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Noise Impact Assessment

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Project ID	20221431.2
Document Title	Noise Impact Assessment
Attention To	Lawrence St Pty Ltd

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	7/11/2024	20221431.2/0711A/R0/HD	HD		AW

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1 INTRODUCTION

Acoustic Logic (AL) have been engaged to conduct an acoustic assessment of potential noise impacts associated with the proposed mixed-use (retail and residential) development to be located at 10–28 Lawrence Street, Freshwater.

As part of this assessment, the following has been undertaken:

- Quantification of the existing noise environment
- Establishment of suitable noise criteria for the development
- Identification of nearby noise sensitive receivers and the noise intrusion and emission sources
- A prediction of the level of noise from proposed use of the site to surrounding receivers
- Recommendations to control noise to surrounding residential receivers
- Construction noise and vibration impacts

This report should be read in conjunction with all supporting material associated with the DA submission.

2 REFERENCED DOCUMENTS

2.1.1 Background information Used

The assessment is based on the following drawings, reports and other information:

- Architectural drawings prepared by Chrofi (project no. 21053, dated 29/11/2024)
- Traffic assessment prepared by Stantec (ref: 300304343).

2.1.2 Guidelines

The following planning instruments and guidelines have been used in the assessment:

- Northern Beaches Council Document – Waringah Development Control Plan (DCP) 2011
- NSW Environment Protection Authority (EPA) - Noise Policy for Industry ("**NPfI**") 2017
- Department of Environment, Climate Change and Water NSW - NSW Road Noise Policy ("**RNP**") 2011
- Australian Standard AS2436:2010 – "Guide to noise control on construction, maintenance and demolition sites."
- NSW Department of Environment & Climate Change document "Interim Construction Noise Guidelines 2009 ("**ICNG**")."
- German Standard DIN 4150-3 "Structural Vibration: Effects of Vibration on Structures".
- Department of Environment and Conservation document – 'Assessing Vibration- A technical guideline.'
- British Standard BS 7385 Part 2-"1993 Evaluation and Measurement for Vibration in Buildings. Part 2. Guide to damage levels from ground borne vibration."

3 SITE DESCRIPTION AND THE PROPOSAL

The site is located at 10-28 Lawrence Street, Freshwater. The proposal will consist of the demolition of existing retail and commercial site and the development of shop-top housing with retail and residential apartments. The development will comprise of:

- 2 levels of basement carparking accommodating 106 parking spaces (44 for residential, 62 for retail).
- Retail and food and beverage tenancy spaces across lower and upper ground floor
- 30 residential apartments above

The predominant external noise sources impacting the site are noise from traffic movements on surrounding local roads.

3.1.1 Surrounding Noise Receivers

Based on site investigations, the following developments surround the site:

Residential Receivers

R1 Residential dwellings located to the south of the site along 2-20 Undercliff Road, Freshwater

R2 Shop top residential apartments to the north at 9-15 Lawrence Street, Freshwater

R3 Shop top residential apartments to the east at 6-8 Lawrence Street, Freshwater

R4 Two-storey mixed-use commercial building to the west of the site at 48 Lawrence Street, Freshwater

Commercial Receivers

C1 Retail receiver to the north-east at 7 Lawrence Street, Freshwater

C2 Commercial/retail receivers to the north along 17-29 Lawrence Street, Freshwater

C3 Harbord Literary Institute to the north-west at 31 Lawrence Street, Freshwater

A site survey including surrounding receivers and monitoring locations is presented in Figure 1 below

Figure 1 – Site Survey, Surrounding Receivers and Monitoring Locations (Source: SIX Maps NSW)

4 AMBIENT NOISE SURVEY SUMMARY

Long term unattended noise monitoring was conducted to quantify the existing acoustic environment at the site and at the identified residential receivers above. Noise measurements were undertaken in November 2022.

Unattended measurements have been undertaken as per the procedures outlines in Fact Sheet A & B of the NSW EPA Noise Policy for Industry. Detailed graphs of the measured noise levels from the unattended noise monitor are presented in the appendices of this report.

Rating background noise levels have been summarised in the Table below. Appendix A provides detailed information on the selected monitoring location, duration and calculation procedures required for the assessment, as well as detailed graphs of the measured noise levels from the monitor.

Table 1 – Measured Rating Background Noise Levels

Monitor Location	Rating Background Noise Level - Time of Day		
	Daytime (7am-6pm)	**Evening (6pm-10pm)**	**Night (10pm-7am)**
M1 Southern Boundary	48 dB(A) $L_{90(period)}$	44 dB(A) $L_{90(period)}$	38 dB(A) $L_{90(period)}$

5 NOISE STANDARDS AND GUIDELINES

Potential noise emissions from the site will be assessed within the context of the site against relevant noise project noise criteria. The primary potential noise sources from the use of the site will be from carpark and retail (patrons, mechanical services) uses, as well as from base building services for the residential component of the development.

The following guidelines have been referenced to as part of the assessment:

- Northern Beaches Council document - Warringah Development Control Plan (DCP) 2011
- NSW EPA Noise Policy for Industry ("NPfI") 2017
- NSW EPA Road Noise Policy ("RNP") 2011

An outline of relevant acoustic criteria is presented below.

5.1 WARINGAH DEVELOPMENT CONTROL PLAN 2011

Warringah DCP provides the following controls with respect to noise emissions from the development:

Requirements

1. *Noise from combined operation of all mechanical plant and equipment must not generate noise levels that exceed the ambient background noise by more than 5dB(A) when measured in accordance with the NSW Industrial Noise Policy [Superseded by the NPfI 2017] at the receiving boundary of residential and other noise sensitive land uses.*

5.2 NSW EPA NOISE POLICY FOR INDUSTRY (NPFI) 2017

The EPA NPfI has two criteria which both are required to be satisfied, namely intrusiveness and amenity. The NPfI sets out acceptable noise levels for various localities. The policy indicates four categories to assess the appropriate noise level at a site. They are rural, suburban, urban and urban/industrial interface. Under the policy the nearest residential receivers would be assessed against the 'urban' criteria.

Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

5.2.1 Intrusiveness Criterion

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 5dB(A).

Table 2 – NPfI Intrusiveness Noise Trigger Levels

Location	Period/Time	Background Noise Level dB(A) $L_{90,(15min)}$	Intrusiveness Noise Level dB(A) $L_{eq(15min)}$
Surrounding residential receivers	Day (7am-6pm)	48	53
	Evening (6pm-10pm)	44	49
	Night (10pm-7am)	38	43

5.2.2 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The EPA's NPfI 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, the Noise Policy for Industry suggests the adoption of the 'Urban' categorisation.

The NPfI requires project amenity noise levels to be calculated in the following manner;

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

The amenity levels appropriate for the receivers surrounding the project site are presented below.

Table 3 – NPfI Amenity Noise Trigger Levels

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

The NSW EPA Noise Policy for Industry defines:

- Day as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening as the period from 6pm to 10pm.
- Night as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

5.2.3 Sleep Arousal Criteria

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

Table 4 – Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
Residential Receivers Night (10pm – 7am)	38 dB(A) L_{90}	43 dB(A)$L_{eq,\ 15min}$; 53 dB(A)L_{Fmax}

- Step 2 – If there are noise events that could exceed the average/maximum criteria detailed 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 60-75dB(A) are not likely to affect health and wellbeing significantly.*

We note that at this stage, no operations have been proposed during the night time period and as such, this assessment is not required. It is expected that any future proposed operations within the night or morning shoulder periods (i.e., between 5am-7am) would be accompanied by a separate planning proposal.

5.2.4 Summarised NPfI Project Noise Trigger Levels

NPfI project noise trigger levels have been presented for the relevant periods below.

Table 5 – NPfI Project Noise Trigger Levels

Receiver	Period	Assessment Background Noise Level dB(A)L_{90}	Project Amenity Noise Level dB(A) $L_{eq(15min)}$	Intrusiveness Noise Level $L_{eq(15min)}$	NPfI Sleep Disturbance Noise Level
Residential Receivers (Urban) R1-R4	Day	48	58	**53**	N/A
	Evening	48	**48**	49	N/A
	Night	38	43	**43**	43 dB(A)$L_{eq,\ 15min}$; **53** dB(A)L_{Fmax}
Commercial C1-C3	When in use	N/A	**63**	N/A	N/A

5.3 TRAFFIC GENERATION

5.3.1.1 NSW EPA Road Noise Policy (RNP)

For land use developments with the potential to create additional traffic, the development shall comply with the requirements detailed in the EPA's RNP guidelines, detailed in the table below. This has been applied to assess the potential acoustic impacts of increased through-traffic that may result from the use of the development.

The surrounding road network is comprised of local roads. The criteria applicable to local roads is adopted for this assessment:

Table 6 – RNP Criteria for Increased Traffic Generation from the Development

Time of Day	Permissible Noise Generation
Day (7am – 10pm)	55 dB(A)$L_{eq(1hour)}$
Night (10pm- 7am)	50 dB(A)$L_{eq(1hour)}$

Given $L_{eq(1hour)}$ traffic noise levels currently exceed the noise levels identified in the above table, the provisions outlined in Section 3.4 of the Road Noise Policy apply, as detailed below:

"If practicable, noise on public roads as a result of increased traffic generation should not result in an increase in traffic noise levels of more than 2 dB(A). In this regard, the policy relevant states that "an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person".

6 NOISE EMISSION ASSESSMENT

A discussion of the potential noise impacts associated with the development have been presented for the following:

- Ground level retail tenancies
- Preliminary assessment of mechanical plant noise emissions (commercial and residential)
- Noise from use of carpark driveway
- Use of rooftop communal open space

6.1 COMMERCIAL USE OF THE SITE

The specific use of each of the ground floor commercial tenancy spaces is unknown at this stage. It is assumed that each tenancy space will be used within a retail or café capacity.

The primary source of noise generated by the retail tenancies are likely to be associated indoor background music (as well as plant noise associated with the use). In this regard, we note the following:

- It is expected that compliance with the relevant noise emission objectives is to be reviewed for any tenancies capable of generating higher noise levels, based on a separate planning approval as part of a fit out development application subject to the specific operations of each individual commercial tenancy once operators have been determined. Tenancies will be capable of achieving noise emission objectives provided the appropriate acoustic treatments and management controls are implemented for each specific application.
- *If* tenancies were to become licensed for the service of alcohol, this use would be subject to a separate planning application which would be accompanied by a noise impact assessment of the proposed use typical for Liquor and Gaming NSW. Acoustic treatments and management controls could be applied to these tenancies use to achieve the relevant noise emission requirements from internal activities (such as upgraded glazing); however, the use of external areas (if any) would be likely management of patron numbers/hours of use to achieve compliance at all times.

6.2 NOISE FROM MECHANICAL PLANT

Mechanical plant servicing the development are not typically selected at this stage, though it is assumed that common plant is to be installed within the basement, ground level and at roof level of the development.

Typically, this is comprised of large axial and centrifugal supply/exhaust fans, AHUs, A/C and refrigeration condensers and the like. A preliminary review of noise generation from mechanical plant has been undertaken below.

6.2.1 Plant Generally

Experience with similar projects dictates that the following acoustic treatment methods may be implemented:

Major Supply / Exhaust Plant

Supply and exhaust fans are typically located within the basement plant rooms or in rooftop plant areas. These units typically emit high noise levels and require acoustic treatment such as silencers/attenuators and internally lined ductwork, and barriers, external lagging or enclosures for external plant. Silencer requirements would be determined once fan selections have been completed.

Minor Plant

Other minor plant items, such as bathroom or kitchen exhaust fans, may also be required. These items typically emit relatively low noise levels and may require minimal acoustic treatment of a standard nature, such as internally lining of ductwork.

A detailed acoustic review should be undertaken prior to CC to determine acoustic treatments to control noise emissions to satisfactory levels.

Acoustic treatments to all plant are to be reviewed by the acoustic consultant prior to construction once final plant selections have been made to ensure relevant noise emission requirements are satisfied. Noise levels are to be satisfied cumulatively from all plant servicing the development.

6.2.2 Rooftop Plant Compounds

Rooftop plant compounds are often required for developments of this size. Chillers, Air handling Units (AHUs) and condenser units (CUs) are most typically located in these areas and are likely to require additional treatment to comply with external noise emission goals, typically in the form of perimeter barriers, attenuators and/or enclosures. Given the detailed number, location and noise levels of rooftop plant is unknown, maximum permissible sound power levels from roof top plant compounds have been determined based on the following assumptions:

- There are two rooftop plant compounds.
- The nearest rooftop plant is approximately 23m from the nearest residential receiver
- Units will operate at up to 100% capacity between 7am-10pm
- Residential CUs will operate at a reduced capacity after 10pm
- Condensing units are to have night quiet mode settings installed for off peak use
- Given the topography and height of the rooftop plant with respect to nearby receivers, a minimum line of sight barrier reduction is assumed.

Based on assumptions above, to comply with Council and NSW EPA guidelines at the nearest sensitive receiver; the maximum permissible *sound power level* for each rooftop bank is:

- 88 dB(A) during the day and evening.
- 83 dB(A) during the night.

Note: these levels are indicative only and are to be reviewed in more detail during the detailed design stage and is to be assessed cumulatively from all external plant in this area.

If the final plant selection exceeds the above cumulative noise levels, additional treatment will be required to either individual plant items or to each roof plant compound as a whole. This may be achieved with solid barriers/screens, acoustic louvres, alternative plant selections, attenuators and/or absorptive linings to wall surfaces.

6.3 CARPARK USE

The following assumptions have been made for cars entering and exiting the carpark:

- In a given peak-hour period, up to 67 vehicles trips will occur.
    - In a peak 15-minute period, 17 parking spaces will either fill or empty.
- Cars and SRVs have been modelled to a sound power level of 84dB(A), typical of these vehicles in the experience of this office.
- Cars and SRVs are assumed to be travelling at 10km/h.
- It is assumed that any peak noise events such as car door slamming and engine starts will be isolated within the basement levels of the development as cars drive into the carpark.
- The retail carpark areas are not in use during the night-time period. As such, transient (L_{max}) noise levels have not been calculated as part of this assessment.

The average ($L_{eq(15min)}$) noise level generated by assumed maximum potential use of the carpark have been predicted to the nearest residential receivers and assessed below. Where compliance is achieved at these receivers, it is expected that noise levels at remaining receivers will also be achieved given that they are located further away.

Table 7 – Predicted Average Noise Levels from Carpark Operation

Emission Scenario	Receiver	Predicted Noise Level dB(A) $L_{Aeq,15min}$	Project Noise Trigger Level	Compliance
Cars and SRVs Entering and Exiting the Carpark	R1 2 Undercliff Road, Freshwater	≤ 30	Evening (6pm – 10pm) ≤ 48 dB(A) $L_{Aeq,15mi}$	**Yes**
	R4 48 Lawrence Street, Freshwater	≤ 36		

6.4 ROOFTOP COMMUNAL OUTDOOR SPACE

In relation to the outdoor communal areas on roof level we note that there are no specific noise emission criteria for use of residential private open spaces, and guidelines such as the commonly adopted NSW EPA Noise Policy for Industry (NPfI) are not appropriate for assessment of this noise type.

As with noise from private open space in detached dwellings, a level of noise generated on residential lots is accepted as part of community living. For example, noise from lawn mowing is accepted as "normal", notwithstanding the relatively high levels of noise generated. These noisier activities are a common occurrence, as are other noise generating activities carried out in private open space from time to time.

Time limits on activities are imposed by legislation to manage these louder activities, and to prevent them from adversely impacting other properties, particularly at night. Given that the nearest receivers around communal open spaces are the occupiers of the same development, it is common for the owners corporations to include by-laws to manage the use of these spaces such as time limits, restriction on the number of users, etc.

Given the communal outdoor space is elevated in relation to both internal and surrounding external receivers, a reasonable and feasible construction treatment to the communal outdoor space includes the provision of solid (e.g., Colourbond, glass, timber, etc.) balustrades to the boundaries of the communal space.

It is recommended that an acoustic review of proposed treatment be undertaken at CC stage for the communal outdoor spaces.

6.5 TRAFFIC GENERATION

The traffic assessment prepared by Stantec (ref: 300304343) provides the following commentary:

> *The site is expected to generate up to an additional 3, 4 and 8 vehicles trips in the AM, PM and Saturday peak hours respectively. There is more than adequate capacity in the surrounding road network to cater for the additional traffic generated by the proposed development.*

There are already a significant number of movements through the town centre road network, however the number of existing movements is not provided in the report.

Considering the increased traffic generation compared to the likely number of existing movements generated by through traffic and traffic generated by the existing commercial and retail development, the proposal is not expected to produce more than the 2 dB increase in traffic noise that the Road Noise Policy considers to be a significant increase.

On this basis it is concluded that increased traffic movements on the surrounding road network generated by the proposed development is unlikely to result in any adverse noise impact.

7 CONSTRUCTION NOISE AND VIBRATION IMPACTS

Construction noise and vibration impacts during the demolition/construction phases of the development have been assessed with reference to the following documents.

- Australian Standard AS2436:2010 – *"Guide to noise control on construction, maintenance and demolition sites*."
- NSW Department of Environment & Climate Change document "*Interim Construction Noise Guidelines* 2009 (ICNG)."
- German Standard DIN 4150-3 "*Structural Vibration: Effects of Vibration on Structures"*.
- Department of Environment and Conservation document – '*Assessing Vibration- A technical guideline.*'
- British Standard BS 7385 Part 2-"*1993 Evaluation and Measurement for Vibration in Buildings. Part 2. Guide to damage levels from ground borne vibration*."

7.1 CONSTRUCTION NOISE MANAGEMENT OBJECTIVES

7.1.1 Australian Standard AS2436:2010 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*"

Australian Standard AS2436 states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites, AS2436 nominates the following:

a. That reasonable suitable noise criterion is established,

b. That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and

c. The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the construction site.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic comprises between construction sites and potential noise affected receivers.

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.
- Adopt management conditions as per AS2436 in the event of a non-compliance.

7.1.2 NSW EPA Interim Construction Noise Guideline

Given the scale of the proposed works, the "quantitative" assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used (as opposed to the simpler "qualitative" assessment method outlined in the guidelines). The quantitative assessment method requires:

- Determination of noise generation management levels (based on background noise levels on site).
- Prediction of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission management levels is not possible.

7.1.2.1 At Residential Receivers

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

Recommended Standard Hours

Monday to Friday (7am – 6pm) & Saturday (8am – 1pm)

- *"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 affected" 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.

Table 8 – Construction Noise Management Levels to Residential Receivers

Location	Recommended Standard Hours "Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
R1 – R4	Monday – Friday 7am – 6pm and Saturday 8am-1pm RBL 48 + 10 = 58	75

7.1.2.2 To Commercial Receivers

Section 4.1.3 *"Commercial and industrial premises"* of the ICNG outlines the following external management noise levels to the most-affected occupied point of the premises:

Table 9 – Noise Management Level for Commercial Premises (ICNG)

Space	Management Level dB(A)$L_{eq\ (15\ min)}$
Facade of Offices, retail outlets	70

7.1.3 Summary of Construction Noise Limits

A summary is presented below of the most stringent construction noise limits.

Table 10 – Summarised Project Noise Management Levels

Receiver Type	Noise Management Level dB(A) $L_{eq(15min)}$
Residential (R1-R4)	***Noise Affected Level*** 58 (Externally) ***Highly Noise Affected Level*** 75 (Externally)
Commercial (C1-C3)	70 (Externally)

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

7.2 CONSTRUCTION VIBRATION MANAGEMENT OBJECTIVES

Vibrations caused by any proposed activities on site, at the façade or incident on the structure of any surrounding sensitive receivers, will be assessed against the following provisions:

- For structural damage vibration, German Standard DIN 4150-3 Structural Vibration: Effects of Vibration on Structures.
- For human exposure to vibration, the evaluation criteria presented in Department of Environment and Conservation document – 'Assessing Vibration- A technical guideline.'

The criteria and the application of these guidelines are discussed in separate sections below.

7.2.1 Vibration Impacts on Surrounding Buildings

7.2.1.1 Structure Borne Vibration

German Standard DIN 4150-3 (2016) provides a guideline for acceptable levels of vibration velocity in building foundations, to assess the effects of vibration on structures. The table give guidance on the maximum accepted values of velocity at the foundation and in the plane of the highest floor of various types of buildings, to prevent any structural damage.

The table following lists the peak particle velocity, which is the maximum absolute value of the velocity signals for the three orthogonal components. This is measured as a maximum value of any of the three orthogonal component particle velocities when 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.

It is noted that if measured vibration levels do not exceed the guidelines listed in the following table, damage that will reduce the serviceability of the building will not occur, and if damage to the building does occur, it is assumed that the damage is related to other causes. Furthermore, the DIN4150-3 guideline states the following regarding the limits presented in Table 1 of the standard:

"Exceeding the guideline values does not necessarily lead to damage. Should they be exceeded, however, further investigations may be necessary, such as determining and evaluating the stresses as detailed in 4.3 and 4.4.".

Table 11 -(Table 1 – DIN 4150-3 (2016)) – Guideline Values for Vibration Velocity, $v_{i,max}$, for Evaluating the Effects of Short-Term Vibration on Structures

	TYPE OF STRUCTURE	Guideline values for $v_{i,max}$ in mm/s				
		Foundation, all directions, i = x, y, z, at a frequency of			Topmost floor, horizontal direction, i = x, y	Floor slabs, vertical direction, i = z
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz [(a)]	All Frequencies	All Frequencies
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20

3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 **and** are of great intrinsic value (e.g. listed buildings) buildings that are under a preservation order)	3	3 to 8	8 to 10	8	20[(b)]

NOTE Even if guideline values as in line 1, columns 2 to 5, are complied with, minor damage cannot be excluded.

a At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.

b It may be necessary to lower the guideline value markedly to prevent minor damage

7.2.1.2 Assessing Amenity

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline*. These levels (extracted from Tables 2.2 and 2.4 of the guideline) are presented in the following table for various types of vibration:

Table 12 - (Table 2.2 Assessing Vibration: A Technical Guideline) – Preferred and Maximum Weighted RMS Values for Continuous and Impulsive Vibration Acceleration (m/s^2) 1-80Hz

Location	Assessment Period [1]	Preferred values		Maximum Values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous Vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.02	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
Workshops	Day or night-time	0.04	0.029	0.080	0.058
Impulsive Vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

1 Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am.

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate task require more stringent criteria than the human comfort criteria specified above. Stipulation of such criteria is outside the scope of this policy, and other guidance documents (e.g. relevant standards) should be referred to. Source: BS6472-1992.

Table 13 -(Table 2.4 Assessing Vibration: A technical guideline) – Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum Value	Preferred value	Maximum Value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

1 Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am.

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source: BS6472-1992.

7.2.2 Recommended Vibration Limits

The table below presents the recommended vibration limit at the nearest vibration sensitive receivers.

Table 14 – Recommended Vibration Limit

Vibration Receiver	Recommended Vibration Limits
R1-R4	≤5mm/s PPV*
C1-C3	≤20mm/s PPV*

*Note: it is for building damage limit only

7.3 RECOMMENDATIONS

Acoustic Logic recommend a Construction Noise and Vibration Management Plan be prepared for submission to council prior to gaining Construction Certificate to assess the impact of Construction on surrounding noise and vibration sensitive receivers.

The report should be prepared by a qualified acoustic consultant and should include the following:

- Identification of the noise and vibration standards and statutory requirements which will be applicable to this project, in line with those presented within Section 7 of this report.
- Identification of potentially impacted nearby sensitive noise receivers to the development, in line with those presented within Section 3 of this report.
- Identify likely sources of noise and vibration generation during construction and predicted noise levels at nearby development.
- Formulation of a strategy to comply with the standards identified and mitigation treatments in the event that compliance is not achievable.

8 CONCLUSION

Acoustic Logic (AL) has conducted an acoustic assessment of potential acoustic impacts associated with the proposed mixed used development at 10-28 Lawrence Street, Freshwater.

The following noise impacts have been addressed:

- Noise emissions from commercial and retail use of the site.
- Noise emissions from mechanical plant servicing the development.
- Noise emissions from use of the carpark.
- Construction noise and vibration Impacts.

Limits for the site have been established for the proposed uses of the development. It is recommended that individual retail tenancies and any proposed mechanical plant be acoustically reviewed as part of future fit out development applications (at which stage the details of specific plant will be confirmed) to ensure that the (cumulative) noise emission criteria established are achieved.

The following documents have been referenced as part of this assessment:

- Northern Beaches Council Document – Waringah Development Control Plan (DCP) 2011
- NSW Environment Protection Authority (EPA) - Noise Policy for Industry ("NPfI") 2017
- Department of Environment, Climate Change and Water NSW - NSW Road Noise Policy ("RNP") 2011
- Australian Standard AS2436:2010 – "Guide to noise control on construction, maintenance and demolition sites."
- NSW Department of Environment & Climate Change document "Interim Construction Noise Guidelines 2009 (ICNG)."
- German Standard DIN 4150-3 "Structural Vibration: Effects of Vibration on Structures".
- Department of Environment and Conservation document – 'Assessing Vibration- A technical guideline.'
- British Standard BS 7385 Part 2-"1993 Evaluation and Measurement for Vibration in Buildings. Part 2. Guide to damage levels from ground borne vibration."

Provided the recommendations within the report are adopted, noise emissions from the proposed development would not adversely impact any of the surrounding developments, and construction noise and vibration impacts will be minimised.

Yours faithfully,

Acoustic Logic Pty Ltd
Hyde Deng
MAAS

APPENDIX A AMBIENT NOISE MONITORING

This appendix summarises the ambient noise data measured near the subject site, and the calculated noise level descriptors adopted to characterise the existing noise environment.

Monitoring has been undertaken to determine background and traffic noise levels at surrounding nearest-affected residential receivers.

A.1 UNATTENDED LONG TERM NOISE MONITORING

A.1.1 Ambient Noise Descriptors

Ambient noise constantly varies in level from moment to moment, so it is not possible to accurately determine prevailing noise conditions by measuring a single, instantaneous noise level.

To quantify ambient noise, a 15 minute measurement interval is typically utilised. Noise levels are monitored on a continuous basis over this period, and statistical and integrating techniques are used to characterise the noise being measured.

The principal measurement parameters are:

L_{eq} - represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of noise impact as it closely corresponds with how humans perceive the loudness of steady state and quasi-steady state noise sources (such as traffic noise).

L_{90} – This is commonly used as a measure of the background noise level as it represents the noise level heard in the quieter periods during the measurement interval. The L_{90} parameter is used to set noise emission criteria for potentially intrusive noise sources since the disturbance caused by a noise 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.

L_{10} is used in some guidelines to measure noise produced by an intrusive noise source since it represents the average of the loudest noise levels produced at the source. Typically, this is used to assess noise from licenced venues.

L_{max} is the highest noise level produced during a noise event, and is typically used to assess sleep arousal impacts from short term noise events during the night. It is also used to assess internal noise levels resulting from aircraft and railway ground vibration induced noise.

L_1 is sometimes used in place of L_{max} to represent a typical noise level from a number of high level, short term noise events.

A.1.2 Monitoring Locations

Monitoring locations are as outlined in Section 3, Figure 1 and detailed as follows:

- M1 – Monitor located along the southern boundary of the project site and is representative of residential receivers along Dowling Street and Undercliff Street. Background noise levels at this location have been conservatively adopted for all surrounding residences, though background levels along Lawrence Street are likely to be higher.

A.1.3 Measurement Period and Equipment Used

Long term unattended noise monitoring was conducted between the 15th to 25th of November 2022.

Unattended noise monitoring was conducted using the following equipment:

- 1 x Rion NL-42 (Type 2) noise monitor
- Rion Sound Level calibrator Type NC 74

The monitoring was continuous, with statistical noise levels recorded at 15-minute intervals throughout the monitoring period. Measurements were taken on "A" frequency weighting and fast time response, unless noted otherwise.

All monitoring equipment used retains current calibration - either manufacturers' calibration or NATA certified calibration. The monitors were field calibrated at the beginning and the end of the measurement with no significant drift in calibration noted.

A.1.4 Weather Affected and Extraneous/Outlying Data

Periods affected by adverse weather conditions are indicated on the following data graphs. Weather data was obtained from records provided by the Bureau of Meteorology for the following station:

- Sydney Olympic Park AWS (Archery Centre)

As the Bureau of Meteorology wind data is typically obtained at an exposed location at 10m above ground level, and the monitoring locations were at approximately 1.5m above ground in more sheltered locations - a wind multiplying factor of 0.5 has been applied to the BOM data to estimate the wind speed at the microphone location.

A.2 CALCULATION OF REPRESENTATIVE AMBIENT NOISE LEVELS

The noise data for the day, evening and night periods have been processed to determine the period ambient noise levels at the monitoring locations. Noise levels that are in bold type indicate that these periods were determined to have been significantly affected by non-representative noise sources (weather, mechanical plant, etc.) and these periods were excluded from subsequent calculations.

The following tables summarise the daily measurements and the representative rating background noise levels and traffic noise levels at the monitoring location.

Table 15 – NPfI Assessment Background Noise Levels – Location M1

Location	Date	ABL		
		Day	Evening	Night
Location M1	Tuesday 15 November 2022	-	46	35
	Wednesday 16 November 2022	**49**	**53**	34
	Thursday 17 November 2022	48	**45**	**35**
	Friday 18 November 2022	47	**54**	35
	Saturday 19 November 2022	48	**50**	42
	Sunday 20 November 2022	48	43	39
	Monday 21 November 2022	**50**	44	39
	Tuesday 22 November 2022	48	43	38
	Wednesday 23 November 2022	49	**54**	38
	Thursday 24 November 2022	47	**55**	41
	Friday 25 November 2022	-	-	-
	RBL	**48**	**44***	**38**

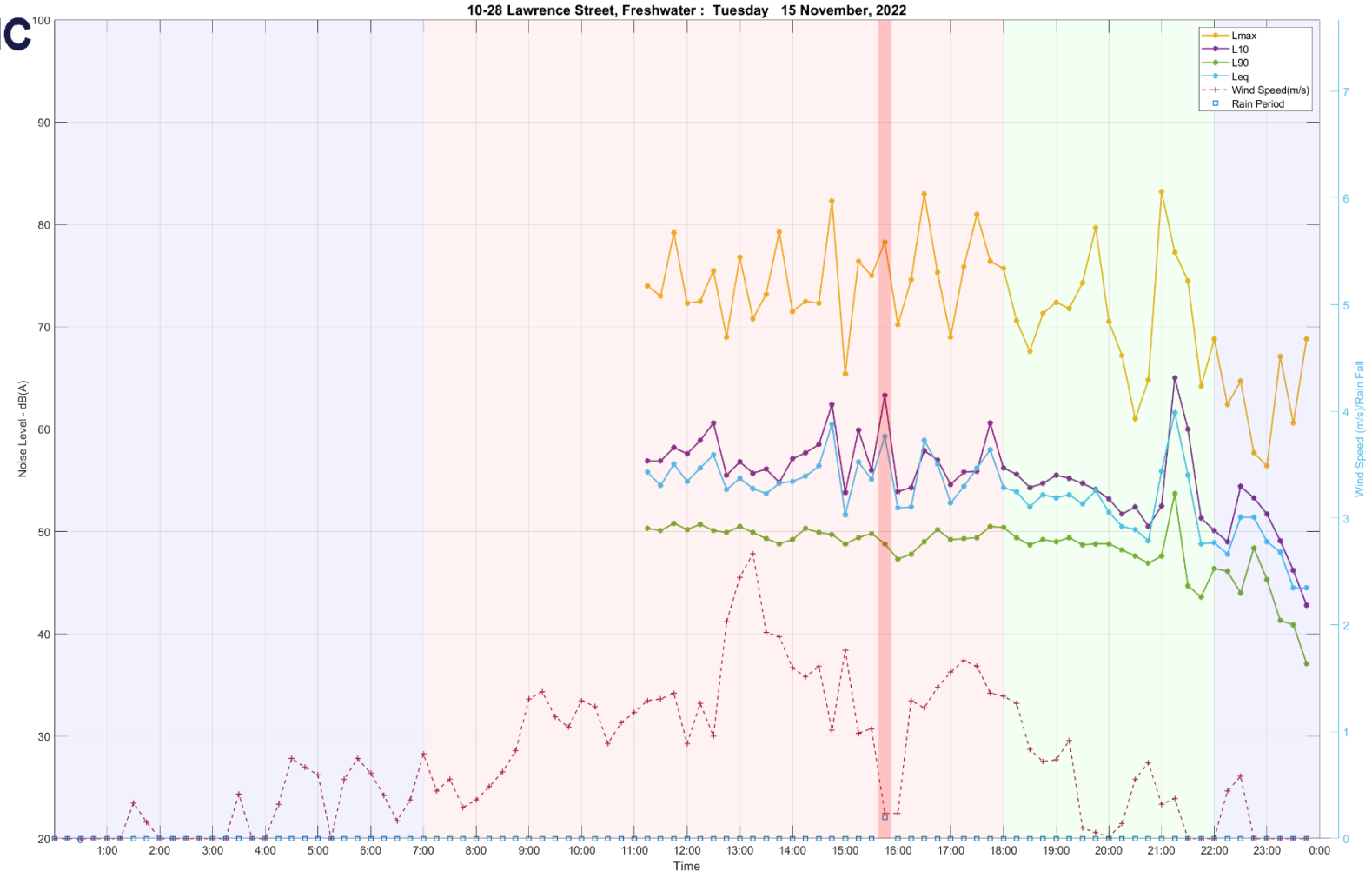
* Note: Logger measurements were impacted during some day and evening periods by mechanical plant and have been removed from the RBL calculation accordingly. The RBL has been calculated for the evening period conservatively by taking the median of the lowest L_{90} recorded throughout each day (where unaffected by mechanical plant noise).

Table 16 – Measured Traffic Noise Levels – Location M1

Location	Date	Traffic Noise Level dB(A) $L_{eq,1\text{-hour}}$	
		Day	Night
Location M1	Tuesday 15 November 2022	-	51
	Wednesday 16 November 2022	59	55
	Thursday 17 November 2022	60	54
	Friday 18 November 2022	59	51
	Saturday 19 November 2022	60	50
	Sunday 20 November 2022	60	52
	Monday 21 November 2022	59	52
	Tuesday 22 November 2022	57	52
	Wednesday 23 November 2022	59	52
	Thursday 24 November 2022	59	53
	Friday 25 November 2022	-	-

A.3 UNATTENDED NOISE MONITORING DATA

Unattended noise monitoring locations are outlined in Section 3. Photographs of the monitoring location are presented below, with respective monitoring graphs provided on the following pages.


10-28 Lawrence Street, Freshwater : Tuesday 15 November, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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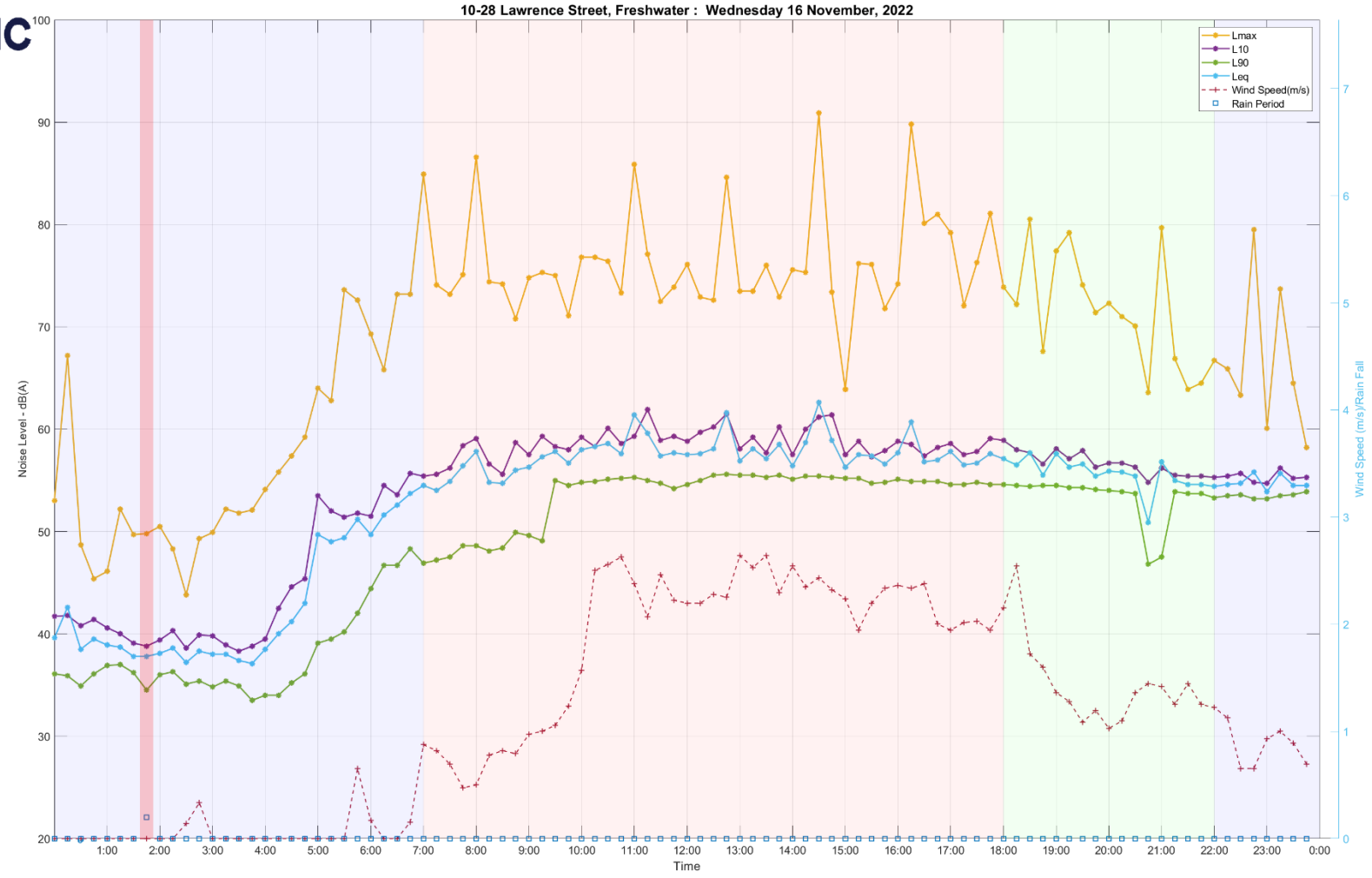
10-28 Lawrence Street, Freshwater : Wednesday 16 November, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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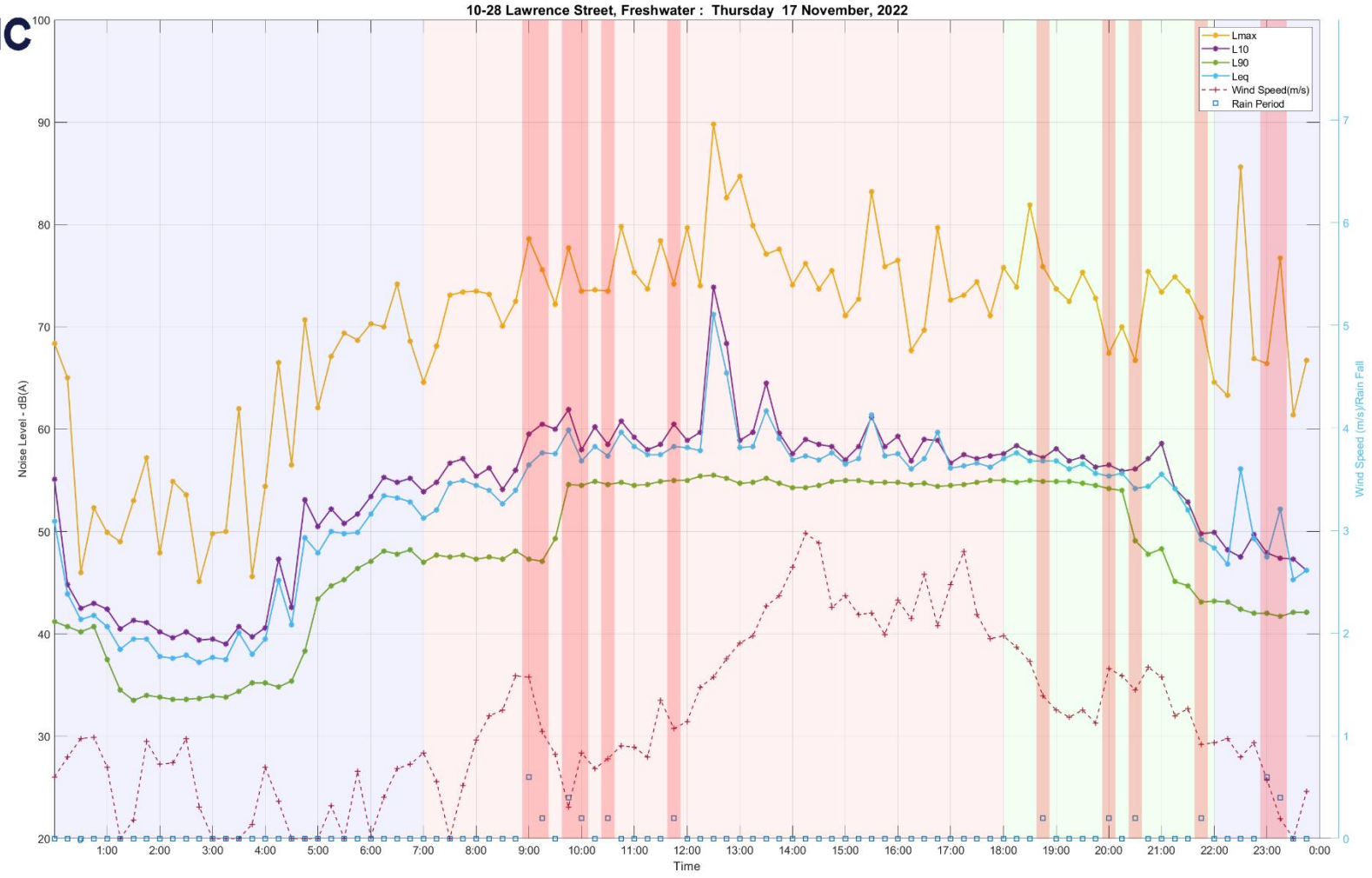
10-28 Lawrence Street, Freshwater : Thursday 17 November, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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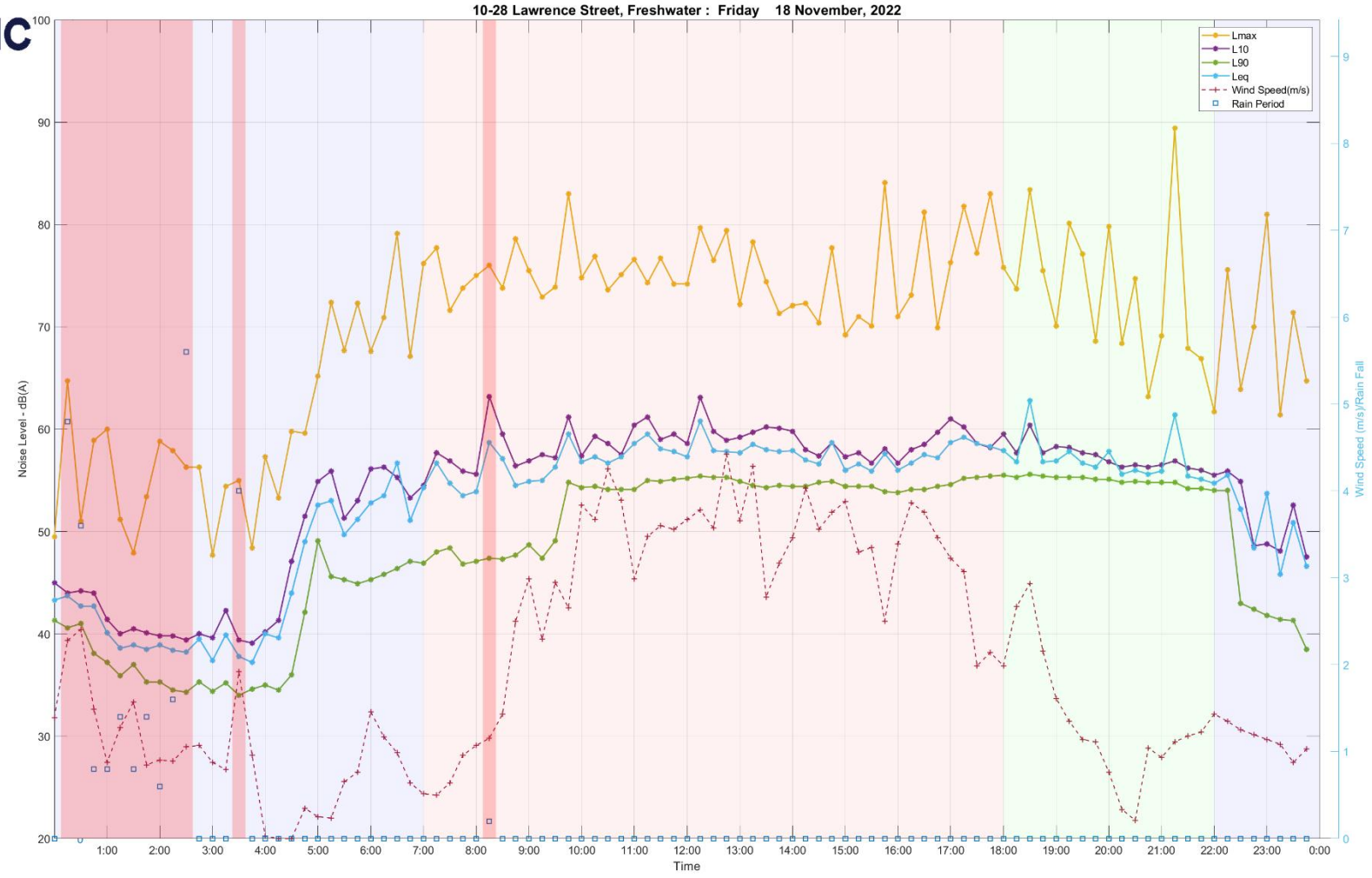
10-28 Lawrence Street, Freshwater : Friday 18 November, 2022
Lmax
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L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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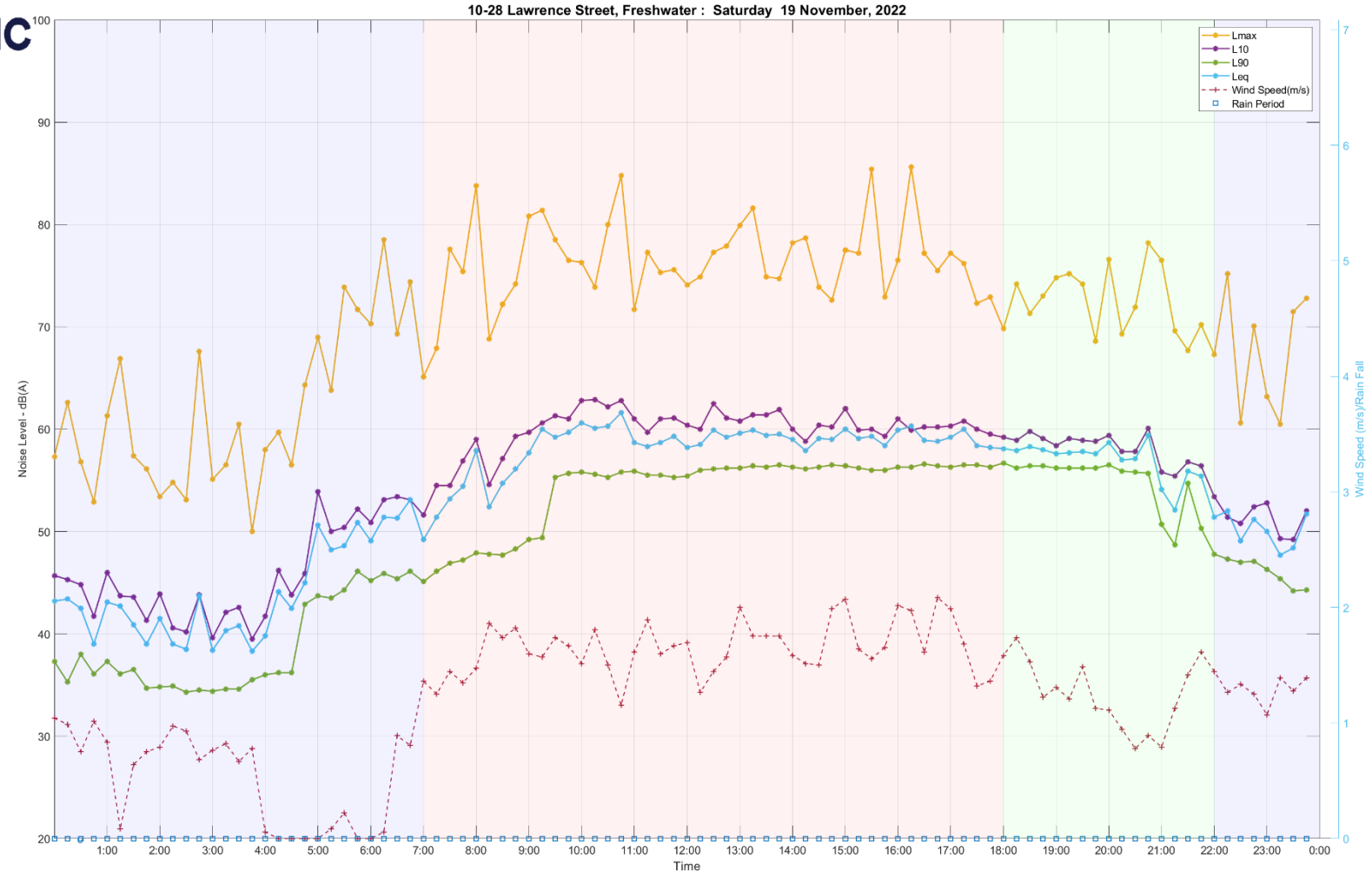
10-28 Lawrence Street, Freshwater : Saturday 19 November, 2022
Lmax
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Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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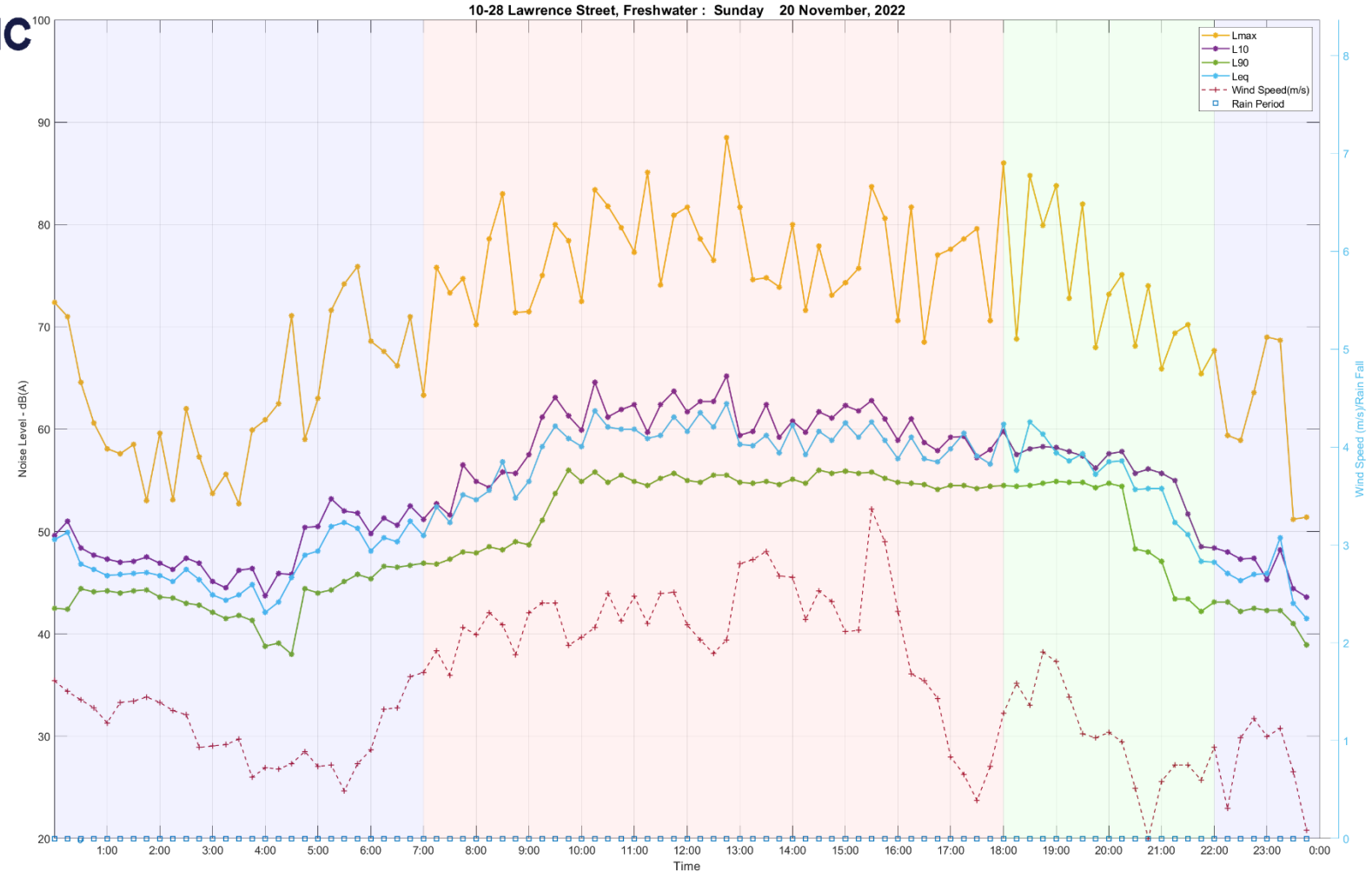
10-28 Lawrence Street, Freshwater : Sunday 20 November, 2022
Lmax
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Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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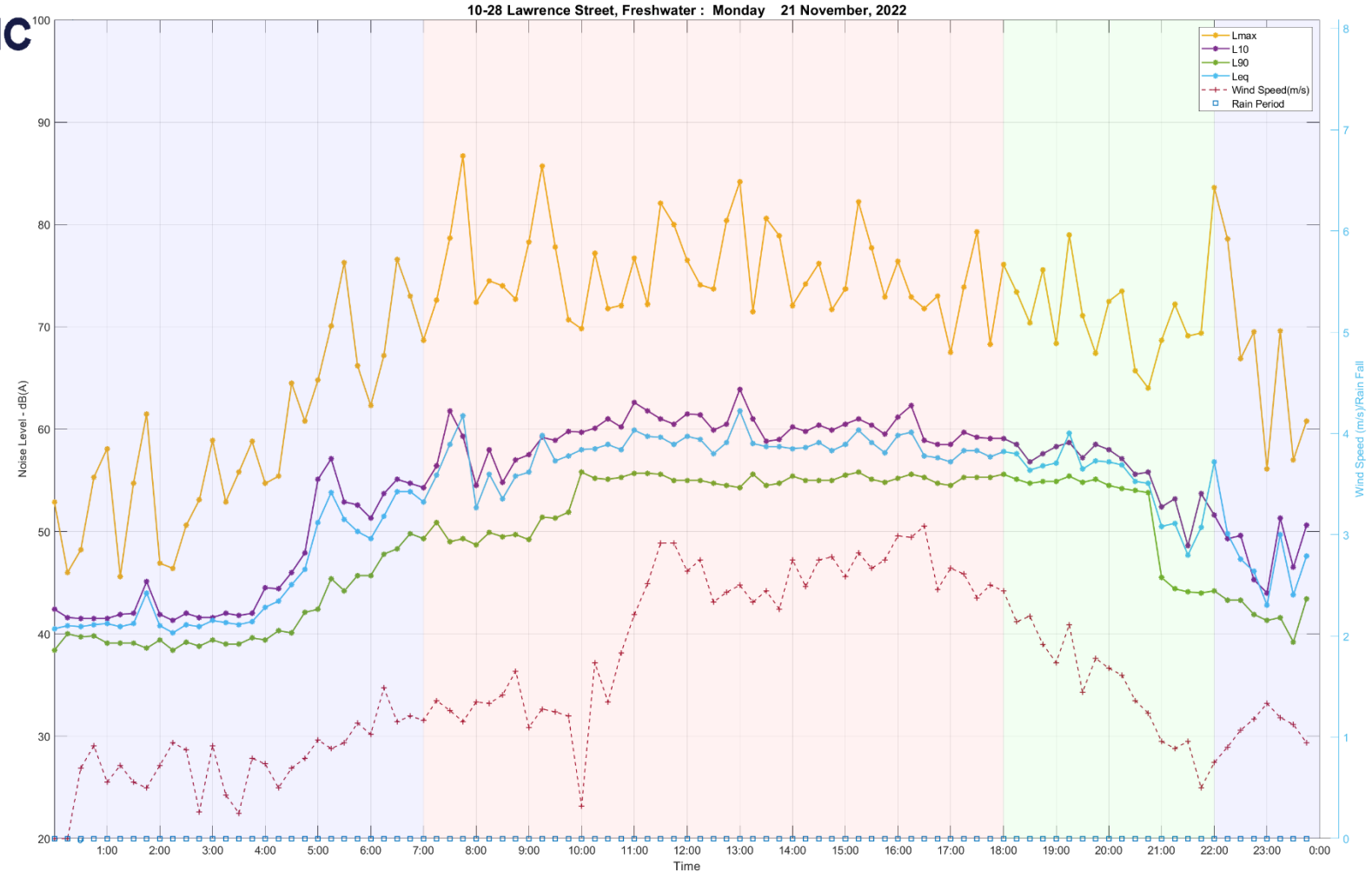
10-28 Lawrence Street, Freshwater : Monday 21 November, 2022
Lmax
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Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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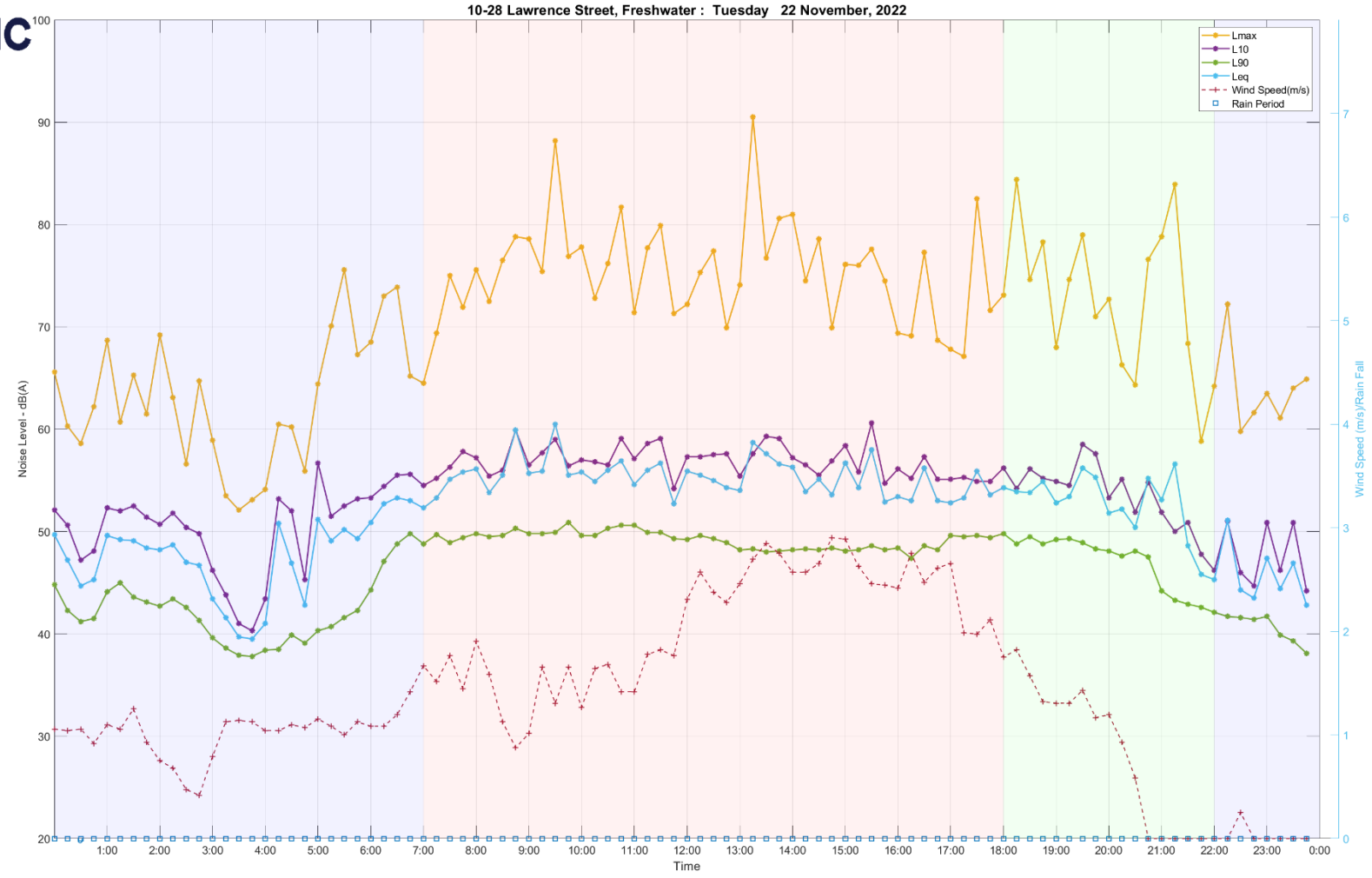
10-28 Lawrence Street, Freshwater : Tuesday 22 November, 2022
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Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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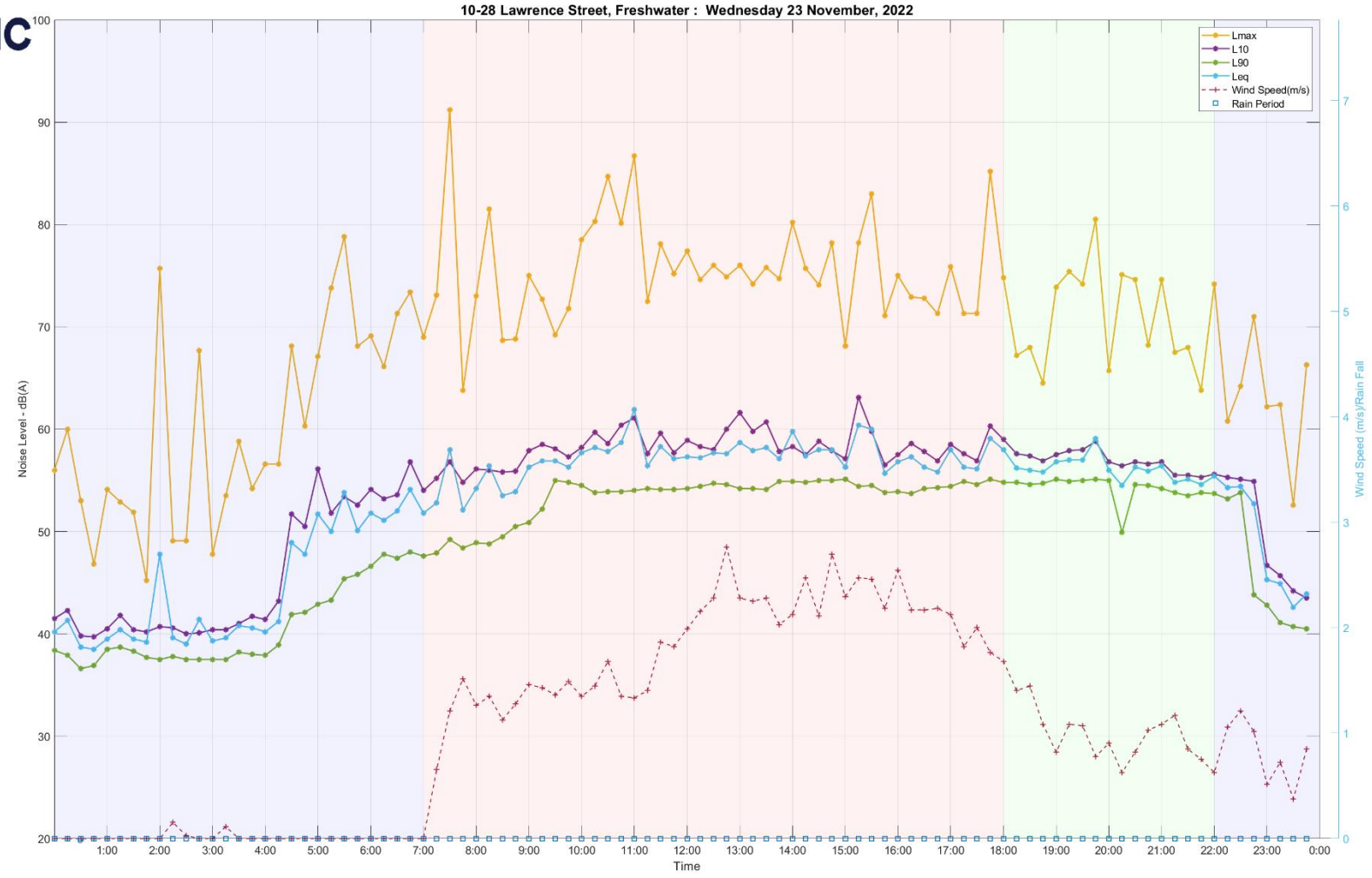
10-28 Lawrence Street, Freshwater : Wednesday 23 November, 2022
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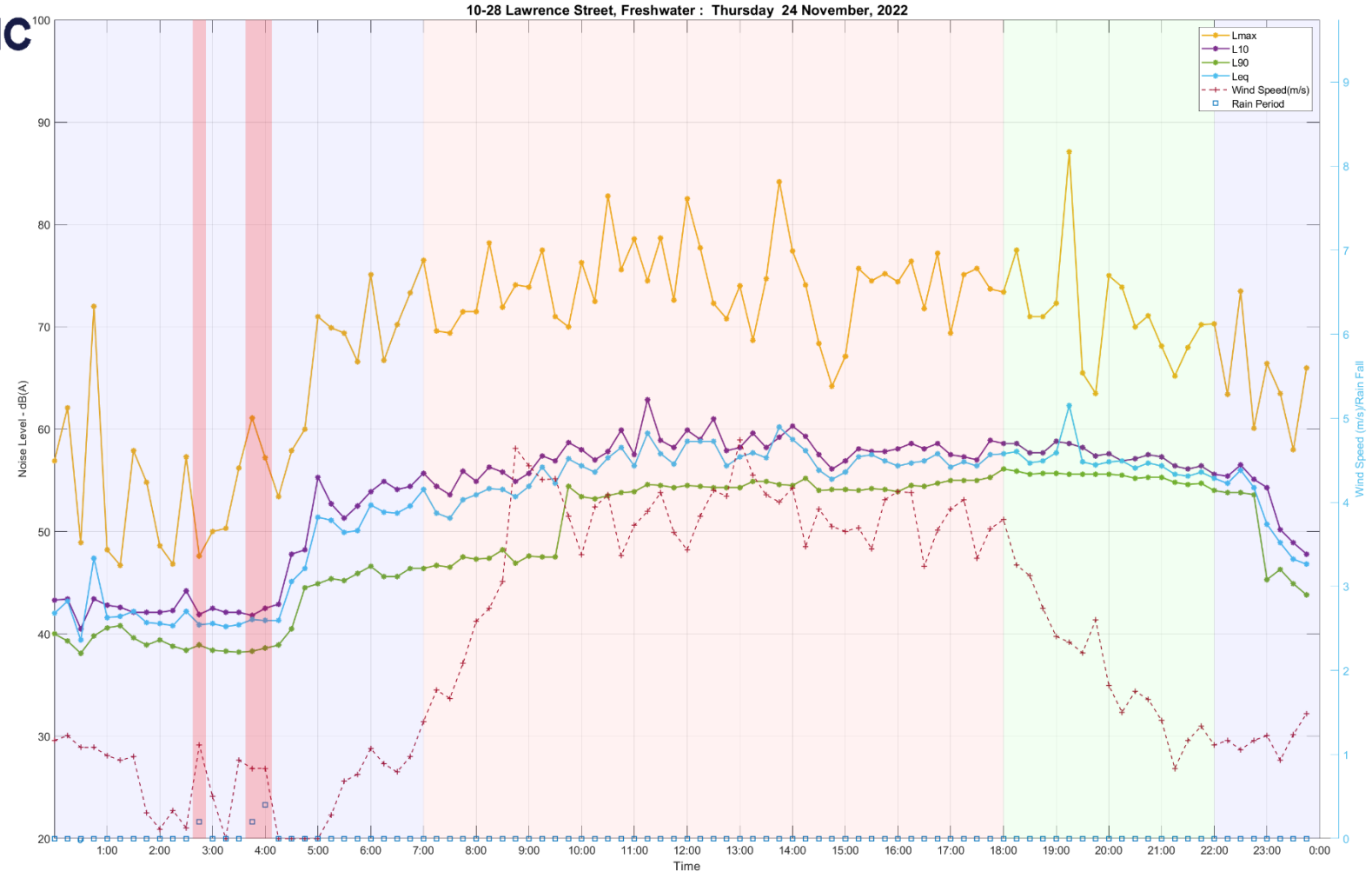
10-28 Lawrence Street, Freshwater : Thursday 24 November, 2022
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