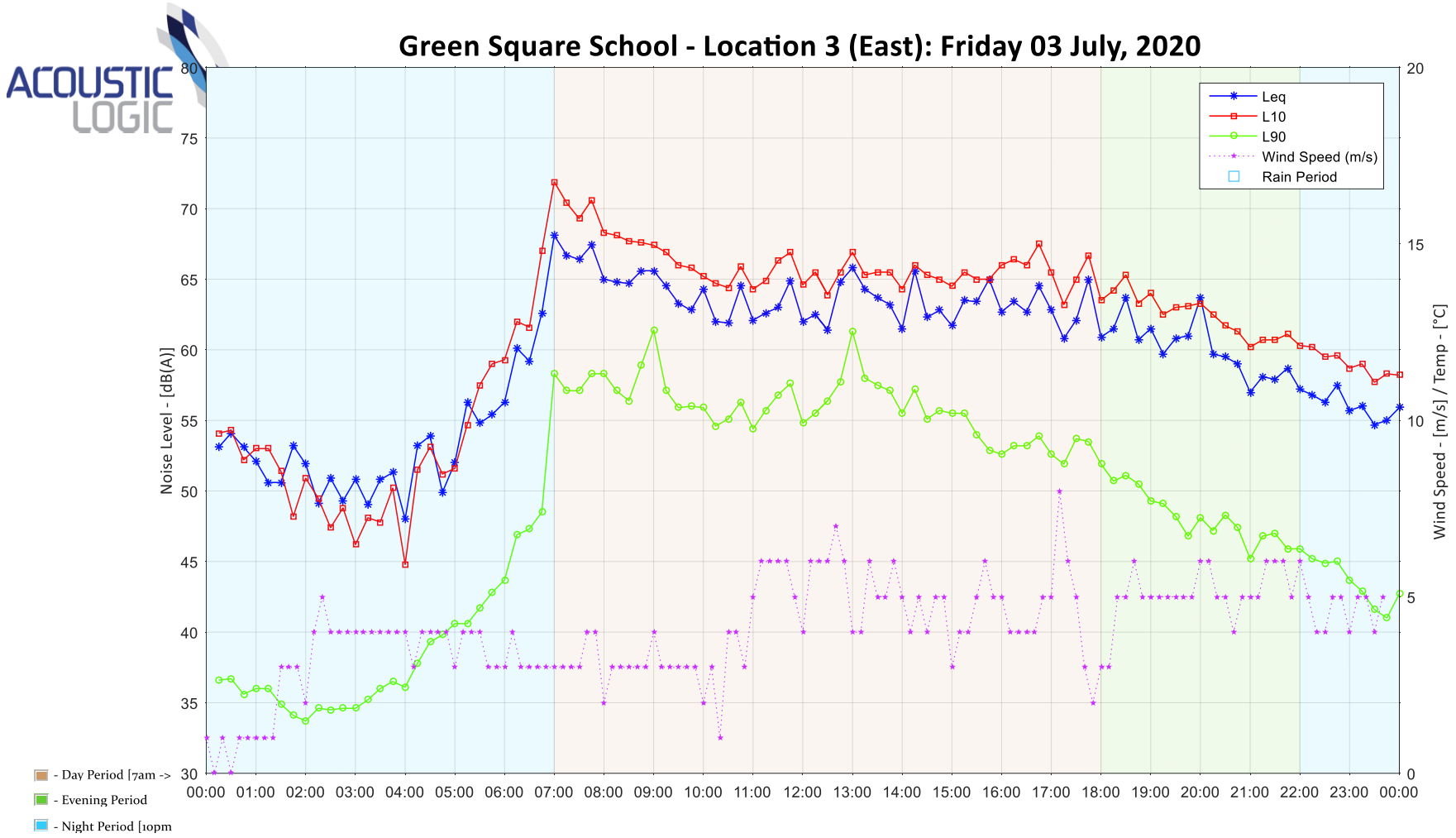

Green Square School - North: Sunday 28 June, 2020
Noise Level - [dB(A)]
90
85
80
75
70
65
60
55
50
45
40
35
30
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Leq
L10
L90
- Day Period [7am ->
- Evening Period
- Night Period [10pm

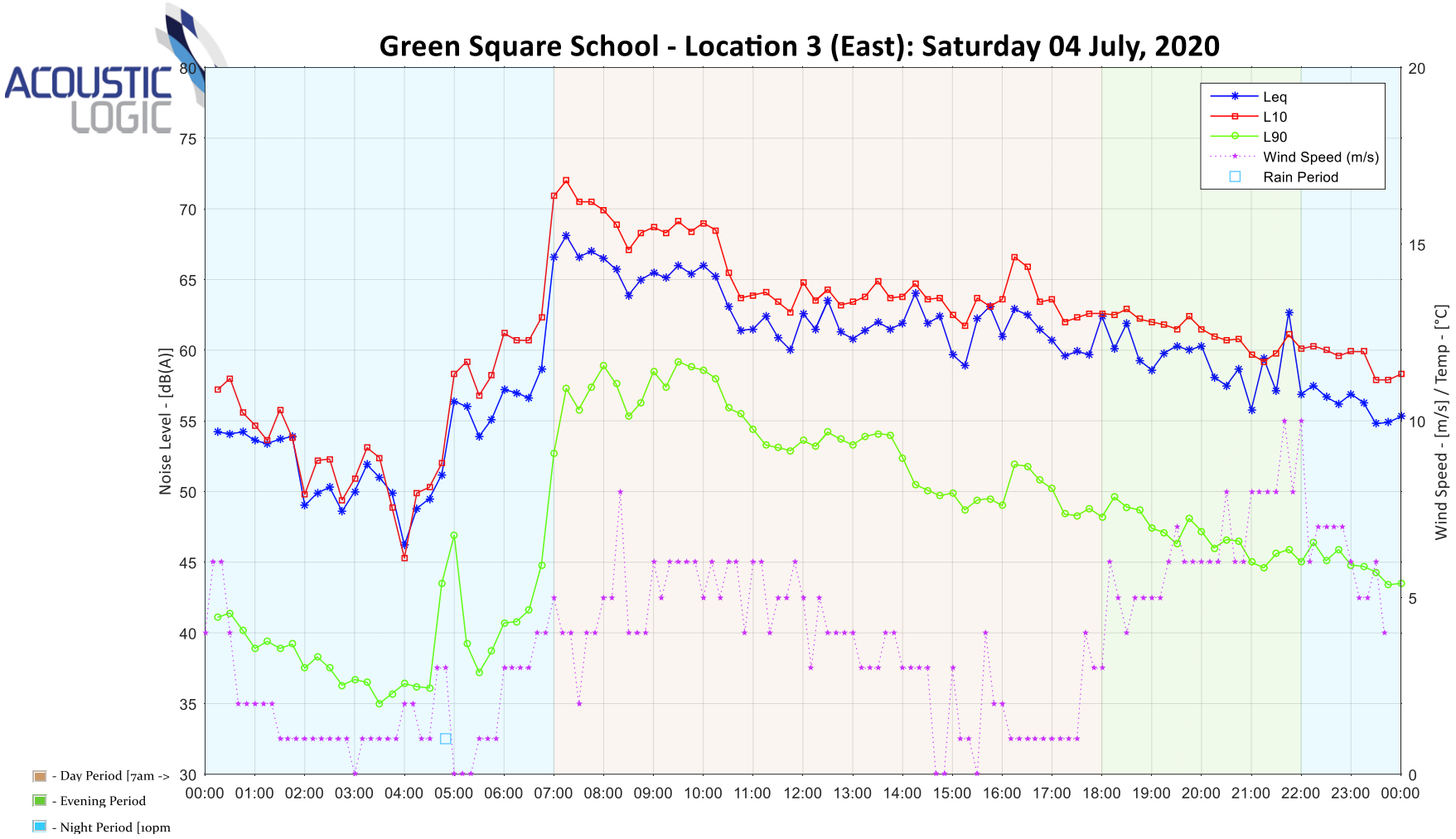

Green Square School - North: Monday 29 June, 2020
Noise Level - [dB(A)]
90
85
80
75
70
65
60
55
50
45
40
35
30
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Leq
L10
L90
- Day Period [7am ->
- Evening Period
- Night Period [10pm

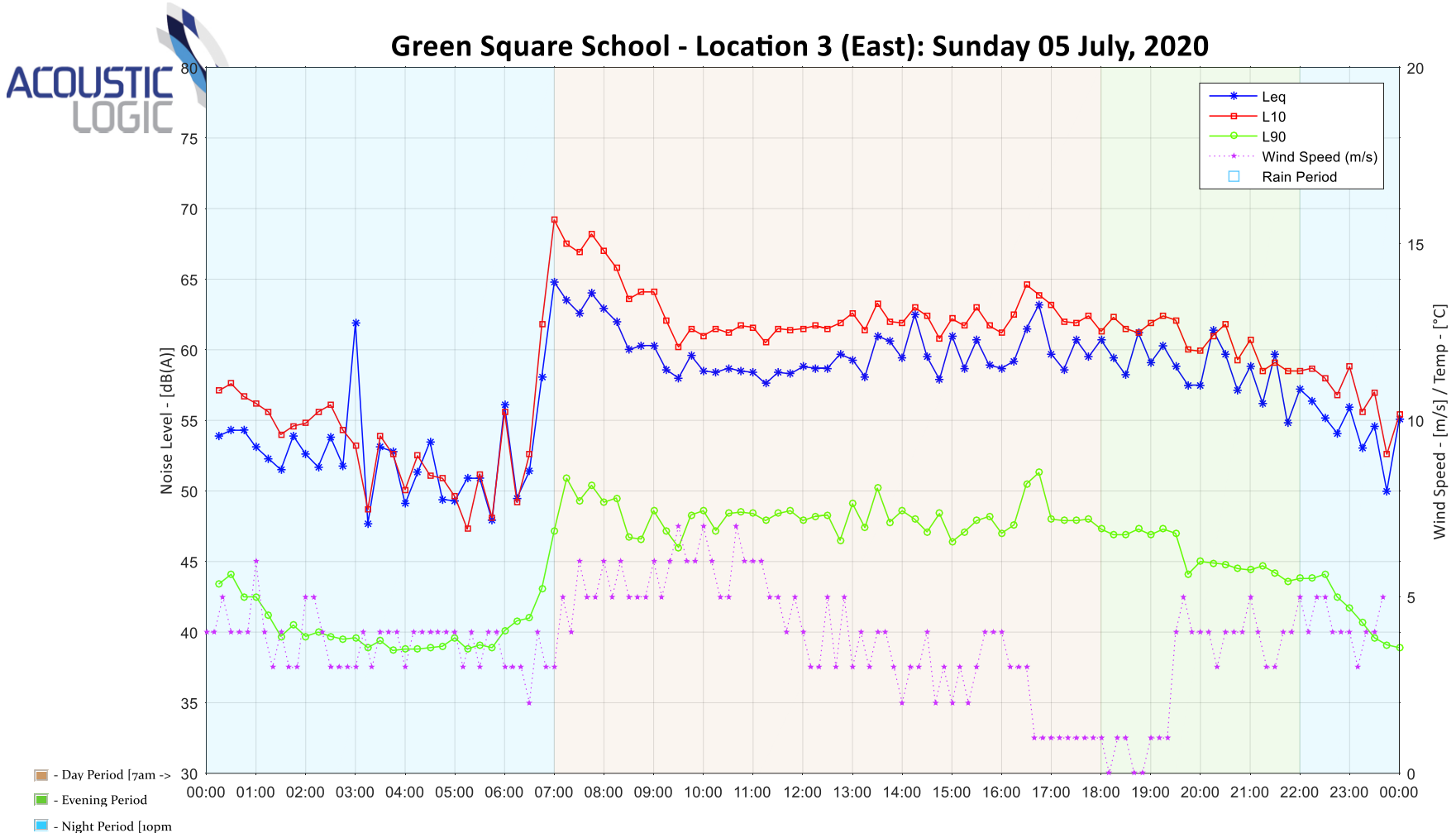
Joynton Avenue Noise Monitor (East of Site)

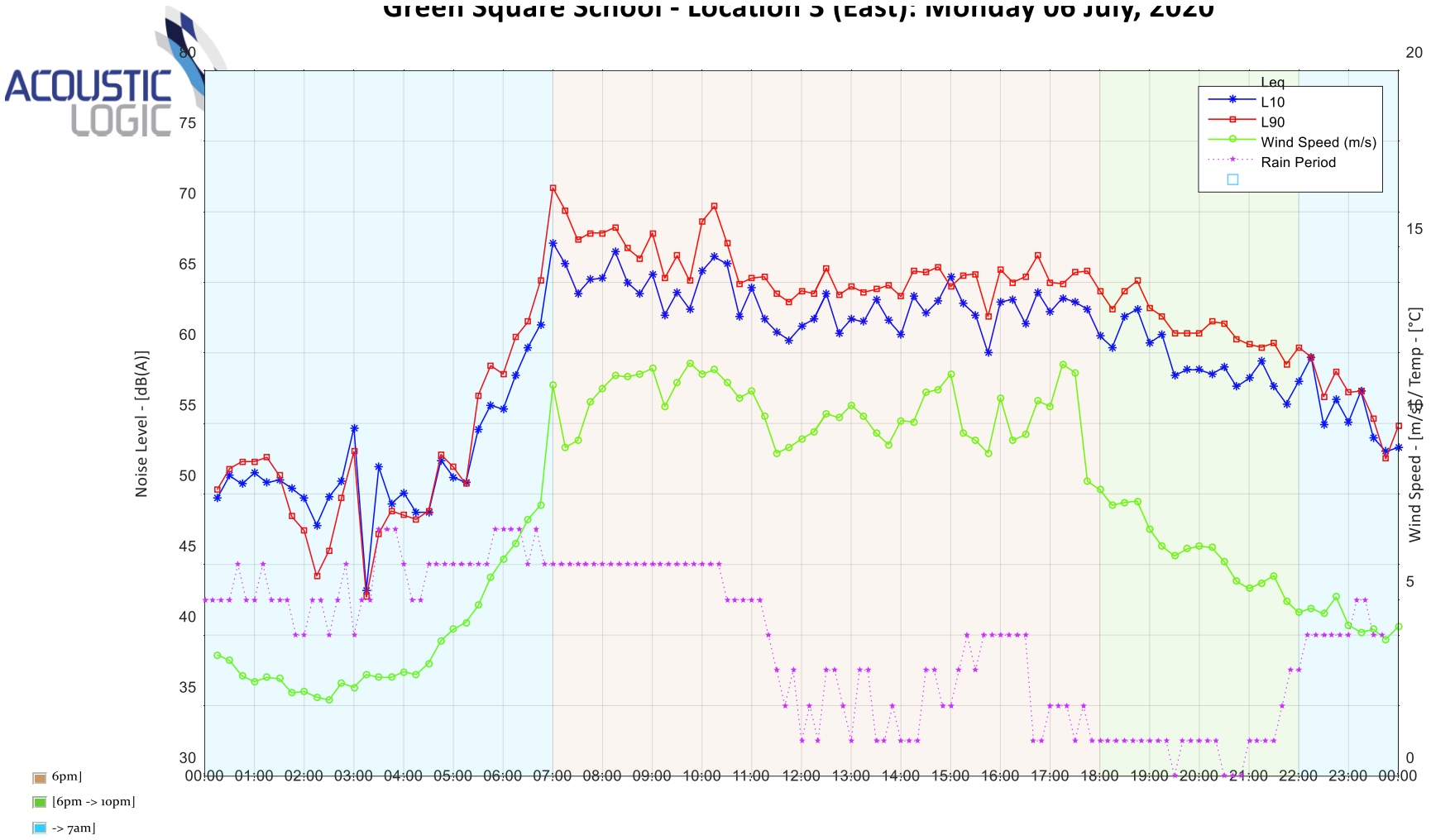

Green Square School - Location 3 (East): Wednesday 01 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am ->
- Evening Period
- Night Period [10pm
80
75
70
65
60
55
50
45
40
35
30
20
15
10
5
0
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00

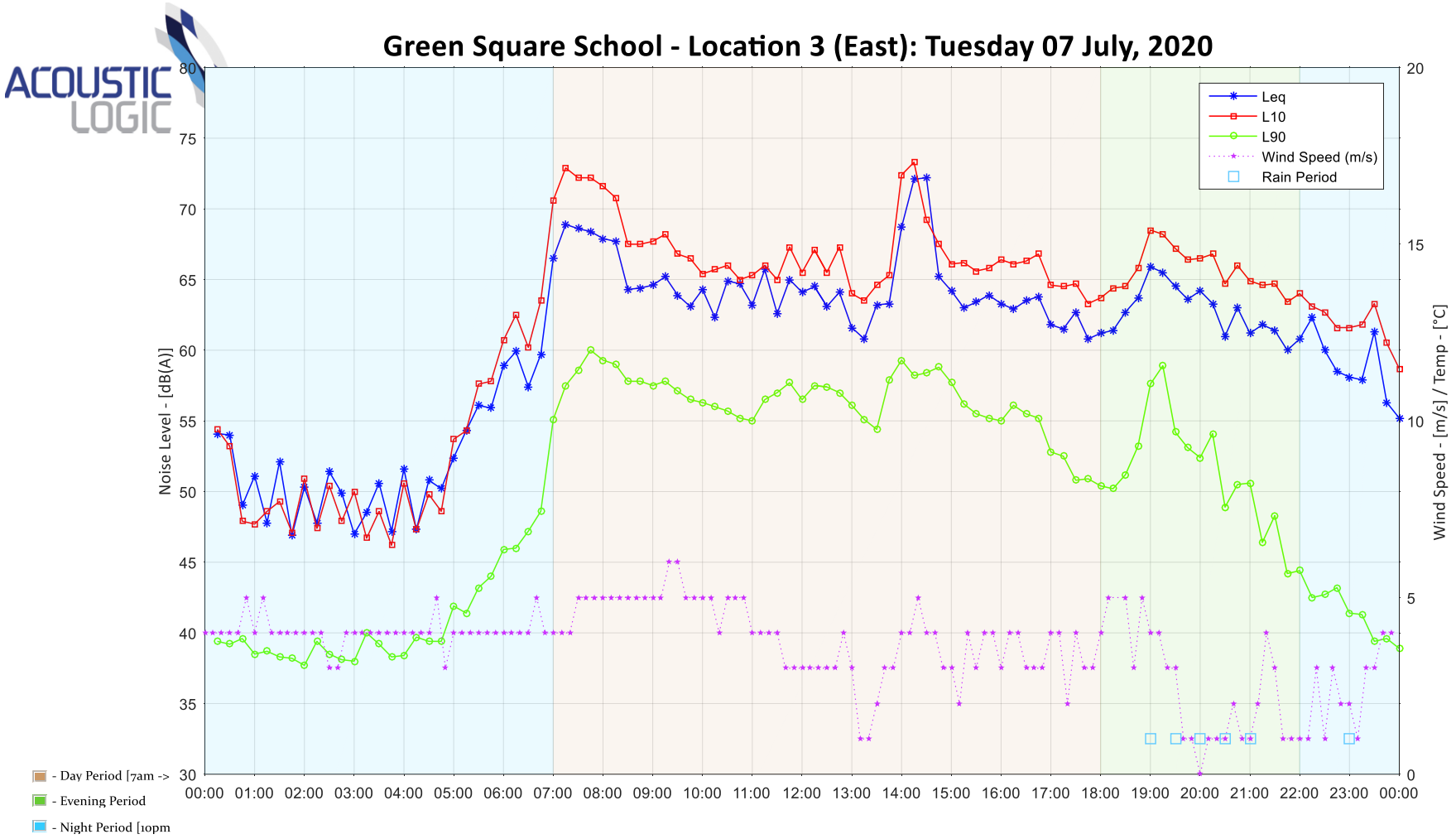

Green Square School - Location 3 (East): Thursday 02 July, 2020
Leq
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
80
75
70
65
60
55
50
45
40
35
30
20
15
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
- Day Period [7am ->
- Evening Period
- Night Period [10pm

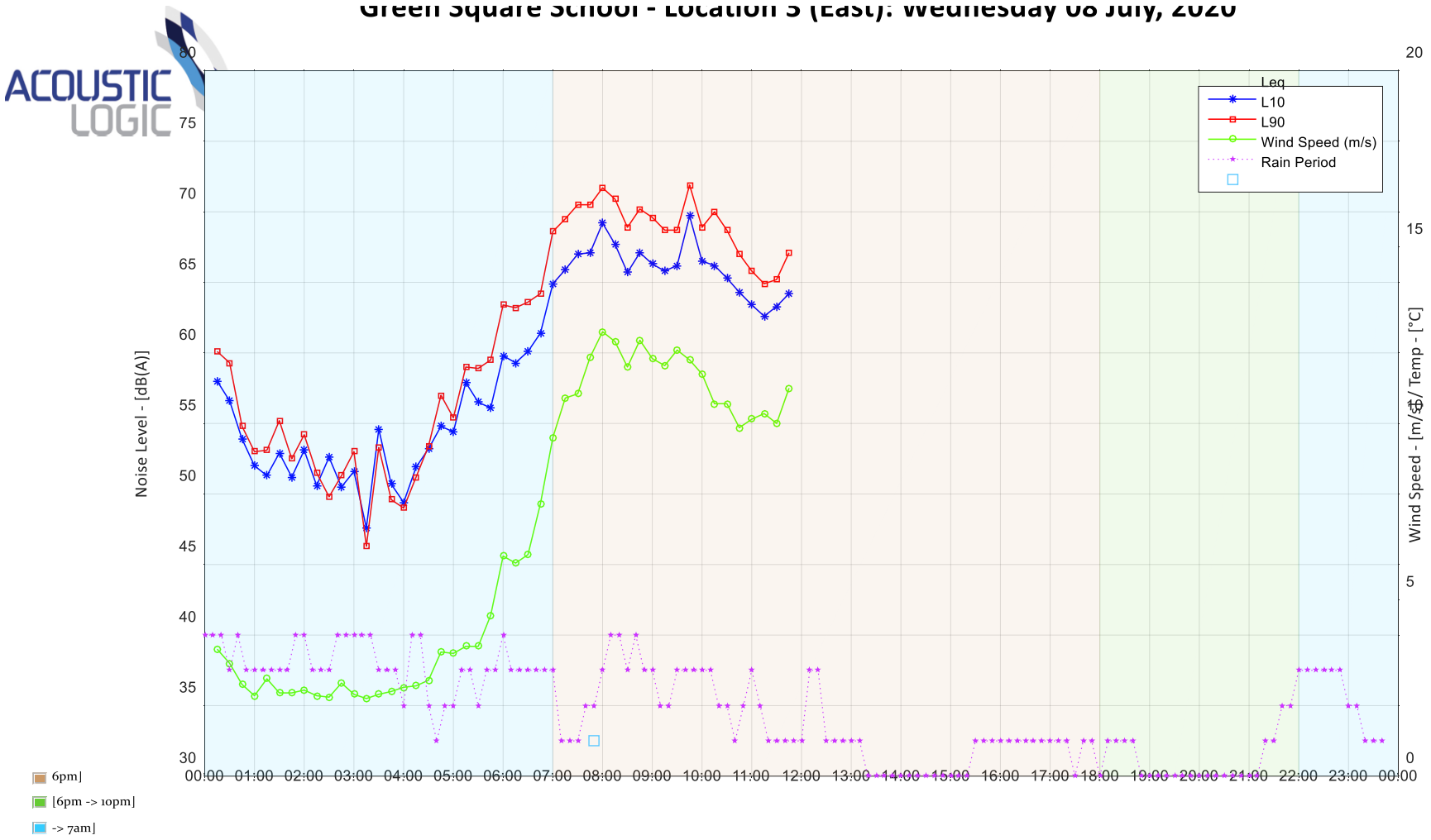

Green Square School - Location 3 (East): Friday 03 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am ->
- Evening Period
- Night Period [10pm
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Green Square School - Location 3 (East): Saturday 04 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am ->
- Evening Period
- Night Period [10pm
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Green Square School - Location 3 (East): Sunday 05 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am ->
- Evening Period
- Night Period [10pm
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Green Square School - Location 3 (East): Monday 06 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
6pm]
[6pm -> 10pm]
-> 7am]


Green Square School - Location 3 (East): Tuesday 07 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Day Period [7am ->
- Evening Period
- Night Period [10pm
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Green Square School - Location 3 (East): Wednesday 08 July, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
80
75
70
65
60
55
50
45
40
35
30
20
15
5
0
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
6pm]
[6pm -> 10pm]
-> 7am]