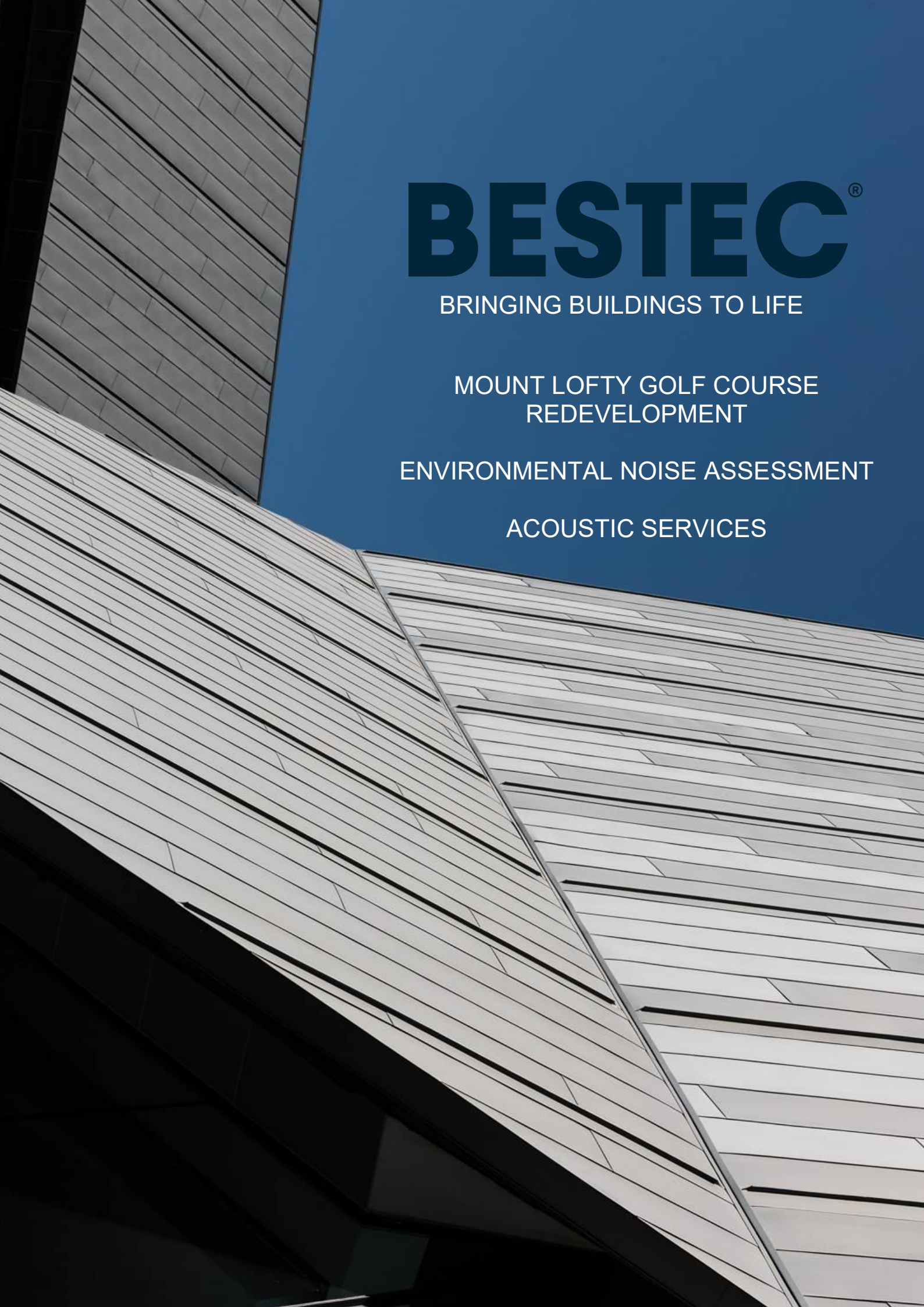

BESTEC®

BRINGING BUILDINGS TO LIFE

MOUNT LOFTY GOLF COURSE REDEVELOPMENT

ENVIRONMENTAL NOISE ASSESSMENT

ACOUSTIC SERVICES

BESTEC

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NPK:AGM
57366/6/1
23 February 2023

Trice - Project & Development Managers
225 Fullarton Road
EASTWOOD SA 5063

Attention: Ms S Mercorella

Dear Madam

MOUNT LOFTY GOLF COURSE REDEVELOPMENT

ENVIRONMENTAL NOISE ASSESSMENT

ACOUSTIC SERVICES

As requested, we enclose a copy of the report on the Acoustic Services for the above project.

We trust that the report provides sufficient information for your immediate purpose and we would be most pleased to further discuss any aspect upon your request.

Yours faithfully
BESTEC PTY LTD

NARAYANA PRASAD KUMAR
ACOUSTIC SERVICES ENGINEER

Encl

REPORT ISSUE REGISTER

REVISION	DATE	REVISION DESCRIPTION
00	14.10.2022	Initial Issue
01	30.11.2022	Revised Issue
02	23.02.2023	Incorporated EPA Comments

CONTENTS

Introduction

BESTEC Pty Ltd has been engaged to assess the environmental noise impact to the nearest noise sensitive receivers resulting from operational activities, including functions, in the proposed new development at the existing Stirling Golf Club, which includes:

- Construction of a new tourist accommodation – a new hotel (3 to 5 levels), 17 private retreats (pods) and one service pod.
- New clubhouse and pro-shop, administration areas and change rooms.
- Car parking for 200 cars in two parking areas.

This document presents a review of the proposed acoustic design criteria, the results of the conducted continuous environmental noise survey, calculated noise levels at the nearest noise sensitive receivers resulting from functions, using the venue and the results of our assessment.

Executive Summary

In summary:

- A continuous noise survey was conducted over 5-day period at the boundary of the nearest noise sensitive receiver. The survey results are presented in Appendix A.
- The architectural concept drawings of the proposed development have been reviewed.
- Appropriate acoustic design criteria were nominated.
- The noise impact to the nearest residential developments associated with the operation of the proposed development has been assessed against the nominated environmental noise criteria, including:
  - Music noise resulting from functions taking place in the function area;
  - Patron noise;
  - Noise associated with the use of the carpark, deliveries and rubbish collection;
  - Acoustic design recommendations in order to comply with the selected acoustic design criteria and recommendations for construction of the building envelope were provided.

Acoustic Analysis

References

The following documents have been referenced within the preparation of this report: -

[1] SA Environment Protection (Noise) Policy 2007.

[2] SA Planning and Design Code.

[3] Music Noise from Indoor Venues and the South Australian Planning System, EPA Guideline, July 2015.

[4] Pearsons, Bennett and Fidel “Speech levels in various noise environments” Report EPA-600/1-77-025, Washington, D.C.: U.S. Environmental Protection Agency, May 1977.

[5] Architectural drawings provided by R Architecture, dated December 2021.

[6] AS ISO 140.4–2006 “Acoustics – Measurement of sound insulation in buildings and of building elements. Part 4: Field measurements of airborne sound insulation between rooms”.

[7] Laurence Nicol and Paul Johnson “Prediction of parking area noise in Australian conditions” Report, Proceedings of Acoustics, Australia, 2011.

Proposed Development

The Stirling golf club is bounded by Golflinks Road, Old Carey Gully Road and Devenport Road. Adjacent to the southern-western boundary are residential properties (highlighted on Figure 1).

The proposed development is summarised as follows:

- Hotel - 3-5 level hotel building comprising:
  - 56 hotel suites.
  - 15 x two bedroom serviced apartments.
  - 15 x three bedroom serviced apartments.
  - 2 penthouse serviced apartments.
  - Back of house, plant storage and maintenance areas.
  - A 537m^2 function room.
  - A 212m^2 restaurant with 89 m^2 external terrace.
  - 186m^2 sports bar.
  - A 189m^2 gallery and cafe.
  - A 94m^2 wellness centre with 125m^2 gym and spa/massage treatment rooms.
- Private retreats – ‘Pods’
  - 17 x one bedroom units.
  - 1 x back of house Service Pod.
- Adaptive reuse of the existing perfumery:
  - Refurbishment of the existing local heritage place to accommodate a multipurpose space for use as café, retail or functions.
  - Extension to the Per.fumery to include a covered outdoor dining area.
  - Orchard and perfumery garden plantings to reimagine the former use of the building as a “Scent Factory”.

- Note: the perfumery building will temporarily house the golf club whilst construction is occurring.

- Golf Course Facilities Building - 2-5 level building comprising:
  - Retention of 18-hole golf course with improvements.
  - Refurbished function facilities, cart storage and 138m^2 clubhouse in new building.
  - New 97m^2 pro-shop, administration areas, gym and change rooms.
- Car Parking, Access and Waste Management
  - A total of 200 car parking spaces in two car parking areas.
  - Emergency vehicle access via western entry from Golflinks Road.
  - Main access point via Golflinks Road.
  - Designated service bay for waste collection and service vehicles.
  - Porte cochere and valet area for guests and buses.
  - A separate entry from Old Carey Gully Road to provide maintenance vehicle access and public access to the perfumery building.
  - Designated waste storage areas.
- Subdivision – following construction of the proposed development, it is proposed to divide the site into three (3) allotments:
  - Allotment 532, with an approximate area of 9,924m^2 together with a right of way ‘A’, comprising the hotel building and pods.
  - Allotment 533, with an approximate area of 5,056m^2 together with a right of way ‘B’, comprising the golf club and facilities building.
  - Allotment 531, with an approximate area of 38.4 hectares, comprising the balance of the golf course, subject to easements ‘A’ and ‘B’.

Continuous Noise Survey

A continuous noise survey was conducted between 01 September and 05 September 2022 with an automatic noise logger located near the boundary between The Stirling Golf Course and the property where the nearest noise sensitive receiver is located (indicated with a star on Figure **1** in order to establish the existing ambient and background noise levels. The survey was conducted using an automatic noise logger Norsonic Nor139.

The logger was set to continuously measure and average A-weighted equivalent continuous noise levels over 15-minute intervals ($L_{Aeq,15min}$), A-weighted maximum noise levels (L_{Amax}) and statistical noise descriptors (L_{A10}, L_{A90}) using 1/3-octave bands (25Hz – 10,000Hz) using Fast time weighting.

The detailed survey results are presented in Appendix A.

Figure 1: Site location

The analysis of the collected data revealed:

- The measured lowest background noise levels (L_{A90}) during the proposed hours of operation is 31 dBA
- The lowest ambient noise level (L_{Aeq}) measured during the proposed hours of operation is 34 dBA.

Conditions

SA Planning and Design Code

The SA Planning and Design Code [1] sets the desired outcome for developments, which might affect the sensitive receivers in adjacent areas as follows:

> *DO 1 Development is located and designed to mitigate adverse effects on or from neighbouring and proximate uses.*

The following requirements (performance outcomes) of the SA Planning and Design Code are relevant to the design and siting of the proposed developments (Section Interface Between Land Uses):

> *PO 1.1 Sensitive receivers are designed and sited to protect residents and occupants from adverse impacts generated by lawfully existing land uses (or lawfully approved land uses) and land uses desired in the zone.*
>
> *PO 1.2 Development adjacent to a site containing a sensitive receiver (or lawfully approved sensitive receiver) or primarily intended to accommodate sensitive receivers is designed to minimise adverse impacts*
>
> *PO 4.1 Development that emits noise (other than music) does not unreasonably impact the amenity of sensitive receivers (or lawfully approved) sensitive receivers.*

A non-residential development is deemed to satisfy the above requirement if the noise emissions that affect the noise sensitive receivers achieves the relevant Environment Protection (Noise) Policy criteria (DTS/DPF 4.1).

PO 4.2 Areas for the on-site manoeuvring of service and delivery vehicles, plant and equipment, outdoor work spaces (and the like) are designed and sited to not unreasonably impact the amenity of adjacent sensitive receivers (or lawfully approved sensitive receivers) and zones primarily intended to accommodate sensitive receivers due to noise and vibration by adopting techniques including:

(a) locating openings of buildings and associated services away from the interface with the adjacent sensitive receivers and zones primarily intended to accommodate sensitive receivers

(b) when sited outdoors, locating such areas as far as practicable from adjacent sensitive receivers and zones primarily intended to accommodate sensitive receivers

(c) housing plant and equipment within an enclosed structure or acoustic enclosure

(d) providing a suitable acoustic barrier between the plant and / or equipment and the adjacent sensitive receiver boundary or zone.

PO 4.5 Outdoor areas associated with licensed premises (such as beer gardens or dining areas) are designed and/or sited to not cause unreasonable noise impact on existing adjacent sensitive receivers (or lawfully approved sensitive receivers).

PO 4.6 Development incorporating music achieves suitable acoustic amenity when measured at the boundary of an adjacent sensitive receiver (or lawfully approved sensitive receiver) or zone primarily intended to accommodate sensitive receivers.

Design Criteria

Environmental Noise

The SA Planning and Design Code refers to the Environment Protection (Noise) Policy 2007 in regards to environmental noise emissions from non-residential buildings and therefore, the criteria below are derived in accordance with the Policy.

Continuous Noise

This criterion will be relevant to noise emitted from the proposed development resulting from operational noise, including patron noise, mechanical plant, carpark movements, deliveries etc.

- The Environment Protection (Noise) Policy 2007 [1], sets the maximum allowable continuous noise in terms of A-weighted Equivalent Continuous Noise Level (L_{Aeq}) based on the time of day and zoning/use of land in which the noise source and receiver are located. With reference to the SA Planning and Design Code [2], we note that The Stirling Golf Club is located within a land zoned “Rural Neighbourhood” and the nearest noise sensitive receiver is located within the same zone. Therefore, the criteria derived in accordance with the Environment Protection (Noise) Policy 2007 should be based on the average of the indicative noise levels for different land categories.

Based on the “Residential” land use category, the applicable indicative noise factors for day and night times are:

- Day time (7:00 a.m. to 10:00 p.m.): 47dBA
- Night time (10:00pm to 7:00am): 40dBA

We note that for planning purposes, the predicted noise level (continuous) for a new development (in this case the proposed development) should not exceed the relevant indicative noise level, minus 5dBA. Therefore, the environmental noise criteria for assessment of the noise impact from the proposed development become:

- Day-time (7:00 a.m. to 10:00 p.m.): 42dBA
- Night-time (10:00 p.m. to 07:00 a.m.): 35dBA

Note that if noise emitted by the proposed development contains any tones, modulation, impulsive or low frequency characteristics, the continuous noise level of the noise source must be adjusted as follows:

- Noise containing 1 characteristic – 5dBA penalty added to source continuous noise level.
- Noise containing 2 characteristics – 8dBA penalty added to source continuous noise level.
- Noise containing 3 or 4 characteristics – 10dBA penalty added to source continuous noise level.

Intermittent Noise

The criteria provided in the above section relate to continuous noise sources, and do not cater for intermittent noise events, such as slamming of car doors, car horns sounding, etc. We recommend the use of the World Health Organisation (WHO) Guidelines for Community Noise, which recommends a maximum A-weighted noise level L_{Amax}, of 45dBA in a bedroom, which is equivalent to approximately 55dBA to 60dBA at the façade of the residential building with windows partially open.

In addition, the EPP 2007 provides assessment criterion of L_{Amax} of 60dBA for night-time for the proposed development (for application for development authorisation), which agrees with the criterion stipulated by the WHO.

Music Noise to the Nearest Noise Sensitive Receivers

This criterion will be relevant to music noise emitted from the proposed development resulting live or pre-recorded music being played inside the function area during functions.

The pre function and function rooms may be used to accommodate functions with live or pre-recorded music such convention events, weddings, corporate events etc. Therefore, an assessment against the EPA Guidelines for Music Noise **[3]** and SA Planning and Design Code requirements is warranted.

EPA provides guidelines for assessment of music emissions from entertainment venues, which is used for acoustic assessment for development approval purposes as well as for acoustic design of residential developments in the vicinity of existing entertainment venues. The criterion is set as follows:

> *"The music noise ($L_{10,15min}$) from an entertainment venue when assessed externally at the nearest existing noise sensitive location should be:*
>
> - *less than 8 dB above the level of background noise ($L_{90,15min}$) in any octave band of the sound spectrum"*

In addition, SA Planning and Design Code Performance Outcome 4.6 (refer Section [3] which stipulates Designated Performance Feature 4.6 as follows

> *"Development incorporating music includes noise attenuation measures that will achieve the following noise levels:*
>
> - *less than 8 dB above the level of background noise ($L_{90,15min}$) in any octave band of the sound spectrum"*

Based on the above EPA Guidelines for music noise and SA Planning and Design Code, to control music noise emissions from the proposed multi-purpose function space, we derived the music noise criteria based on the lowest background noise levels (L_{A90}) measured within the stipulated hours of operation during the most recent continuous noise survey[1], presented in Table 1 below along with the calculated music noise criterion. Therefore, the calculated music noise criteria relevant to the neighbouring residential noise sensitive receivers will be as detailed below.

[1] The lowest background noise level was measured at 23:45 on 04 September 2022.

	Octave band sound pressure level dB re 20µPa							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Background noise level $L_{90,\ 15min}$	44	38	30	29	30	26	17	15
Maximum allowable exceedance	8	8	8	8	8	8	8	8
Maximum allowable music noise level, $L_{10,15min}$ at the nearest noise sensitive boundary	52	46	38	37	38	34	25	23

Table 1: Criteria for music noise at the nearest sensitive receiver

Building Acoustics

The level of background and transient/intermittent noise, the speech privacy rating and the intelligibility of speech define the quality of the acoustics within a building. The criteria presented in Table 2 and below are based on AS/NZS 2107:2016 “Acoustics – Recommended design sound levels and reverberation times for building interiors” as well as on our experience in acoustic design of similar facilities. Please refer to each individual section below for interpretation of the criteria.

Type of occupancy/activity	**Background Noise dBA**	**Reverberation Time Secs**	**Speech Privacy D_w**	**Weighted Sound Reduction Index with Spectrum Adaptation Term R_w+C_{tr}**
Amenities	< 55	N/A	40 – 45	
Kitchen	< 55	Minimise as practical	40 – 45	
Function spaces	35 – 40	0.7 – 1.0	45 – 50	
Restaurant	45 – 50	Minimise as practical	N/A	
Dining/Kitchen	40 – 45	Minimise as practical	N/A	
Office	40 – 45	0.4 – 0.6	40	
Hotel Suites	30 – 40			45
Admin	40 – 50	< 0.7	35 – 40	
Car park	<65	N/A	N/A	

Table 2: Recommended Acoustic Design Criteria for the hotel development

Type of occupancy/activity	**Background Noise dBA**	**Reverberation Time Secs**	**Speech Privacy D_w**
Sleeping Areas	30 – 35	N/A	N/A
Living Areas	35 – 40	N/A	N/A

Table 3: Recommended Acoustic Design Criteria for the accommodation pods

Background Noise

AS 2107-2016 [6] sets out the design criteria for steady state noise such as from air-conditioning systems and road traffic depending on the type/use of the different rooms. Recommendations for each space are provided in Table 2 in terms of A-weighted equivalent continuous sound pressure level (L_{Aeq}).Table 4 details the subjective response of individuals to the proposed sound levels for interpretation of the recommendations.

Average Sound Pressure Levels (dBA)	Subjective Rating
35 - 40	Audible but unobtrusive
40 - 45	Moderate but unobtrusive
45 - 50	Unobtrusive with low levels of surrounding activities
50 - 55	Unobtrusive with high levels of surrounding activities

Table 4: Subjective ratings for various average sound pressure levels.

Sound Insulation

For enclosed spaces, the noise from activities in the adjacent rooms transmitted through walls, floors, ceilings etc. increases the background noise level similarly to the noise intrusion from any outside sources. The level of noise transmitted from the adjacent rooms and the level of sound insulation/speech privacy is controlled by the design of building elements and providing adequate level of sound attenuation through specifying appropriate construction types for walls, floors, doors, ceilings etc.

There are no recommended Australian or International Standards for sound insulation ratings for adjoining spaces. Recommendations are based on experience from previous projects, with these recommendations reflecting user expectations. The privacy rating is dependent on the sound absorption and background noise level in the adjoining space as well as the area and acoustic performance of the dividing partition.

The proposed criteria for speech privacy between the spaces separated by partitions (extending either to the ceiling level or to the roof structure above are presented in terms of Weighted Sound Level Difference (D_W) as defined by AS ISO 140.4–2006, which is related to the sound level difference between two spaces and are detailed in Table 2. The criteria are based on our experience in the acoustic design of similar facilities. Table 5 details the subjective response of individuals to the proposed privacy ratings for interpretation of the recommendations.

D_W Rating	Subjective Rating
50-55	Confidential privacy
45-50	Very good privacy. Speech inaudible unless raised
40-45	Good privacy. Speech audible but unintelligible
35-40	Normal privacy. Neighbouring conversations are audible and may be understood
< 35	Privacy not required

Table 5: Subjective perceptions for various privacy ratings

Room Acoustics

AS/NZS 2107:2016 sets out the design criteria for reverberation times within occupied spaces. The reverberation time defines the time taken for sound to decay within a space and thus the degree of intelligibility of both unassisted speech and sound reinforcement systems. The criterion for a given space depends on the volume of the space, with Table 7 outlining the subjective impression for spaces with varying volume. Criteria considered appropriate for the spaces listed in Table 2.

Reverberation Time (sec)			Subjective Rating
Small (100m3)	Medium (1,000 m3)	Large (10,000m3)	
<0.3	0.3-0.5	0.6-0.8	Dead
0.3-0.5	0.5-0.7	0.8-1.0	Medium dead
0.5-0.7	0.7-1.0	1.0-1.5	Average
0.7-1.0	1.0-1.5	1.5-2.5	Medium live
1.0-2.0	1.5-2.5	2.5-4.5	Live

Table 6: Subjective response to various reverberation times and room volumes

Music Noise to the Hotel Suites and Accommodation Pods

As the Deemed-to-Satisfy/Designed Performance Feature (DTS/DPF 4.6) sets criteria for music noise based on the background noise levels, we propose the internal noise levels resulting from music entertainment in the function centre be based on the background noise level (L_{90}) measured in Room 1012 of the Mayfair Hotel in Adelaide (4.5-star rating), during the commissioning of the development as a basis to determine the music noise criterion inside the proposed accommodation pods. The measured background noise level and the derived music noise criterion are presented in Table 7 below.

	Octave band sound pressure level dB re 20µPa								Overall level, dBA
	63	125	250	500	1000	2000	4000	8000	
Background noise level $L_{90,\ 15min}$ measured in Room 1012 at The Mayfair Hotel (4.5-star) with the AC on	47	39	35	26	24	19	14	15	30
Maximum allowable exceedance	8	8	8	8	8	8	8	8	5
Maximum allowable music noise level, $L_{10,15min}$	55	47	43	37	32	27	22	23	35

Table 7: Background noise level $L_{90,15min}$ measured in 4.5-star hotel room with only the air-conditioning on and the derived relevant internal criteria for music noise in the accommodation pods

Understanding and Assumptions

We have based our assessment on the following understanding and assumptions:

- Music sound levels in the function centre – the function areas may be used for weddings, parties, corporate events etc., which might include live or pre-recorded music. Based on that, the following reverberant sound levels was used (previously measured in a similar venue):

Type of Activity	Octave band sound pressure level (L_{10}) dB re 20µPa								Overall level L_{10}, dBA
	63	125	250	500	1000	2000	4000	8000	
Music	88	90	87	86	87	80	80	78	90

Table 8: Reverberant music sound level (L_{10}) used in the assessment

- Delivery and rubbish collection vehicles will be accessing the site via Golflinks Rd;
- All deliveries and rubbish collection will be taking place during day time, i.e., after 7:00 and before 22:00.
- The functions taking place in the function centre will cease at 0:00.
- Construction of the function centre and accommodation pods building envelope elements:
  - Façade – framed construction consisting of profiled steel cladding to the external side of steel structural frame and flush plasterboard internal lining with fibrous cavity infill;
  - External glazing – laminated glass;
  - Roof/ceiling structure – conventional steel roof cladding over foil faced fibrous insulation on 150mm deep purlins with perforated plasterboard ceiling overlaid with 75mm, 32kg/m^3 polyester for reverberation control suspended on RONDO steel ceiling grid forming 400mm deep ceiling cavity.
- Typical function with 300 guests in total.

Assessment and Recommendations

General Recommendations

Acoustic Sealants

We note that for the acoustic integrity of building elements to be maintained, all gaps and interfaces along the junctions and joints of linings must be sealed with an appropriate acoustic grade sealant. Penetrations for mechanical or electrical services must be properly caulked and sealed around the ductwork and cabling to ensure the intended acoustic rating of the partition is retained.

Appropriate acoustic caulking products include:

- Bostik Firemastic.
- Bostik Seal-n-flex 2637.
- Pyropanel Multiflex.
- Trafalgar Fyreflex.
- Dow-Corning 790 Silicone.
- Dow-Corning 795 Silicone.
- Sika Sikaflex-11 FC.
- Fosroc Flamex 3.

Cavity Infill

Where a cavity infill is recommended, equivalent alternatives are:

- Fibreglass – 50mm, 12kg/m^3.
- Rockwool – 50mm, 38kg/m^3.
- Polyester – 900gsm.

Ceiling Overlay

Where a ceiling overlay is recommended, equivalent alternatives are:

- Glasswool – 100mm, 12kg/m^3.
- Rockwool – 100mm, 38kg/m^3.
- Polyester – 100mm, 32kg/m^3.

Where higher durability and/or water resistance is required, 6mm compressed fibre cement sheeting could be used in lieu of the 13mm fire-rated plasterboard and 9mm compressed fibre cement in-lieu of 16mm fire-rated plasterboard.

Building Envelope

Function Centre

We calculated the music noise levels at the nearest noise sensitive receiver (approximately 200m from the function centre) resulting from music being played in the function centre under the assumptions above and considering the distance. The following constructions of the building envelope elements are required for the selected music noise criterion to be achieved (minimum requirements):

- Solid façade – the architectural drawings indicate the following façade constructions:
  - precast walls and we recommend 150mm precast concrete[2] panels. The sound transmission loss provided by 150mm precast concrete will be sufficient, however, internal lining and fibrous insulation might be required for thermal insulation reasons.
  - slate shingles and we recommend 15mm thick shingles installed to 1 layer of 9mm fibre cement to the external side of 92mm steel studs and 1 layer of 13mm plasterboard to the internal side with cavity infill of 75mm, 14kg/m^3 glasswool.
  - timber cladding and we recommend 12mm thick timber cladding installed to 1 layer of 9mm fibre cement to the external side of 92mm steel studs and 1 layer of 13mm plasterboard to the internal side with cavity infill of 75mm, 14kg/m^3 glasswool.
- Roof – roof steel cladding (0.48mm BMT) with Anticon 100 HP, R2.5 insulation blanket on 300mm deep purlins and 2 layers of 13mm fire rated plasterboard fixed to the underside of the purlins.
- Glazing –minimum 10.38mm laminated glass

Any operable glazing should be fitted with appropriate compressible acoustic seals (Raven or Schlegel ranges). Please note that the above glazing construction is sufficient from acoustic point of view, however it may be subject to change to satisfy structural and thermal requirements.

In order to control the music sound level inside the function centre, we recommend an automatic sound limiter be used to monitor the sound pressure levels during performance. The sound limiter should be connected to the main amplifier power and set to cut the power if the maximum sound pressure level is exceeded. To facilitate this, the following is required:

- Any performers/DJ's should use only the sound system and amplifier provided by the function centre;
- The sound system should be tuned and commissioned by an acoustic engineer once the function centre is completed and the sound limiter is installed. The measured sound level at 1m from each speaker should not exceed the C-weighted sound pressure levels detailed in Table 9 below when pink noise is fed into the system.

C-Weighted Sound Pressure Level (dB re 20µPa) from each Speaker at Octave Band Centre Frequency, Hz (measured at 1m)								Overall, dBC
63	125	250	500	1000	2000	4000	8000	
93	96	93	92	93	86	85	81	100

Table 9: Sound Pressure Levels measured at 1m from the speakers (based on assumed 4 speakers in the function centre)

Please note that the above sound pressure levels are based on the assumption that the function centre sound system will have four speakers and have to be re-assessed if different number of speakers is proposed.

- Once the system is tuned:

[2] The sound transmission loss of the construction would be sufficient from acoustic point of view; however, internal lining of 1 layer of 13mm plasterboard and fibrous insulation might be required for thermal insulation reasons.

- The noise levels at the nearest residential receivers should be measured and the sound system settings adjusted if required to ensure the noise levels at the residential properties complies with the maximum allowable music noise levels detailed in Table 1.
- The noise levels in the nearest hotel suits and accommodation pods should be measured with the windows and doors closed and the sound system settings adjusted if required to ensure the noise levels in the accommodation pod is below the maximum allowable values for music noise detailed in Table 7.

When the nominated noise levels are achieved, the sound limiter and main amplifier should be locked by the system engineer to prevent the settings being adjusted by staff of performers.

Hotel

- Façade:
  - precast walls and we recommend 150mm precast concrete[3] panels. The sound transmission loss provided by 150mm precast concrete will be sufficient, however, internal lining and fibrous insulation might be required for thermal insulation reasons.
  - timber cladding and we recommend 12mm thick timber cladding installed to 1 layer of 9mm fibre cement to the external side of 92mm steel studs and 1 layer of 13mm plasterboard to the internal side with cavity infill of 75mm, 14kg/m^3 glasswool.
- Glazing - minimum 6.38mm laminated glass.
- Roof - roof steel cladding (0.48mm BMT) with Anticon 100 HP, R2.5 insulation blanket on 300mm deep purlins and 1 layer of 13mm fire rated plasterboard fixed to the underside of the purlins.

Accommodation Pods

- Façade:
  - 0.48mm BMT profiled steel cladding to the external side of minimum 92mm deep structural steel studs and 1 layer of 13mm plasterboard to the internal side with cavity infill of 50mm 11kg/m^3 glasswool.
  - The architectural drawings indicates that timber cladding is proposed and we recommend 3mm thick timber cladding with a layer of fibre cement to the external side of 92mm steel studs and 1 layer of 13mm plasterboard to the internal side with cavity infill of 75mm, 14kg/m^3 glasswool.
- Glazing – minimum 6mm annealed glass. Operable glazing should be fitted with acoustic seals (Raven or Schlegel ranges).
- Roof – 0.48mm BMT steel roof cladding roof over Anticon 100 HP, R2.5 foil faced insulation blanket on minimum 150mm deep steel purlins and ceiling of 13mm flush plasterboard.

Noise associated with Mechanical Service Plant

The engineering services design is currently being developed and detailed recommendation will be provided when it is sufficiently developed, however, we note that airborne noise emissions from all plant and equipment will be assessed against the nominated environmental and internal noise criteria and engineering noise controls will be designed to ensure compliance. In order to limit vibration emissions and structure borne noise, vibrations will be designed for all plant units.

Noise associated with Carpark

We have calculated the noise impact to the nearest residential receiver from the development associated with the use of the carpark assuming the following activity durations and measured noise levels from similar activities [7]:

- Vehicle movement through car parking spaces

[3] The sound transmission loss of the construction would be sufficient from acoustic point of view; however, internal lining of 1 layer of 13mm plasterboard and fibrous insulation might be required for thermal insulation reasons.

- Vehicle Ignition
- Vehicle door slamming
- Vehicle idle and take off from car parking and drop off zones

A time weighted averaged approach was implemented, based on the above breakdown of noise generating activities.

To calculate the noise levels from the carpark operation over a 15 minutes period, we assumed 30 vehicles either entering or exiting the carpark during the period. We note that the impact noise level at the nearest receiver is within the 47dBA limit suggested by EPA at the façade of the nearest receivers and meets the criteria for the development.

Noise associated with Deliveries

We note that there would be a loading bay located on level 1 on the north east side of the building and calculated the A-weighted Equivalent Continuous Noise Level over a typical 15-minute interval (LAeq,15min) assuming the following activity durations and measured noise levels from similar activities on a previous project:

- Delivery vehicle accessing the loading dock (including reverse alarm) – 30 seconds, 70dBA at 5m.
- Loading/unloading activities including noise from refrigeration unit on the delivery vehicle – 10 minutes, 76dBA at 5m.
- Delivery vehicle departing – 30 seconds, 73dBA at 5m.
- The balance of a 15-minute interval – 4 minutes, 54dBA (ambient noise level).

The calculated A-weighted Equivalent Continuous Noise Level over a typical 15-minute interval (LAeq, 15min) resulting from delivery vehicle activities, which we used in the assessment was 74dBA at 5m.

Based on the above we predicted incident noise levels of 42 dBA at the nearest residential noise sensitive receiver (residents on Golflinks Road). We note that the noise emissions due to the delivery vehicle activities achieves the day-time environmental noise criteria and would not affect the amenity of the adjacent residential area. However, it is recommended that delivery be restricted to the EPA stipulated day time only (i.e., after 7:00 am and before 10:00pm) Monday to Friday and after 9:00 am on Saturday and Sunday (if applicable).

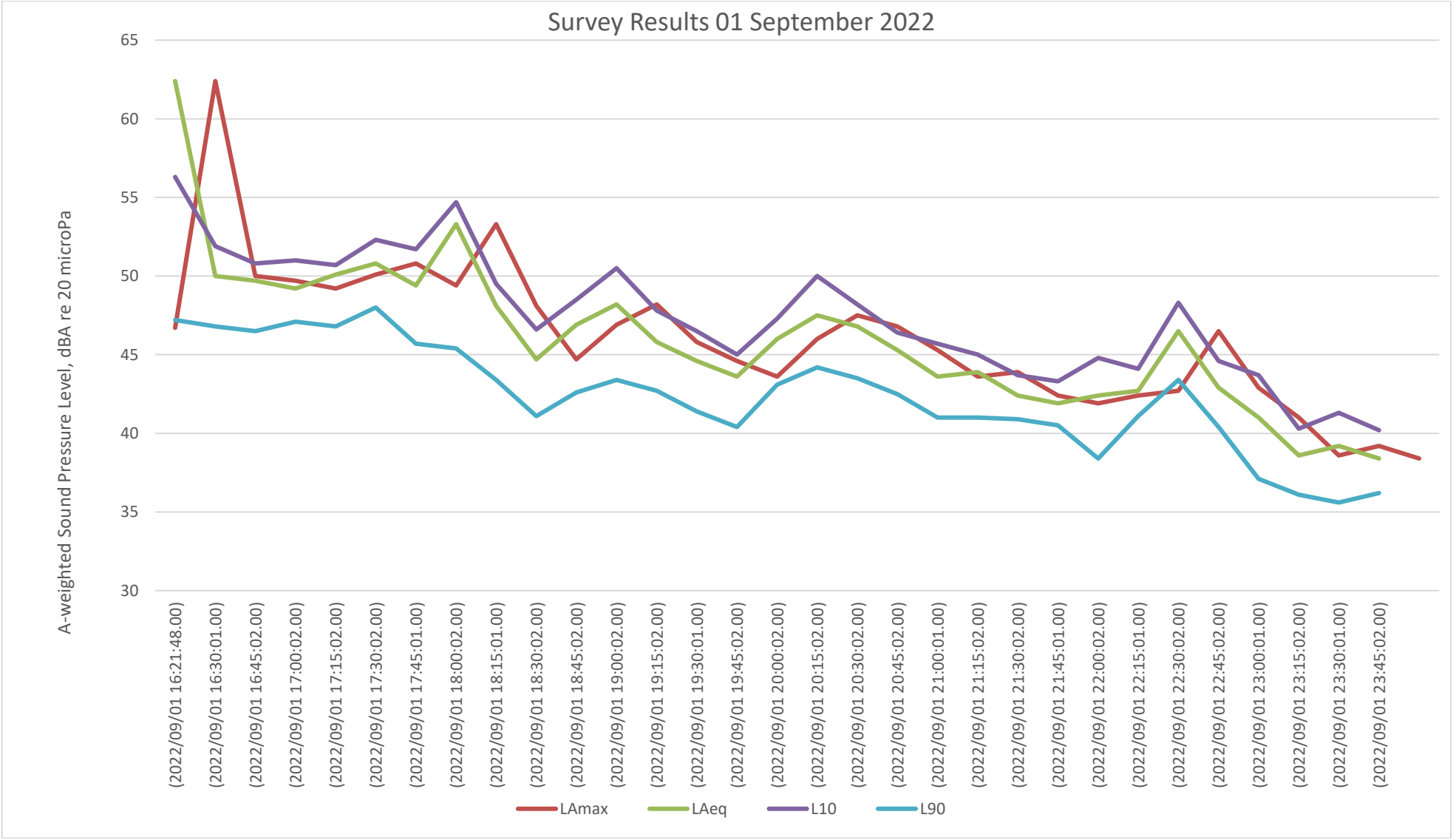
Conclusion

An assessment of the music and patron noise resulting from a typical function taking place at proposed development was conducted against relevant environmental noise criteria derived in accordance with the SA Planning and Design Code and SA EPA Environment Protection (Noise) Policy 2007. The results of the assessment revealed:

- The predicted music noise levels at the nearest noise sensitive receiver will achieve the selected criteria under worst case meteorological conditions provided the sound pressure levels from each speaker is limited to 90dBA at 1m based on 4 speakers being used.
- The continuous noise levels at the nearest noise sensitive boundary resulting from patrons at the terrace and inside the function hall will achieve the selected continuous noise criteria under worst case meteorological conditions.

APPENDIX A

Detailed Survey Results


Survey Results 01 September 2022
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60
55
50
45
40
35
30
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(2022/09/01 23:00:01.00)
(2022/09/01 23:15:02.00)
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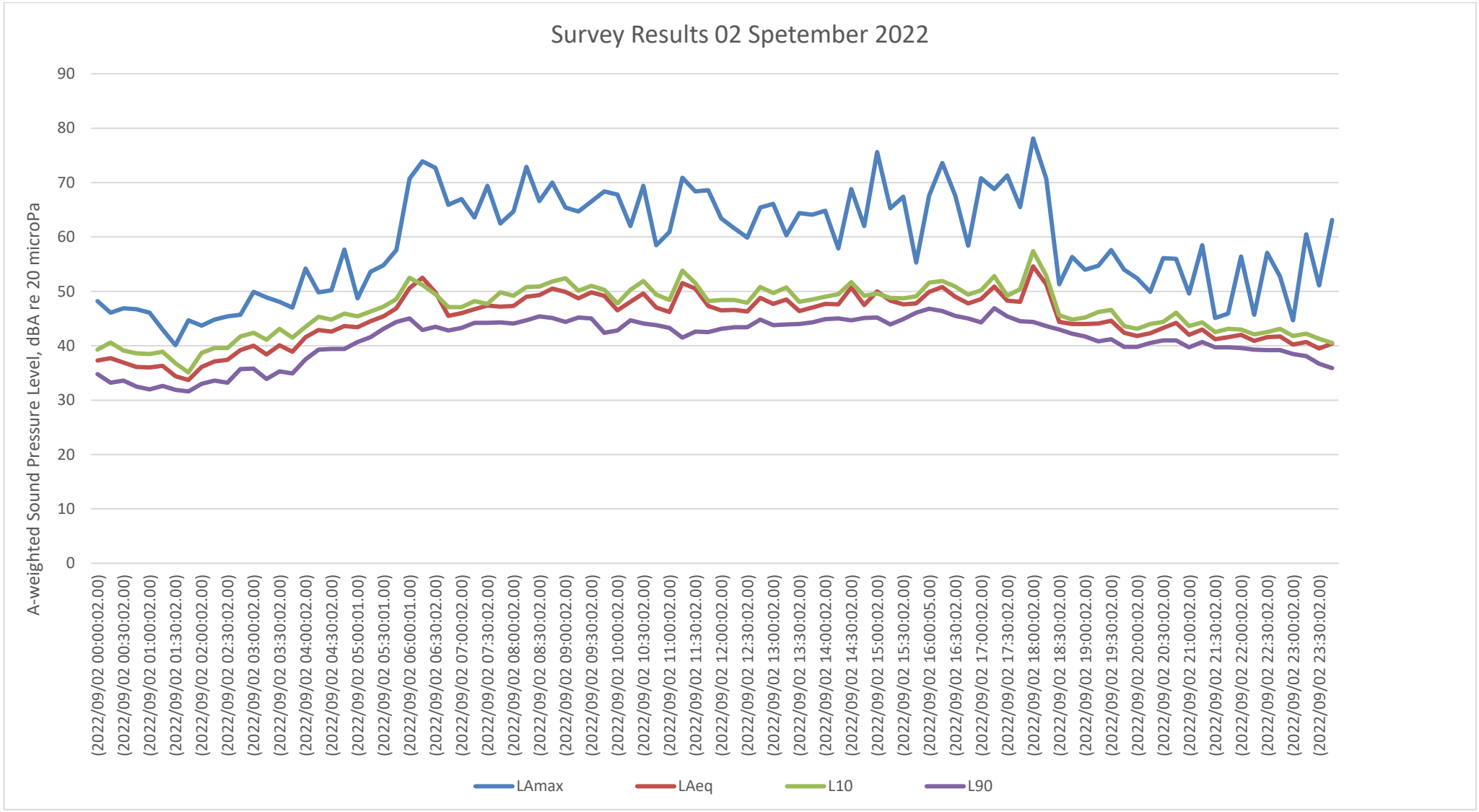
LAmax
LAeq
L10
L90


Survey Results 02 Spetember 2022
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70
60
50
40
30
20
10
0
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(2022/09/02 00:30:02.00)
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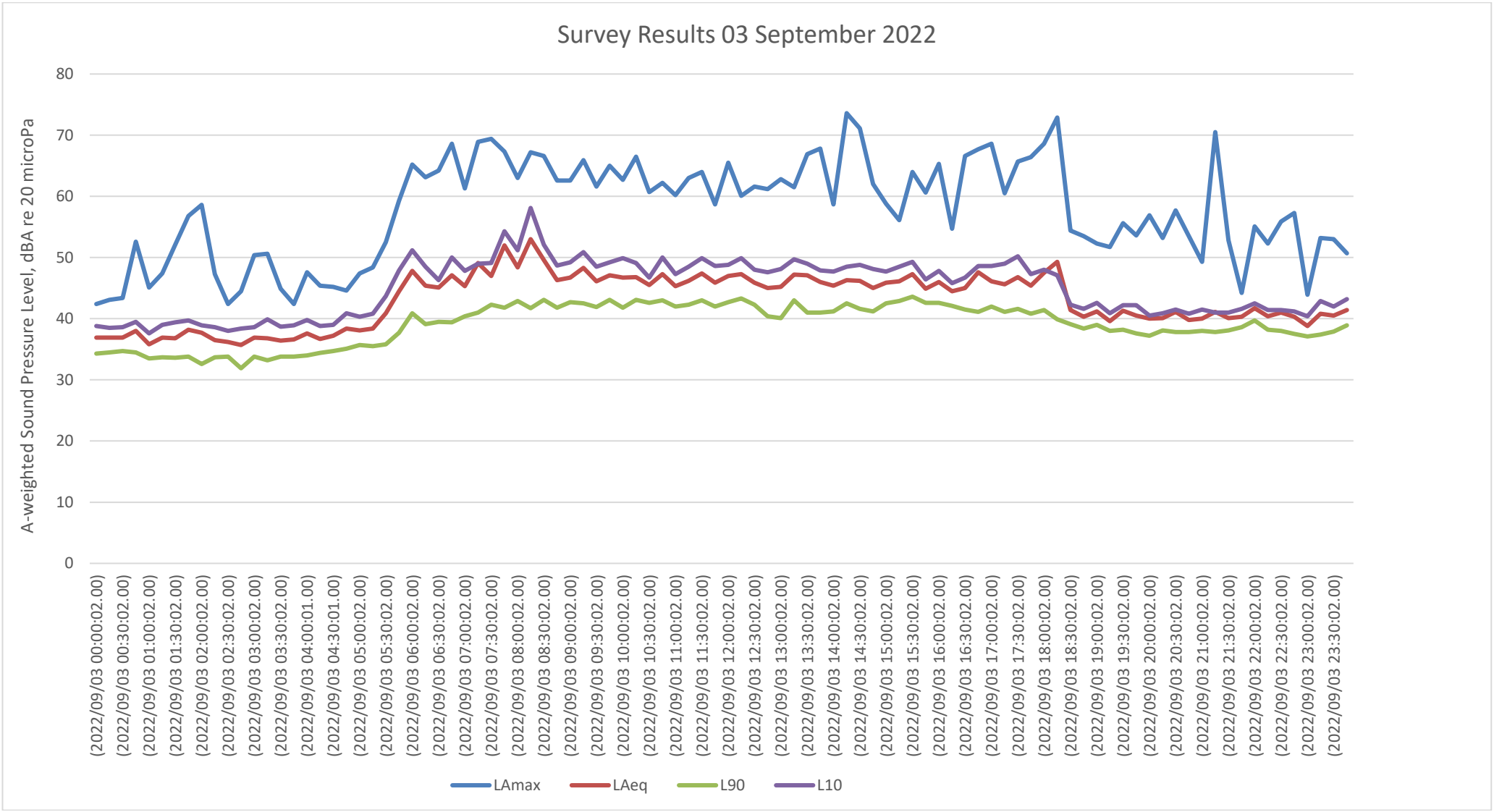
L10
L90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60
50
40
30
20
10
0
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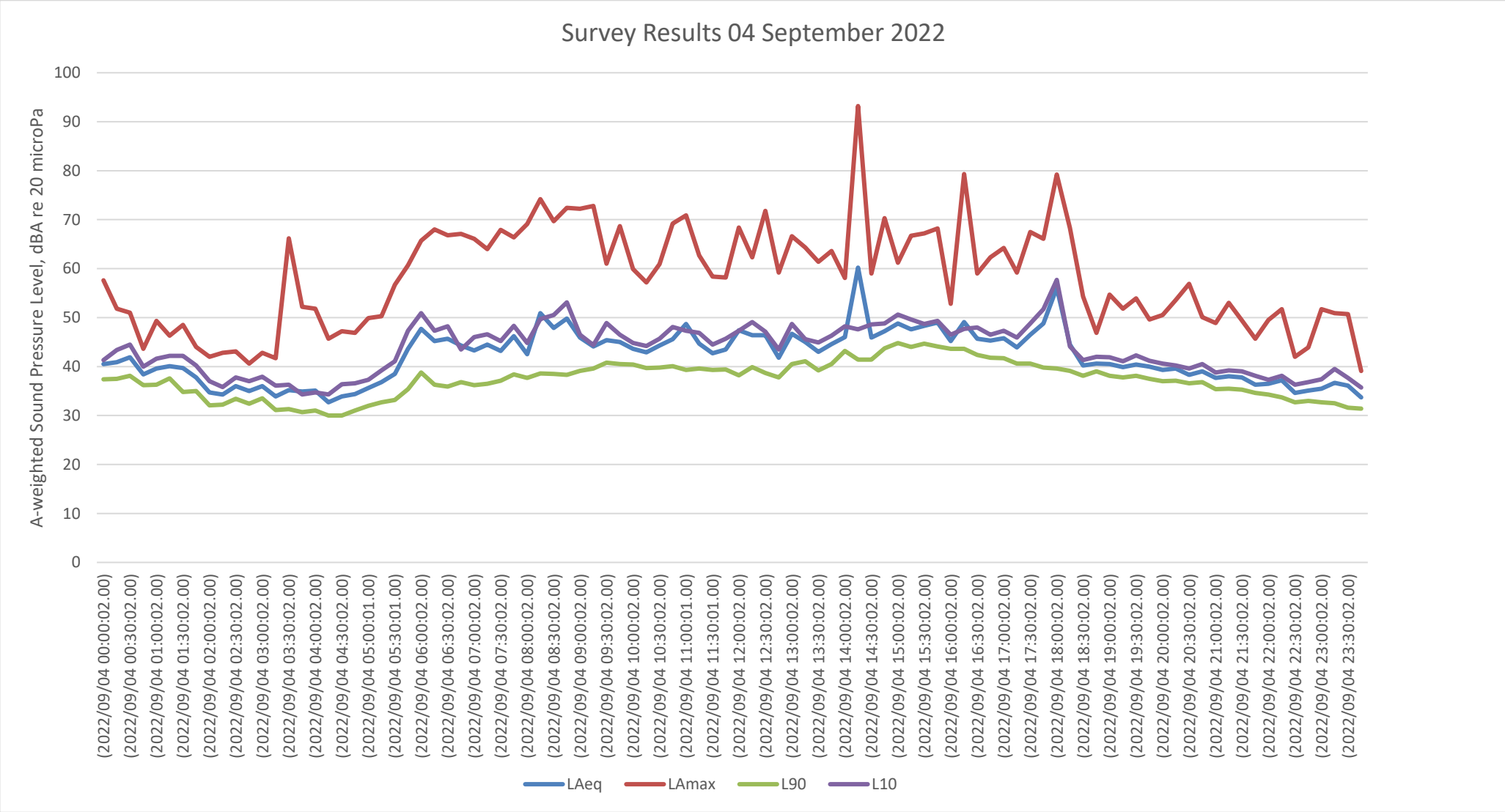
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70
60
50
40
30
20
10
0
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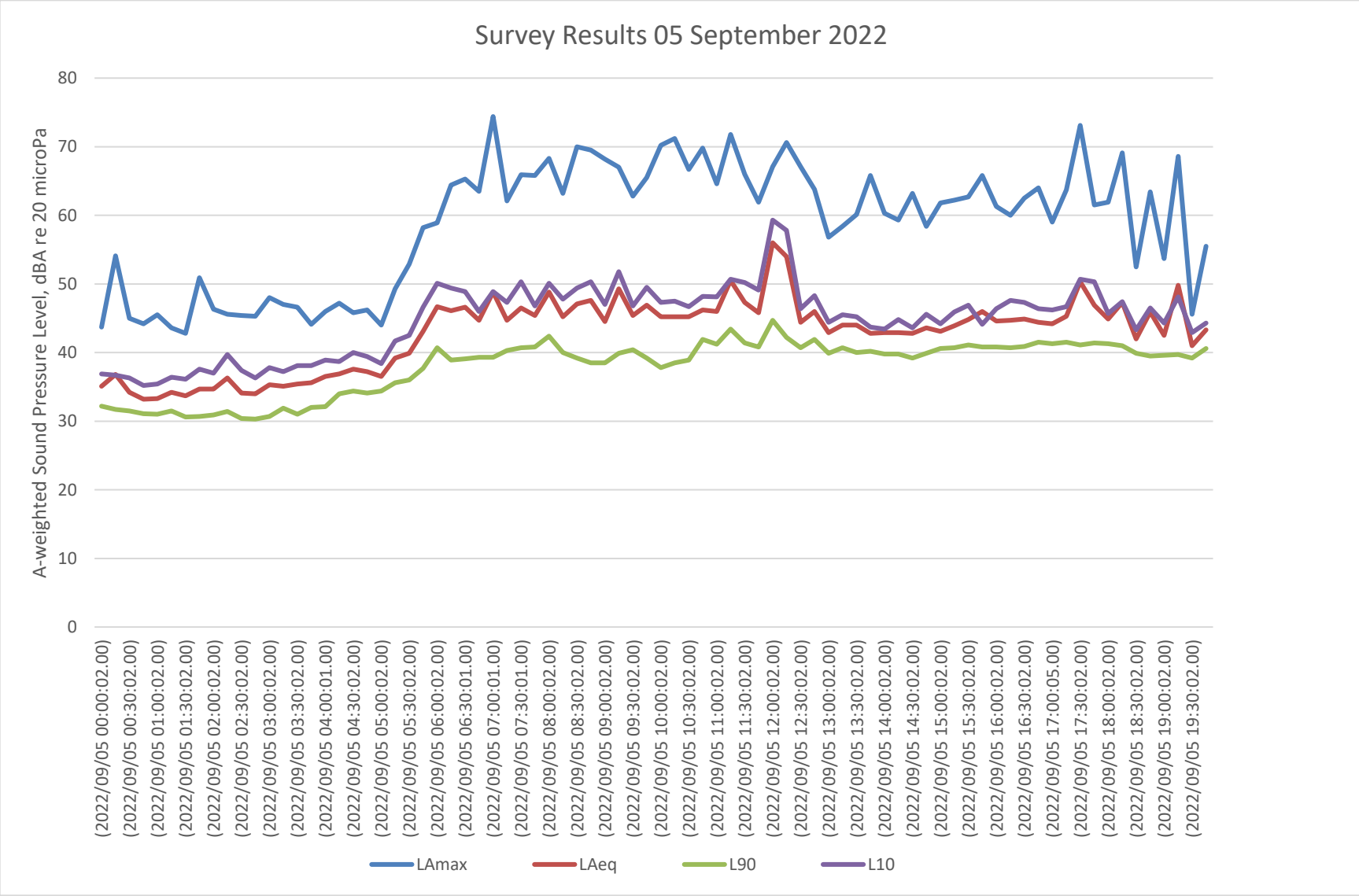
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50
40
30
20
10
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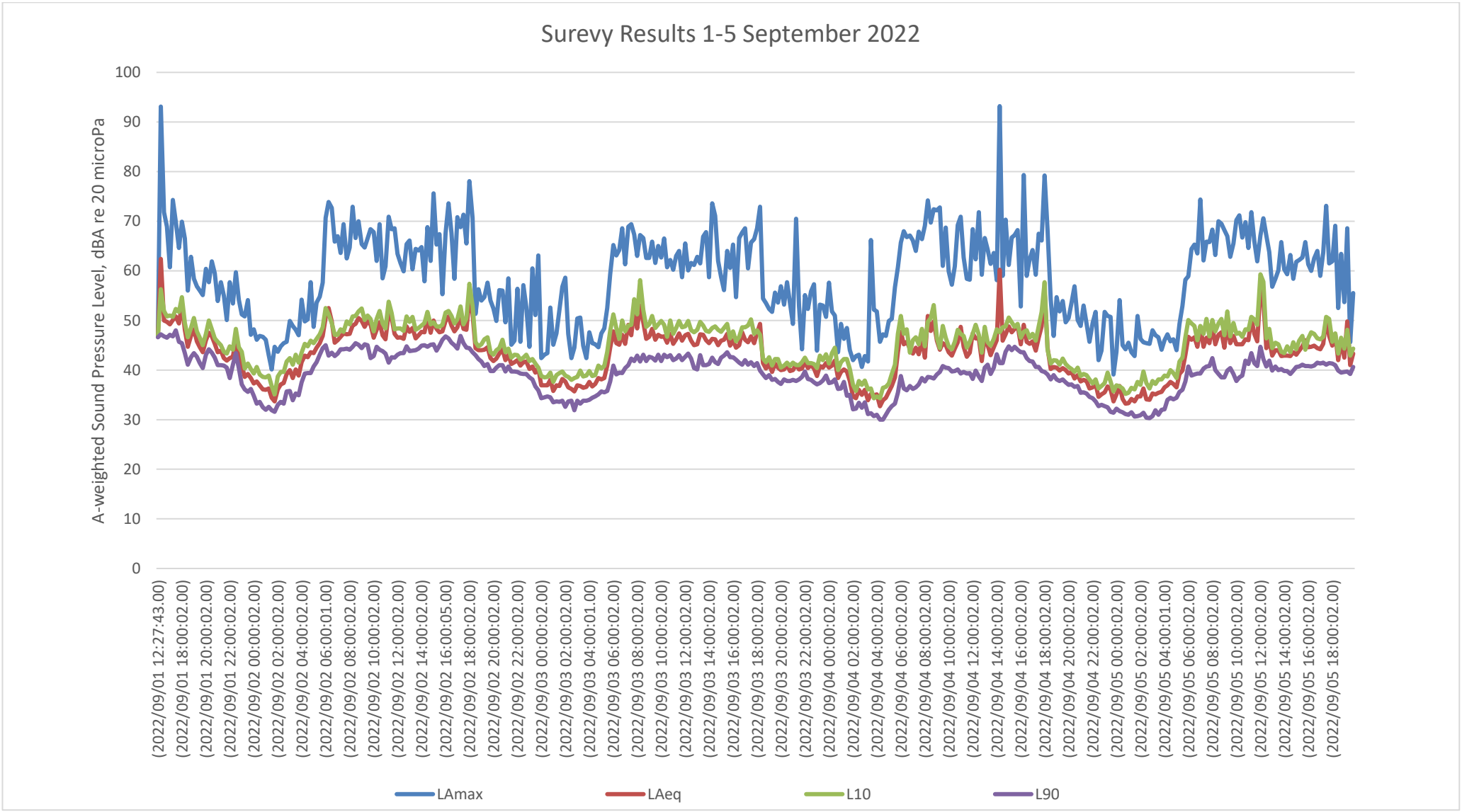
LAmax
LAeq
L90
L10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80
70
60
50
40
30
20
10
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(2022/09/05 10:00:02.00)
(2022/09/05 12:00:02.00)
(2022/09/05 14:00:02.00)
(2022/09/05 16:00:02.00)
(2022/09/05 18:00:02.00)
LAmax
LAeq
L10
L90

APPENDIX B

Glossary of Acoustic Terminology

dB(A) Also referred to as dBA. A unit of measurement, decibels (A), of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate human ear response at a loudness level of 40 phons. The table below outlines the subjective rating of different sound pressure levels.

Noise Level (dBA)	Subjective Rating
25-30	Barely audible and very unobtrusive.
30-35	Audible but very unobtrusive.
35-40	Audible but unobtrusive.
40-45	Moderate but unobtrusive.
45-50	Unobtrusive with low levels of surrounding activity.
50-55	Unobtrusive with high levels of surrounding activity.

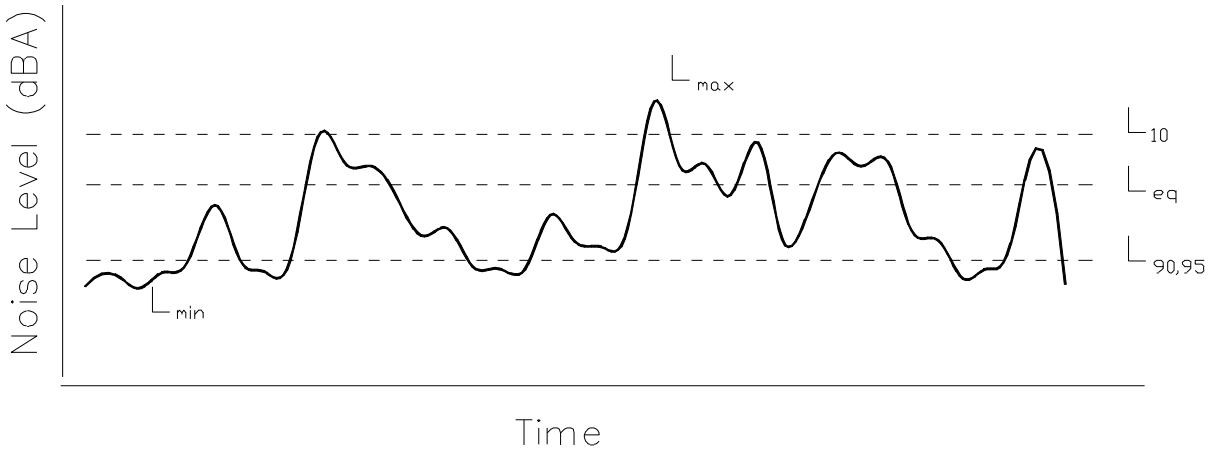
L_1 The noise level which is equalled or exceeded for 1% of the measurement period. L_1 is an indicator of the impulse noise level, and is used in Australia as the descriptor for intrusive noise (usually in dBA).

L_{10} The noise level which is equalled or exceeded for 10% of the measurement period. L_{10} is an indicator of the mean maximum noise level, and is used in Australia as the descriptor for intrusive noise (usually in dBA).

L_{90}, L_{95} The noise level which is equalled or exceeded for 90% of the measurement period. L_{90} or L95 is an indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dBA).

L_{eq} The equivalent continuous noise level for the measurement period. L_{eq} is an indicator of the average noise level (usually in dBA).

L_{max} The maximum noise level for the measurement period (usually in dBA).



Note: The subjective reaction or response to changes in noise levels can be summarised as follows: A 3dBA increase in sound pressure level is required for the average human ear to notice a change; a 5dBA increase is quite noticeable and a 10dBA increase is typically perceived as a doubling in loudness.

STC/R_W Sound Transmission Class or Weighted Sound Reduction Index. Provides a single number rating (from the sound transmission loss or sound reduction index for each frequency band) of the sound insulation performance of a partition. The higher the value, the better the performance of the partition. The subjective impression of different ratings is shown in the table below.

Type of noise source	STC/Rw Rating				
	40	45	50	55	60
Normal Speech	Audible	Just Audible	Not Audible		
Raised speech	Clearly Audible	Audible	Just Audible	Not Audible	
Shouting	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Small television/small entertainment system	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Large television/large hi-fi music system	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Just Audible
DVD with surround sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible
Digital television with surround sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible

FSTC/R_W' The equivalent of STC/R_W, unit for sound insulation performance of a building element measured in the field.

C_I, C_{tr} The ratings (R_W, D_{nTw}, L_{nTw}) are weighted in accordance to a spectrum suited to speech. This term modifies the overall rating to account for noise with different spectra, such as traffic (C_{tr}) or footfalls (C_I). The ratings may be written as R_W+C_{tr}, or $D_{nTw}/L_{nTw}+C_I$.

NNIC/D_{nTw} Normalised Noise Isolation Class, or Weighted Standardised Sound Level Difference. Provides a single number rating of the sound level difference between two spaces, and incorporates the effects of flanking noise between two spaces. This rating is generally accepted to be about 5 points less than the STC/R_W rating.

IIC/L_{nw} Impact Insulation Class, or Weighted Normalised Impact Sound Level. L_{nw}=110-IIC. The higher the IIC rating, or the lower the L_{nw} rating the better the performance of the building element at insulating impact noise. The table below gives the subjective impression of different ratings:

IIC	Lnw	Subjective Rating
40	70	Clearly Audible
45	65	Clearly Audible
50	60	Audible
55	55	Audible
60	50	Just Audible
65	45	Inaudible

FIIC/L_{nTw}' The equivalent of IIC/L_{nw}, but the performance is for the building element measured in the field.