Resonate

Botany Aquatic Centre

Acoustic Report for Development Application

S200100RP3 Revision C

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Document Information

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Revision Table

Report revision	Date	Description	Author	Reviewer
0	10 February 2021	First issue	Sam Johnson	Andrew Parker
A	19 March 2021	Updated issue	Sam Johnson/Julia Knight	Andrew Parker
B	15 July 2021	Update to incorporate Council Comments	Sam Johnson	Andrew Parker
C	21 July 2021	Minor amendments	Sam Johnson	Andrew Parker

Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to approximate human hearing at lower noise levels. A-weighted levels are used as human hearing does not respond equally at all frequencies.
C-weighting	A spectrum adaption that is applied to measured noise levels to approximate human hearing at high noise levels. C-weighted levels are used as human hearing does not respond equally at all frequencies.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of loudness.
dB(A)	'A' Weighted sound level in dB.
dB(C)	'C' Weighted sound level in dB.
dB(Lin)	Linear (un-weighted) sound level in dB. A measure of the absolute pressure fluctuation in the air.
Frequency (Hz)	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second.
L_{eq}	Equivalent noise level—Energy averaged noise level over the measurement period.
$L_{eq,\ (15\ min)}$	A-weighted energy averaged noise level over a 15-minute period. Used in the EPA Interim Construction Noise Guideline (ICNG).
Rating Background Level (RBL)	The Rating Background Level for each period is the median value of the average background values for the period over all of the days measured. There is an RBL value for each period (day, evening and night).

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1 Introduction

Resonate Consultants has been engaged by CO-OP Studio to undertake a noise impact assessment for the proposed Botany Aquatic Centre redevelopment. This assessment report forms part of the Development Application (DA) documentation to be submitted to Bayside Council for Stage 1 of the project.

The principal purpose of this report is to:

- measure and document the ambient acoustic environment;
- determine appropriate project specific noise trigger levels and acoustic criteria for nearby noise sensitive receivers;
- predict operational noise emission from the development to nearby noise sensitive receivers; and
- assess the predicted operational noise emissions against industry standard noise criteria.

This report presents Resonate's methodology, assessment criteria and recommendations to control the operational noise from the redevelopment.

2 Project Description

Stage 1 of the project involves the construction of an outdoor aqua play area including pools, water slides, a change room and a plantroom housing associated plant items located to the north of the site, as well as the demolition of an existing toddler pool and shade structure. The extent of Stage 1 works is shown in Figure 1. Stage 1 works are not proposing to alter existing hours of operation which are currently 6 am to 6 pm.

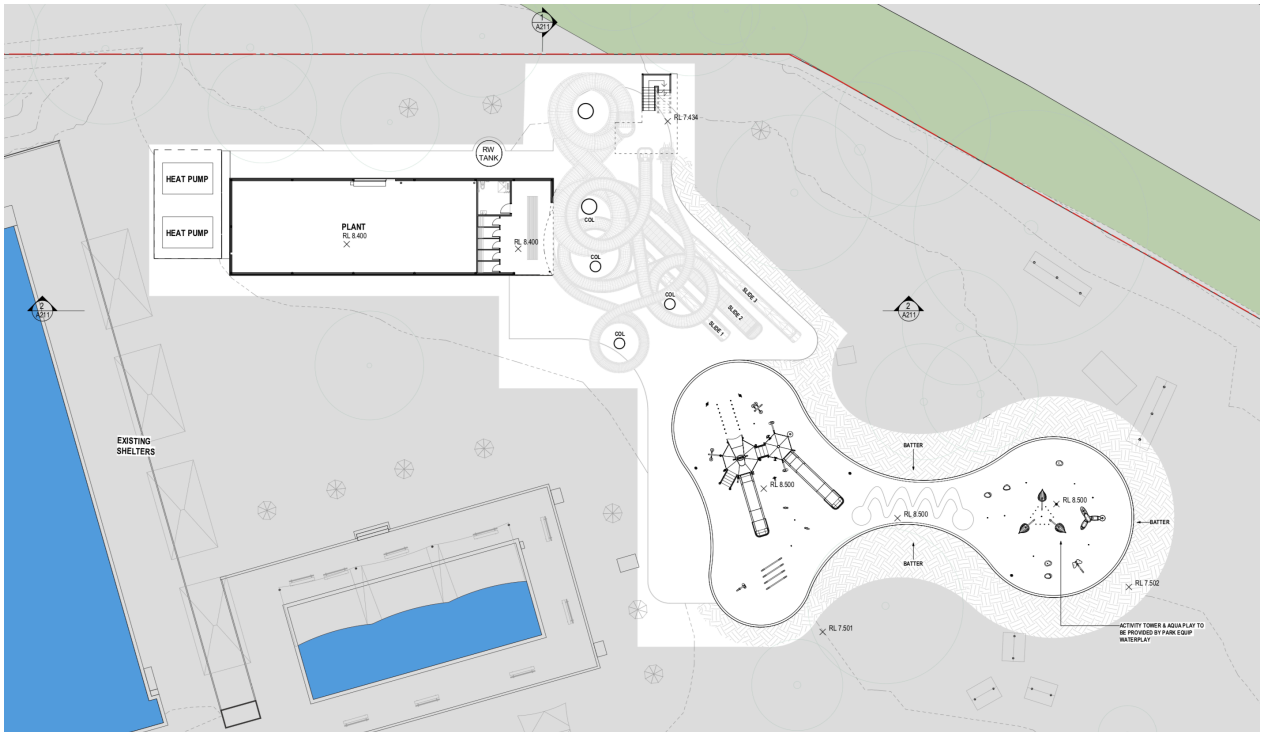


Figure 1 Extent of Stage 1 works

Residential receivers are located to the south of the site on Myrtle Street with the potentially most affected being 9-19 Myrtle Street, located approximately 100 metres south of the works. A list of potentially affected receivers and their orientation relating to Stage 1 works is presented in Table 1. The entire site in context and surrounding receivers are shown in Figure 2.

Table 1 List of nearby receivers

Receiver Reference	Receiver address	Receiver usage	Distance to works
R1	9-19 Myrtle Street	Residential	100m south
R2	Schindler Lifts Australia	Industrial	35m to the north-west
R3	East Lake Golf Club	Active Recreation	110m to the north
R4	Booralee Park	Active Recreation	150m to the west

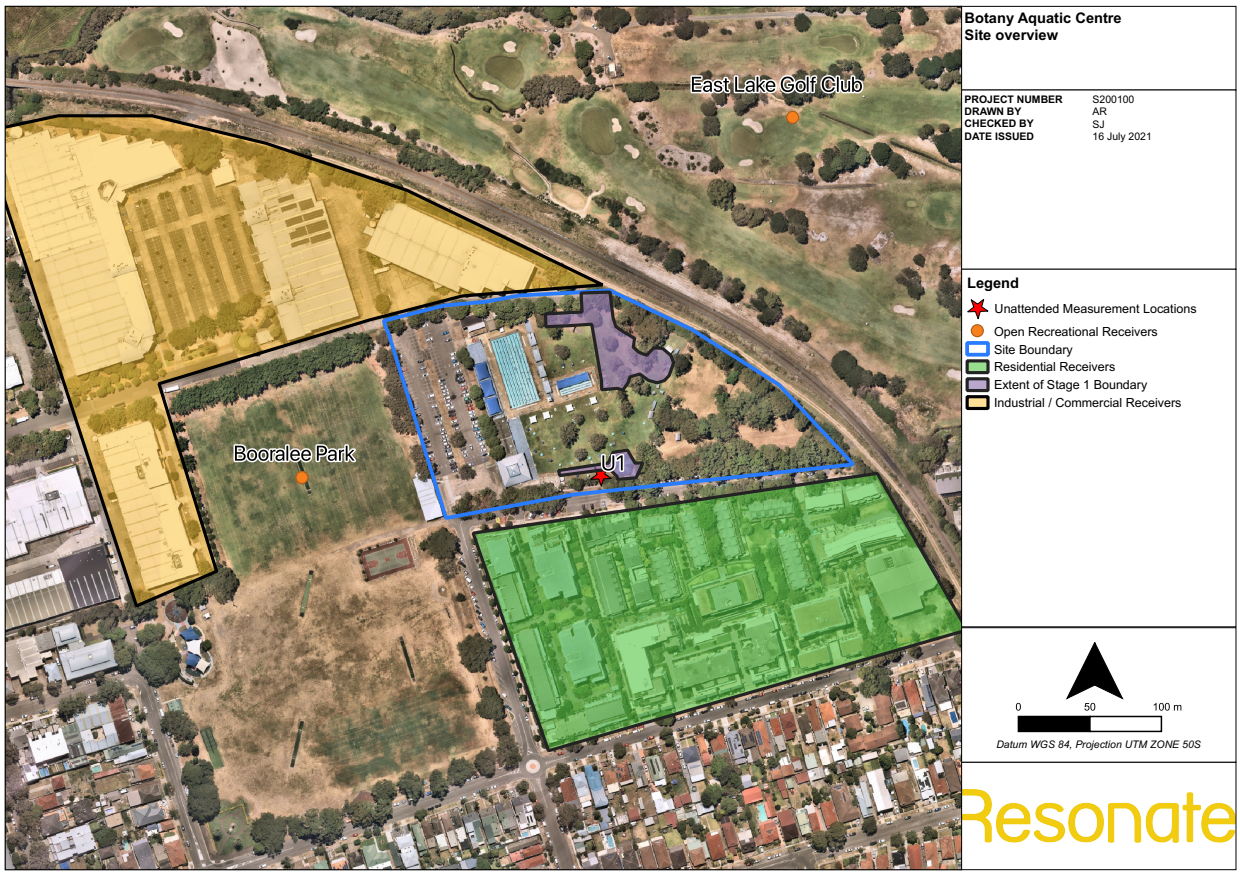


Figure 2 Site in context

3 Existing Acoustic Environment

In order to characterise the existing acoustical environment of the study area, unattended noise monitoring was conducted between the period of 22 May to 4 June and between 7 June and 20th June on the project site as shown in Figure 2. Logger locations were selected with consideration to other noise sources which may influence readings, security issues for noise monitoring equipment and gaining permission for access from landowners.

Instrumentation for the survey comprised of two Rion NL-42 Type 2 environmental noise loggers bearing the serial numbers 00946977 and 00946978, fitted with microphone windshields. Calibration of the loggers were checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Measured data has been filtered to remove data measured during adverse weather conditions upon consultation with historical weather reports provided by the Bureau of Meteorology (BOM). The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10}, L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary for definitions).

Table 2 below presents the Rating Background Level (RBL) and average total noise level for the surrounding environment. These noise levels were used to establish the relevant noise criteria in accordance with the NSW *Noise Policy for Industry* (NPI).

Table 2 Measured noise levels at background noise logging location

	Description	Noise Level during Period – dB(A)		
		Daytime 07:00 – 18:00	Evening 18:00 – 22:00	Night-time 22:00 – 07:00
Logger U1 – Southern boundary	Rating Background Level (L_{A90})	45	45	42
	Ambient Noise Level (L_{Aeq})	55	51	49

A detailed summary of the noise survey is provided in Appendix A and weekly noise logging graphs are presented in Appendix B.

4 Criteria – Noise Policy for Industry

Noise emissions from the site when operational should comply with the requirements of the NSW *Noise Policy for Industry* (NPI).

The NPI sets two separate noise criteria to meet desirable environmental outcomes:

- Intrusiveness – steady-state noise from the site should be controlled to no more than 5 dB(A) above the background noise level in the area. In this case, the steady-state L_{eq} noise level should not exceed the background noise level measured for different time periods in the environment.
- Amenity – amenity criteria are set based on the land use of an area. It requires noise levels from new industrial noise sources to consider the existing industrial noise level such that the cumulative effect of multiple sources does not produce noise levels that would significantly exceed the amenity criteria.
- The most stringent of the intrusiveness and amenity is selected to be the limiting criterion for residential receivers.
- Non-residential receivers noise criteria are based on the amenity criteria established in Table 2.2 of the policy

Based upon an unattended noise survey summarised in Appendix A, the project specific operational noise criteria for nearby receivers are provided in Table 3.

Table 3 Operational noise emission criteria

Location	Noise Emission Criteria (dB L_{Aeq})		
	Daytime 07:00 – 18:00	**Evening 18:00 – 22:00**	**Night-time 22:00 – 07:00**
Nearby residential premises	50	48	43
Active recreation	55 dB(A) when in use		
Industrial receivers	70 dB(A) when in use		

Refer to Appendix A for further information on the derivation of the noise emission criteria.

5 Assessment

Operational noise emissions from Stage 1 works of the development have been predicted to the potentially most affected receivers identified in Table 1. Operational noise emissions were predicted using Resonate's proprietary acoustic calculation software Ping.Calculation, which implements acoustic principles and formulas. The results of the predictions are presented in Table 4 below.

The prediction includes the following assumptions:

- Plant Room
  - A cumulative maximum sound power level of 99 dB(A) has been assumed for all plant items located inside the plant room. The key noise generating items include pumps associated with existing and future pools, spray park and water slides.
  - An external plant zone incorporating two heat pumps with an assumed cumulative sound power level of 89 dB(A).
- Aqua Play
  - A total sound power level of 97 dB(A) has been assumed which includes up to 40 active participants (raised voices, screams, children at play etc) and up to 10 passive participants (observers, conversational voice effort) at any given time. Water park source noise levels were determined from operator attended noise measurements conducted at similar facilities on previous occasions.
- Water Slides
  - A total sound power level of 97 dB(A) has been assumed which includes up to 40 active participants (raised voices, screams, children at play etc) and up to 10 passive participants (observers, conversational voice effort) at any given time. Water park source noise levels were determined from operator attended noise measurements conducted at similar facilities on previous occasions.
- Sound power to sound pressure level to the distances stated for each receiver in Table 1.
- Whilst the Aquatic Centre is operational from 6:00 am, it is understood that the operation of the Stage 1 works will only occur during daytime hours from 7:00 am. As such, the evening and night time periods have not been considered in this assessment.

Table 4 Calculated operational noise levels at nearby residential receivers

Receiver Location	Period	Noise Criteria – dB(A)	Predicted Noise Level $L_{eq(15\ minute)}$ – dB(A)		Compliance
			Scenario 1	Scenario 2	
R1 - 9-19 Myrtle Street	Daytime 7am – 6pm	50	35	49	✓
	Evening 6pm – 10pm	48	35		✓
	Night-time 10pm – 7am	43	35		✓
R2 - Schindler Lifts Australia	When in use	70	49	59	✓
R3 - East Lake Golf Club	When in use	55	34	50	✓
R4 - Booralee Park	When in use	55	29	45	✓

(1) Scenario 1: Pre-season start-up: All pool plant operating 24 hours per day but facility closed to the public (water slides and aqua play area not in operation).

(2) Scenario 2: All plant operational during the daytime only except only one of the two heat pumps would be operational at 40% capacity and the facility would be open to public.

6 Discussion and Recommendations

6.1 Water slides and aqua play

A total cumulative sound power level of 100 dB(A) has been assumed for the water slid and aqua play areas incorporating 100 participants. Water park source noise levels were determined from operator attended noise measurements conducted at similar facilities on previous occasions. It has been assumed that the operation of the aqua play areas included the following items which aligns with the operational description of the proposed development:

- Children calling out,
- Children laughing,
- The occasional scream,
- Water splashes due to water falling on the ground (continuous), and
- Large volumes of water dumping on the ground (intermittent).
- It has been advised by Council that the new aqua play and water slide area expects to draw a peak daily patronage of 400 people adding to the existing peak daily patronage (busiest summer day) of 640 people.
  - It has been assumed that a quarter of the daily patronage would utilise the facility during a typical hour equating to approximately 250 people.
    - 100 people would utilise the aqua play and water slides at any one time.
    - 150 would utilise the existing swimming and recreational facilities.
    - In reality the average hourly throughput is likely to be lower over the 12 hours of daily operation however the assumed number of patrons is considered a reasonable estimate for noise assessment purposes.

6.2 Plant

6.2.1 Plant room

Key noise generating plant associated with the existing and proposed pools, slides and aqua play are a series of pumps and will be housed within a plant room adjacent to the water slide area. Initial equipment selections have been provided by the mechanical engineers in order to estimate sound power levels. The predicted noise levels provided in Table 4 require the following minimum treatments to be incorporated:

- The plant room should be entirely enclosed.
- The wall and roof build-up should comprise an acoustic performance of Rw 50 with indicative build ups as follows:
  - Walls: 9mm Fibre Cement / 92 mm stud tracks with 64 mm staggered studs / 27kg/m^3 insulation / 13 mm sound rated plasterboard.
  - Roof: 0.6 mm steel sheet with thermal insulation on top of purlins / 24kg/m^3 insulation / 16 mm sound rated plasterboard.
  - Door to be minimum Rw 30 and oriented away from highly utilised areas on site.
  - It is recommended that the partition separating the plant room and amenities be full height and potentially include an additional layer of plasterboard on one side.
  - Any ventilation penetrations to incorporate acoustic louvres or silencers to suit the open area requirements to be specified by the mechanical engineer with noise reductions selected based on final penetration dimensions as part of the detailed design. The penetrations should be oriented away from highly utilised areas on site.
  - All gaps must be acoustically sealed including at partition and roof junctions.
  - Final design to be reviewed and detailed to meet acoustic amenity objectives of the site and surrounds.

6.2.2 Heat pumps

Two heat pumps are proposed to be installed adjacent to the plant room as shown in Figure 1. The predicted noise levels provided in Table 4 require the following minimum treatments to be incorporated:

- The heat pumps should incorporate a louvred enclosure.
- A roof should not be required.
- The louvres should be of type Fantech SBL 2 or acoustic equivalent to a height that matches the adjacent plant room (nominally 4m).

6.2.3 Additional Considerations

- Selecting the quietest plant for a given task
- Judicious location and orientation
- Use larger plant at a slower speed rather than smaller plant at a higher speed
- Using variable speed drives to lower plant speed in response to lower duty/load requirements.

On the basis of the above assumptions, no exceedances of the NPI criteria are expected. A full assessment of mechanical plant noise emission is required during the detailed design phase.

7 Conclusion

A noise impact assessment of operational noise from the proposed Botany Aquatic Centre Redevelopment Stage 1 has been conducted.

Project specific noise criteria have been established in accordance with the NSW Noise Policy for Industry guidelines based on unattended and attended noise monitoring conducted for this project.

Operational noise emissions from the proposed redevelopment were predicted at potentially affected noise sensitive receivers. The predicted operational noise levels have been assessed to comply with the noise criteria provided that the recommendations presented in Section (1) are implemented into the design. The final design is to be reviewed and detailed to meet acoustic amenity objectives of the site and surrounds.

Appendix A – Noise Survey

Unattended noise logging

An unattended noise survey was conducted during the period of 22 May and 4 June 2020 and between 7 June and 20 June 2020. Noise logging was conducted at the south and south-east boundaries of Botany Aquatic Centre, as shown in Figure 1.

Equipment and set-up

Two Rion NL-42 sound level meters were used, serial numbers 00946977 and 00946978. Field calibration was conducted at the commencement and conclusion of the logging period and no significant calibration drift was observed.

The noise logger was configured to record all relevant noise indices, including background noise level (L_{A90}) and equivalent continuous noise levels (L_{Aeq}). Samples were accumulated at 15-minute intervals. The time response of the logger was set to 'fast'.

The noise measurements were taken in general accordance with AS1055.1[1]

Weather conditions

In order to provide an indication that noise data was obtained during suitable meteorological conditions, half-hourly weather data was obtained from the Bureau of Meteorology (BOM) Automatic Weather Station (AWS) 066194 at Canterbury Racecourse.

Noise data has been excluded from the processed results if:

- Rain was observed during a measurement period, and/or
- Wind speed exceeded 5 m/s (18 km/h) at the measurement height of the noise logger. Wind data obtained from the BOM is presented as the value at 10 m above ground and adjusted to the measurement height of the noise logger.

Noise Policy for Industry

In order to determine mechanical services noise emission criteria, data from the unattended noise monitoring outlined in above was processed according to the procedures and time periods in the NSW Noise Policy for Industry (NPI) time periods as follows:

- Daytime: 7 am to 6 pm
- Evening: 6 pm to 10 pm
- Night-time: 10 pm to 7 am

It is necessary to establish a representative noise level for each of these time periods. The procedure set out in the NSW NPI has been used to derive a representative background noise level (Rating Background Level or RBL) for the daytime, evening and night-time periods. An RBL is the median of the lowest 10th percentile of the background L_{A90} samples for each daytime, evening and night-time measurement period.

Noise levels during the defined times are presented in Table 5.

[1] Australian Standard AS1055.1 1997: Description and measurement of environmental noise – Part 1: General Procedures

Table 5 Measured noise levels at background noise logging locations

	Description	Noise Level during Period – dB(A)		
		Daytime 07:00 – 18:00	Evening 18:00 – 22:00	Night-time 22:00 – 07:00
Logger 1 – Southern boundary	Rating Background Level (L_{A90})	45	45	42
	Ambient Noise Level (L_{Aeq})	55	51	49

Derivation of noise emission criteria

Both intrusiveness and amenity criteria are derived from the ambient noise survey and the NPI. They are then compared with each other and the lowest and most stringent noise level is adopted to represent the project specific noise criterion for the relevant time period, day, evening and night time.

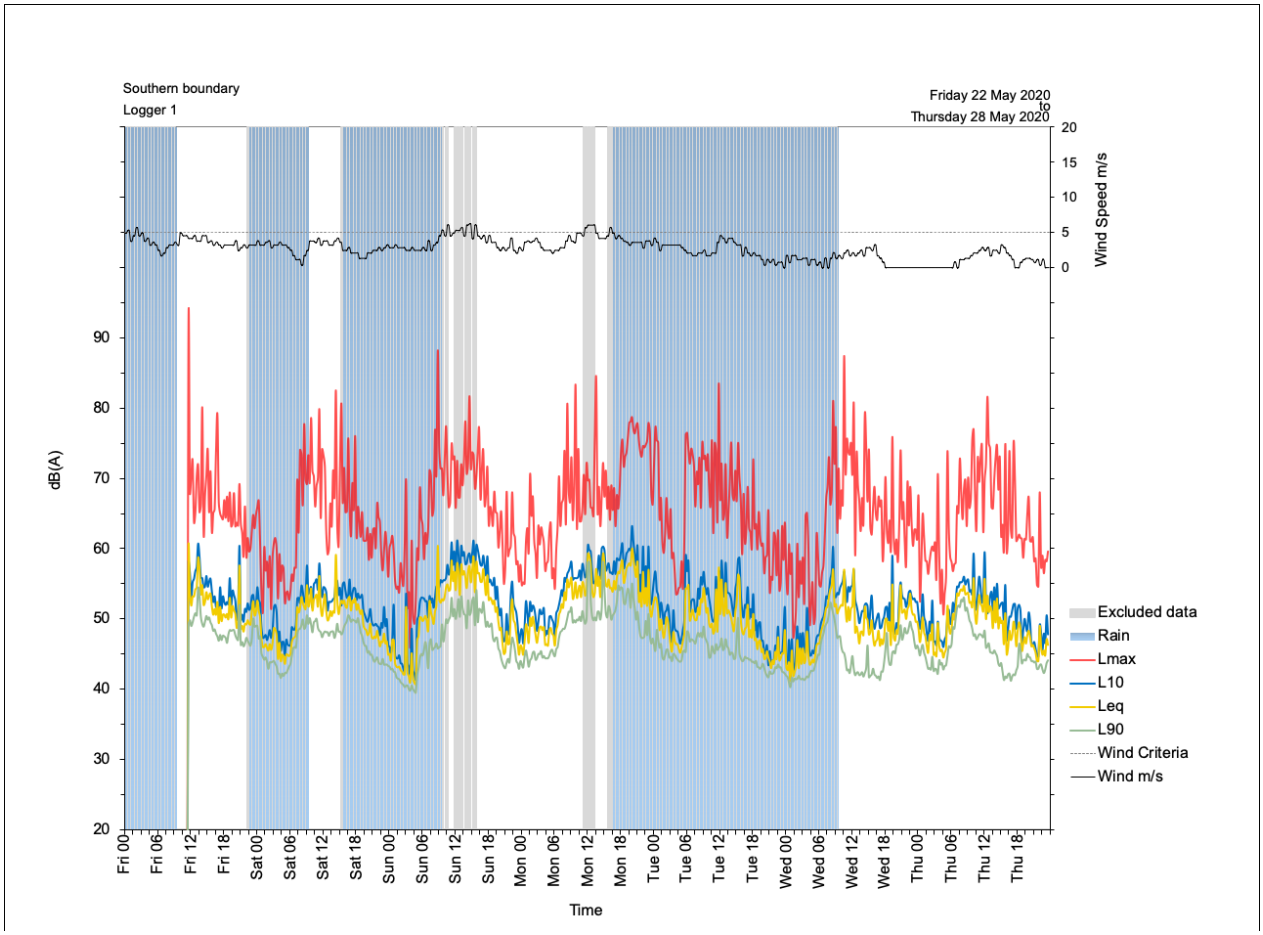
Table 6 NPI noise emission criteria

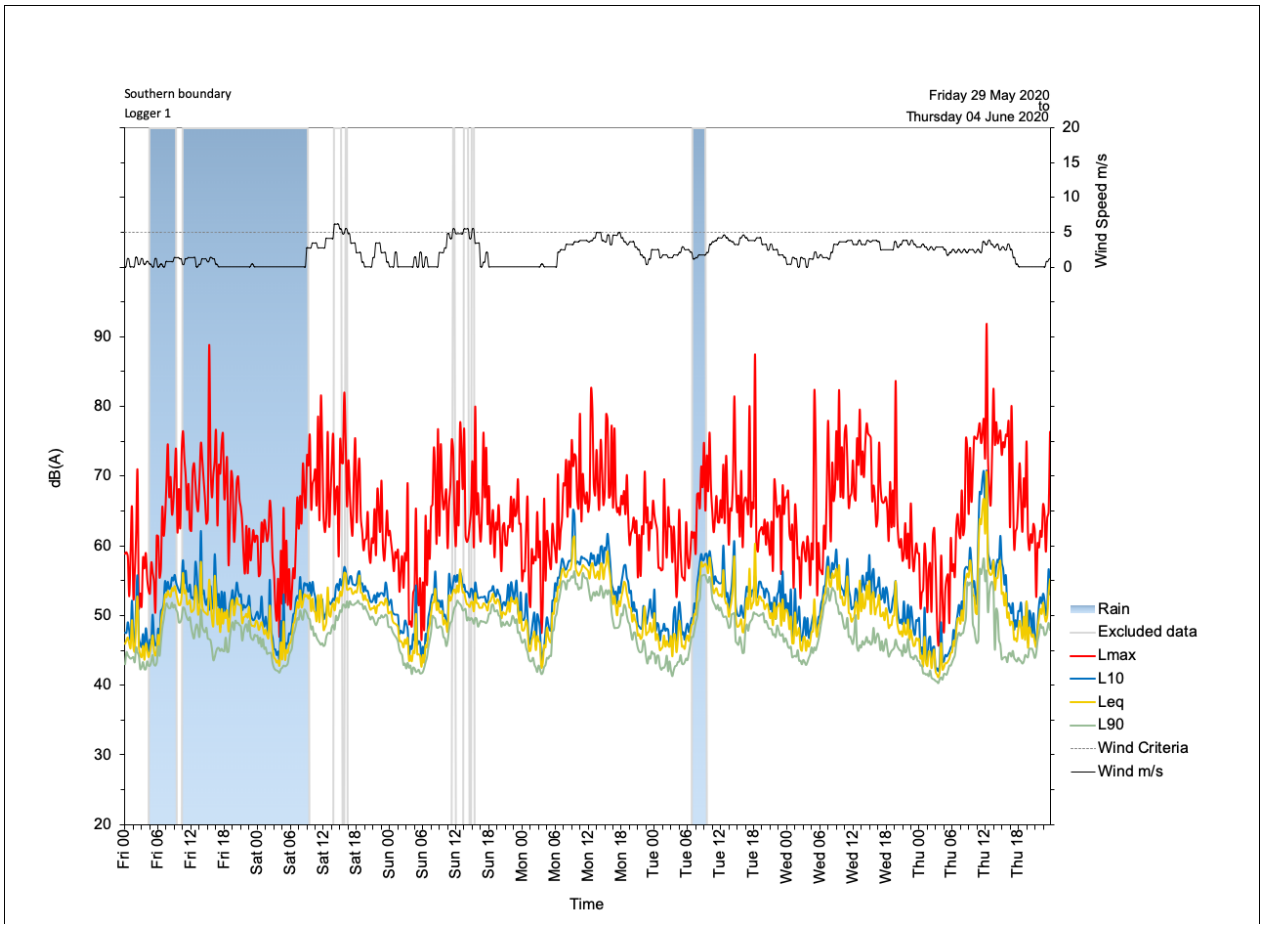
Location	NPI Noise Level (dB re 20 µPa) during Period		
Residential receivers	**Daytime 07:00 – 18:00**	**Evening 18:00 – 22:00**	**Night-time 22:00 – 07:00**
Rating Background Level (RBL)	45	45	42
Intrusive criterion (RBL + 5 dB)	50	50	47
NPI amenity Level (Urban[1])	60	50	45
Amenity Criterion (NPI amenity level – 5 dB + 3 dB)	58	48	43
NPI Project specific criteria for residential land uses[2]	**50**	**48**	**43**

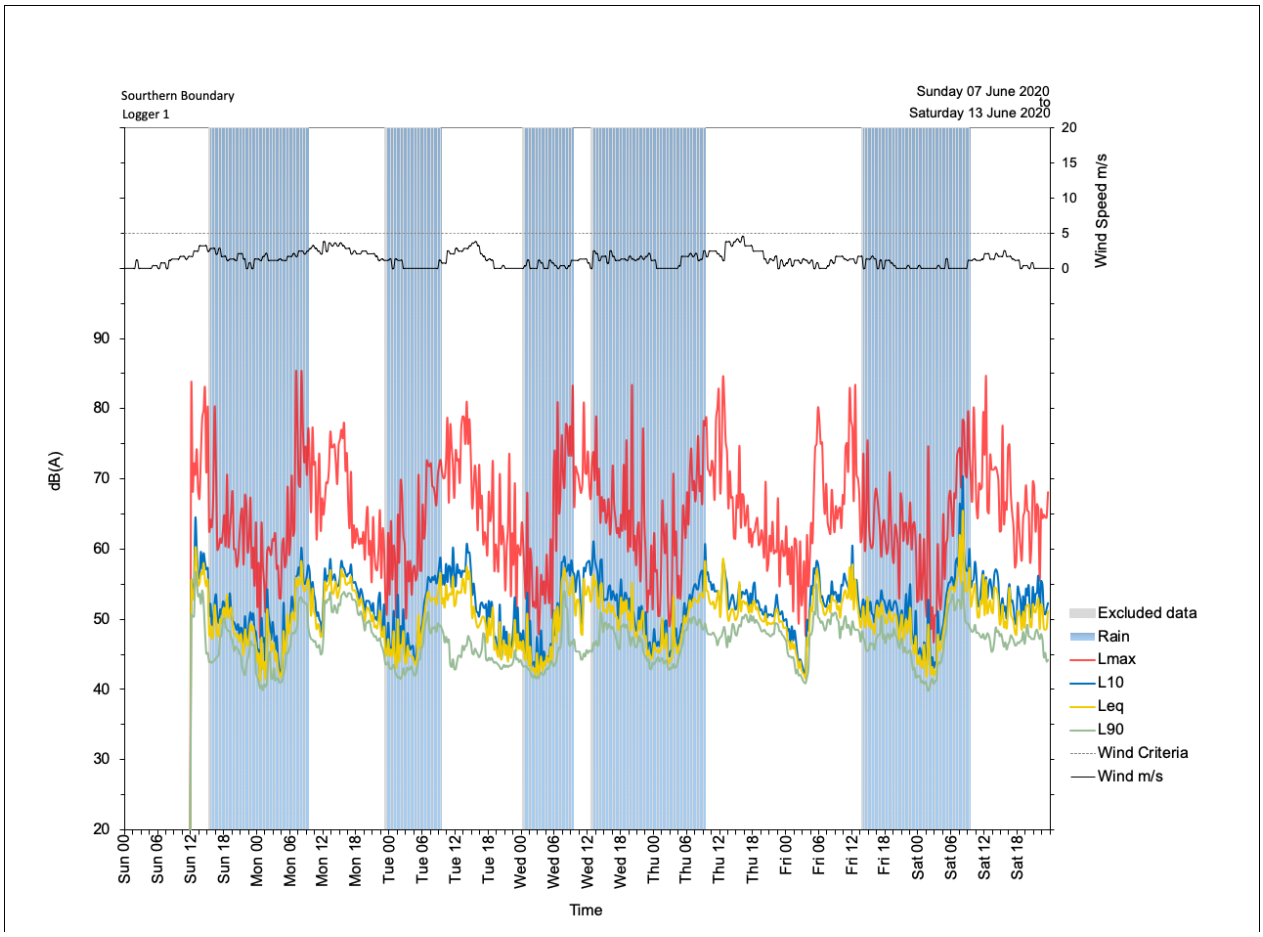
(1) An Urban classification has been adopted for the site.

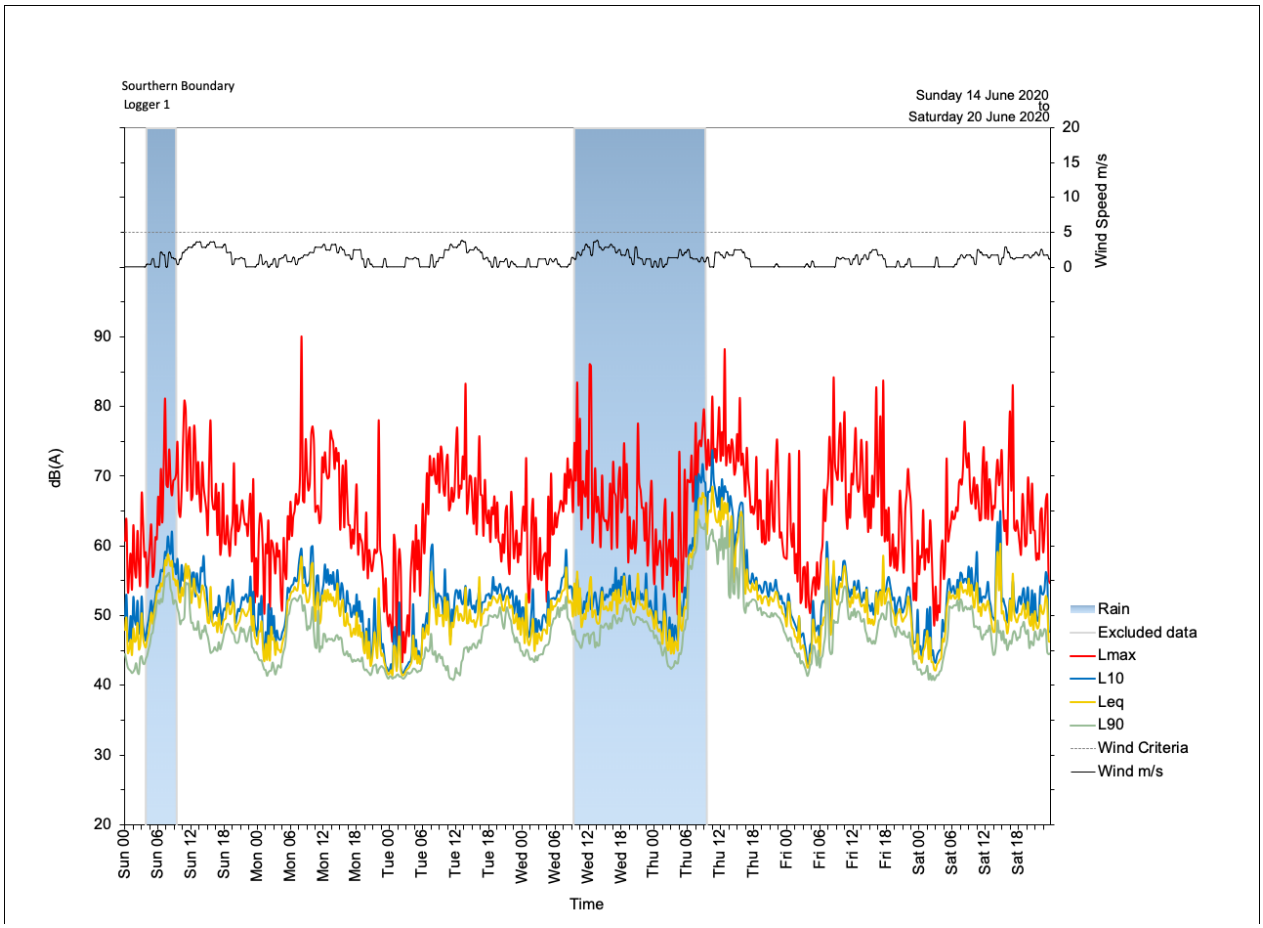
(2) The project-specific criteria are the lowest of the Intrusive criterion and the Amenity criterion for new sources for each time period.

Appendix B – Weekly Noise Graphs




Southern boundary
Logger 1
Friday 29 May 2020
to
Thursday 04 June 2020
dB(A)
Wind Speed m/s
Time
Rain
Excluded data
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


Sourthern Boundary
Logger 1
Sunday 07 June 2020
to
Saturday 13 June 2020
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


Sourthern Boundary
Logger 1
Sunday 14 June 2020
to
Saturday 20 June 2020
dB(A)
Wind Speed m/s
Time
Rain
Excluded data
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s