

# BALMORAL QUAY STAGE 5

## Town Planning Acoustic Report

26 November 2021

Balmoral Quay Pty Ltd C/- HUB Property Group

MD213-01F01 Town Planning Acoustic Report (r3).docx

## Document details

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## Document control

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## Executive summary

### November 2021 Update

This update responds to the City of Greater Geelong's RFI, requesting "an updated Acoustic Report (or letter from the consultant) addressing whether the proposal complies with the new EPA legislation".

All updates to this report, including those addressing the above, are denoted in green text.

Renzo Tonin & Associates has undertaken a town planning acoustic assessment for the proposed residential development, Balmoral Quay Stage 5, to be located at 43 Liverpool Street, Rippleside (the Subject Site/Development).

The assessment comprised:

- Review of the surrounding the Subject Site and the development proposal
- Measurement and observation of the existing noise environment at the Subject Site
- Determination of relevant noise criteria and legislation:
  - Victoria Planning Provision Clause 55.07
  - Australian Standard 2107 internal noise criteria
  - Environment Protection Authority Publication 1826 'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues' which supersedes the State Environment Protection Policy No. N-1 'Control of Noise from Industry, Commerce and Trade' (SEPP N-1)
  - EPA Guidelines for domestic plant noise, deliveries and waste collection
- Glazing and façade specification for compliance with relevant criteria
- Commentary on the low-risk nature of base building plant noise emissions and domestic mechanical plant noise emissions from the Subject Development

Provided that the recommendations contained in this report are implemented, it is expected that the Subject Development can operate without adverse impact on residential amenity in the area and provide suitable amenity to the proposed apartments of the Subject Development.

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## 1 Introduction

Renzo Tonin & Associates has undertaken a town planning acoustic assessment for the proposed residential development, Balmoral Quay Stage 5, to be located at 43 Liverpool Street, Rippleside (the Subject Site/Development). This report documents the findings of the assessment. The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

## 2 Site and development overview

Renzo Tonin & Associates has based its assessment of the proposed Subject Development on the following drawings:

- [Town Planning Issue drawing set entitled "Balmoral Quay Pty Ltd – Liverpool Street, Rippleside", Job No. 21511, dated May 2021, by SJB Architects](#)

Figure 1 and Table 1 present an overview of Subject Site and surrounding land uses.

**Table 1: Land uses surrounding the Subject Site**

Subject Site	43 Liverpool Street <ul style="list-style-type: none"> <li>• Comprehensive Development Zone 2 (CDZ2)</li> <li>• Existing: car park for neighbouring construction sites</li> <li>• Proposed: seven-storey residential development</li> </ul>
North of the Subject Site	Barwon water pump station and Electrical Substation 5 Balmoral Crescent <ul style="list-style-type: none"> <li>• General Residential Zone 1 (GRZ1)</li> <li>• Dwelling under construction adjacent to the Subject Site</li> </ul> 7-11 Balmoral Crescent <ul style="list-style-type: none"> <li>• General Residential Zone 1 (GRZ1)</li> <li>• Single storey dwellings</li> </ul>
East of the Subject Site	Opticom and NBN substation Balmoral Quay Apartments (Stage 1-4) <ul style="list-style-type: none"> <li>• Comprehensive Development Zone 2 (CDZ2)</li> <li>• 2- to 3-storey townhouse dwellings (Stage 2-4 currently under construction) across Harbourside Drive</li> </ul>
South of the Subject Site	Rippleside Park <ul style="list-style-type: none"> <li>• Public Park and Recreation Zone (PPRZ)</li> <li>• Open air car park serving Rippleside Park and Rippleside Beach</li> </ul>
West of the Subject Site	39-41 Liverpool Street and 50-52 Walker Street <ul style="list-style-type: none"> <li>• General Residential Zone 1 (GRZ1)</li> <li>• 1- to 2-storey dwellings across Balmoral Crescent</li> </ul>

Figure 1: Site overview



## 3 Existing noise environment

### 3.1 Noise monitoring

To quantify the existing noise levels, Renzo Tonin & Associates conducted unattended noise monitoring from Wednesday 15<sup>th</sup> July 2020 to Thursday 23<sup>rd</sup> July 2020. The noise monitor locations are shown in Figure 1 and described in Table 2. Appendix B presents the graphed noise monitor data.

**Table 2: Noise monitoring location**

ID	Location	Description
L1	Southeast corner of the Subject Site, at the corner of Harbourside Drive and Liverpool Street	<ul style="list-style-type: none"> <li>i. Monitor Duration: Wednesday 15<sup>th</sup> July 2020 to Thursday 23<sup>rd</sup> July 2020</li> <li>ii. Microphone: approx. 1.5 metres above ground level</li> <li>iii. The monitor was set to record broadband and spectral noise descriptors, and audio to assist in source recognition</li> <li>iv. The noise environment was dominated by typical suburban noise</li> </ul>
L2	Northeast corner of the Subject Site, abutting Harbourside Drive	<ul style="list-style-type: none"> <li>i. Monitor Duration: Wednesday 15<sup>th</sup> July 2020 to Wednesday 22<sup>nd</sup> July 2020 (limited by noise monitor battery life)</li> <li>ii. Microphone: approx. 3.8 metres above ground level</li> <li>iii. The monitor was set to record broadband and spectral noise descriptors, and audio to assist in source recognition</li> <li>iv. The noise environment consisted of <u>construction noise</u> from nearby works and typical suburban noise</li> </ul>

Notes: NTL XL2 Class 1 noise monitors were used for the campaign. The calibration of the devices was checked in the field immediately before and after the measurement using a Brüel & Kjær Type 4231 calibrator; no drift in calibration was observed. The noise monitors conform with IEC 61672-3 and IEC 61260-3; the sound calibrator conforms with IEC 6094, and; all carry manufacturers certification or NATA certification detailing Standard conformance testing within the last two years and one year respectively.

Table 3 presents background and ambient noise levels measured for this assessment.

**Table 3: Summary of noise monitoring results**

Location ID	Minimum background noise level, L <sub>90</sub> dB(A)			Ambient noise level L <sub>eq</sub> dB(A)	
	Day <sup>1</sup>	Evening <sup>1</sup>	Night <sup>1</sup>	Day/Evening <sup>2,4</sup>	Night <sup>2,3,4</sup>
L1	44	40	38	51	44 (51)
L2	48	44	41	59	50 (56)

- Notes:
- Minimum period average noise levels that occurred during monitoring for each period.  
Background noise periods as defined by EPA Pub. 1826:  
    - Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A
    - Evening: Monday-to-Saturday 6pm-to-10pm; Sundays 7am-to-10pm
    - Night: All days 10pm-to-7am
  - Highest measured representative energy averaged ambient noise level per period. Periods: Day/Evening 6am-10pm, Night 10pm-6am.
  - (in brackets) highest morning peak energy average from 6-7am as measured during the monitored period.
  - Ambient noise levels affected by nearby construction

Noise emissions from the existing Barwon water pump station, electrical substation and Opticom/NBN substation (shown in Figure 1) were observed not to contribute to the noise levels at the noise monitor locations or proposed building façade locations.

## 4 Criteria

### 4.1 Internal amenity criteria

#### 4.1.1 Victoria Planning Provision Clause 55.07

Victoria Planning Provision Clause 55.07-6 Standard B40 provides target criteria for environmental noise impacts on applicable developments in Victoria. These criteria cover continuous or semi-continuous noise sources including traffic and railway and noise from industrial zones.

Clause 55.07-6 Standard B40 states the following regarding traffic noise:

*Buildings within a noise influence area specified in Table B6...(Roads carrying 40,000 daily traffic, 300 metres from the nearest trafficable lane)... should be designed and constructed to achieve the following noise levels:*

- *Not greater than 35dB(A) for bedrooms, assessed as an LAeq,8h from 10pm to 6am.*
- *Not greater than 40dB(A) for living areas, assessed LAeq,16h from 6am to 10pm.*

#### 4.1.2 Australian Standard 2107 internal noise criteria

*Australian/New Zealand Standard AS/NZS 2107: 2016 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors (AS2107) provides target criteria for environmental noise impacts on apartments, as presented in Table 4. These criteria are appropriate for continuous or semi-continuous noise sources (mechanical plant, traffic etc.).*

**Table 4: AS2107 internal noise level criteria**

Type of occupancies within apartments / hotels near entertainment districts or near major roads	Recommended design sound level range, L <sub>eq</sub> dB(A)
Living areas	35 to 45
Sleeping areas <sup>1</sup>	35 to 40

Notes: 1. Criteria in sleeping areas has been applied during the night time period, 10pm to 6am

The criteria are presented in terms of satisfactory and maximum equivalent continuous (L<sub>eq</sub>) noise levels over a ... *sufficiently long period to characterise the sound source.*

Renzo Tonin & Associates has referred to the highest measured day (6am to 10pm) and night (10pm to 6am) period energy average traffic noise levels to provide guidance on minimum glazing requirements to achieve the levels 5dB(A) below the upper AS2107 criterion for each space. Noise levels during the morning shoulder period (6-7am) for compliance with 40dB(A) in sleeping areas has also been assessed.

## 4.2 Noise emission criteria

### 4.2.1 EPA Publication 1826

Effective from 1 July 2021, EPA Publication 1826 'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues' (EPA 1826) supersedes:

- State Environmental Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1 (SEPP N-1) and

For this assessment's application, EPA Publication 1826 uses the same methods to assess noise impacts as SEPP N-1, but with slight amendments to the period definitions of day evening and night. For the sake of familiarity, both EPA Pub. 1826, and superseded SEPP N-1 shall be referenced. Environment Protection Regulations 2021 define the superseding EPA Publication 1826 day, evening and night period definitions, implemented following.

#### 4.2.1.1 Commercial noise limits - EPA Pub. 1826 / SEPP N-1

EPA Pub. 1826 / SEPP N-1 noise limits are calculated from planning overlays and background noise levels measured within an area in absence of intrusive commercial noise sources. Table 5 presents the applicable noise limits, assessable over a 30-minute period outside dwellings, places of sleep and places of education.

**Table 5: EPA Pub. 1826 / SEPP N-1 noise criteria**

Period	Zoning level, $L_{eq}$ dB(A)	Background noise level, $L_{90}$ dB(A) <sup>1</sup>	Classification	SEPP N-1 / EPA Pub. 1826 limit, $L_{eq}$ dB(A)
Day	50	44	Neutral	50 <sup>2</sup>
Evening	44	40	Neutral	44 <sup>2</sup>
Night	39	38	High background	39 <sup>2</sup>
EPA Pub. 1826 period definitions:	Day: Monday-to-Saturday 7am-to-6pm; Evening: Monday-to-Saturday 6pm-to-10pm; Night: All days 10pm-to-7am		Sundays N/A Sundays 7am-to-10pm	

- Notes:
1. Background noise levels per Table 3.
  2. As a conservative measure, noise limits have been applied using the "neutral" methodology.

Per EPA Pub. 1826, an adjustment is applied for indoor assessments:

Circumstances	Adjustment
The noise reduction performance of the building envelope is known, in octave or one third octave bands, from design specifications, calculations or measurements, and The frequency spectrum of the indoor noise has been measured.	Site specific adjustment based on the noise reduction performance of the building envelope (taking into account the volume and acoustic properties of the room).
Where the noise reduction performance is unknown, the adjustment is based on the following assessment of the building envelope:	+20dB
Meets or exceeds energy efficiency requirements set out in the Building Code of Australia 2006 (BCA 2006) including sealing requirements.	
Does not meet energy efficiency requirements or sealing requirements set out in the BCA 2006.	+15dB

## 4.2.2 Environment Protection Regulations for domestic plant

Noise from the operation of domestic plant located on a private title shall be designed to comply with, and be assessed against, the applicable criteria defined in the *Environment Protection Act 2017* and the *Environment Protection Regulations 2021*. The *Act* and *Regulations* refer to unreasonable noise and apply a requirement for inaudibility (which can be tested subjectively) during the night period. Typically, Renzo Tonin & Associates has found that domestic plant operating at a noise level 5 dB lower than background does not lead to adverse response.

EPA document *Noise Control Guidelines* (Publication 1973) states that the intrusive noise exceeding the background noise level by more than 5dB at the affected receiver during the day or evening, may be considered unreasonable.

**Table 6: Criteria for noise from domestic plant**

Period	Background L <sub>90</sub> <sup>1</sup> dB(A)		Permissible limit L <sub>eq</sub> dB(A)
Day	44	+ 5 =	49
Evening	40	+ 5 =	45
Night	38	- 5 =	33 <sup>2</sup>

Period definitions: Day: 7am – 6pm; Evening: 6pm – 10pm\*; Night: 10pm\* – 7am

\*Environment Protection Regulations 2021 permits audible air conditioning operation until 11pm

- Notes:
1. Minimum hourly background noise levels applied from Table 3
  2. Typically, Renzo Tonin & Associates has found that domestic plant operating at a noise level 5 dB lower than background does not lead to adverse response during the night period

## 4.2.3 Deliveries and waste collection

EPA Victoria Publication 1254 *Noise Control Guidelines* provides the following guidelines to mitigate the impact of deliveries and waste collection on residential amenity.

### 4.2.3.1 Deliveries

EPA Victoria Publication 1254 *Noise Control Guidelines* provides the following guidelines for deliveries:

*Schedule: Deliveries to shops, supermarkets & service stations*

- 7 am — 10 pm Monday to Saturday
- 9 am — 10 pm Sundays and public holidays

*(Outside these hours) ... deliveries should be inaudible in a habitable room of any residential premises ... regardless of whether any door or window ... is open*

### 4.2.3.2 Waste collection

EPA Victoria Publication 1254 *Noise Control Guidelines* provides the following guidelines for waste collection:

- Refuse bins should be located at sites that provide minimal annoyance to residential premises.
- Compaction should be carried out while the vehicle is moving

- *Noisy verbal communication between operators should be avoided where possible.*

The following times are recommended for waste collection:

*One collection per week*

- *6:30 am - 8 pm Monday to Saturday*
- *9 am - 8 pm Sunday and public holidays*

*Two or more collections per week*

- *7 am - 8 pm Monday to Saturday*
- *9 am - 8 pm Sunday and public holidays*

## 5 Assessment and recommendations

### 5.1 Noise impacts from existing conditions on the Subject Development

A CadnaA three-dimensional noise model, implementing ISO 9613 noise propagation algorithms was built to calculate noise propagation to the Subject Development's façade from existing conditions. The built form of the Subject Development and proximate buildings were integrated into the model. The following propagation effects were included in the predictive model:

- Mitigation of noise with distance, including geometrical spreading and air absorption
- Reflections from buildings and environment
- Barrier effects due to obstructions between noise sources and residential receivers
- Ground absorption effects
- Local topographical changes

#### 5.1.1 Glazing requirements

Table 7 provides details of the performance requirements for sound insulation of glazing systems, along with an example of a specification that satisfies the performance requirement for conformance with AS2107 criteria and Victoria Planning Provision Clause 55.07.

**Table 7: Glazing specification for development**

Façade element	Performance requirement - Acoustic rating of glazing assembly $R_w$ (Ctr)	<u>Example</u> of acceptable glazing system	Laboratory test reference
All glazing	30	Fixed windows/ Awning windows / Sliding doors Framing with single- or double-glazed system with at least one (1) pane of 6mm thick glazing.	ATF 768

NOTES:

1. The term "glazing system" means the glass, frame and seals including the perimeter seal at the wall junction.
2. The specified  $R_w$  (Ctr) rating must be achieved by the glazing product specified or selected.
3. The weighted sound reduction index  $R_w$  is a measure of the noise reduction property of a partition, a higher rating implying a higher sound reduction performance.

NOTES FOR GLAZING CONSTRUCTIONS:

4. Where the information in this table is provided for the purpose of Council approvals process or cost planning it shall not be used for construction unless otherwise approved in writing by the acoustic consultant.
5. Unless otherwise approved in writing by the acoustic consultant the design in this table is preliminary and a comprehensive assessment shall be conducted prior to Construction Certification.
6. Before committing to any form of construction or committing to any builder, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the glazing assembly where only an "estimate" is available for the sound insulation properties of recommended materials.
7. The builder shall ensure that installation techniques will not diminish the  $R_w$  (Ctr) performance of the glazing when installed on site.
8. All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon to enable the  $R_w$  (Ctr) rating performance of the glazing to be maintained.
9. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Thicker glazing may be required for structural loading, wind loading etc. If thicker glazing is used, check its suitability with the acoustic consultant.
10. The sealing of all gaps in acoustic rated glazing assemblies and partitions is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
11. Check design of all junction details with acoustic consultant prior to construction.
12. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

### 5.1.2 Non-vision elements

Opaque façade elements and roofs (the construction of which has not yet been determined, specified at Detailed Design phase), shall be designed to provide 10dB greater performance than vision-façade elements, the details of which shall be established by an acoustic engineer during the design development process, when more information is available. Due to observed low noise levels in the area, noise transfer through non-vision façade elements is considered low risk.

## 5.2 Noise emissions from the Subject Development

### 5.2.1 Base building plant noise

Whilst the details of base building mechanical plant selection are not finalised during the Concept Design / Town Planning phase, Renzo Tonin & Associates is able to provide commentary on the likely compliance of the Subject Development with noise criteria, drawing on experience from similar projects:

- Base building plant is typically located in car parks or on the roof of the development.
- Distances and the Subject Development building itself are expected to provide sufficient noise reduction between plant locations and noise sensitive receivers. If required, typical noise barriers are expected to be effective to reduce plant noise emissions
- During the Detailed Design phase, when mechanical service requirements have been scoped, equipment performance and localised treatments shall be specified to achieve EPA Pub. 1826 / SEPP N-1 compliance at all existing and proposed residences. It is not practical to scope such treatments at this stage.

Once plans for mechanical services have progressed sufficiently, a detailed acoustic assessment shall be conducted. With acoustic consultation during the Design and Construction phase, it is anticipated that plant noise from the Subject Development can achieve compliance with EPA Pub. 1826 / SEPP N-1 noise limits.

### 5.2.2 Domestic plant noise

Renzo Tonin & Associates is able to provide commentary with respect to domestic scale plant at the Subject Development, drawing on experience from similar projects:

- Small scale domestic plant is generally fairly quiet and is generally found to result in an acceptable outcome with respect to EPA guidelines. However, as a guide:
  - As set out in Planning Scheme Clause 55.07 Standard B40, equipment shall not be placed near bedrooms of immediately adjacent dwellings
  - Plant should not be located near adjacent dwelling habitable rooms or near outdoor areas where domestic use may occur
  - As practical, the distance from plant to adjacent dwellings should be maximised; and plant should be positioned such that obstructions break line of sight to adjacent dwellings

### 5.2.3 Deliveries and waste collection

Deliveries and waste collection shall be conducted in accordance with Section 4.2.3.

## 6 Conclusion

Renzo Tonin & Associates has undertaken a town planning acoustic assessment for the proposed residential development, Balmoral Quay Stage 5, to be located at 43 Liverpool Street, Rippleside (the Subject Site/Development).

The assessment comprised:

- Review of the surrounding the Subject Site and the development proposal
- Measurement and observation of the existing noise environment at the Subject Site
- Determination of relevant noise criteria and legislation:
  - Victoria Planning Provision Clause 55.07
  - Australian Standard 2107 internal noise criteria
  - *Environment Protection Authority Publication 1826 'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues' which supersedes the State Environment Protection Policy No. N-1 'Control of Noise from Industry, Commerce and Trade' (SEPP N-1)*
  - EPA Guidelines for domestic plant noise, deliveries and waste collection
- Glazing and façade specification for compliance with relevant criteria
- Commentary on the low-risk nature of base building plant noise emissions and domestic mechanical plant noise emissions from the Subject Development

Provided that the recommendations contained in this report are implemented, it is expected that the Subject Development can operate without adverse impact on residential amenity in the area and provide suitable amenity to the proposed apartments of the Subject Development.

## APPENDIX A Glossary of terminology

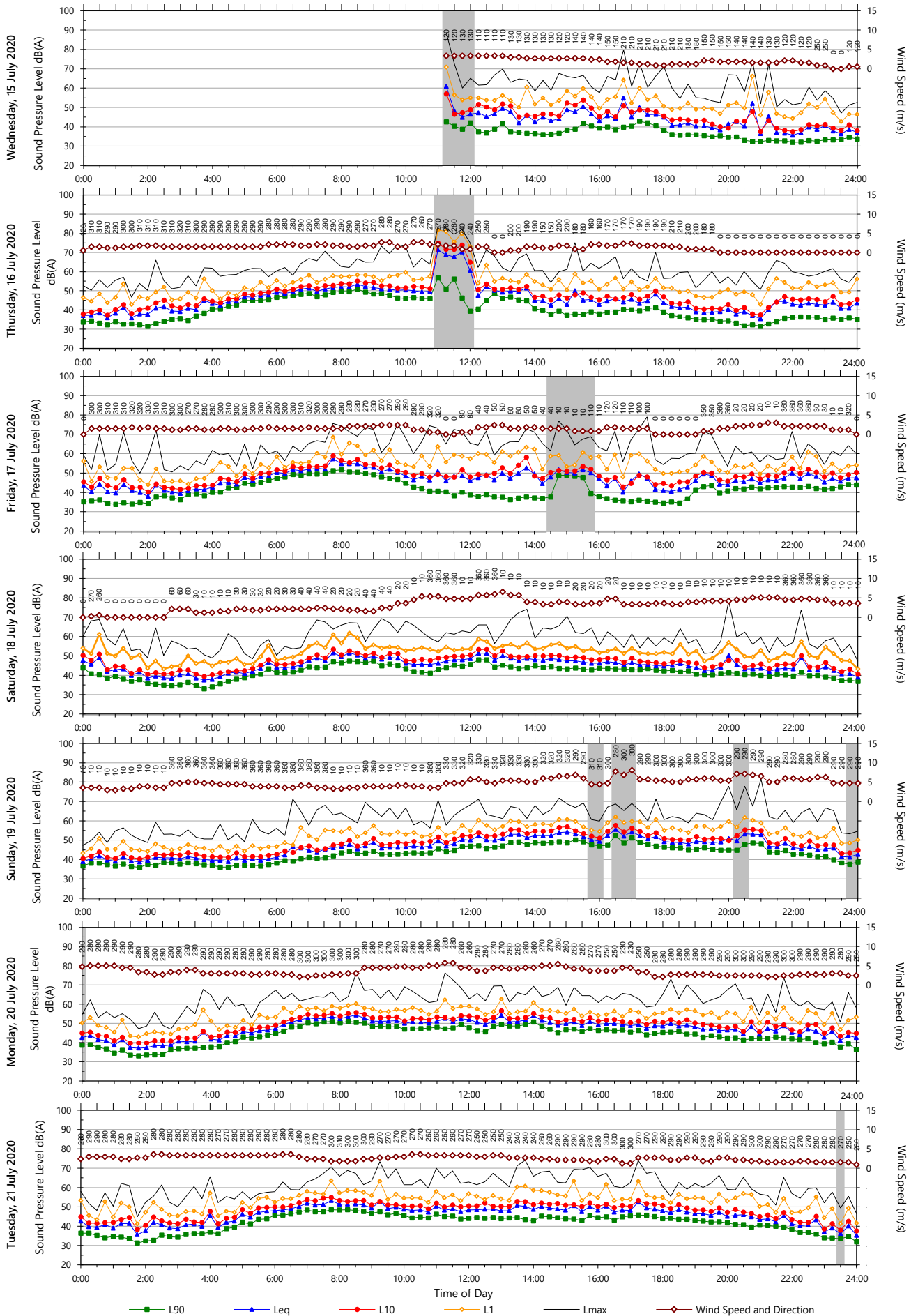
The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).																																													
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.																																													
Assessment period	The period in a day over which assessments are made.																																													
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).																																													
Decibel [dB]	<p>The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:</p> <table border="0"> <tr> <td>threshold of hearing</td> <td>0 dB</td> <td>The faintest sound we can hear</td> </tr> <tr> <td></td> <td>10 dB</td> <td>Human breathing</td> </tr> <tr> <td>almost silent</td> <td>20 dB</td> <td></td> </tr> <tr> <td></td> <td>30 dB</td> <td>Quiet bedroom or in a quiet national park location</td> </tr> <tr> <td>generally quiet</td> <td>40 dB</td> <td>Library</td> </tr> <tr> <td></td> <td>50 dB</td> <td>Typical office space or ambience in the city at night</td> </tr> <tr> <td>moderately loud</td> <td>60 dB</td> <td>CBD mall at lunch time</td> </tr> <tr> <td></td> <td>70 dB</td> <td>The sound of a car passing on the street</td> </tr> <tr> <td>loud</td> <td>80 dB</td> <td>Loud music played at home</td> </tr> <tr> <td></td> <td>90 dB</td> <td>The sound of a truck passing on the street</td> </tr> <tr> <td>very loud</td> <td>100 dB</td> <td>Indoor rock band concert</td> </tr> <tr> <td></td> <td>110 dB</td> <td>Operating a chainsaw or jackhammer</td> </tr> <tr> <td>extremely loud</td> <td>120 dB</td> <td>Jet plane take-off at 100m away</td> </tr> <tr> <td>threshold of pain</td> <td>130 dB</td> <td></td> </tr> <tr> <td></td> <td>140 dB</td> <td>Military jet take-off at 25m away</td> </tr> </table>	threshold of hearing	0 dB	The faintest sound we can hear		10 dB	Human breathing	almost silent	20 dB			30 dB	Quiet bedroom or in a quiet national park location	generally quiet	40 dB	Library		50 dB	Typical office space or ambience in the city at night	moderately loud	60 dB	CBD mall at lunch time		70 dB	The sound of a car passing on the street	loud	80 dB	Loud music played at home		90 dB	The sound of a truck passing on the street	very loud	100 dB	Indoor rock band concert		110 dB	Operating a chainsaw or jackhammer	extremely loud	120 dB	Jet plane take-off at 100m away	threshold of pain	130 dB			140 dB	Military jet take-off at 25m away
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loud	80 dB	Loud music played at home																																												
	90 dB	The sound of a truck passing on the street																																												
very loud	100 dB	Indoor rock band concert																																												
	110 dB	Operating a chainsaw or jackhammer																																												
extremely loud	120 dB	Jet plane take-off at 100m away																																												
threshold of pain	130 dB																																													
	140 dB	Military jet take-off at 25m away																																												
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.																																													
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.																																													
L <sub>eq</sub>	The "equivalent noise level" is the summation of noise events and integrated over a selected time period.																																													
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.																																													

## APPENDIX B    Noise monitoring graphs

Unattended Monitoring Results

Location: Balmoral Quay Stage 5 - L1 Southeast Corner

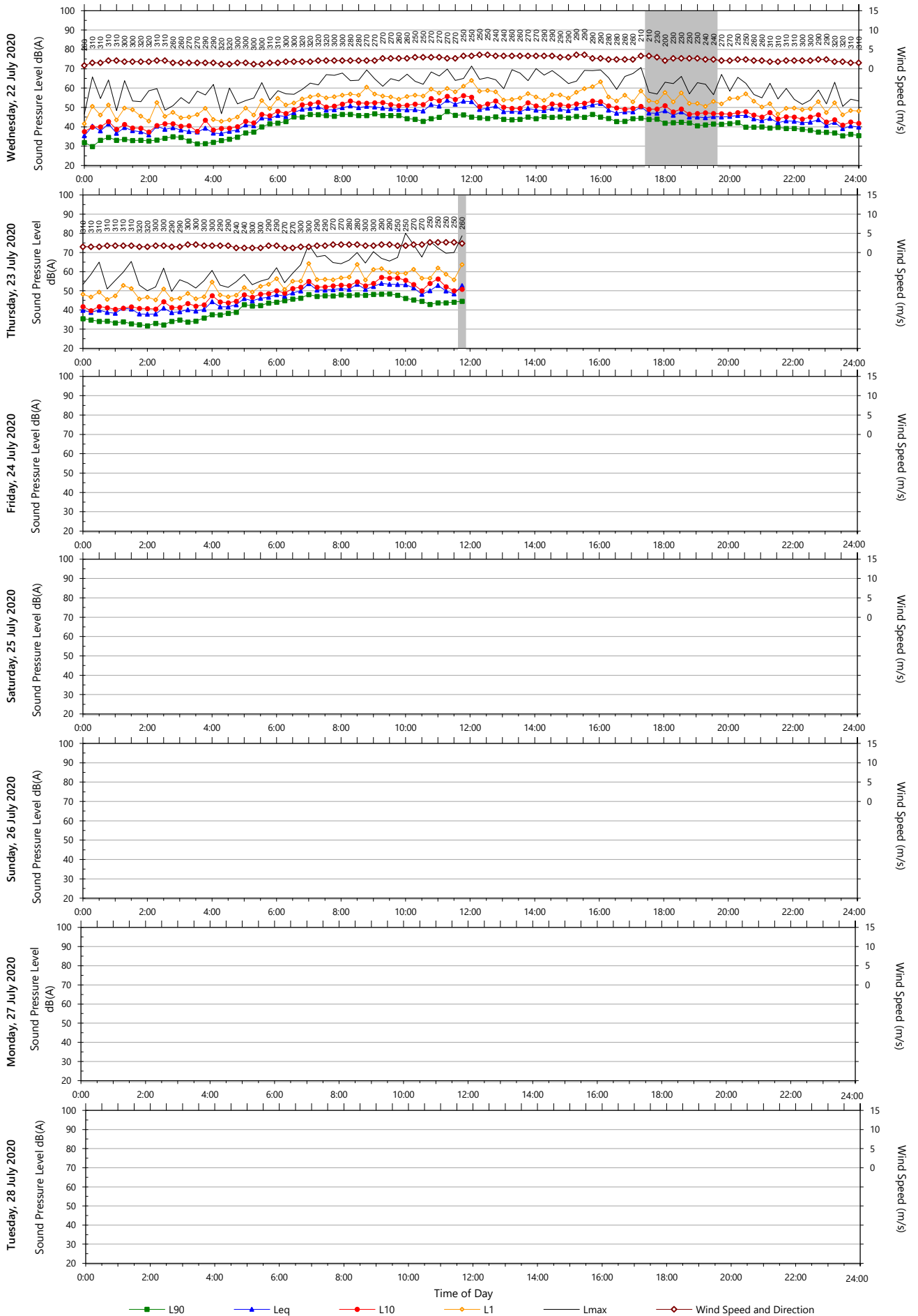


Data File: 2020-07-15\_SLM\_004\_123\_Rpt\_Report.txt

Template: QTE-26 Logger Graphs Program (r32)

Unattended Monitoring Results

Location: Balmoral Quay Stage 5 - L1 Southeast Corner

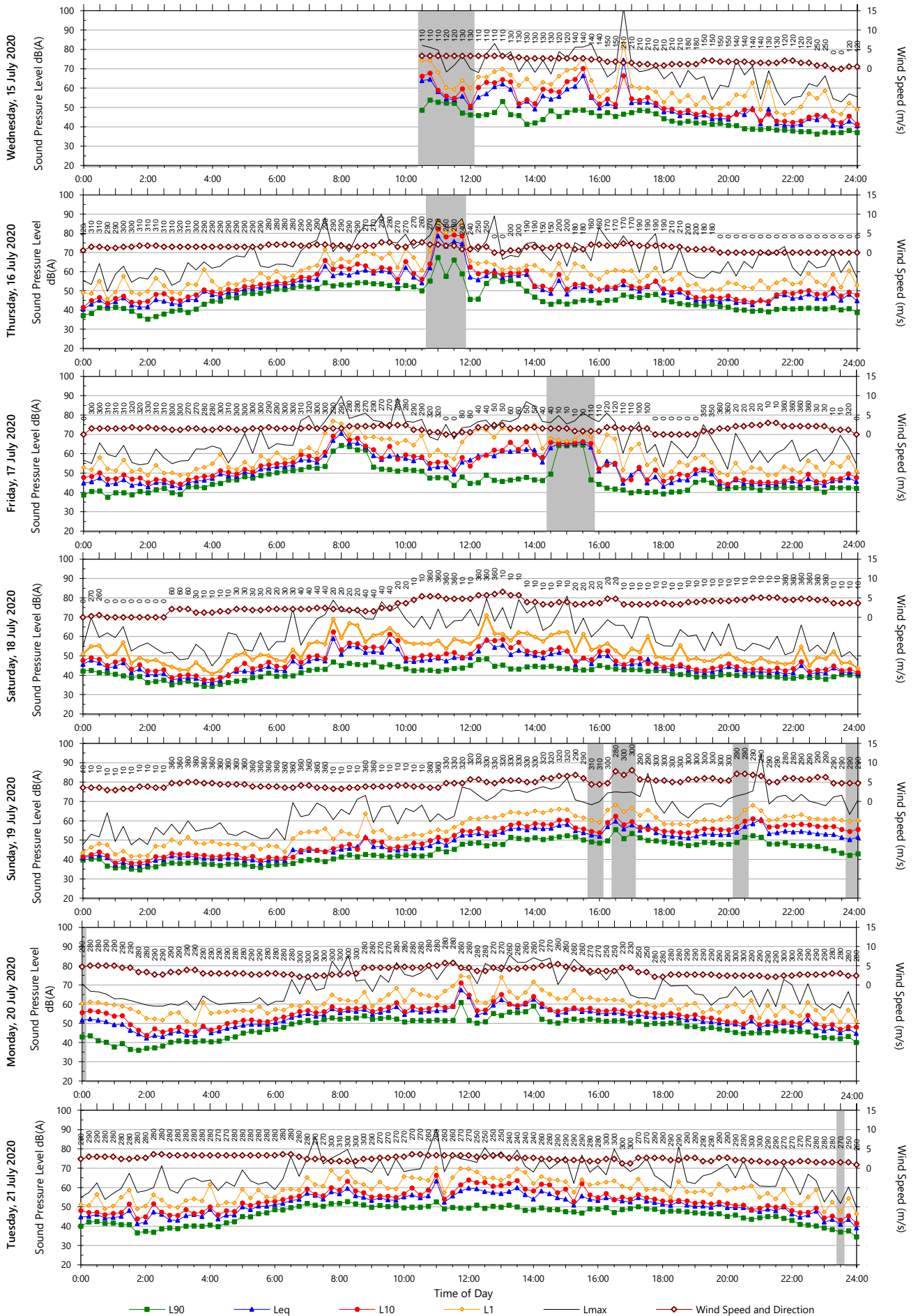


Data File: 2020-07-15\_SLM\_004\_123\_Rpt\_Report.txt

Template: QTE-26 Logger Graphs Program (r32)

Unattended Monitoring Results

Location: Balmoral Quay Stage 5 - L2 Northeast Corner



Data File: 2020-07-15\_SLM\_000\_123\_Rpt\_Report.txt

Template: QTE-26 Logger Graphs Program (r32)

